

A world map globe is positioned in the background, showing a detailed map of the world's continents and oceans. The globe is mounted on a stand, with a small portion of the stand visible in the foreground.

GEOGRAPHY

What is Geography?



Syllabus

Preliminary examination

Part A-Preliminary Examination

Paper I - (200 marks)

Duration : Two hours

- Current events of national and international importance
- History of India and Indian National Movement
- Indian and World Geography- Physical, Social, Economic Geography of India and the World.
- Indian Polity and Governance- Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.
- Economic and Social Development- Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, etc.
- General issues on Environmental ecology, Bio-diversity and Climate Change - that do not require subject specialization.
- General Science.

Syllabus

Mains Paper I

- ❑ Salient features of world's physical geography.
- ❑ Distribution of key natural resources across the world (including South Asia and the Indian sub-continent); factors responsible for the location of primary, secondary, and tertiary sector industries in various parts of the world (including India).
- ❑ Important Geophysical phenomena such as earthquakes, Tsunami, Volcanic activity, cyclone etc., geographical features and their location-changes in critical geographical features (including water-bodies and ice-caps) and in flora and fauna and the effects of such changes.

Part A—Preliminary Examination

Paper I - (200 marks)

Duration: Two hours

- ❑ Current events of national and international importance.
- ❑ History of India and Indian National Movement.
- ❑ Indian and World Geography-Physical, Social, Economic Geography of India and the World.
- ❑ Indian Polity and Governance-Constitution, Political System, Panchayati Raj, Public Policy, Rights Issues, etc.
- ❑ Economic and Social Development-Sustainable Development, Poverty, Inclusion, Demographics, Social Sector Initiatives, etc.
- ❑ General issues on Environmental ecology, Bio-diversity and Climate Change - that do not require subject specialization.
- ❑ General Science.

General Studies-III: Technology, Economic Development, Bio diversity, Environment, Security and Disaster Management

- ❑ Indian Economy and issues relating to planning, mobilization, of resources, growth, development and employment.
- ❑ Inclusive growth and issues arising from it.
- ❑ Government Budgeting.
- ❑ Major crops-cropping patterns in various parts of the country, - different types of irrigation and irrigation systems storage, transport and marketing of agricultural produce and issues and related constraints; e-technology in the aid of farmers.
- ❑ Issues related to direct and indirect farm subsidies and minimum support prices; Public Distribution System- objectives, functioning, limitations, revamping; issues of buffer stocks

- and food security; Technology missions; economics of animal-rearing.
- ❑ Food processing and related industries in India- scope' and significance, location, upstream and downstream requirements, supply chain management.
 - ❑ Land reforms in India.
 - ❑ Effects of liberalization on the economy, changes in industrial policy and their effects on industrial growth.
 - ❑ Infrastructure: Energy, Ports, Roads, Airports, Railways etc.
 - ❑ Investment models.
 - ❑ Science and Technology- developments and their applications and effects in everyday life.
 - ❑ Achievements of Indians in science & technology; indigenization of technology and developing new technology.
 - ❑ Awareness in the fields of IT, Space, Computers, robotics, nano-technology, bio-technology and issues relating to intellectual property rights.
 - ❑ Conservation, environmental pollution and degradation, environmental impact assessment.
 - ❑ Disaster and disaster management.

Units in Geography

Physical Geography - World	Physical Geography - India	Economic & Human Geography – World & India
Earth, Solar system and Universe	Physiography	Oceanic and water resources
Geomorphology	Drainage pattern	Natural Vegetation
Climatology	Climate	Agriculture
Oceanography	Soil	Mineral and energy resources
Biogeography		Industries
		Transportation & infrastructure
		Population
		Settlements
Map Locations		

Previous years' question papers

Weightage

Geography - Number of questions
(2011 - 2022)



Year	Geography - total marks
2013	70
2014	100
2015	75
2016	100
2017	115
2018	85
2019	100
2020	100
2021	95

Geography - Total marks in GS 1 (Mains)



Sample Questions - Prelims

On 21st June, the Sun

- (a) does not set below the horizon at the Arctic Circle
- (b) does not set below the horizon at Antarctic Circle
- (c) shines vertically overhead at noon on the Equator
- (d) shines vertically overhead at the Tropic of Capricorn

Static & Conventional

With reference to 'Indian Ocean Dipole (IOD)' sometimes mentioned in the news while forecasting Indian monsoon, which of the following statements is/are correct?

1. IOD phenomenon is characterised by a difference in sea surface temperature between tropical Western Indian Ocean and tropical Eastern Pacific Ocean.

2. An IOD phenomenon can influence an El Nino's impact on the monsoon.

Select the correct answer using the code given below:

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

Current Affairs based

Sample Questions - Prelims

Among the following cities, which one lies on a longitude closest to that of Delhi?

- (a) Bengaluru
- (b) Hyderabad
- (c) Nagpur
- (d) Pune

Location - static

Consider the following pairs:
Regions sometimes mentioned in news - Country

- 1. Catalonia - Spain
- 2. Crimea - Hungary
- 3. Mindanao - Philippines
- 4. Oromia - Nigeria

Which of the pair given above are correctly matched?

- (a) 1, 2 and 3
- (b) 3 and 4 only
- (c) 1 and 3 only
- (d) 2 and 4 only

Location – Current Affairs based

Sample Questions - Mains

2018	Define mantle plume and explain its role in plate tectonics.	10	Geophysical phenomena	Static - Basic
2015	How far do you agree that the behaviour of the Indian monsoon has been changing due to humanizing landscape? Discuss.	12.5	Geophysical phenomena	Static - Applied
2017	How does the Juno Mission of NASA help to understand the origin and evolution of the Earth ? (150 words)	10	Physical Geography	Static + Current Affairs
2018	Why is Indian Regional Navigational Satellite System (IRNSS) needed? How does it help in navigation?	10	Economic Activities	Current Affairs

Prelims - 9 years papers' analysis

(2014 to 2022)

<https://www.youtube.com/watch?v=S4JUhSzCr5s&t=4893s>

https://www.youtube.com/watch?v=3E_SMw4pJyo&t=3539s

<https://www.youtube.com/watch?v=OMP7gh5MXTw&t=2739s>

<https://www.youtube.com/watch?v=CbWHIP2Pm4w>

Mains - 8 years papers' analysis

2014 to 2018

https://www.youtube.com/watch?v=pFB7H5AR_OA&t=918s

<https://www.youtube.com/watch?v=05OSXWZ6dQM&t=3790s>

2019 analysis

<https://www.youtube.com/watch?v=URamrq7ZkbQ&t=952s>

2020 analysis

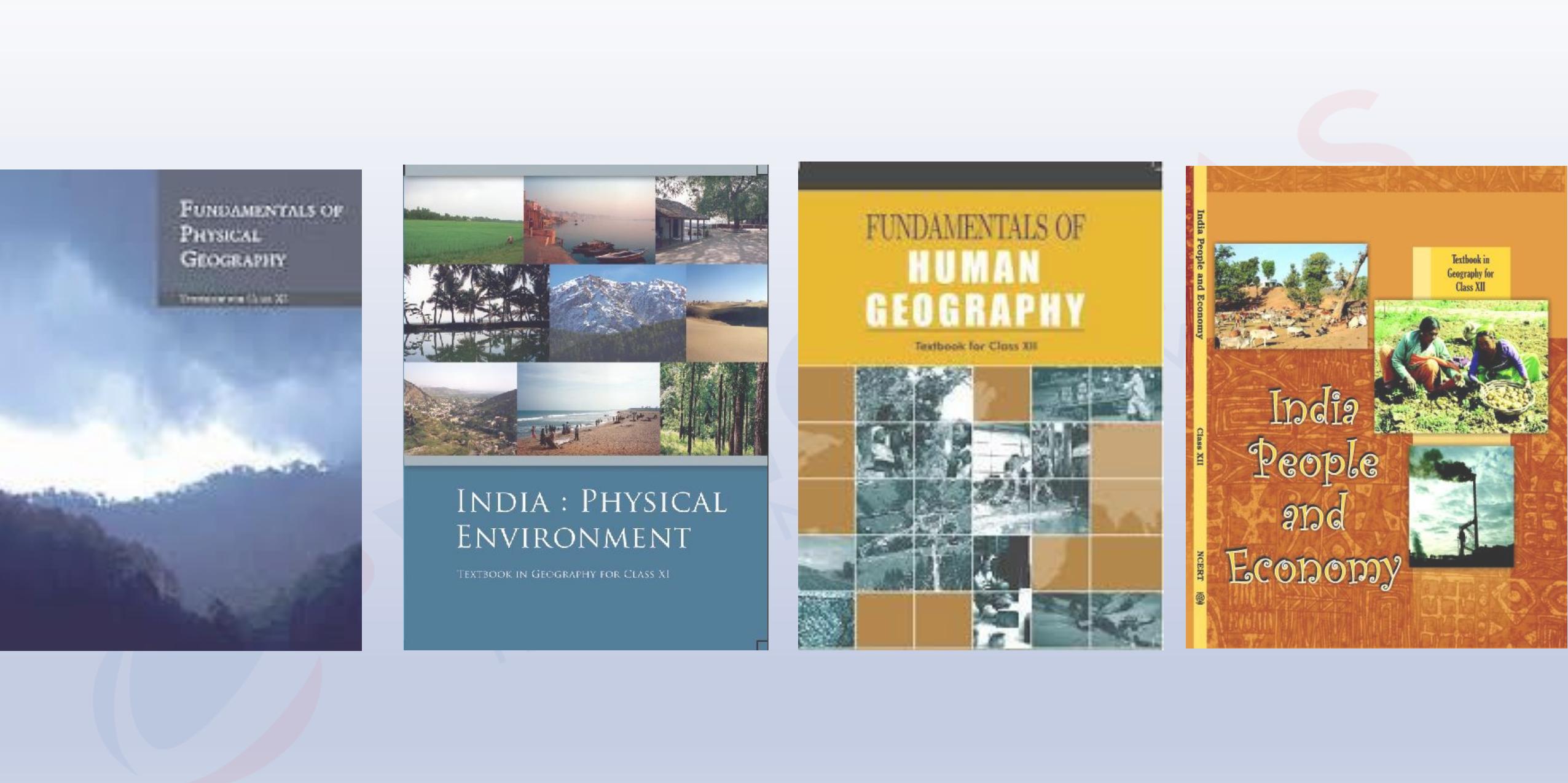
https://www.youtube.com/watch?v=2_3J9H0W5ho&t=4322s

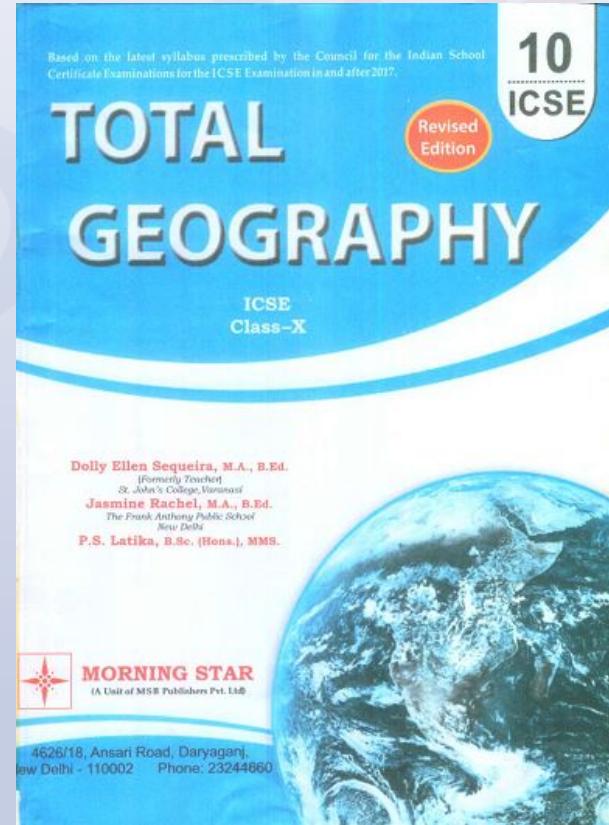
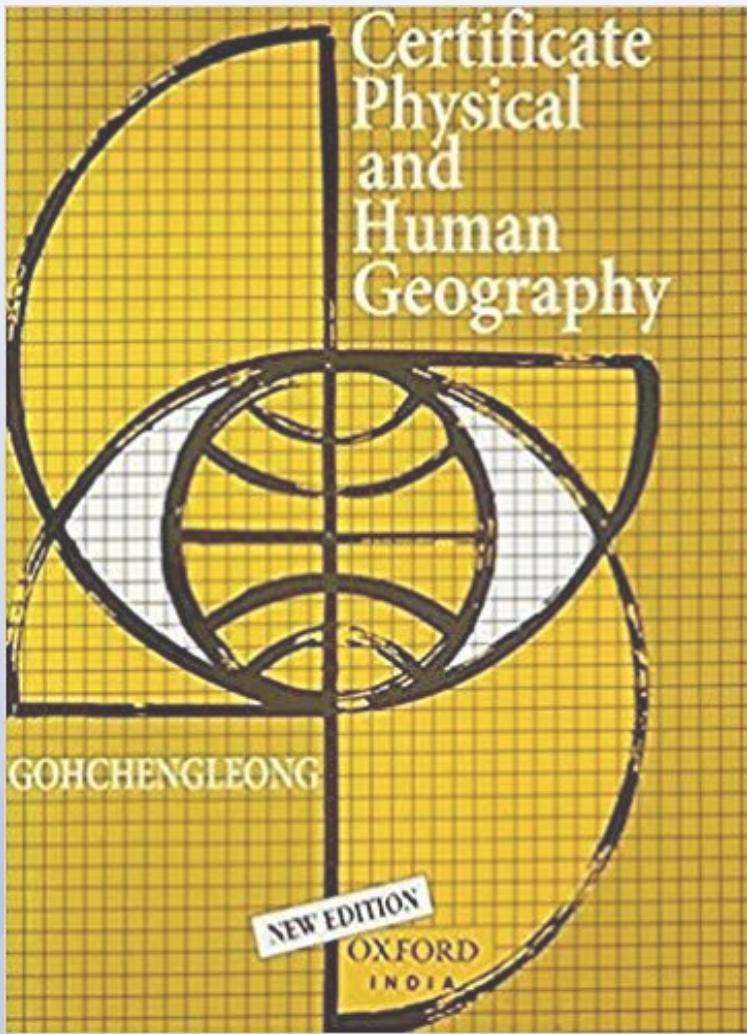
2021 analysis

<https://www.youtube.com/watch?v=O-J62-kpzDI>

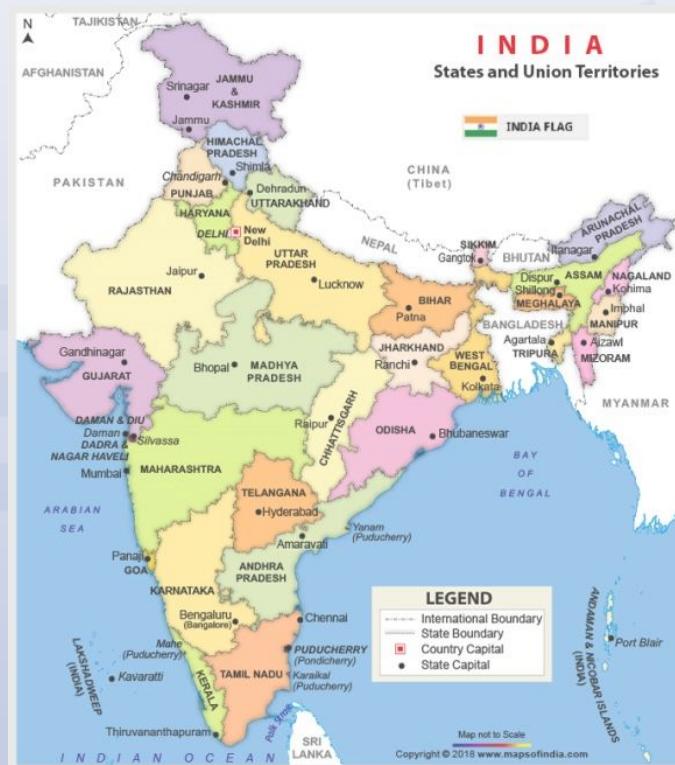
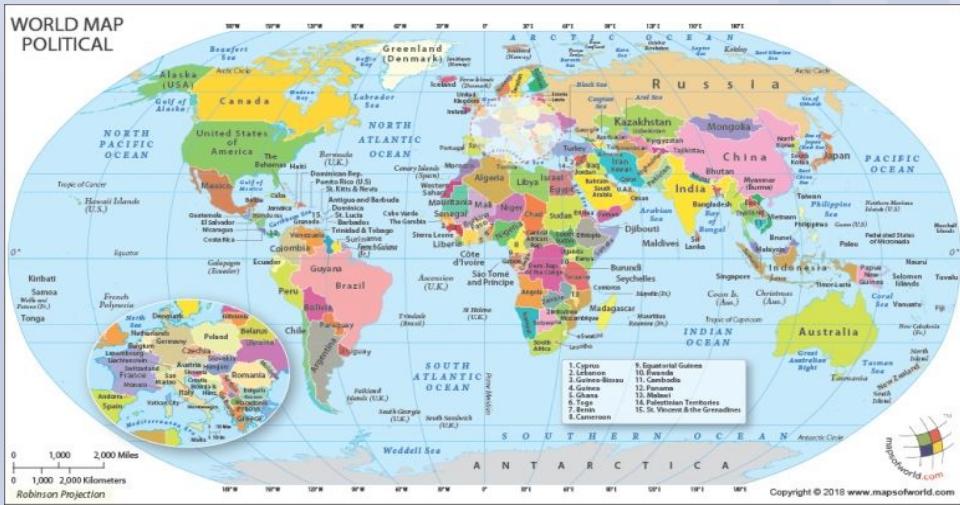
Sources

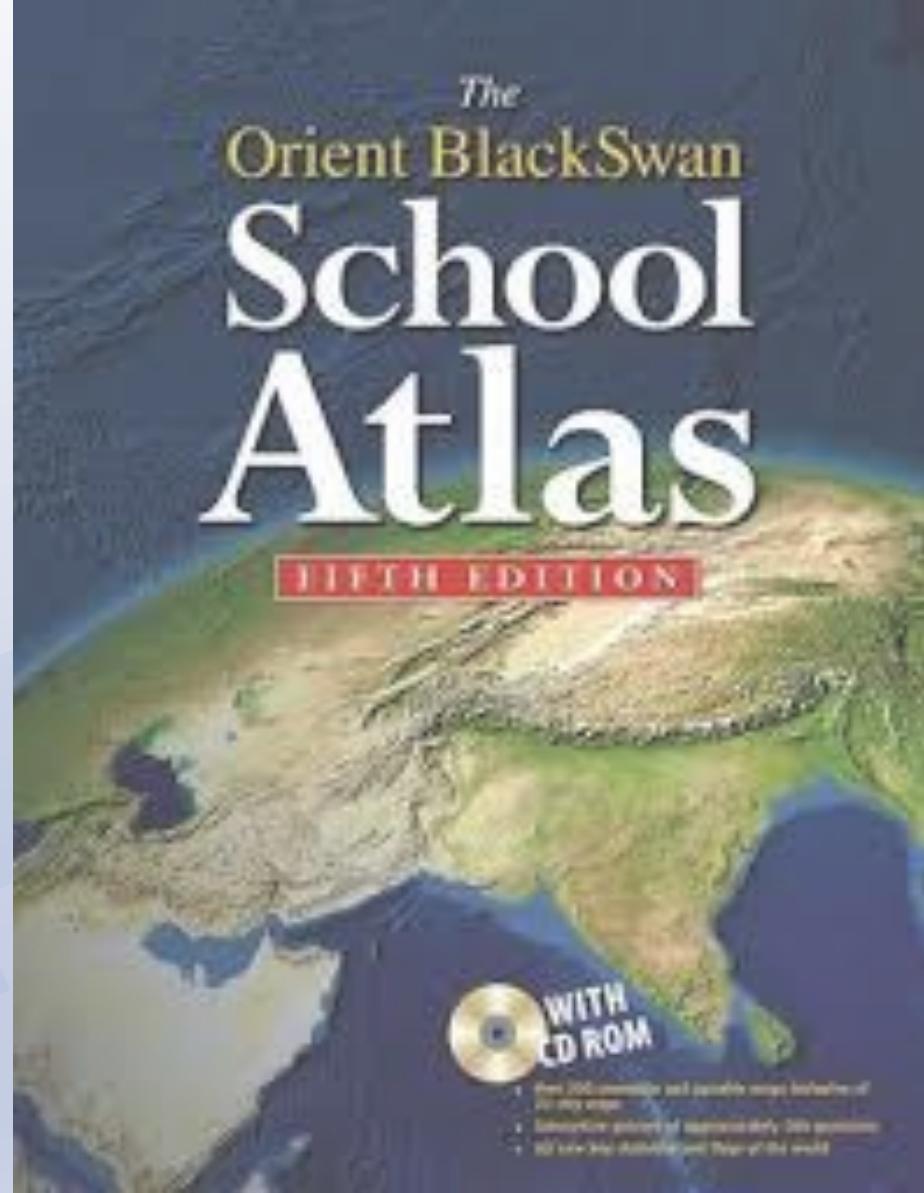




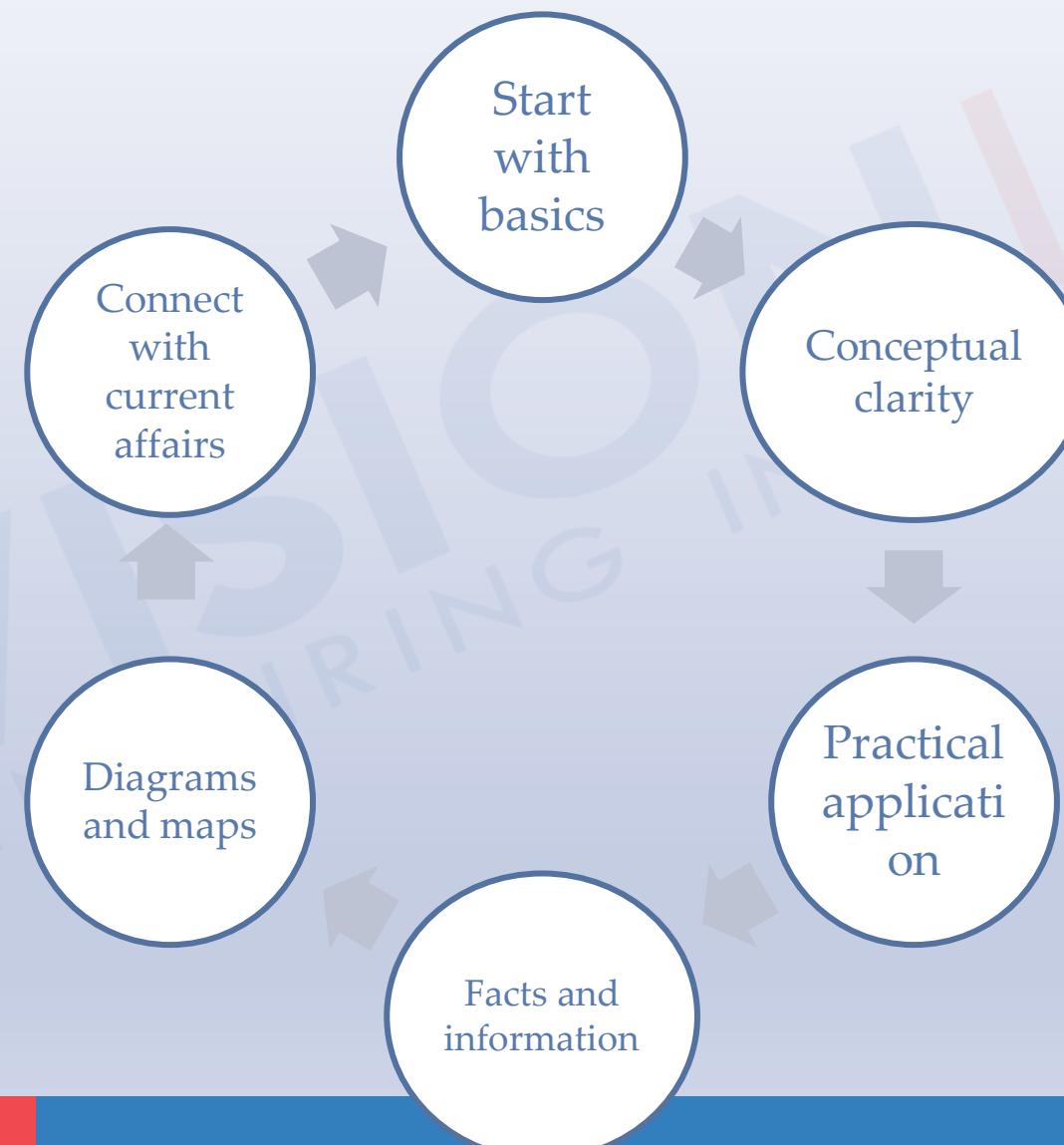


Map reading





How to approach Geography?





Questions??



- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

Earth, Solar System And Universe

Shape of earth

Latitudes & Longitudes

Rotation & Revolution

Seasons

Time zones and IDL

Universe and Origin of universe

Life cycle of a star

Galaxies and stars

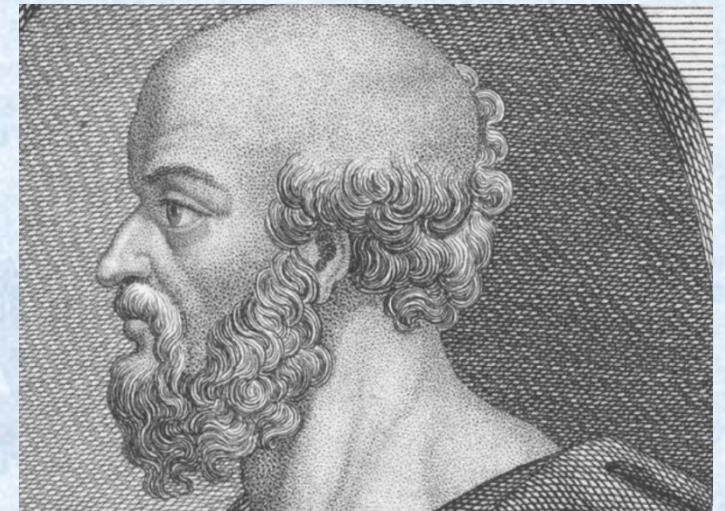
Origin of solar system

Sun

Planets, satellites and other bodies

Eclipses

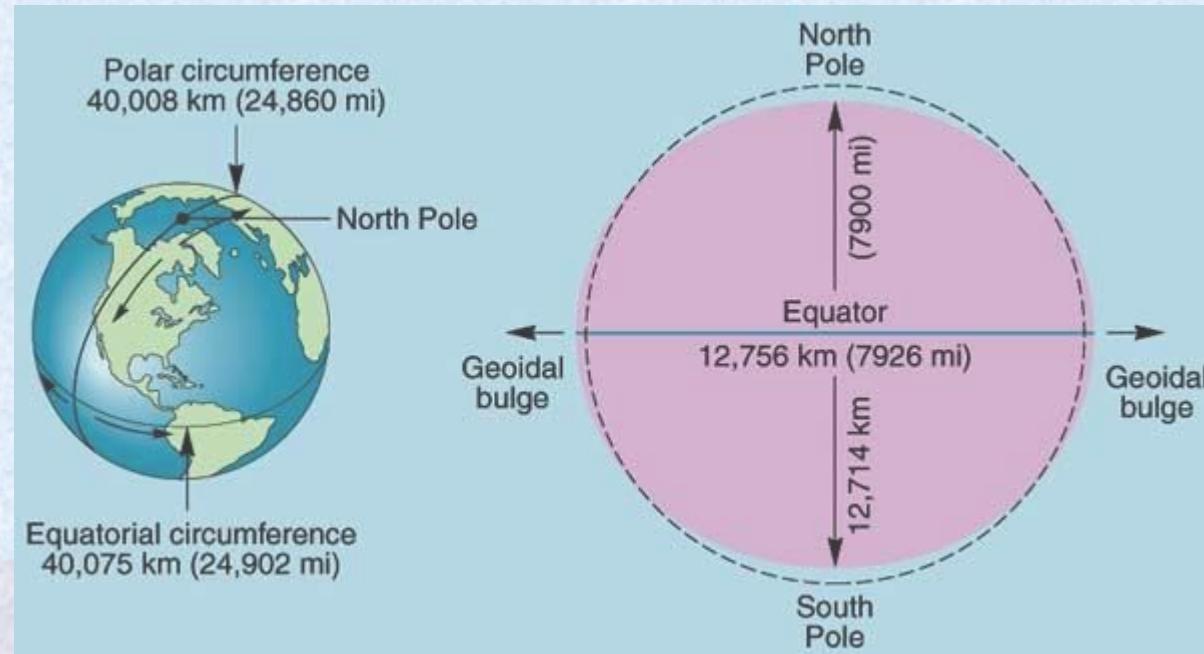
What is Geography?



Erastosthenes

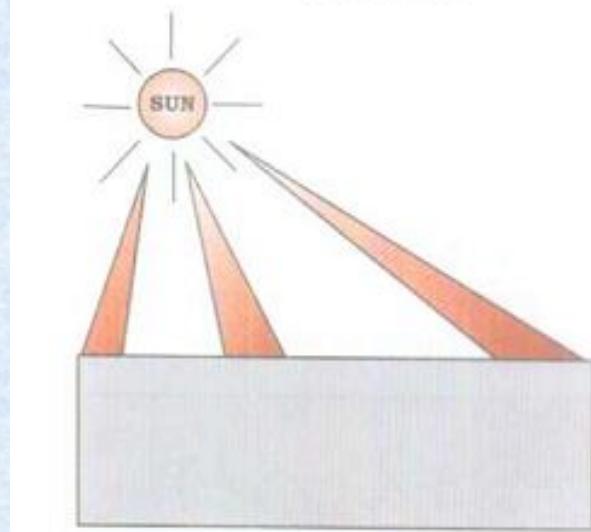
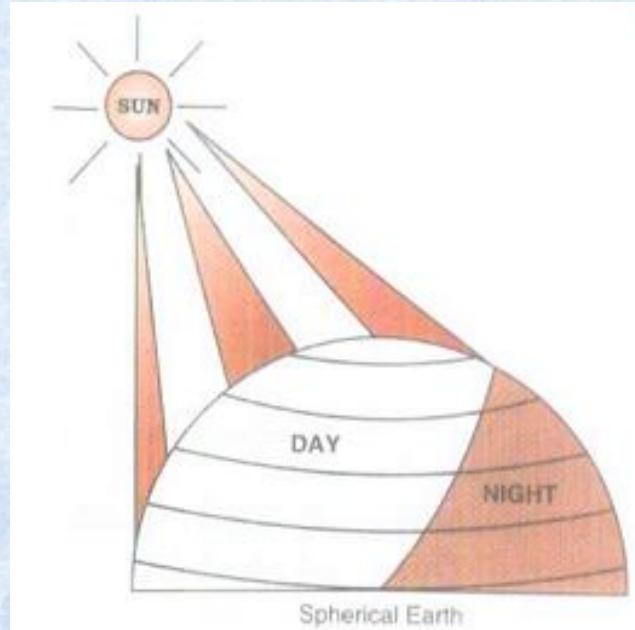
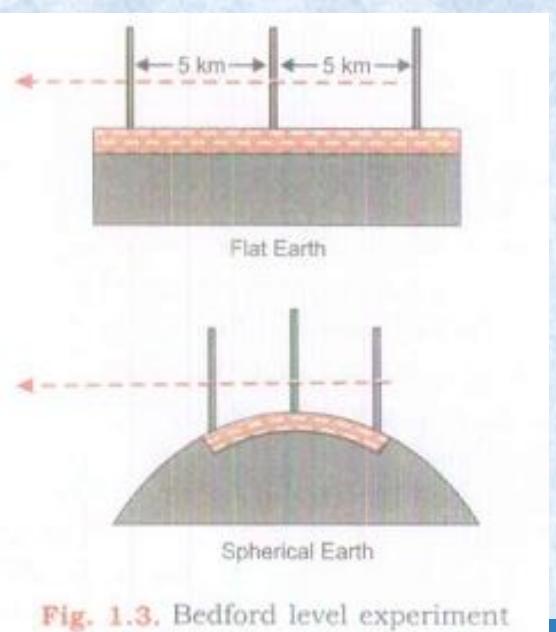
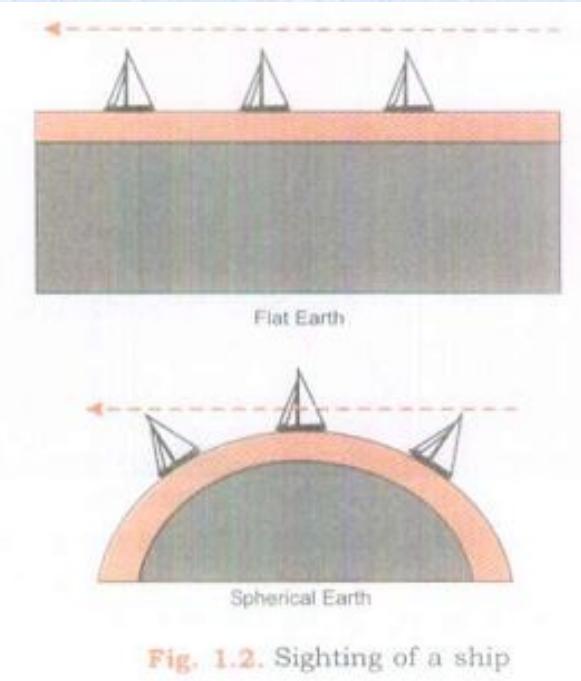
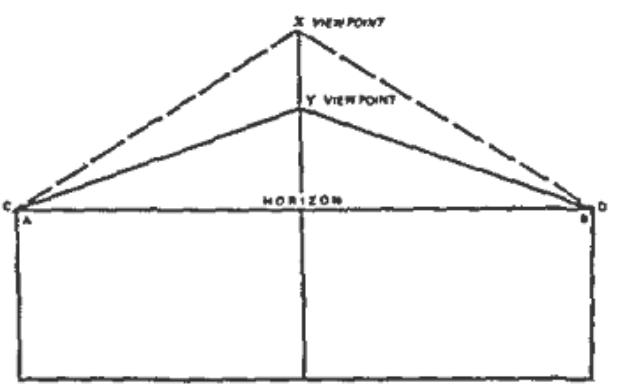
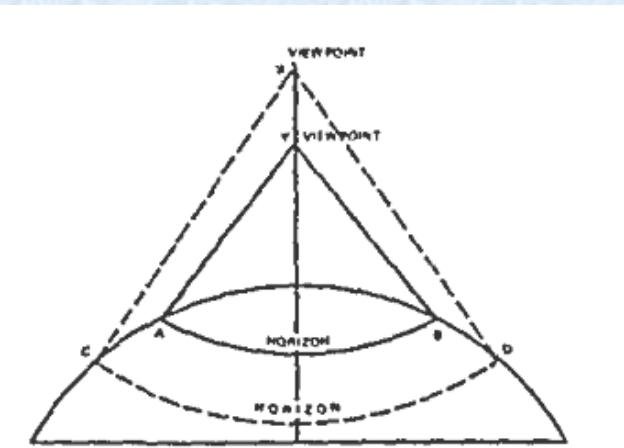
Father of Geography

Shape of the Earth

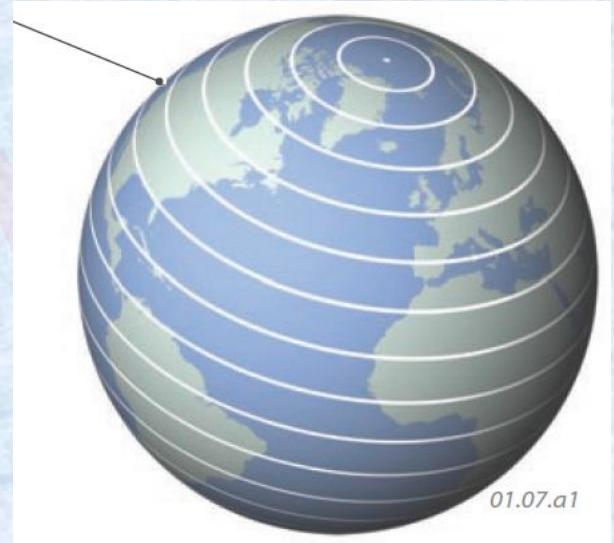
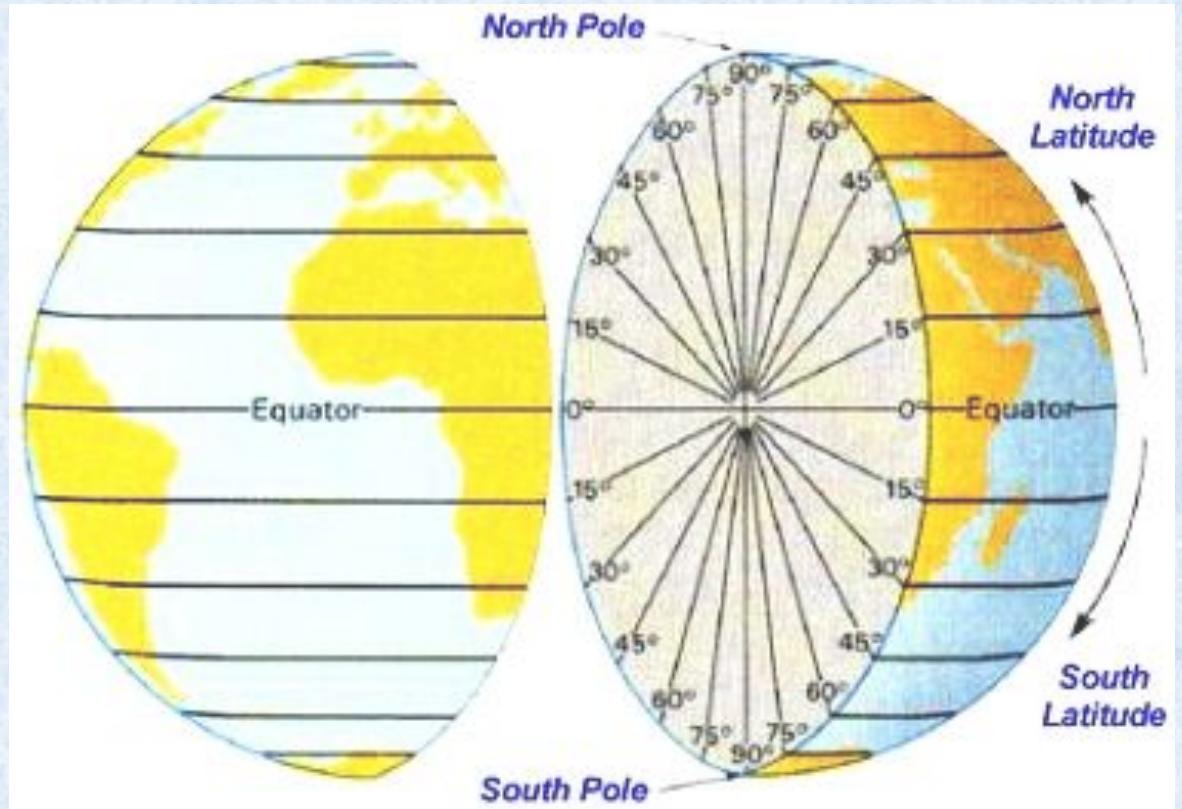


Geoid

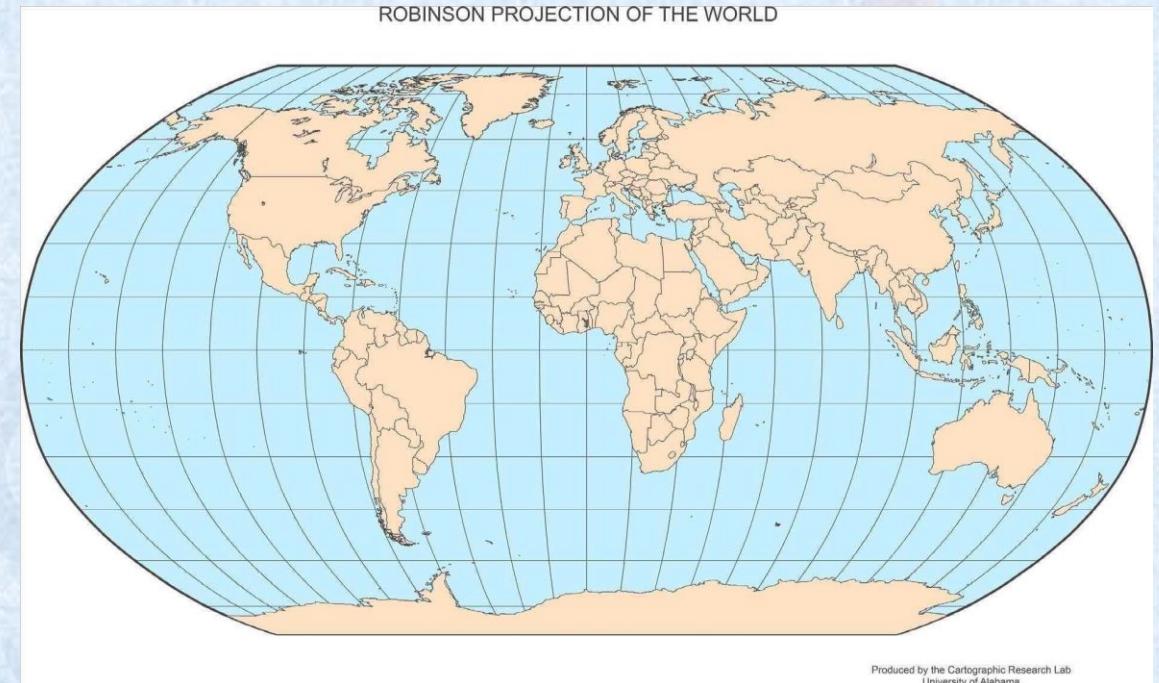
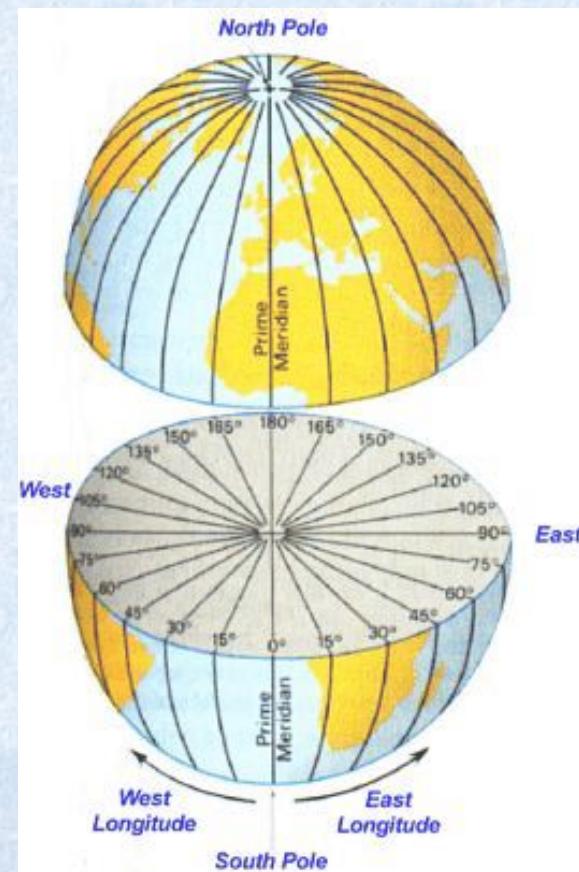
Shape of the Earth

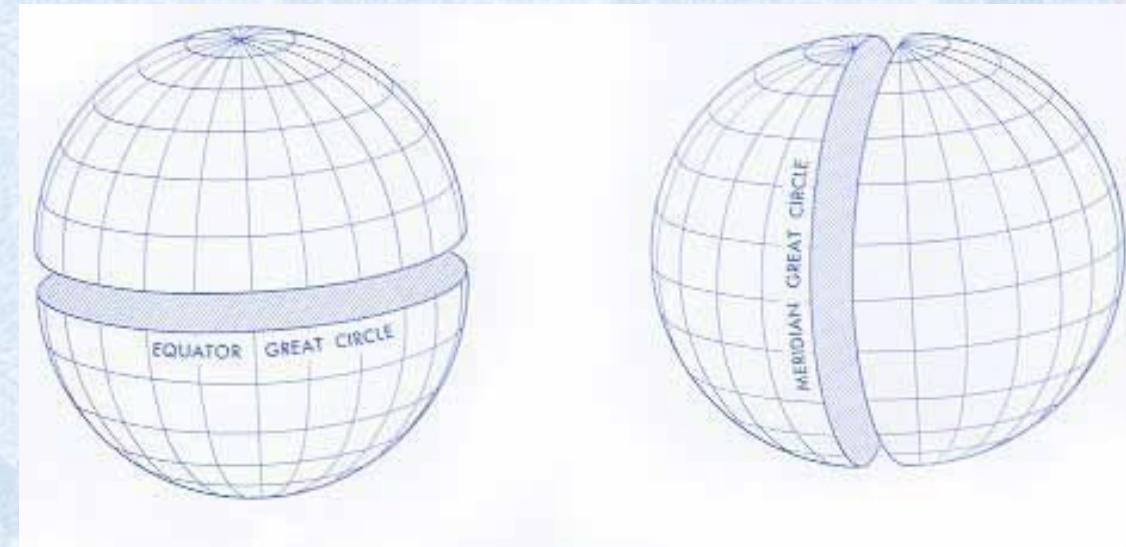


Latitudes and Longitudes



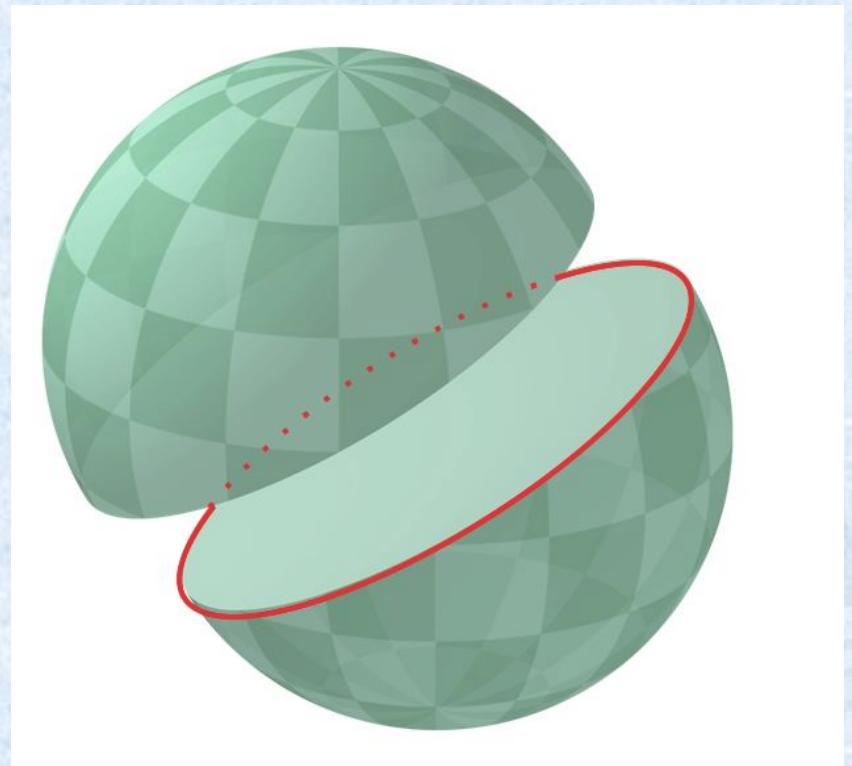
Latitudes and Longitudes



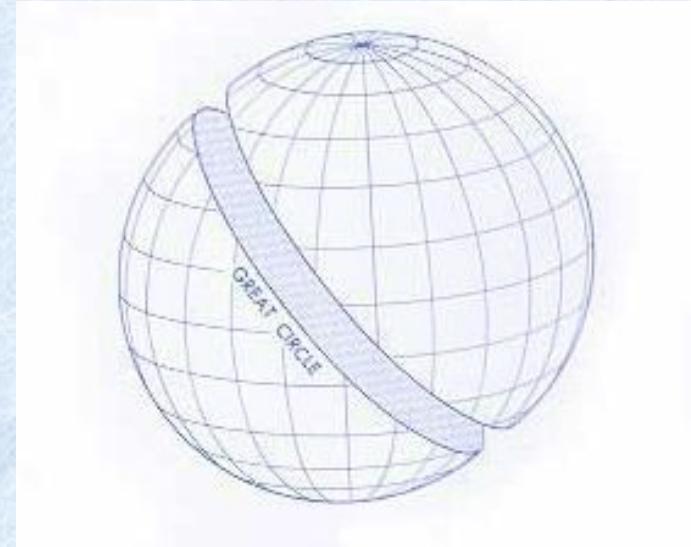


Great Circle

Latitudes and Longitudes



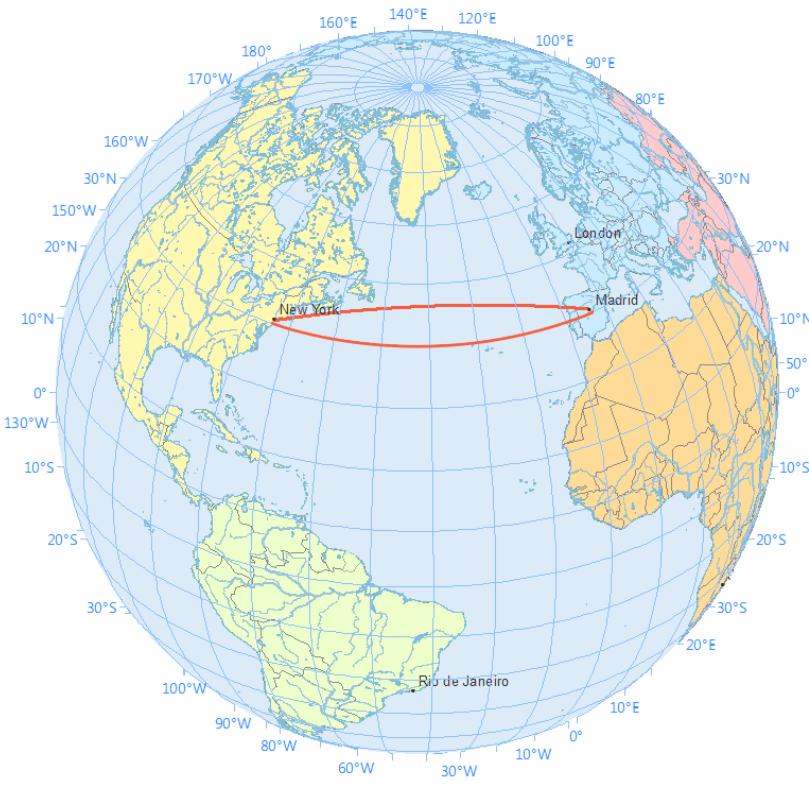
Great Circle



Latitudes and Longitudes



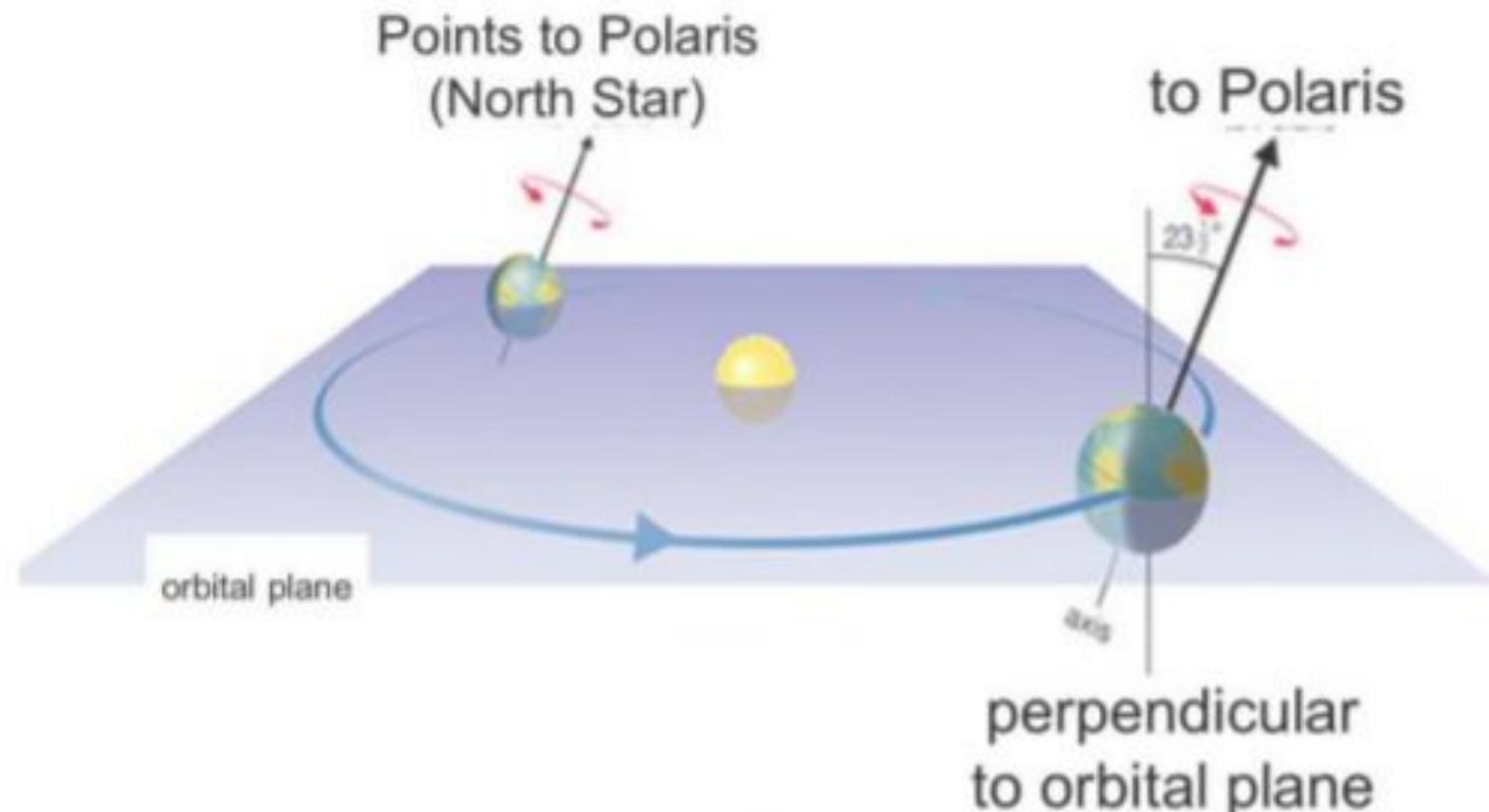
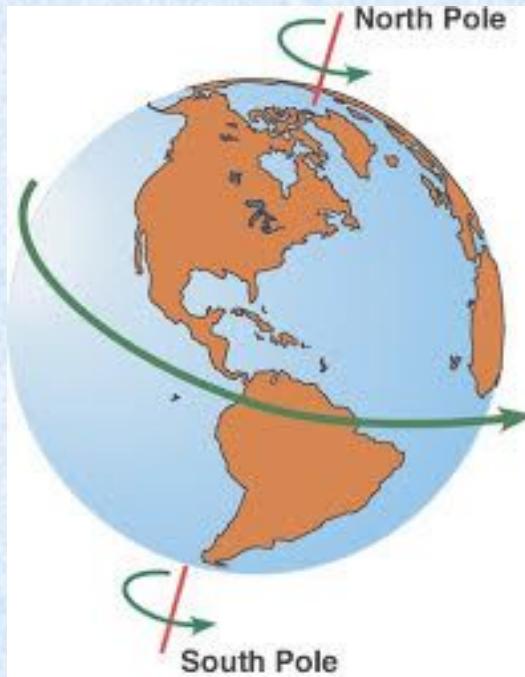
Latitudes and Longitudes



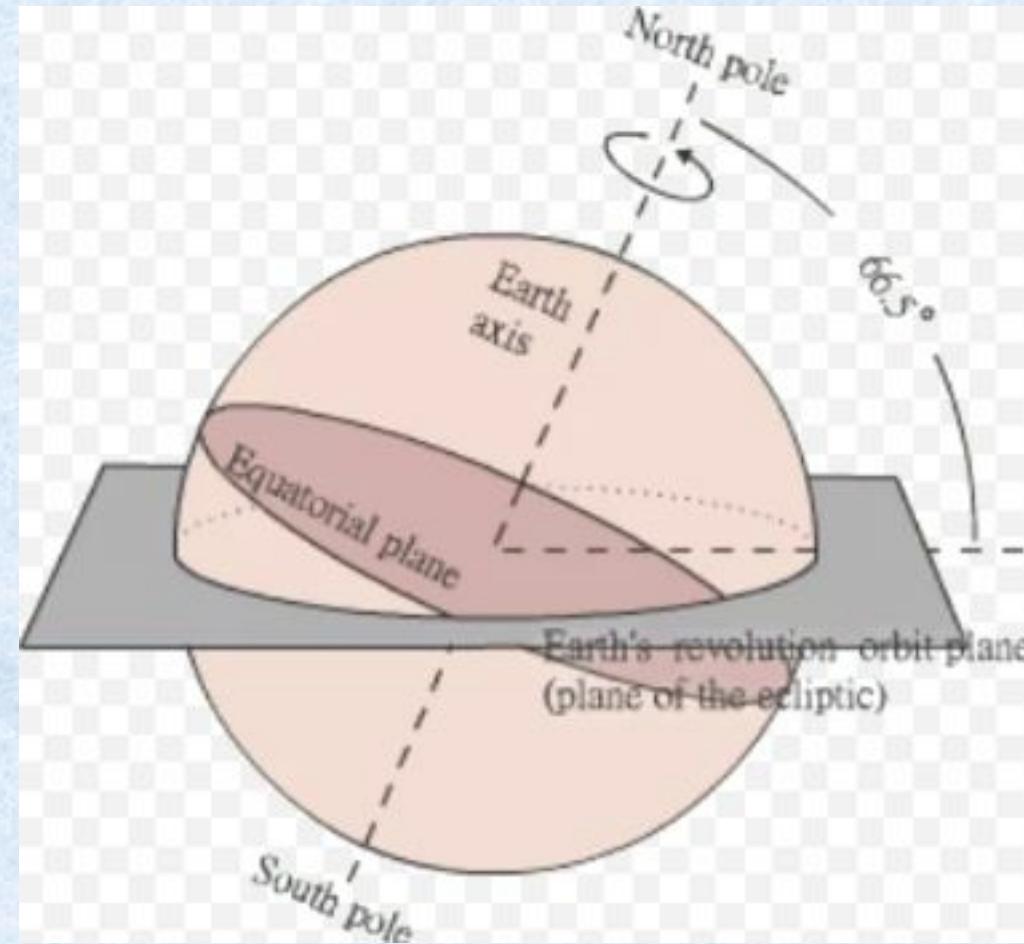
Great Circle in
measuring shortest
distance



Earth's Orbital Plane

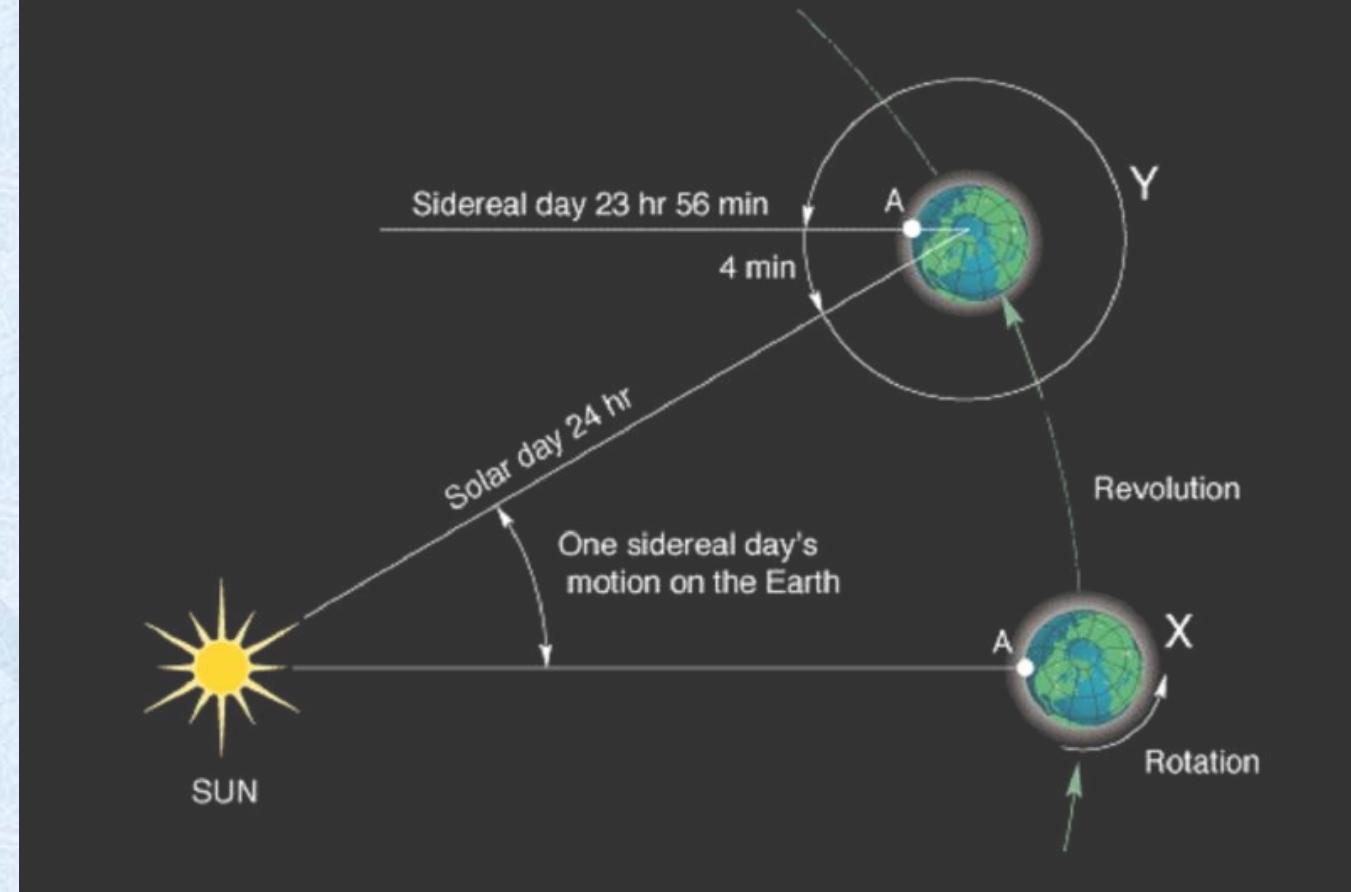


Axis of rotation and Orbital plane



Axis of rotation and Orbital plane

Sidereal Day vs. Solar Day

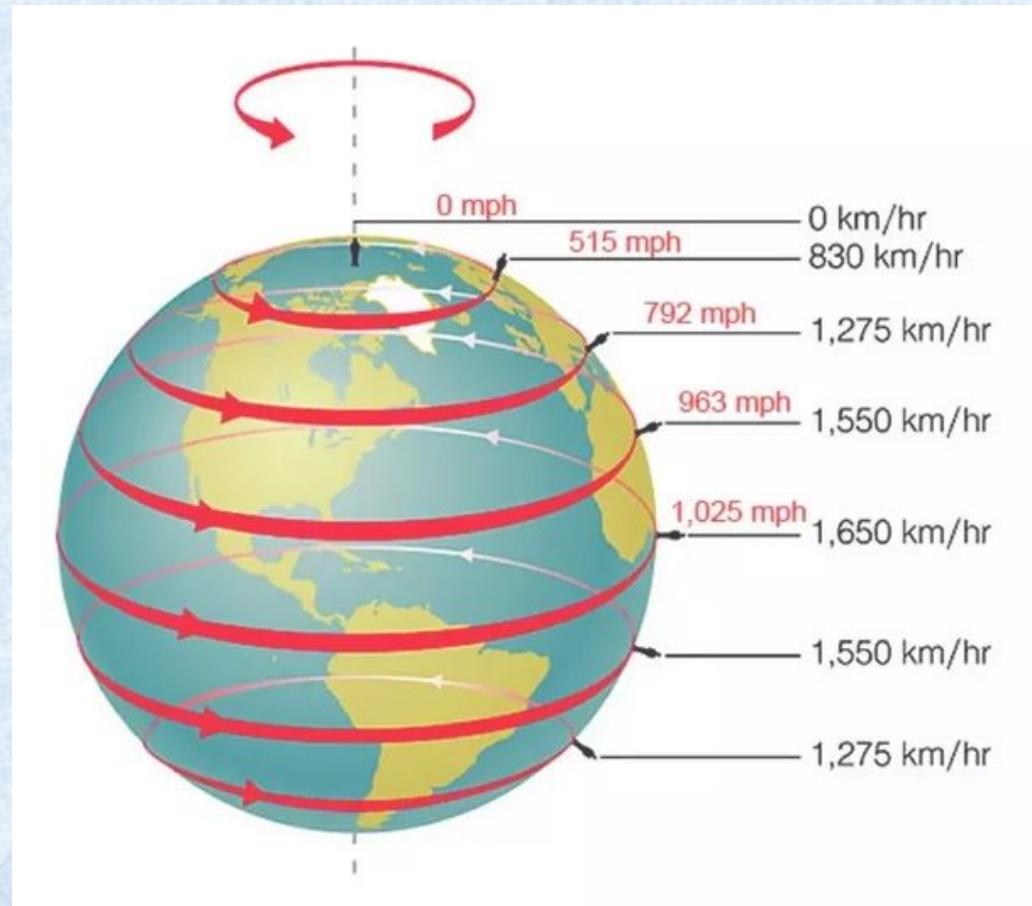


Solar day & Sidereal day

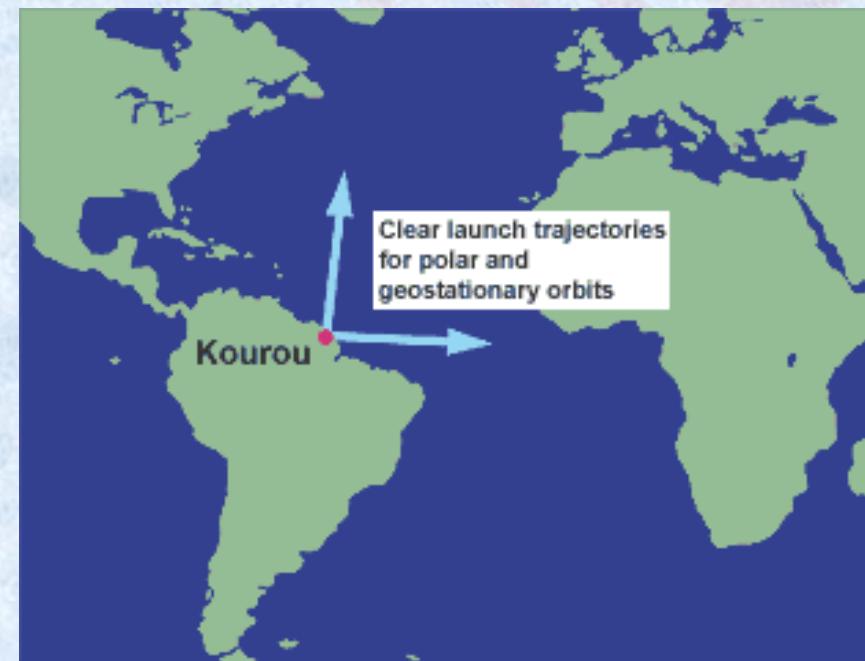
<https://www.youtube.com/watch?v=1wGFJd3j3ds>

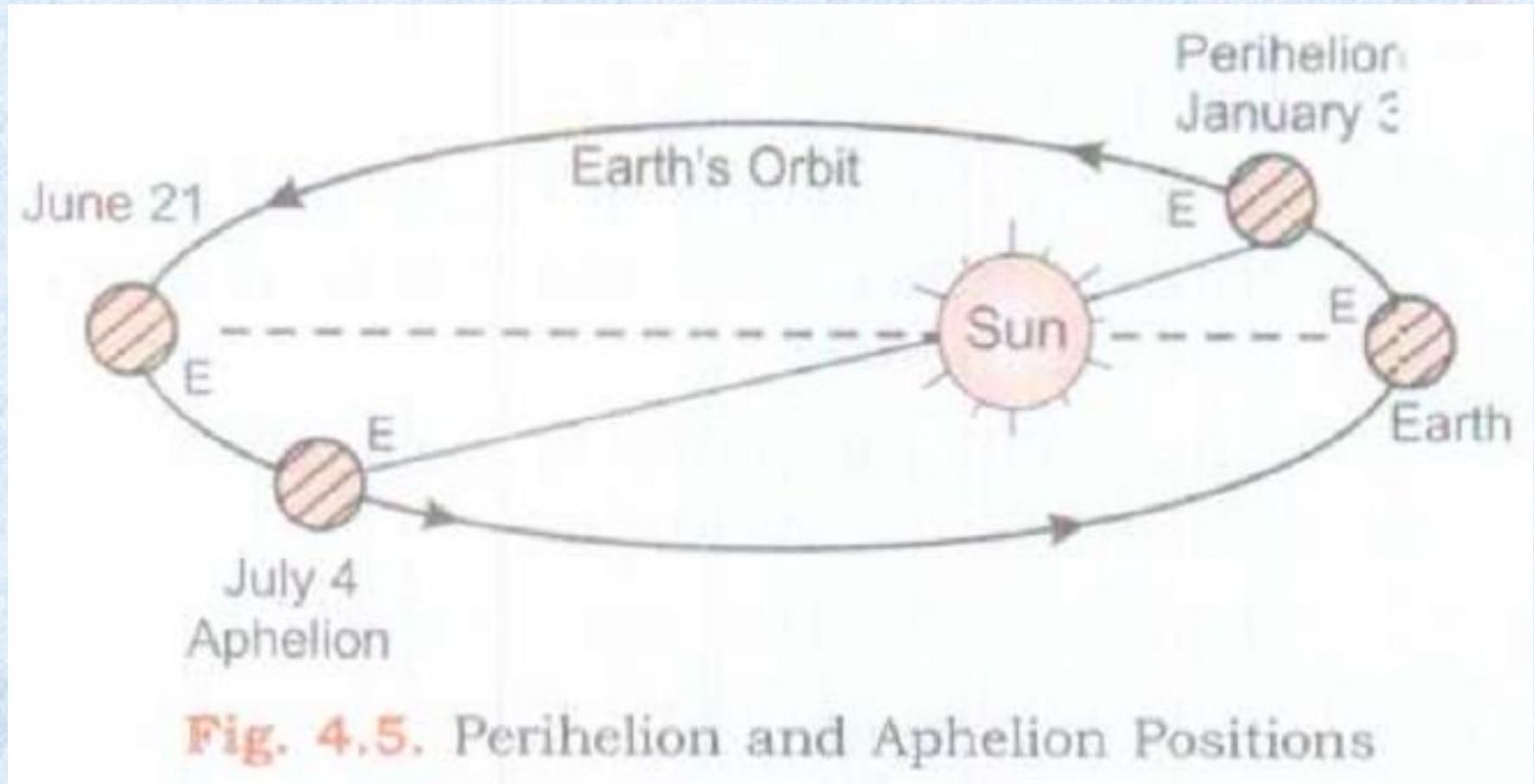
Solar day & Sidereal day

Rotation and Revolution



Linear speed of rotation





Revolution of Earth

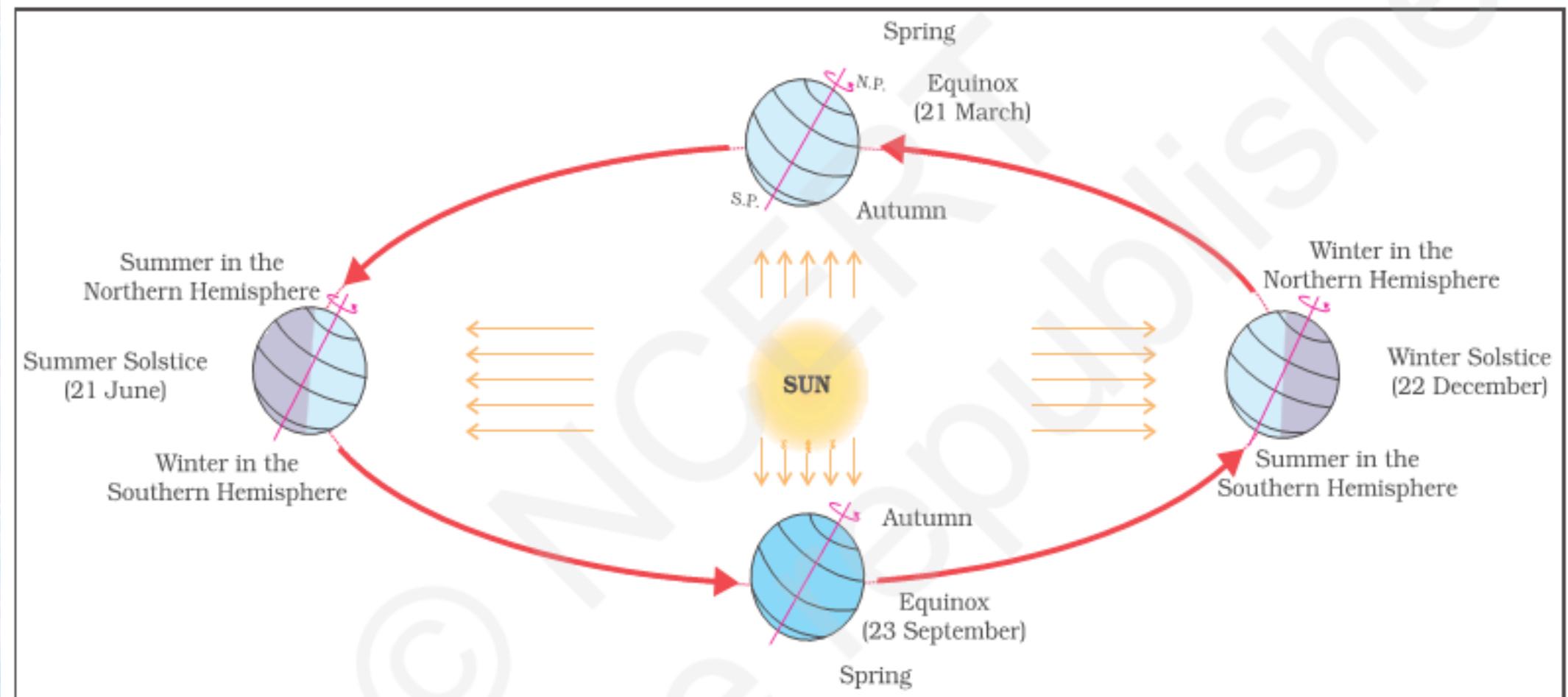
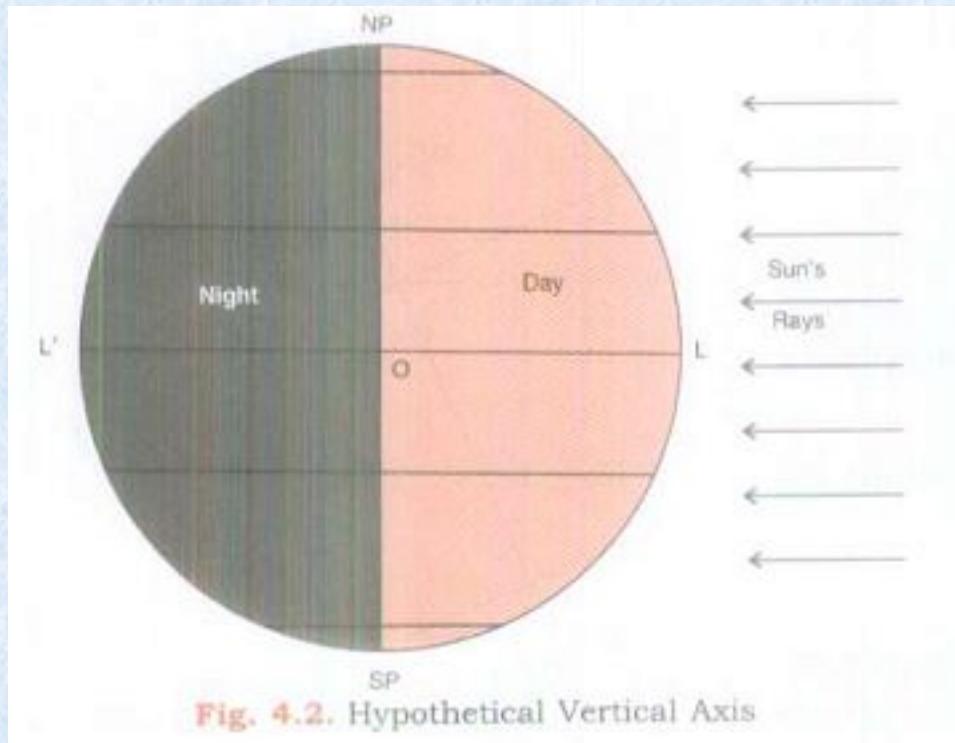


Figure 3.3 : Revolution of the Earth and Seasons

Revolution with constant
tilted axis



Circle of illumination

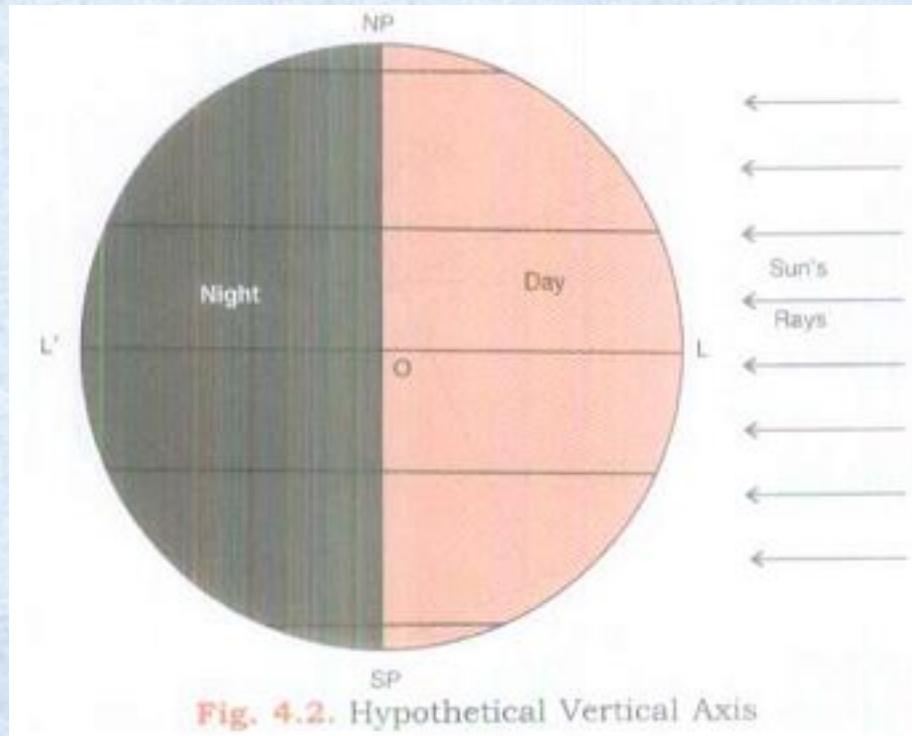


Fig. 4.2. Hypothetical Vertical Axis

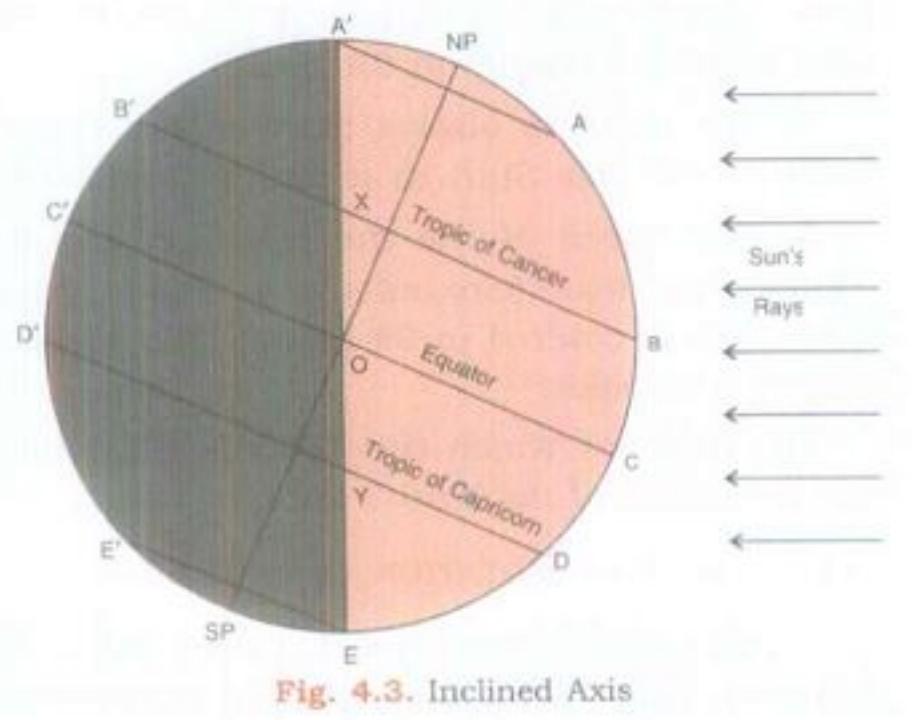
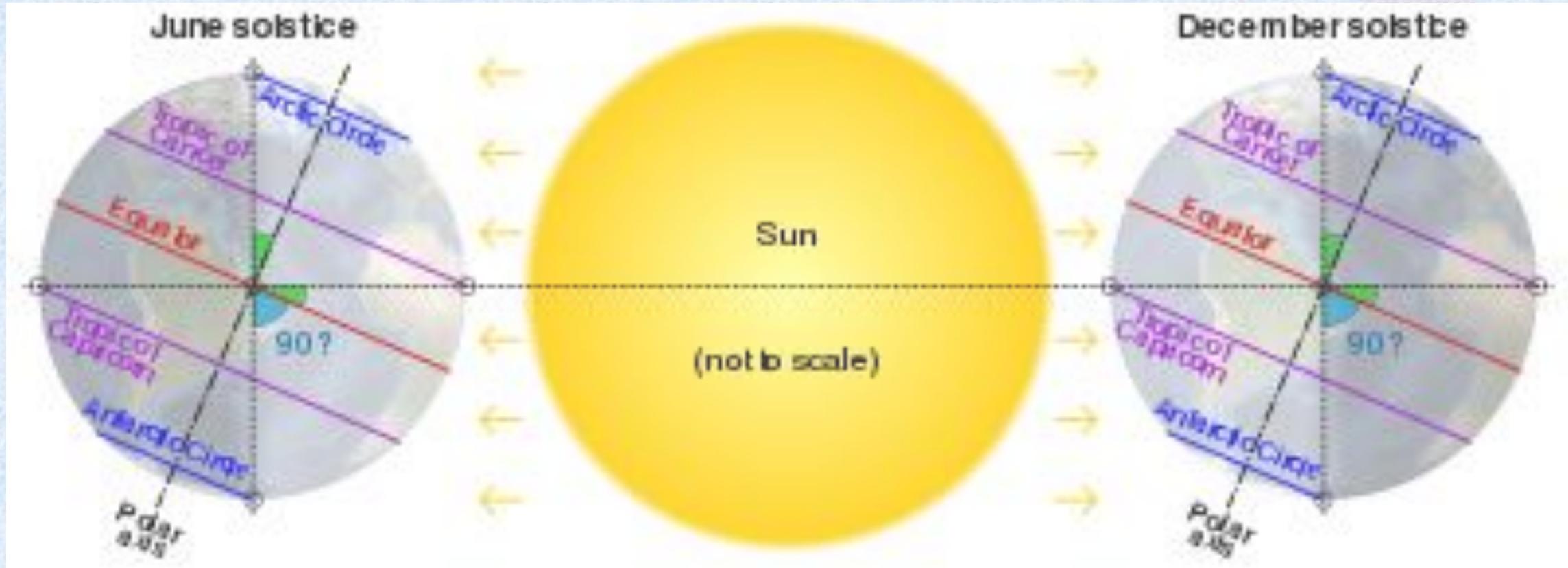


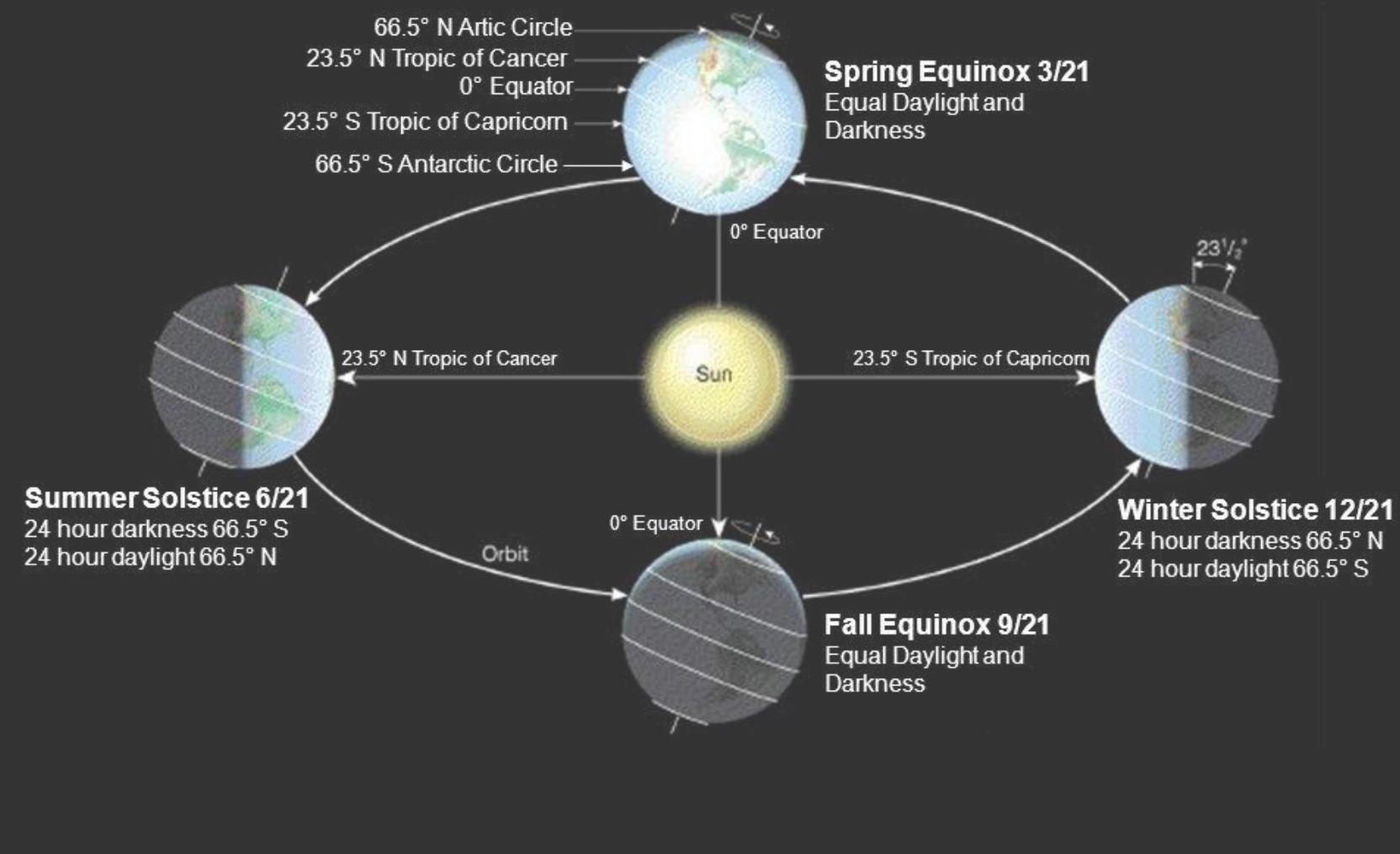
Fig. 4.3. Inclined Axis

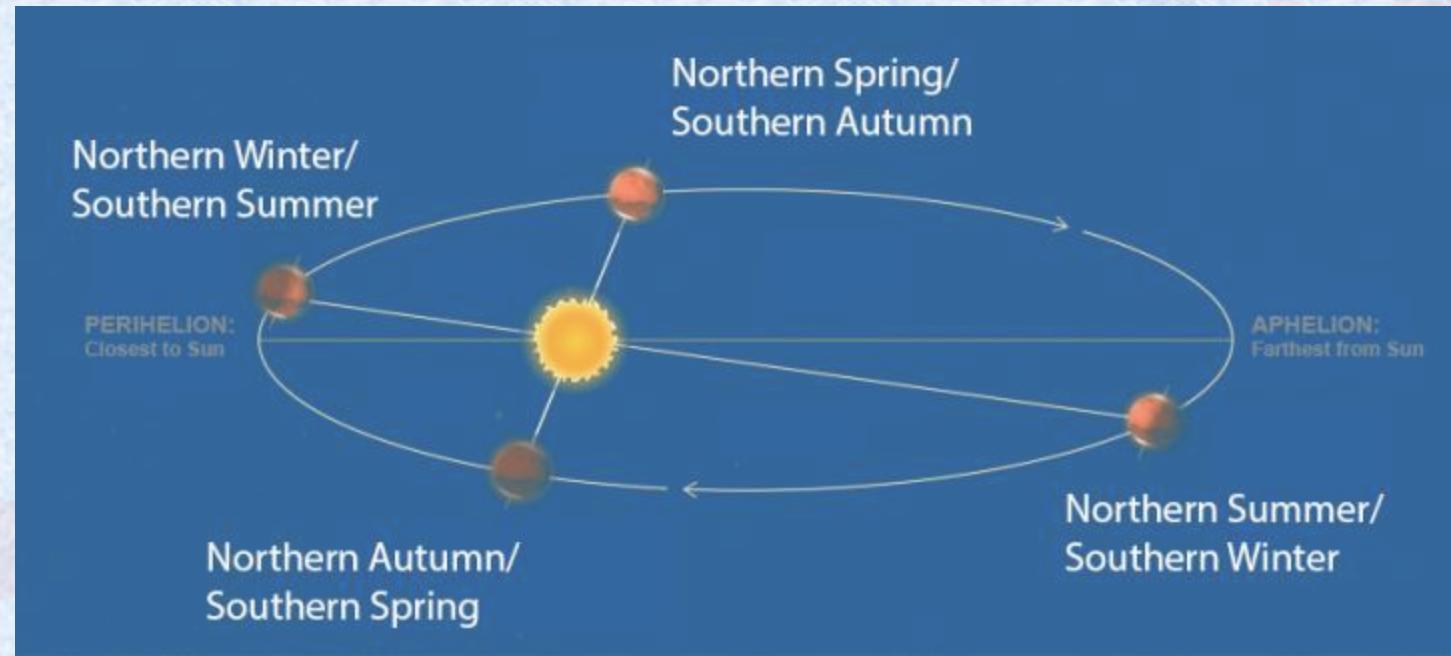
Variation of day length



Variation of day length
with seasons

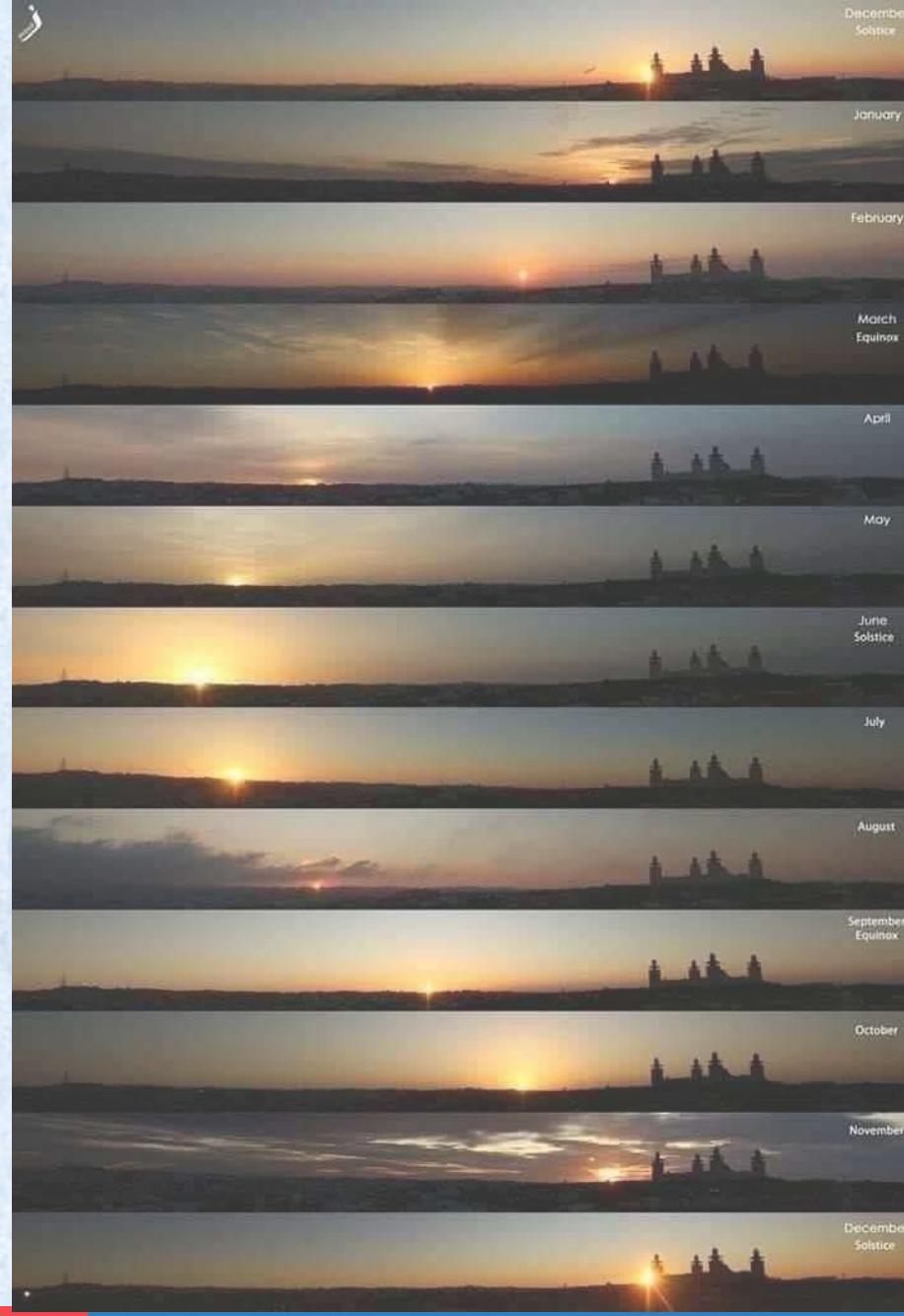
Earth Sun Relations





https://www.youtube.com/watch?v=WgHmqv_-UbQ

https://www.youtube.com/watch?v=taHTA7S_JGk



23. Solar System and Earth

2013

Variations in the length of daytime and nighttime from season to season are due to
(a) the earth's rotation on its axis.
(b) the earth's revolution round the sun in an elliptical manner.
(c) latitudinal position of the place.
(d) revolution of the earth on a tilted axis.

80.

On 21st June, the Sun

- (a)does not set below the horizon at the Arctic Circle
- (b)does not set below the horizon at Antarctic Circle
- (c)shines vertically overhead at noon on the Equator
- (d)shines vertically overhead at the Tropic of Capricorn

Time Zones

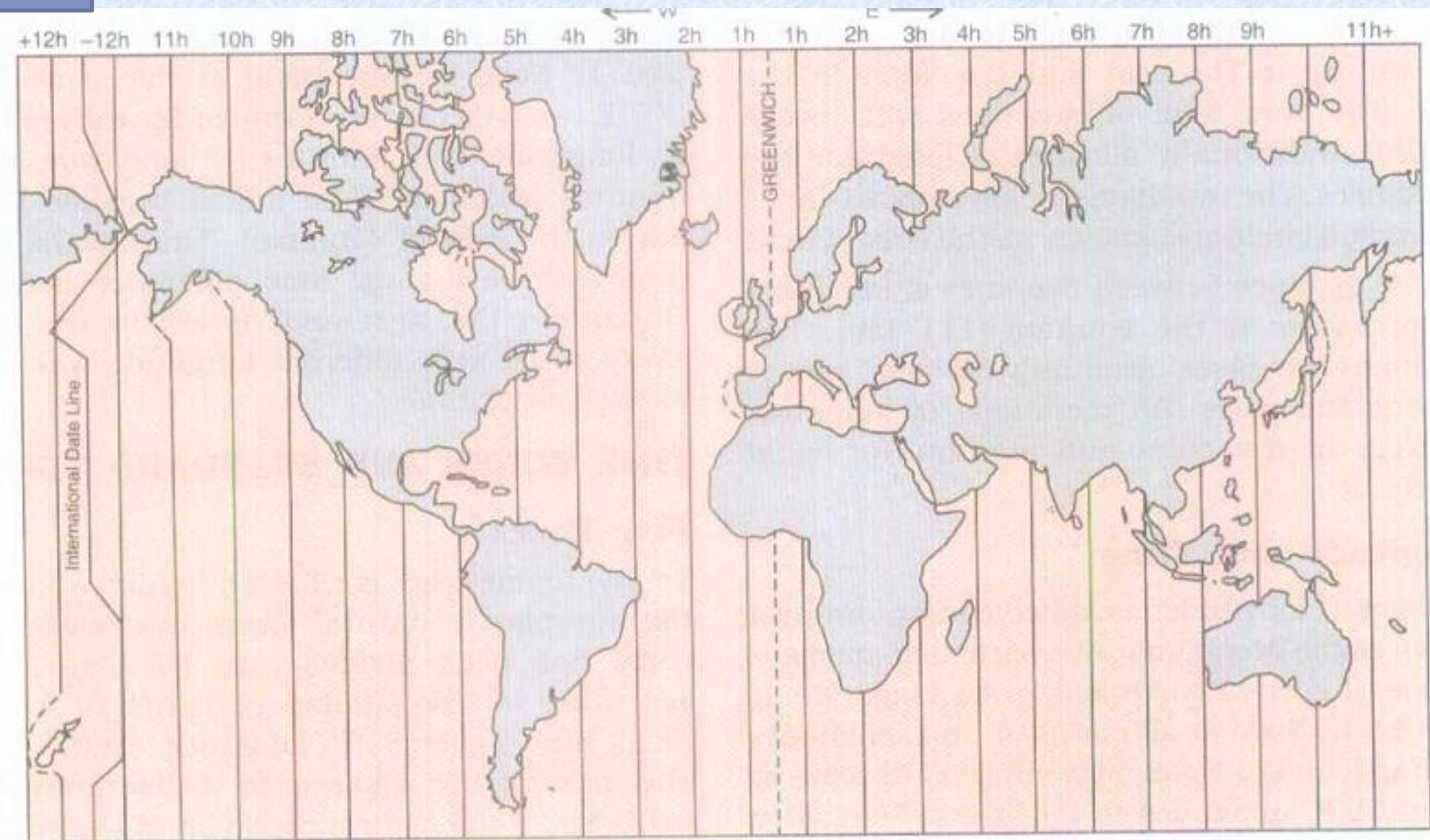
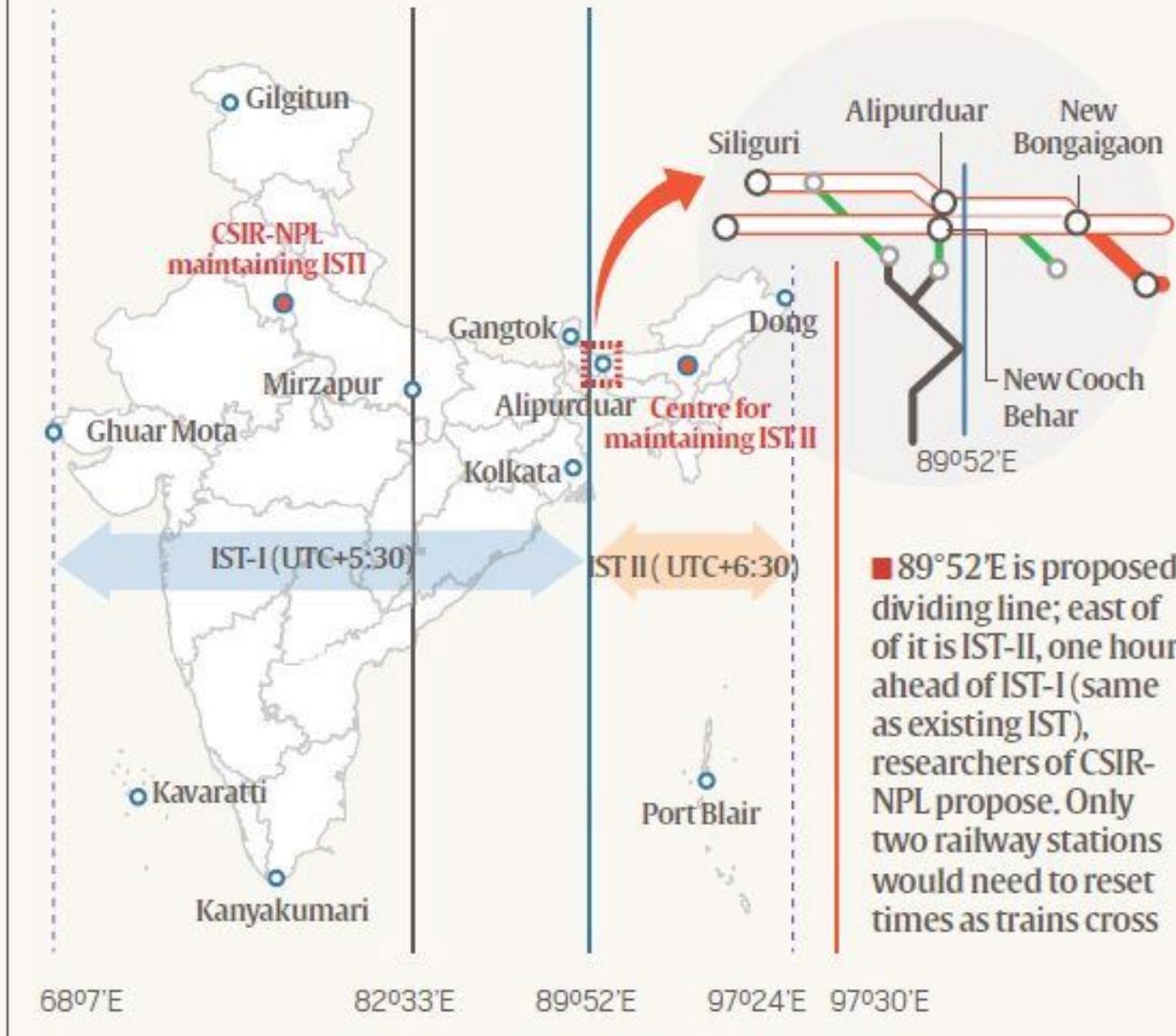


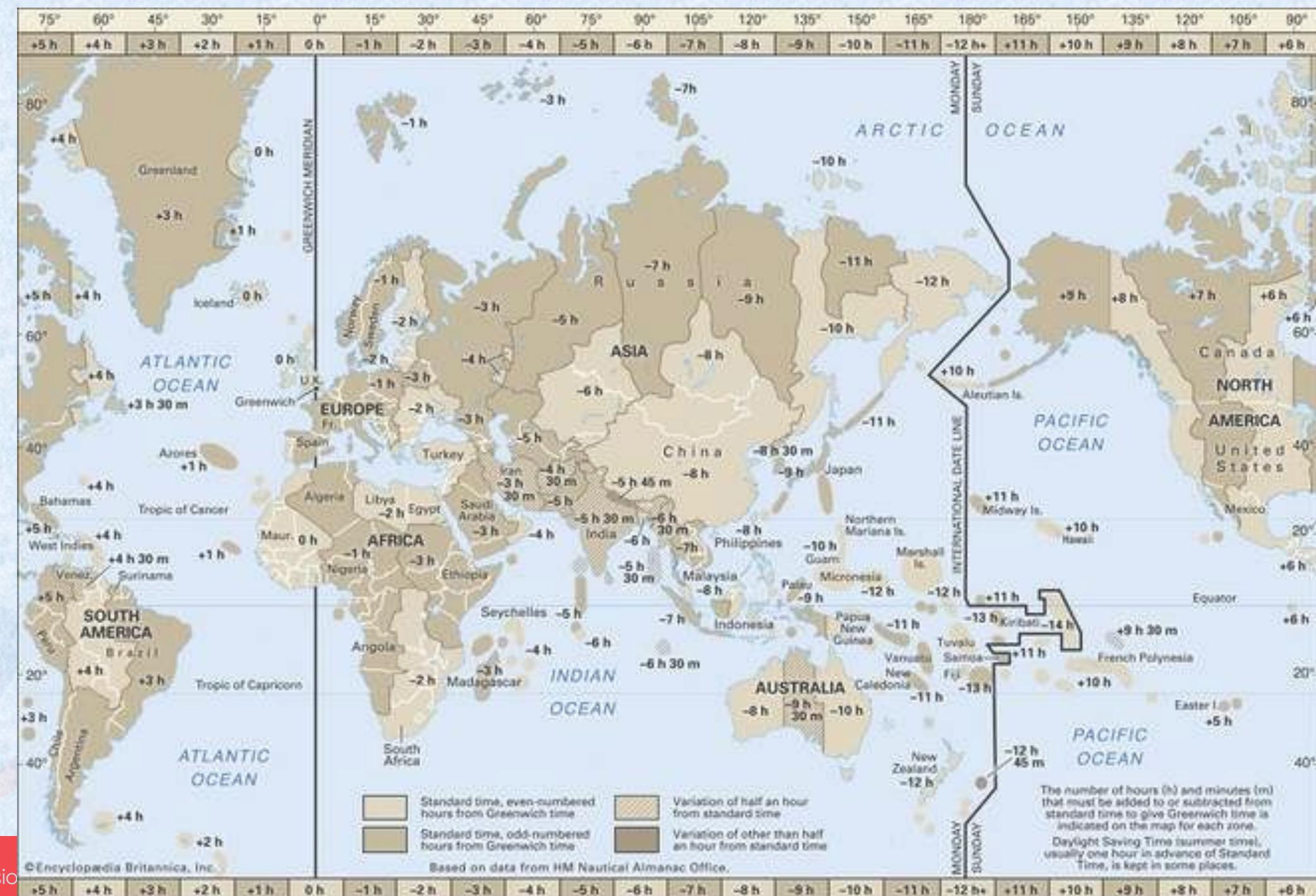
Fig. 3.8. International Date Line

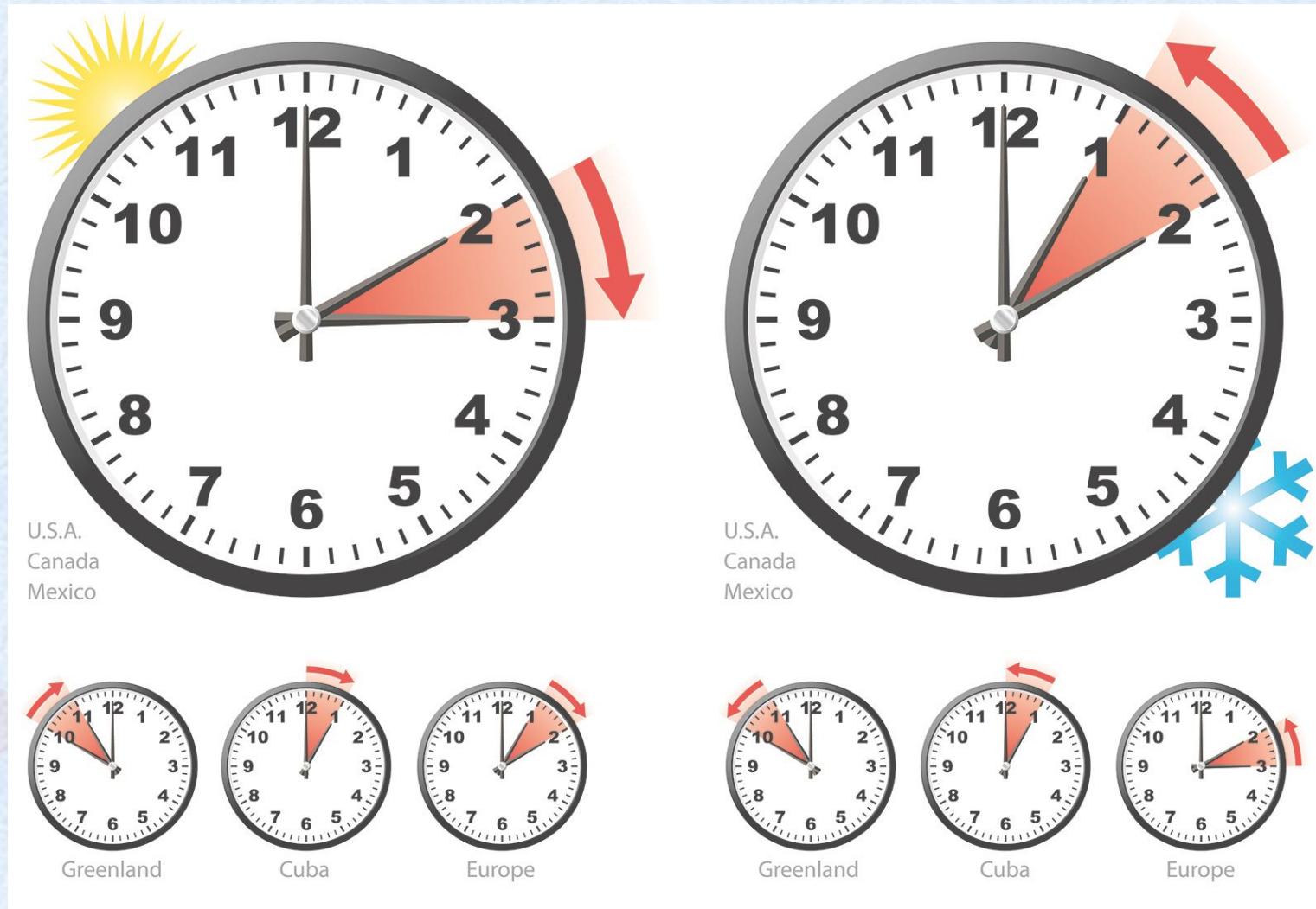


DIVISION AT 'CHICKEN NECK'



International Date Line





Questions??

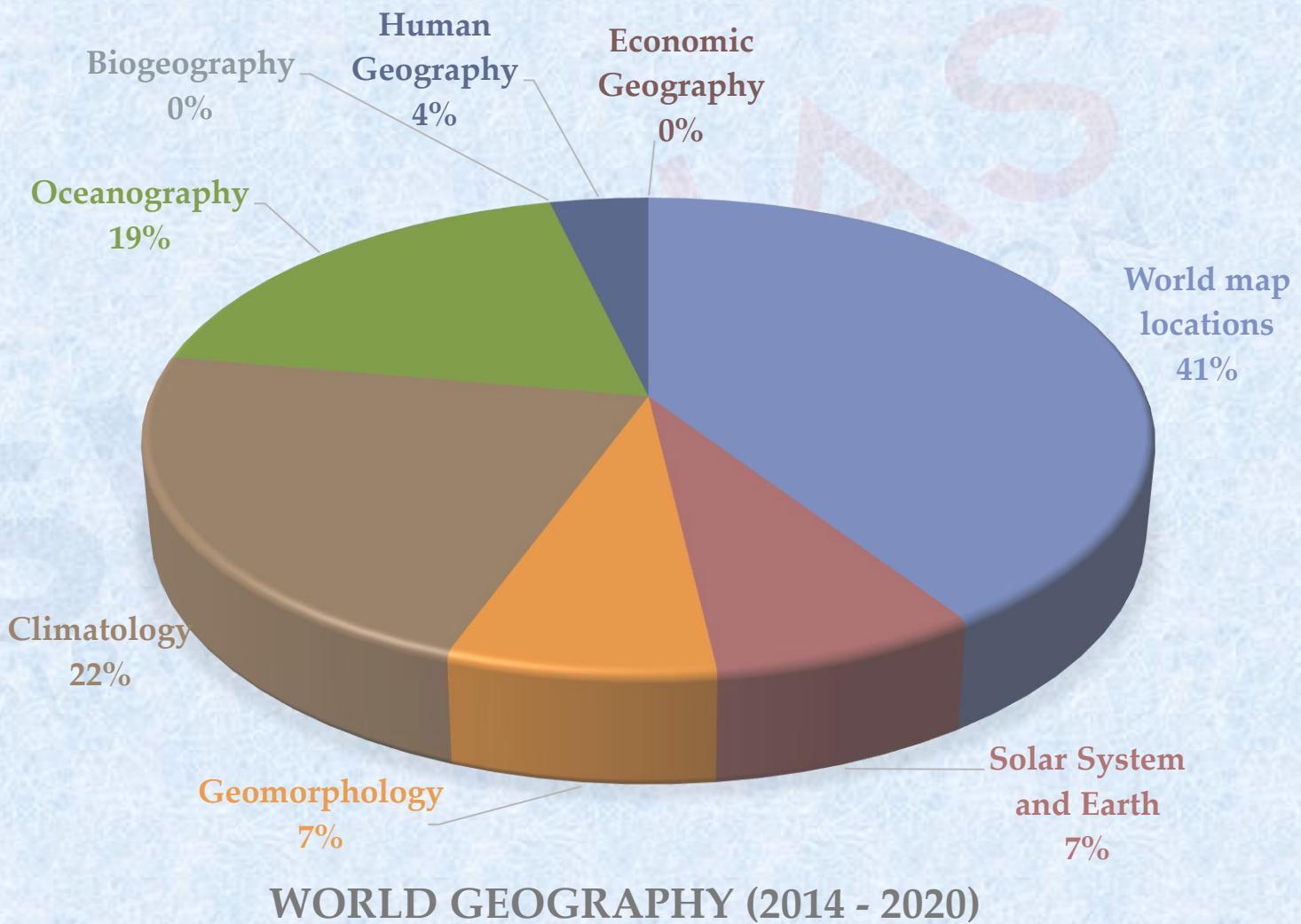


- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

Topic	Number of questions
World map locations	11
Solar System and Earth	2
Geomorphology	2
Climatology	6
Oceanography	5
Biogeography	0
Human Geography	1
Economic Geography	0
Total	27



Earth, Solar System And Universe

Shape of earth

Latitudes & Longitudes

Rotation & Revolution

Seasons

Time zones and IDL

Universe and Origin of universe

Life cycle of a star

Galaxies and stars

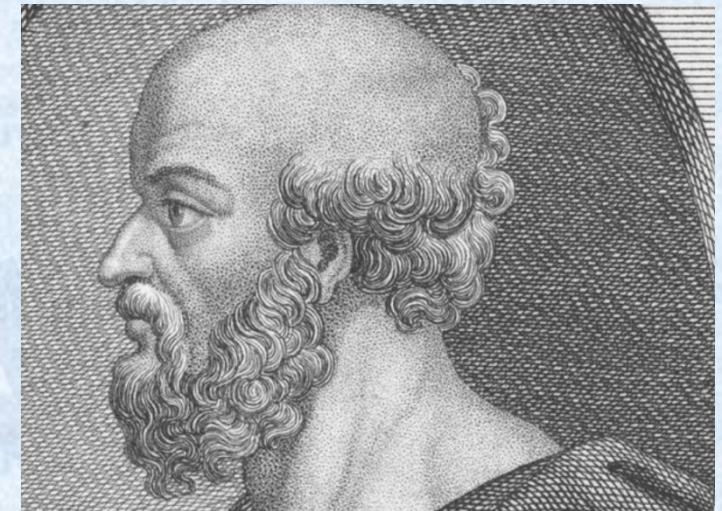
Origin of solar system

Sun

Planets, satellites and other bodies

Eclipses

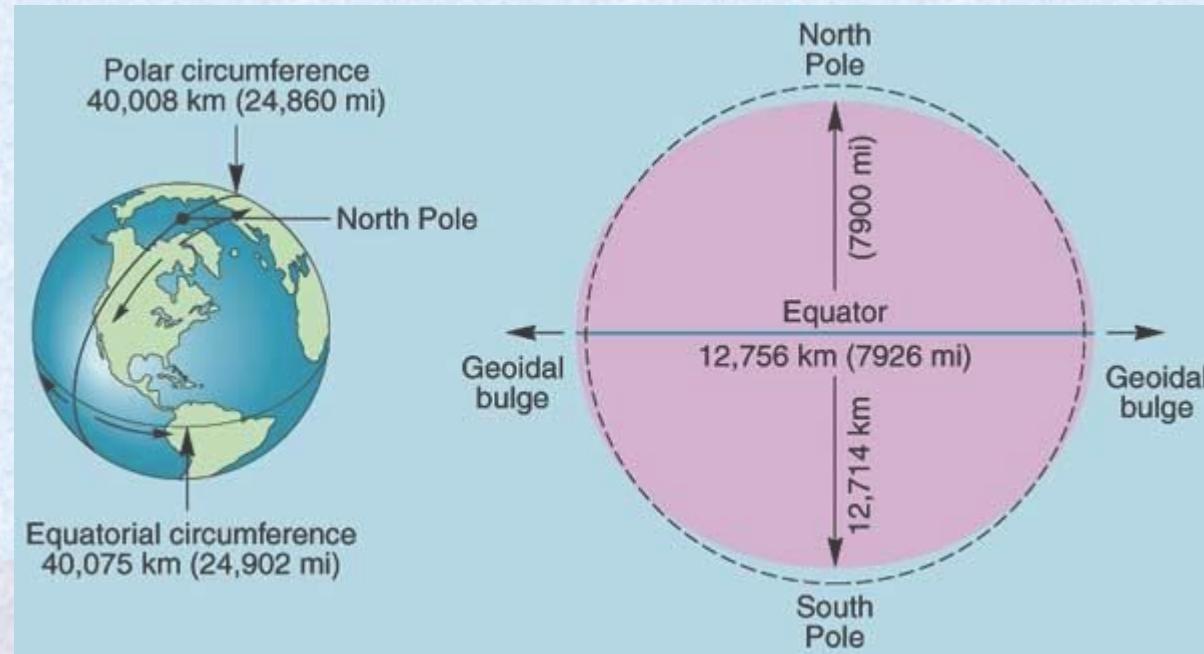
What is Geography?



Erastosthenes

Father of Geography

Shape of the Earth



Geoid

Shape of the Earth

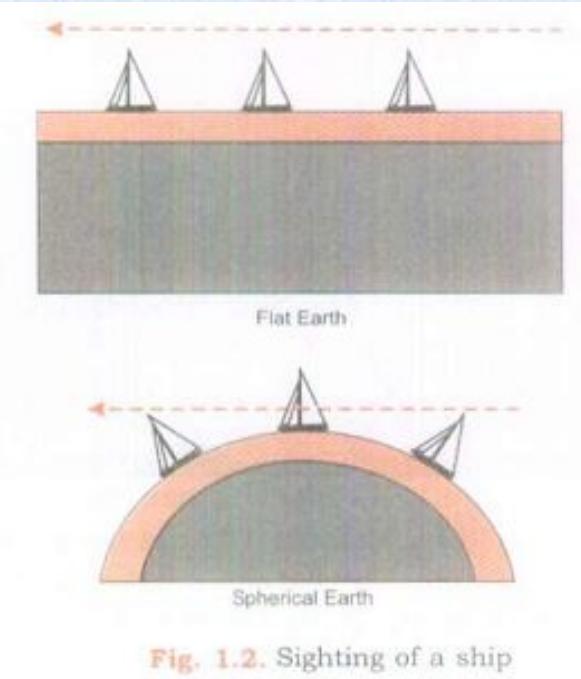
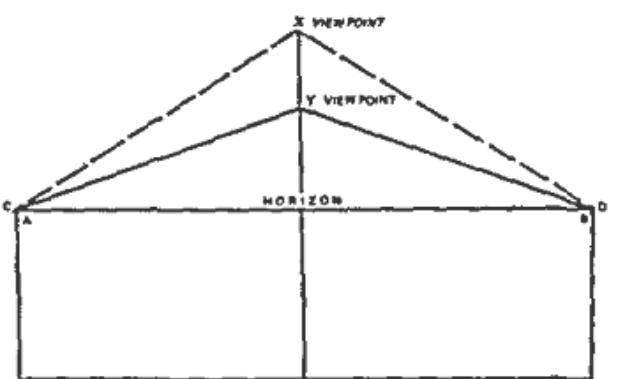
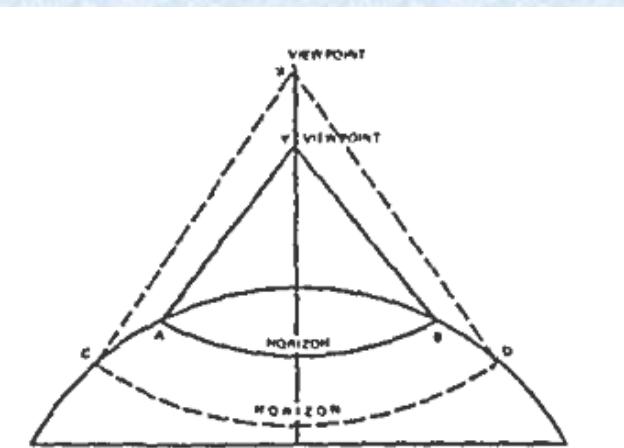


Fig. 1.2. Sighting of a ship

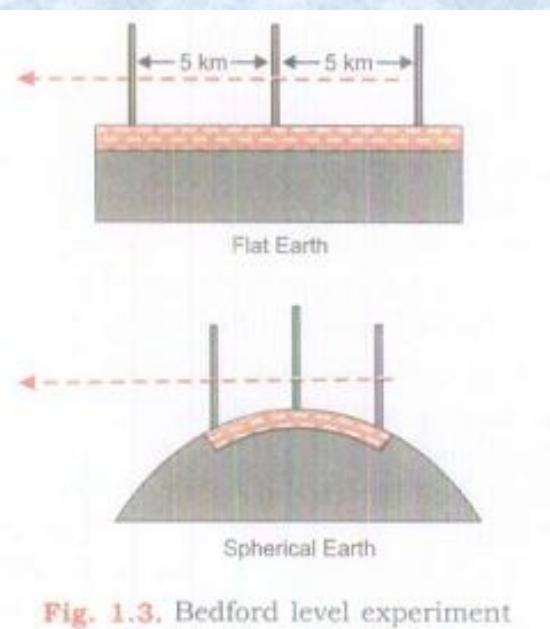
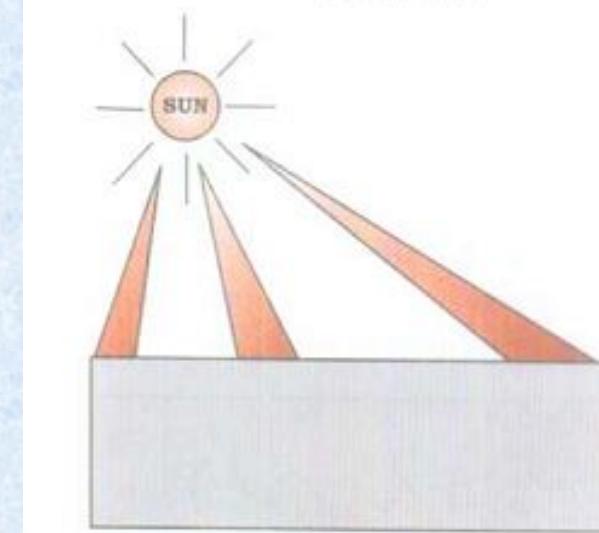
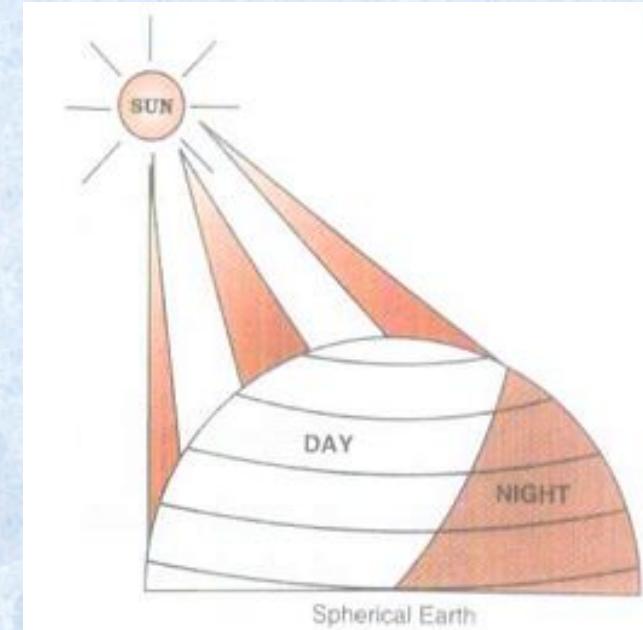
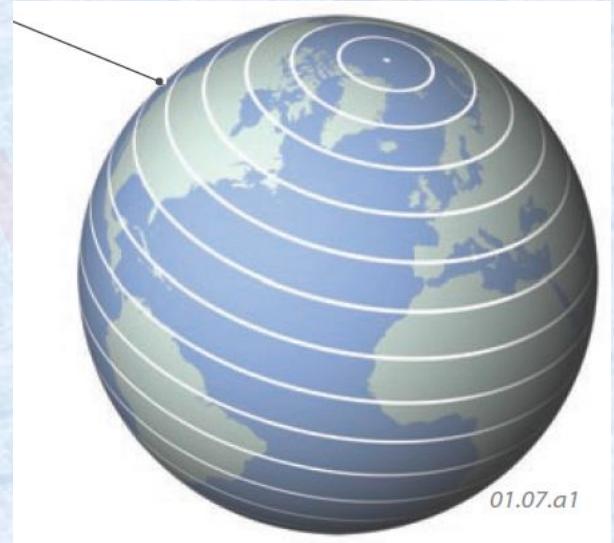
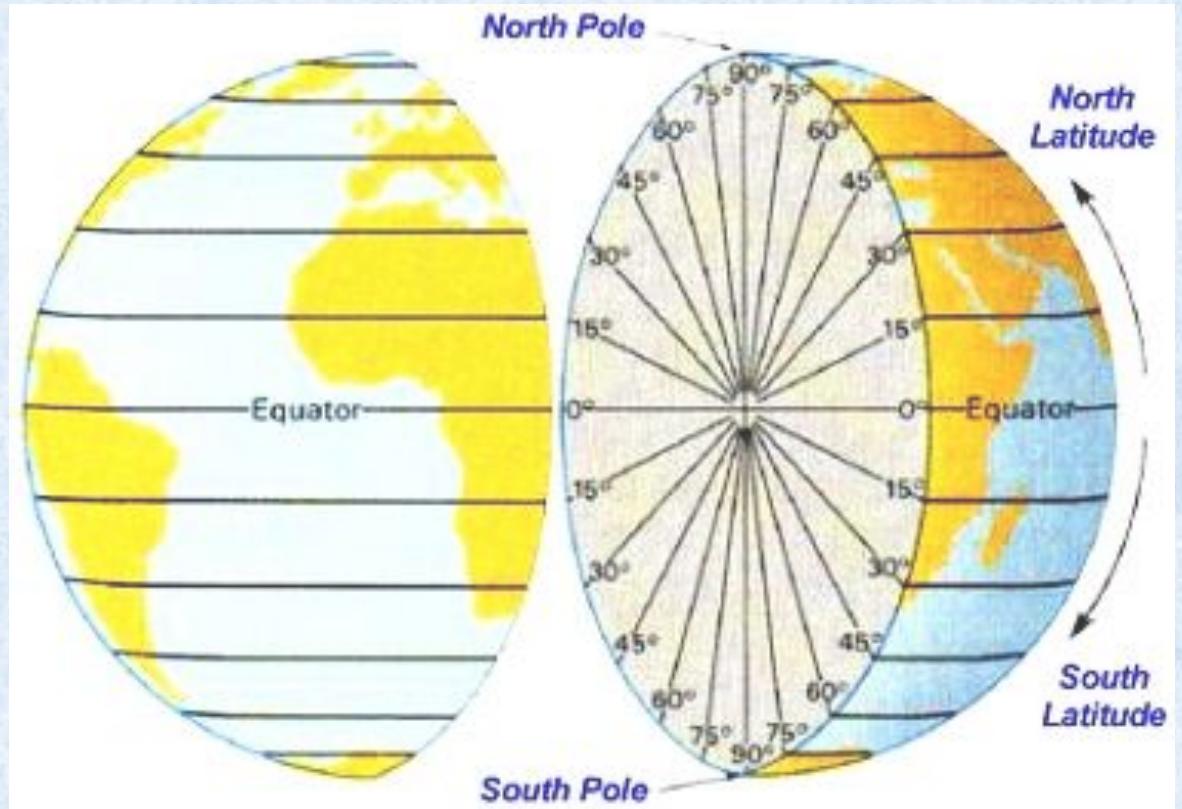


Fig. 1.3. Bedford level experiment

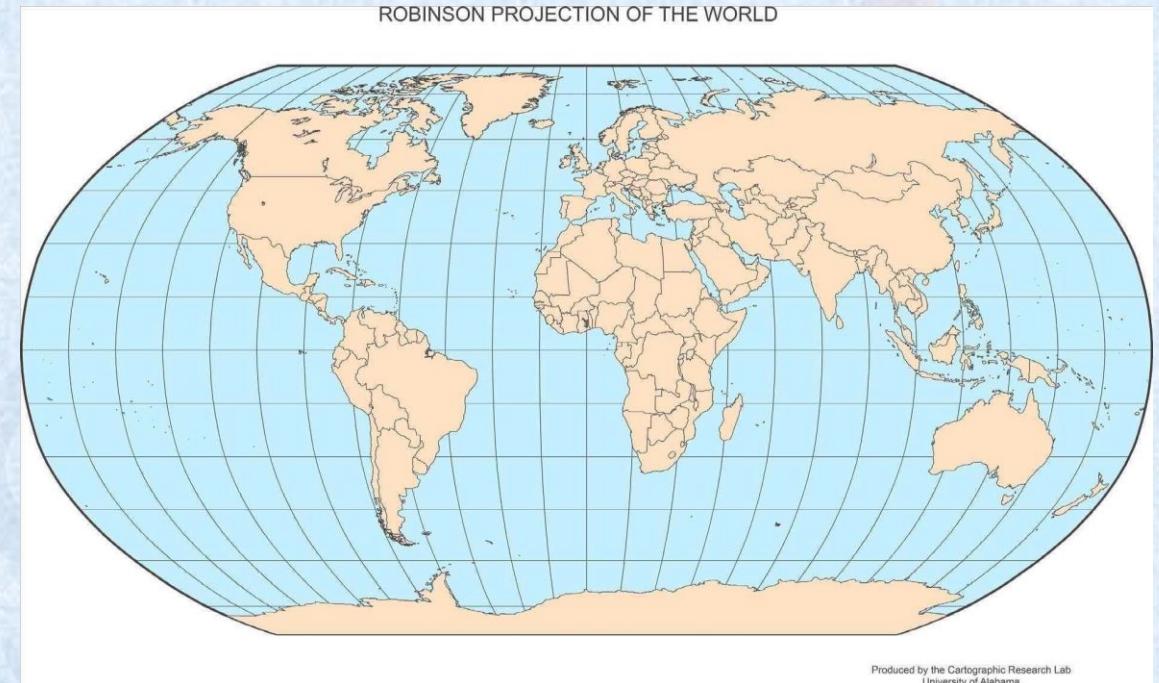
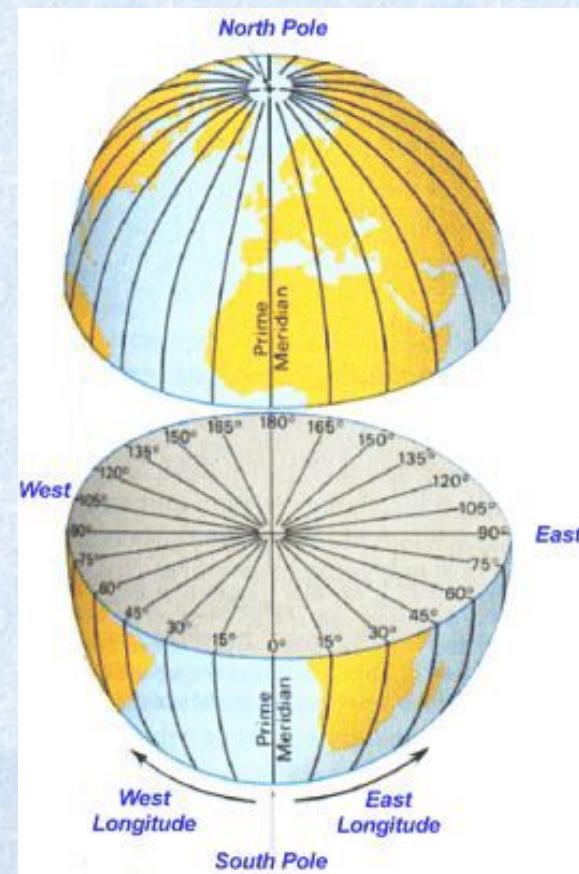


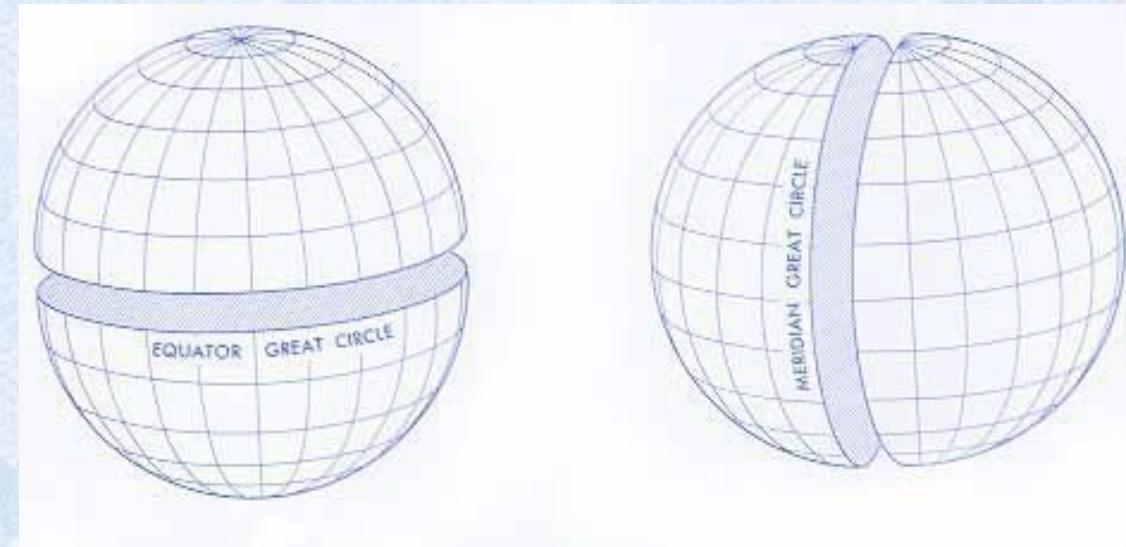
g. 1.8. Sunrise and Sunset occurs at different times at different places

Latitudes and Longitudes



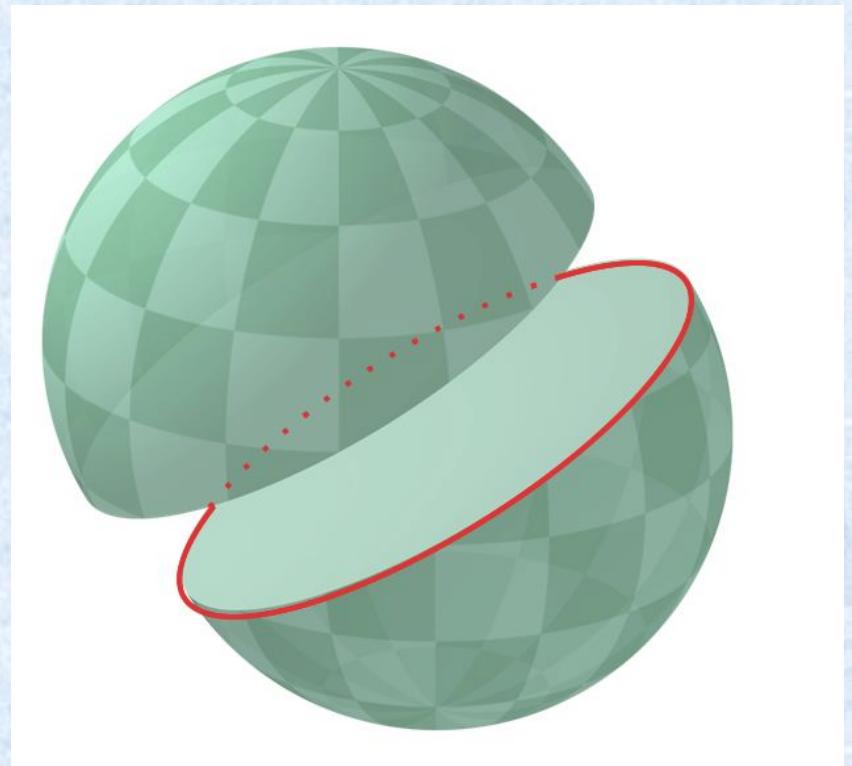
Latitudes and Longitudes



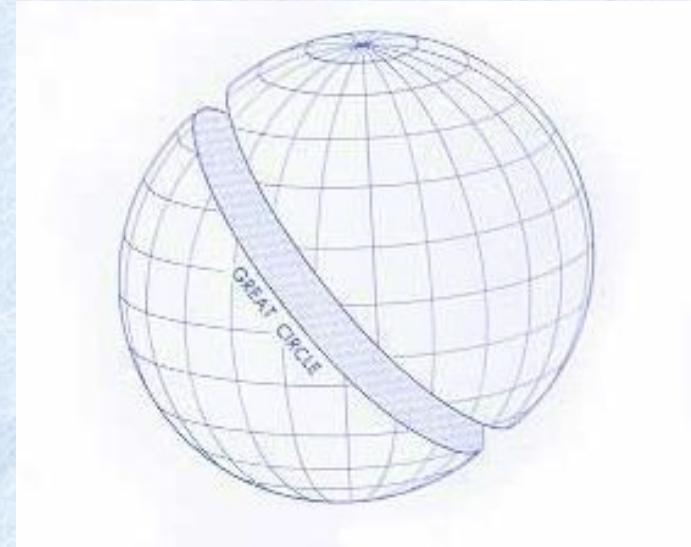


Great Circle

Latitudes and Longitudes



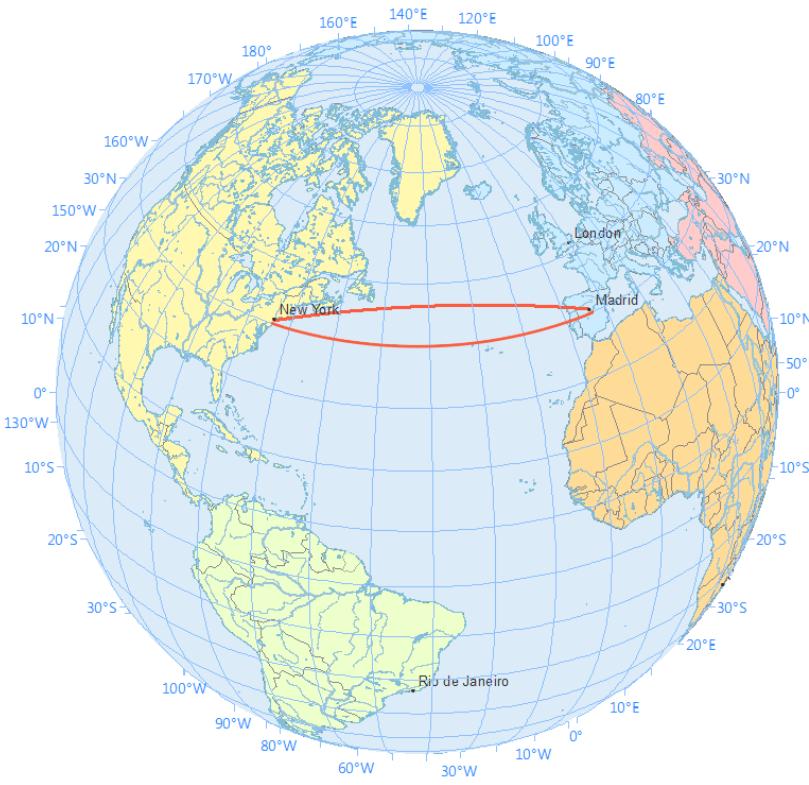
Great Circle



Latitudes and Longitudes



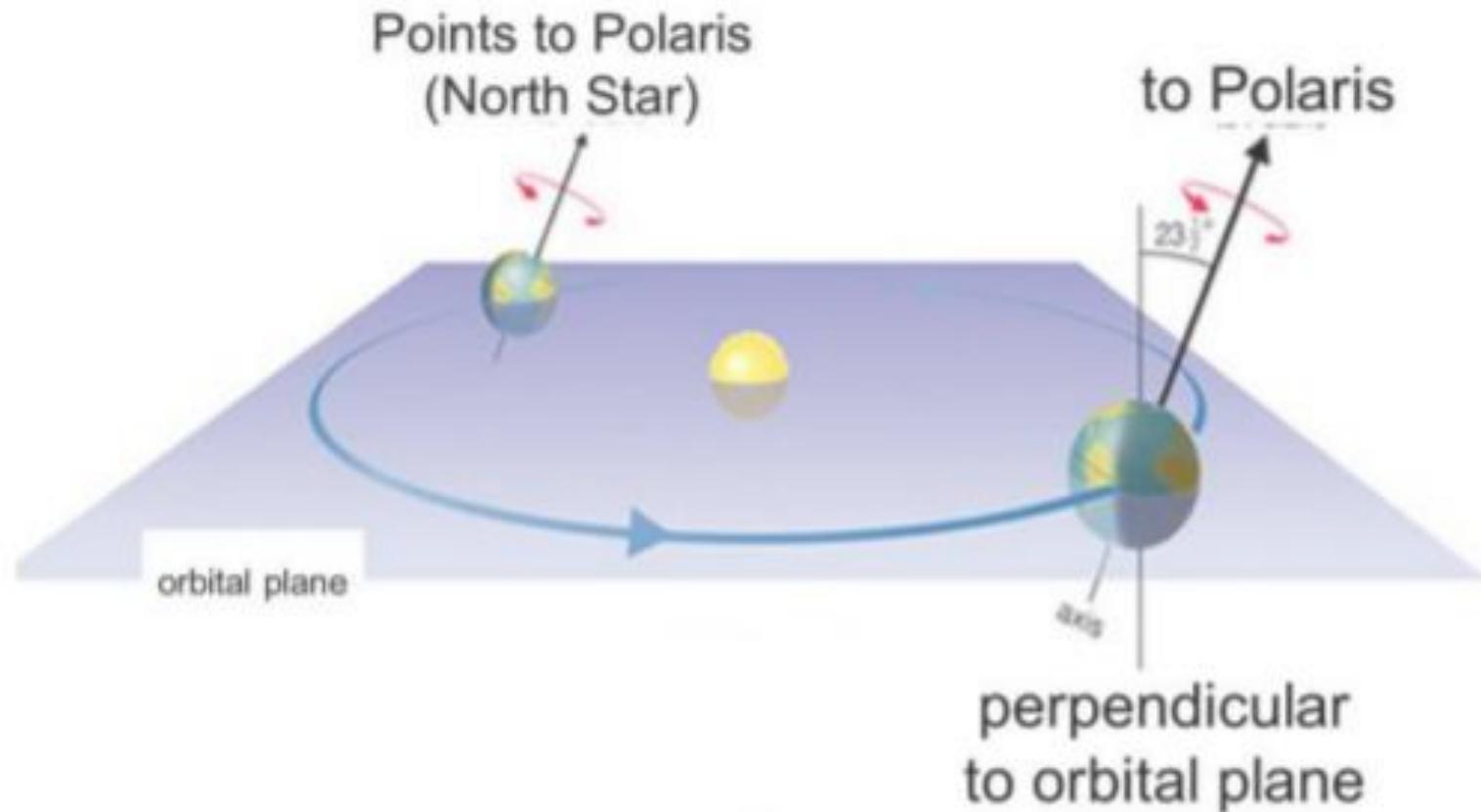
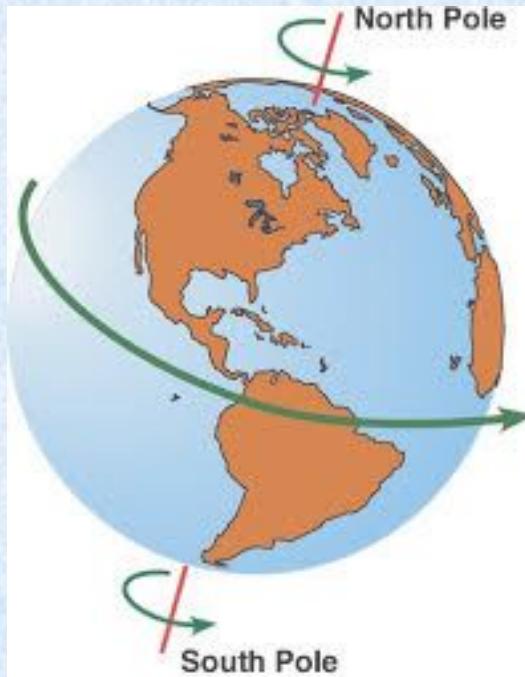
Latitudes and Longitudes



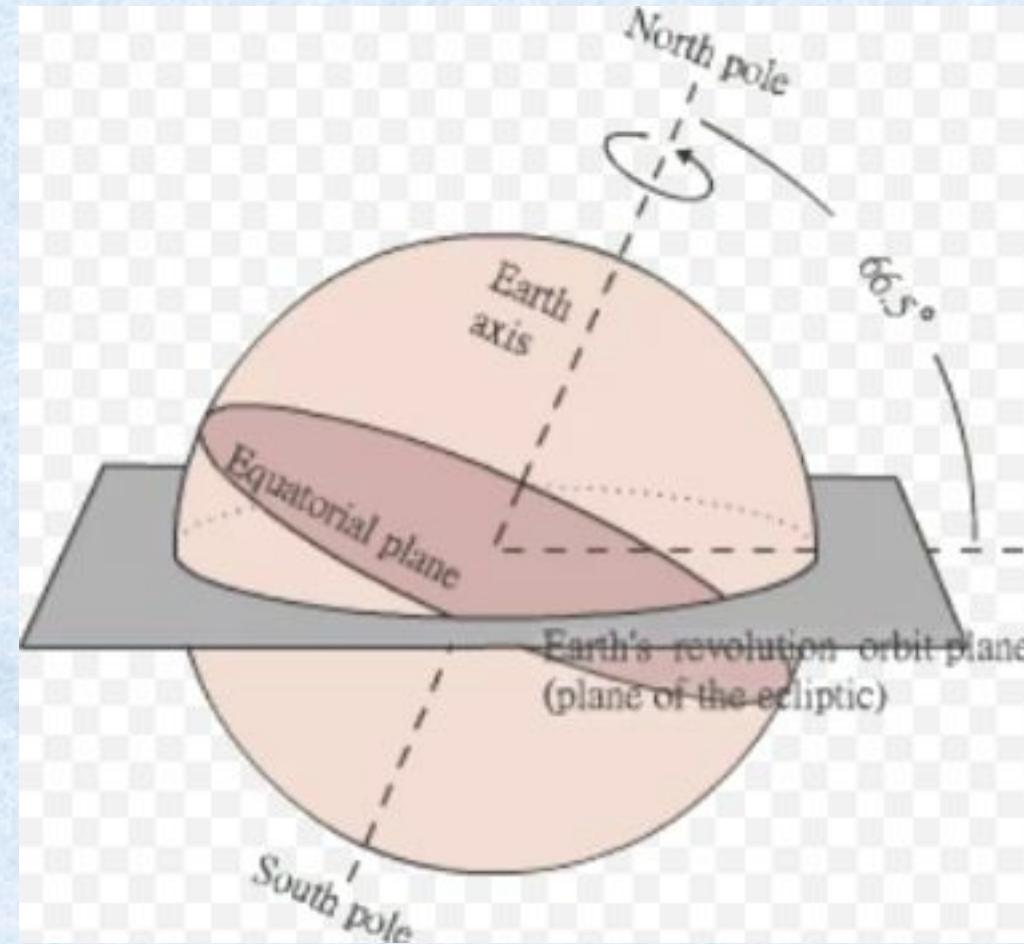
Great Circle in
measuring shortest
distance



Earth's Orbital Plane

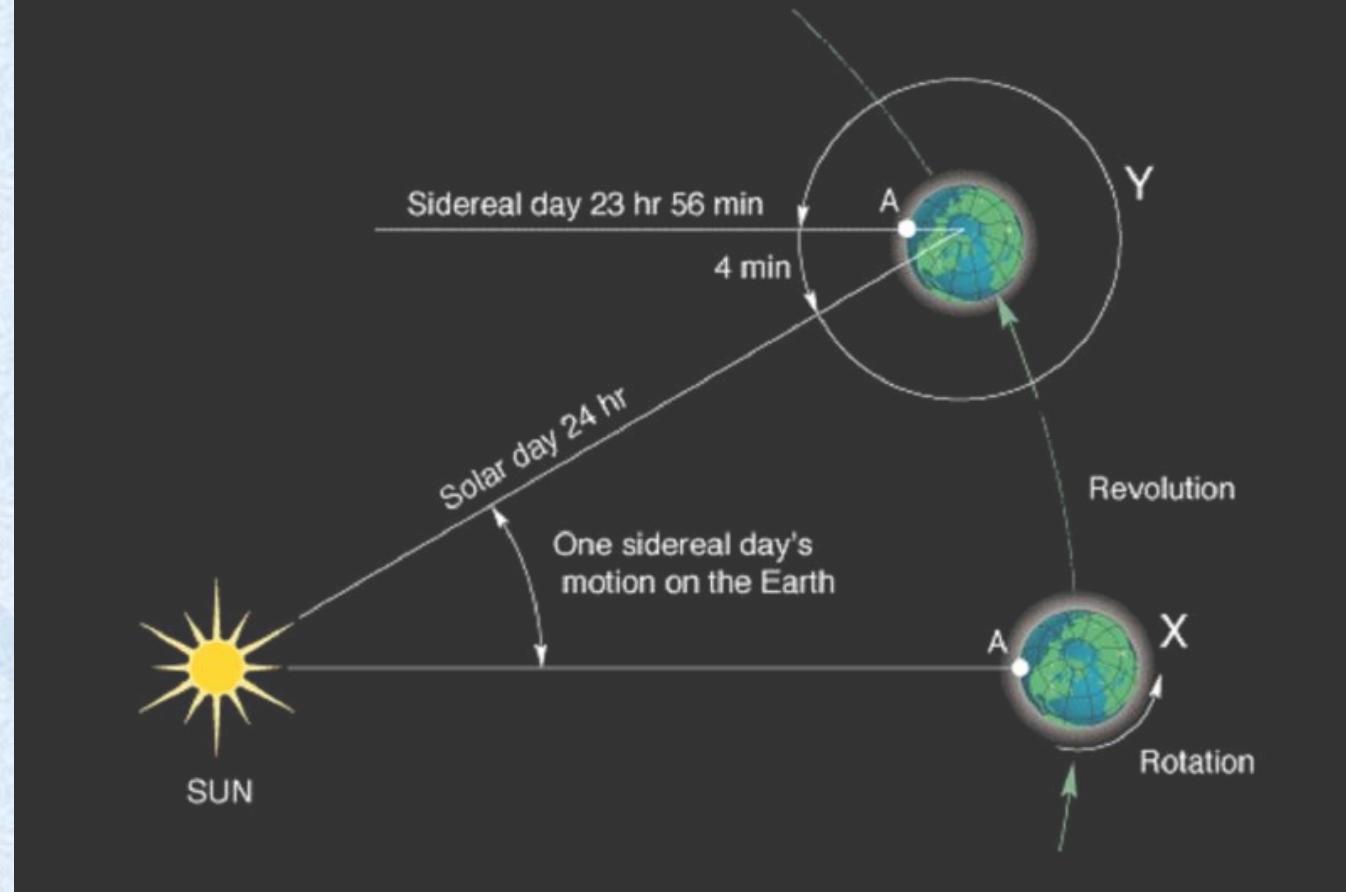


Axis of rotation and Orbital plane



Axis of rotation and Orbital plane

Sidereal Day vs. Solar Day

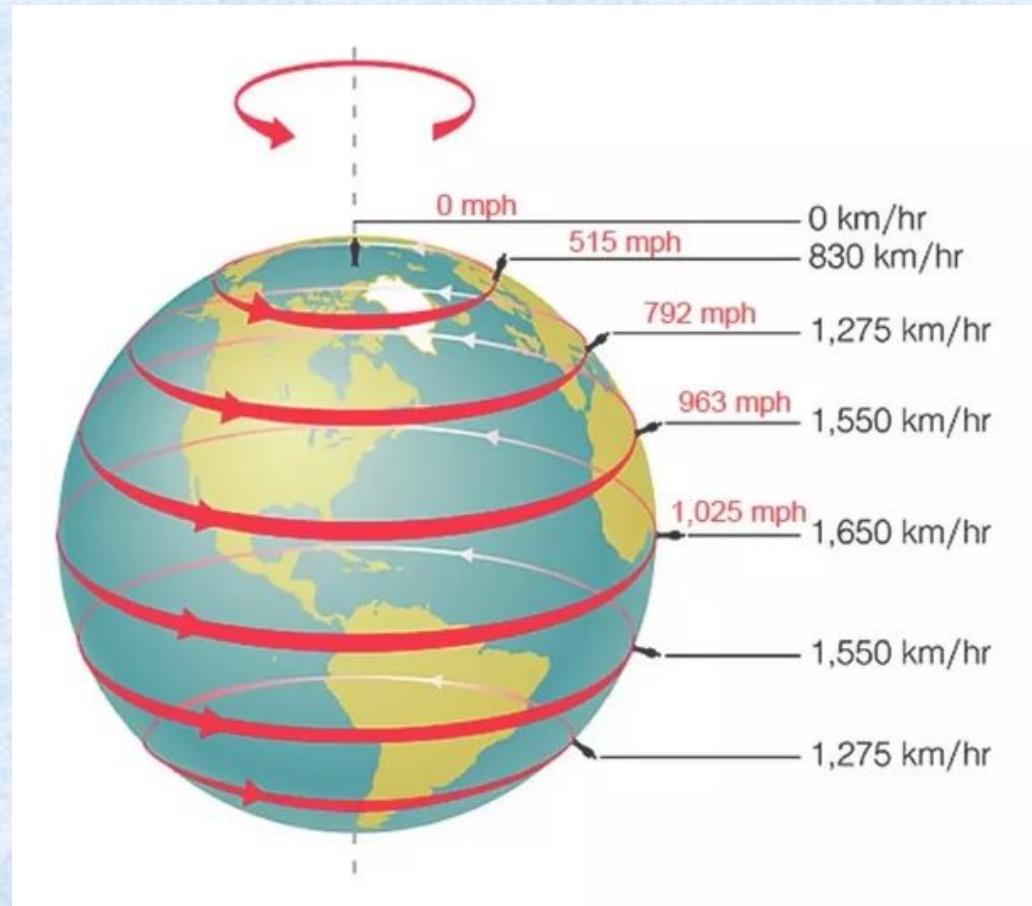


Solar day & Sidereal day

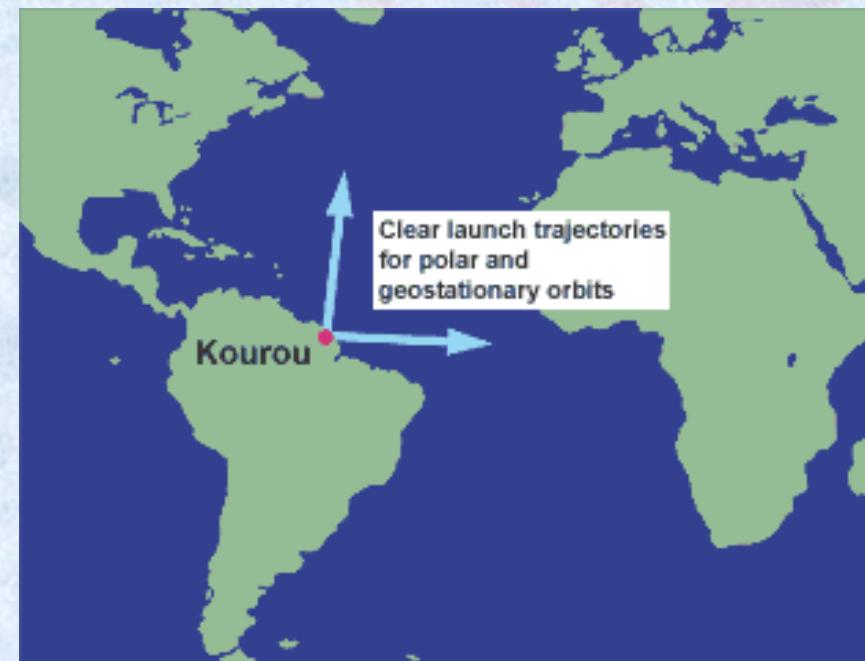
<https://www.youtube.com/watch?v=1wGFJd3j3ds>

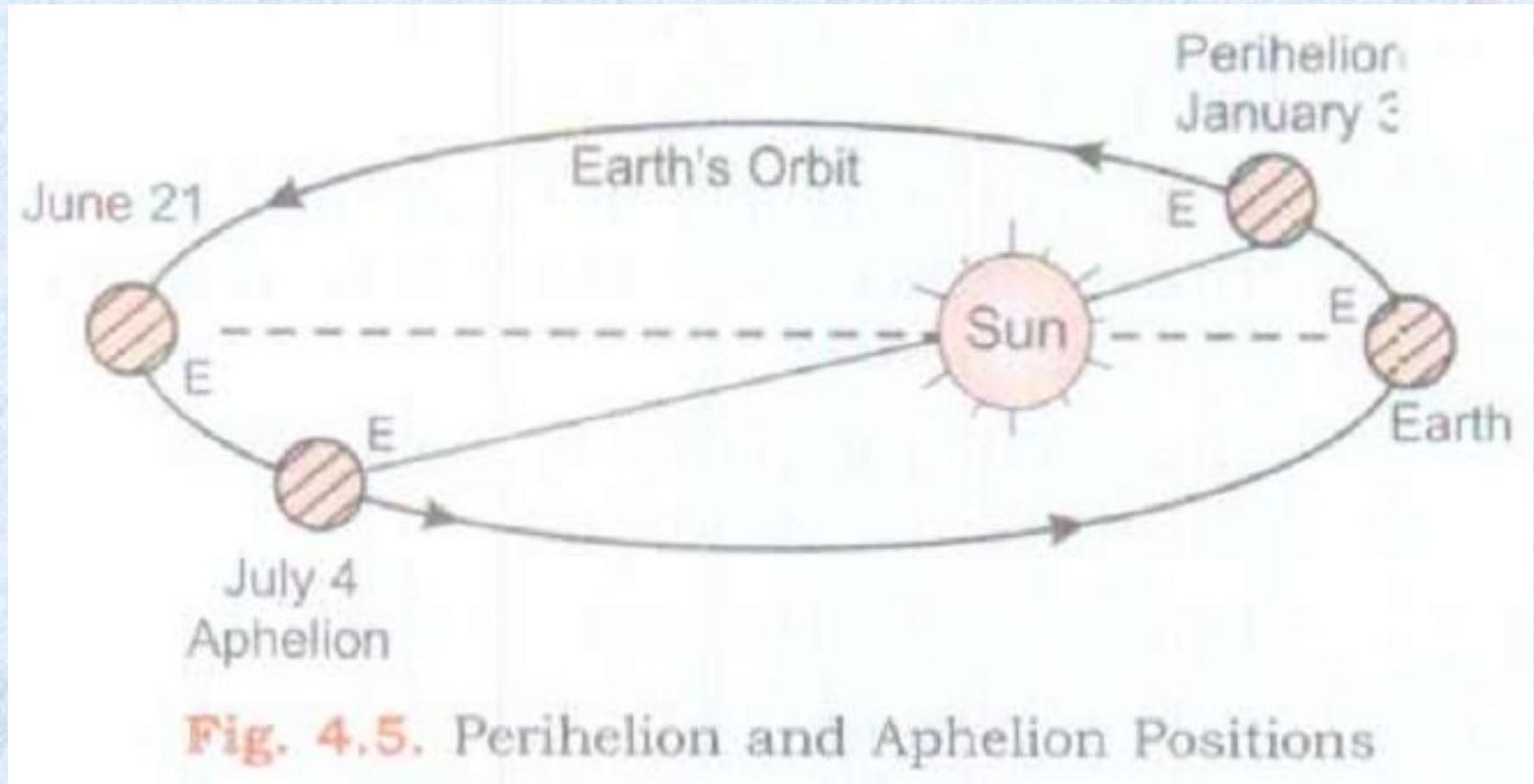
Solar day & Sidereal day

Rotation and Revolution



Linear speed of rotation





Revolution of Earth

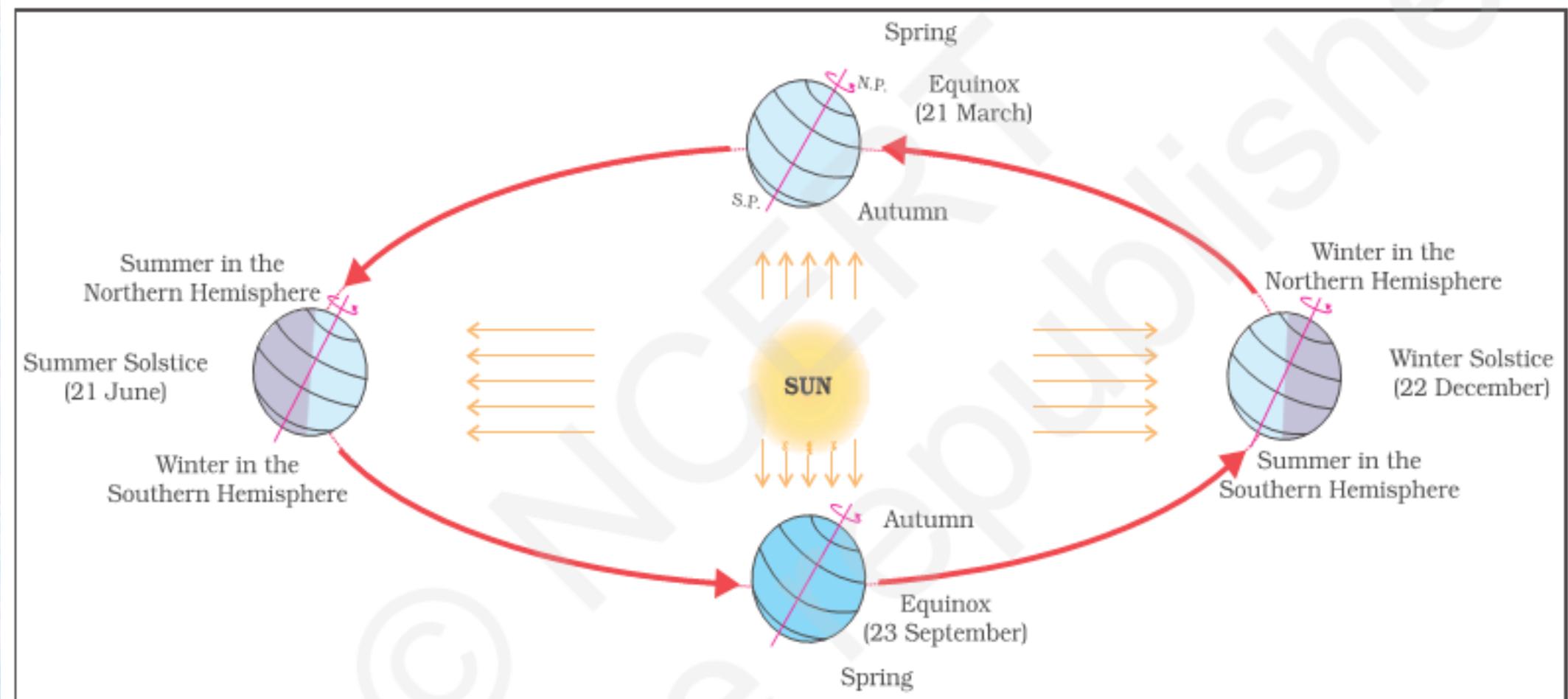
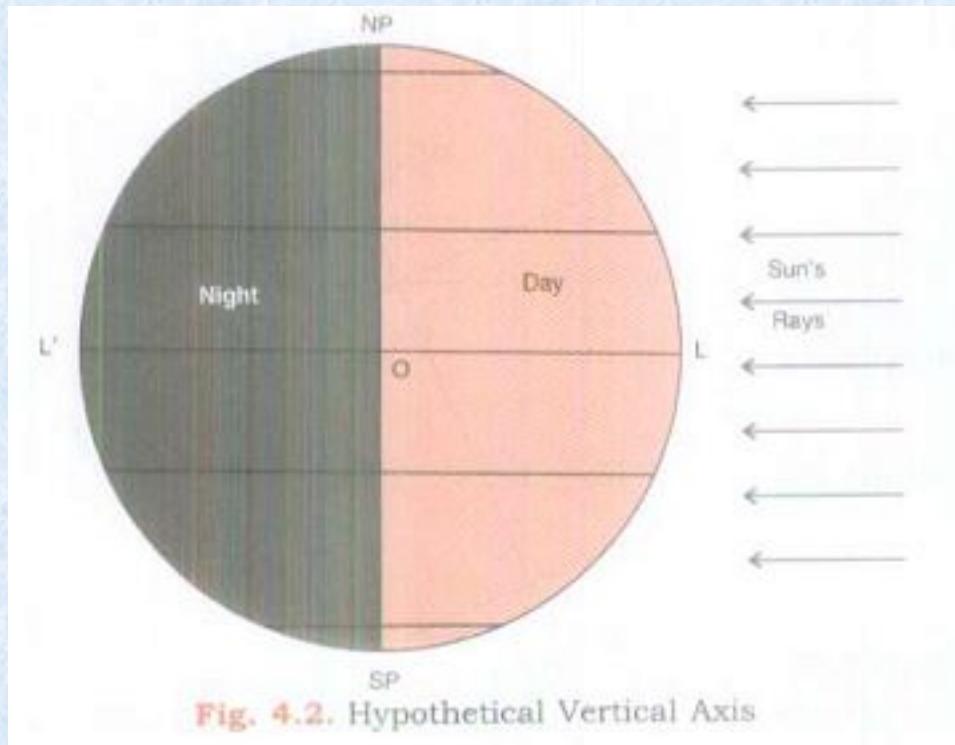
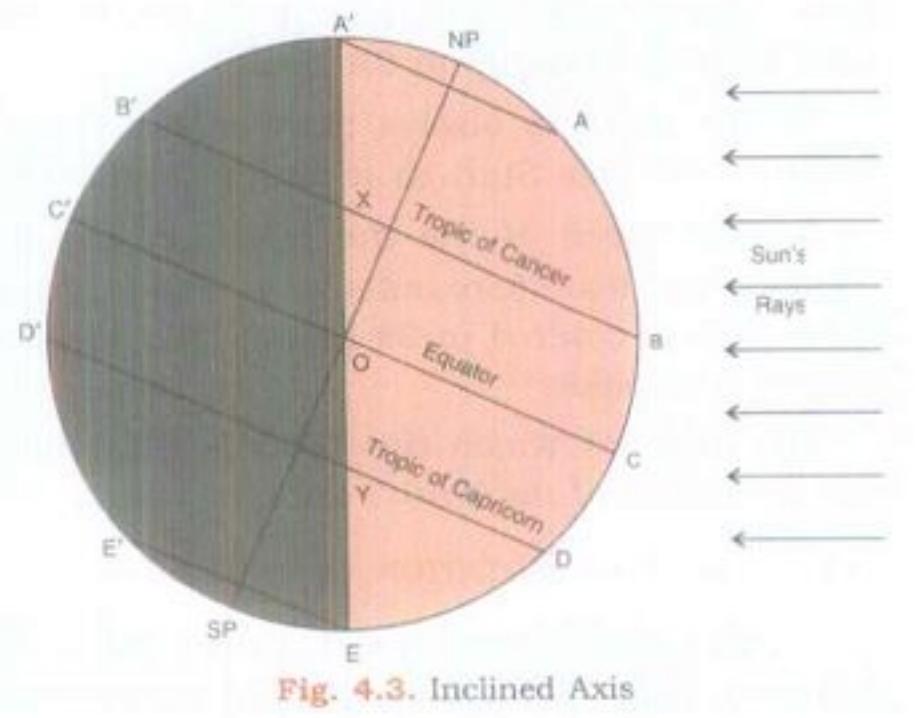
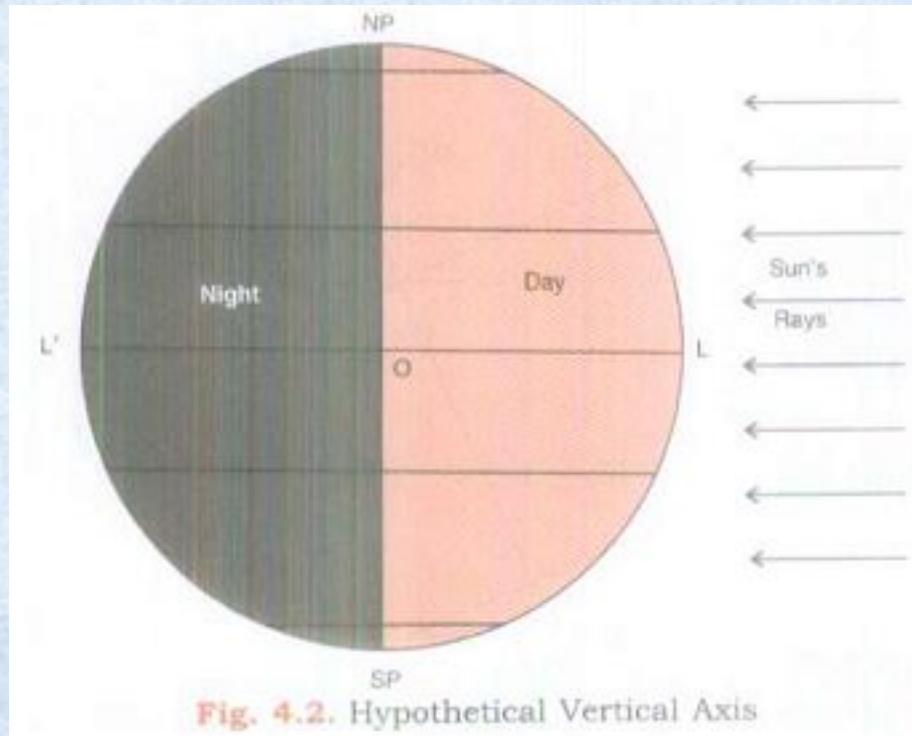


Figure 3.3 : Revolution of the Earth and Seasons

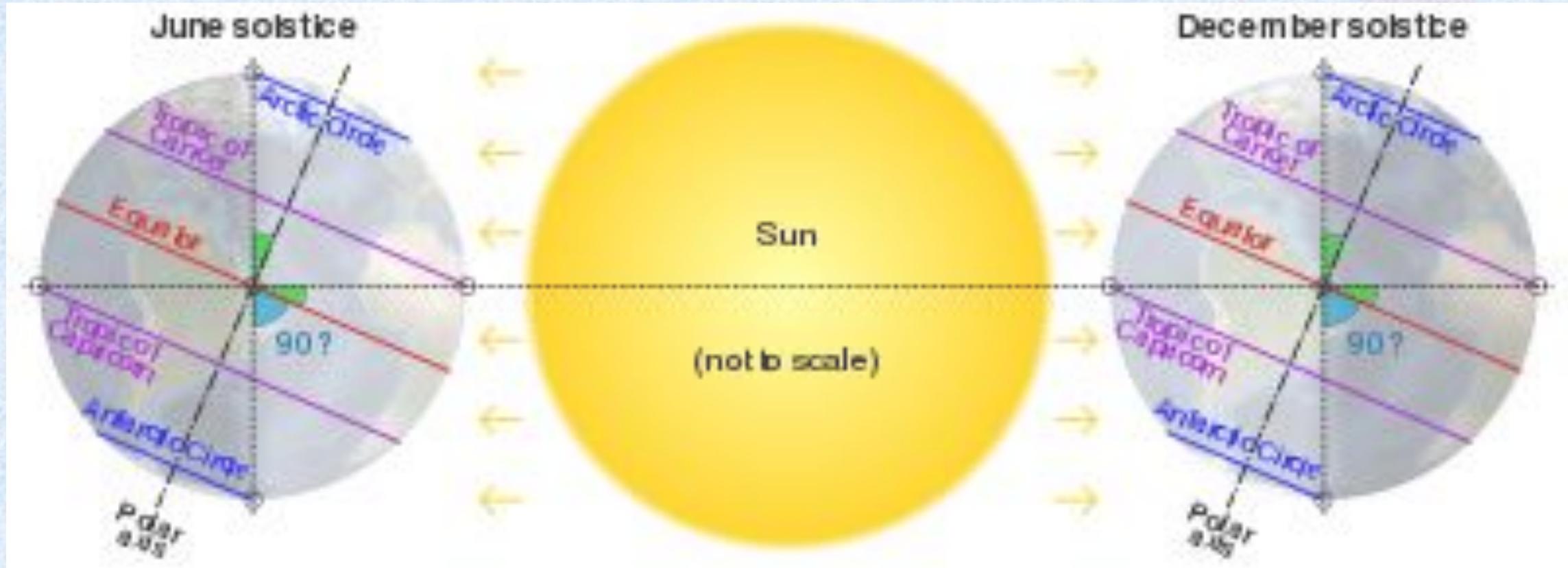
Revolution with constant
tilted axis



Circle of illumination

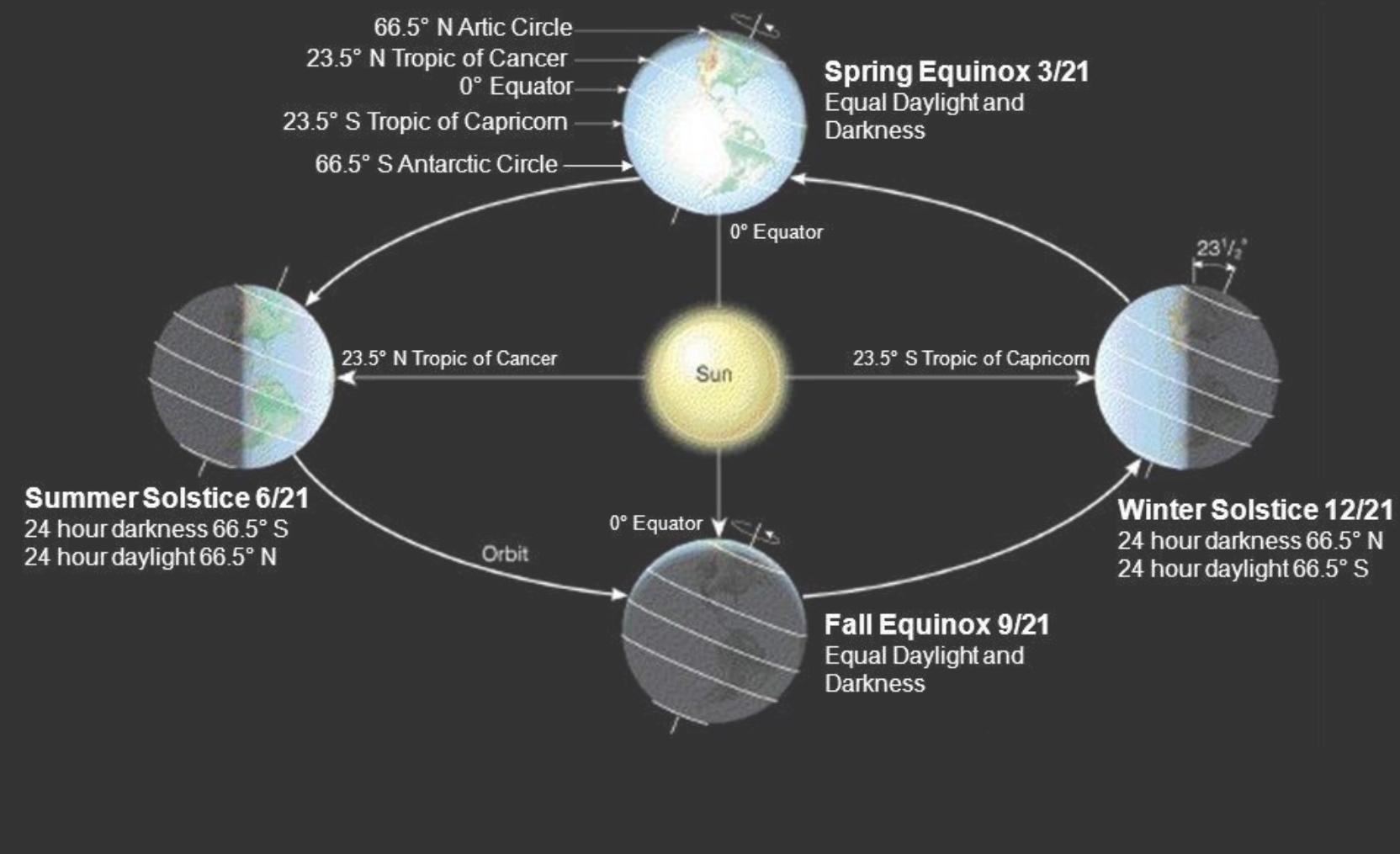


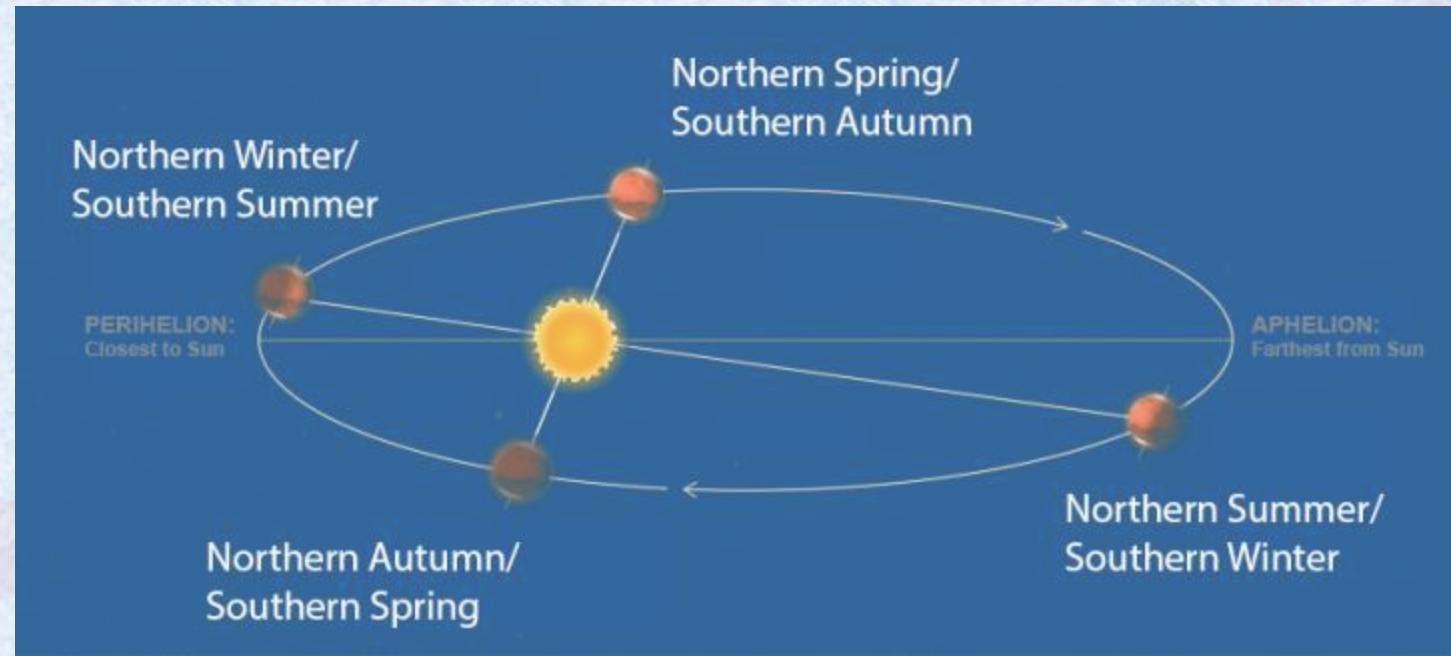
Variation of day length



Variation of day length
with seasons

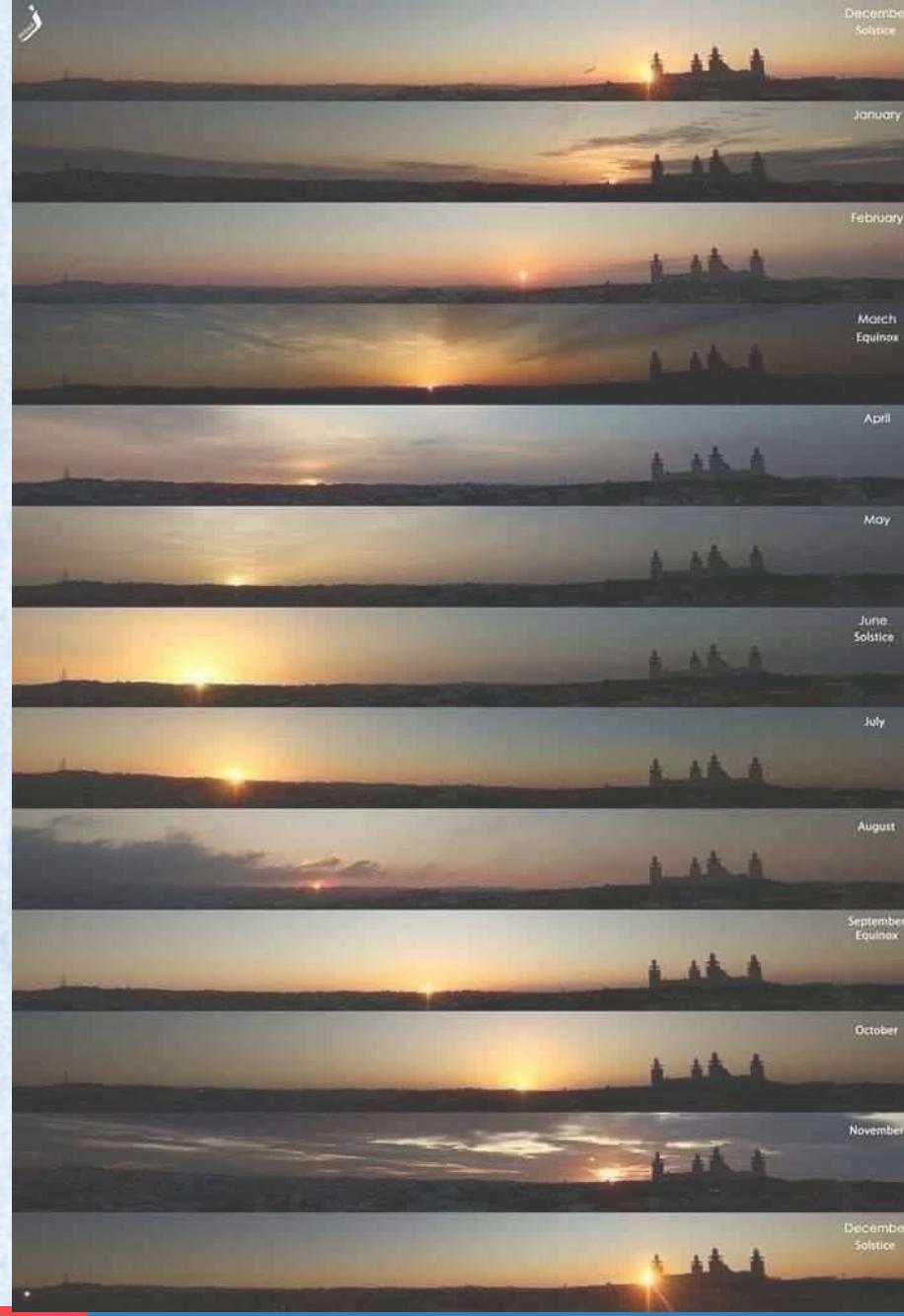
Earth Sun Relations





https://www.youtube.com/watch?v=WgHmqv_-UbQ

https://www.youtube.com/watch?v=taHTA7S_JGk



23. Solar System and Earth

2013

Variations in the length of daytime and nighttime from season to season are due to
(a) the earth's rotation on its axis.
(b) the earth's revolution round the sun in an elliptical manner.
(c) latitudinal position of the place.
(d) revolution of the earth on a tilted axis.

80.

On 21st June, the Sun

- (a)does not set below the horizon at the Arctic Circle
- (b)does not set below the horizon at Antarctic Circle
- (c)shines vertically overhead at noon on the Equator
- (d)shines vertically overhead at the Tropic of Capricorn

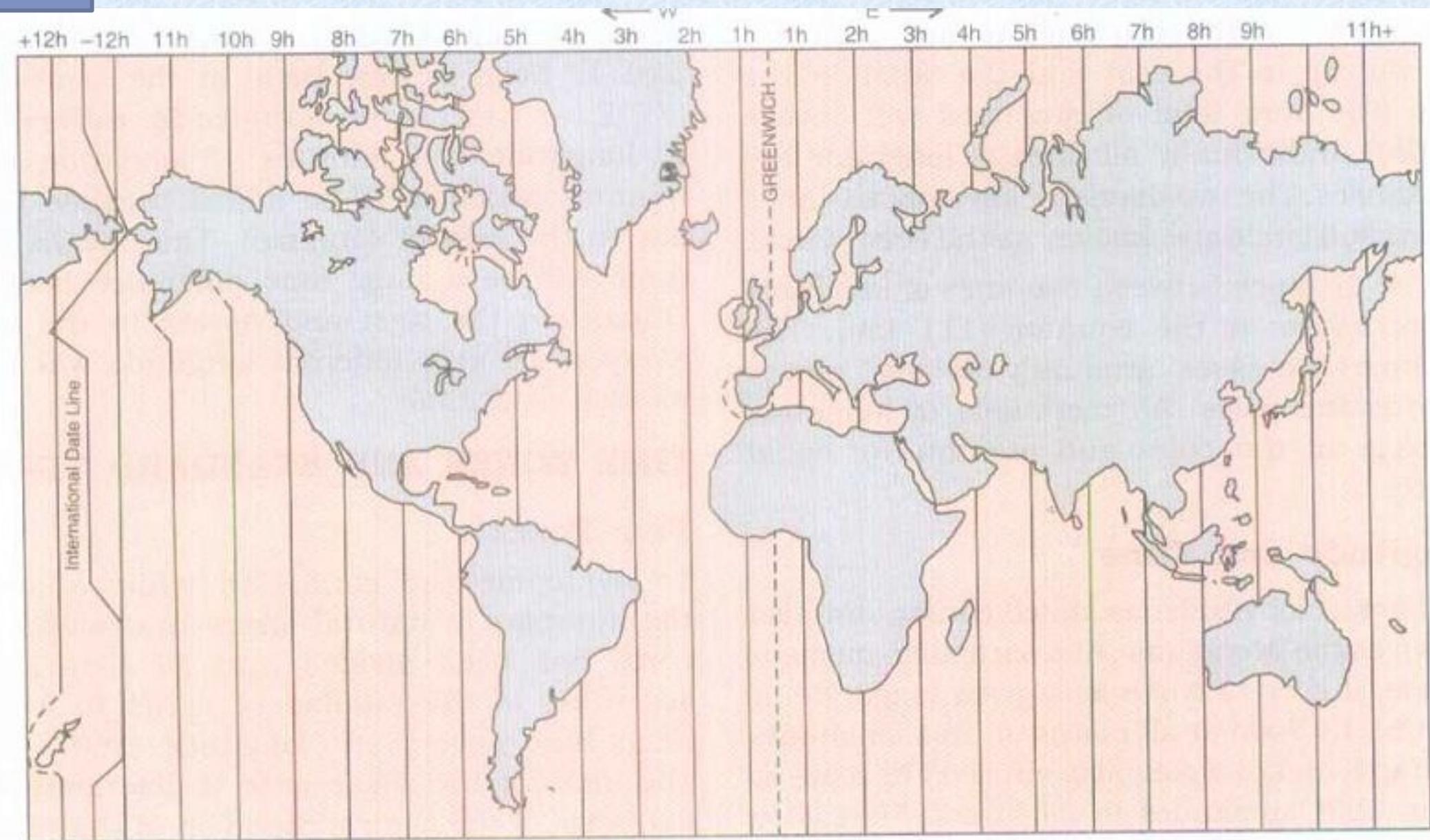
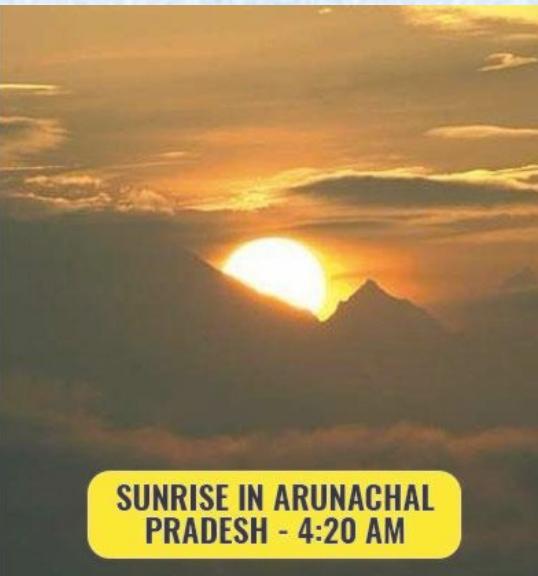
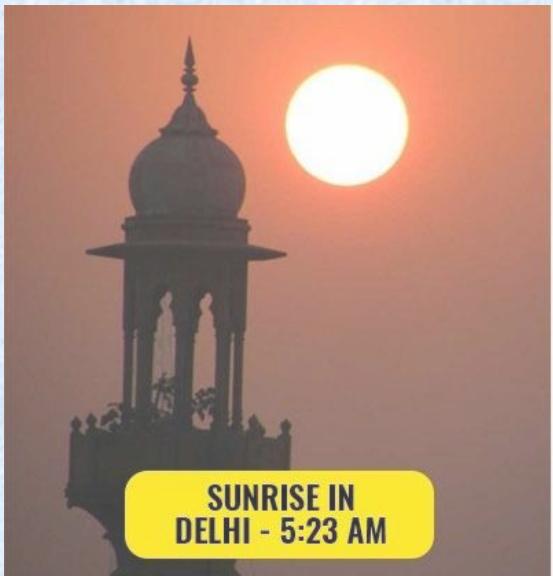
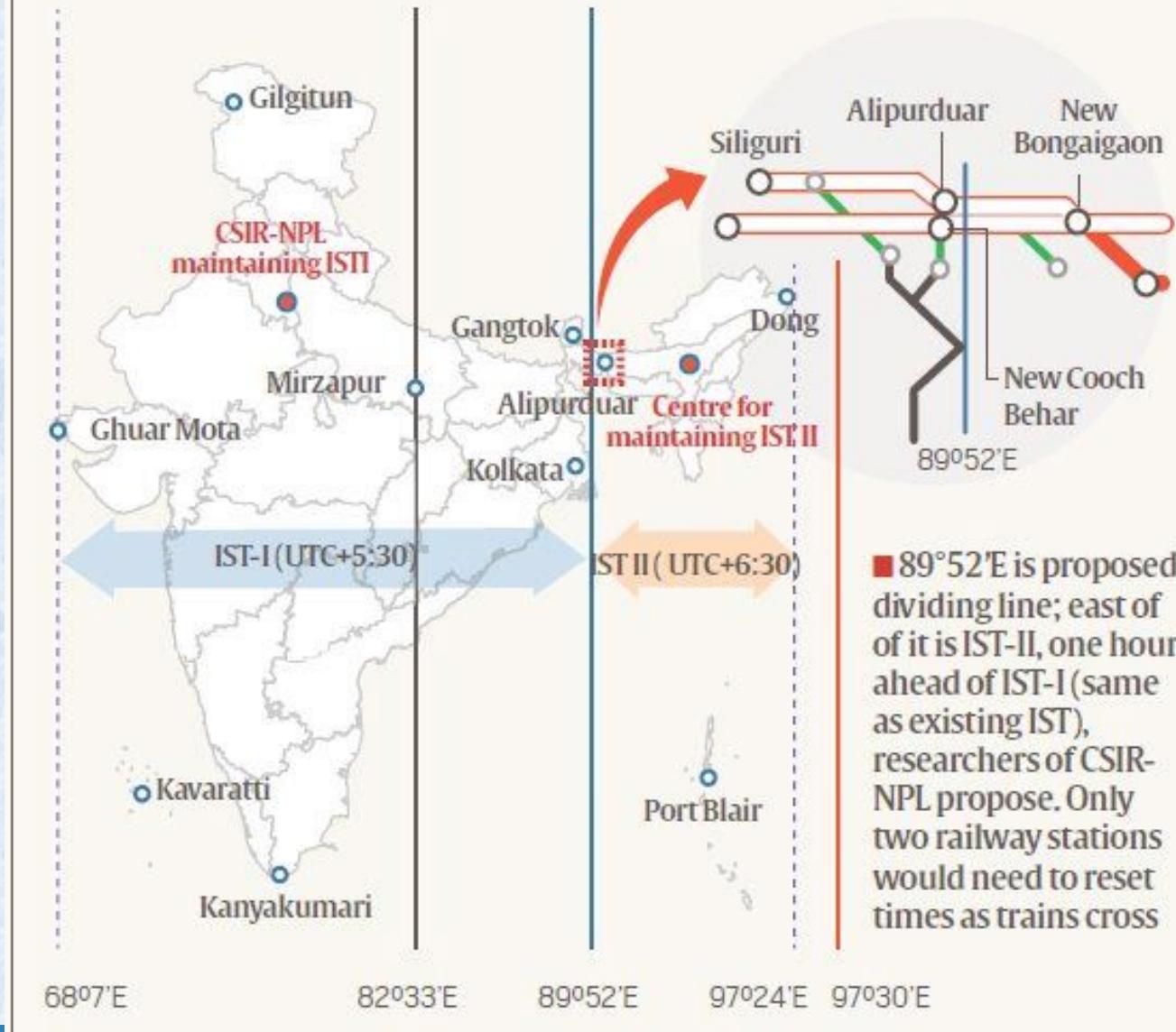


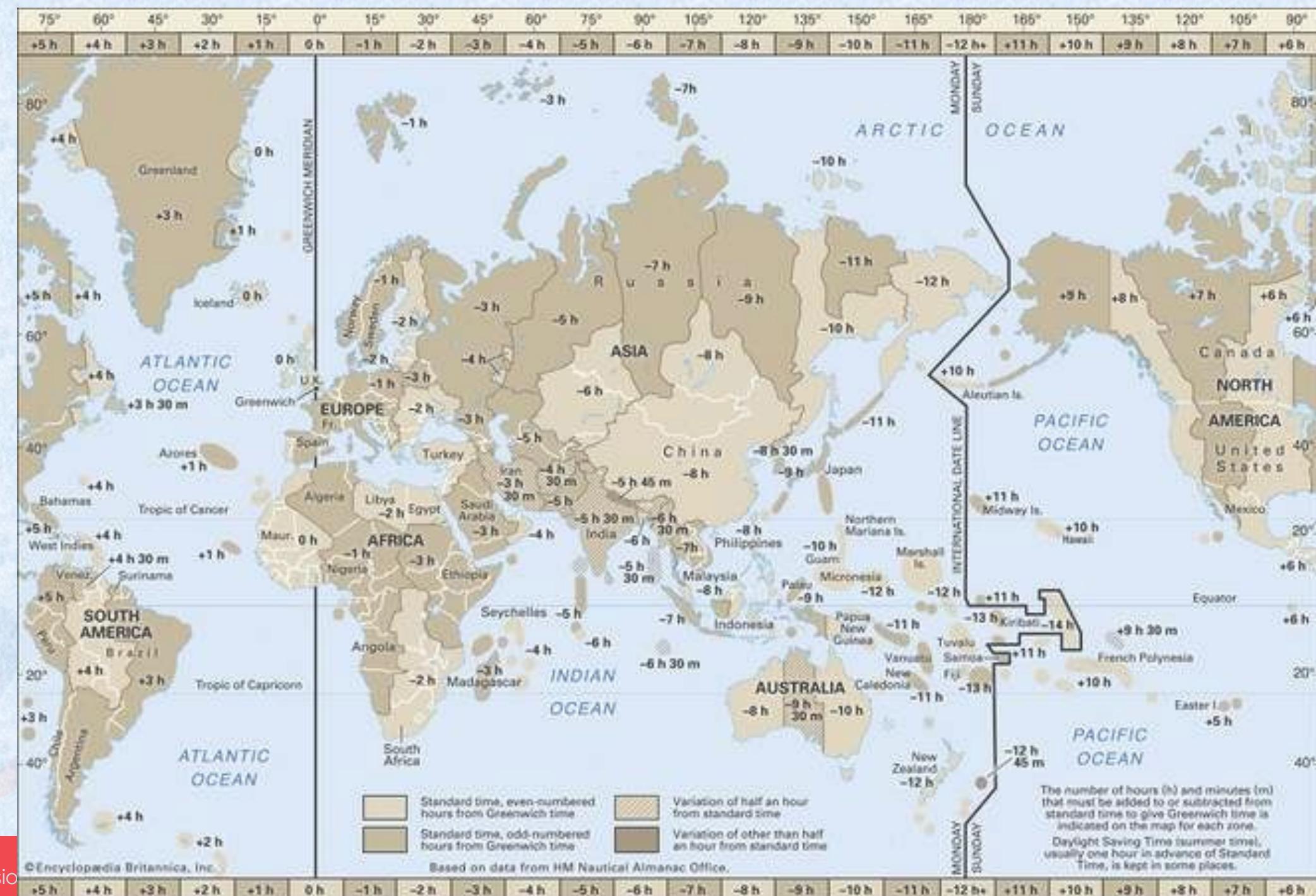
Fig. 3.8. International Date Line

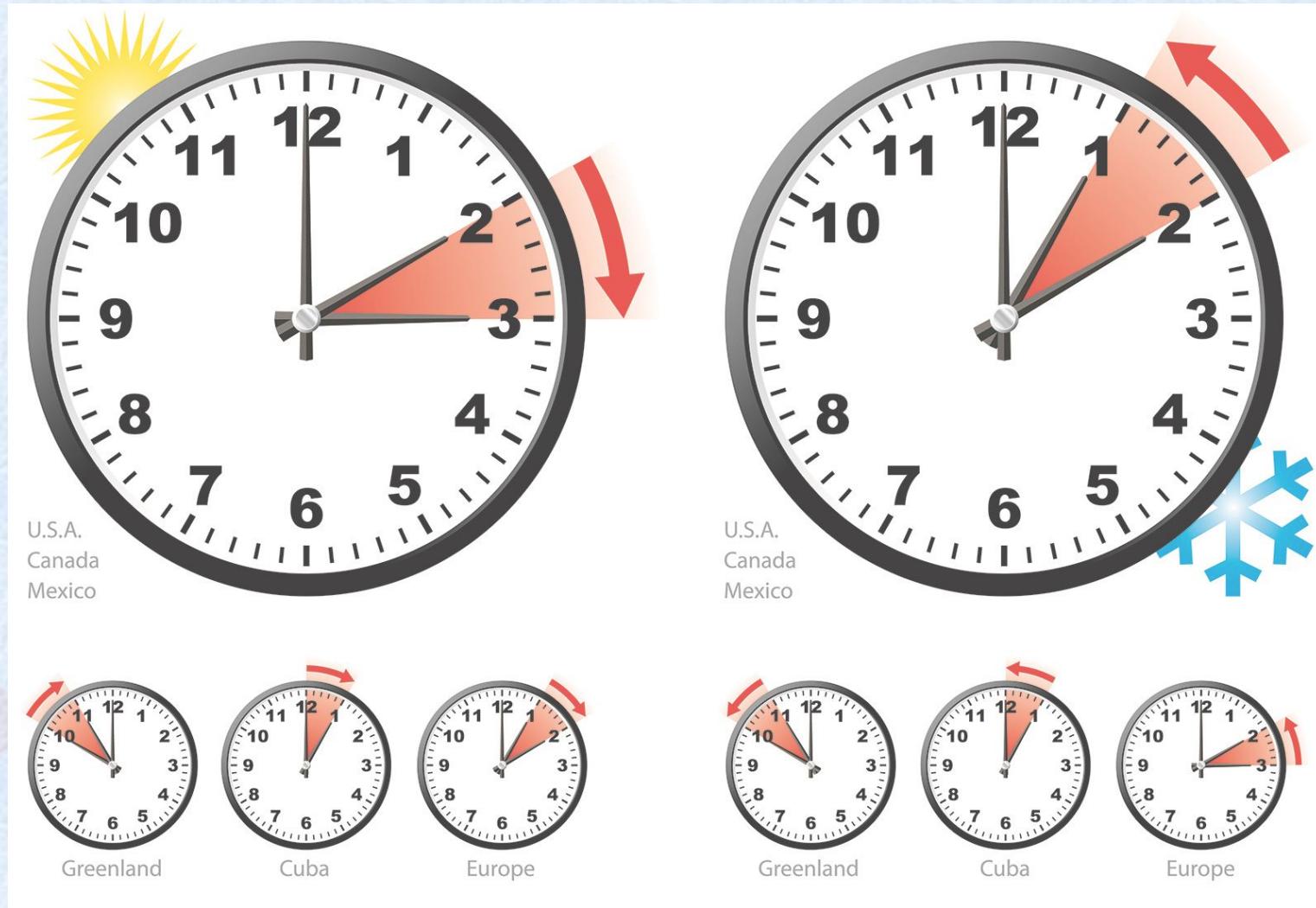


DIVISION AT 'CHICKEN NECK'



International Date Line





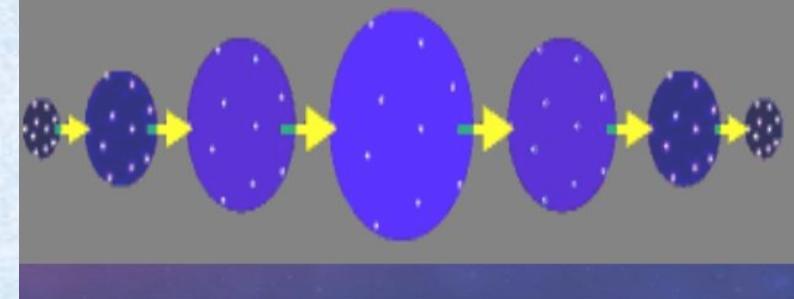
What is Universe?

Origin of Universe

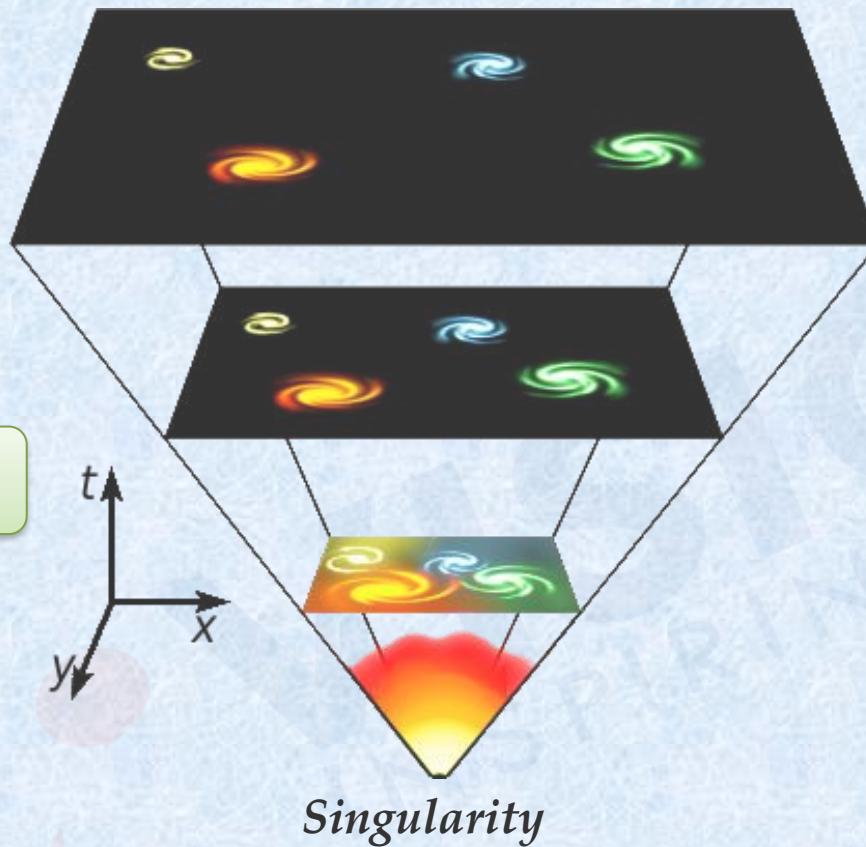
- Steady state theory
- Pulsating theory
- Big Bang theory



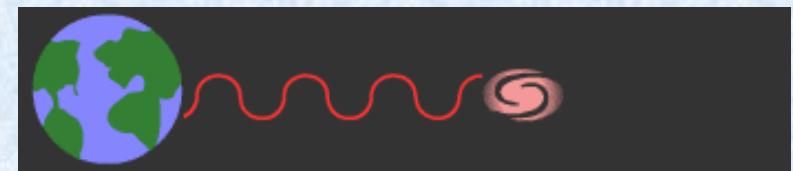
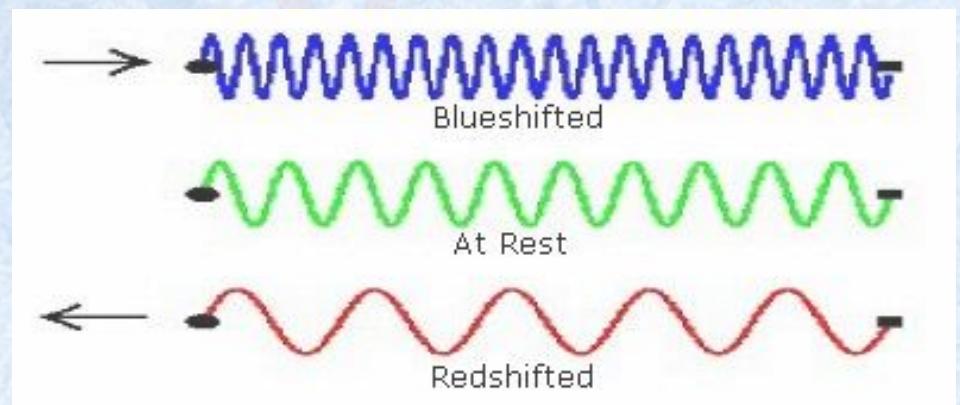
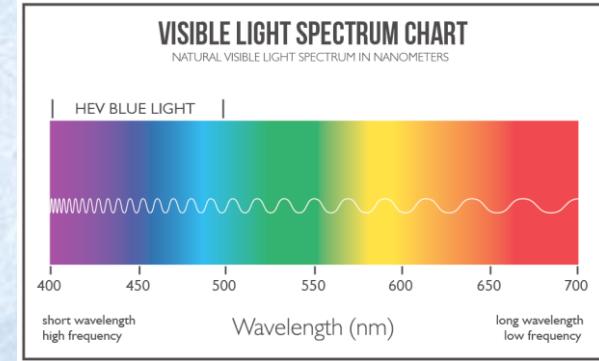
Pulsating Universe Theory



Universe and Origin of universe

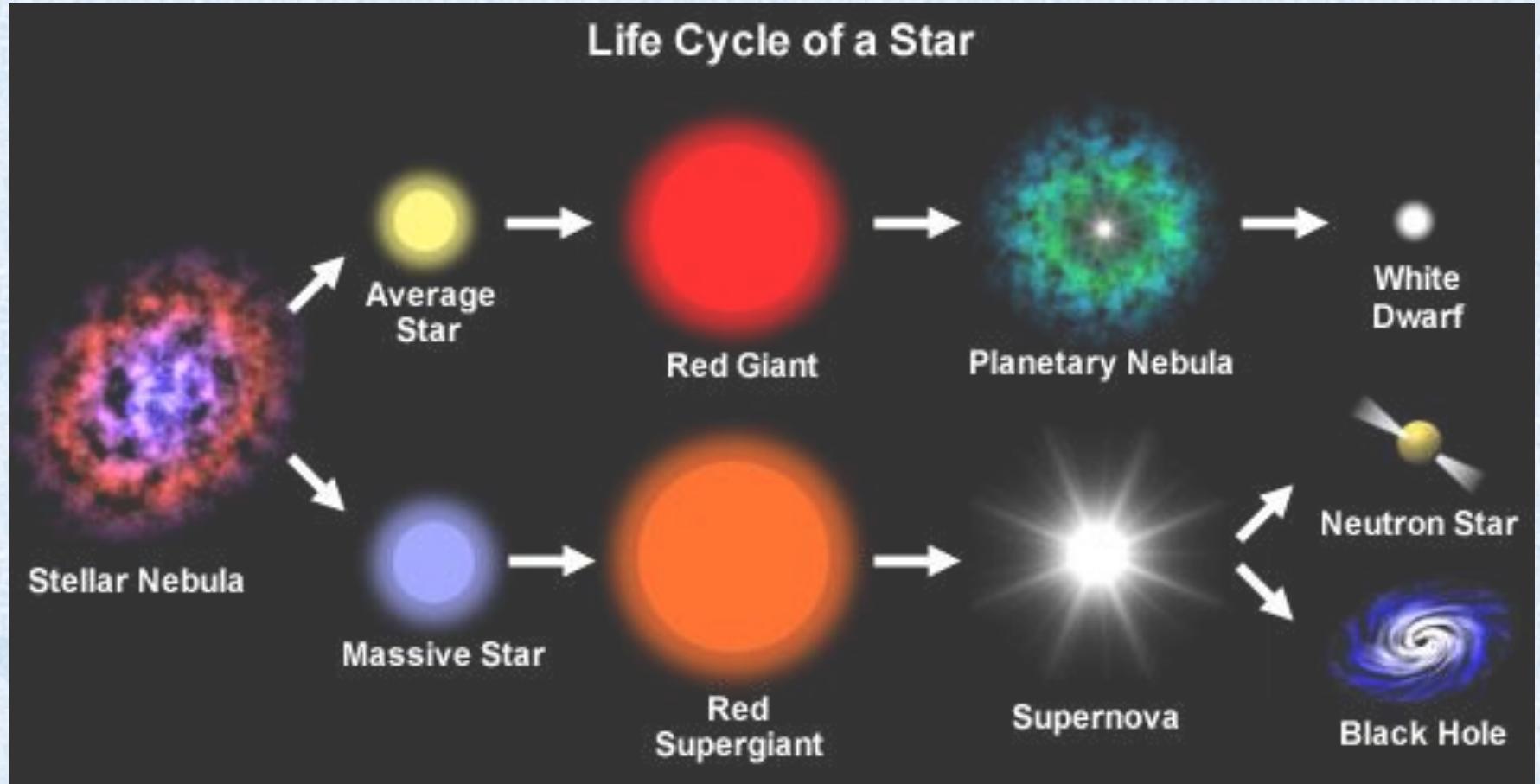


Big Bang Theory



Hubble's constant

Life cycle of a star



Galaxies & Stars



Spiral galaxy



Elliptical galaxy



Irregular galaxy



Milkyway Galaxy

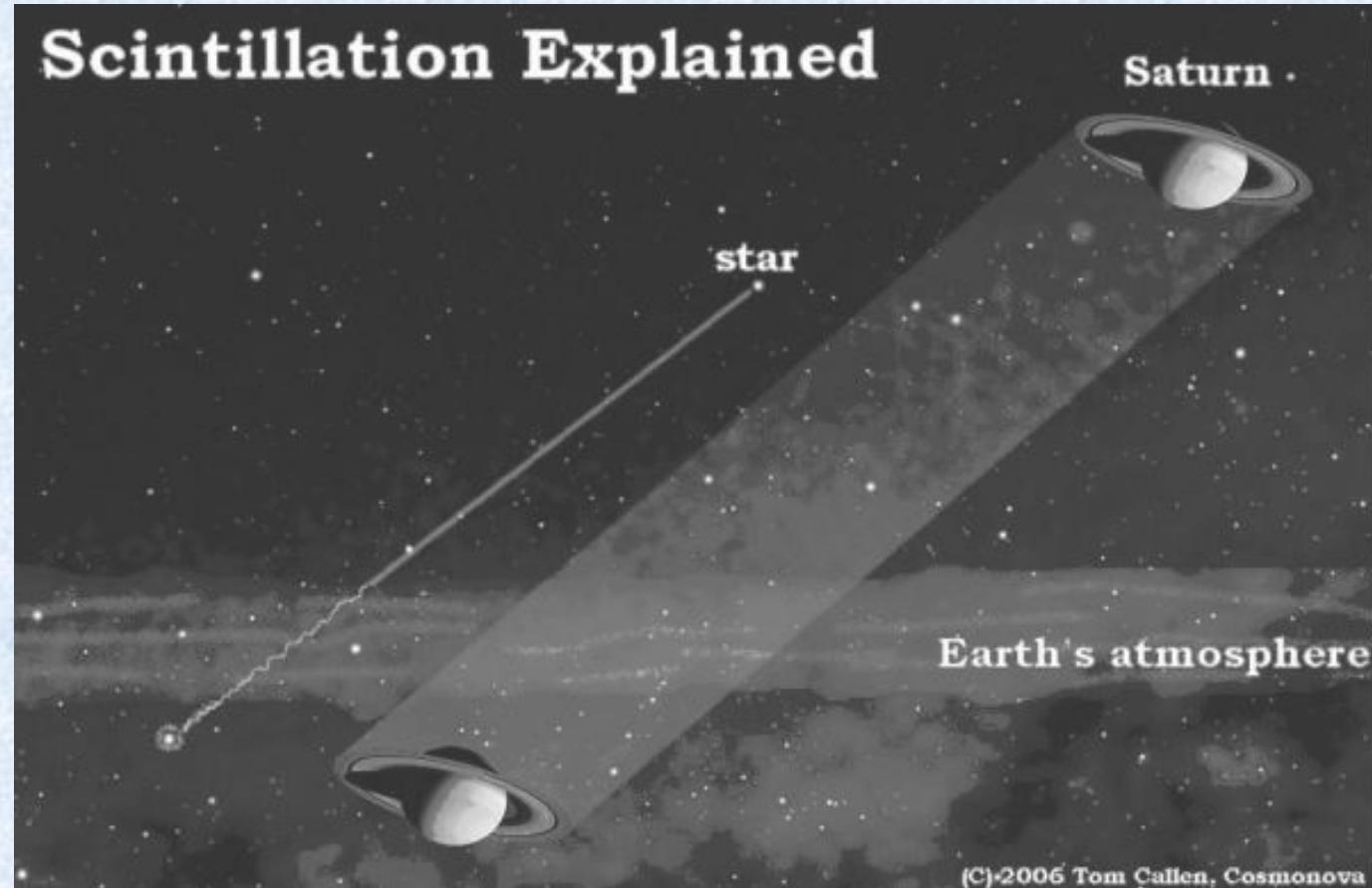
<https://www.youtube.com/watch?v=1zJ9FnQXmJI>

Rotation of Earth



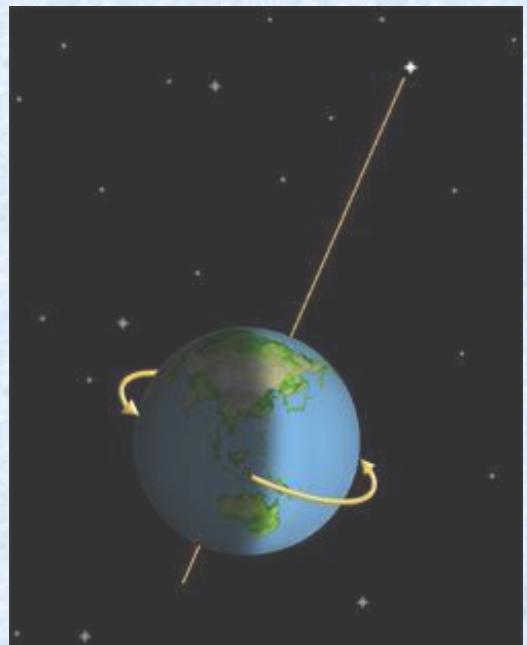
Today

**Collision of Milkyway and
Andromeda Galaxies**

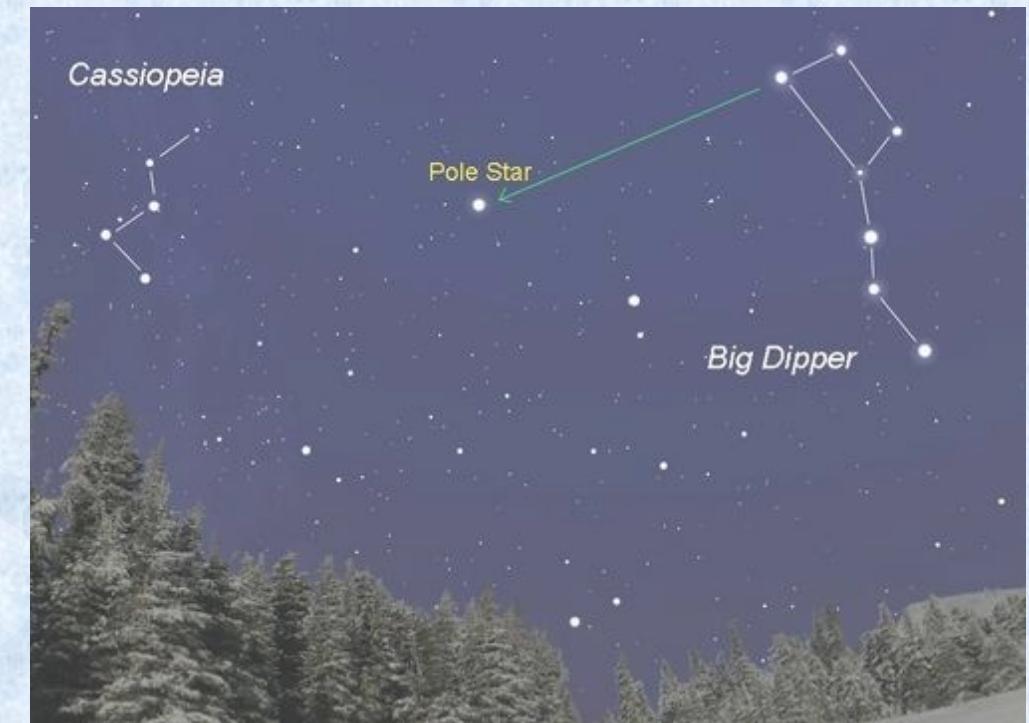


Twinkling of stars

Galaxies & Stars

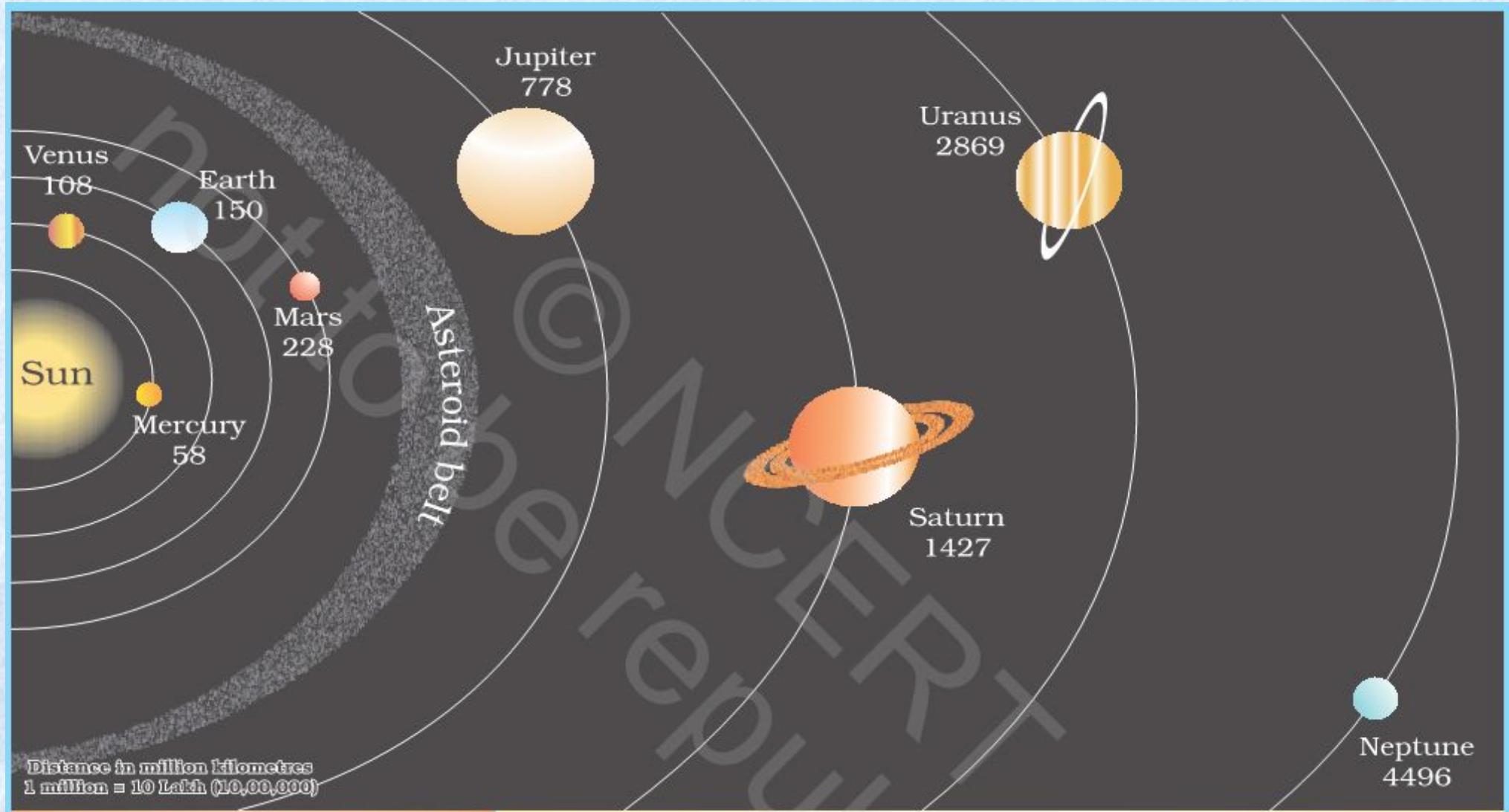


Pole star



22.	Solar System and Earth	2012	A person stood alone in a desert on a dark night and wanted to reach his village which was situated 5 km east of the point where he was standing. He had no instruments to find the direction but he located the polestar. The most convenient way now to reach his village is to walk in the (a) direction facing the polestar (b) direction opposite to the polestar (c) direction keeping the polestar to his left (d) direction keeping the polestar to his right
-----	------------------------	------	---

Solar System

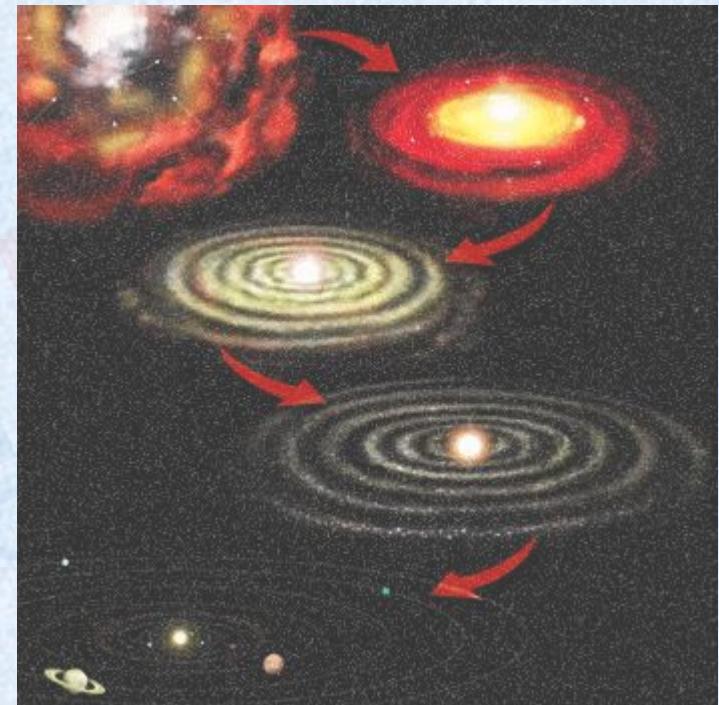


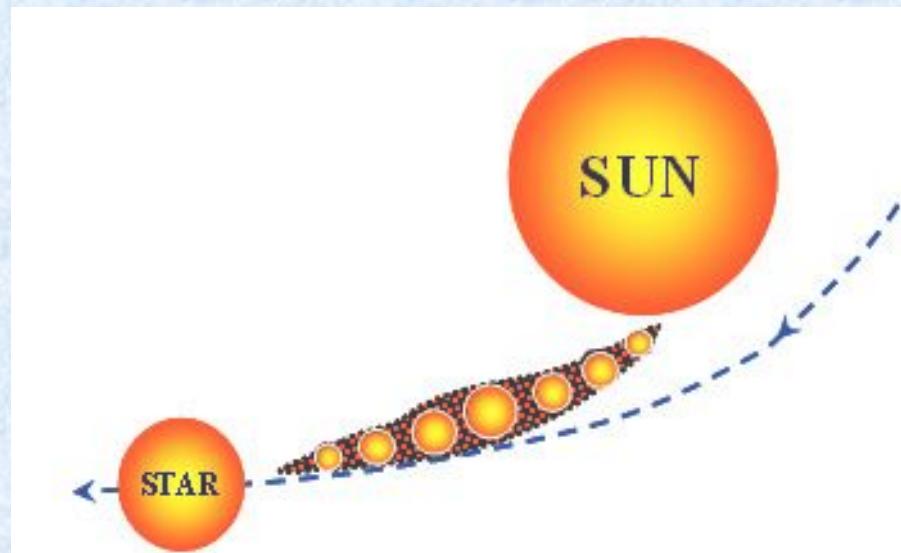
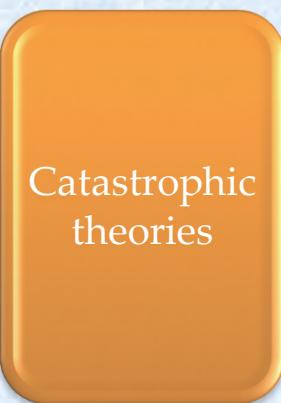
Evolutionary Theories

- Gaseous hypothesis
- Nebular hypothesis

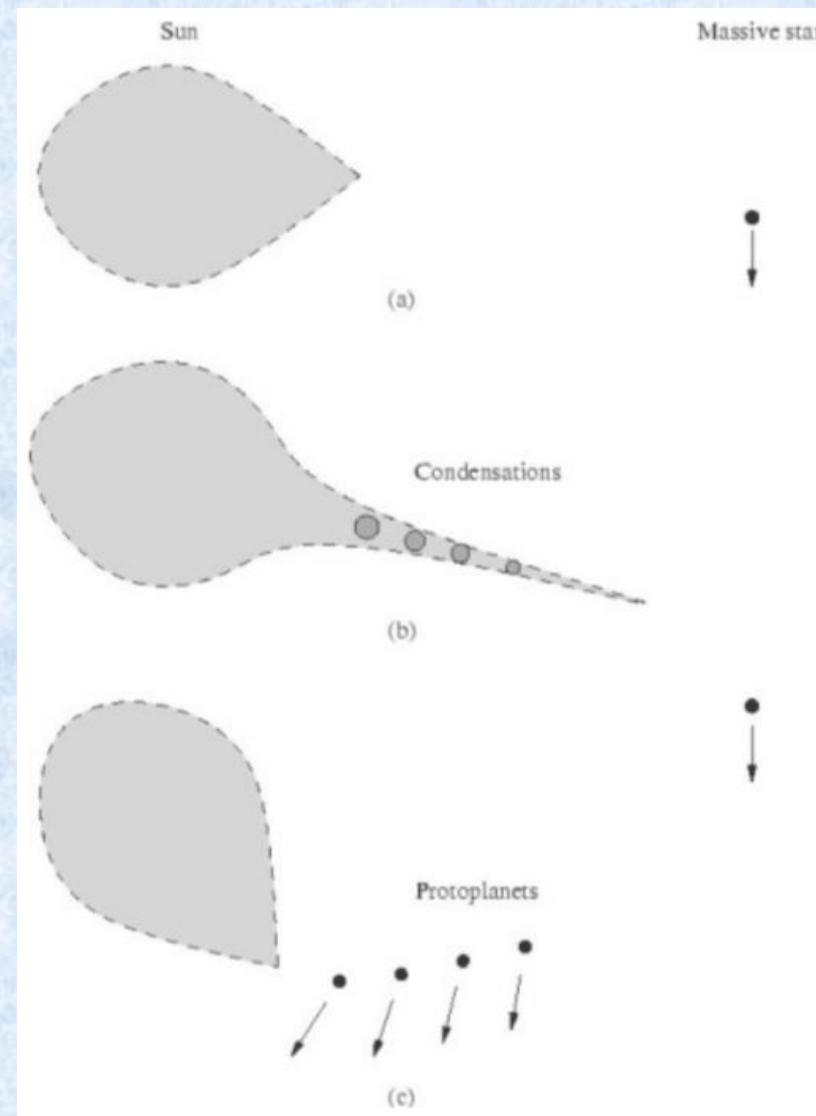
Catastrophic theories

- Planetesimal theory
- Tidal hypothesis



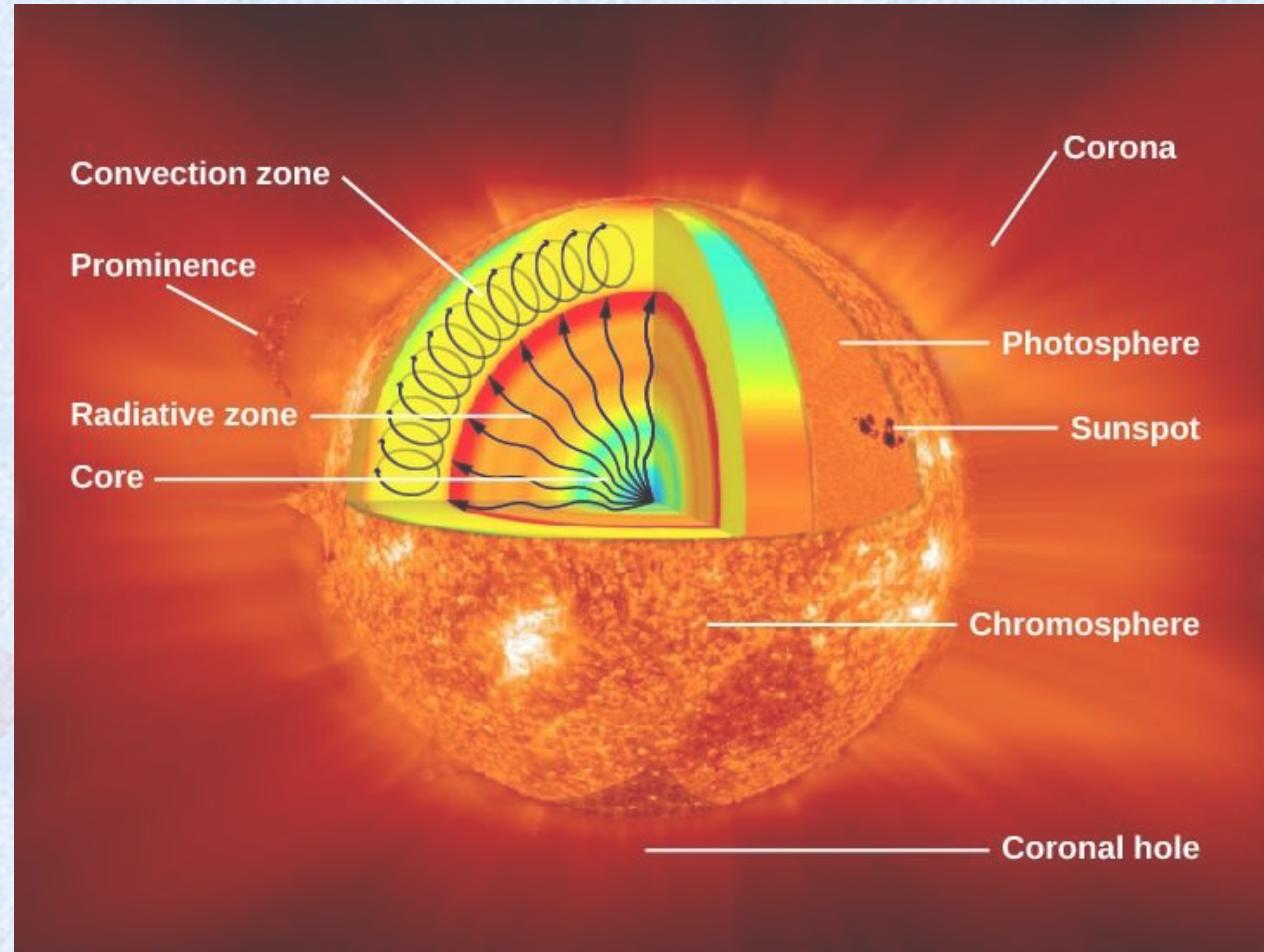


Planetesimal theory

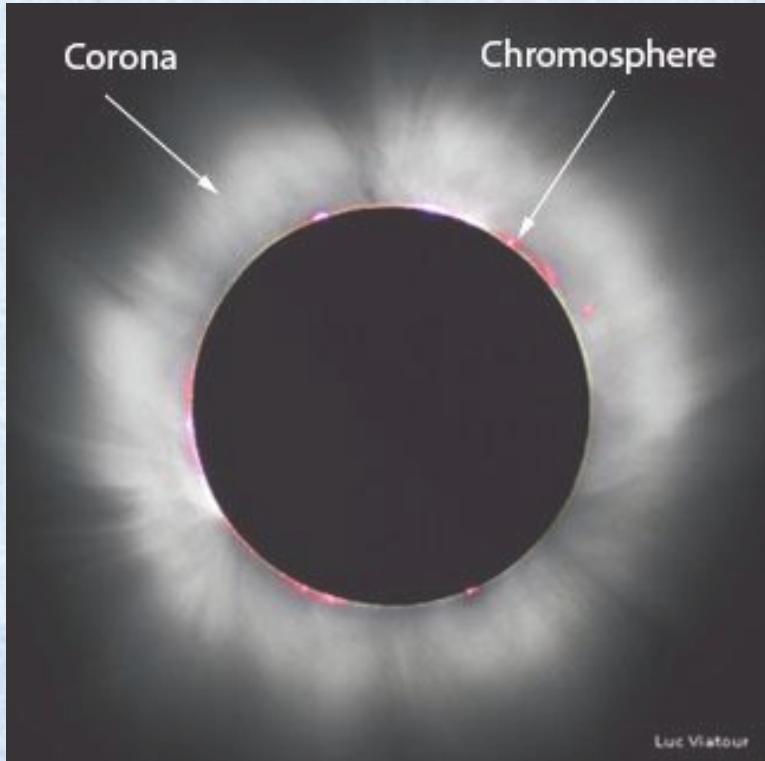


Tidal Hypothesis

Different layers of the Sun



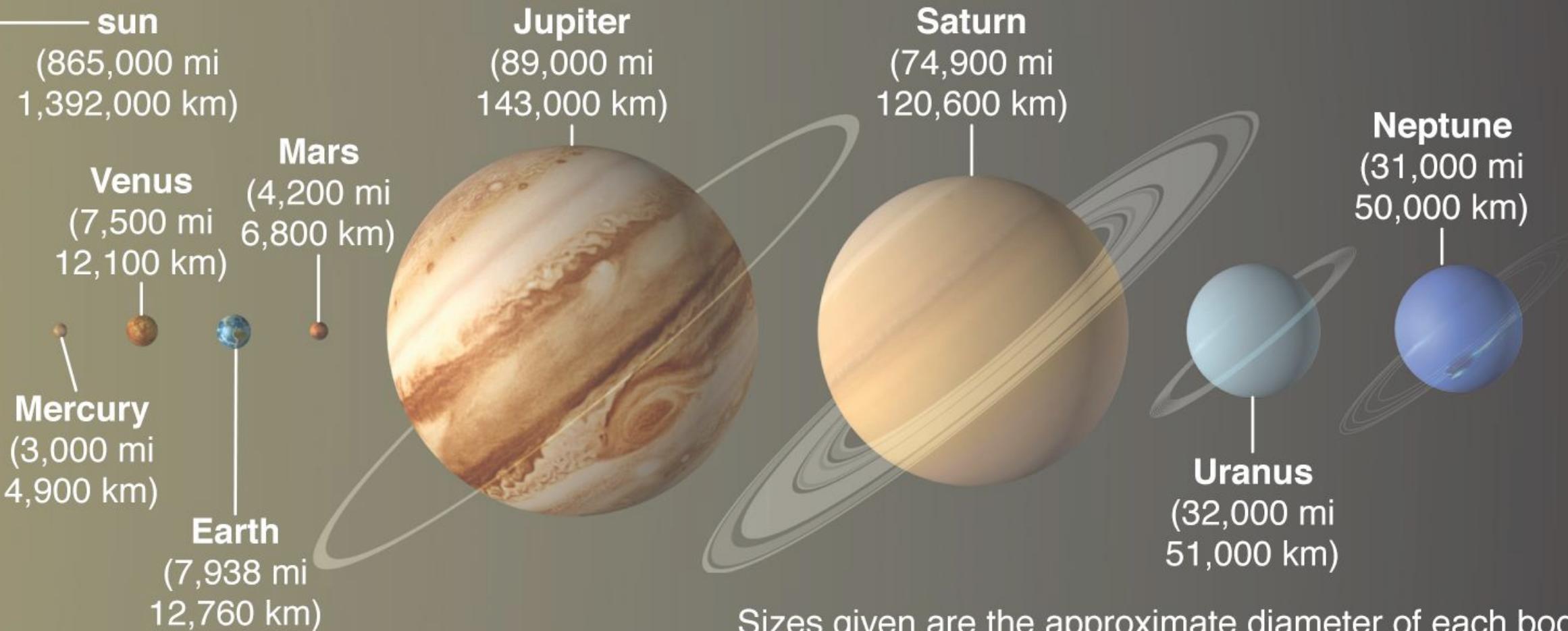
Different layers of the Sun



<https://www.youtube.com/watch?v=S3I30ZzsIKU>

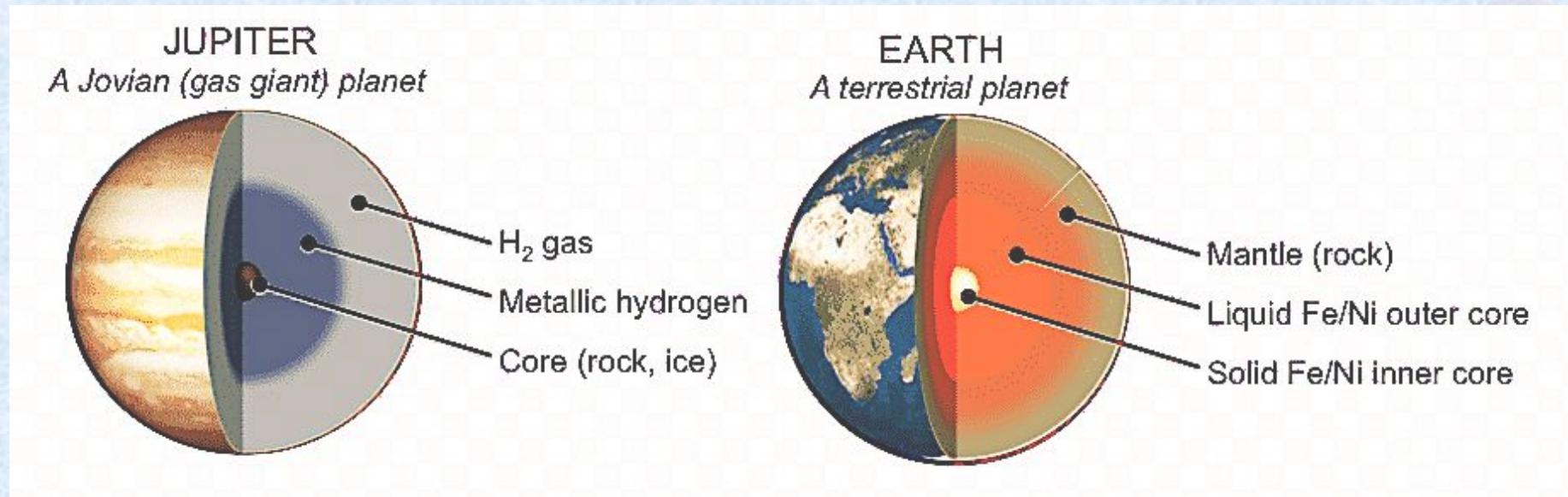
Different layers of the Sun

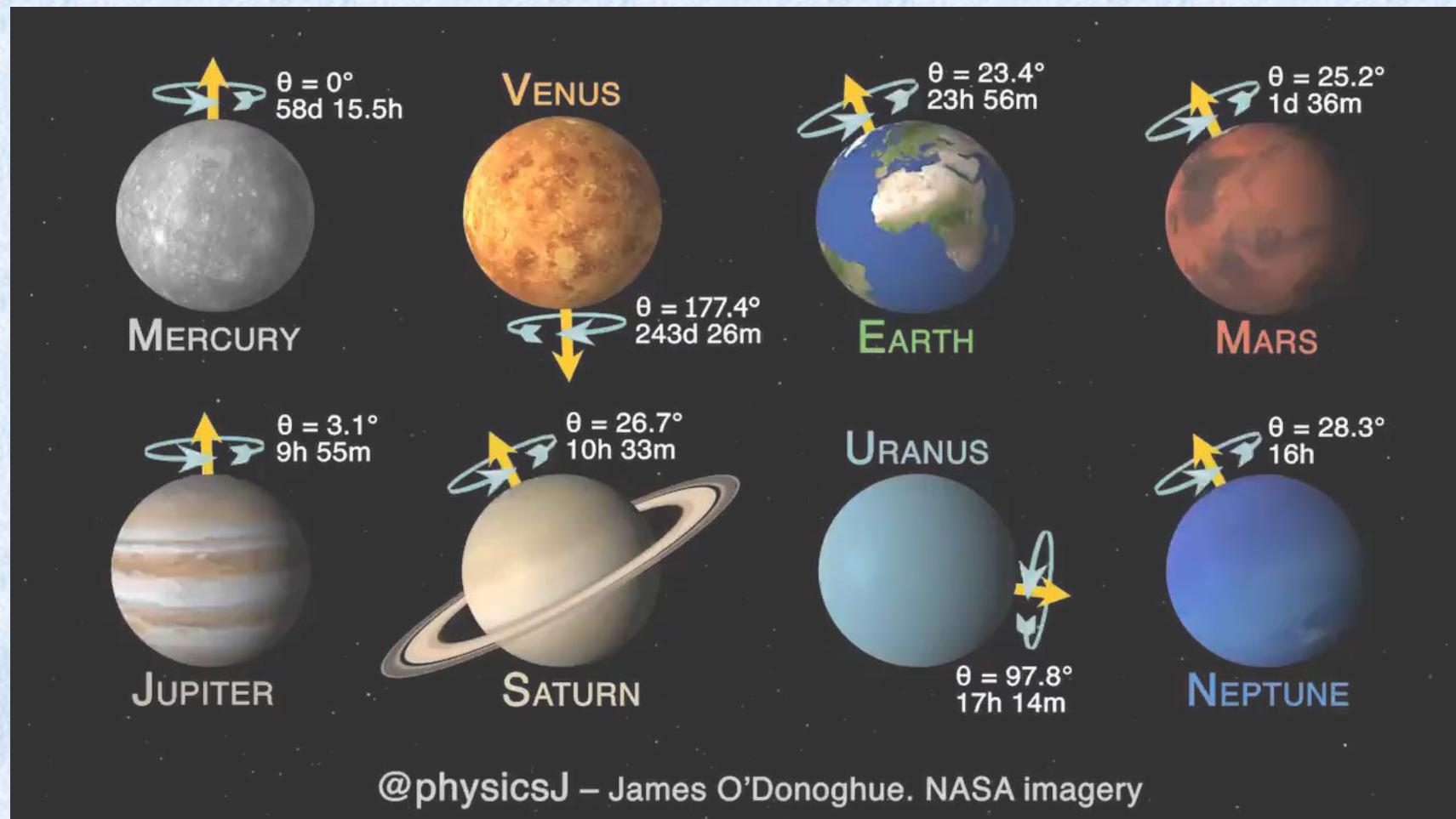


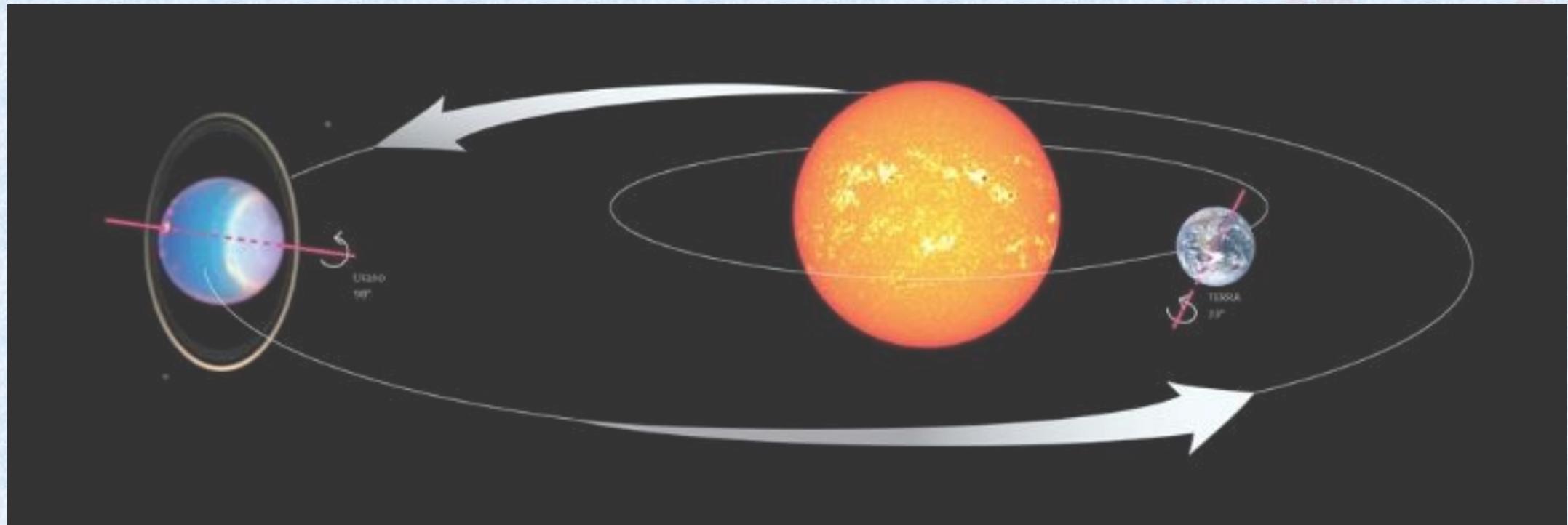


Sizes given are the approximate diameter of each body.

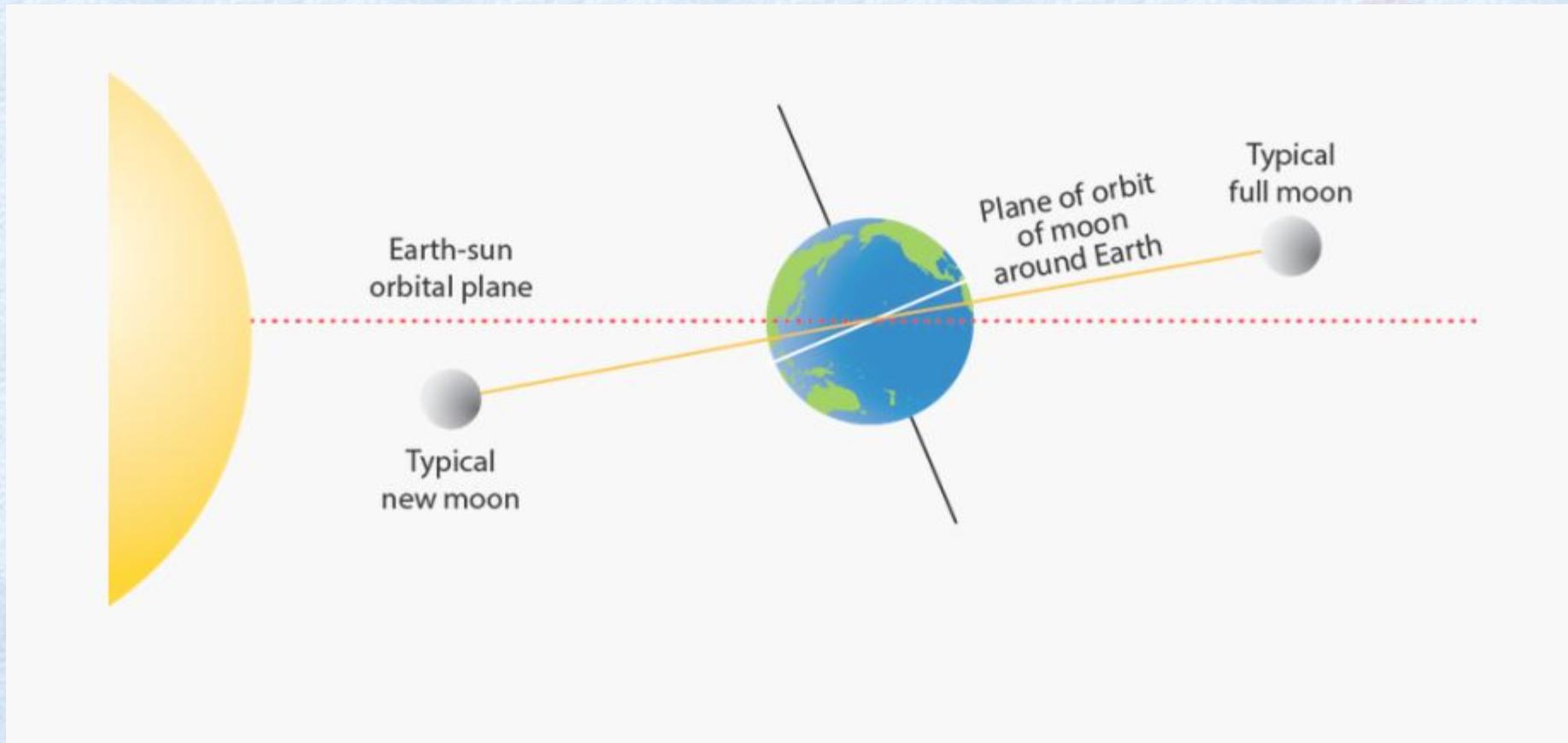
© Encyclopædia Britannica, Inc.





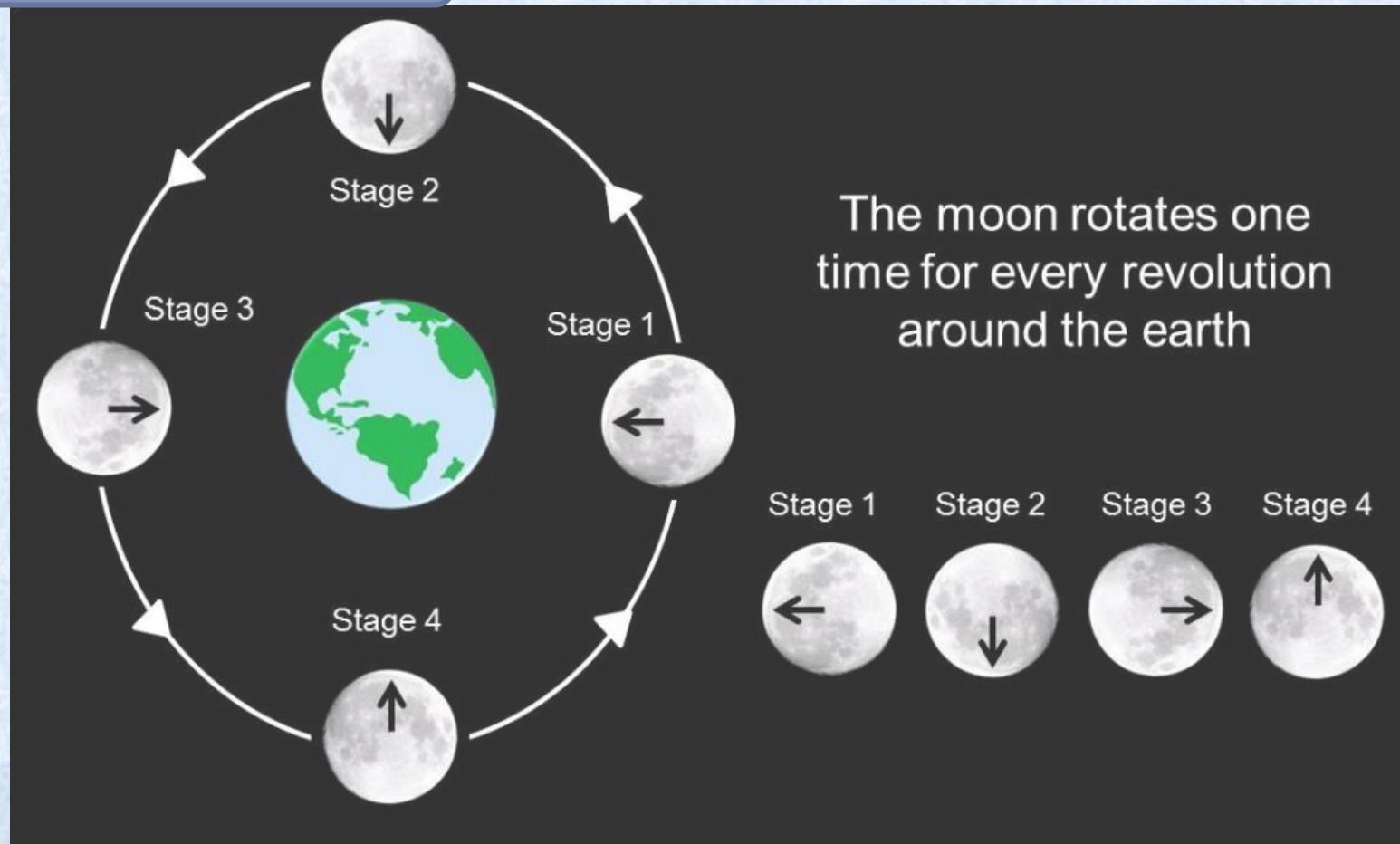


24.	Solar System and Earth	2015	The term "Goldilocks Zone" is often seen in the news in the context of (a) the limits of habitable zone above the surface of the Earth (b) regions inside the Earth where shale gas is available (c) search for the Earth-like planets in outer space (d) search for meteorites containing precious metals
-----	------------------------	------	--



Position of Sun, Earth & Moon





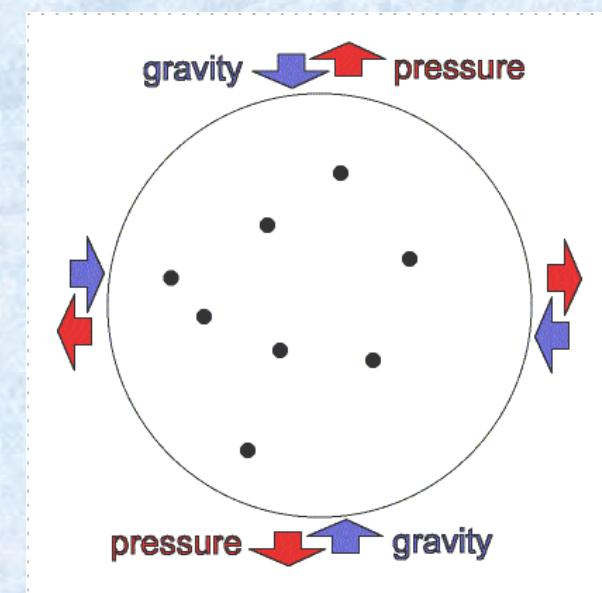
https://www.youtube.com/watch?v=OZIB_leg75Q

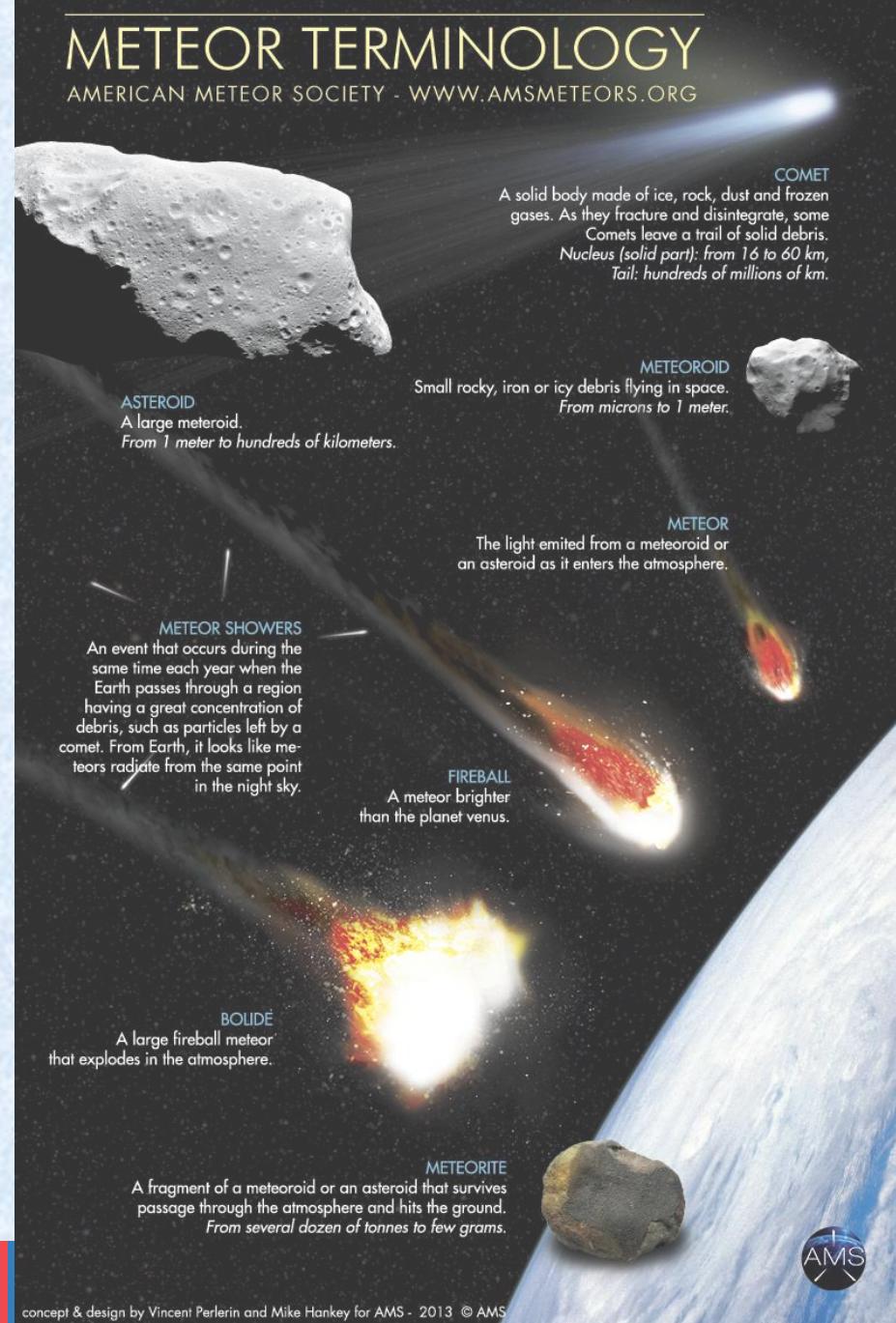
What is a Dwarf Planet?

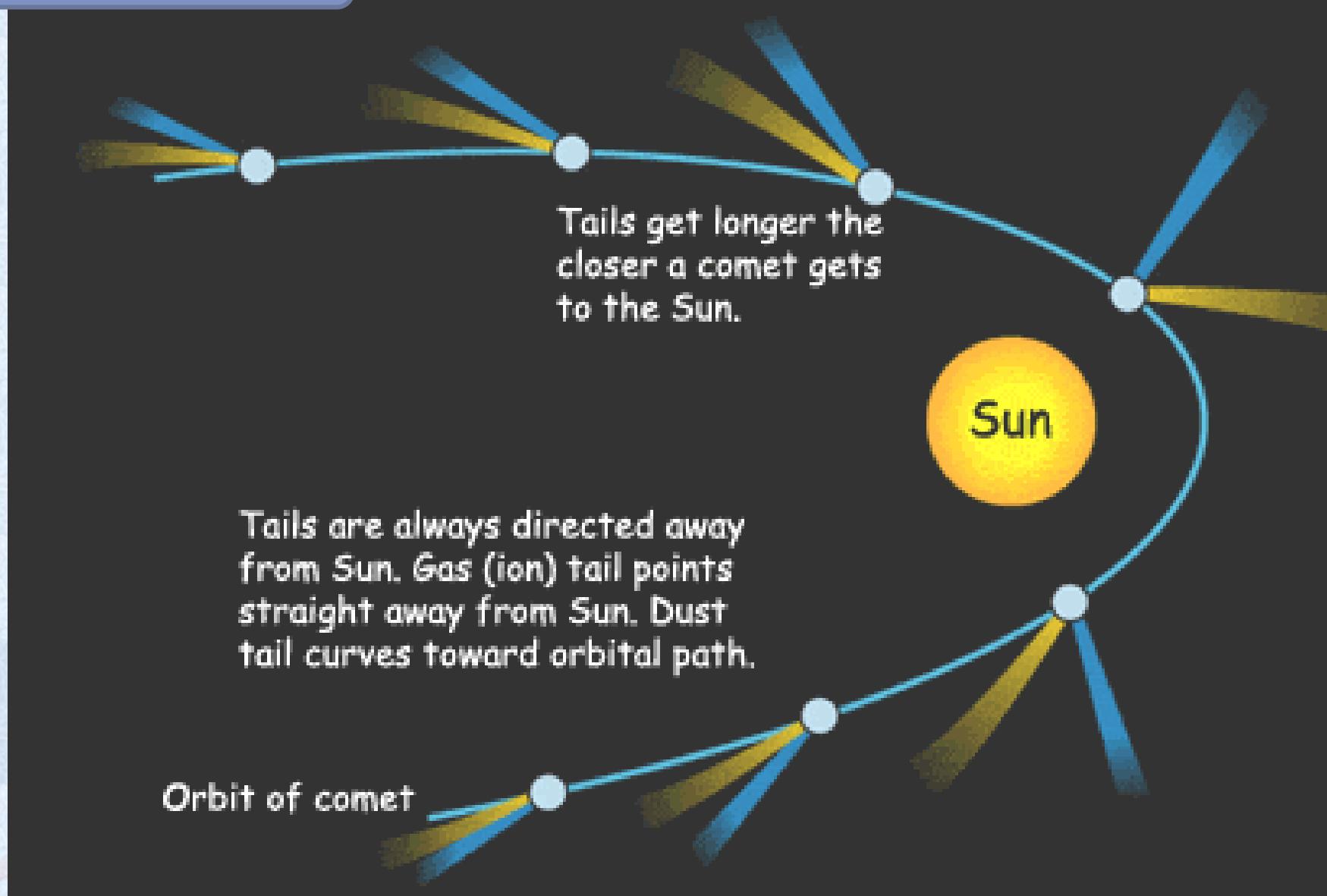
Orbit around the sun

Enough mass to achieve hydrostatic equilibrium

Cleared neighborhood









Comet Neowise

19.	Solar System and Earth	2008	In order of their distances from the Sun, which of the following planets lie between Mars and Uranus? (a) Earth and Jupiter (b) Jupiter and Saturn (c) Saturn and Earth (d) Saturn and Neptune
20.	Solar System and Earth	2009	Which one of the following planet has largest number of natural satellites or moons? (a) Jupiter (b) Mars (c) Saturn (d) Venus
21.	Solar System and Earth	2011	Which is the difference between asteroids and comets? 1. Asteroids are small rocky planetoids, while comets are formed of frozen gases held together by rocky and metallic material. 2. Asteroids are found mostly between the orbits of Jupiter and Mars, while comets are found mostly between Venus and Mercury. 3. Comets show a perceptible glowing tail, while asteroids do not. Which of the statements given above is/are correct? (a) 1 and 2 only (b) 1 and 3 only (c) 3 only (d) 1, 2 and 3

Size of Universe

<https://www.youtube.com/watch?v=TXfOzhZGtNw&t=171s>

Solar system to scale

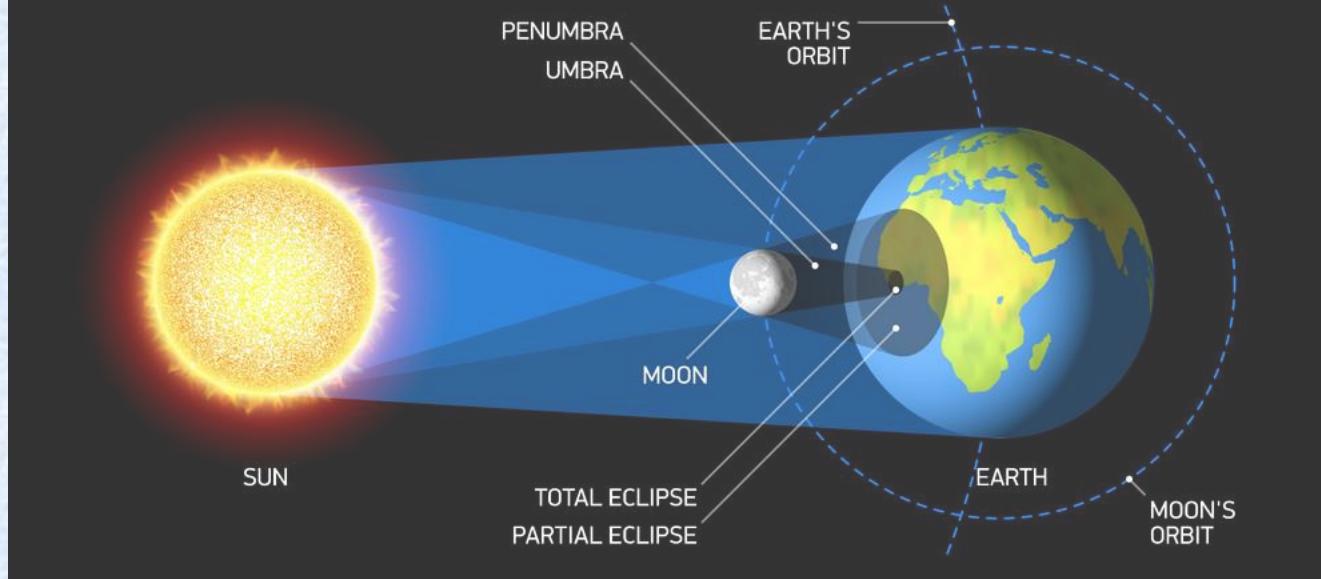
<https://www.youtube.com/watch?v=zR3Igc3Rhfg>

Solar system in motion

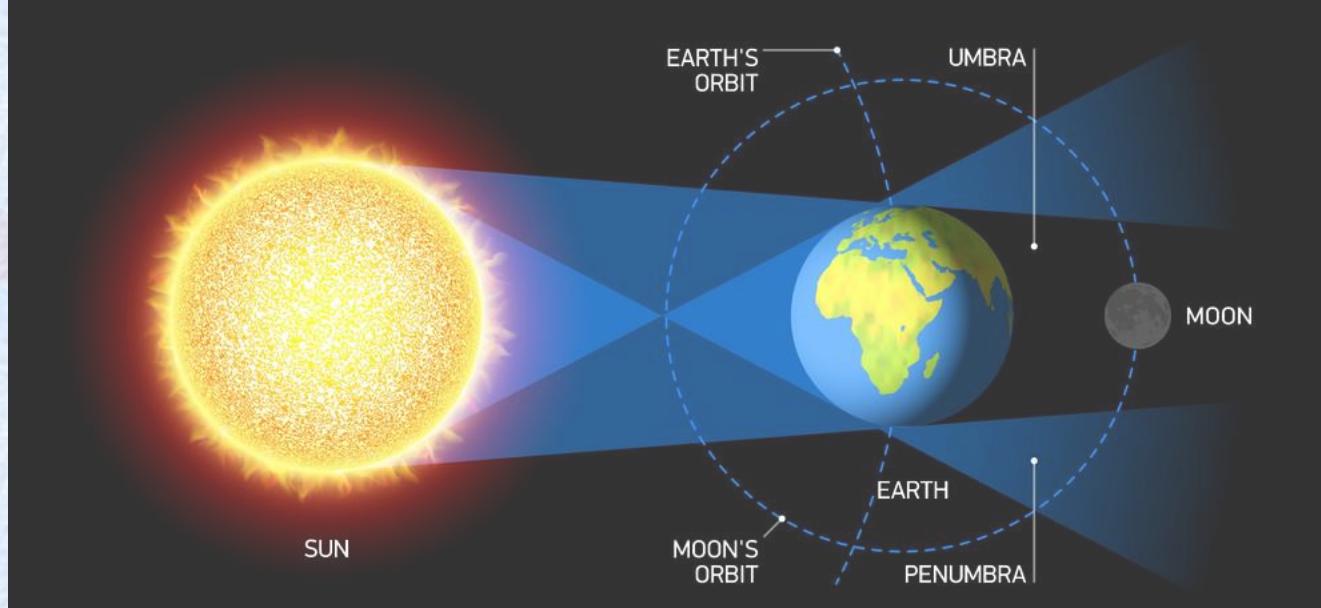
https://www.youtube.com/watch?v=0jHsq36_NTU

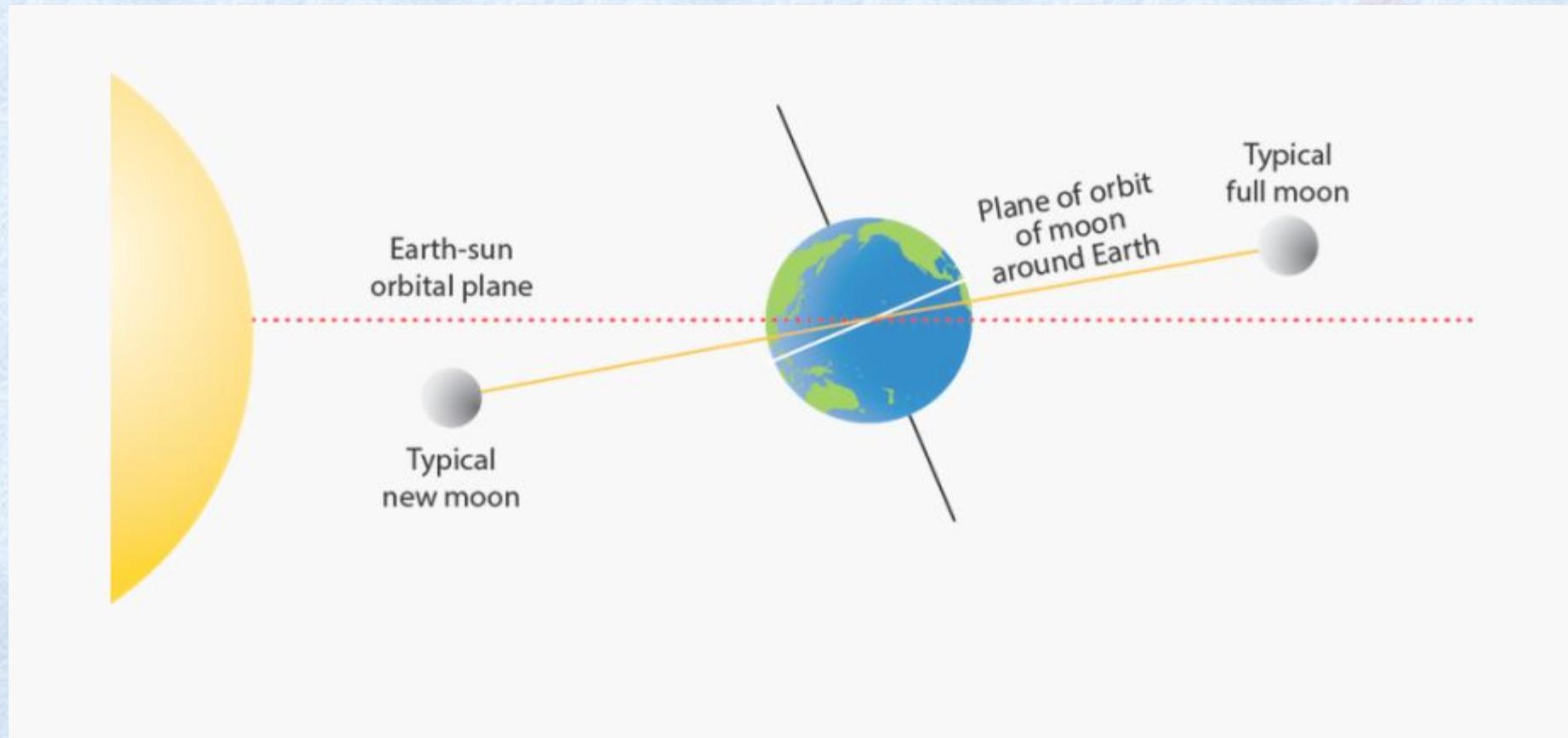
Eclipses

Solar eclipse

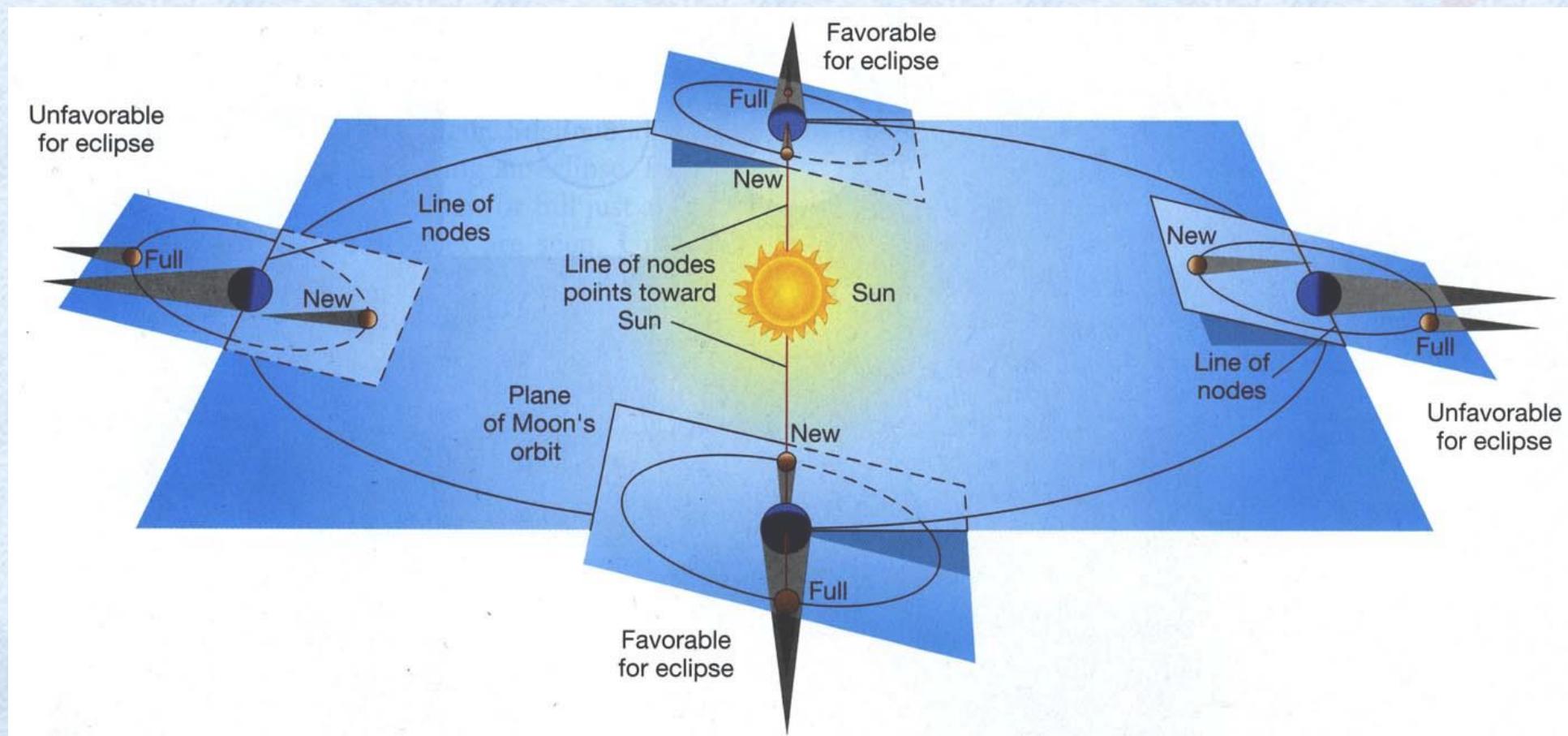


Lunar eclipse

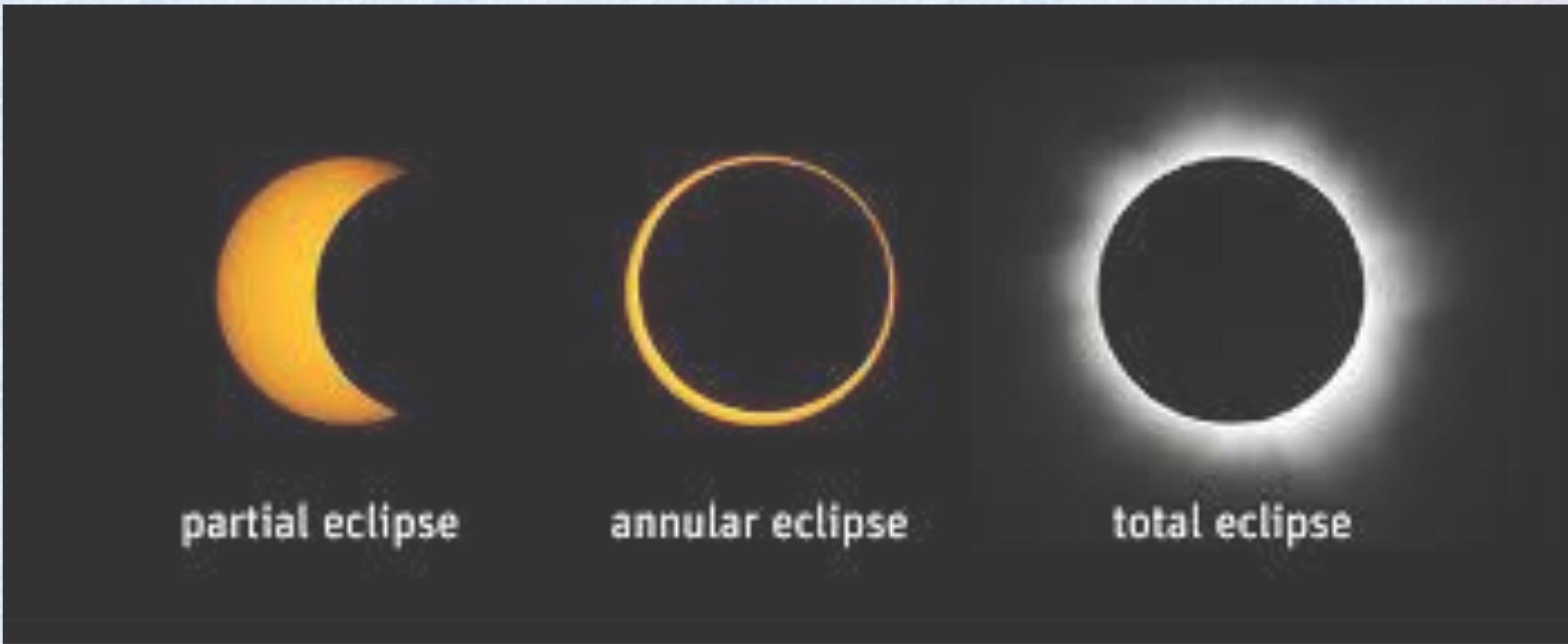




Position of Sun, Earth & Moon



Position of Sun, Earth & Moon



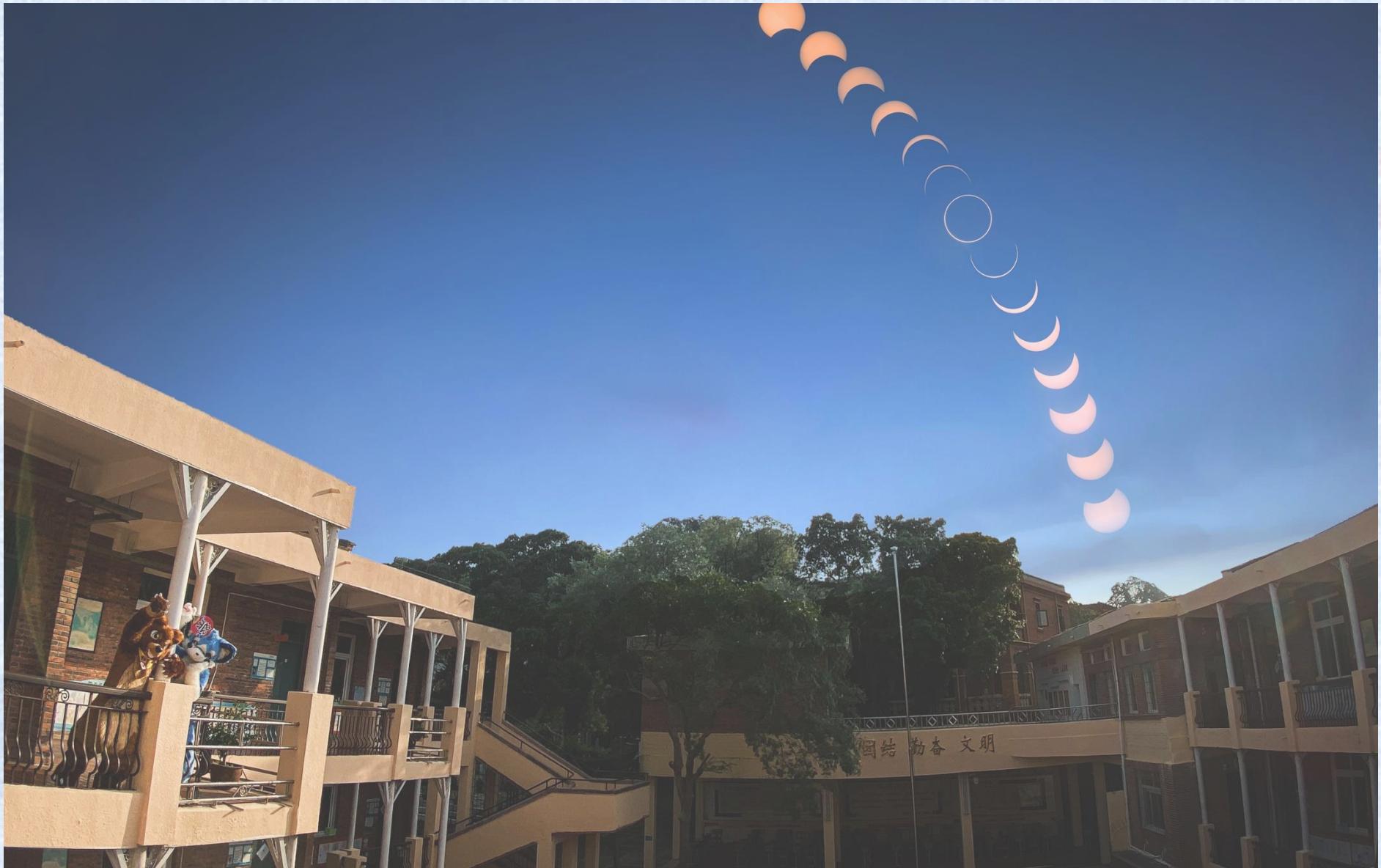
partial eclipse

annular eclipse

total eclipse

Types of Solar
eclipse

<https://www.youtube.com/watch?v=cxrLRbkOwKs>



Annular Solar eclipse of
21 June, 2020

Types of Lunar eclipse

<https://www.youtube.com/watch?v=VW2xRR75lKE>

Total Lunar Eclipse



Partial Lunar Eclipse



Penumbral Lunar Eclipse





Blood Moon



Questions??



- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

Geomorphology

Origin and evolution of Earth

Geological Time Scale

Interior of the Earth

Types of Rocks

Earth movements

Continental Drift Theory

Sea Floor spreading

Plate Tectonics theory

Vulcanism

Geomagnetism

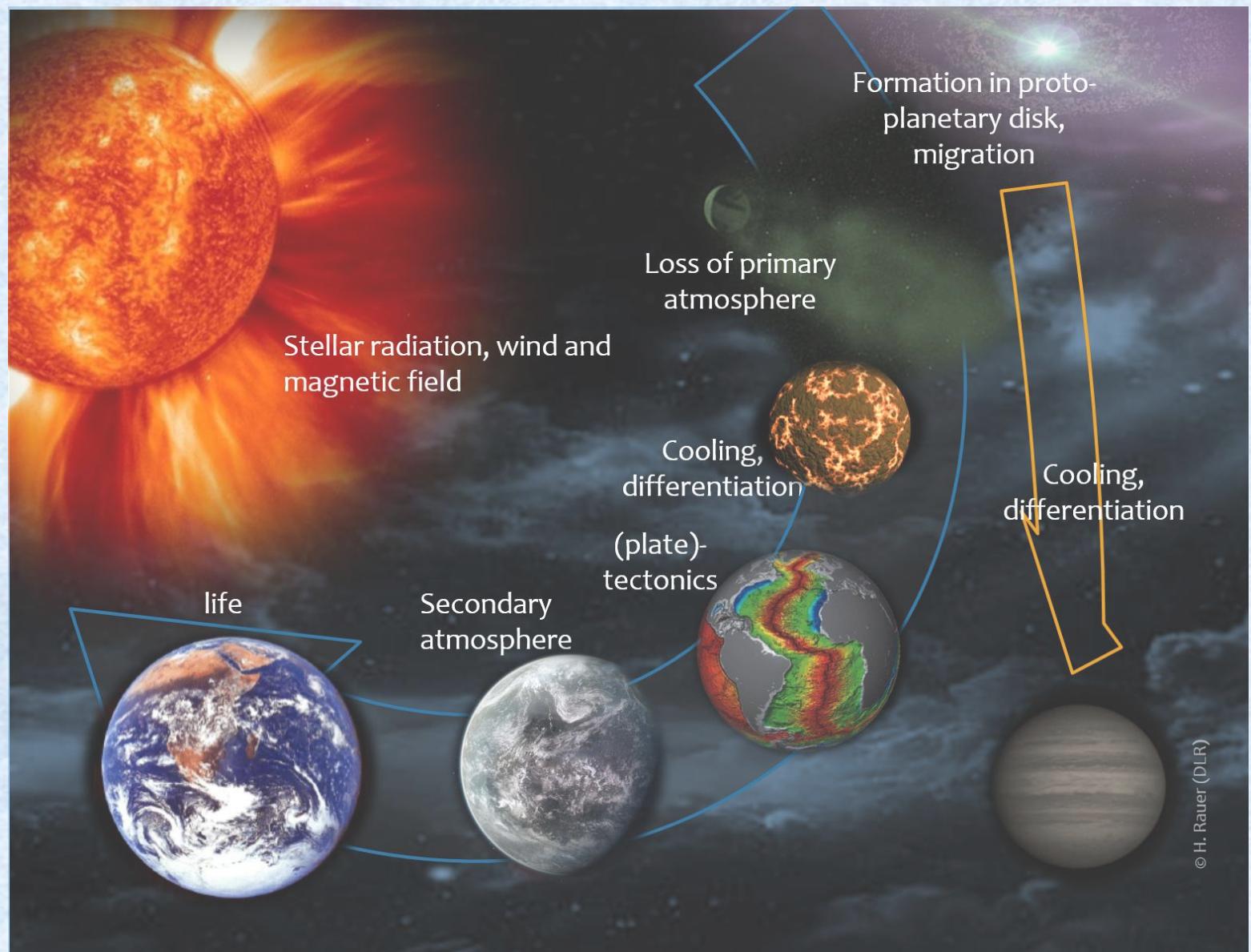
Earthquakes

Tsunamis

Exogenic movements

Landforms

Origin and Evolution of Earth



<https://www.youtube.com/watch?v=HCDVN7DCzYE>

Origin and Evolution of Earth

Hot and volatile

Density separation

Condensation

Differentiation

Early atmosphere

Degassing

Volcanic eruptions

Condensation of water vapour

Formation of oceans

Blue Green Algae

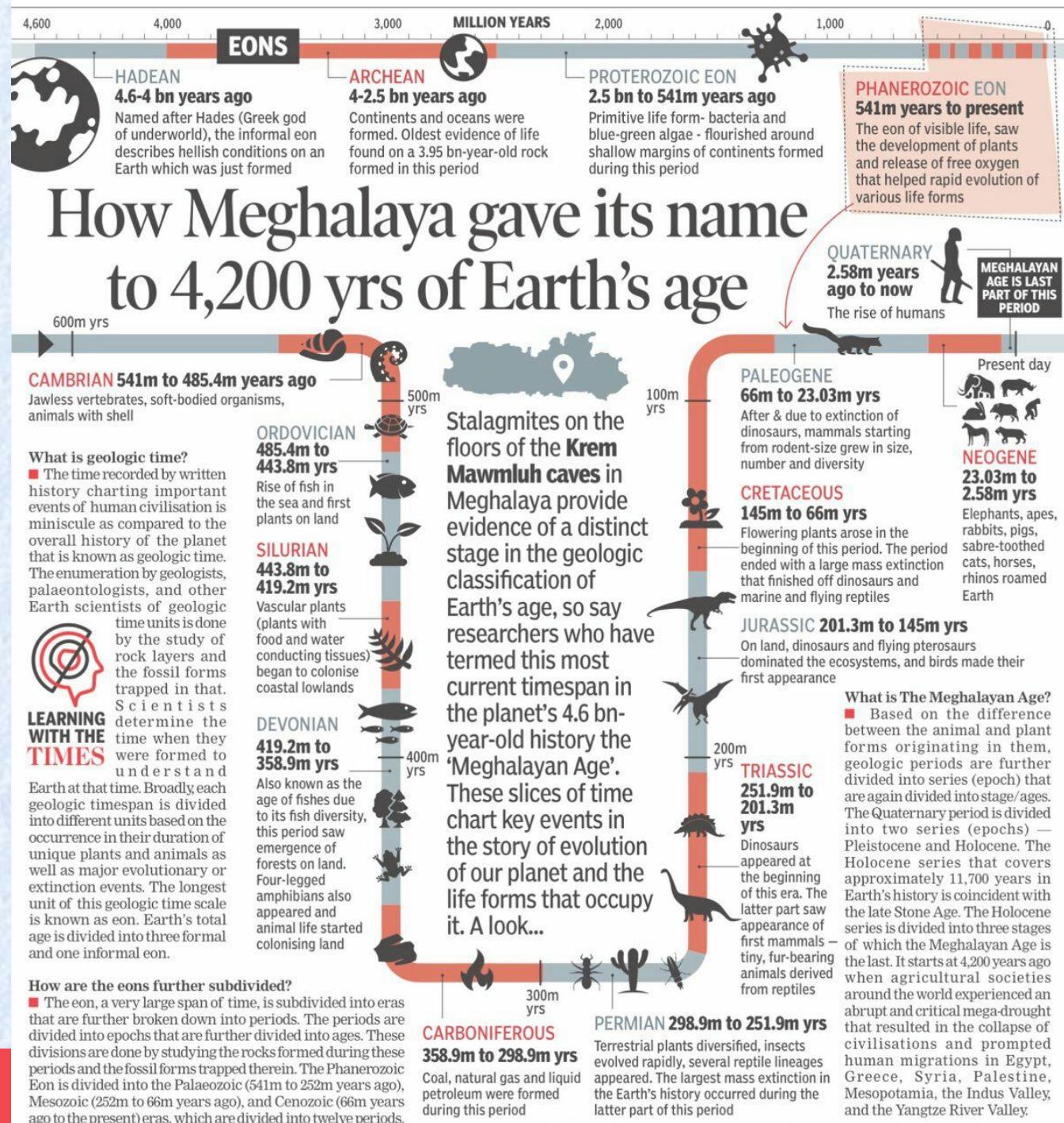
Flooding of atmosphere with Oxygen

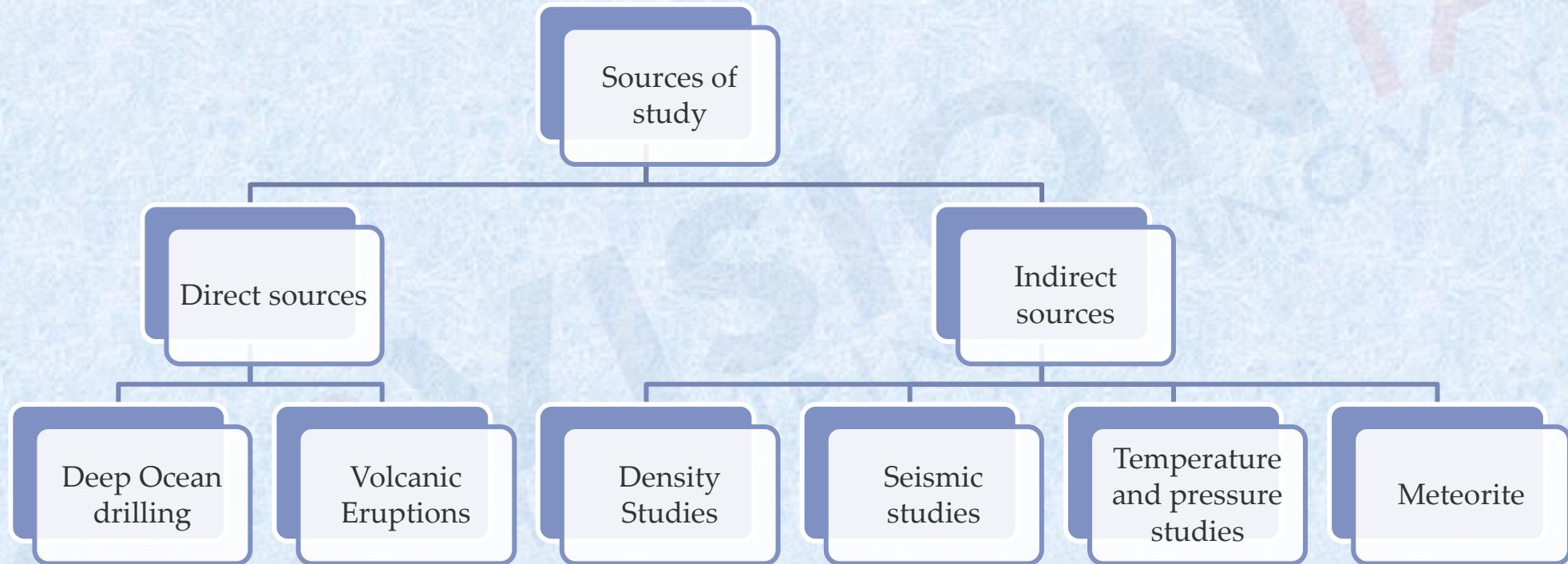
Geological Time Scale

Geological Time Scale

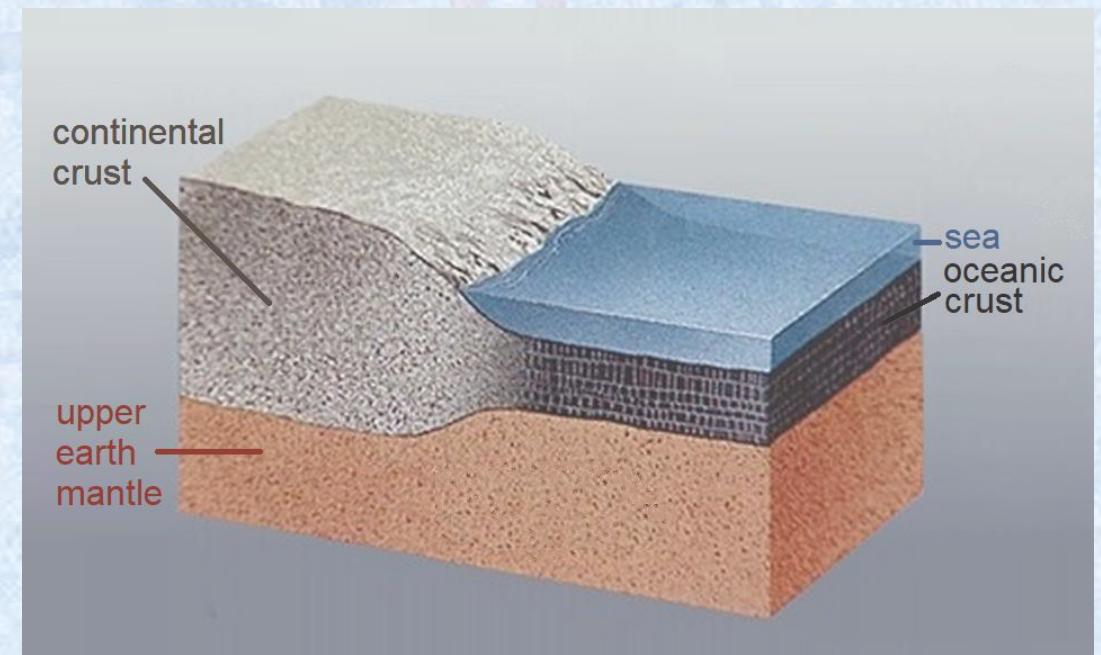
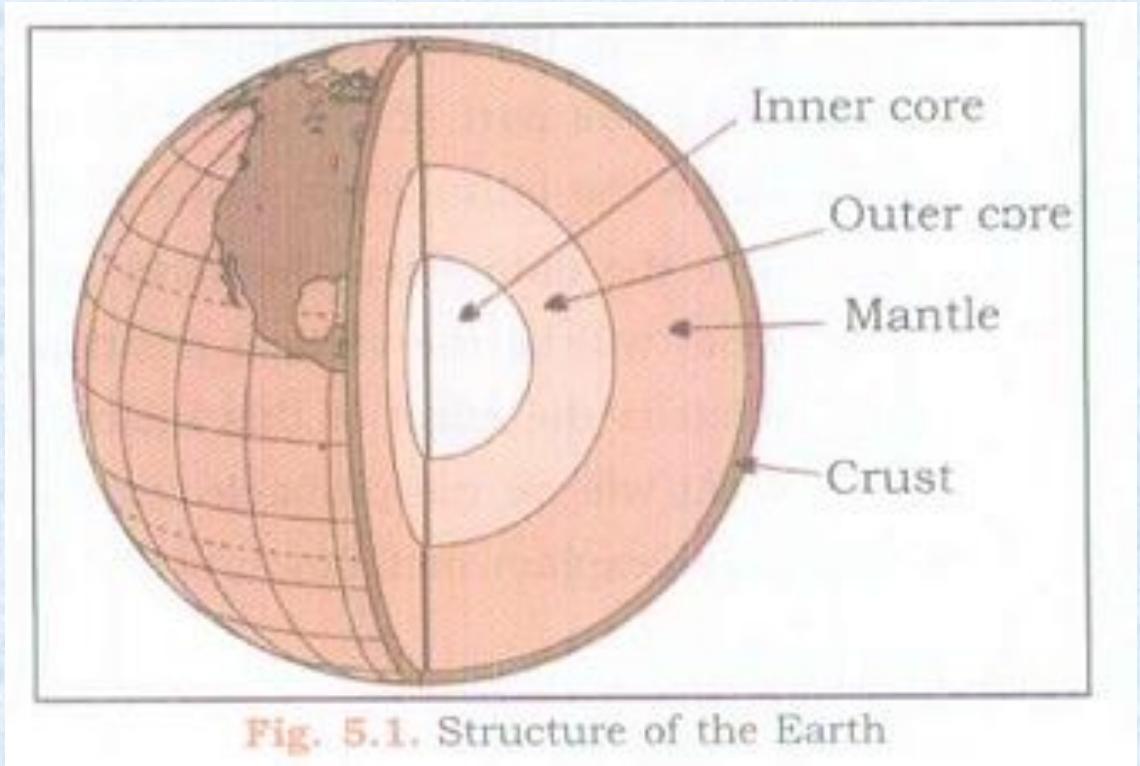
Eons	Era	Period	Epoch	Age/ Years Before Present	Life/ Major Events
	Cainozoic (From 65 million years to the present times)	Quaternary	Holocene Pleistocene	0 - 10,000 10,000 - 2 million	Modern Man Homo Sapiens
		Tertiary	Pliocene Miocene Oligocene Eocene Palaeocene	2 - 5 million 5 - 24 million 24 - 37 Ma 37 - 58 Million 57 - 65 Million	Early Human Ancestor Ape: Flowering Plants and Trees Anthropoid Ape Rabbits and Hare Small Mammals : Rats – Mice
	Mesozoic 65 - 245 Million Mammals	Cretaceous Jurassic Triassic		65 - 144 Million 144 - 208 Million 208 - 245 Million	Extinction of Dinosaurs Age of Dinosaurs Frogs and turtles
	Palaeozoic 245 - 570 Million	Permian Carboniferous Devonian Silurian Ordovician Cambrian		245 - 286 Million 286 - 360 Million 360 - 408 Million 408 - 438 Million 438 - 505 Million 505 - 570 Million	Reptile dominate-replace amphibians First Reptiles: Vertebrates: Coal beds Amphibians First trace of life on land: Plants First Fish No terrestrial Life : Marine Invertebrate
Proterozoic Archean Hadean	Pre-Cambrian 570 Million - 4,800 Million			570 - 2,500 Million 2,500 - 3,800 Million 3,800 - 4,800 Million	Soft-bodied arthropods Blue green Algae: Unicellular bacteria Oceans and Continents form – Ocean and Atmosphere are rich in Carbon dioxide
Origin of Stars Supernova Big Bang	5,000 - 13,700 Million			5,000 Million 12,000 Million 13,700 Million	Origin of the sun Origin of the universe

Geological Time Scale



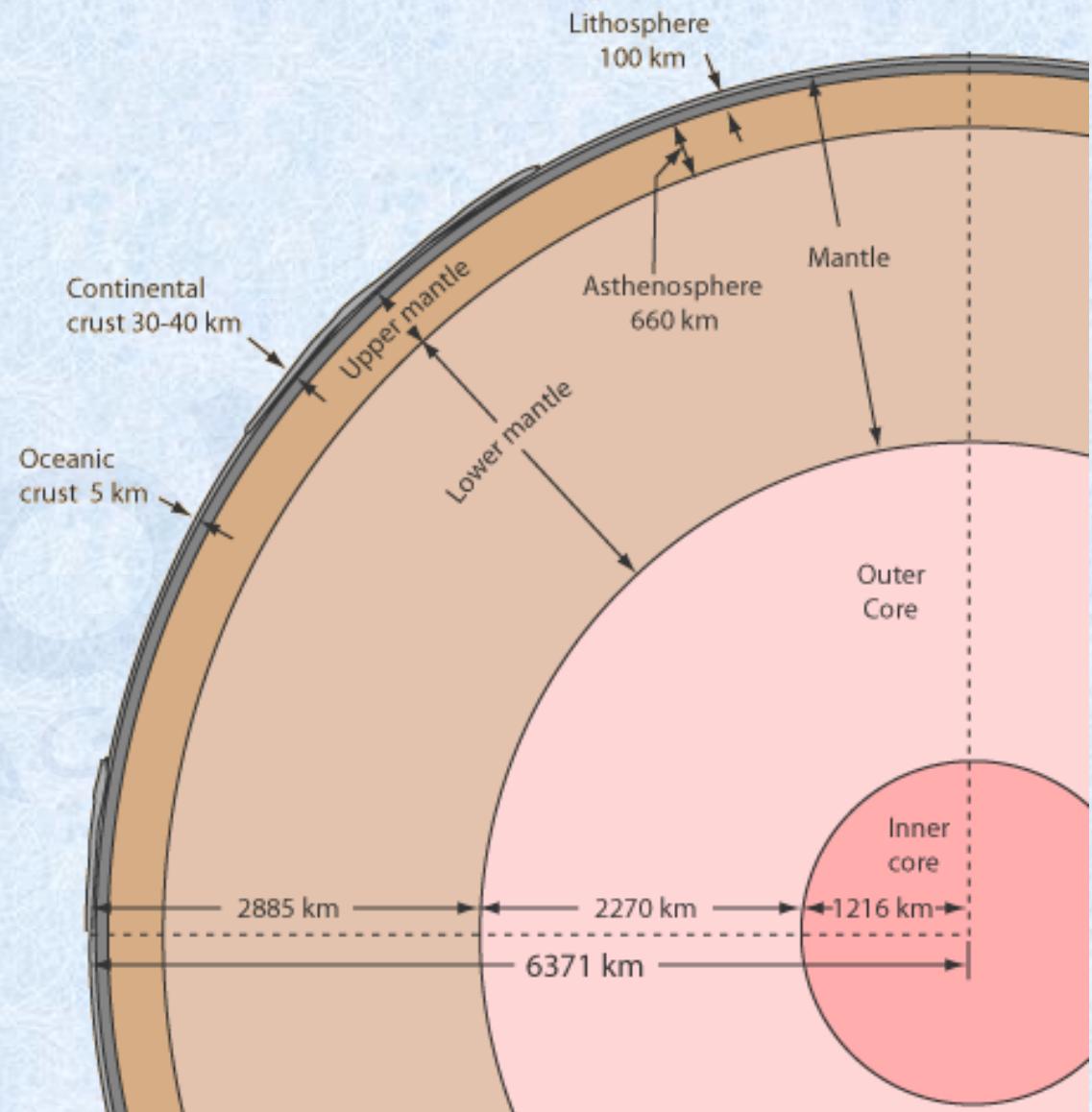
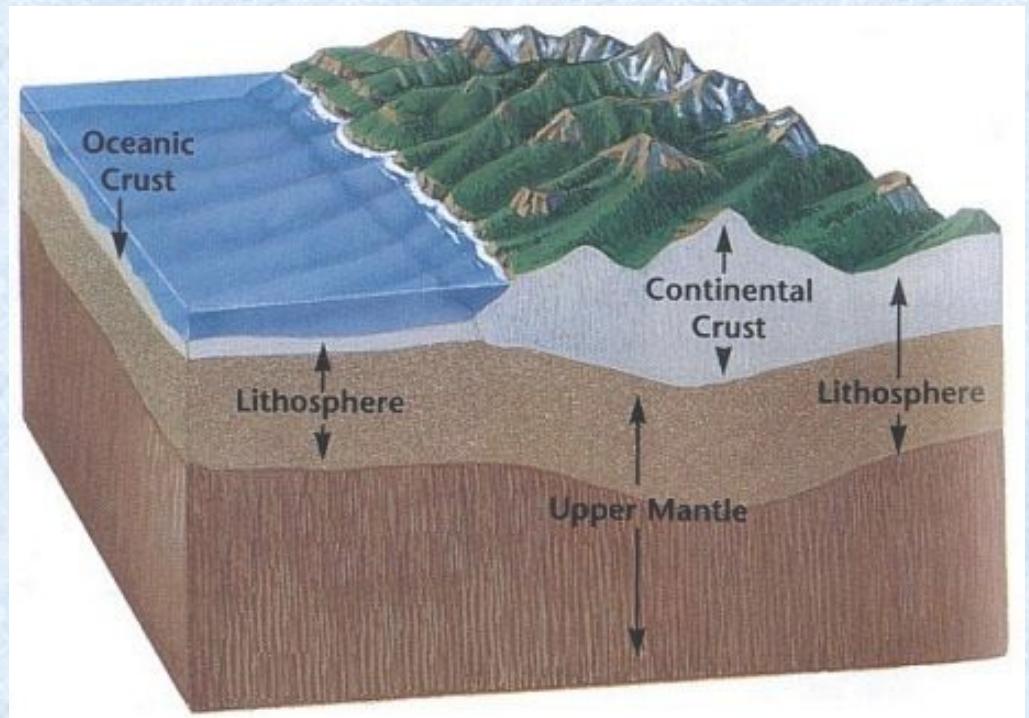


Interior of the Earth



Chemical divisions

Interior of the Earth

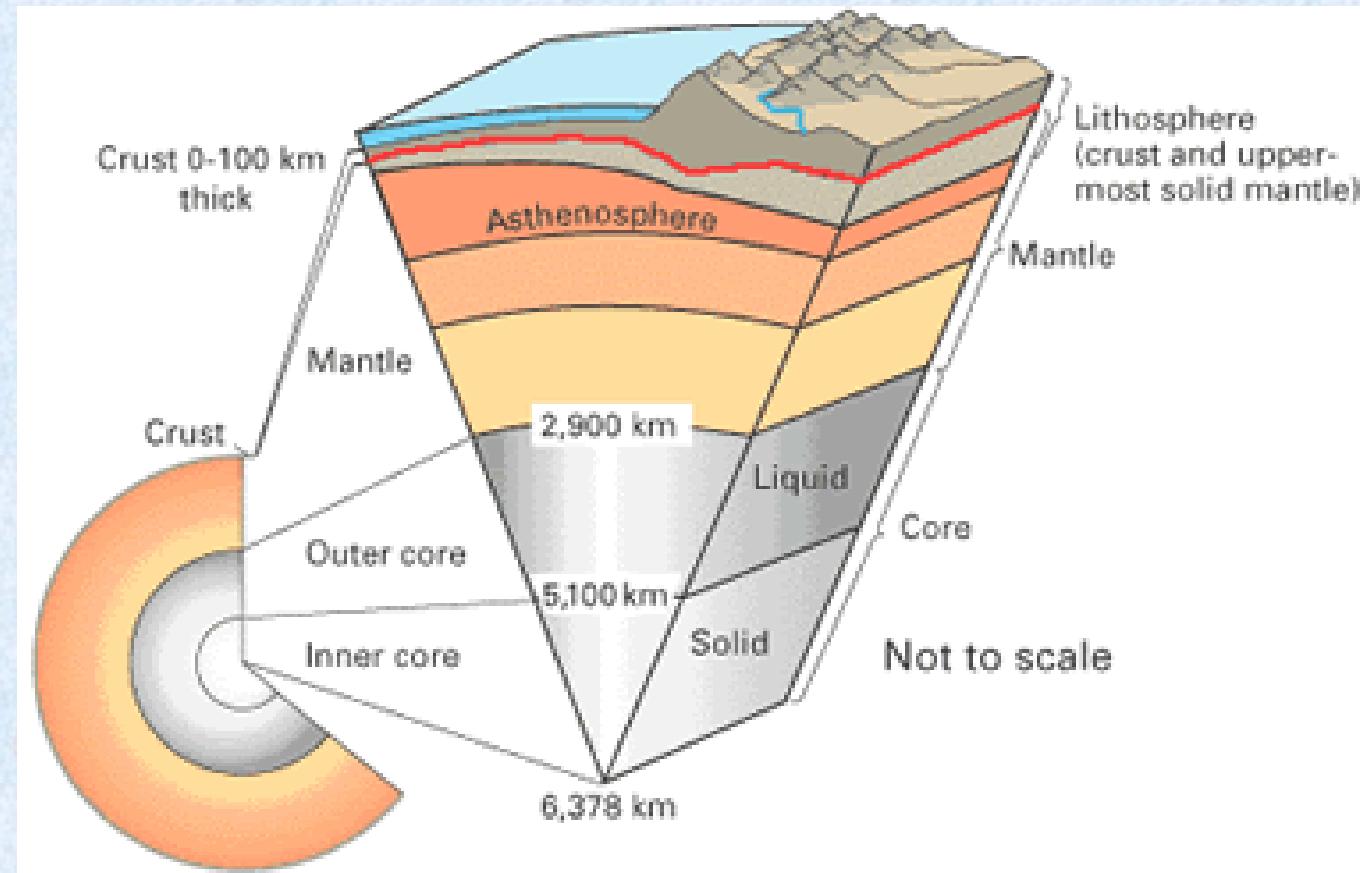


Physical divisions

Table 5.1 : The Major Elements of the Earth's Crust

Sl. No.	Elements	By Weight(%)
1.	Oxygen	46.60
2.	Silicon	27.72
3.	Aluminium	8.13
4.	Iron	5.00
5.	Calcium	3.63
6.	Sodium	2.83
7.	Potassium	2.59
8.	Magnesium	2.09
9.	Others	1.41

Element (Entire earth)	%
Iron	35
Oxygen	30
Silicon	15
Magnesium	13
Nickel	
Sulphur	



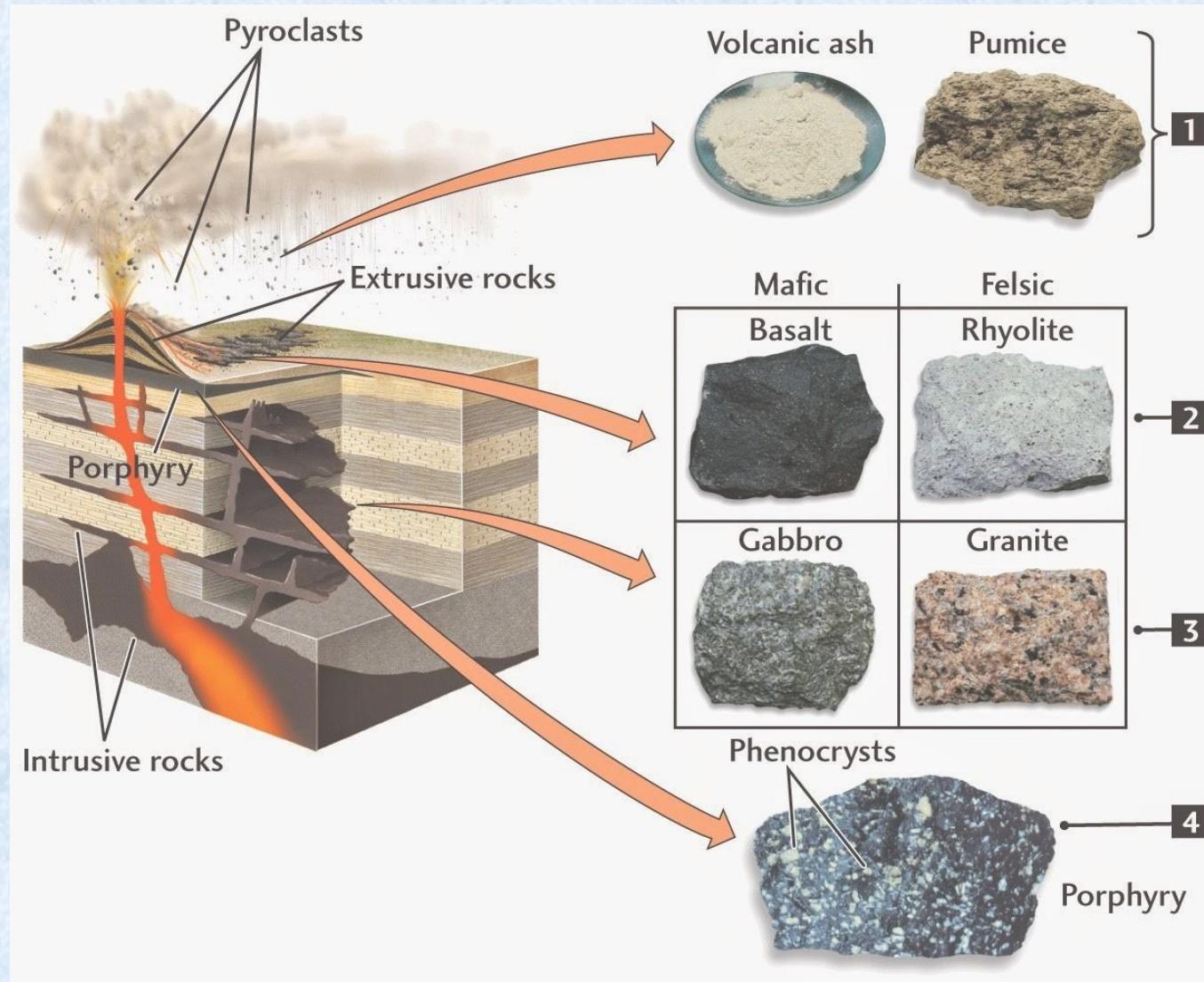
Discontinuities

2009	In the structure of planet Earth, below the mantle, the core is mainly made up of which one of the following? (a) Aluminum (b) Chromium (c) Iron (d) Silicon
------	--

Table 7.1. Difference between Rocks and Minerals

Rocks	Minerals
<ol style="list-style-type: none">1. Rocks are aggregates of mineral elements.2. A rock has no definite chemical composition.3. Minerals are organised to form rocks.4. Three chief types of rocks are <i>Igneous</i>, <i>Sedimentary</i> and <i>Metamorphic</i>.5. Basalt, granite, sandstone, slate and quartz are some important types of rocks.	<ol style="list-style-type: none">1. Minerals are solid inorganic substances occurring naturally.2. Minerals have a definite chemical composition.3. Elements are organised to form compounds which are known as minerals. An element is a pure substance.4. Four chief mineral groups are <i>silicates</i>, <i>carbonates</i>, <i>sulphides</i> and <i>metallic minerals</i>.5. Iron, silicon, magnesium, nickel, calcium, potassium, sodium are abundant minerals of the earth.

Types of Rocks

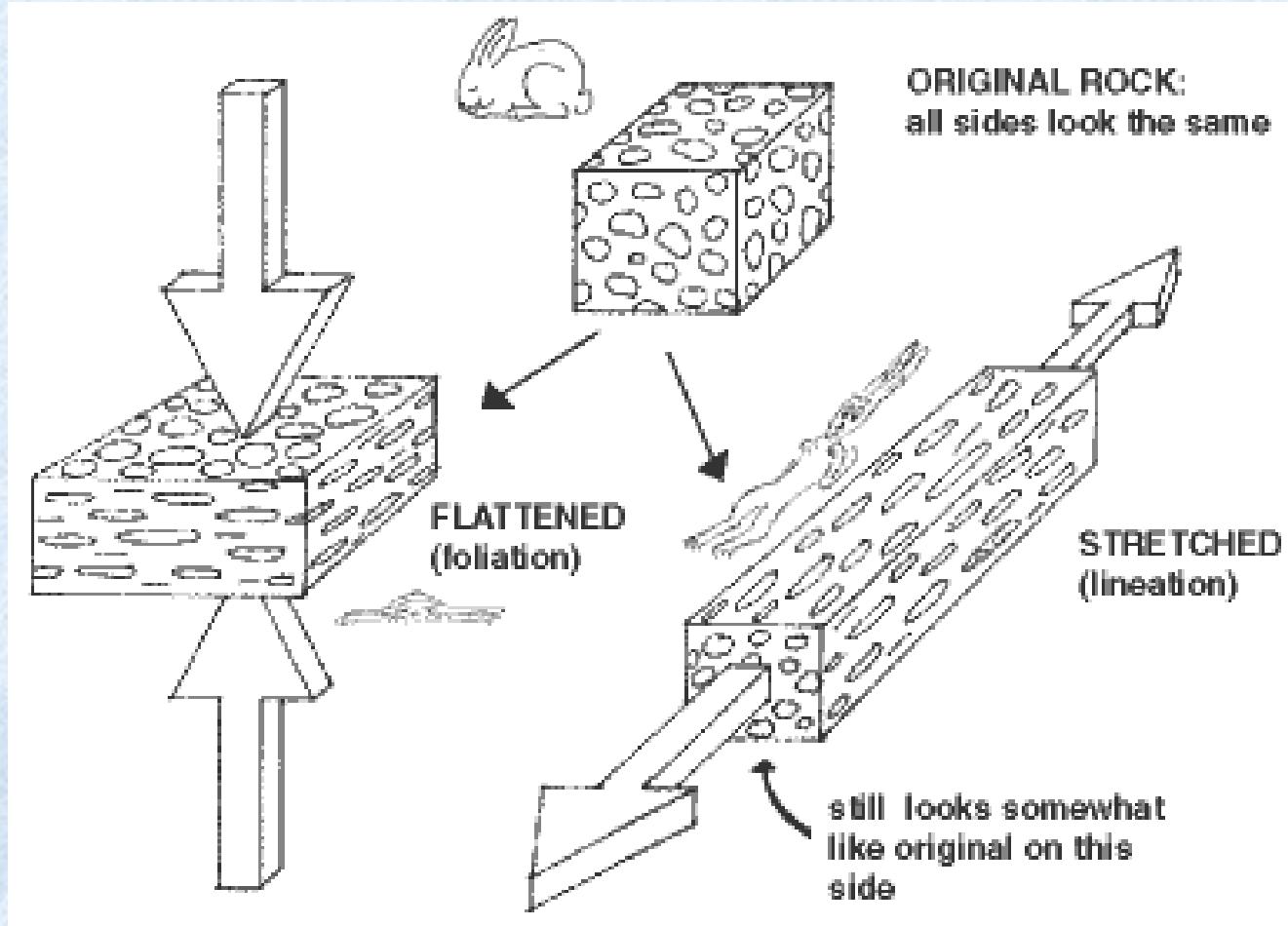


Types of Rocks



Sedimentary Rocks

Types of Rocks



Types of Rocks



Lineation Quartz



Non foliated Quartz

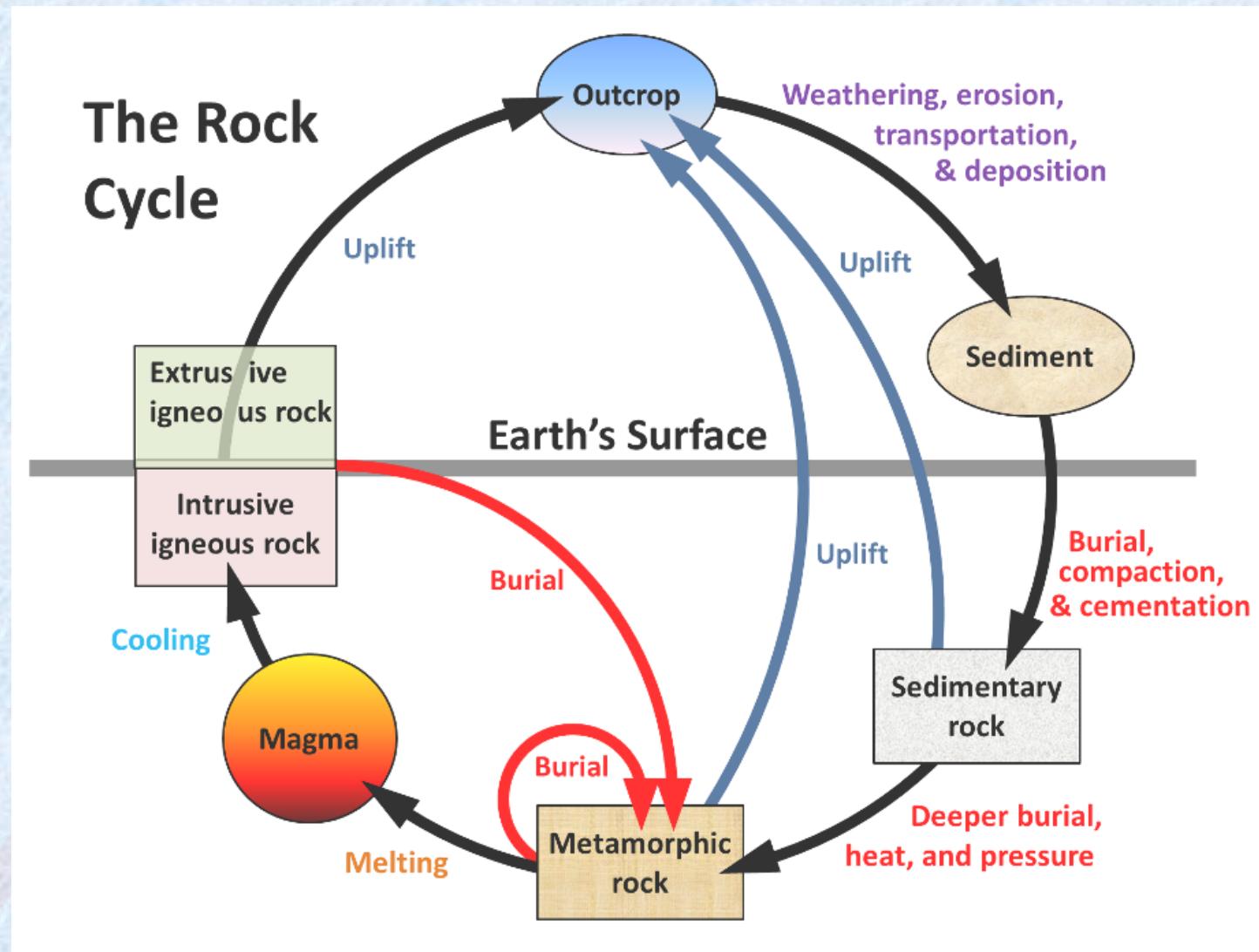


Foliated Gneiss

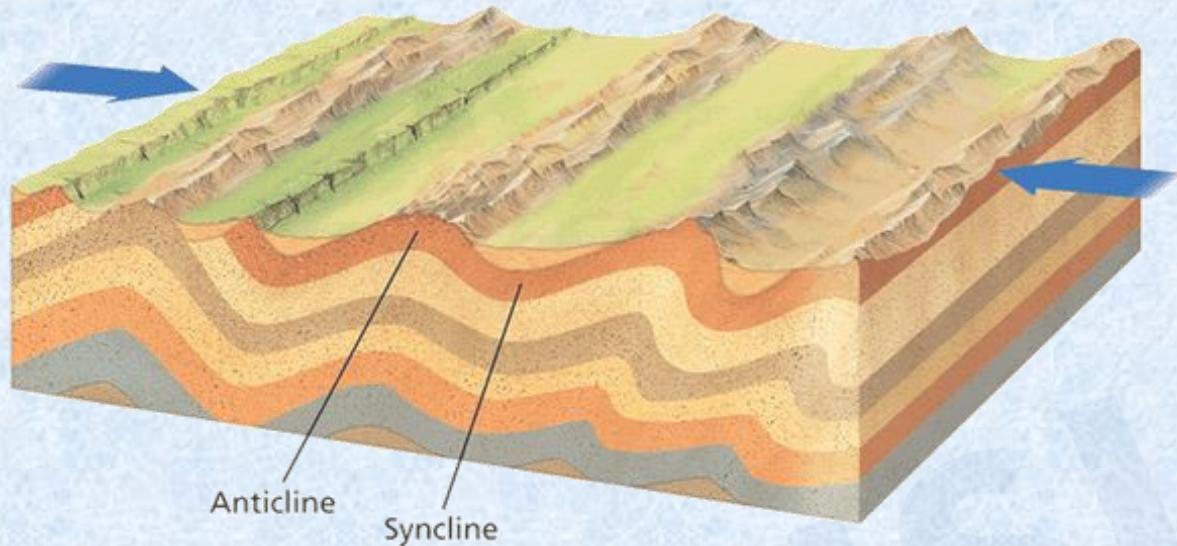
Types of Rocks



© geology.com



Earth's Movements



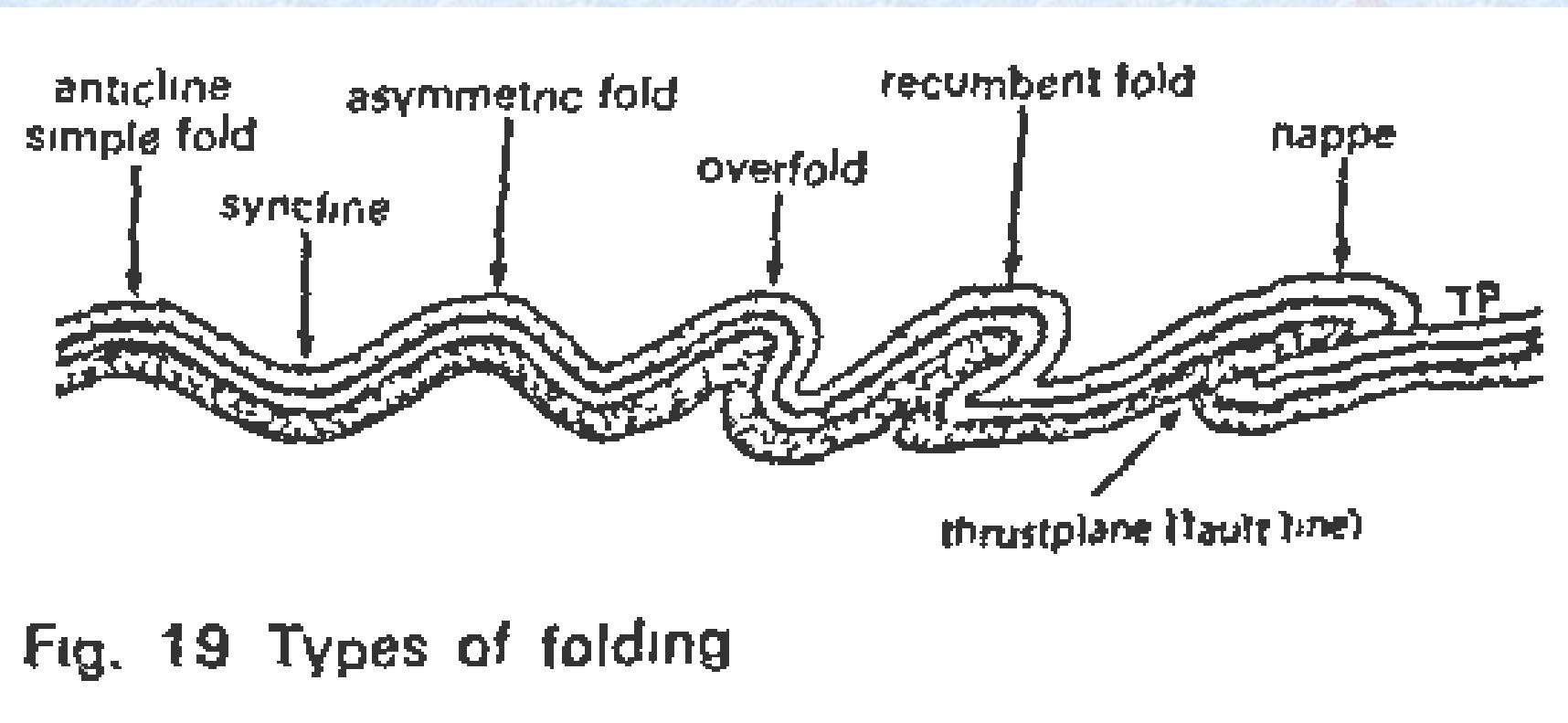
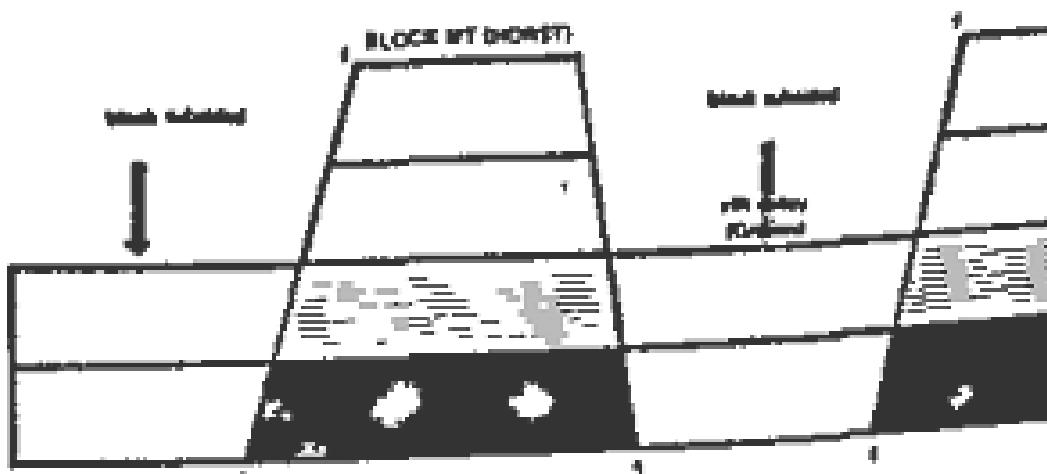
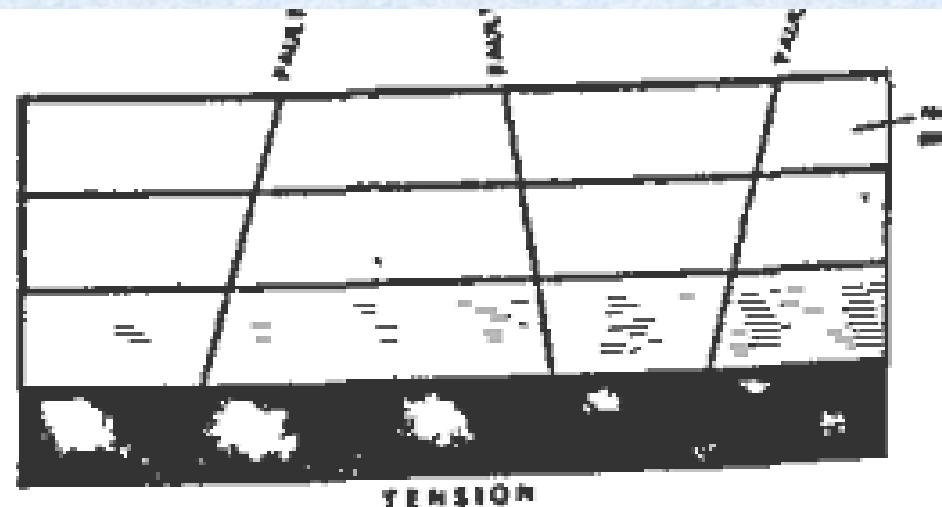
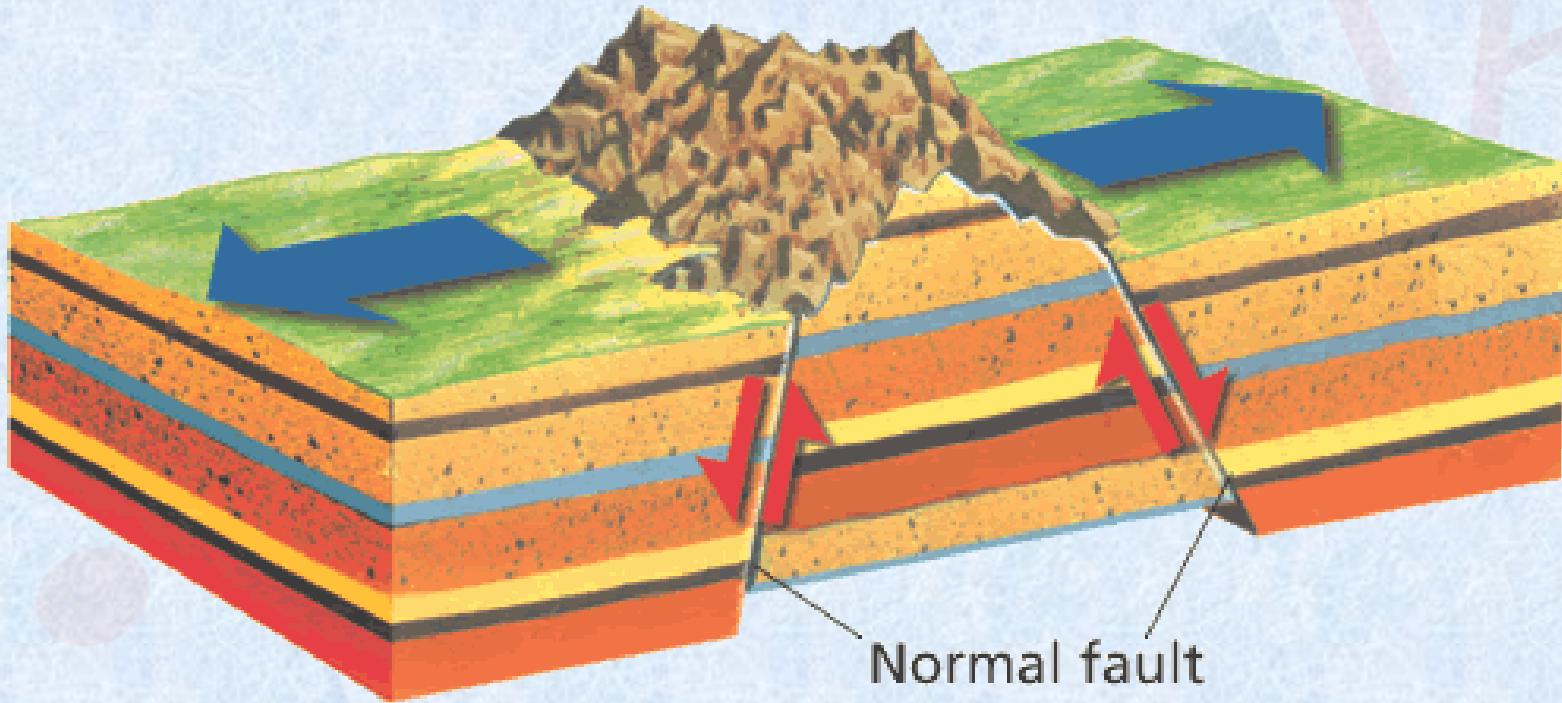


Fig. 19 Types of folding



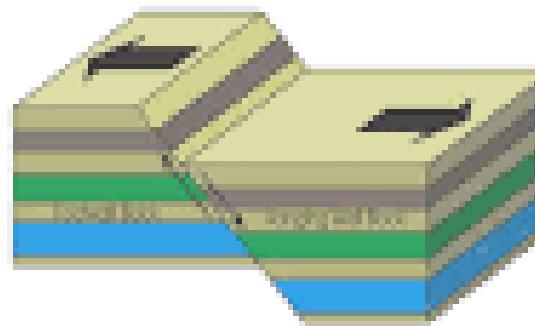
21 (a) Block mountain (horst) formed by tension when faults develop

Fault-Block Mountain

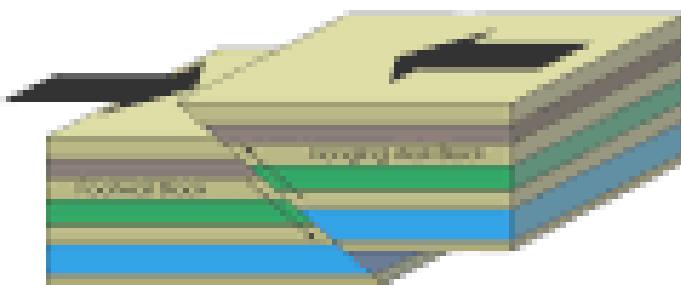




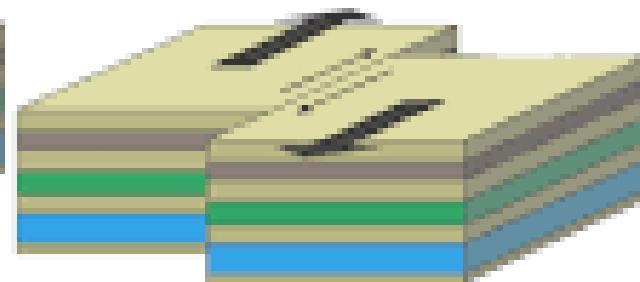
What are the three main types of faults?



Normal fault



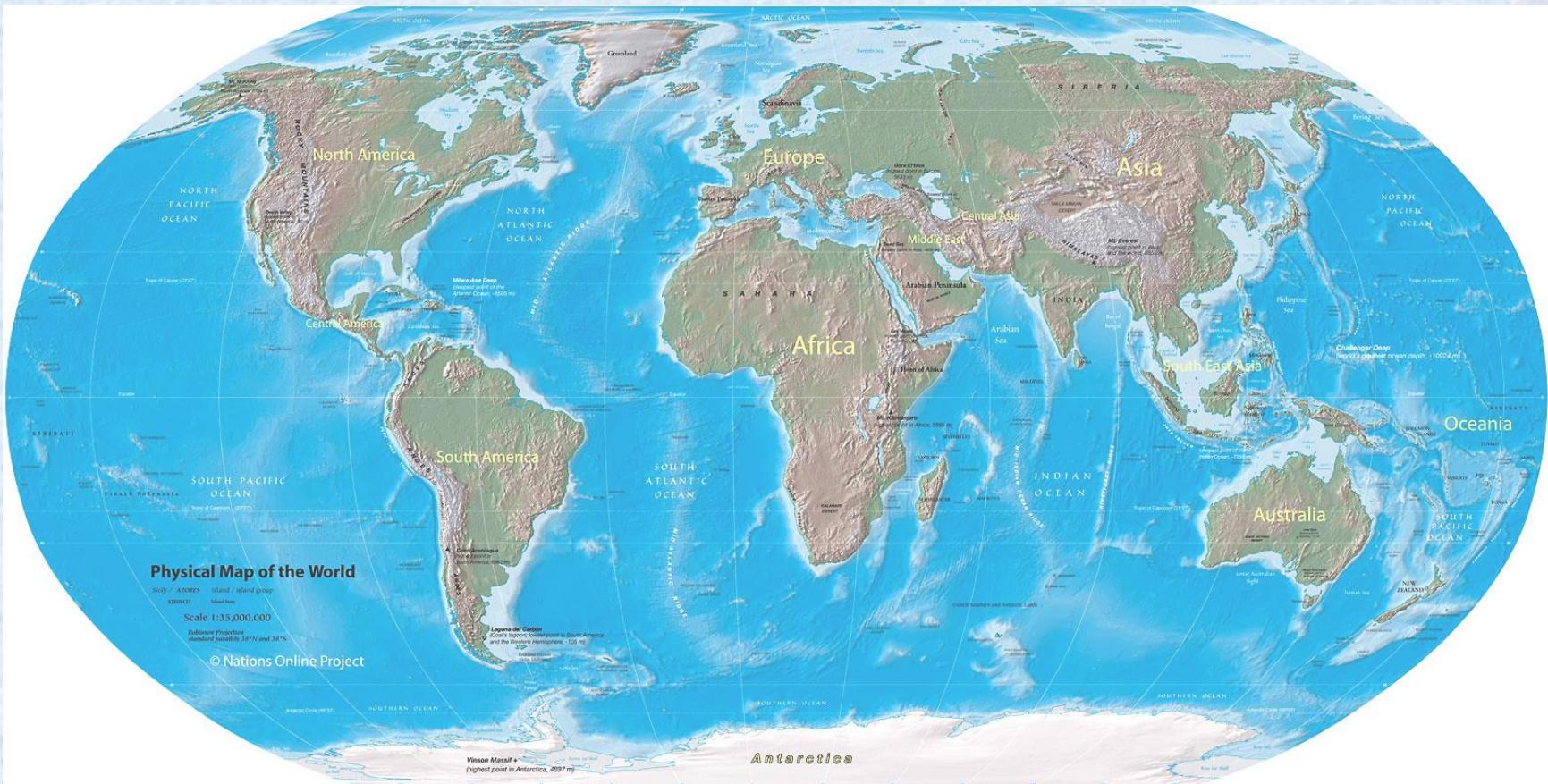
Reverse fault



Strike-slip fault

www.GeologyPage.com

Continental Drift Theory



Continental Drift Theory

CONTINENTAL DRIFT OF PLATES



225 Million Years Ago



150 Million Years Ago

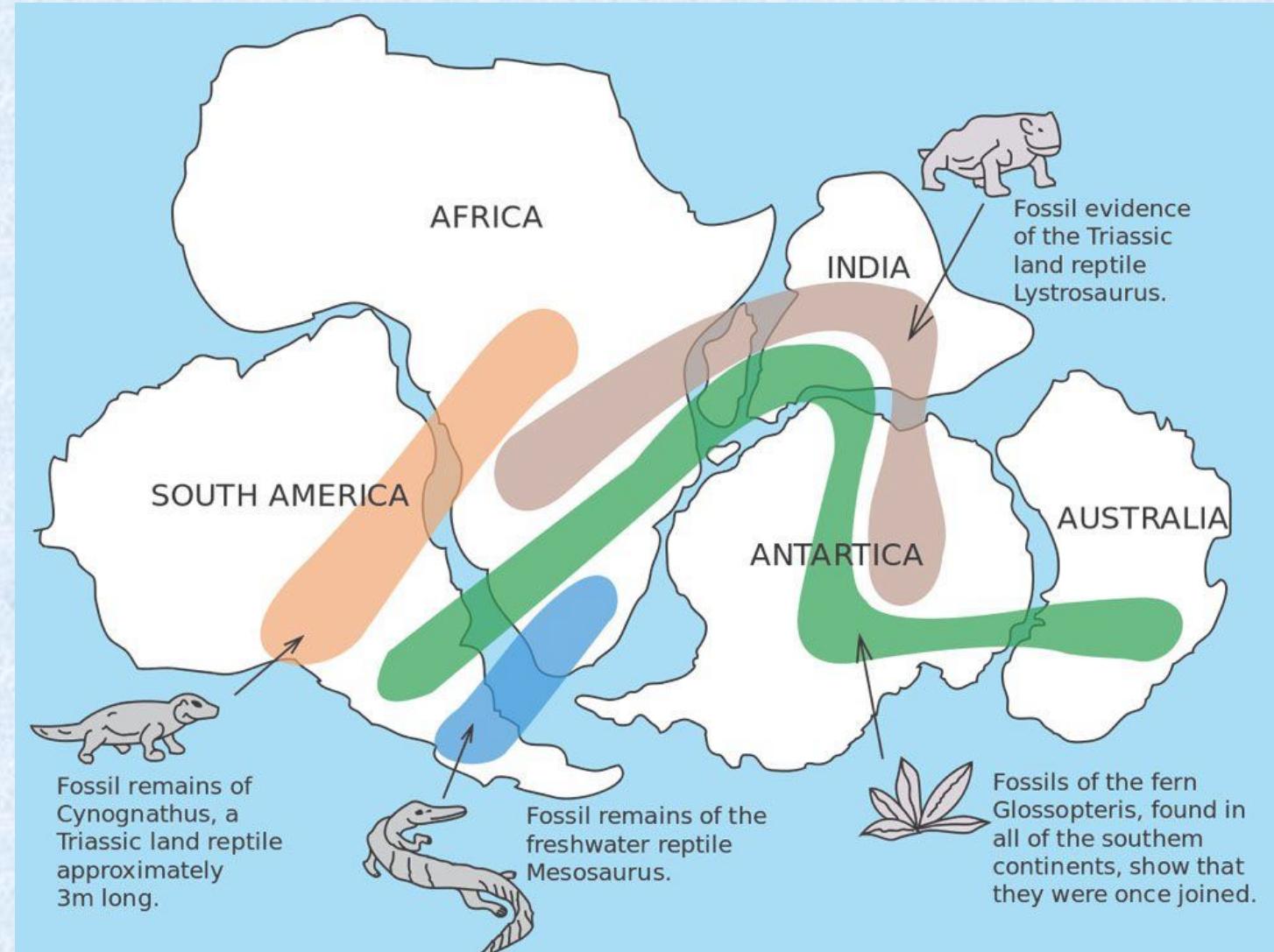


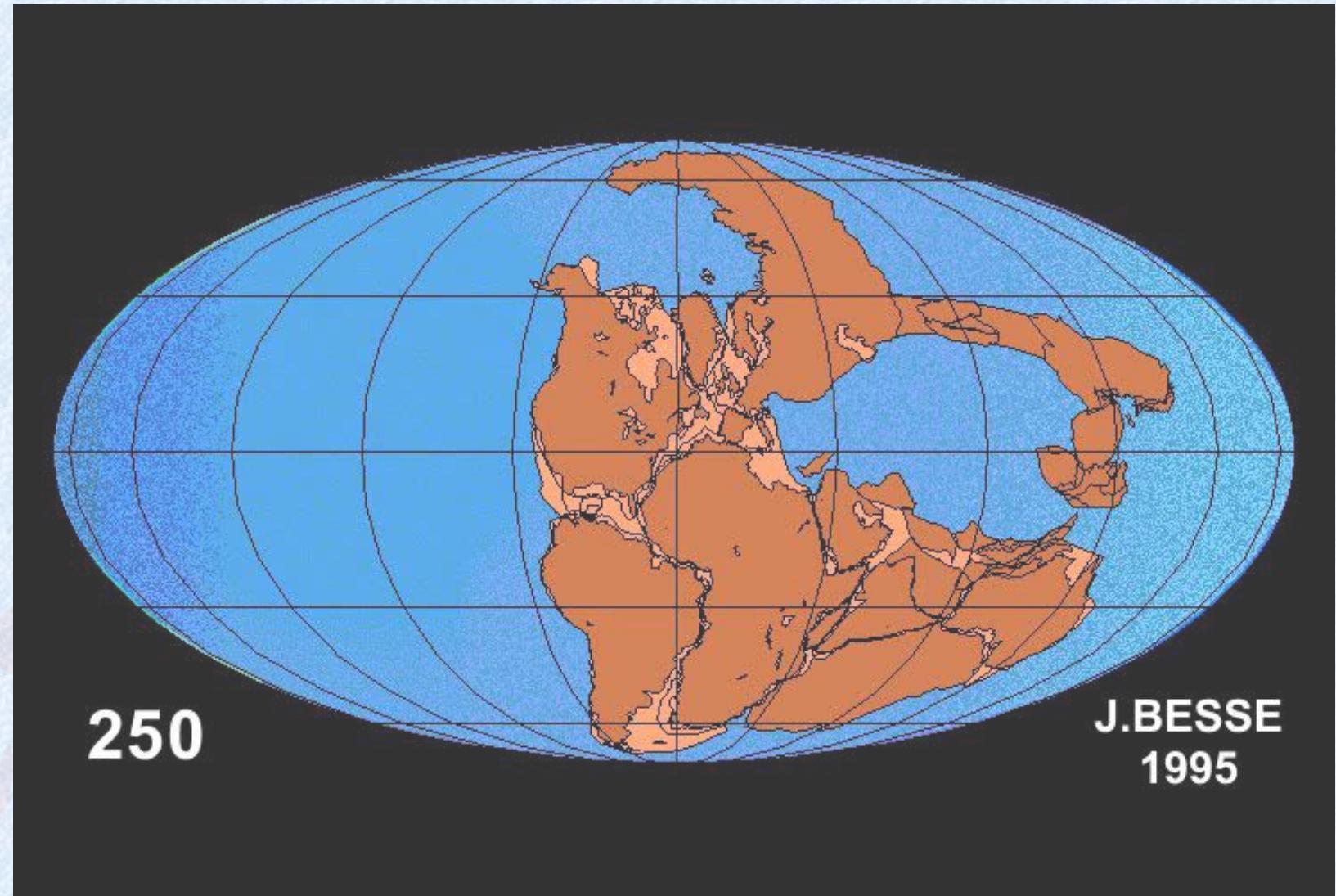
100 Million Years Ago



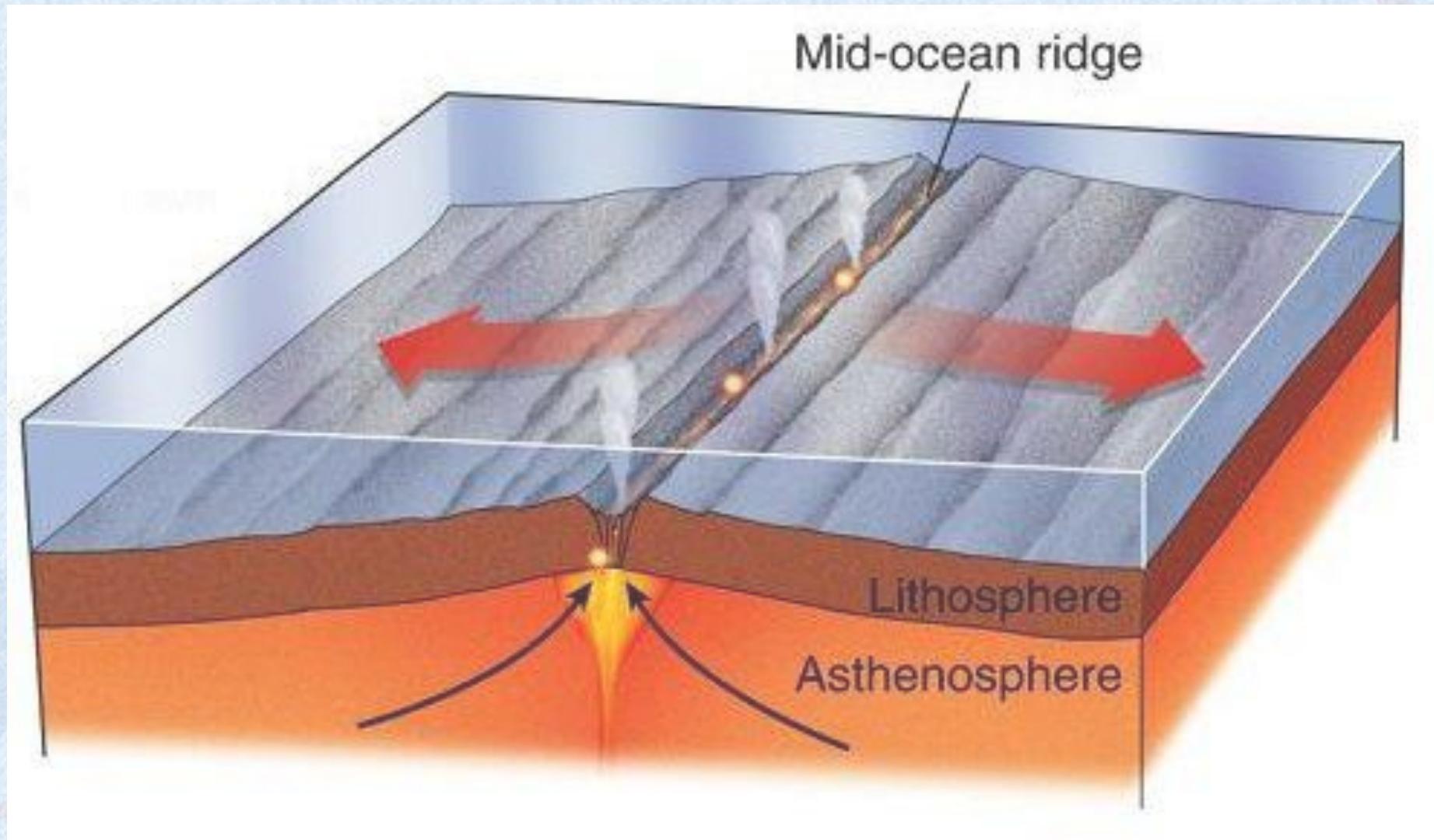
Earth Today

Continental Drift Theory

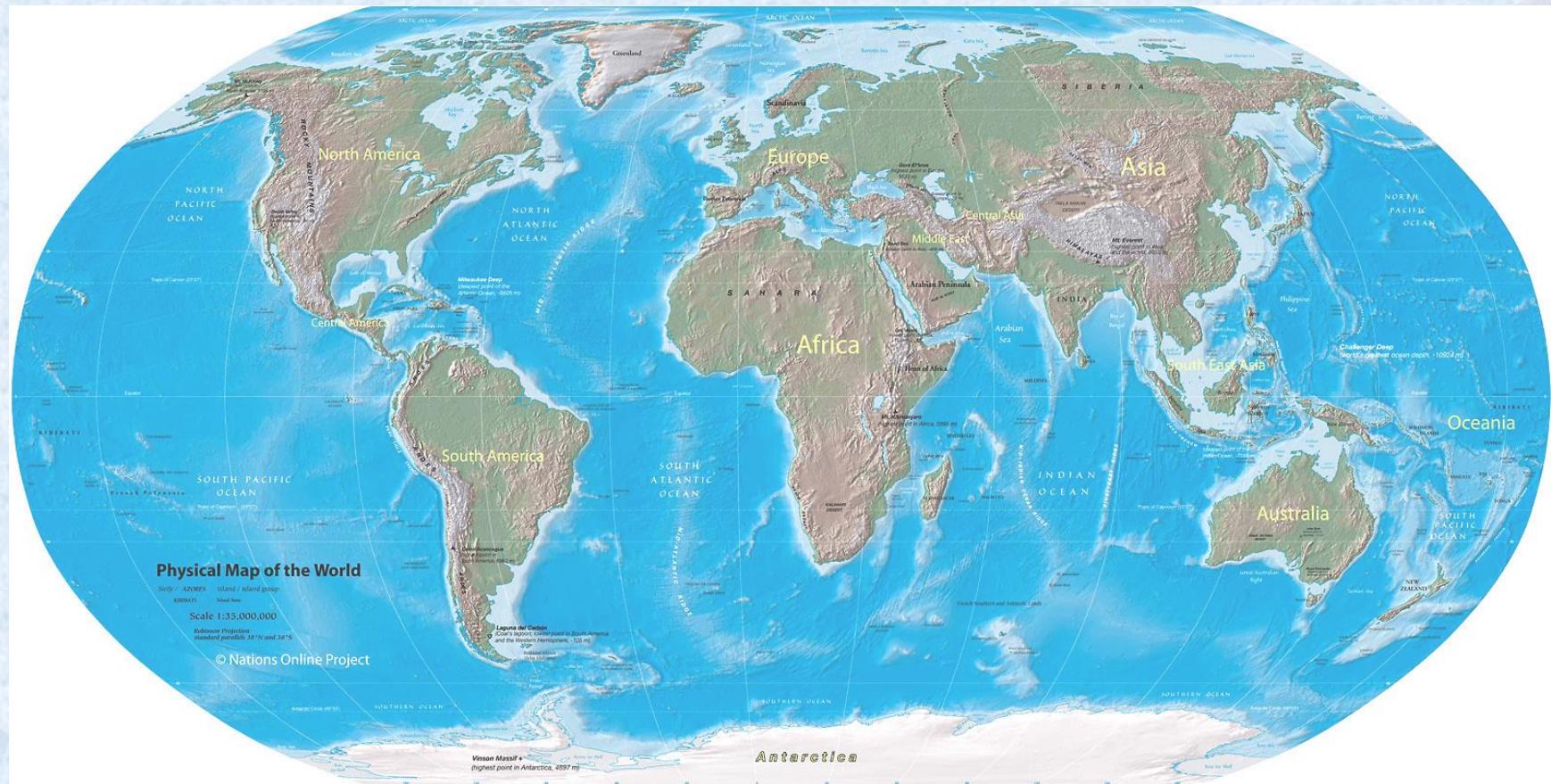




Sea floor spreading



Sea floor spreading



https://www.youtube.com/watch?v=k-_Z6p5cjKg

Plate Tectonics Theory

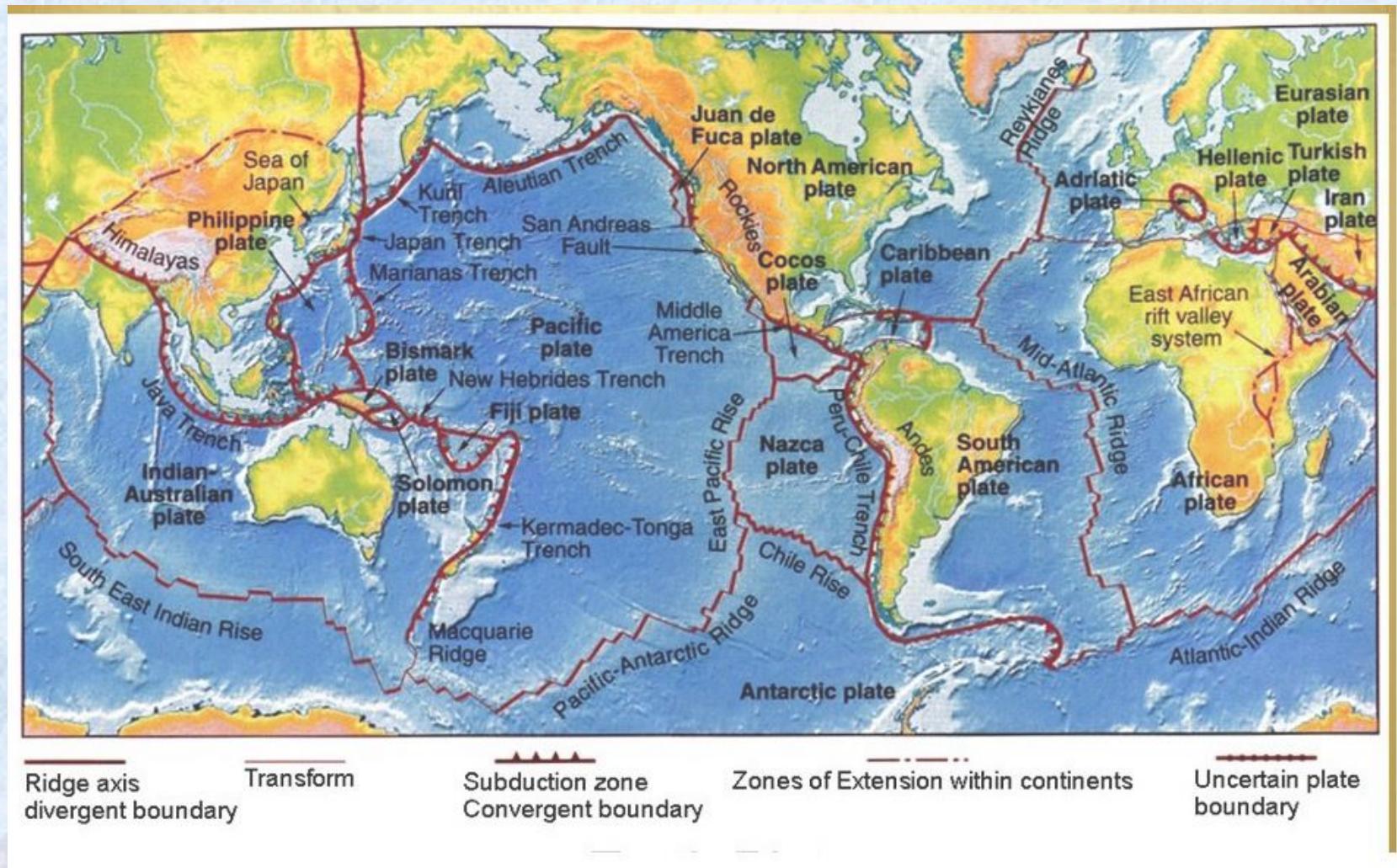


Plate Tectonics Theory

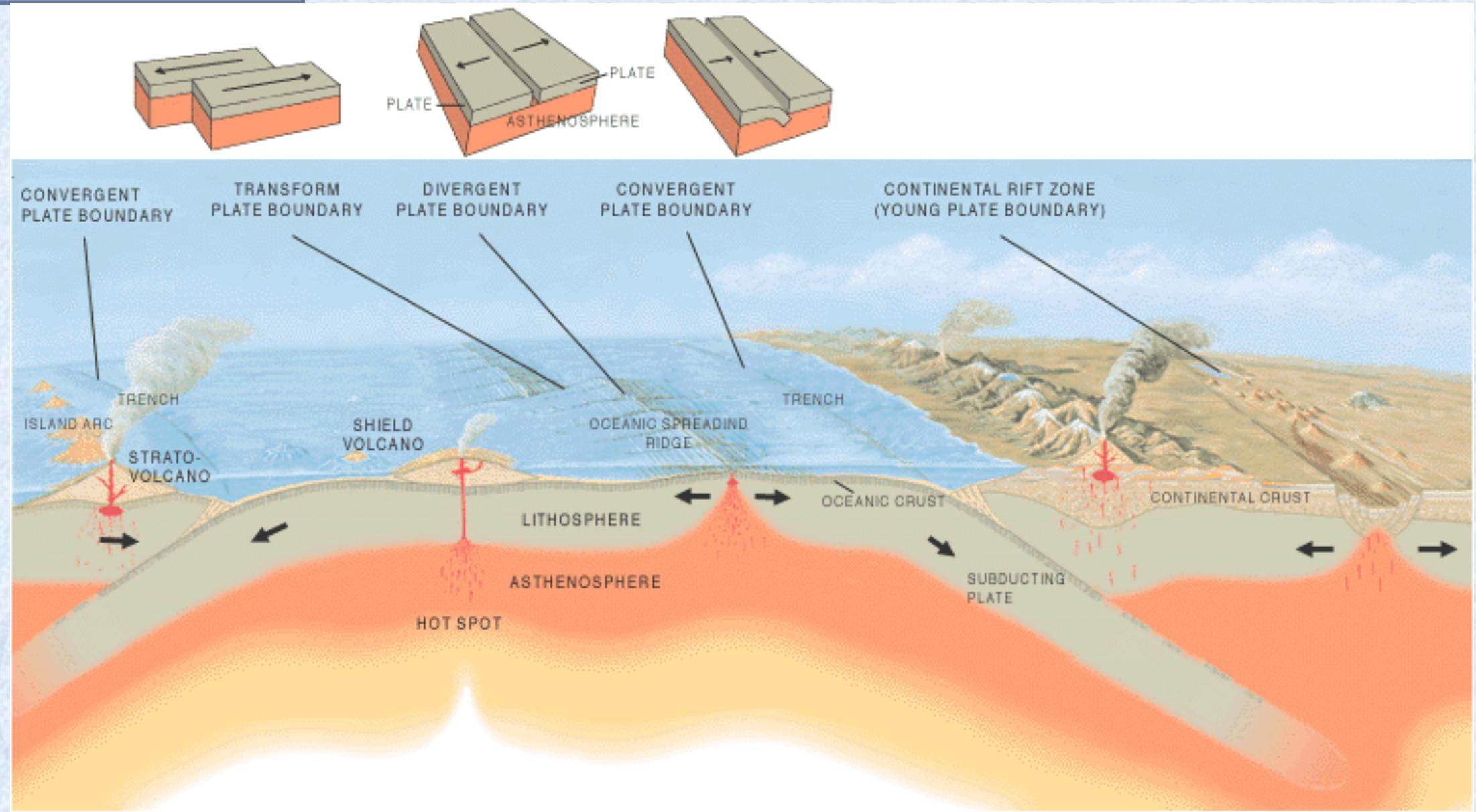


Plate Tectonics Theory

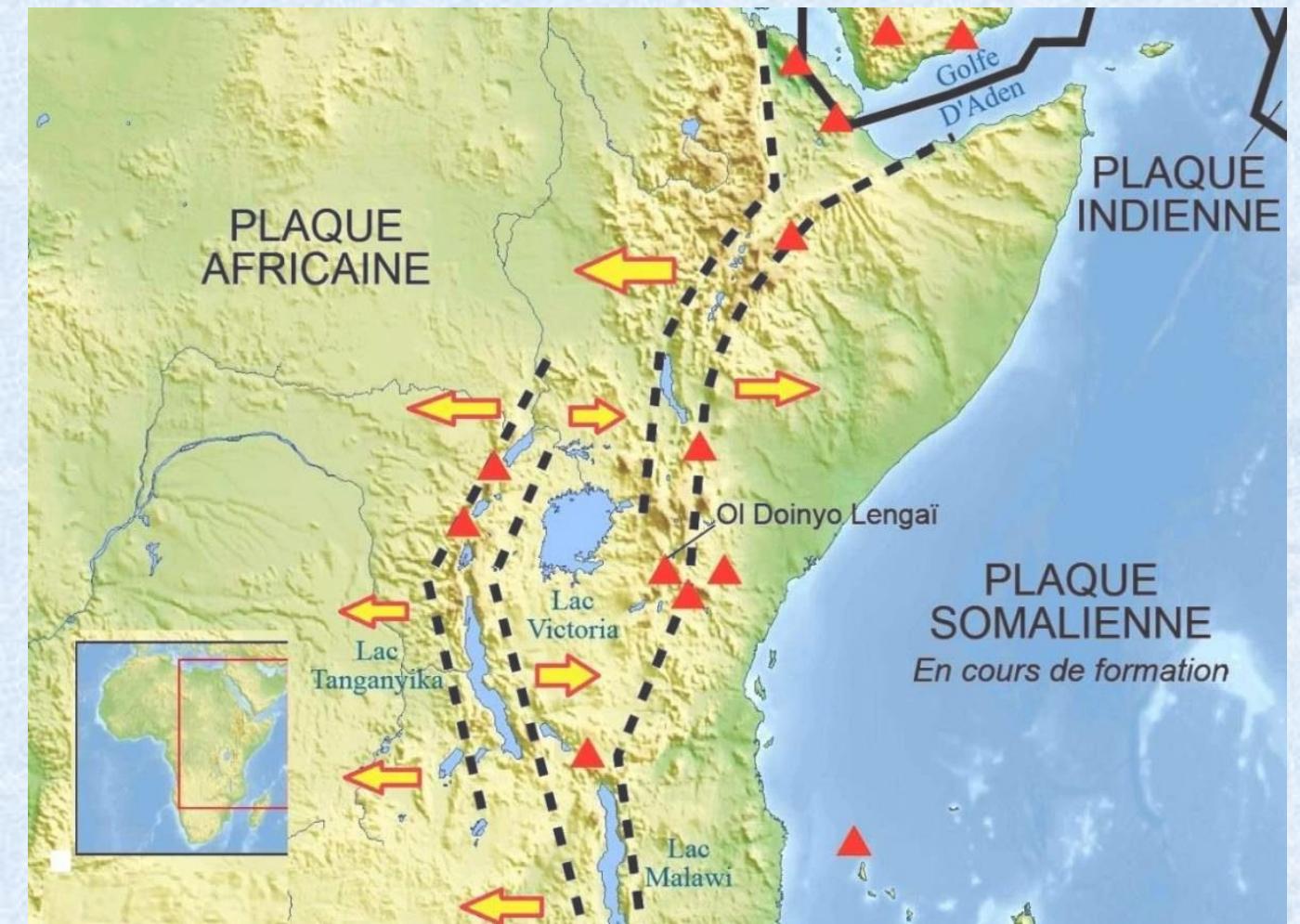
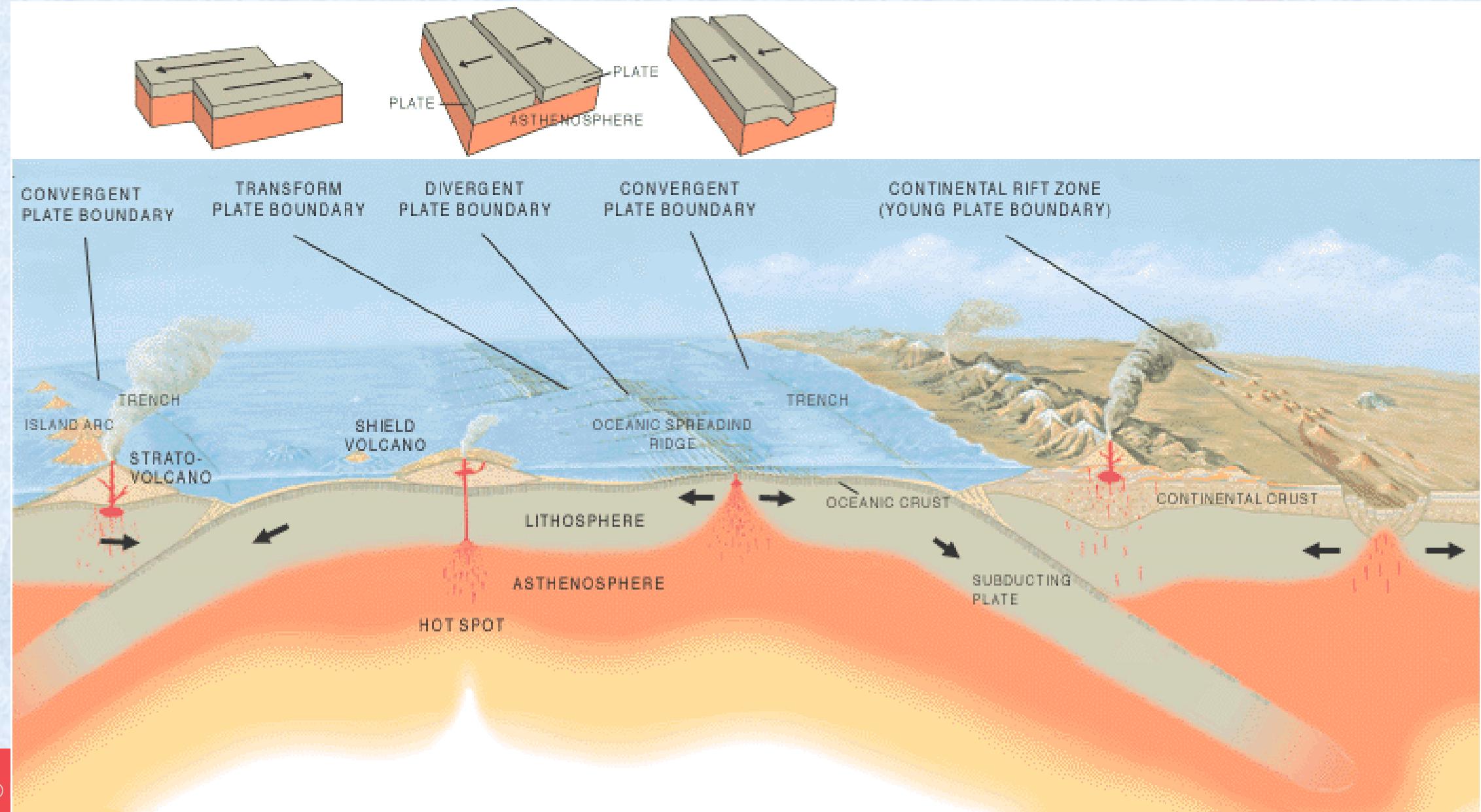
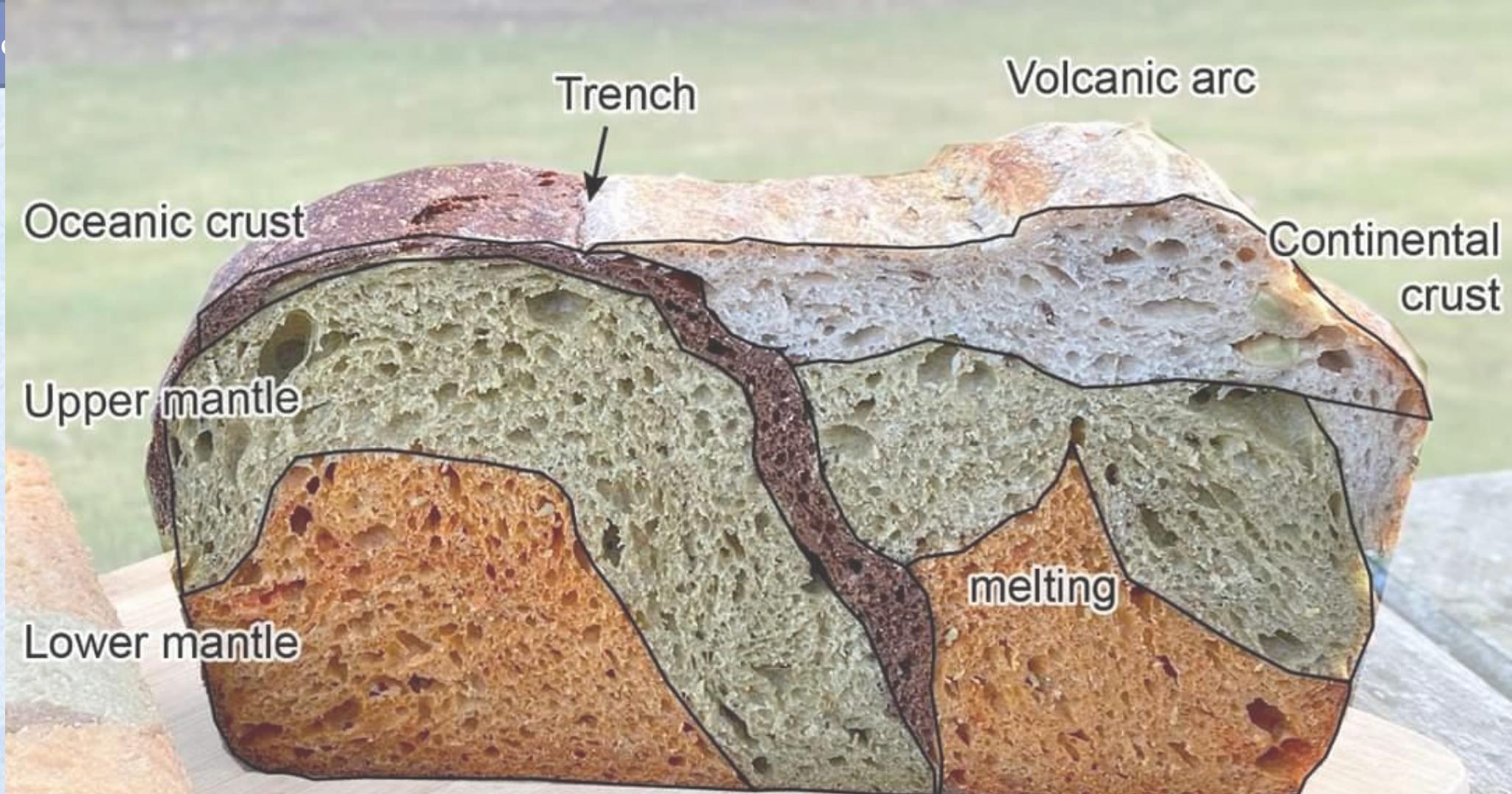


Plate Tectonics Theory





Sourdough flavors:

orange asthenosphere: paprika and pumpkin

green upper mantle: spinach and basil

brown oceanic crust: unsweetened cocoa

white cont. crust: roasted garlic and caraway

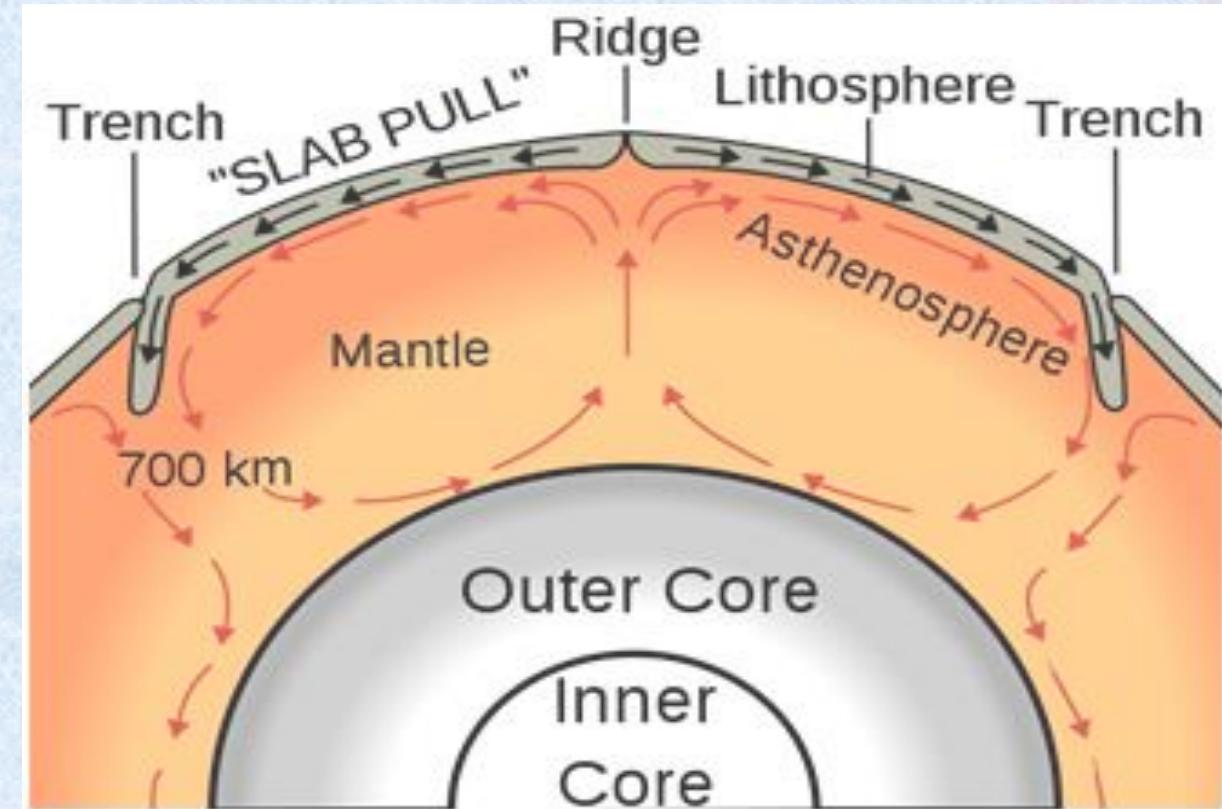


Plate Tectonics Theory



Rajesh Govindaraj

https://www.youtube.com/watch?v=1-HwPR_4mP4

<https://www.youtube.com/watch?v=fzhPmemffII>

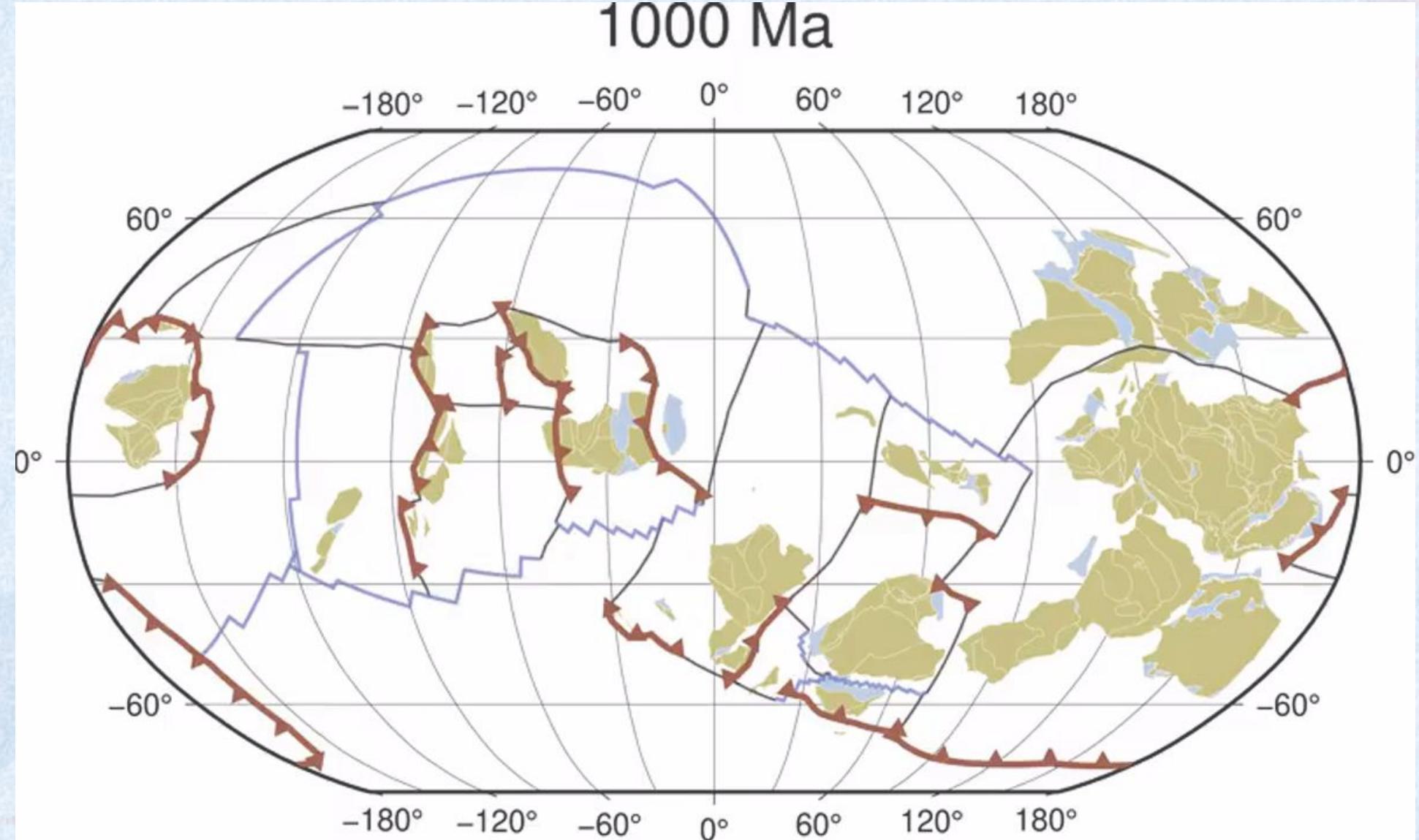


Plate Tectonics Theory

2014	Why are the world's fold mountain systems located along the margins of continents? Bring out the association between the global distribution of fold mountains and the earthquakes and volcanoes.	10
2014	Explain the formation of thousands of islands in Indonesian and Philipines archipelagos.	10
2018	Define mantle plume and explain its role in plate tectonics.	10

Questions??



- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

▼Table 1 Data on Planets and the Sun

	DIAMETER Kilometers	AVERAGE DISTANCE FROM SUN Millions of Kilometers	AVERAGE SURFACE TEMPERATURE		MAIN ATMOSPHERIC COMPONENTS
			°C	°F	
Sun	1,392 × 103		5,800	10,500	—
Mercury	4,880	58	260*	500	—
Venus	12,112	108	480	900	CO ₂
Earth	12,742	150	15	59	N ₂ , O ₂
Mars	6,800	228	-60	-76	CO ₂
Jupiter	143,000	778	-110	-166	H ₂ , He
Saturn	121,000	1,427	-190	-310	H ₂ , He
Uranus	51,800	2,869	-215	-355	H ₂ , CH ₄
Neptune	49,000	4,498	-225	-373	N ₂ , CH ₄
Pluto	3,100	5,900	-235	-391	CH ₄

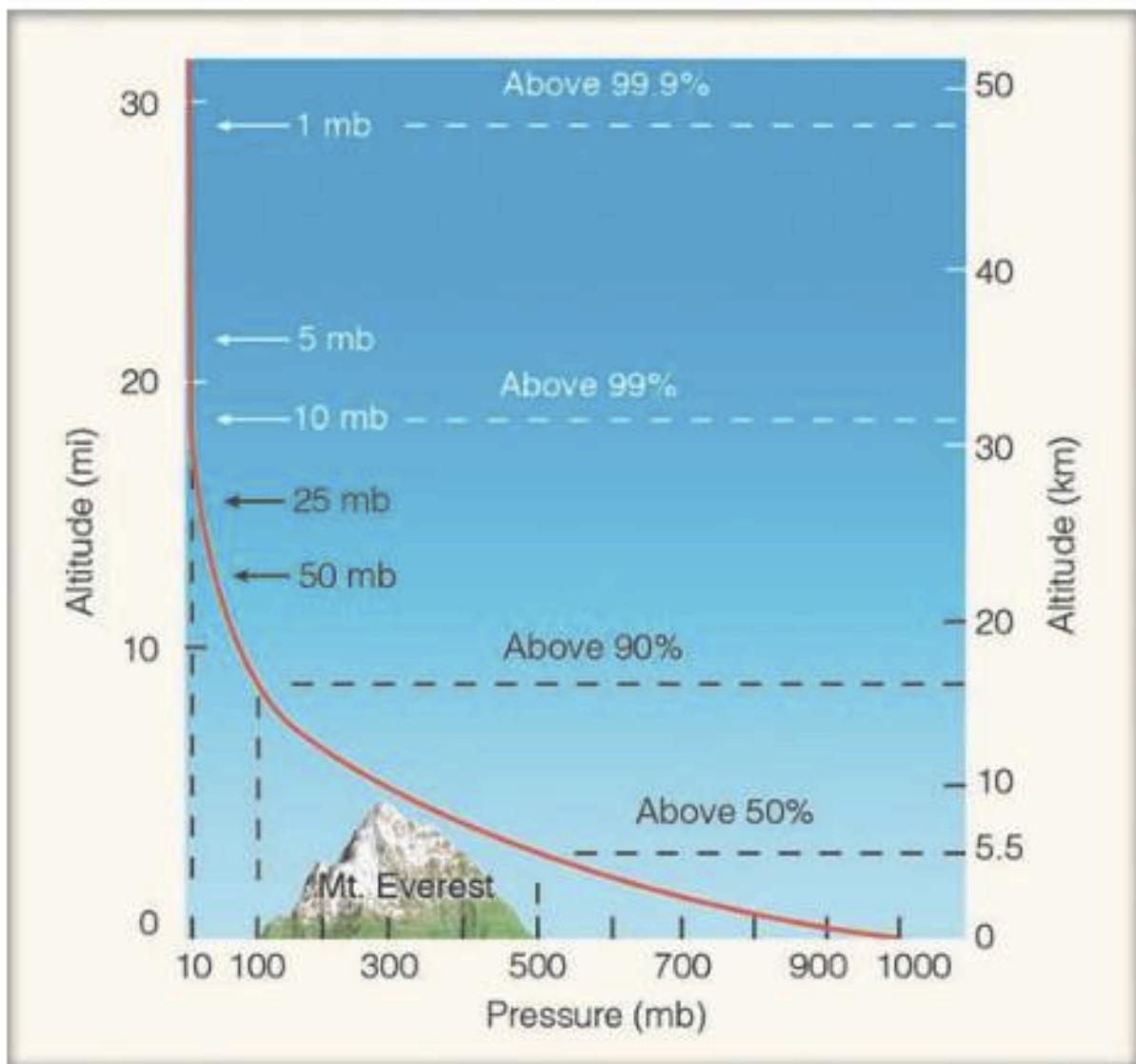
*Sunlit side.

Constituent gas	Percentage volume
-----------------	-------------------

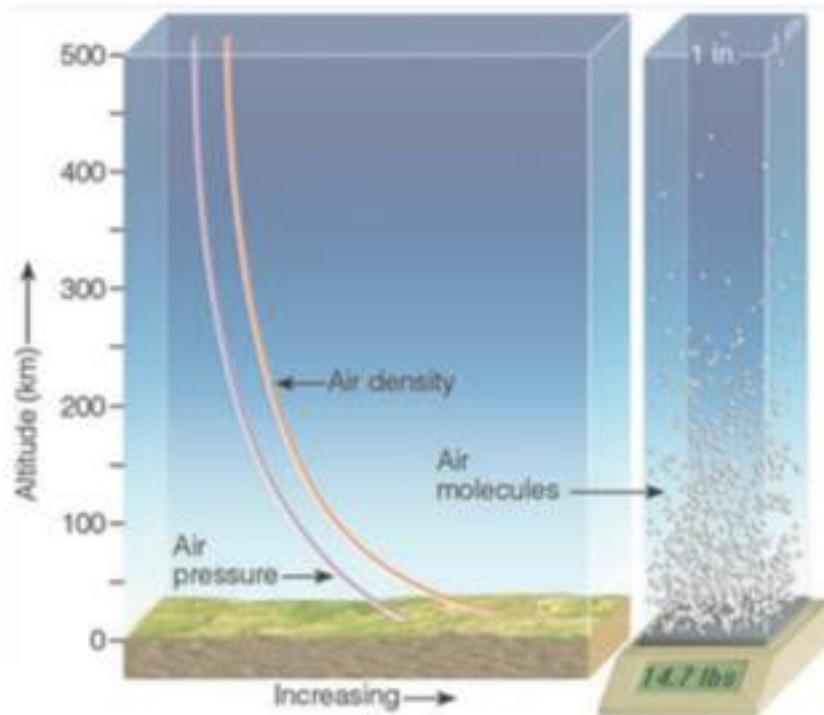
Nitrogen	78.08
Oxygen	20.95
Argon	0.93
Carbon dioxide	0.036
Neon	0.002
Helium	0.0005
Krypton	0.001
Xenon	0.00009
Hydrogen	0.00005

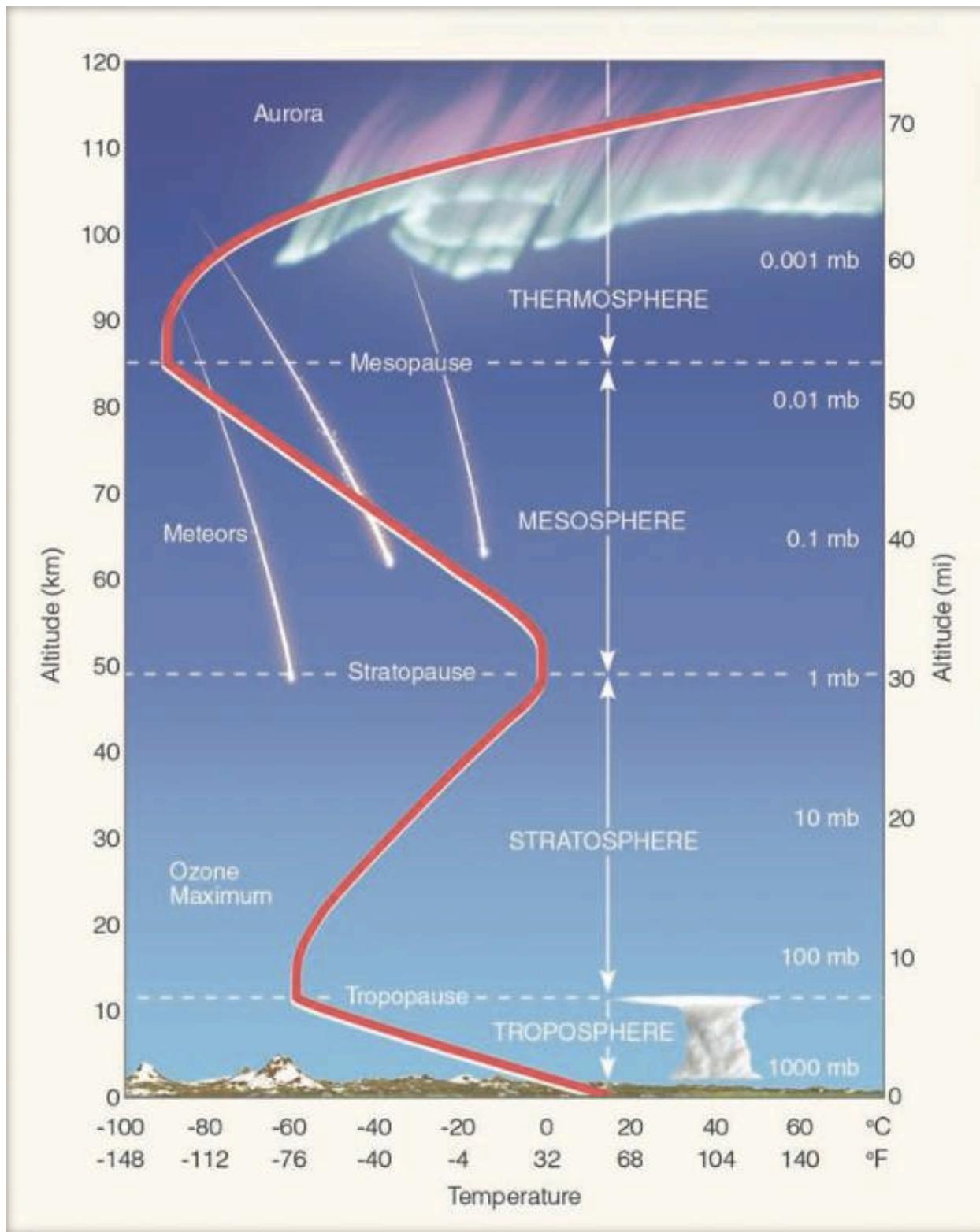
Table 1 – Average composition of dry air

Figure 1 – Structure of atmosphere on the basis of temperature

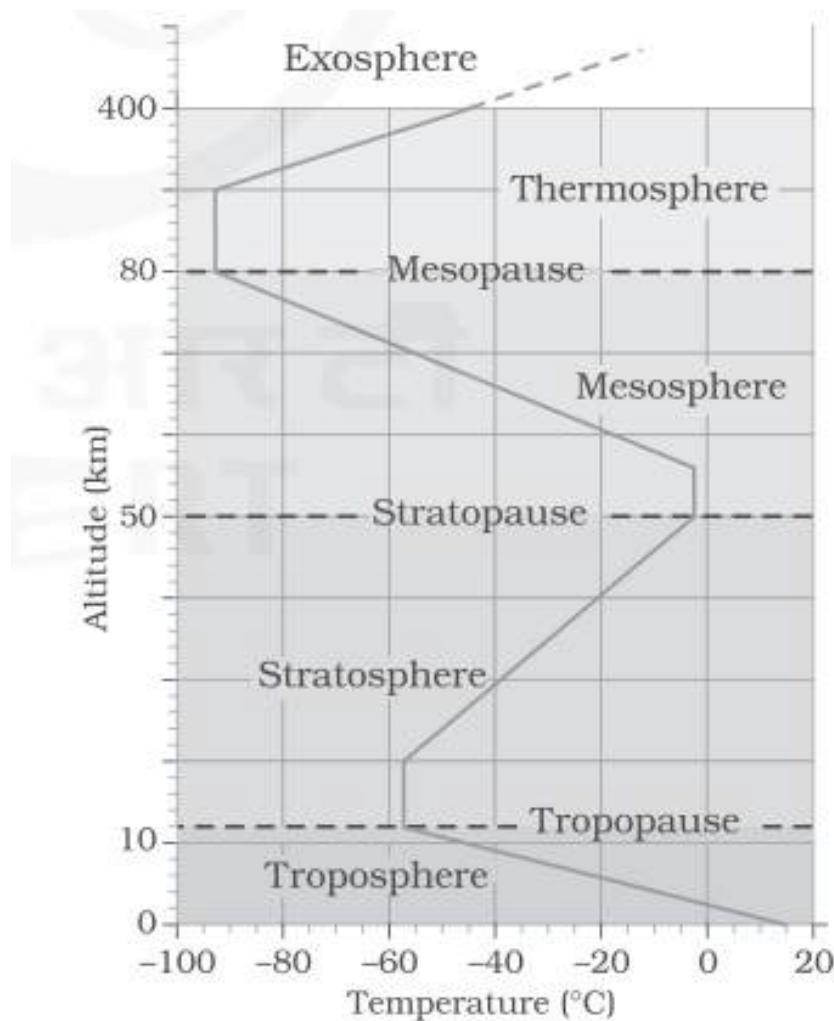


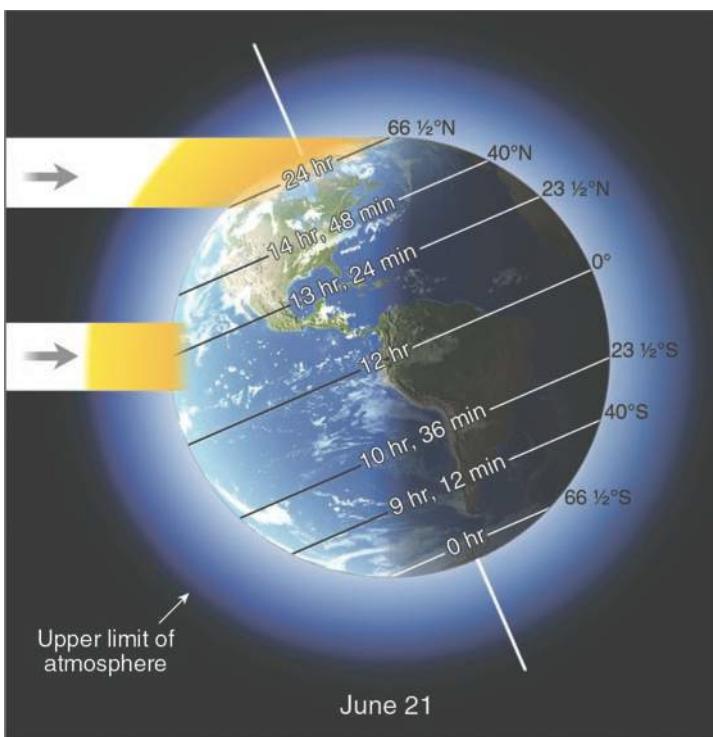
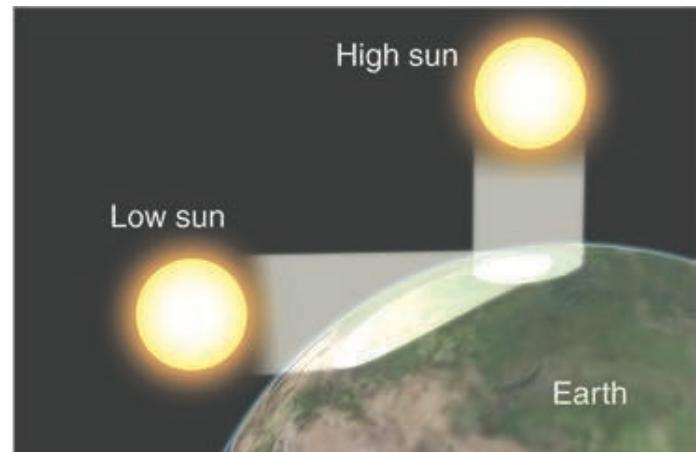
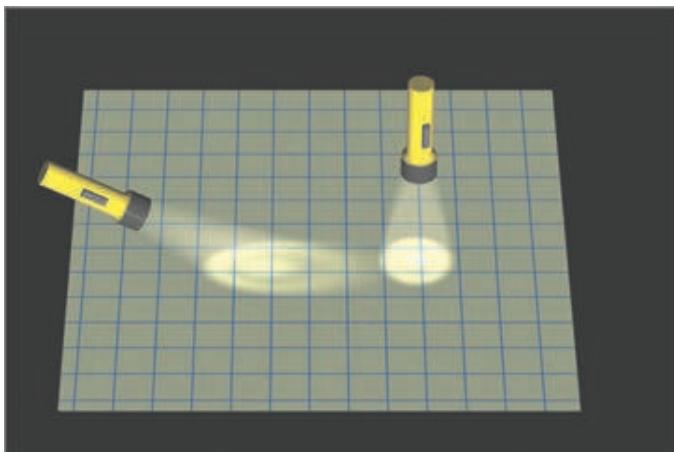
● **FIGURE 1.10** Atmospheric pressure decreases rapidly with height. Climbing to an altitude of only 5.5 km, where the pressure is 500 mb, would put you above one-half of the atmosphere's molecules.

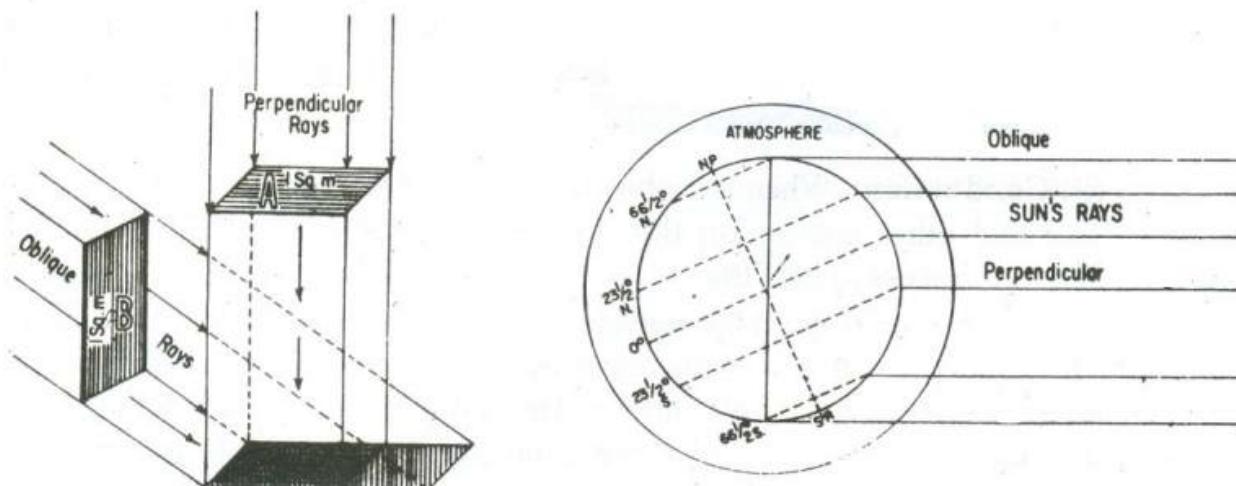
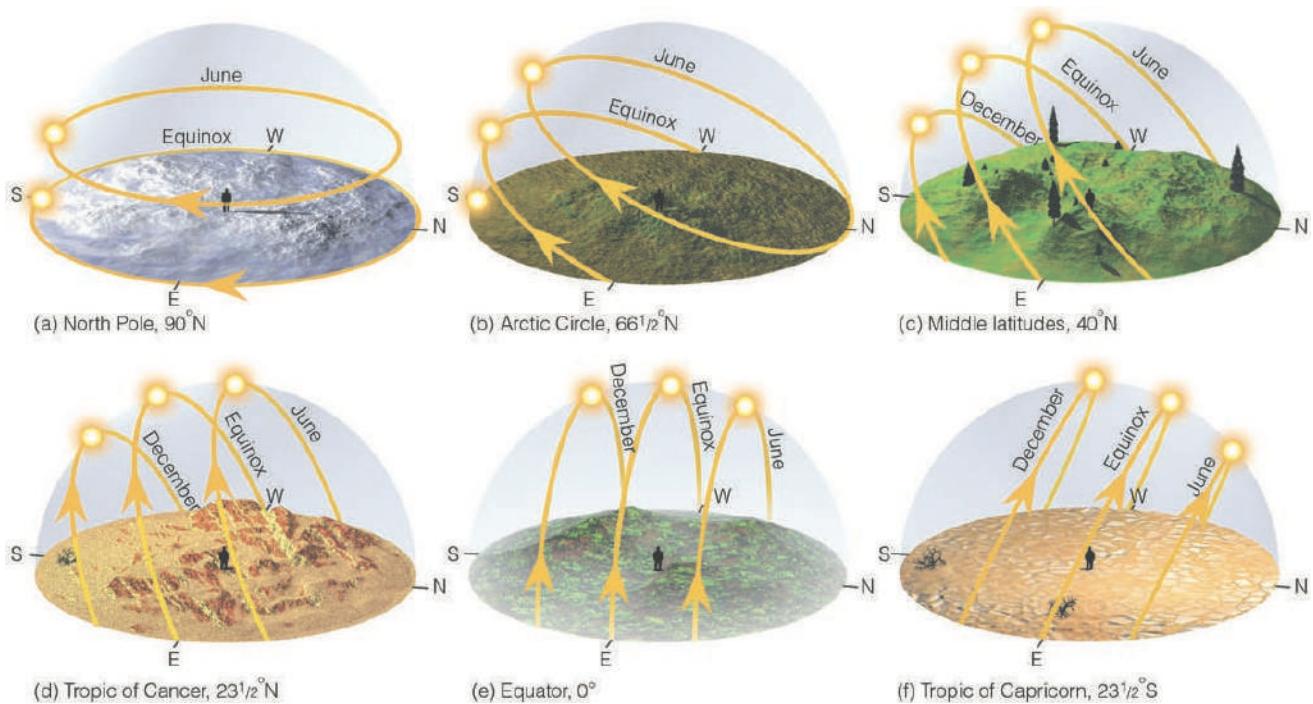




• **FIGURE 1.11** Layers of the atmosphere as related to the average profile of air temperature above Earth's surface. The heavy line illustrates how the average temperature varies in each layer.







Latitude	0°	20°	40°	60°	90°
December 22 (winter solstice)	12h 00m	10h 48m	9h 8m	5h 33m	0 m

June 21(summer Solstice)	12h	13h 12m	14h 52m	18h 27m	6 months
--------------------------	-----	---------	---------	---------	----------

Table 1 – Length of Day on winter and summer Solstices in the Northern Hemisphere

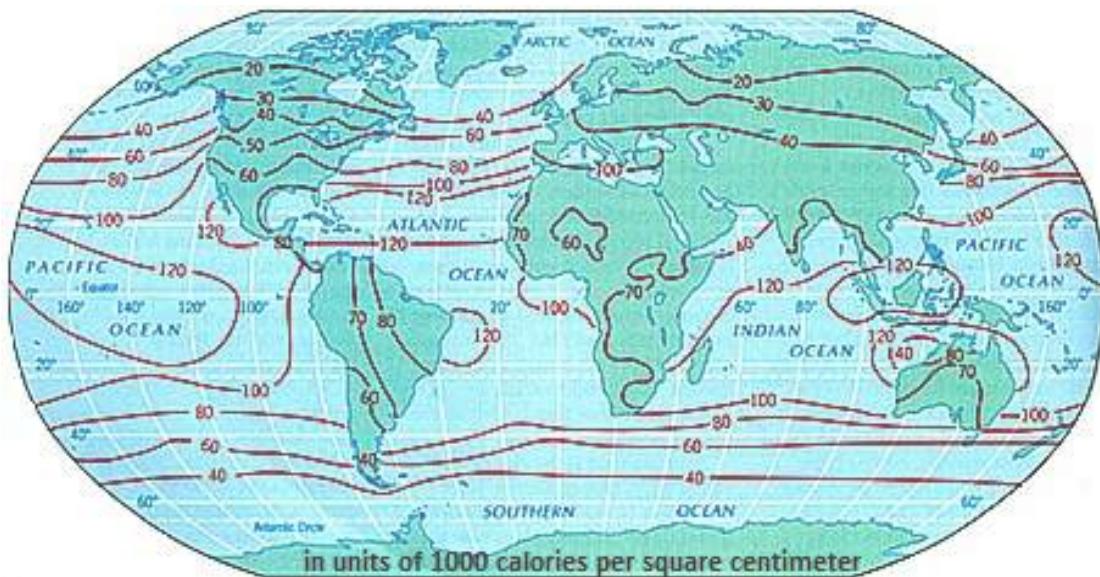


Figure 2 – average annual insolation on the surface of the earth

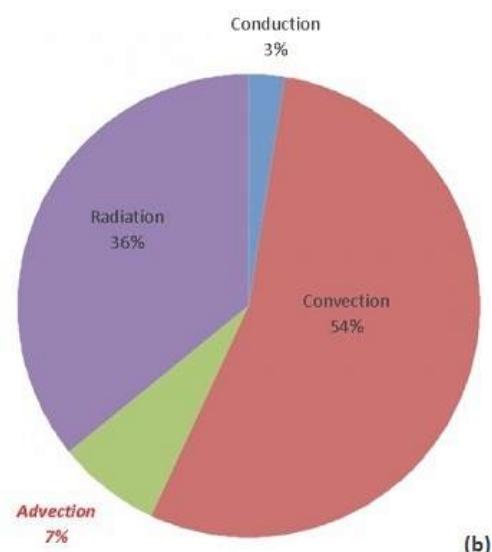
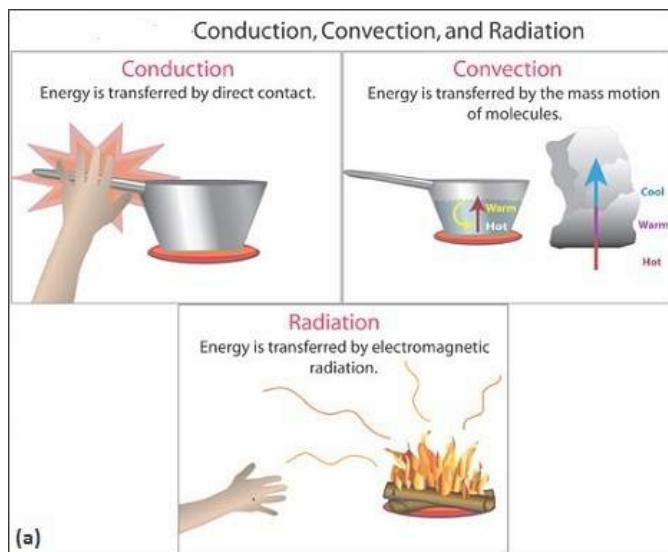


Figure 3 – (a) processes of heating and cooling of atmosphere and (b) per cent share of processes in heating up of atmosphere

Roughly **35 units** are **reflected** back to space even before reaching the earth's surface. The details of this reflected radiation are as under:

• Reflected from the top of clouds	-	27 units
• Reflected by ice-fields on earth	-	02 units
• Reflected by the atmosphere	-	06 units
Total	-	35 units

The reflected amount of radiation is called the **albedo of the earth**. The above given radiation does neither heat the atmosphere nor the earth's surface.

The remaining **65 units** are **absorbed** as:

• Absorbed by the atmosphere	-	14 units
• Absorbed by the earth	-	51 units (Scattered + direct radiation)
Total	-	65 units

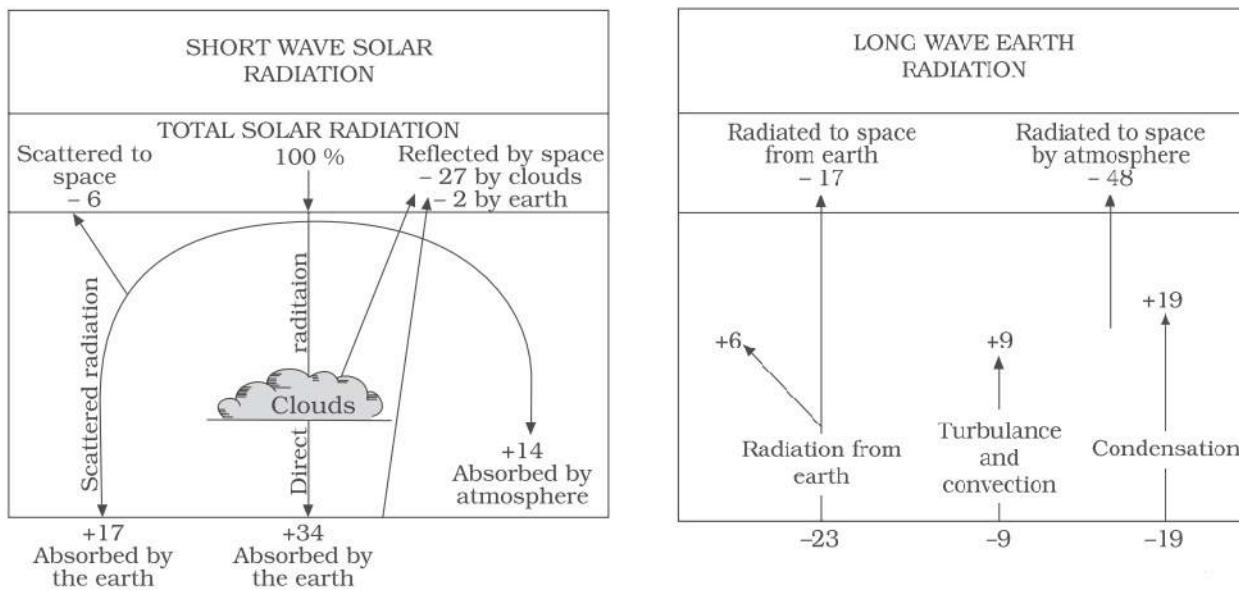


Figure 4 – Heat Budget of the Earth

• Radiated to space directly	-	17 units
• Radiated to atmosphere	-	34 units

The details of 34 units radiation absorbed by atmosphere from terrestrial radiations are as under

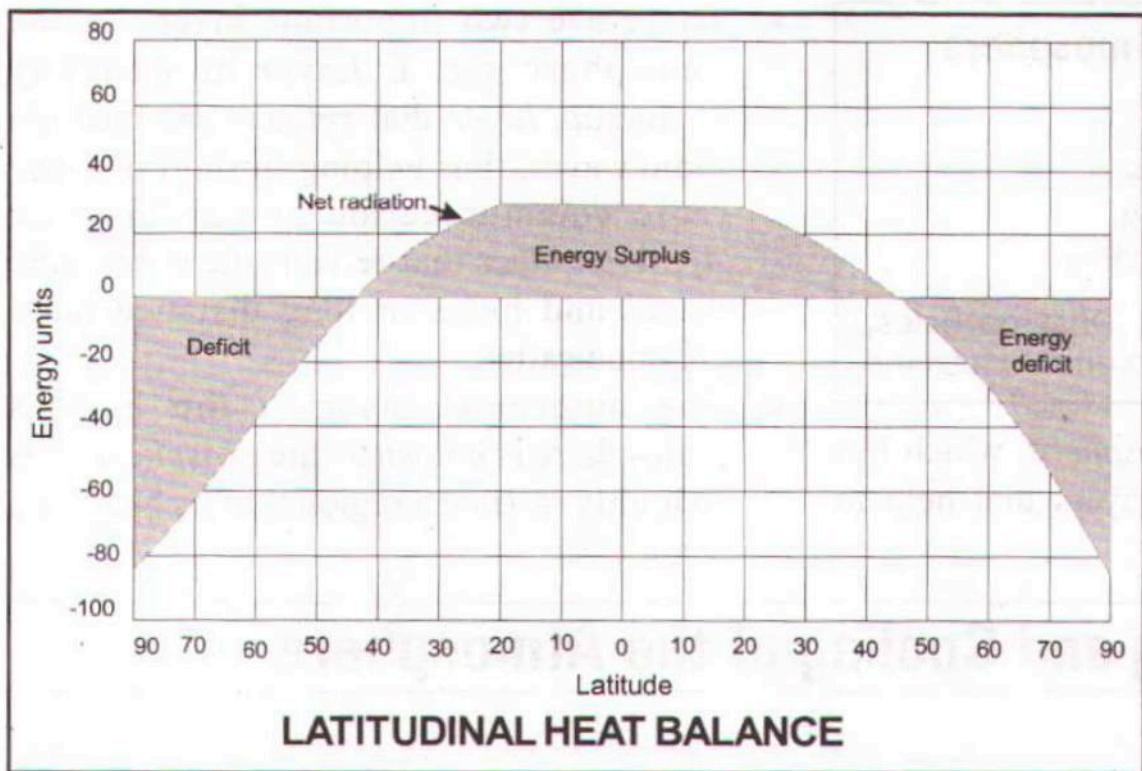
• Absorbed directly	-	06 units
• Absorbed through convection and turbulence	-	09 units
• Absorbed through Latent heat of condensation ⁵	-	19 units

Total	-	34 units
-------	---	----------

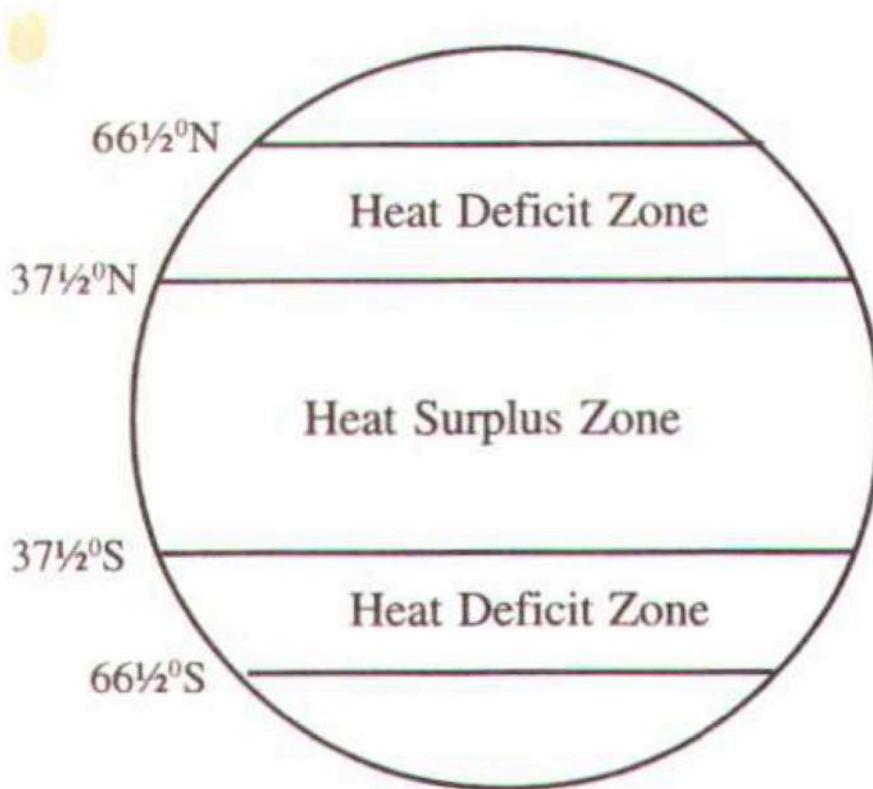
Total units absorbed by the atmosphere are 48 (14 units insolation + 34 units Terrestrial radiation). These are radiated back into space. Thus, the total radiation returning from the earth and the atmosphere respectively is:

• Radiated back by earth	-	17 units
• Radiated back by atmosphere	-	48 units
Total	-	65 units

These returning 65 units balance the total of 65 units received from the sun. This account of incoming and outgoing radiation always maintains the balance of heat on the surface of the earth. This is termed the heat budget or **heat balance** of the earth.



Latitudinal heat balance



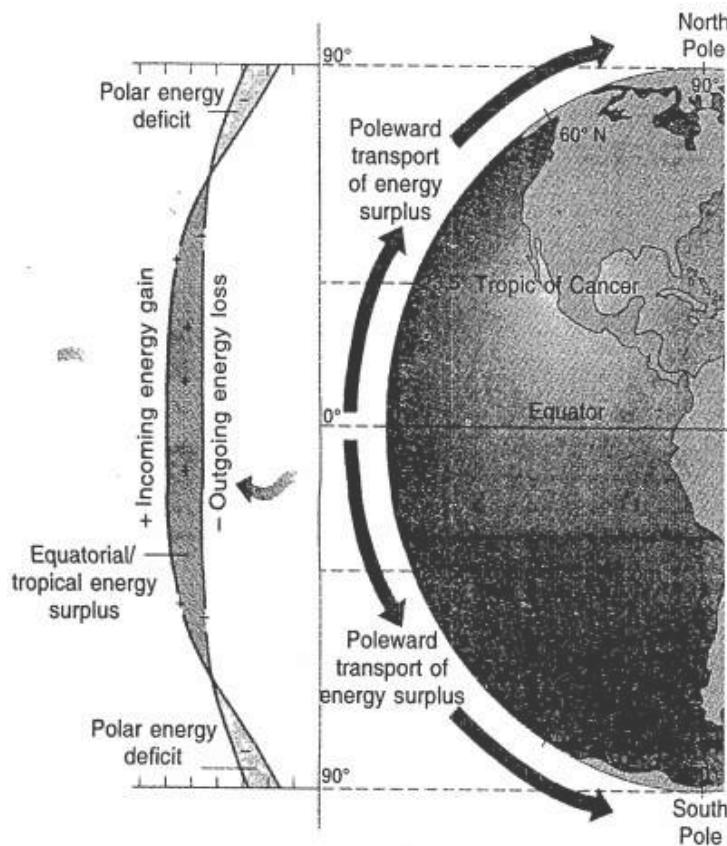
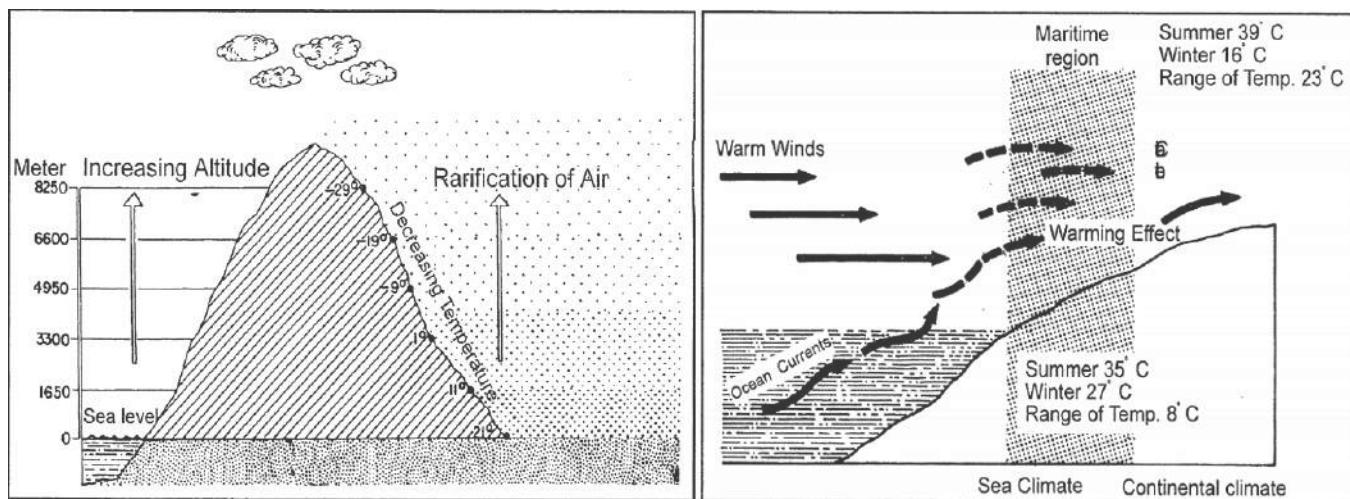


Figure 5 – heat energy budget by latitudes

1.



(a) – effect of altitude

(b) – maritime influence

Figure 6 – effect of altitude & distance from sea on temperature

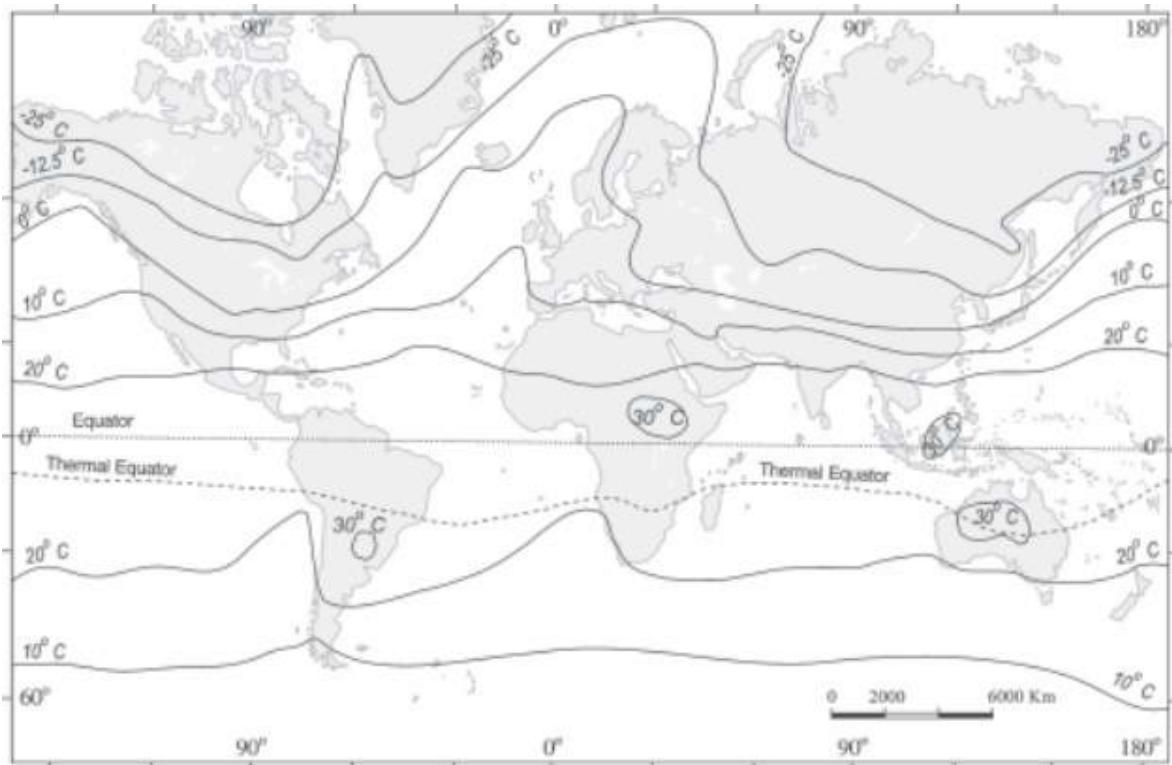
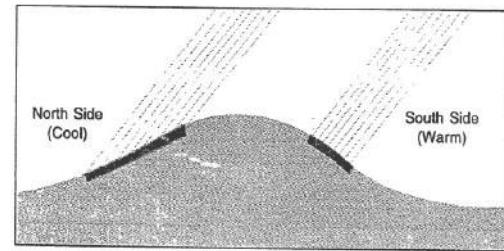
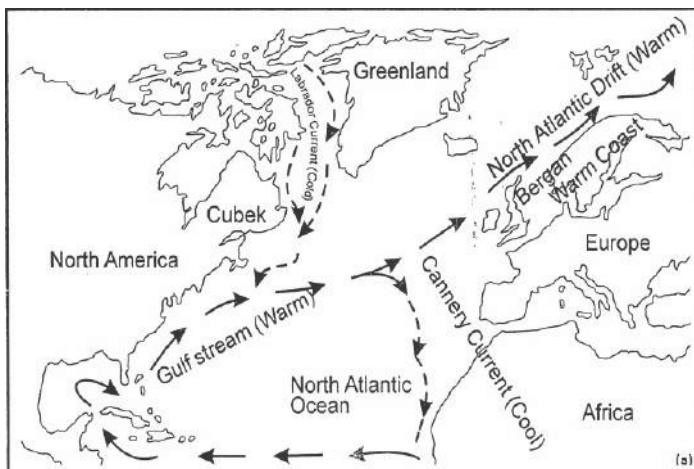


Figure 8 – isotherms in the month of January

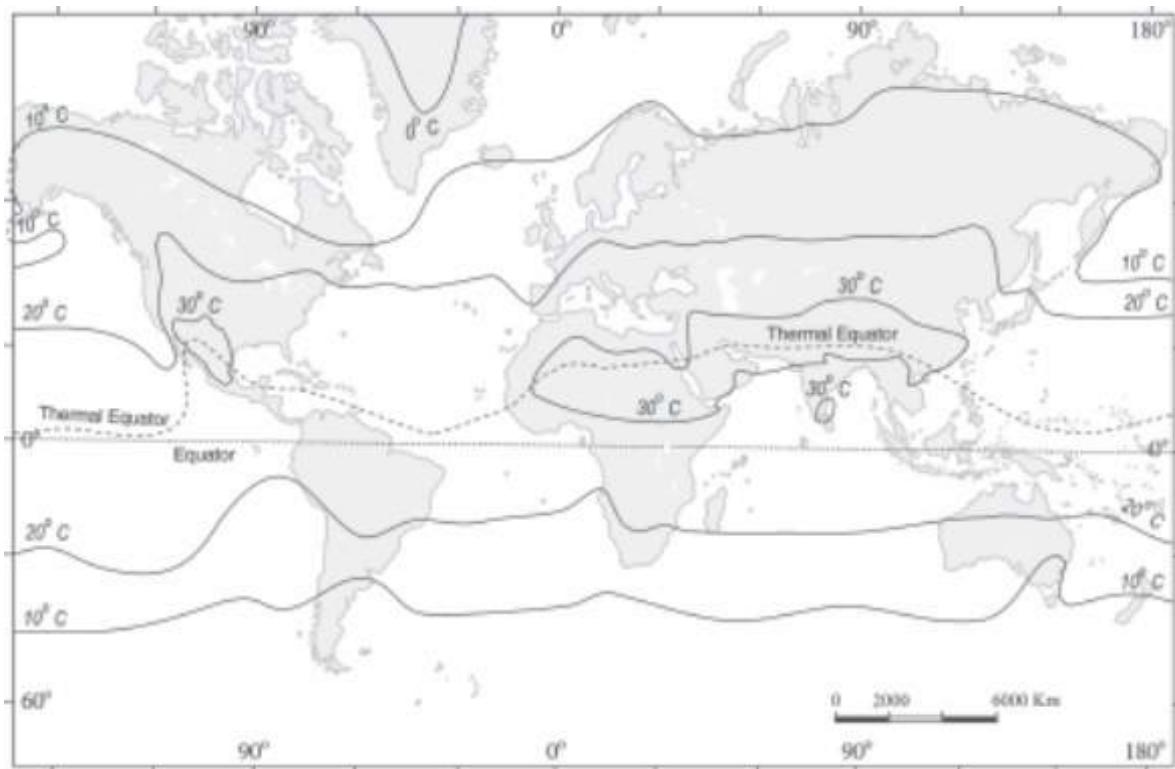


Figure 9 – isotherms in the month of July

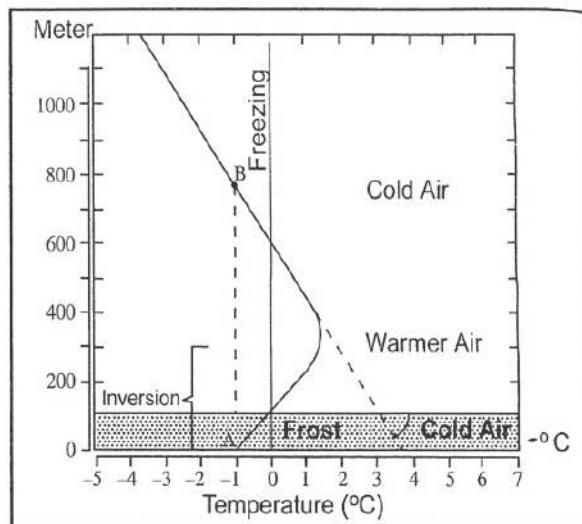
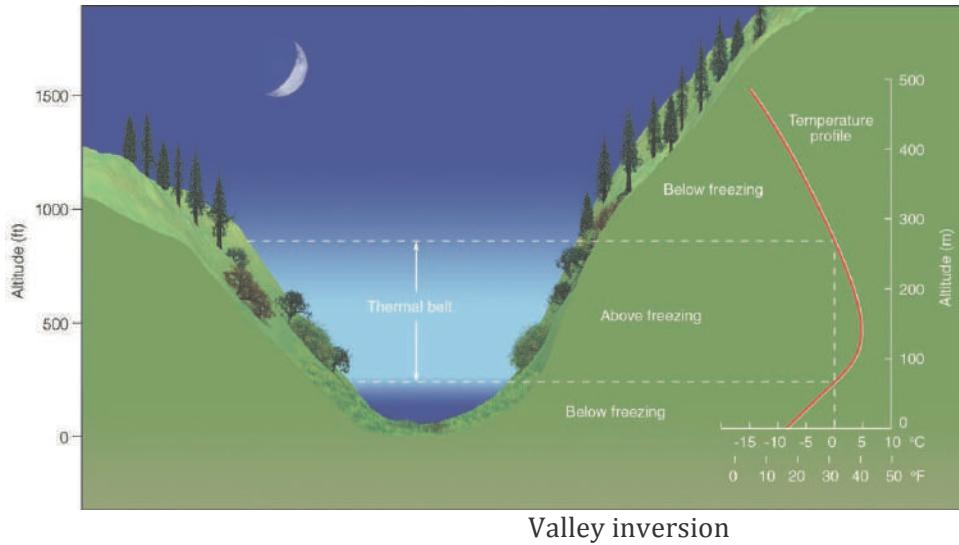
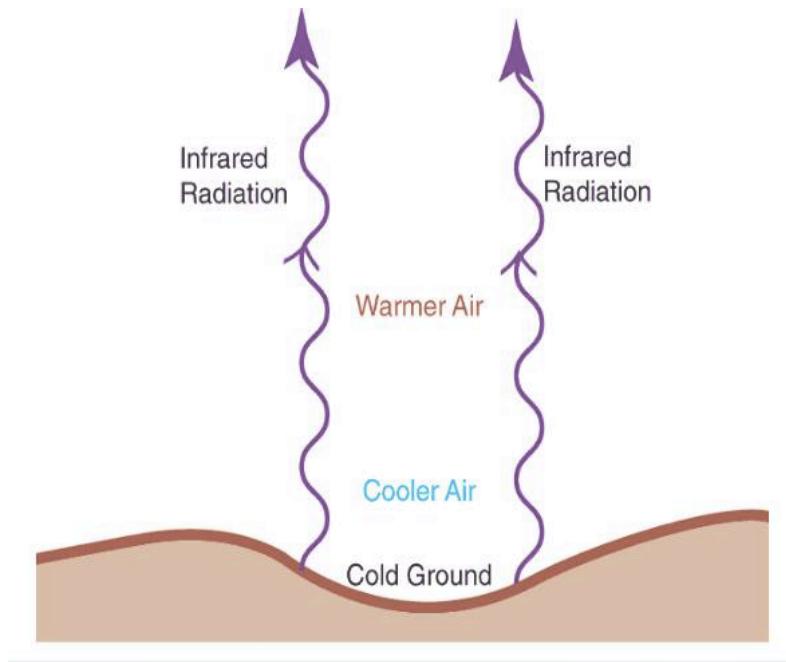


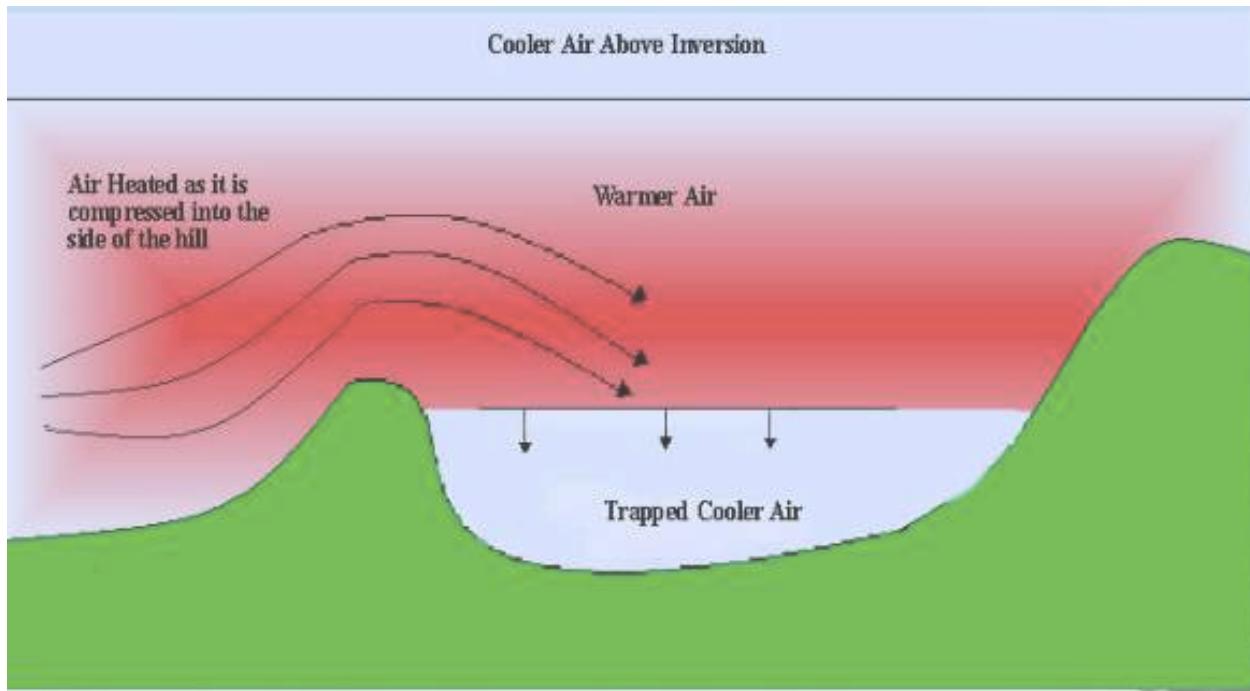
Figure 10 – temperature inversion



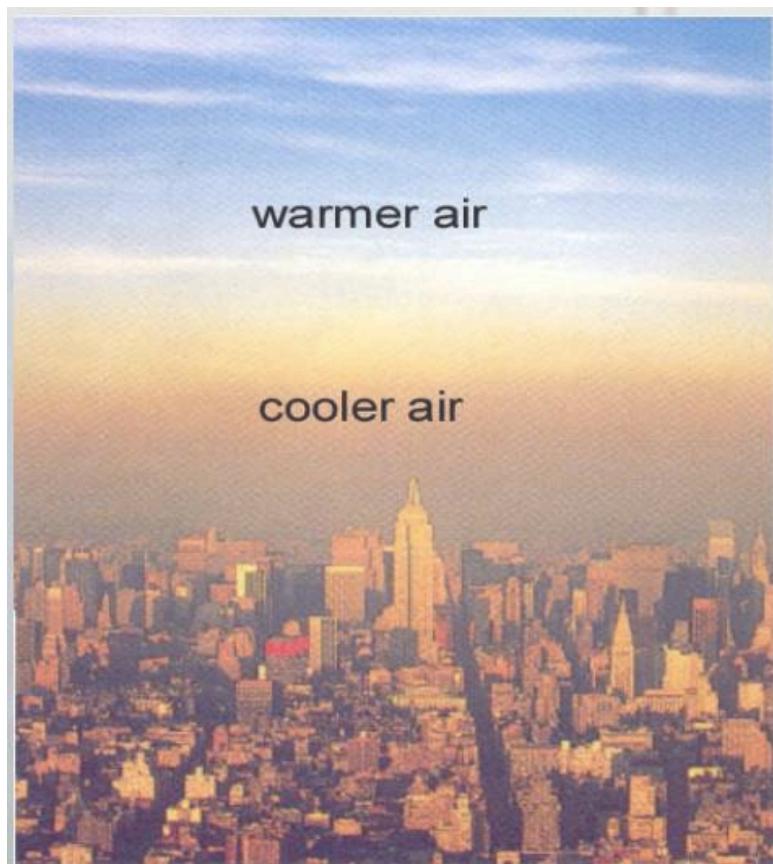
Valley inversion

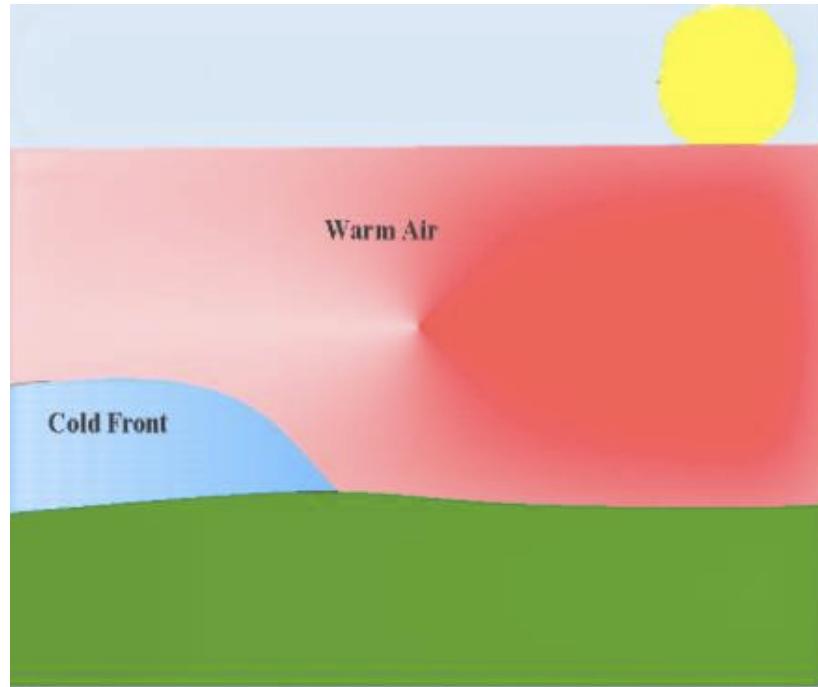


Radiation Inversion

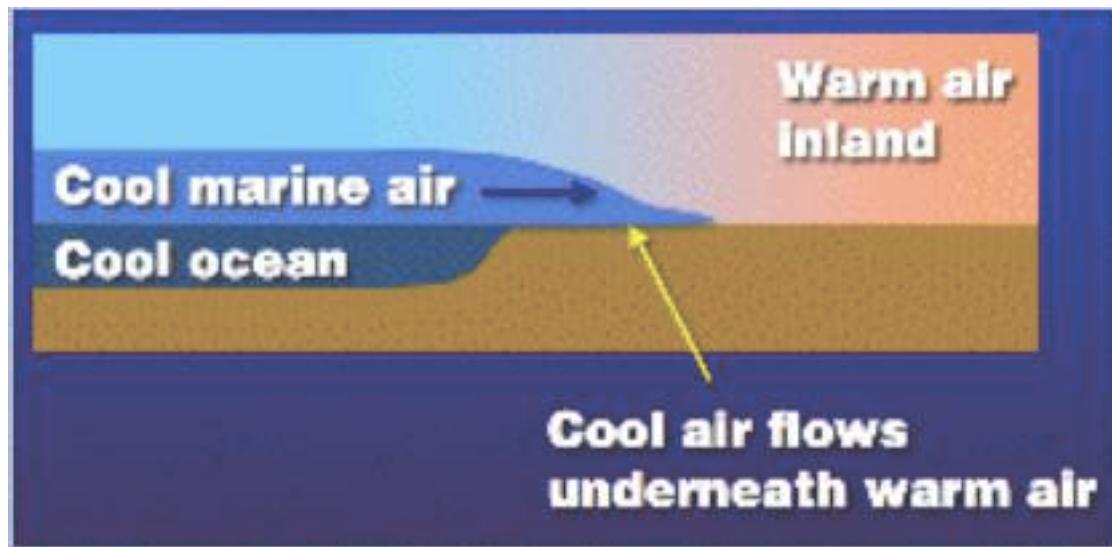


Subsidence Inversion

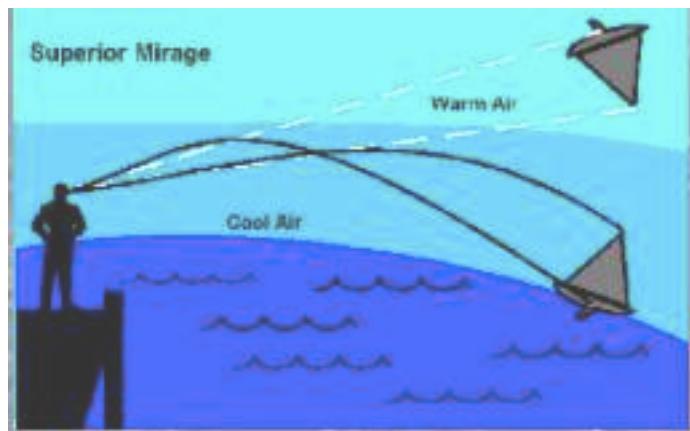




Frontal inversion



Marine Inversion



superior mirage due to inversion

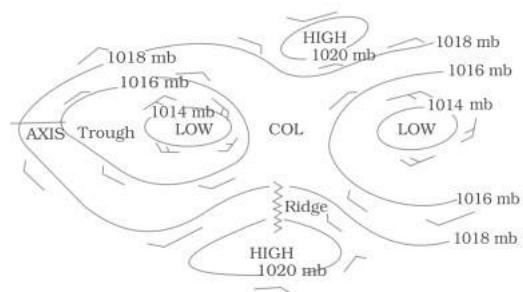
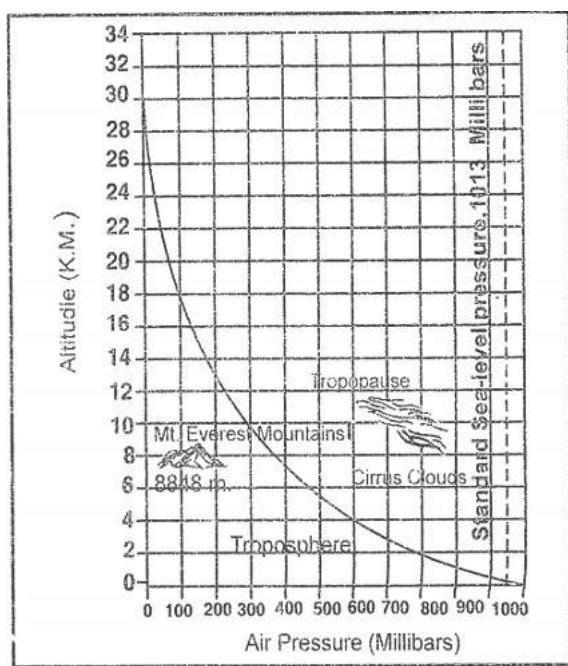
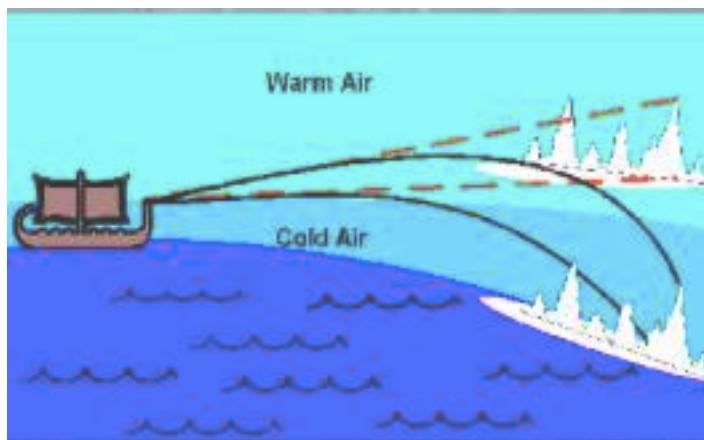


Figure 11 - vertical pressure variation

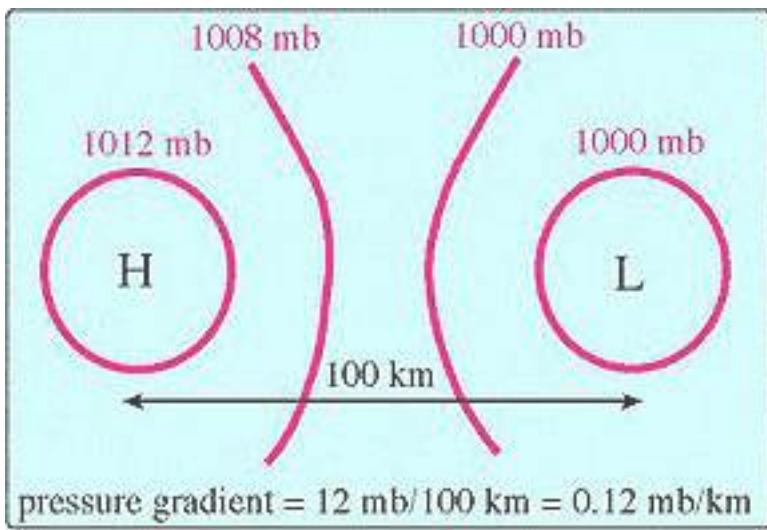
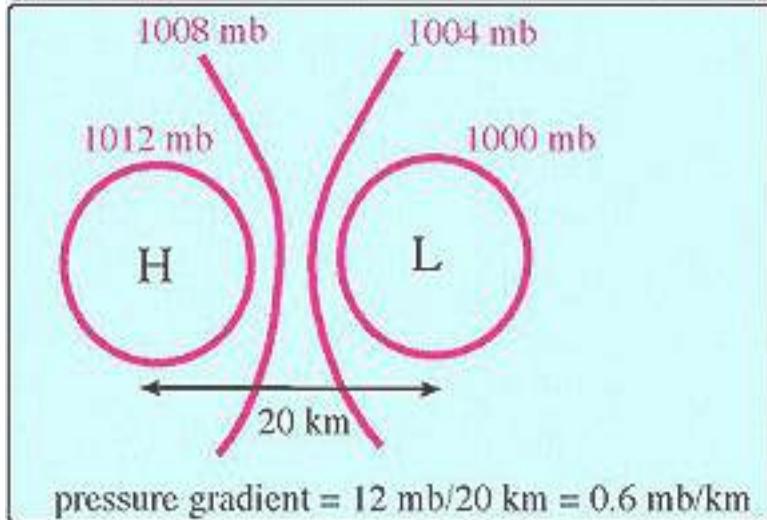
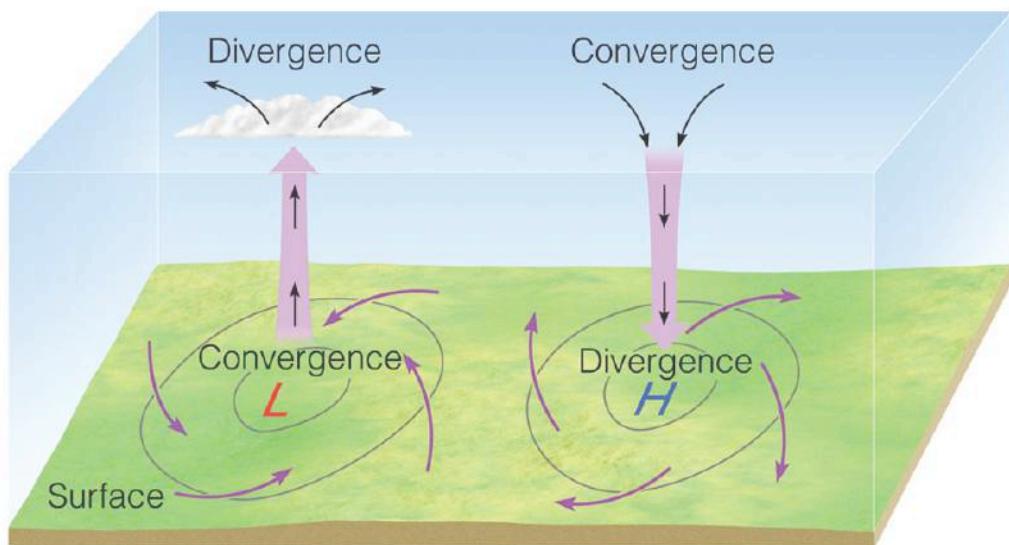


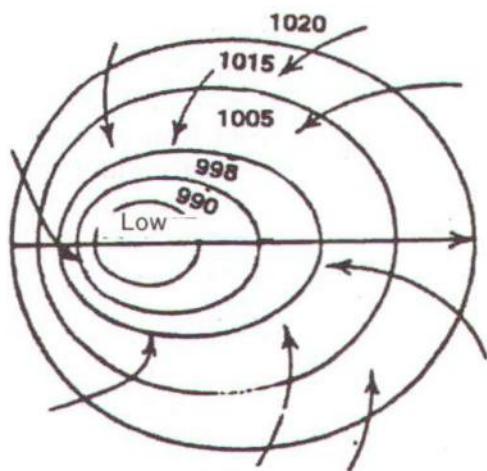
Figure 12 - Isobars, High pressure and Low

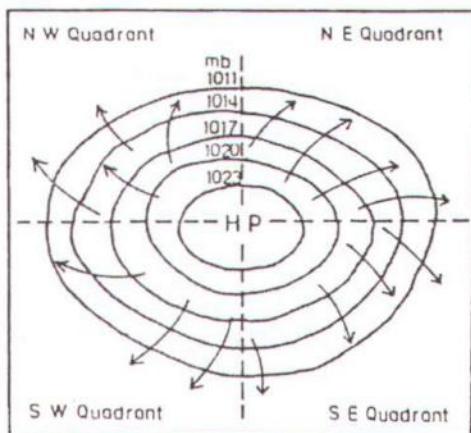




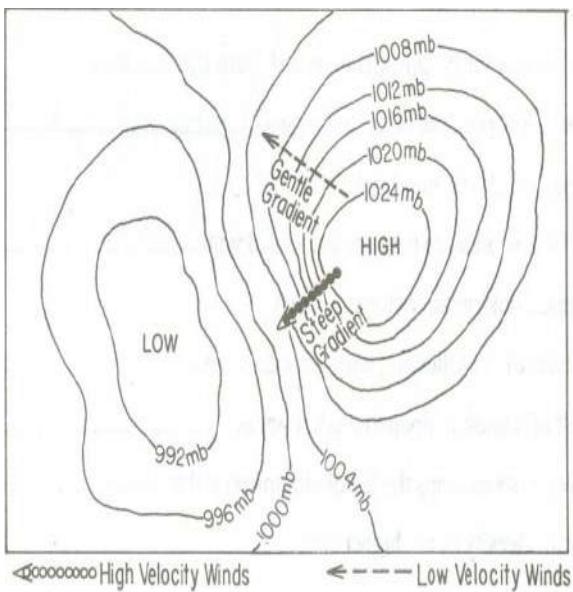
© 2007 Thomson Higher Education

pressure system





**Airpressure and Wind System
in an Anti-cyclone**



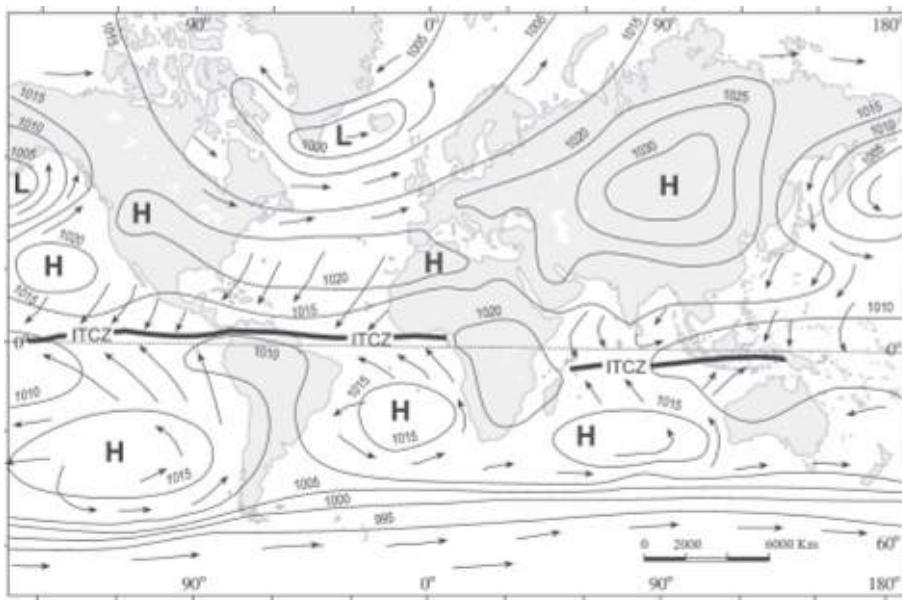
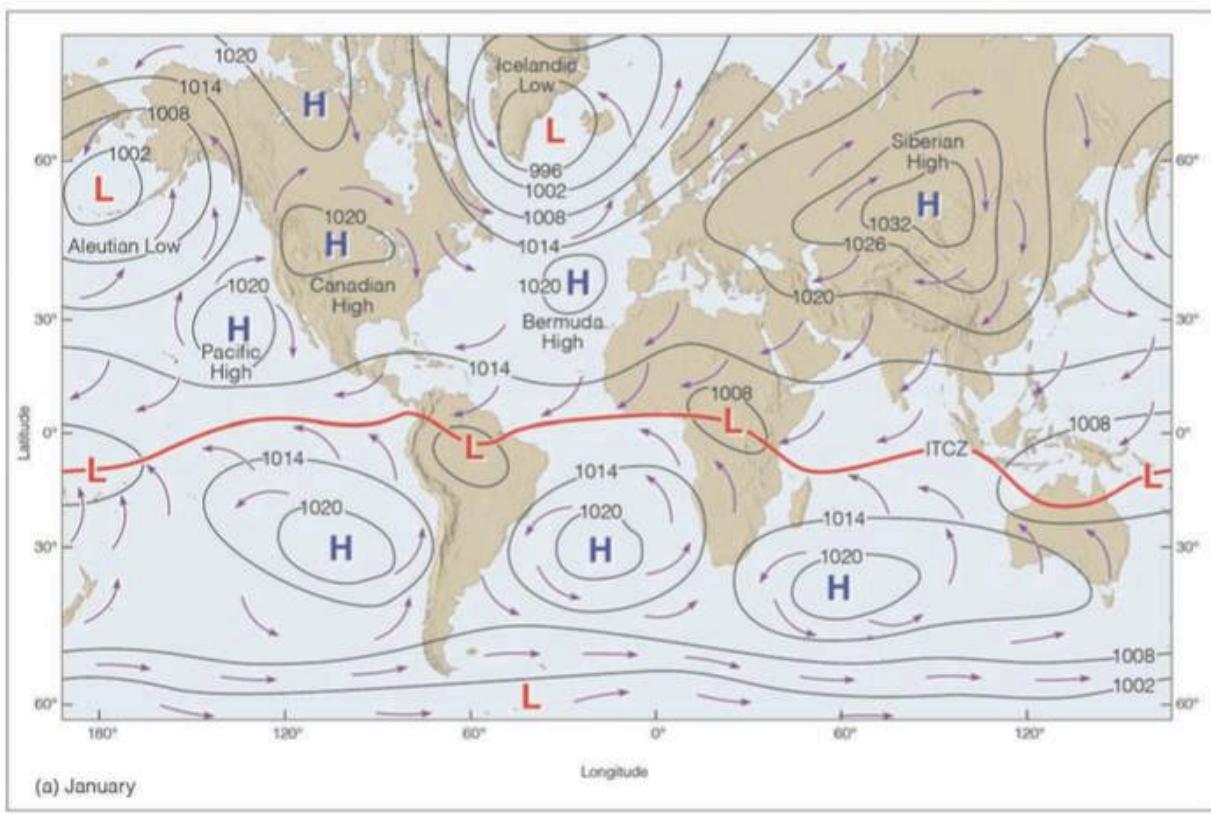


Figure 13 – Distribution of pressure (in mb) for January month



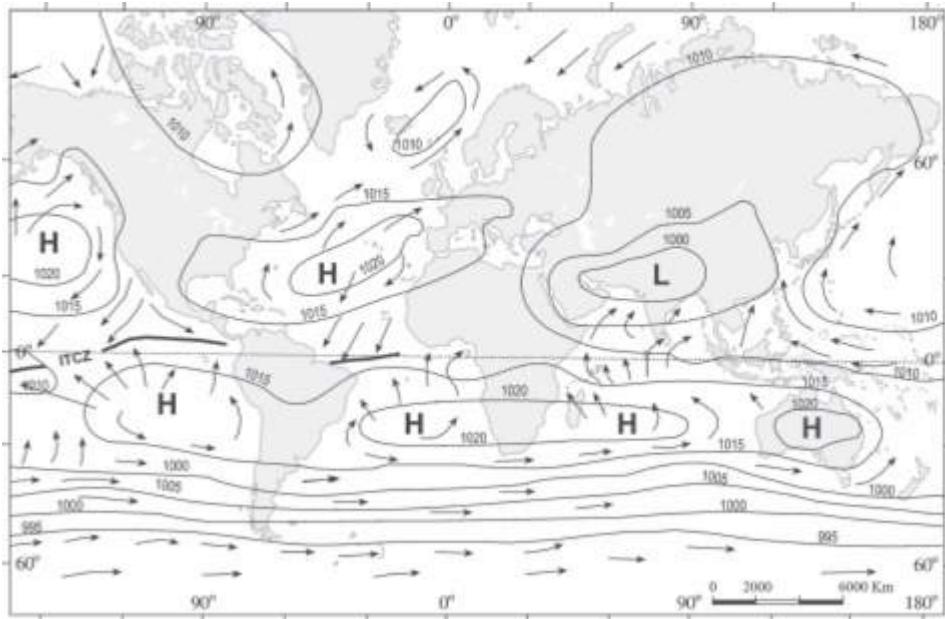
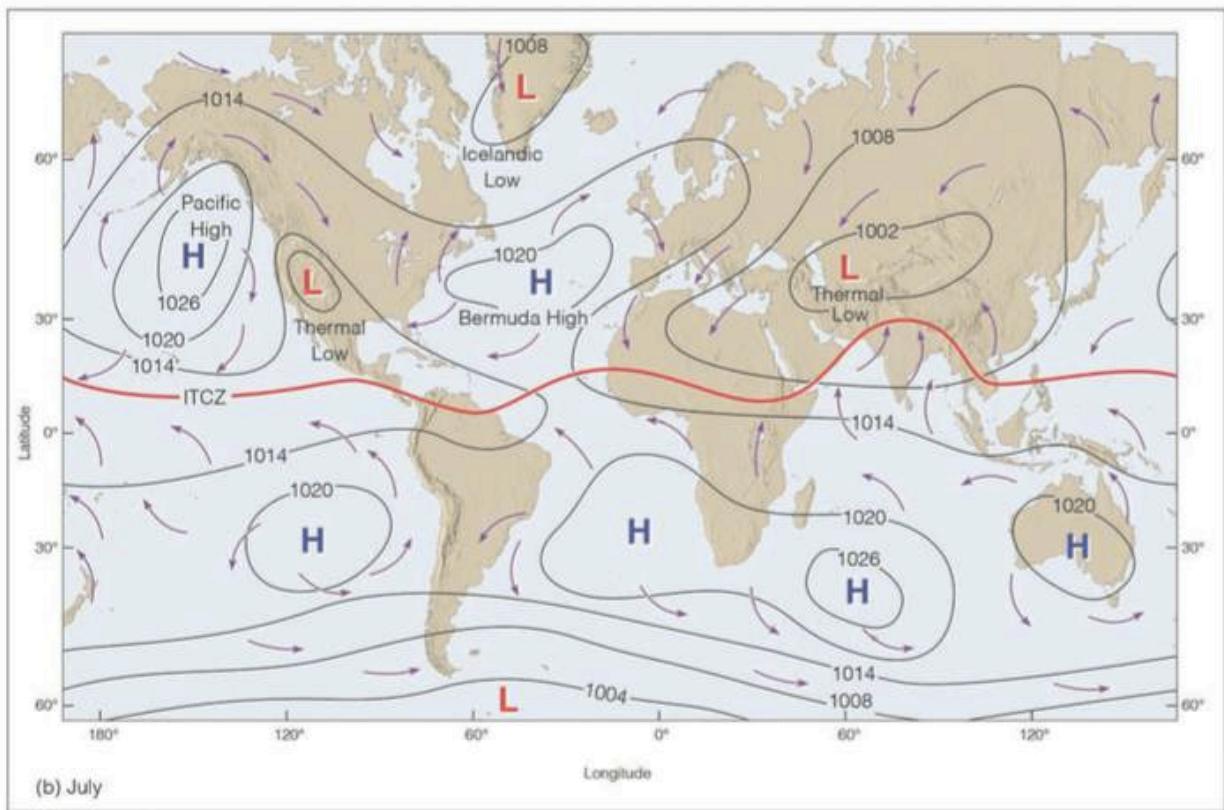
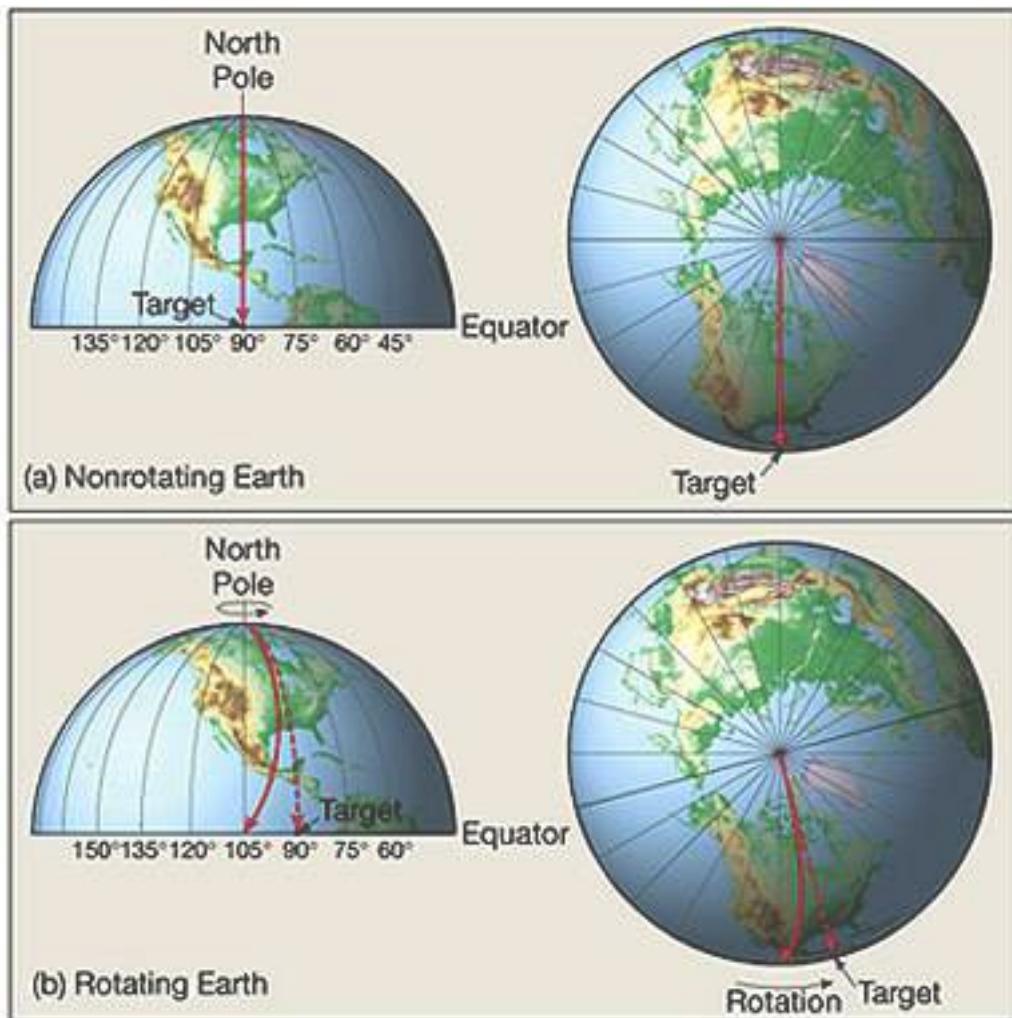
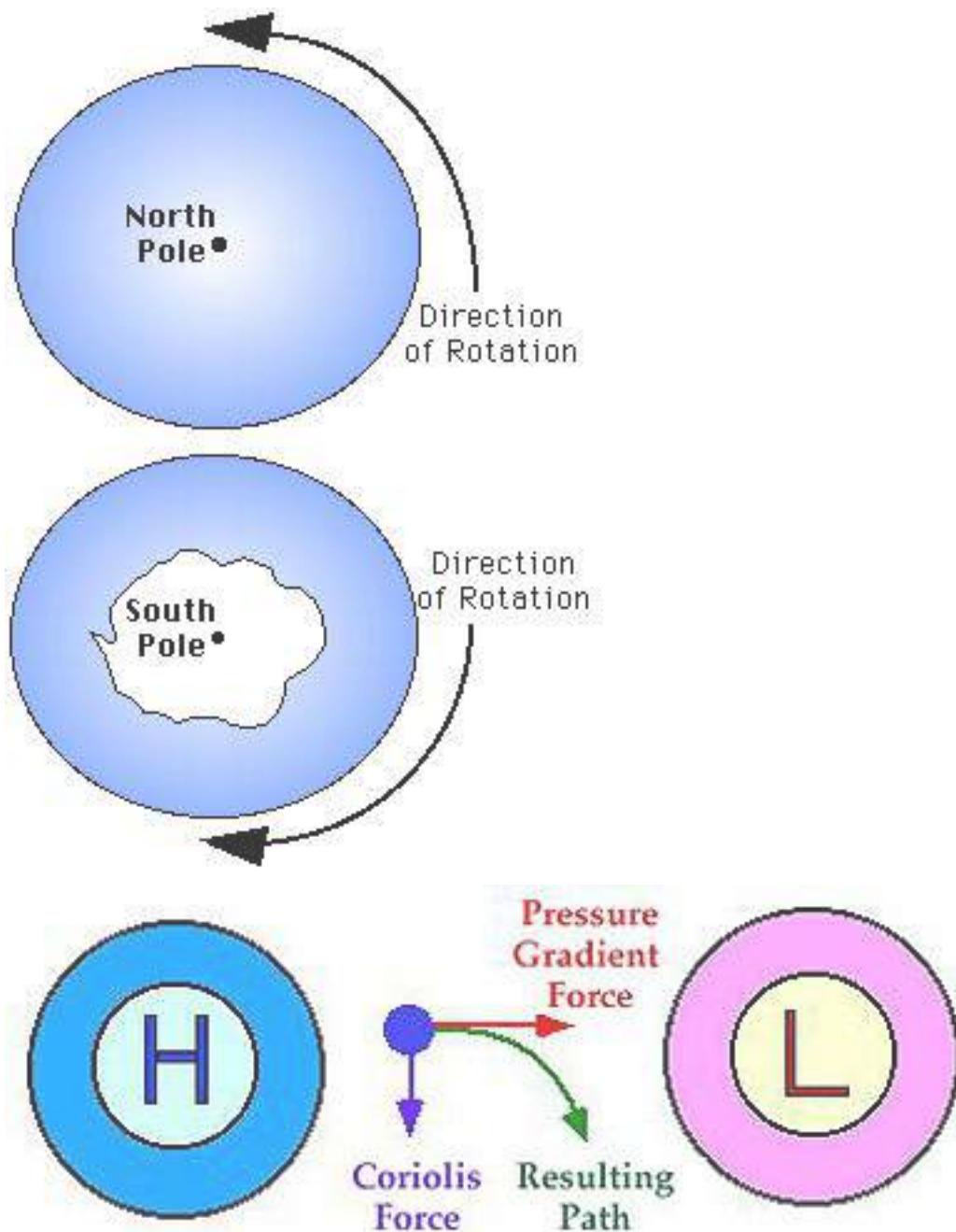


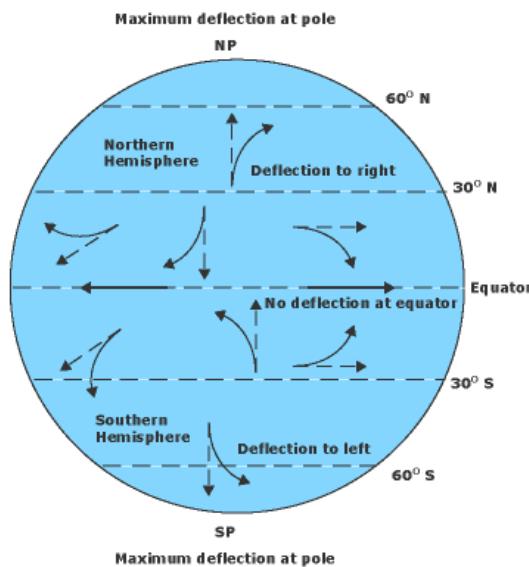
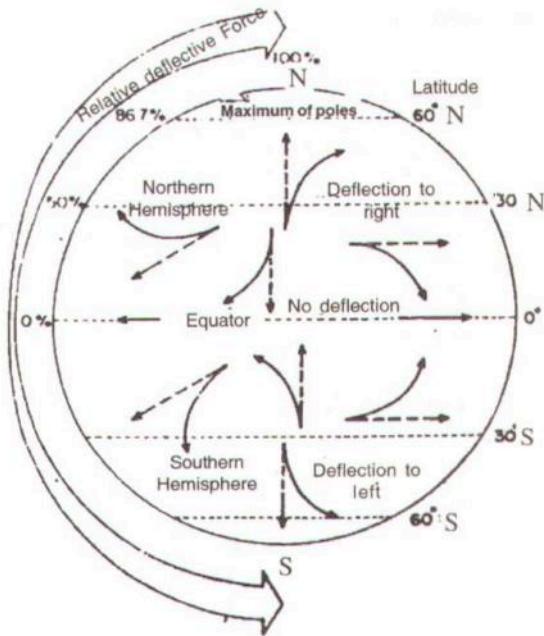
Figure 14 – Distribution of pressure (in mb) for July month



● FIGURE 10.5 Average sea-level pressure distribution and surface wind-flow patterns for January (a) and for July (b). The solid red line represents the position of the ITCZ.



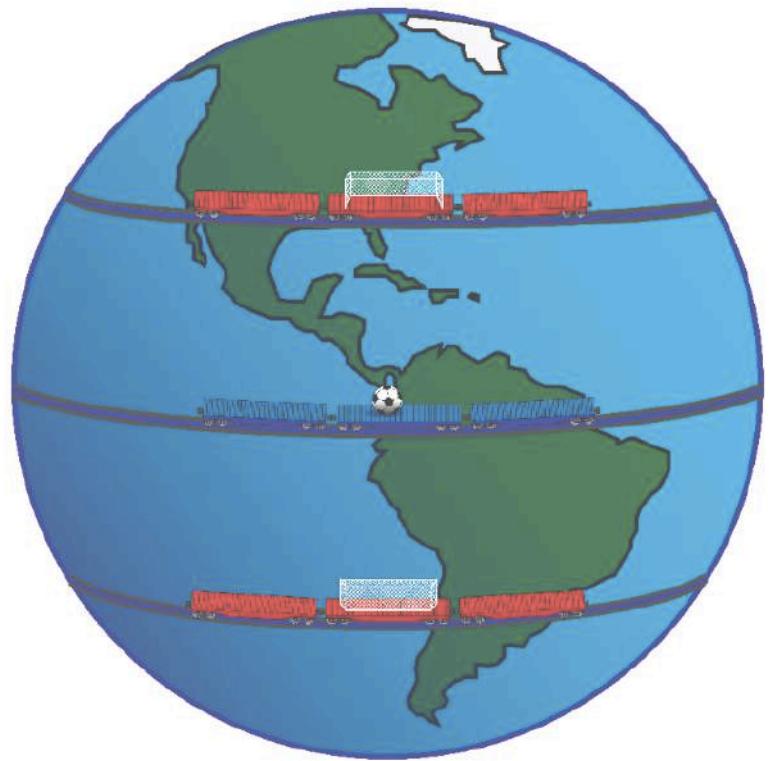




- (a) Relationship between pressure gradient and speed of winds

- (b) Coriolis force under action

Figure 15 – forces governing air movement



The trains still move at different speeds, but now they would appear to travel parallel to each other.

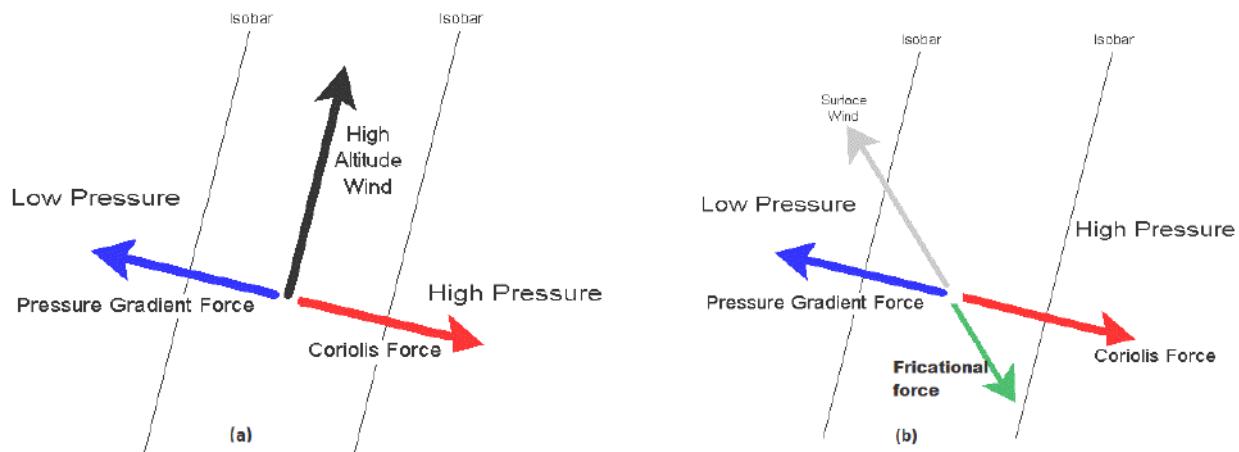
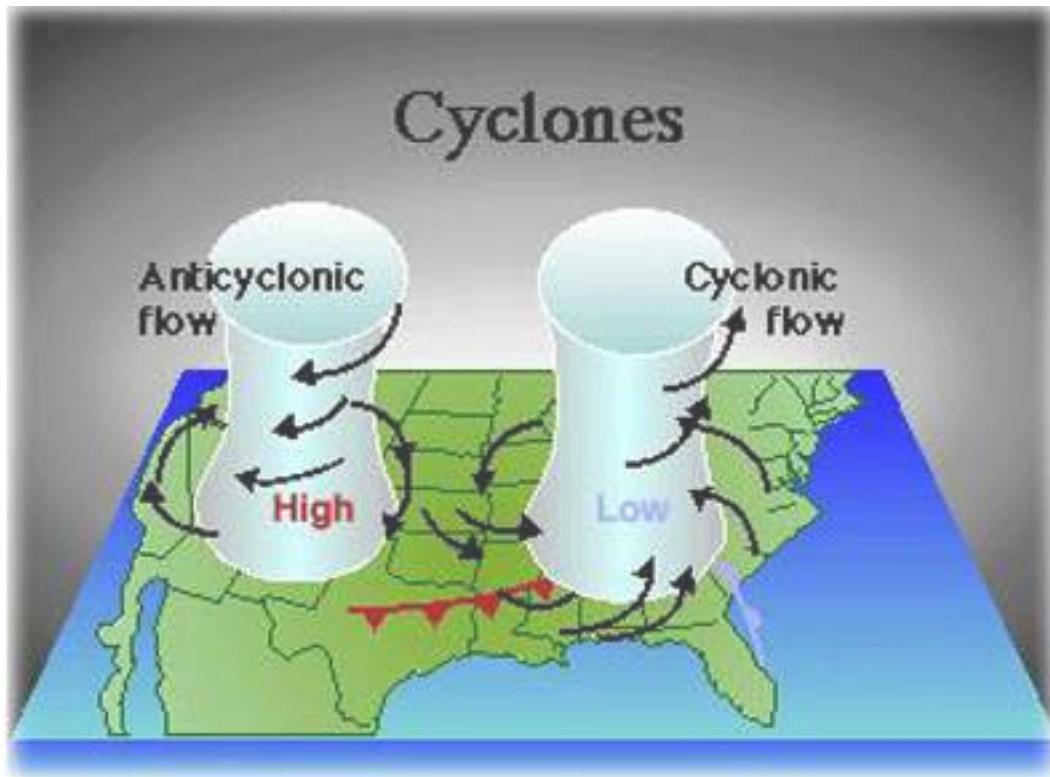
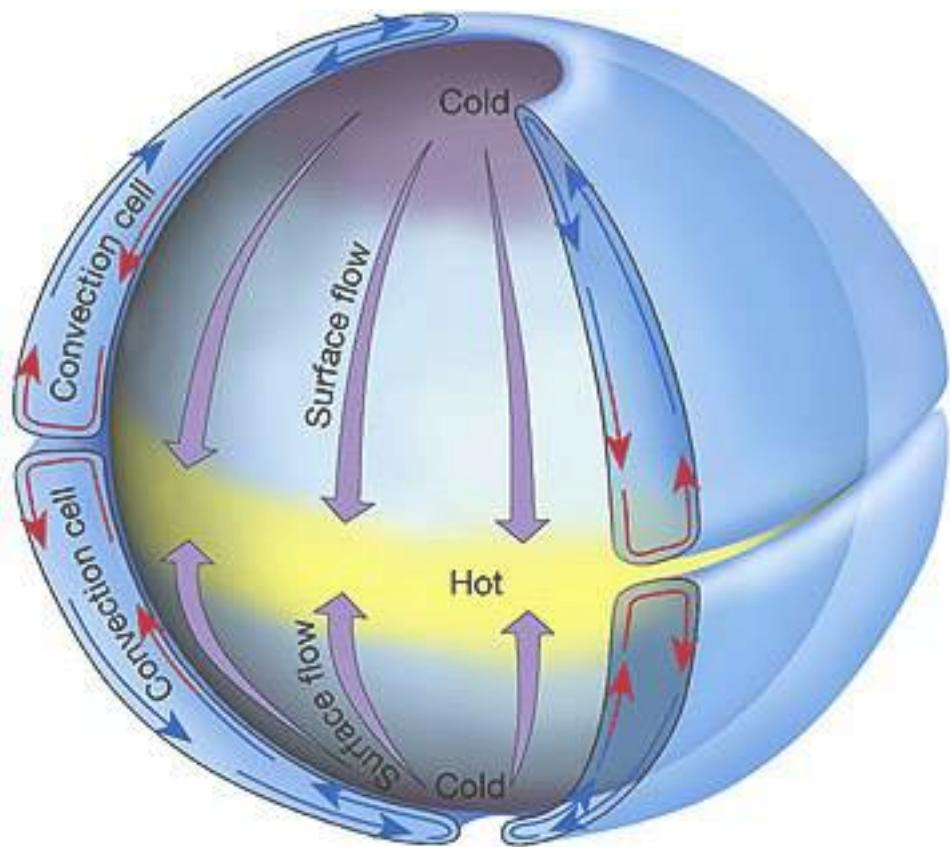
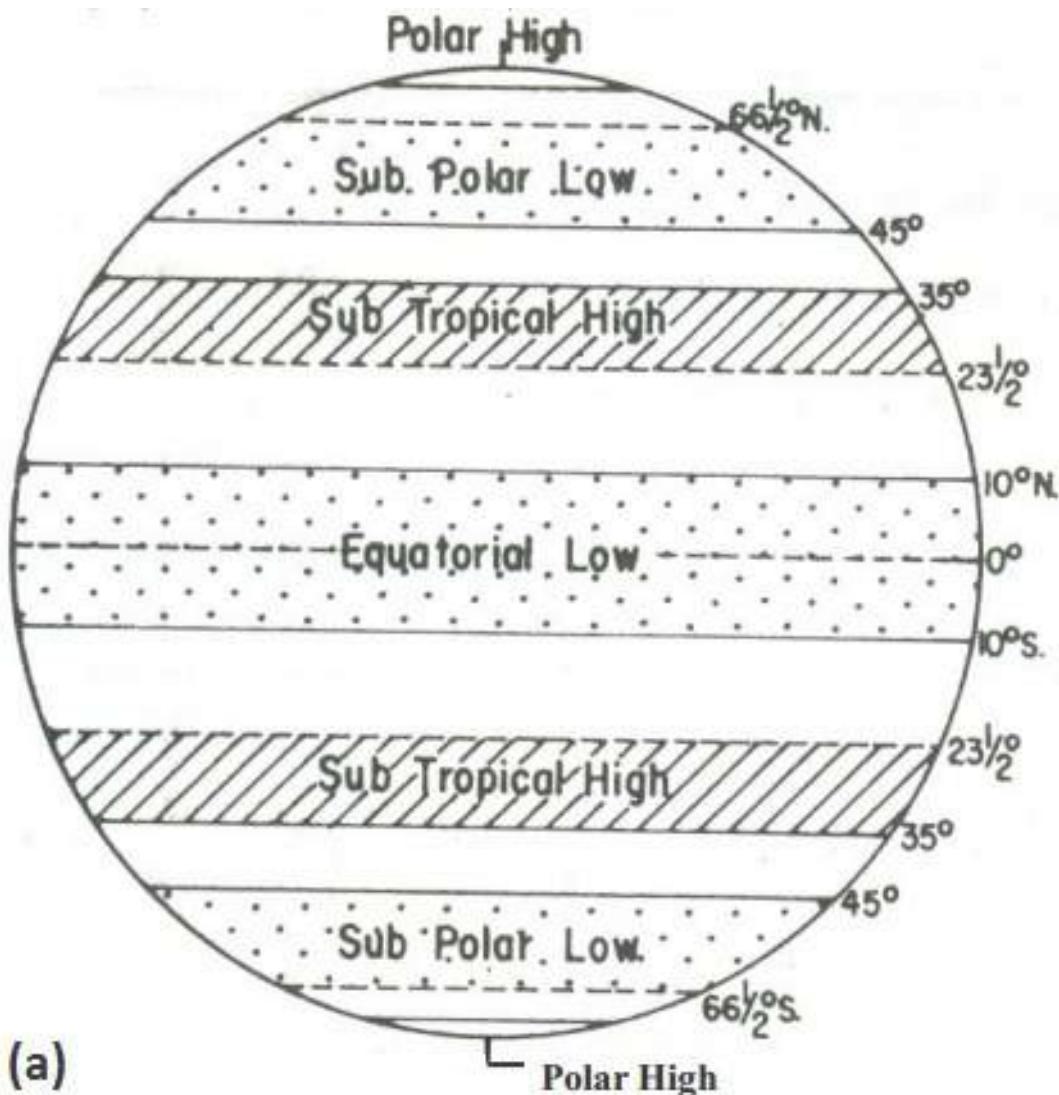


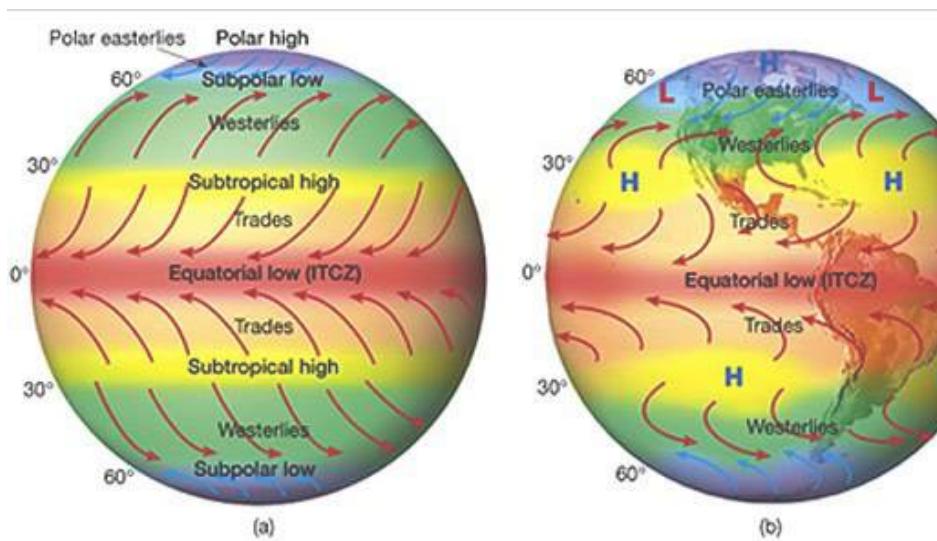
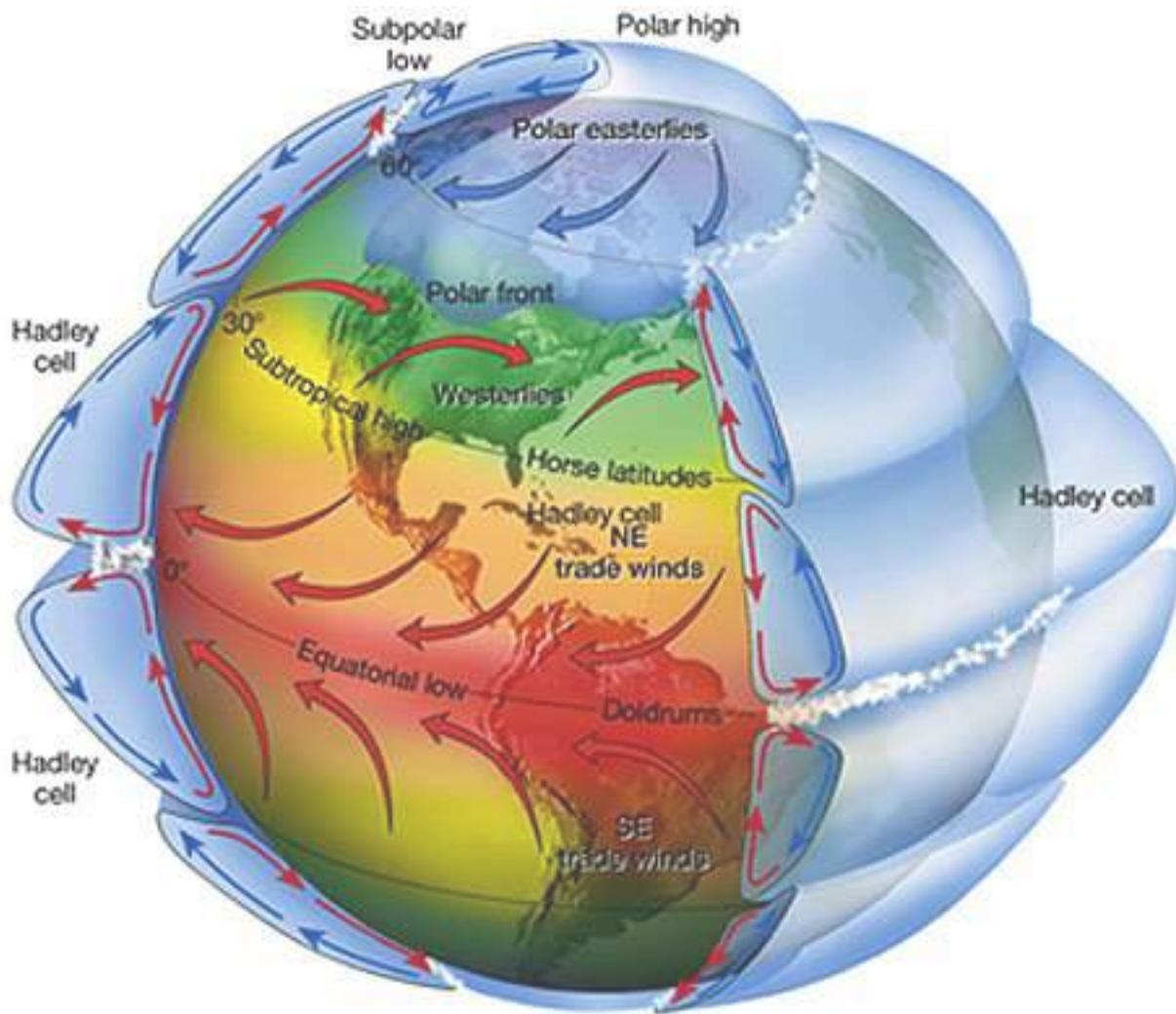
Figure 16 – forces governing air movement: (a) geostrophic balance between pressure gradient and Coriolis force; (b) the additional effect of frictional force on surface wind







(a)



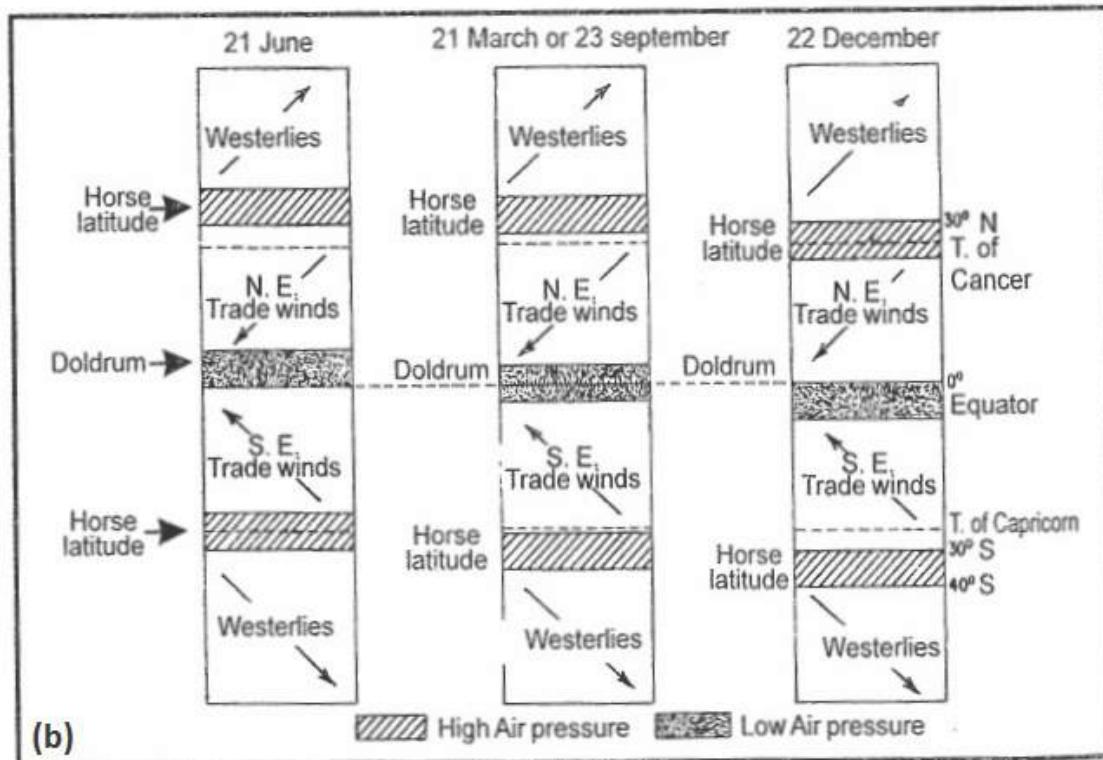


Figure 17 – (a) global pressure belts and (b) shifting of pressure belts

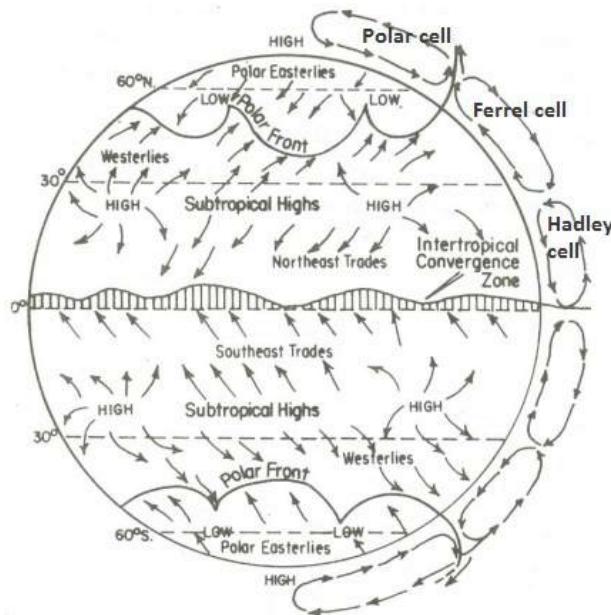
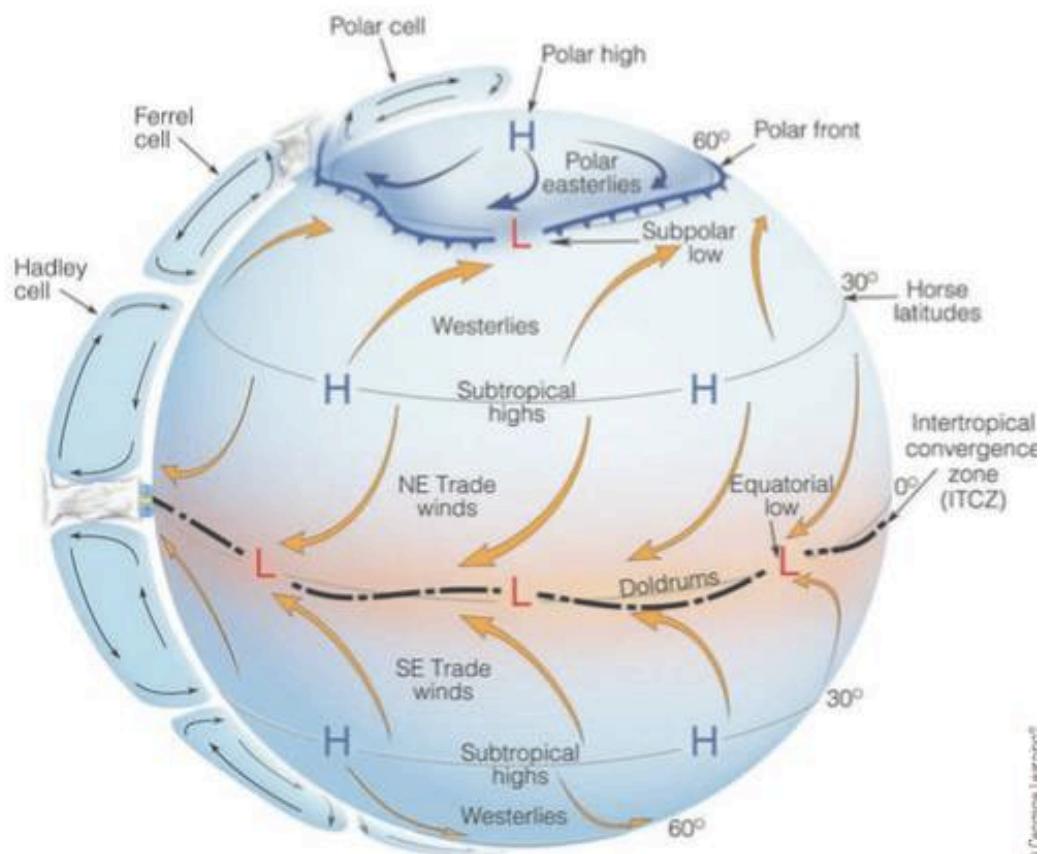
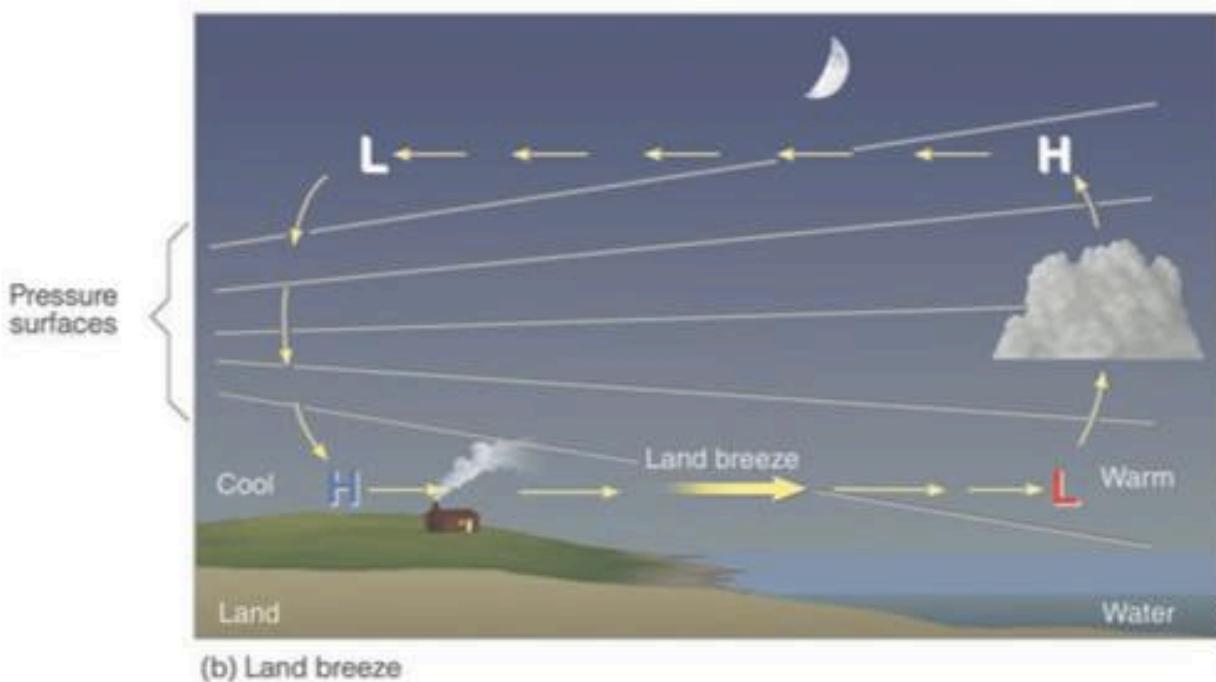
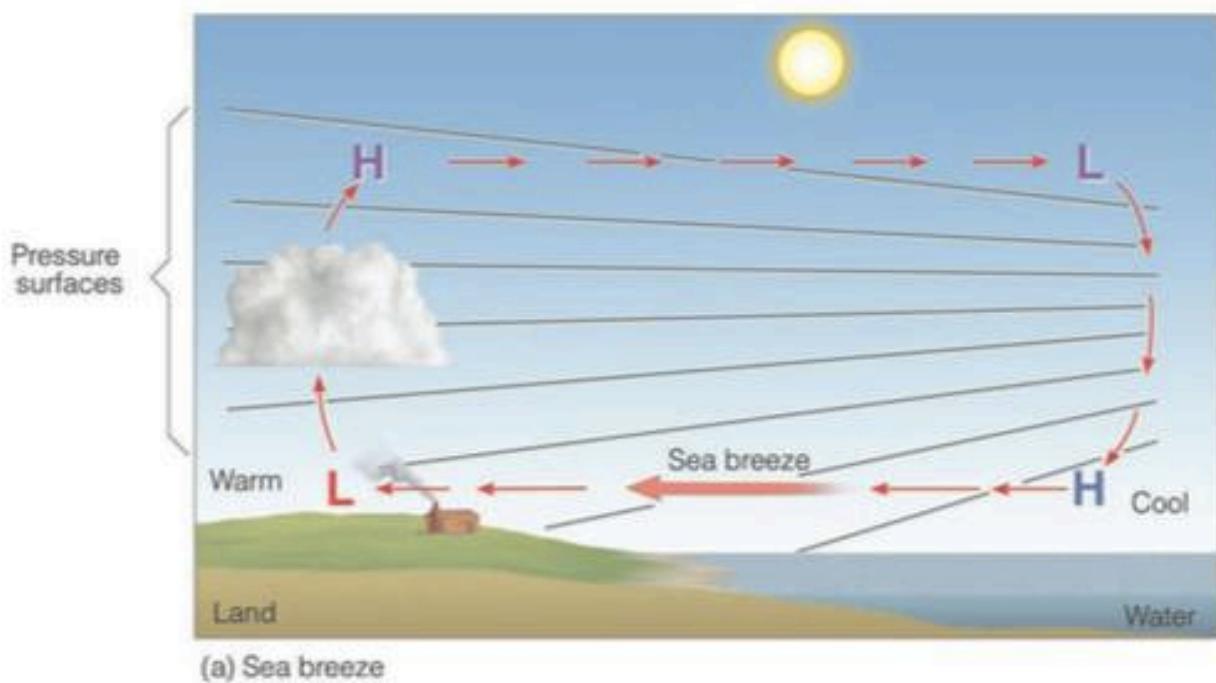
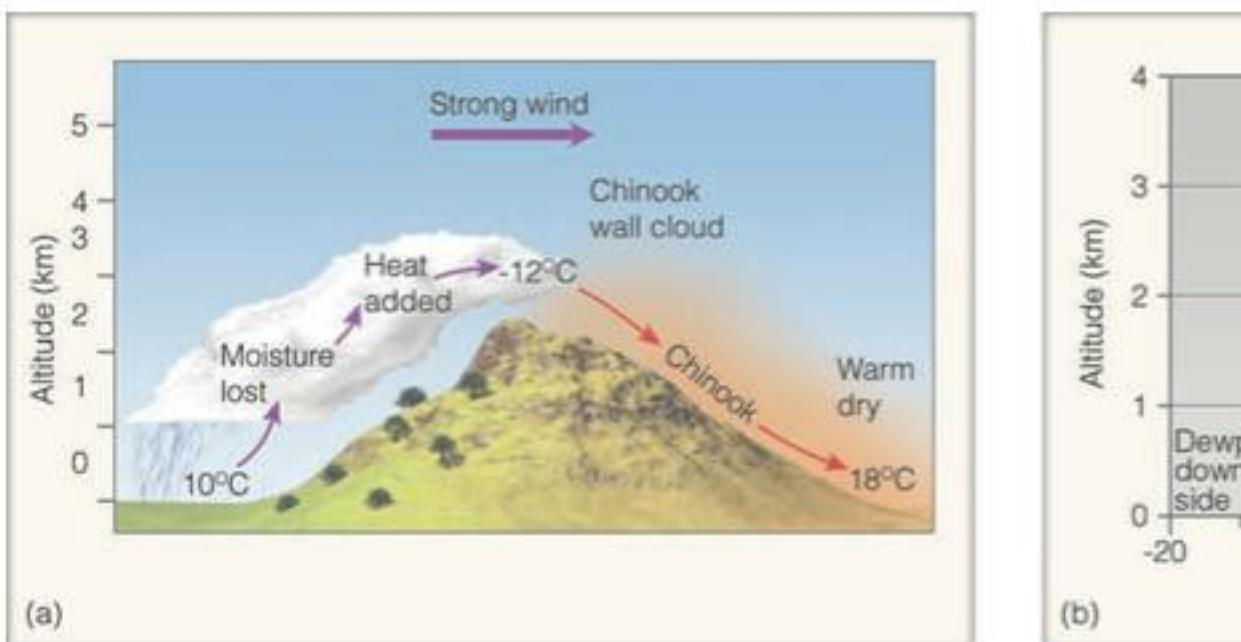
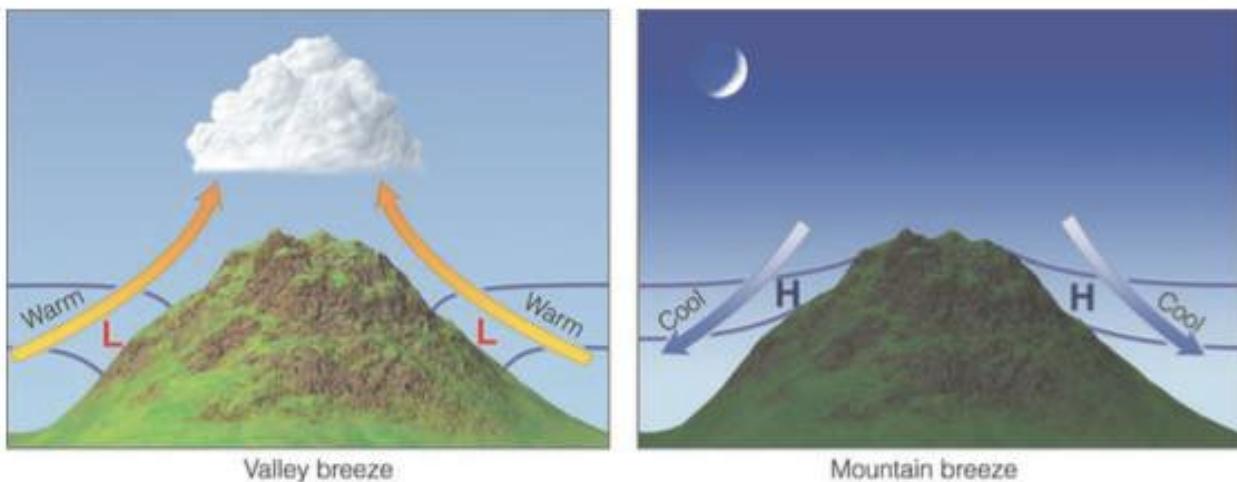


Figure 18 – Planetary winds



(P) Visionias IAS Academy



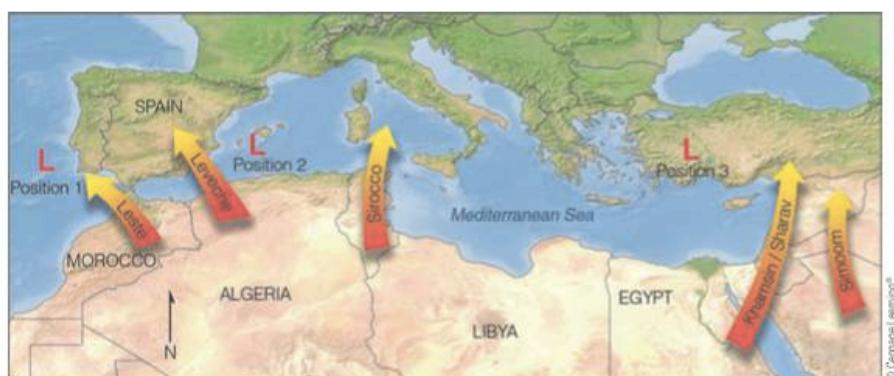


• **FIGURE 9.26** (a) A chinook wind can be enhanced when clouds form on the mountain's windward side.



© Nitin Rencro

● **FIGURE 9.36** A well-developed dust devil moves over a hot desert landscape on a clear summer day.



• FIGURE 9.37 Exceptionally hot, dry local winds that form over North Africa and the Sahara Desert.

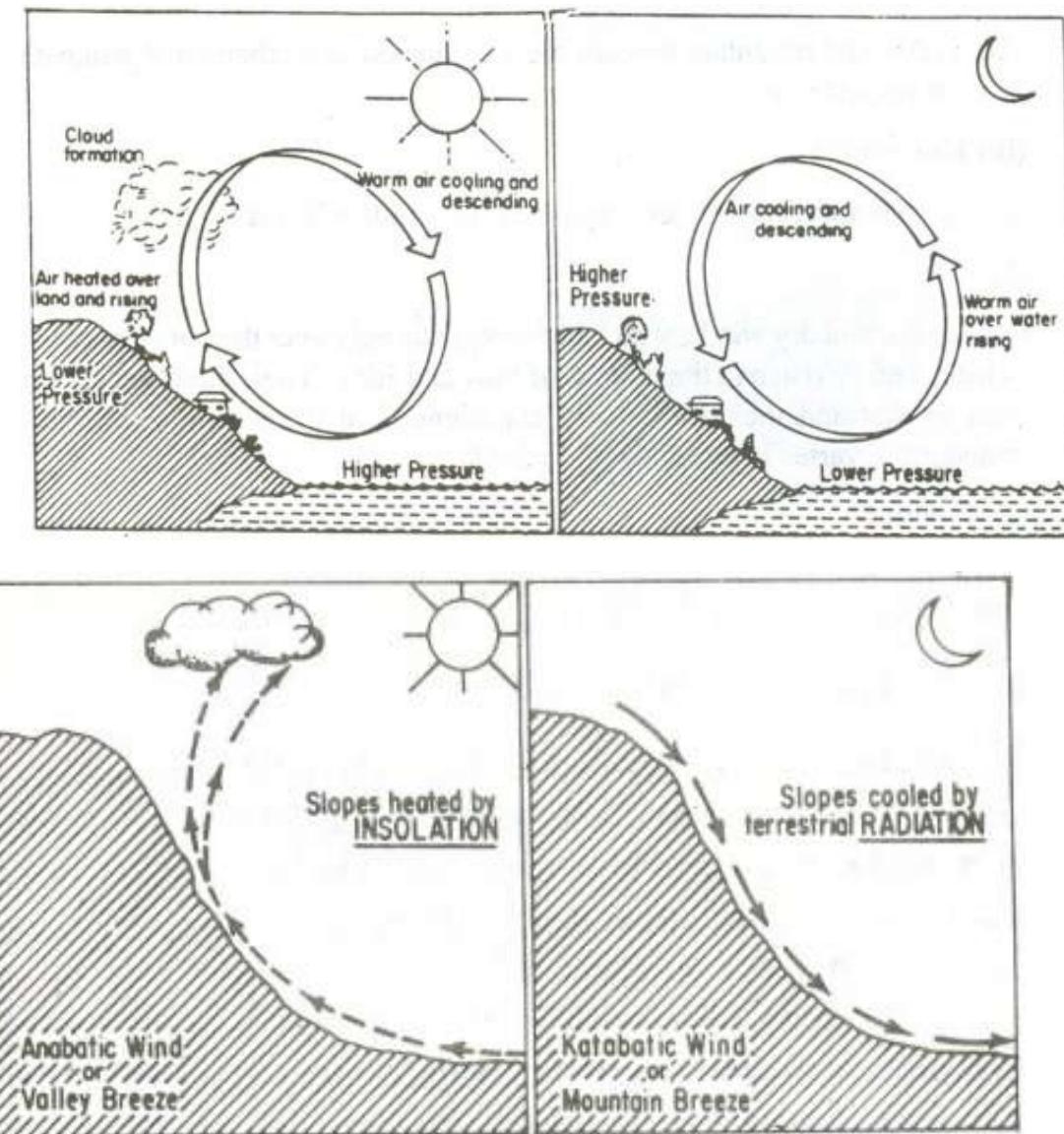
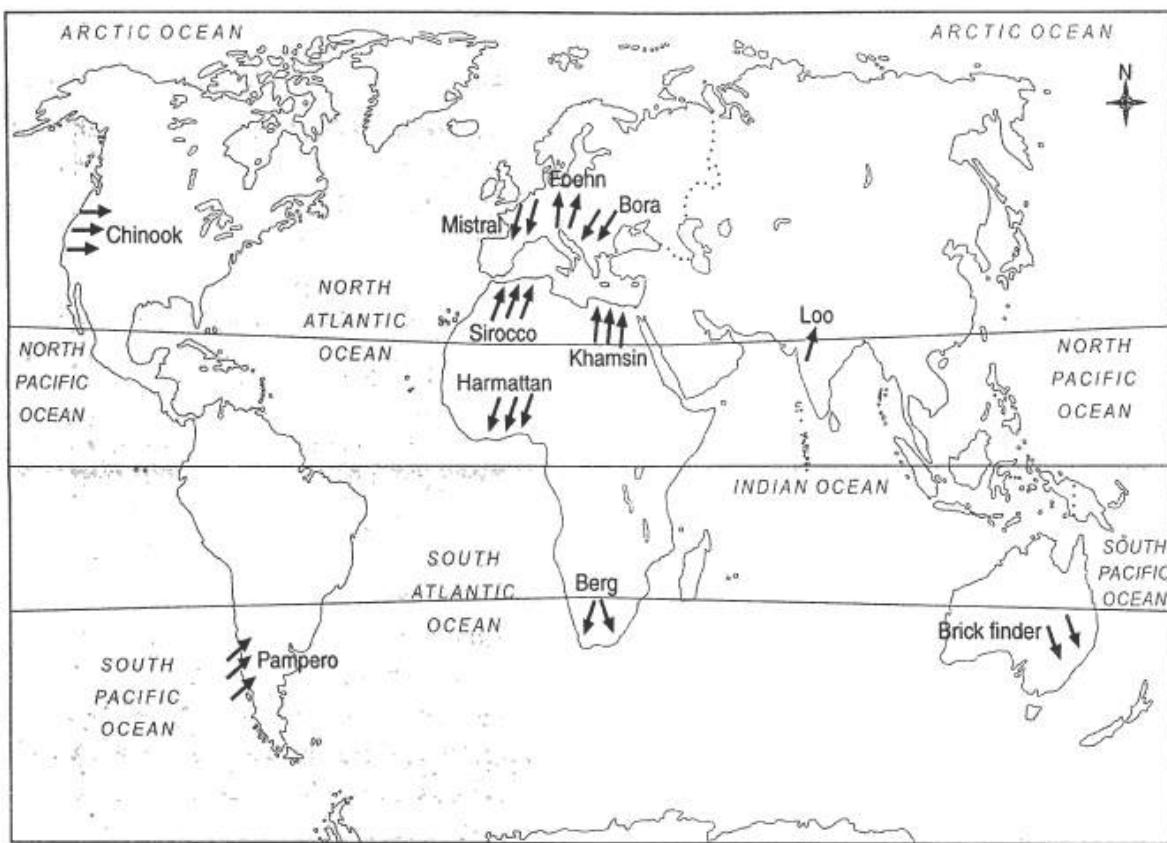
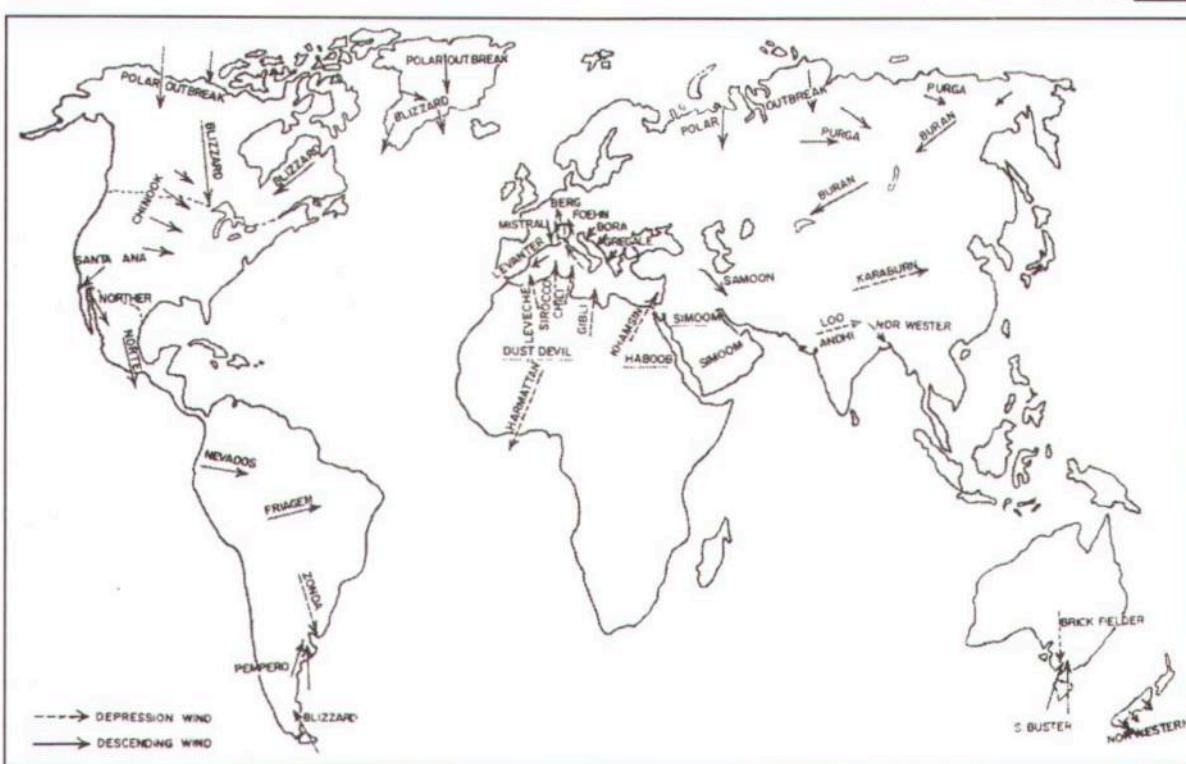
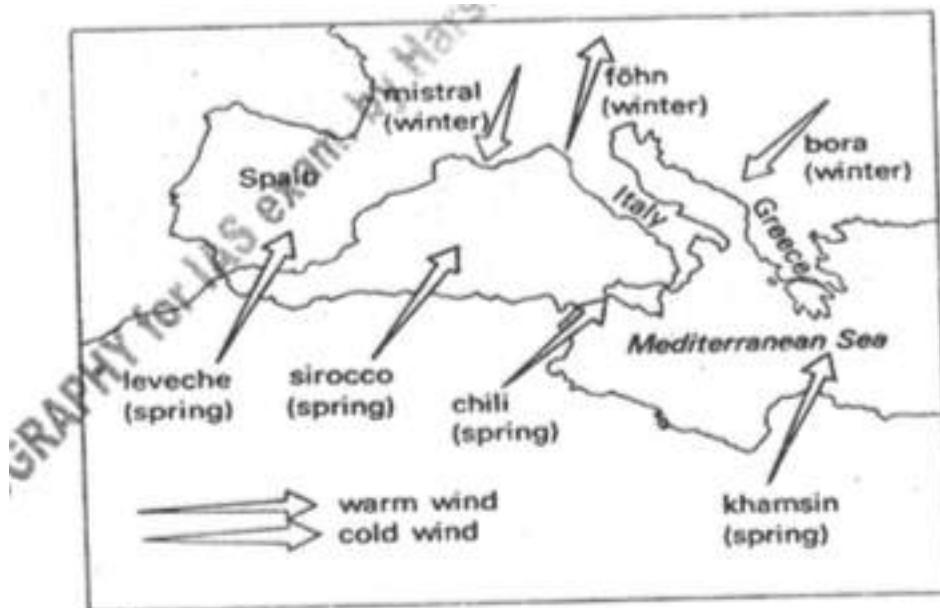
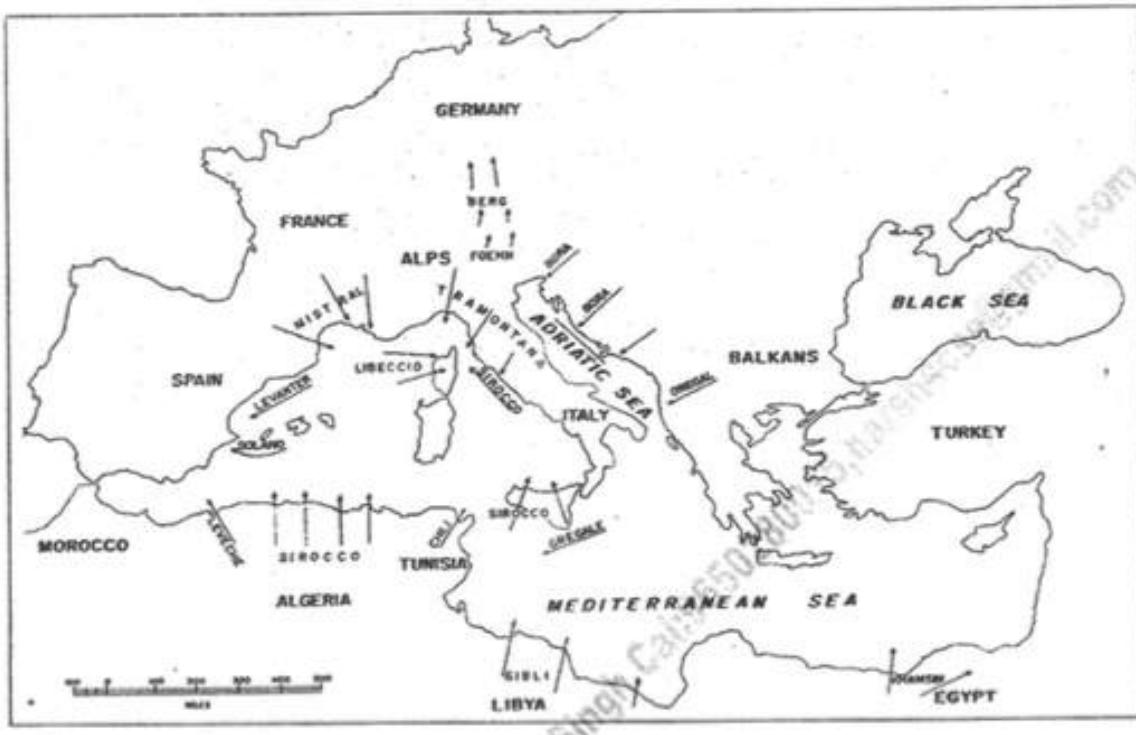
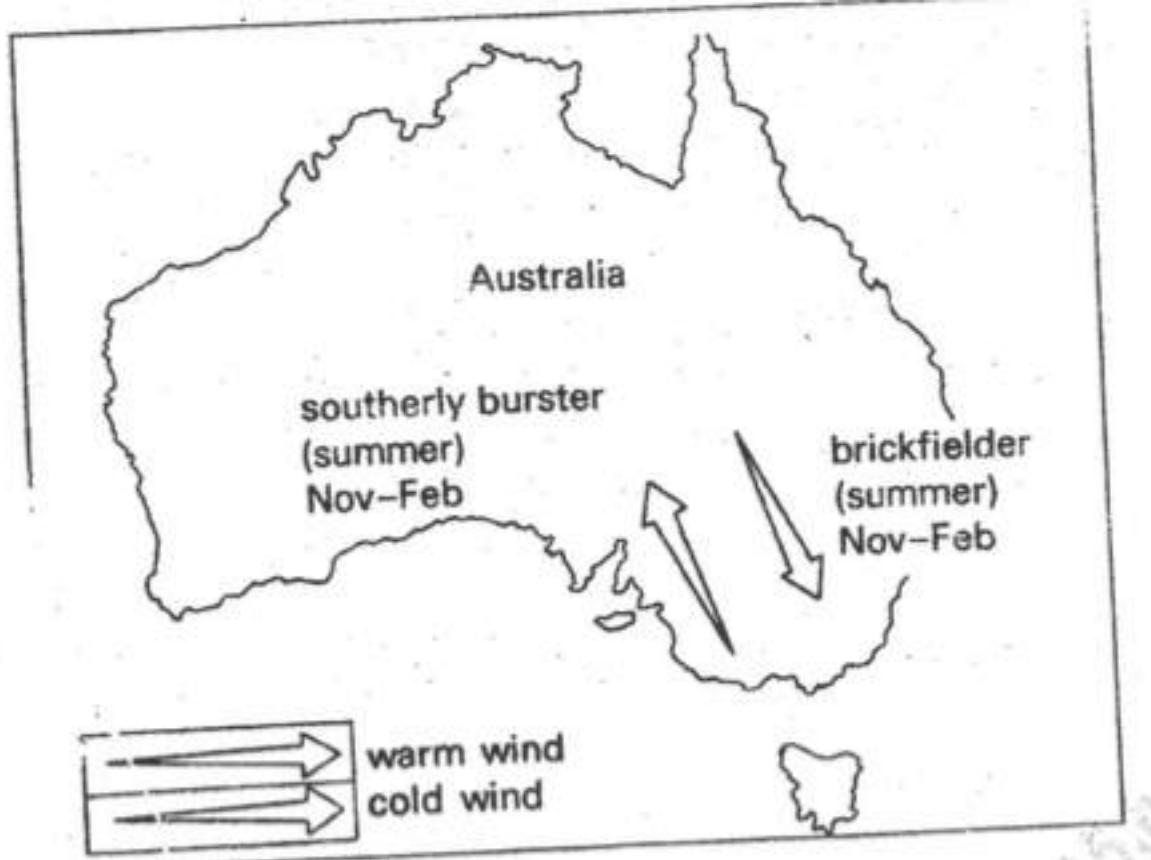


Figure 20 – mountain and valley breezes

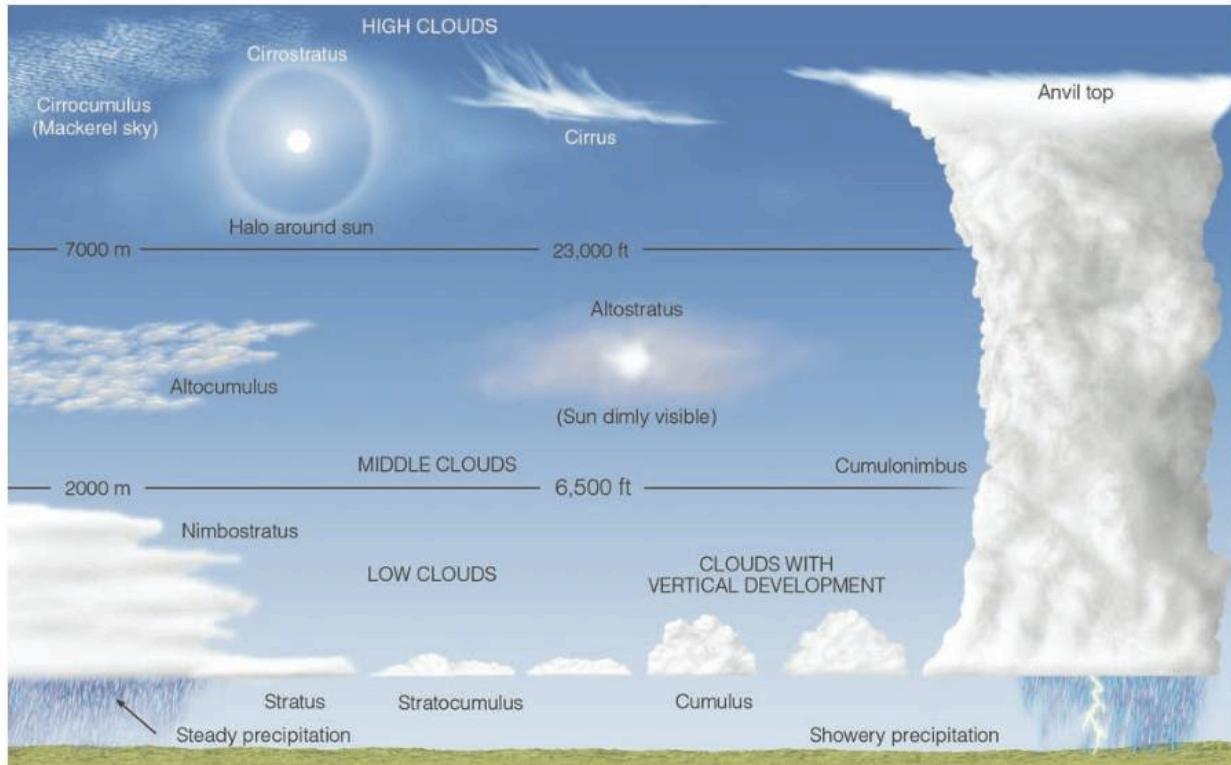








Clouds and precipitation



● **FIGURE 5.23** A generalized illustration of basic cloud types based on height above the surface and vertical development.

Name the Clouds

What kind of clouds does each picture show? Write the answers in the blanks below. Some of them may be especially hard to identify because you may not be able to judge the altitude of the clouds. Hint: Try using the process of elimination.
For more help identifying clouds, visit <http://asd-www.larc.nasa.gov/SCOOOL/tutorial/clouds/cloudtypes.html> or http://www.srh.weather.gov/srh/jetstream/synoptic/ll_clouds1.htm.



1. _____ cumulus



4. stratocumulus _____



2. _____ nimbostratus



5. cumulonimbus _____



3. cirrus _____



6. cirrocumulus _____



7. altostratus _____



8. stratus _____



9. altocumulus _____



10. cirrostratus _____

Answers:

1. Cumulus; 2. Nimbostratus; 3. Cirrus; 4. Stratocumulus; 5. Cumulonimbus;
6. Cirrocumulus; 7. Altostratus; 8. Stratus; 9. Altocumulus; 10. Cirrostratus

1. Cumulus; 2. Nimbostratus; 3. Cirrus; 4. Stratocumulus; 5. Cumulonimbus;
6. Cirrocumulus; 7. Altostratus; 8. Stratus; 9. Altocumulus; 10. Cirrostratus



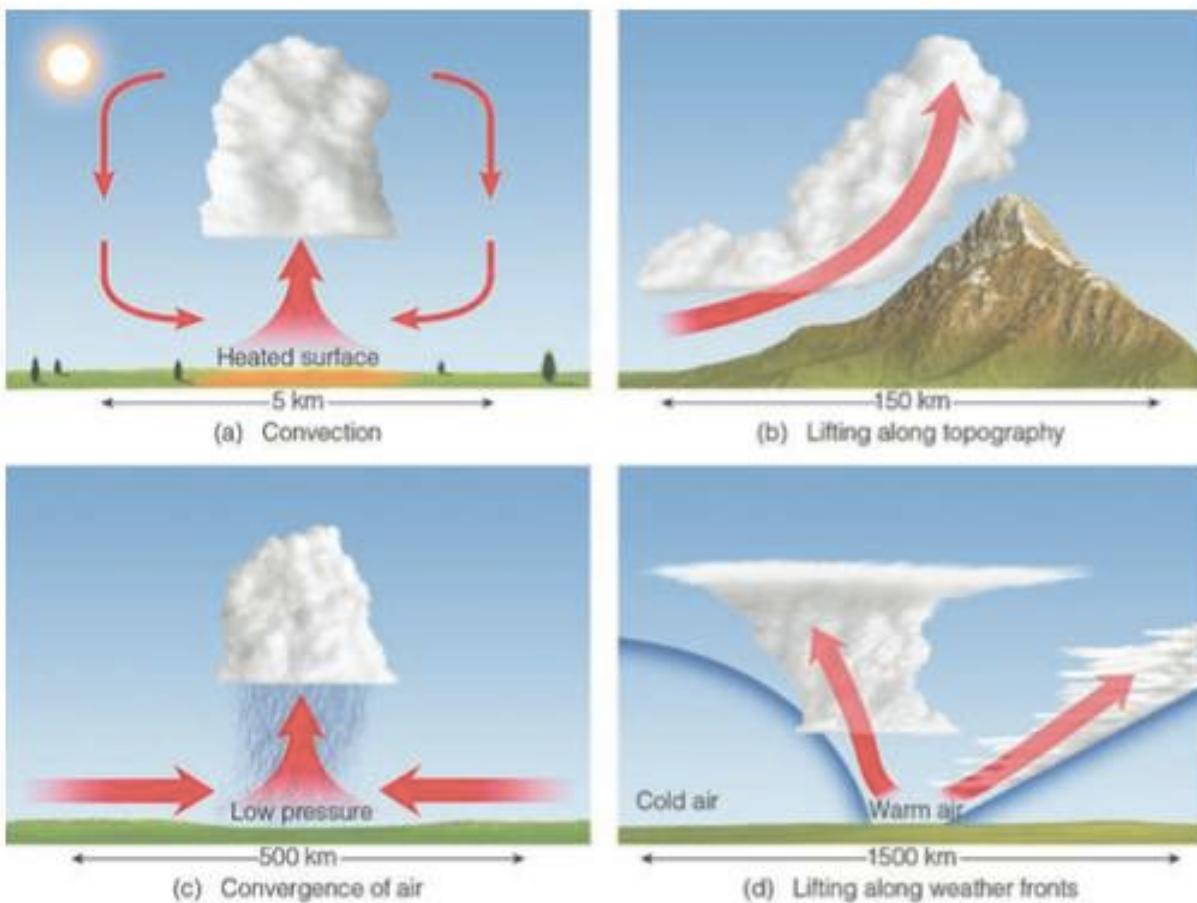
noctilucent clouds



polar stratospheric clouds

▼**Table 5.2 The Four Major Cloud Groups and Their Types**

1. HIGH CLOUDS	3. LOW CLOUDS
Cirrus (Ci)	Stratus (St)
Cirrostratus (Cs)	Stratocumulus (Sc)
Cirrocumulus (Cc)	Nimbostratus (Ns)
2. MIDDLE CLOUDS	4. CLOUDS WITH VERTICAL DEVELOPMENT
Altostatus (As)	Cumulus (Cu)
Altocumulus (Ac)	Cumulonimbus (Cb)



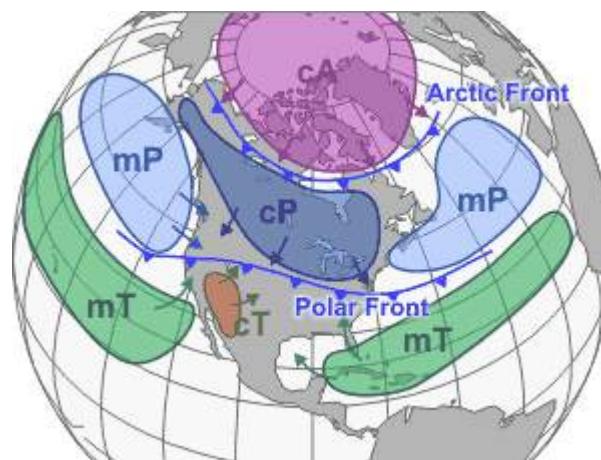
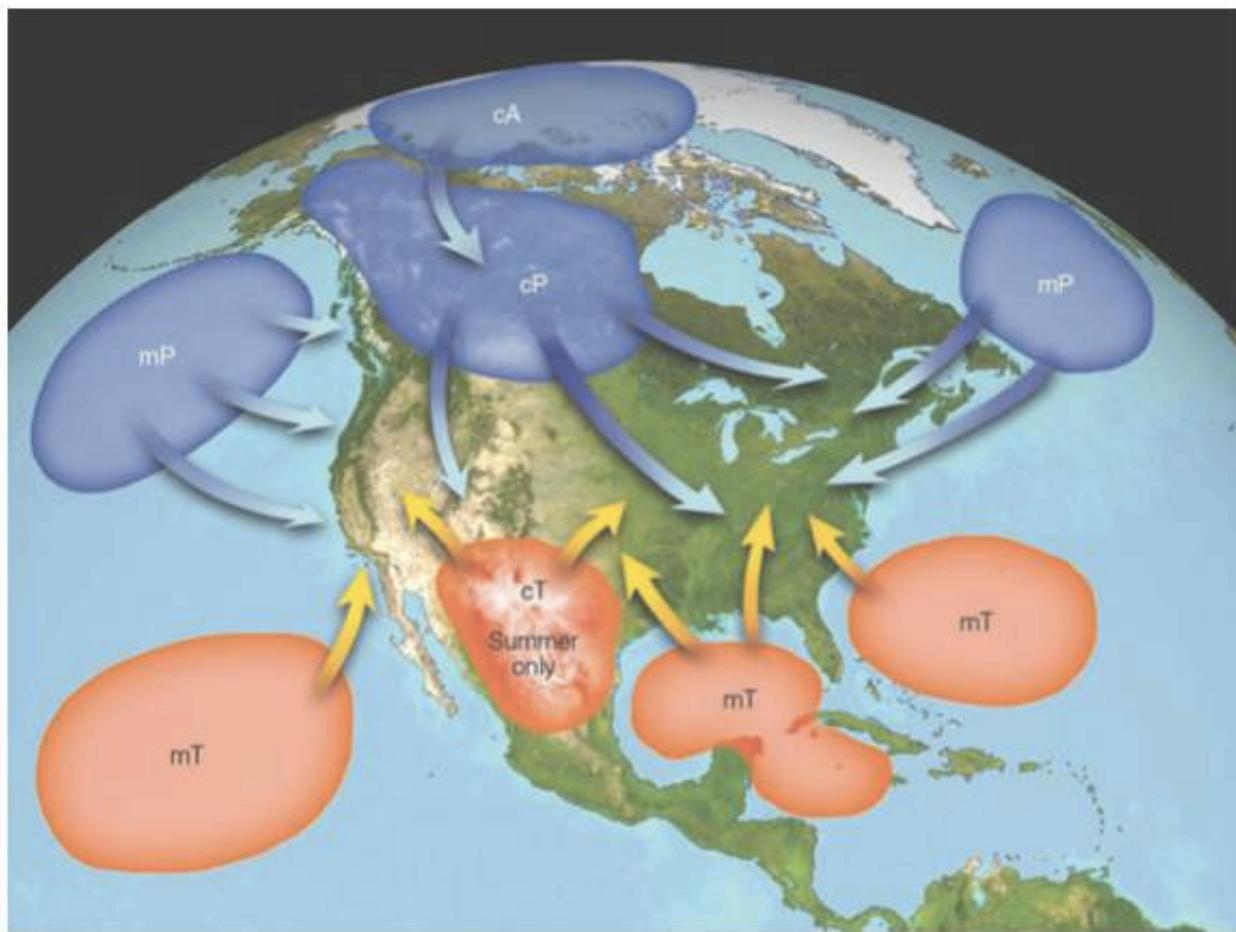
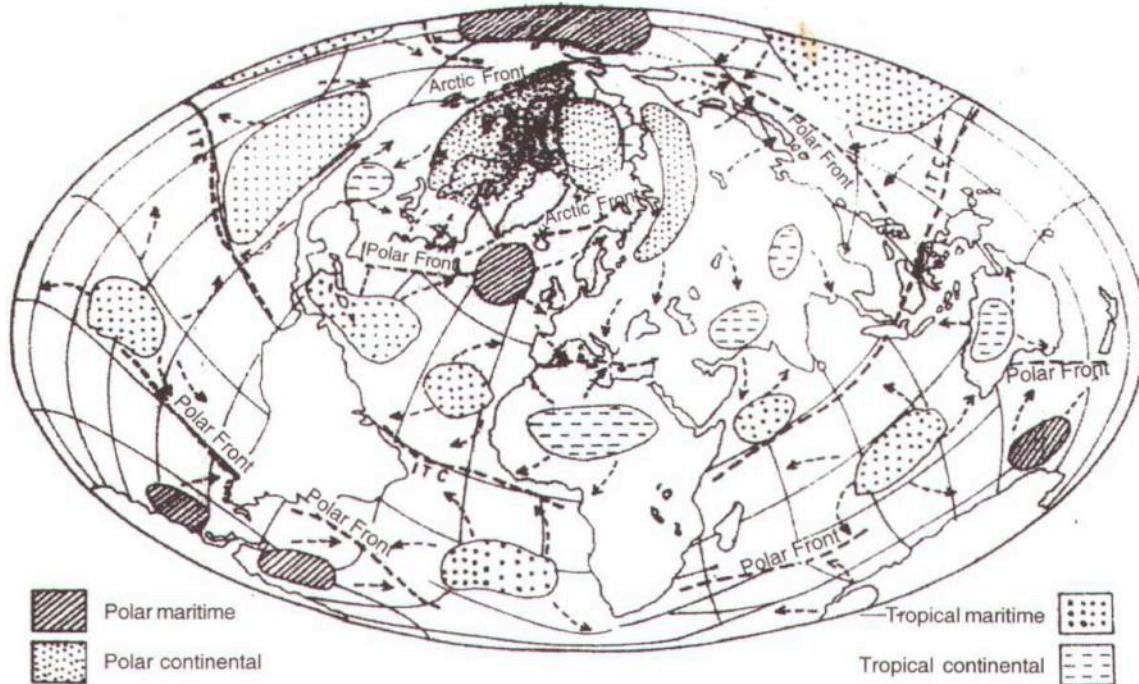


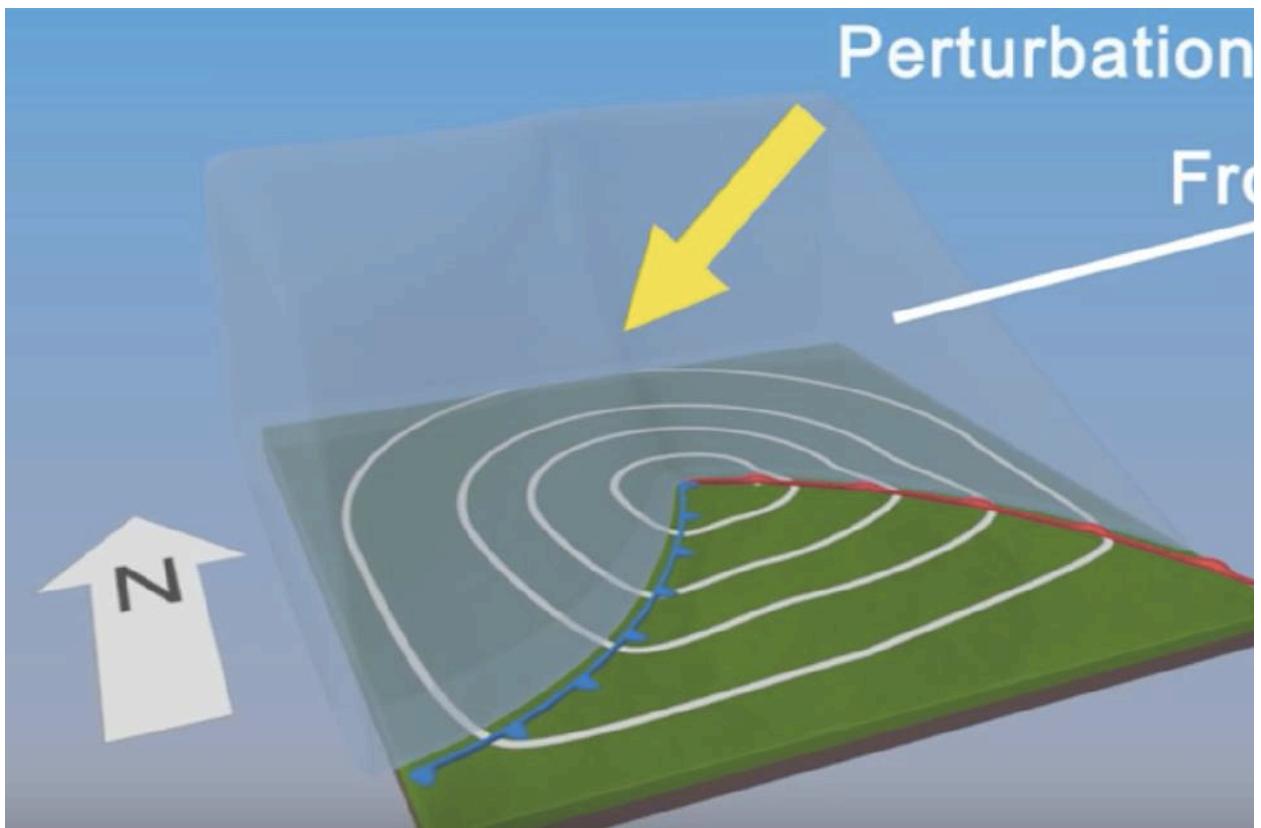
Figure 25 – Airmasses

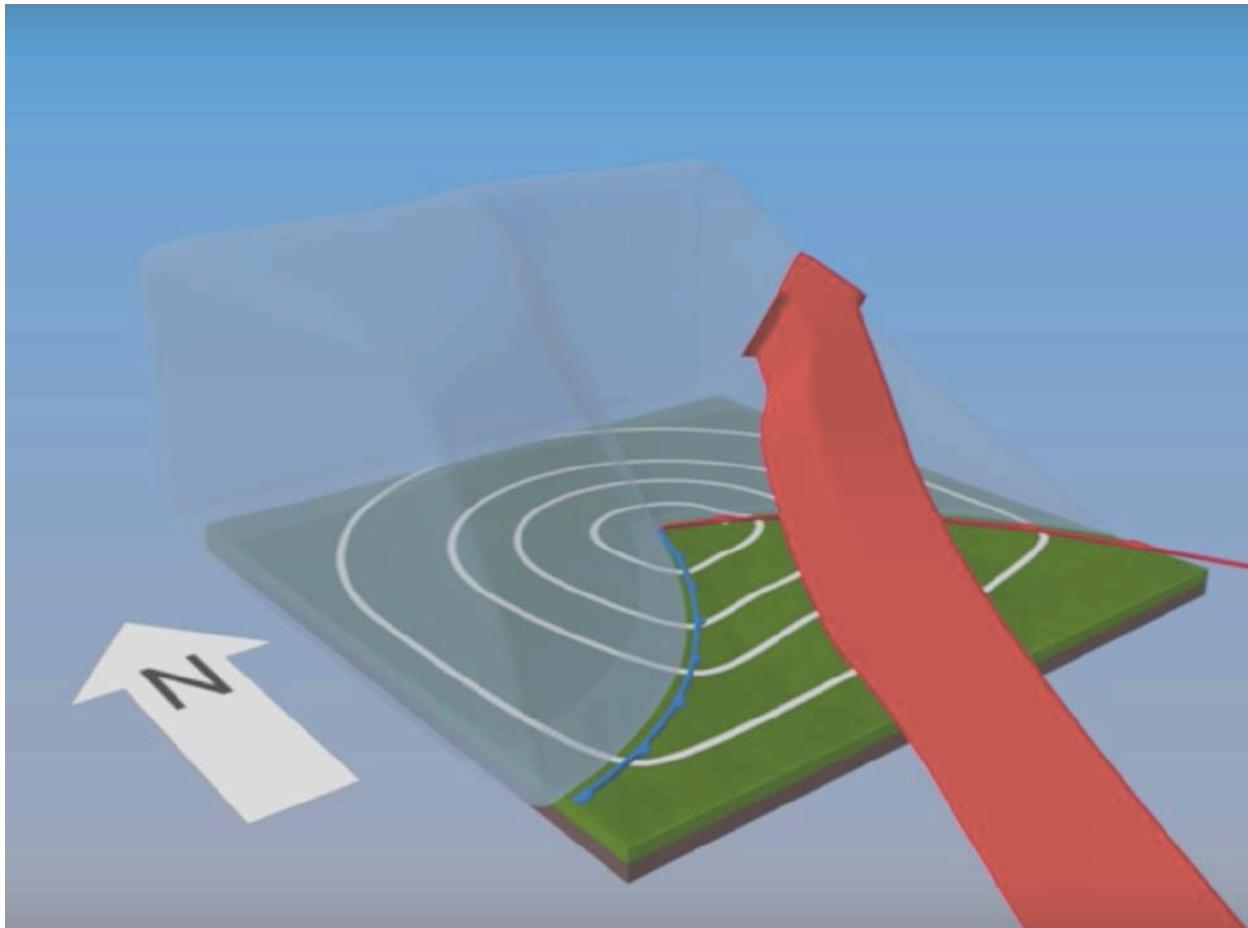
- i. Maritime tropical (mT)
- ii. Continental tropical (cT)
- iii. Maritime polar (mP)

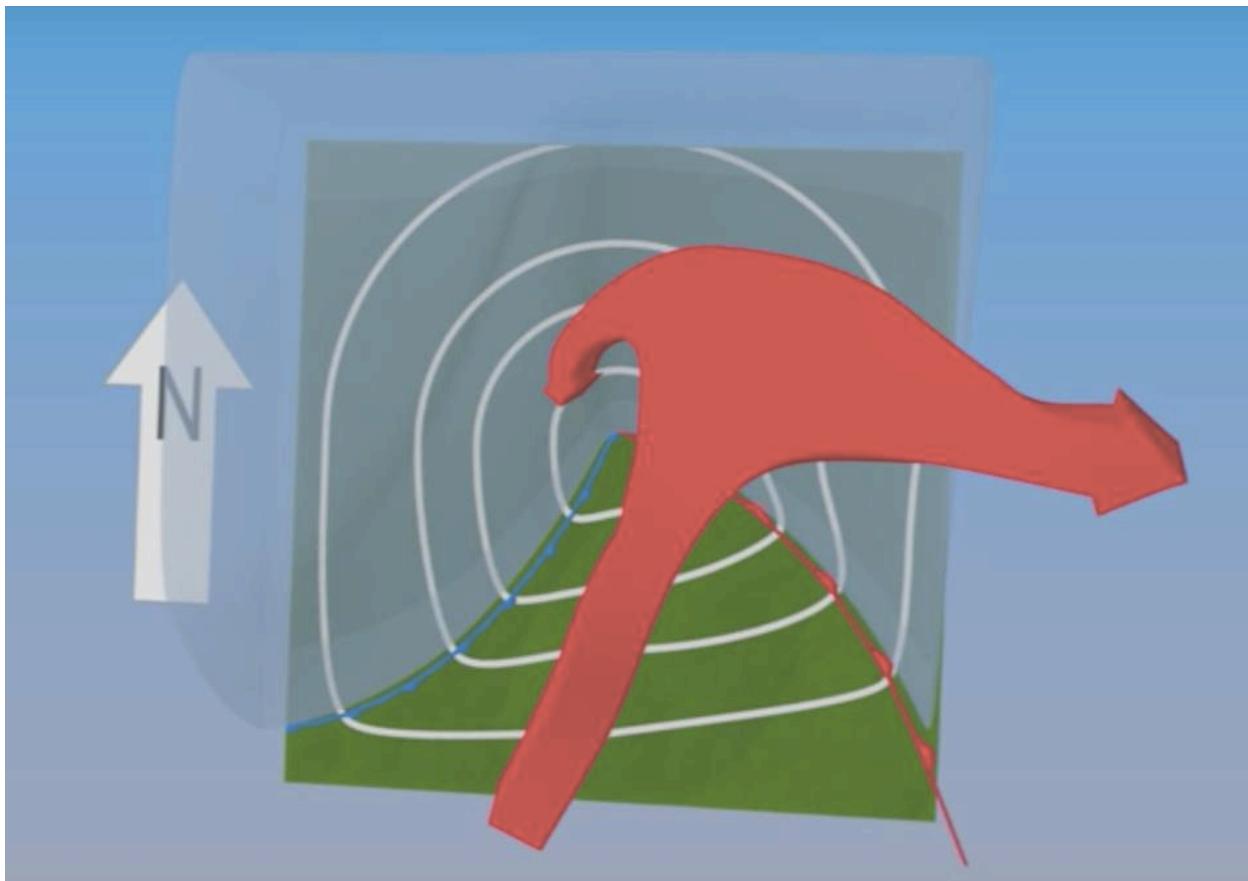
- iv. Continental polar (cP)
- v. Continental arctic (cA).

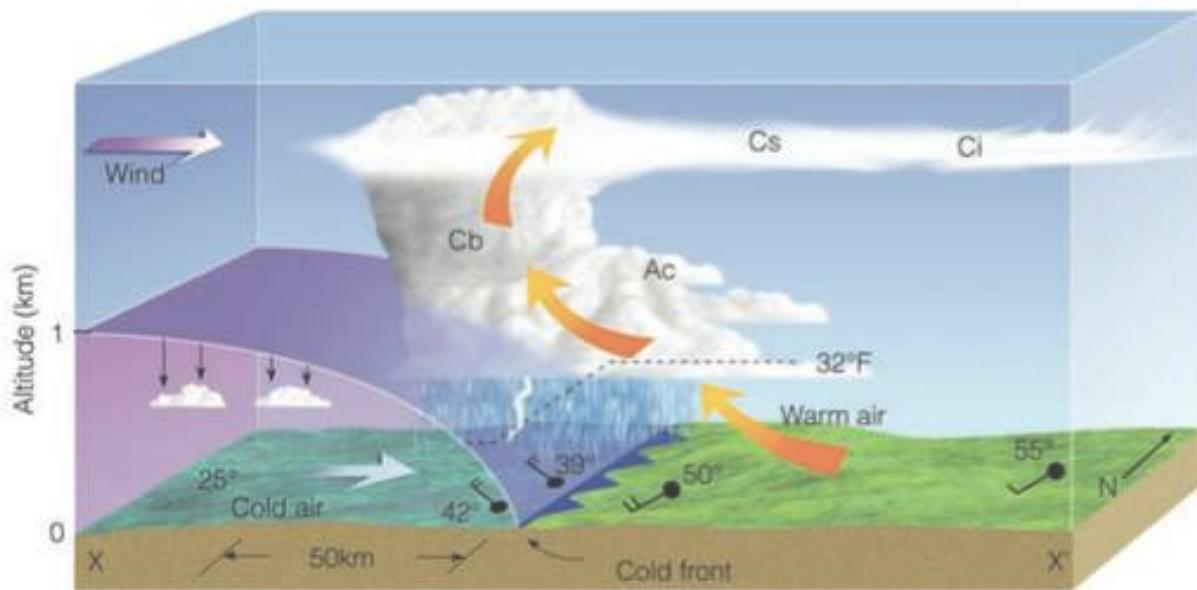
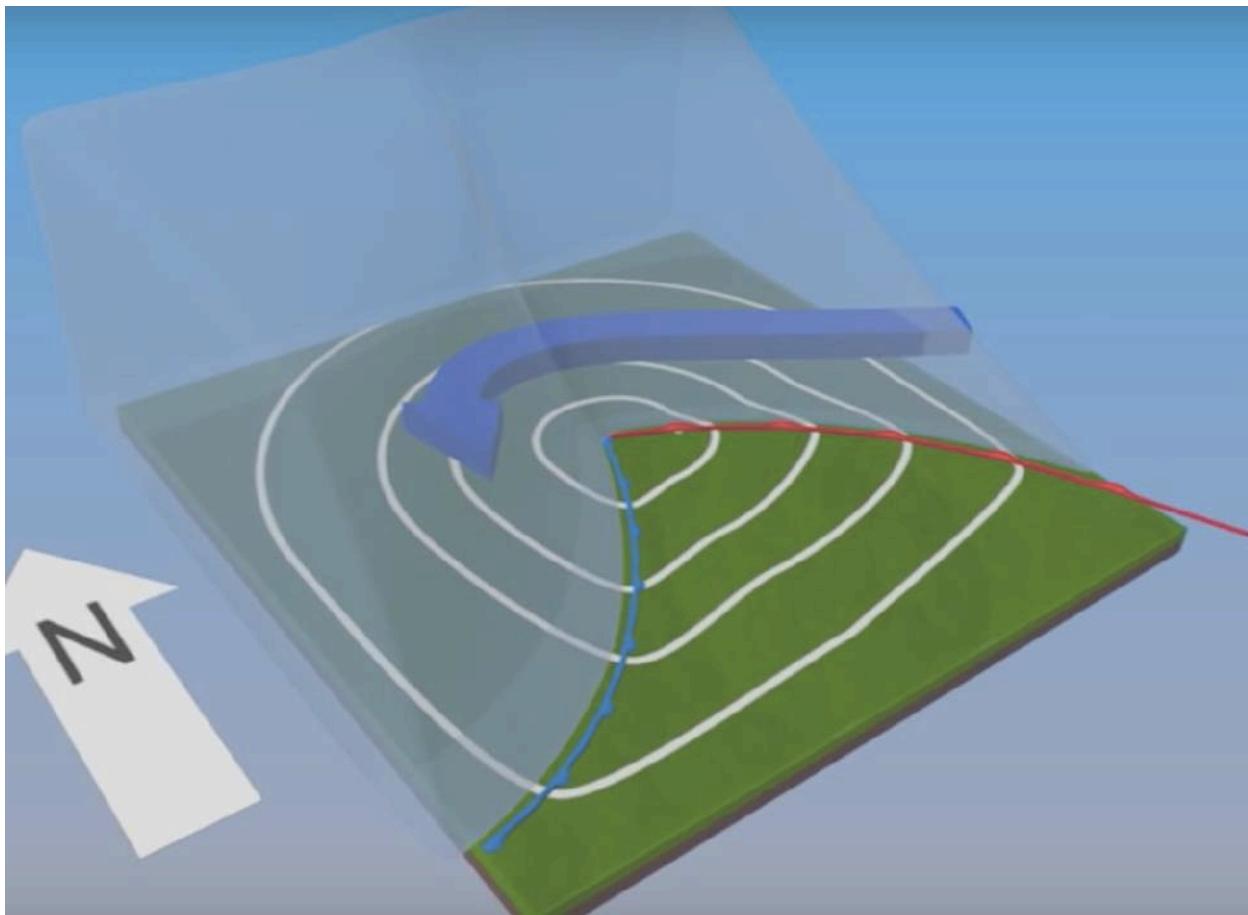


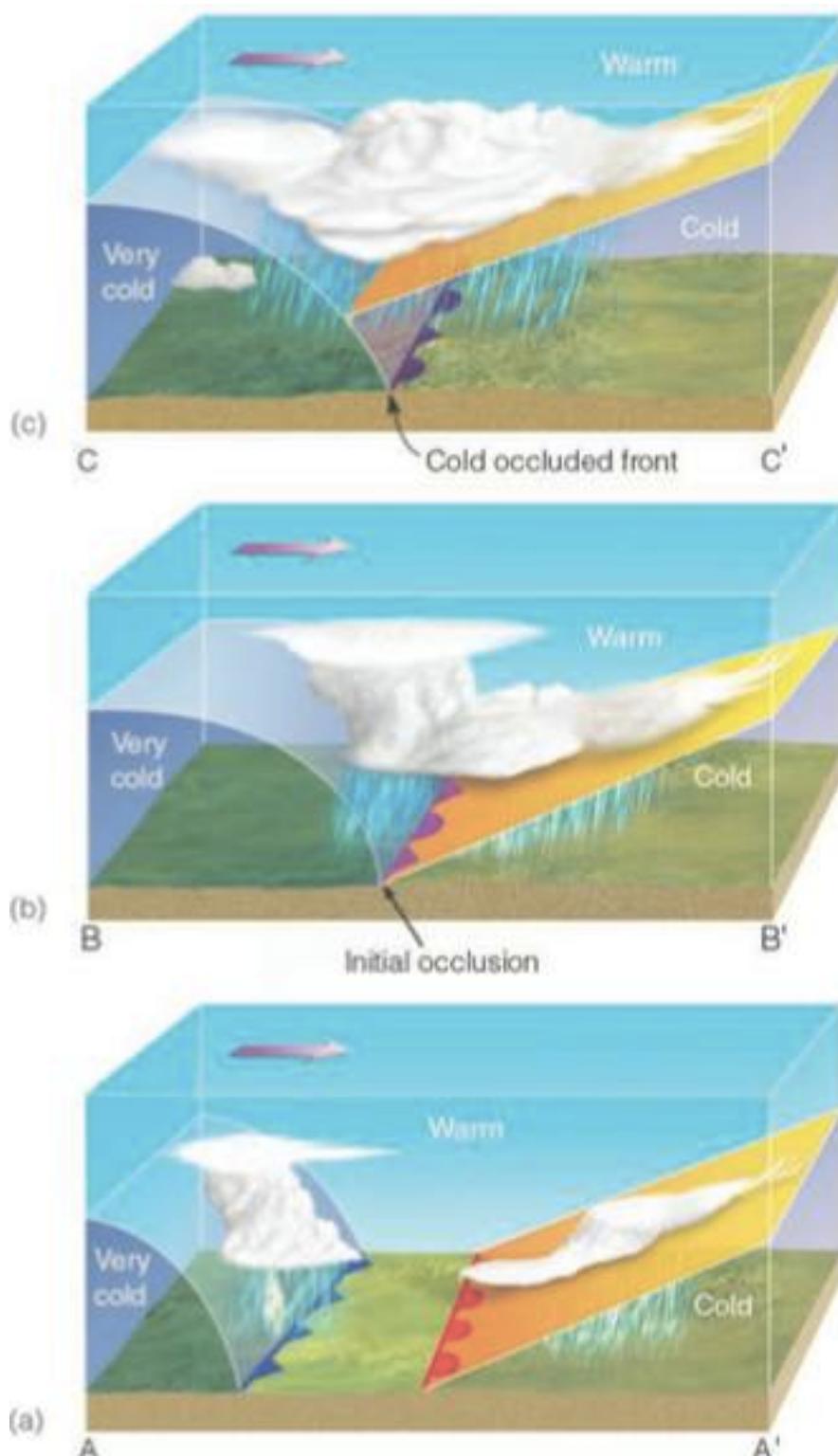
- vi.

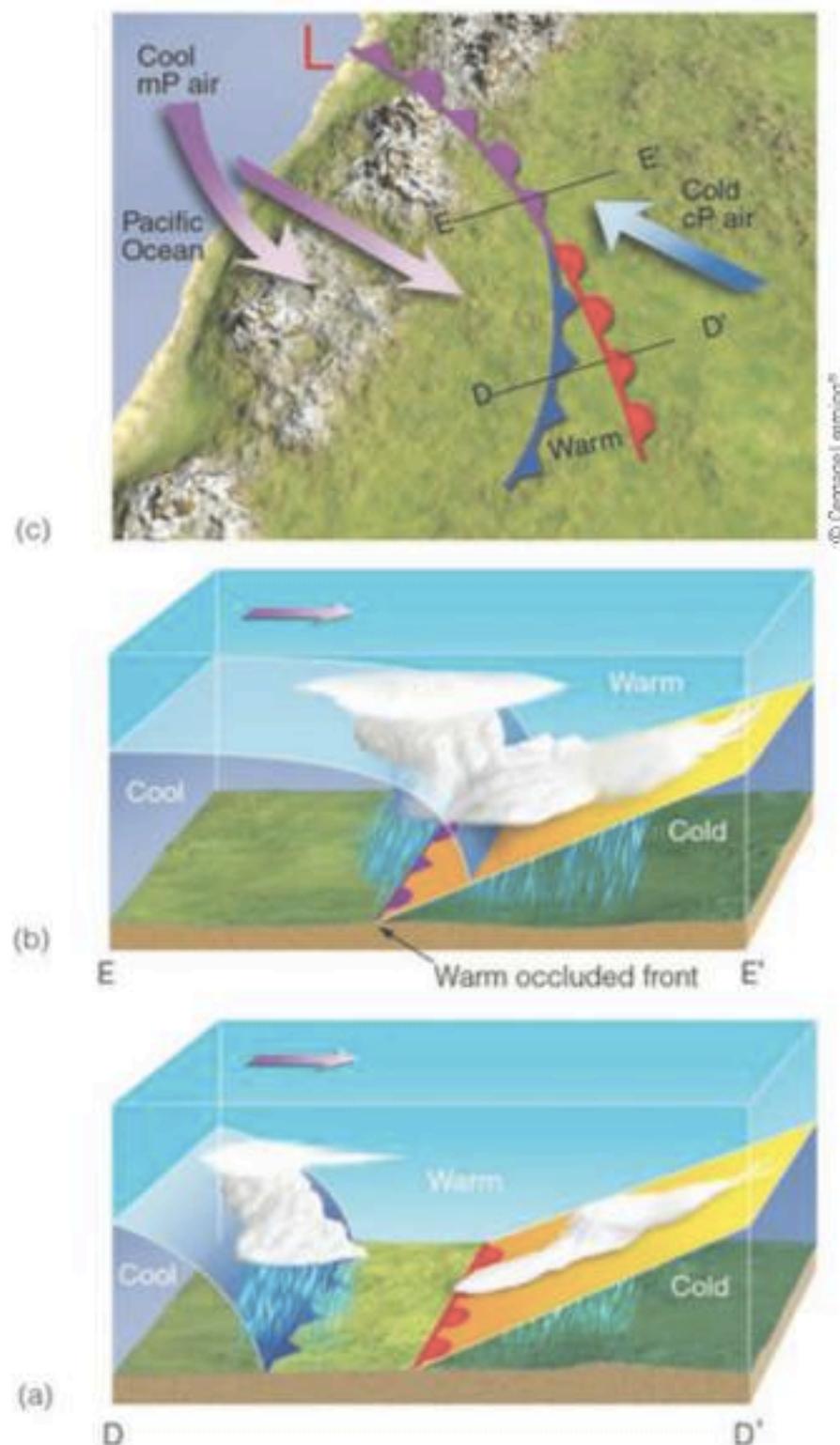




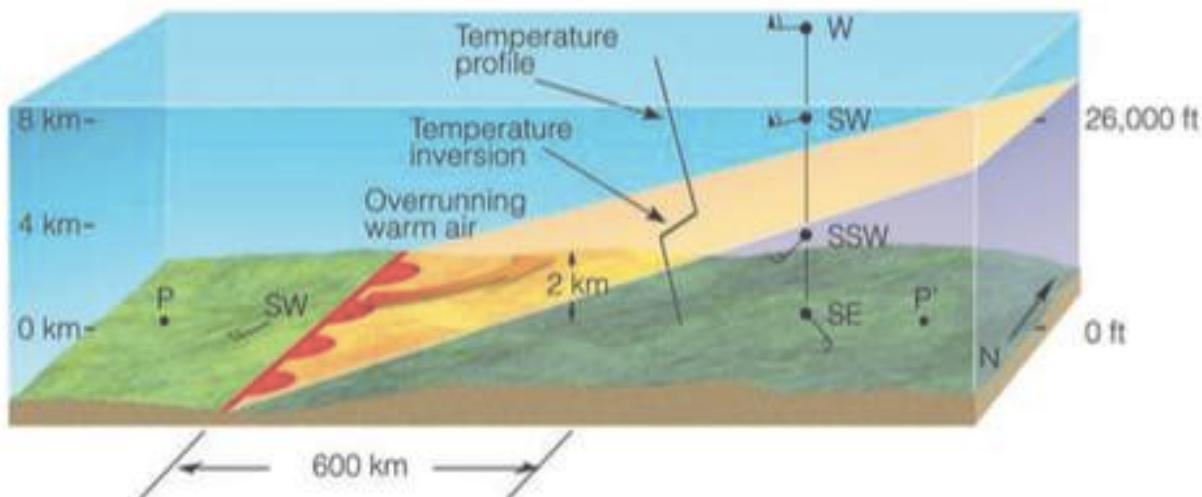
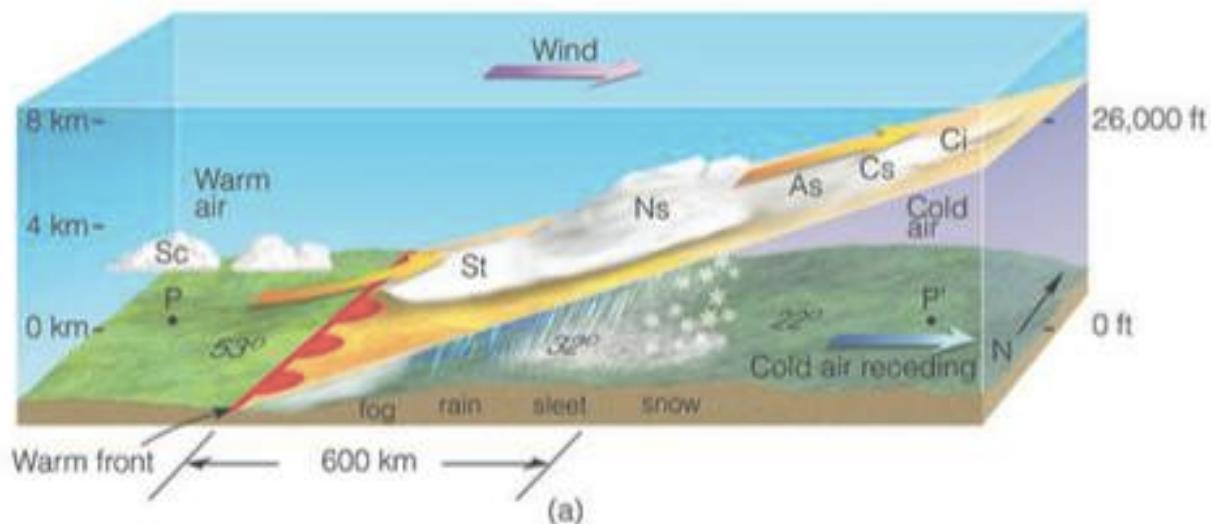








● **FIGURE 11.26** A model illustrating the formation of a warm-type occluded front.



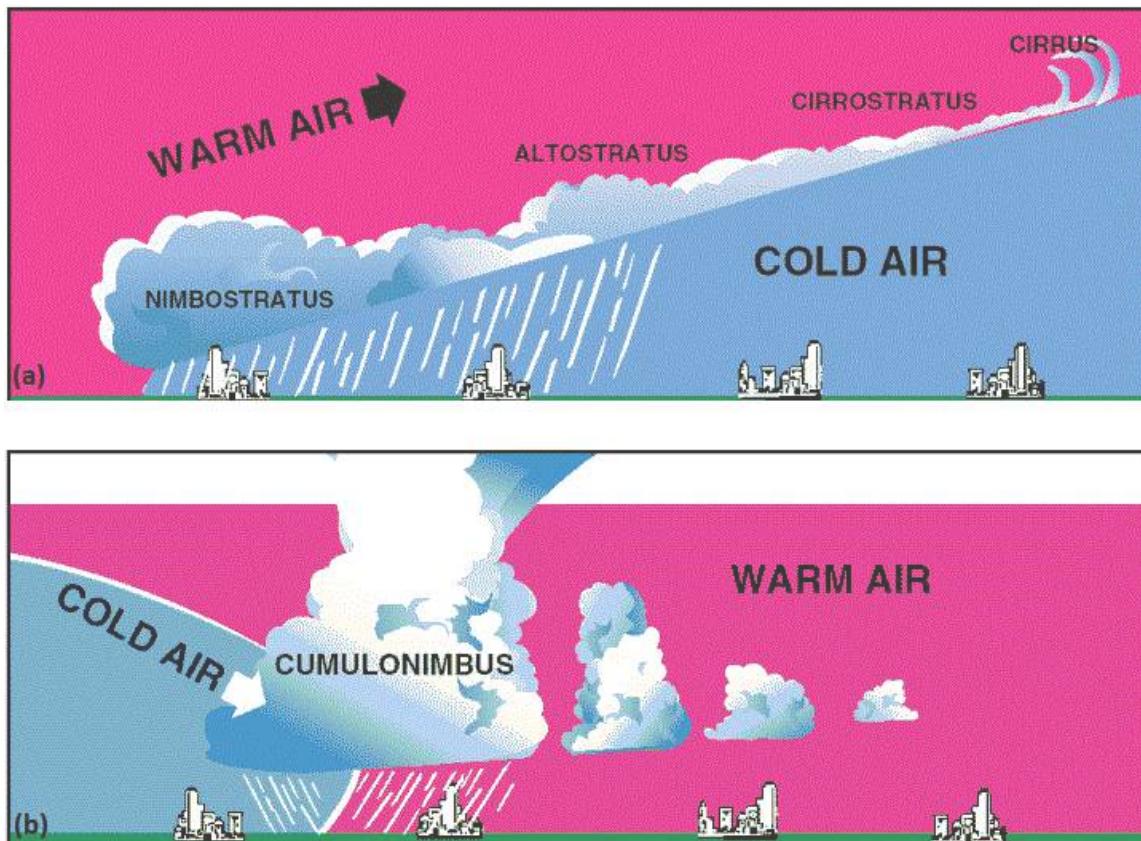
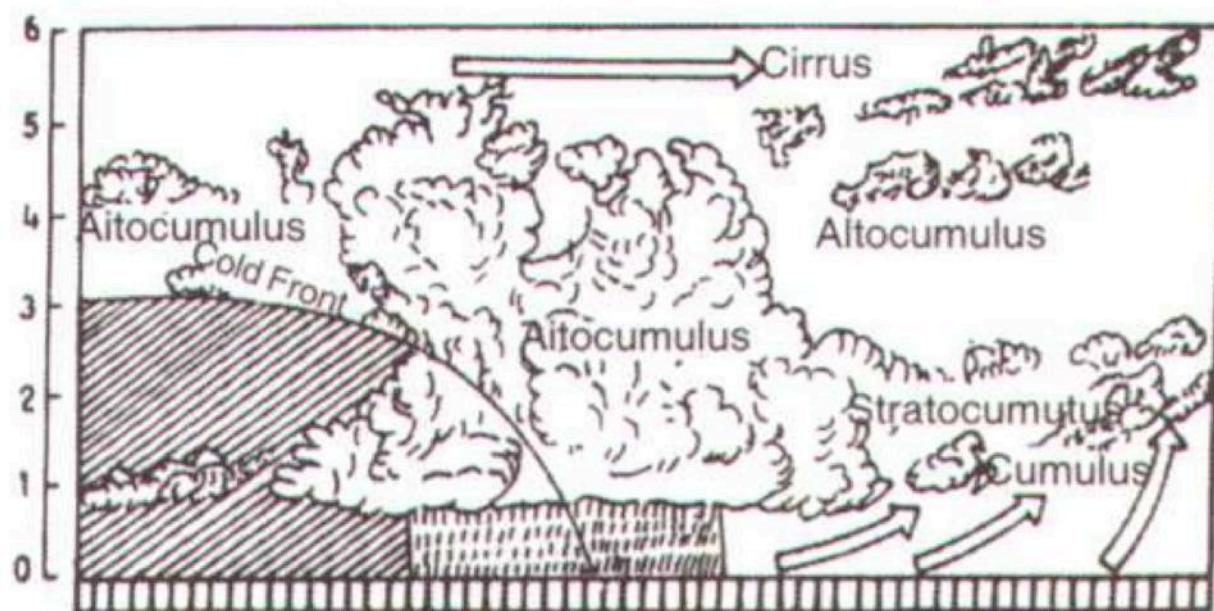
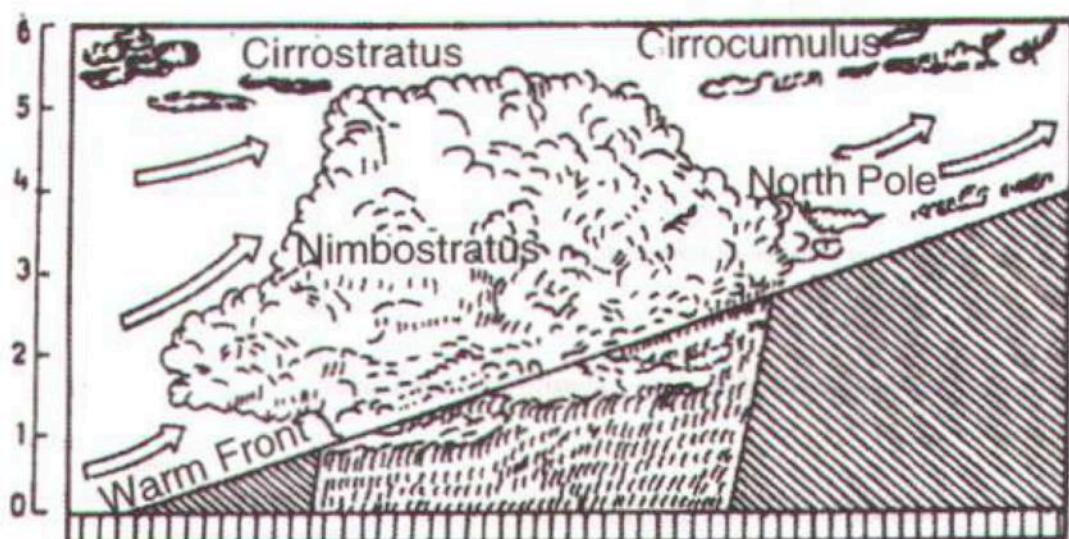
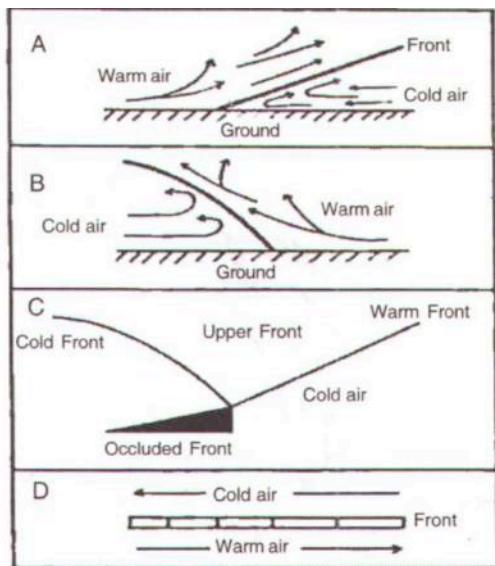


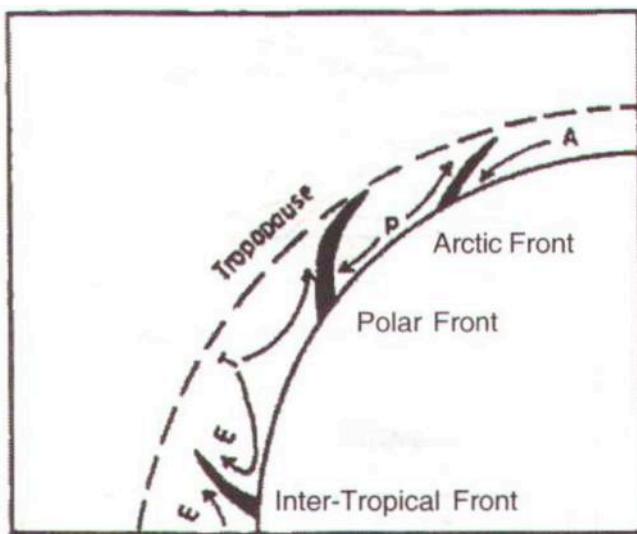
Figure 26 – Fronts: (a) Warm front; (b) Cold front

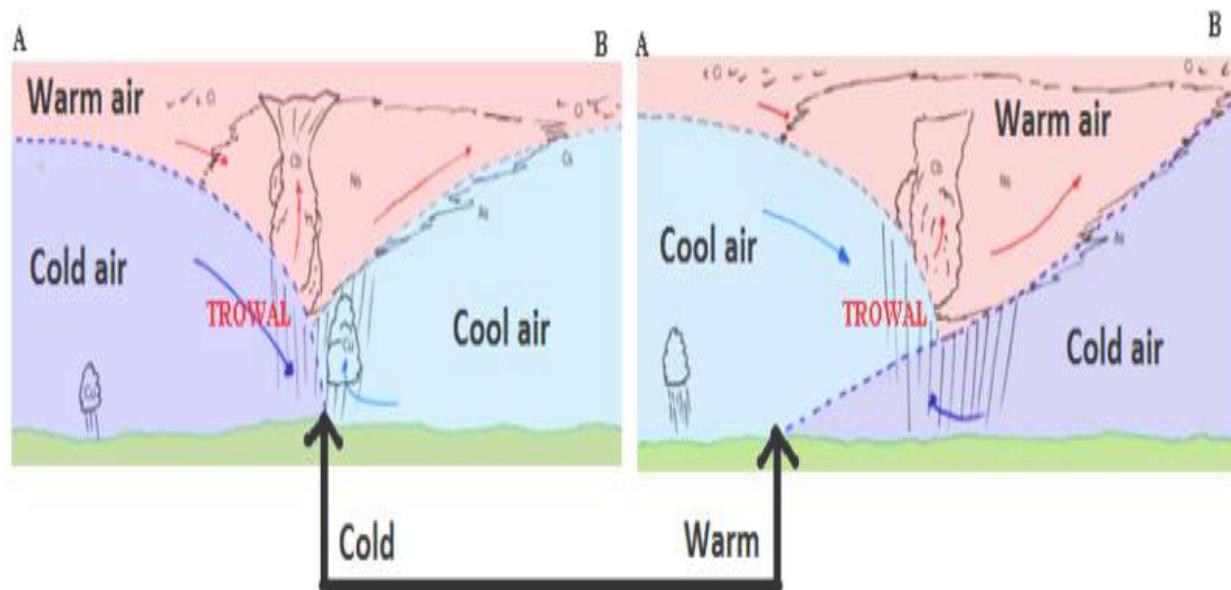


Vertical cross-section of a cold front and associated clouds and precipitation



A= Warm front, B=Cold Front, C=Occluded Front,
 and D=Stationary Front





Occluded front

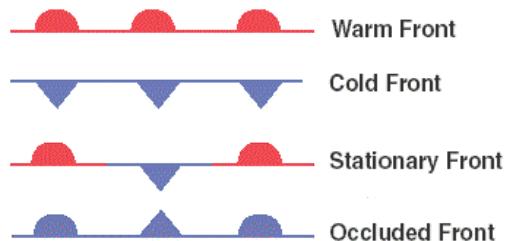


Figure 27 – cold front occlusion and warm front occlusion
 Fronts

Figure 28 – symbols used for

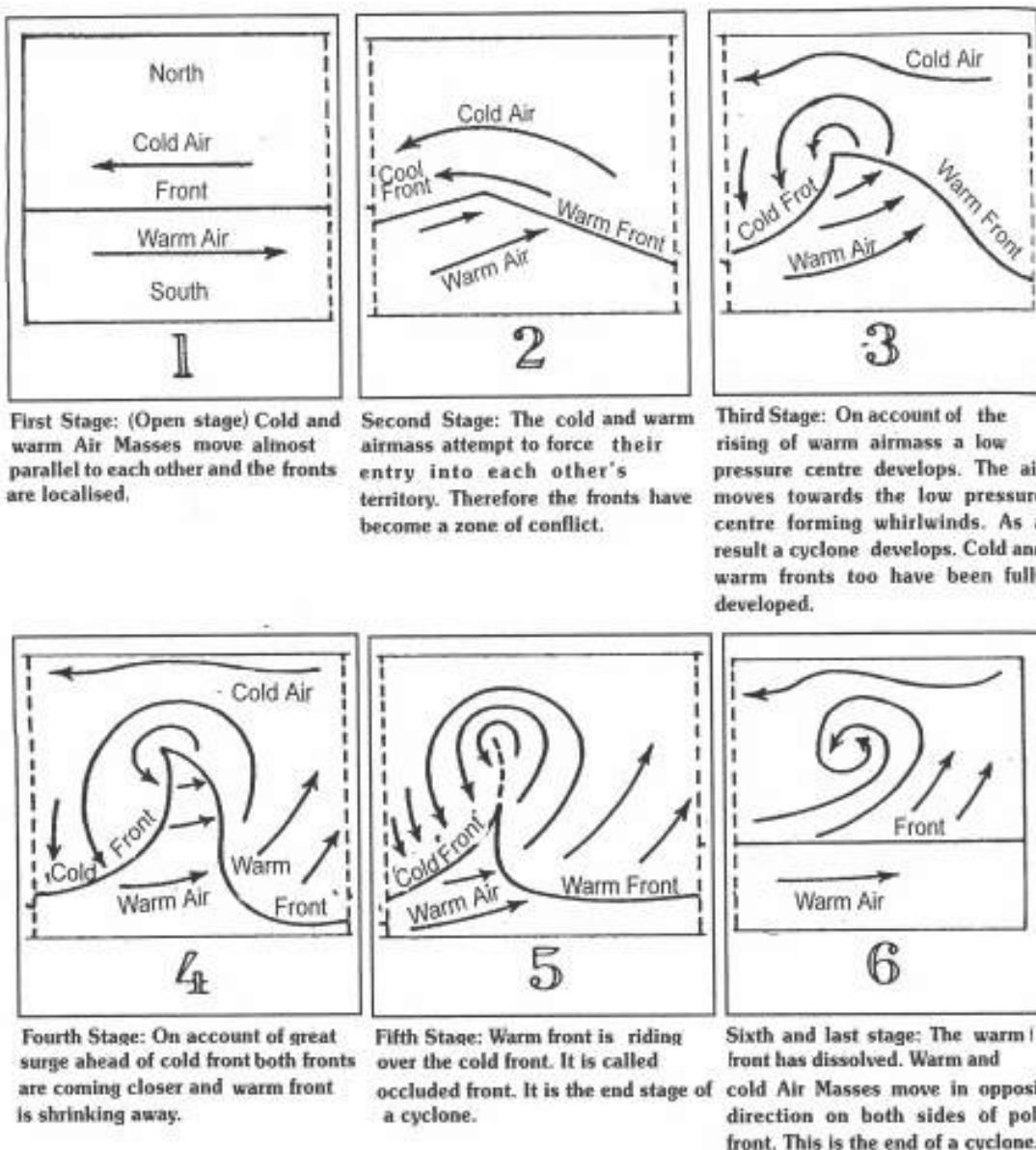


Figure 29 – life cycle of an extra-tropical cyclone

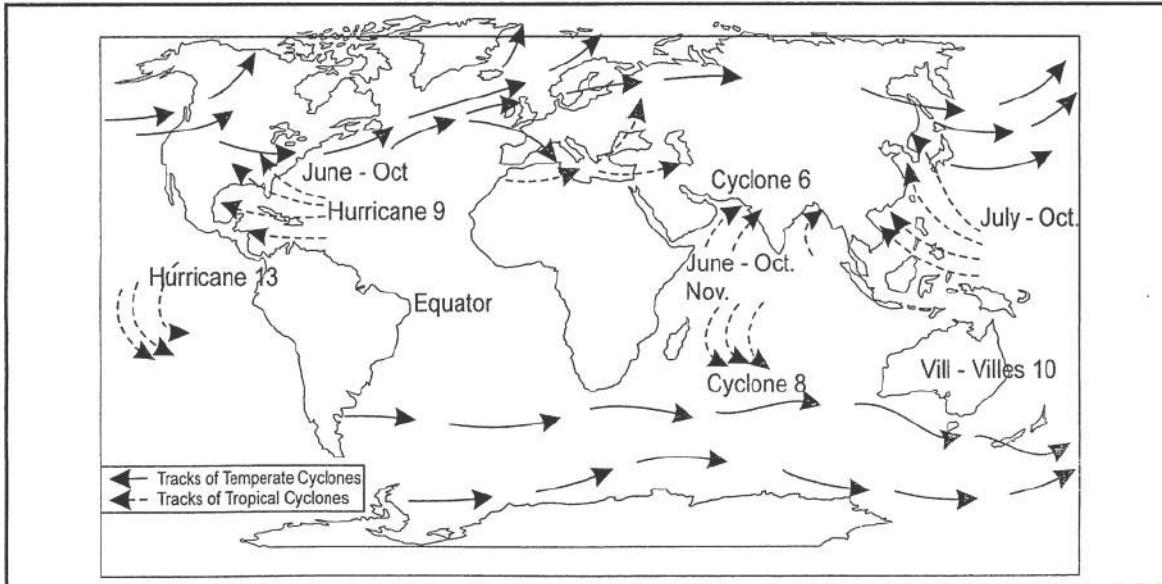
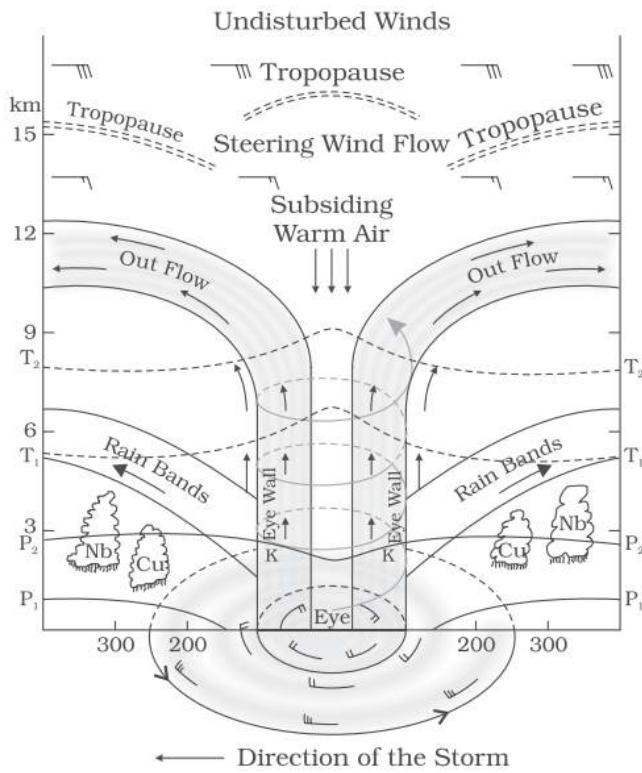
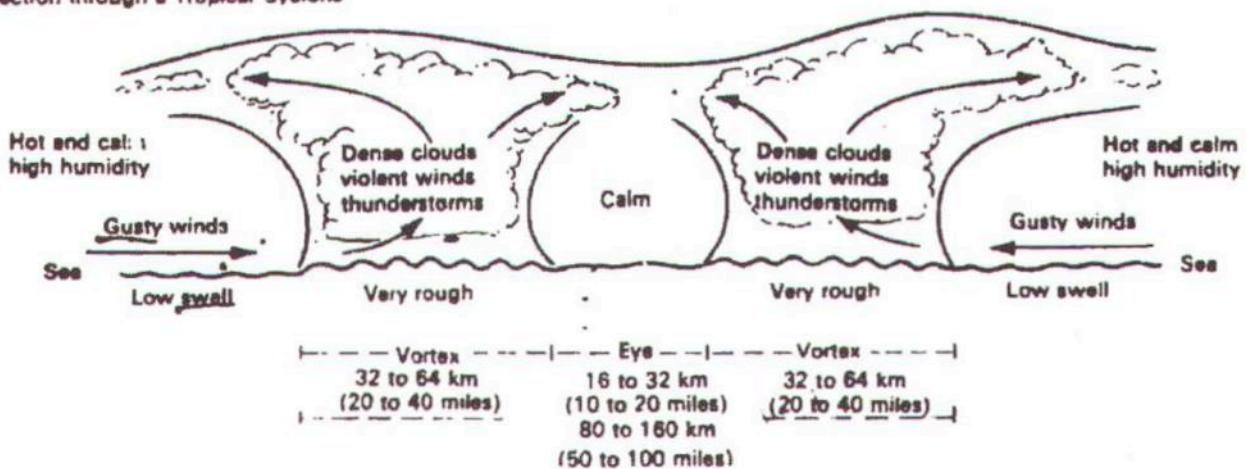


Figure 30 – world: pathways of cyclones (Numbers indicate average frequency of cyclones)



Section through a Tropical Cyclone



Structure of tropical Cyclone

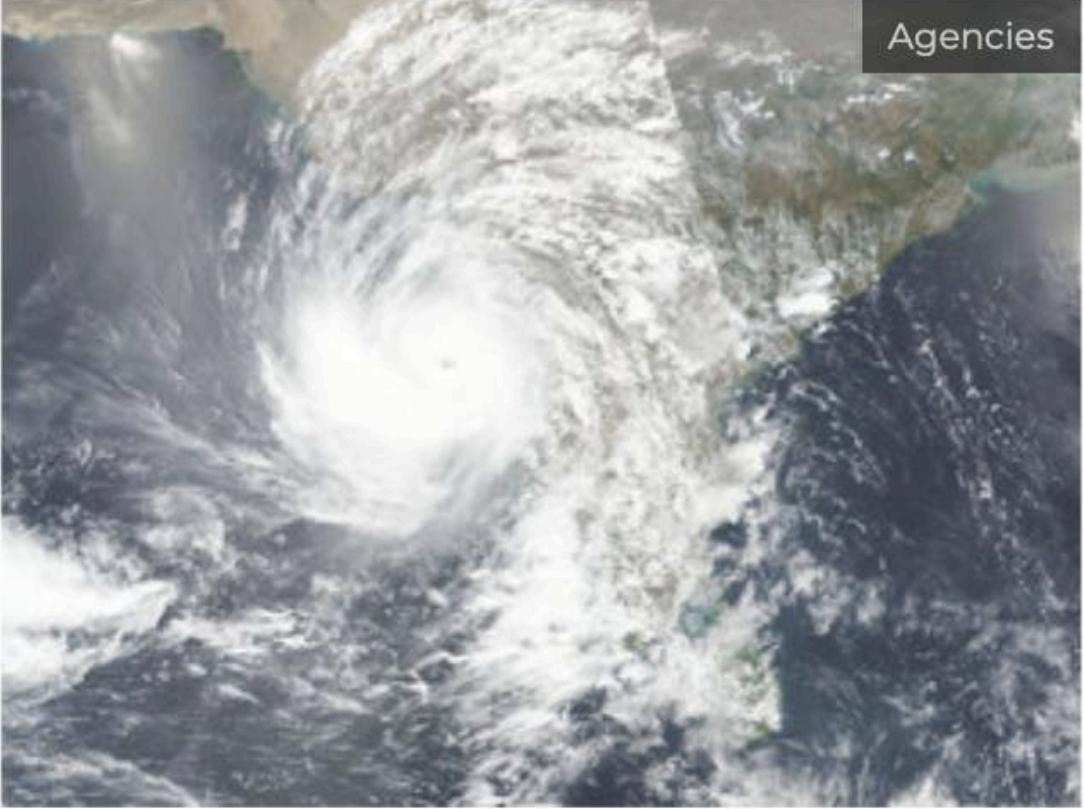
Region	Local name
Indian Ocean	Cyclone or chakryaat
Atlantic	Hurricanes
Western Pacific and South China Sea	Typhoons
Western Australia	Willy-willies

Figure 31 – tropical cyclone

Figure 32 – different names of tropical This is



Hurricane Harvey struck the Texas coast in August 2017. Credit: NOAA

A satellite photograph of a cyclone, showing a large, well-defined eye at the center surrounded by concentric bands of clouds. The clouds appear darker and more turbulent near the eye, transitioning to lighter, more organized bands further out. The surrounding landmasses are visible as green and brown areas.

Agencies

Cyclones are low-pressure systems that form over warm tropical waters, with gale-force winds near the centre. The winds can extend hundreds of kilometres (miles) from the eye of the storm.

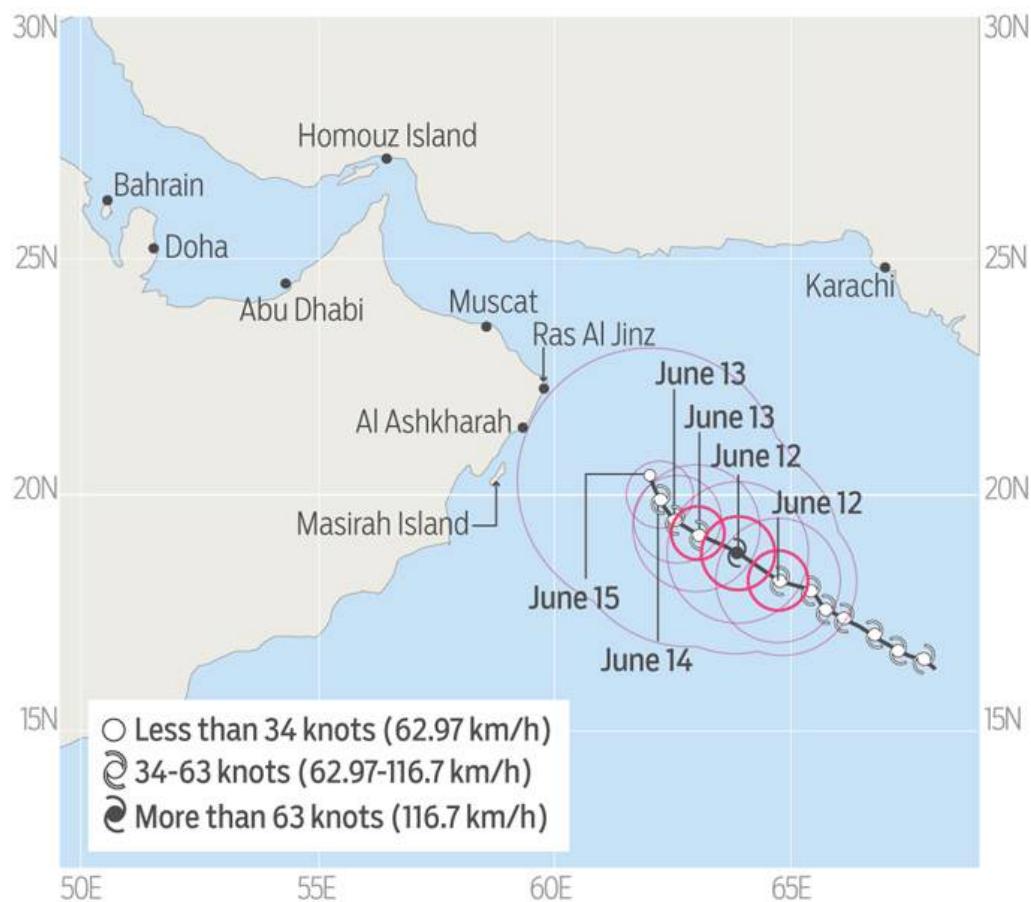
New List of Names for Tropical Cyclone over North Indian Ocean

Place	List 1	List 2	List 3	List 4	List 5	List 6	List 7	List 8	List 9	List 10	List 11	List 12	List 13
Bangladesh	Nisarga	Biparjoy	Arab	Upakul	Barshan	Rajani	Nishith	Urmi	Meghala	Samiron	Pratikul	Sarobor	Mahanisha
India	Gati	Tej	Murasu	Aag	Vyom	Jhar	Probaho	Neer	Probanjan	Ghurni	Ambud	Jaledi	Vega
Iran	Nivar	Hameon	Akvan	Sepand	Booran	Anahita	Azar	Pooyan	Arsham	Hengame	Savas	Tahamtan	Toofan
Maldives	Burevi	Midhili	Koani	Odi	Kenau	Endheri	Riyu	Guruva	Kurangi	Kuredhî	Horangu	Thundi	Faana
Myanmar	Tauktae	Michaung	Ngamann	Kyarthit	Sapakye	Wetwun	Mwaihout	Kywe	Pinku	Yinkaung	Linyone	Kyekkan	Boutphat
Oman	Yaas	Remal	Sail	Naseem	Muzn	Sadeem	Dima	Manjour	Rukam	Watad	Al-jarz	Rabab	Raad
Pakistan	Gulab	Asna	Sahab	Afshan	Manhil	Shujana	Parwaz	Zannata	Sarsar	Badban	Sarab	Gulnar	Waseq
Qatar	Shaheen	Dana	Lulu	Mouj	Suhail	Sadaf	Reem	Rayhan	Anbar	Oud	Bahar	Seef	Fanar
Saudi Arabia	Jawad	Fengal	Ghazeer	Asif	Sidrah	Hareed	Faid	Kaseer	Nakheel	Habooib	Bareq	Alreem	Wabil
Sri Lanka	Asani	Shakhti	Gigum	Gagana	Verambha	Garjana	Neeba	Ninnada	Viduli	Ogha	Sailtha	Rivi	Rudu
Thailand	Sitrong	Montha	Thianyot	Bulan	Phutola	Aiyara	Saming	Kraison	Matcha	Mahingga	Phraewa	Asuri	Thara
United Arab Emirates	Mandous	Senyar	Afoor	Nahhaam	Quffal	Daaman	Deem	Gargoor	Khubb	Degi	Athmad	Boom	Saffar
Yemen	Mocha	Ditwah	Diksam	Sira	Bakhor	Ghwyzi	Hawf	Balhaf	Brom	Sheqra	Fartak	Darsah	Samhah

The new list of names for the tropical cyclones over the North Indian Ocean

(India Meteorological Department)

CYCLONE NANAUK Track forecast



Joint Typhoon Warning Center, US Navy

©Gulf News

Storm surges, created due to tropical cyclones, are a major cause of destruction



storm surge

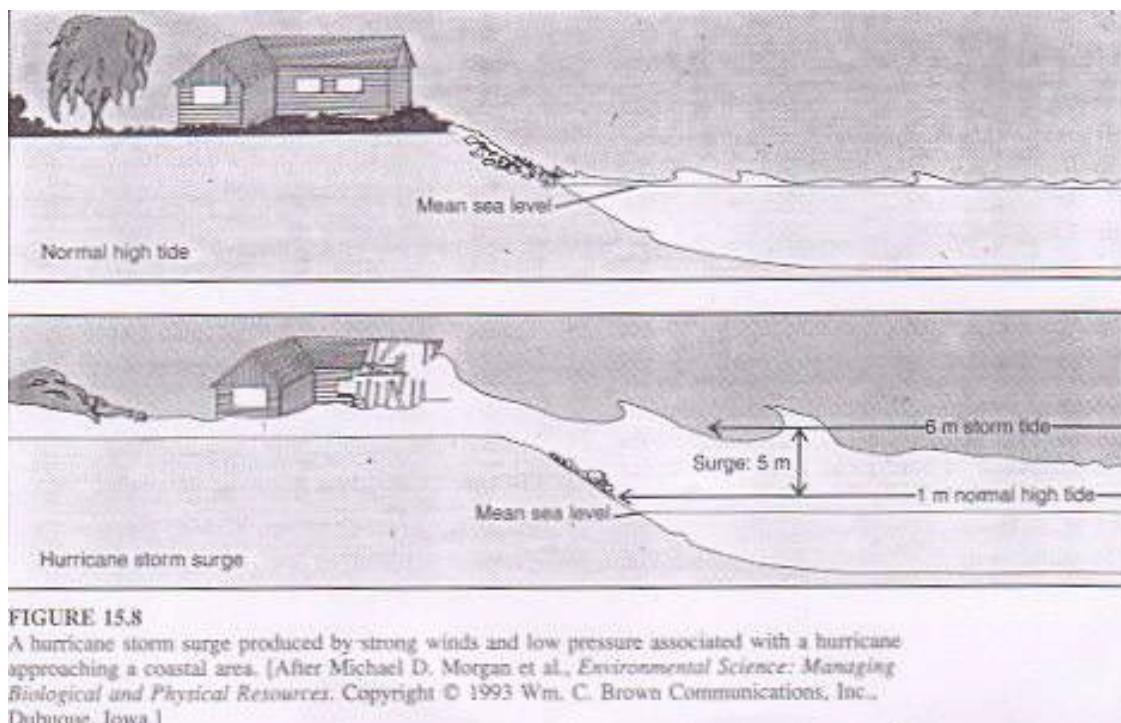
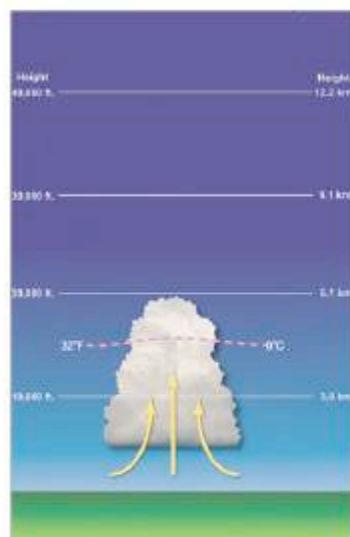


FIGURE 15.8

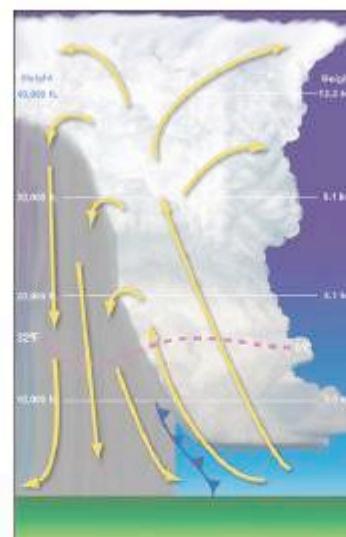
A hurricane storm surge produced by strong winds and low pressure associated with a hurricane approaching a coastal area. [After Michael D. Morgan et al., *Environmental Science: Managing Biological and Physical Resources*. Copyright © 1993 Wm. C. Brown Communications, Inc., Dubuque, Iowa.]

The Thunderstorm Life Cycle



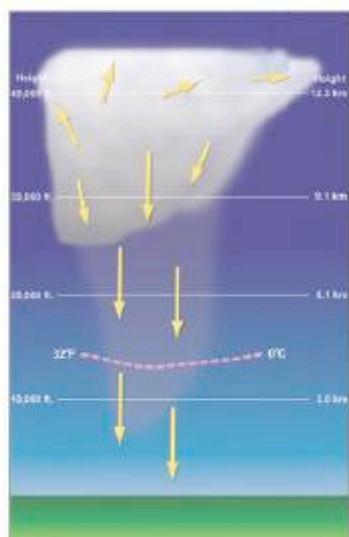
Developing Stage

- Towering cumulus cloud indicates rising air
- Usually little if any rain during this stage
- Lasts about 10 minutes
- Occasional lightning



Mature Stage

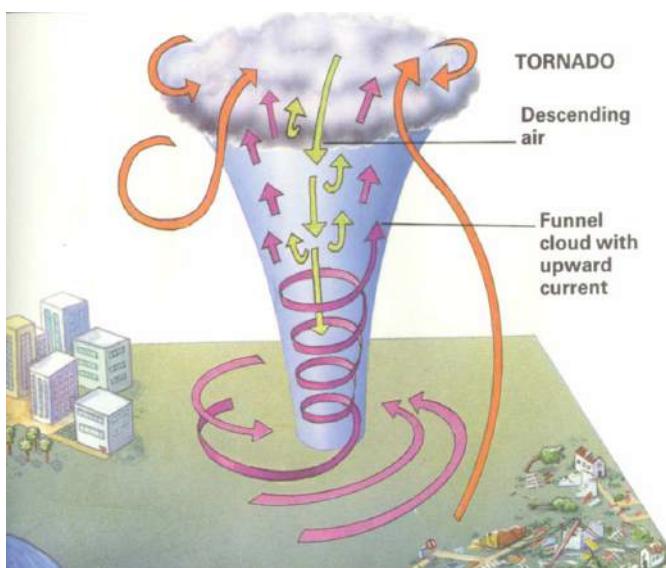
- Most likely time for hail, heavy rain, frequent lightning, strong winds, and tornadoes
- Storm occasionally has a black or dark green appearance
- Lasts an average of 10 to 20 minutes but some storms may last much longer

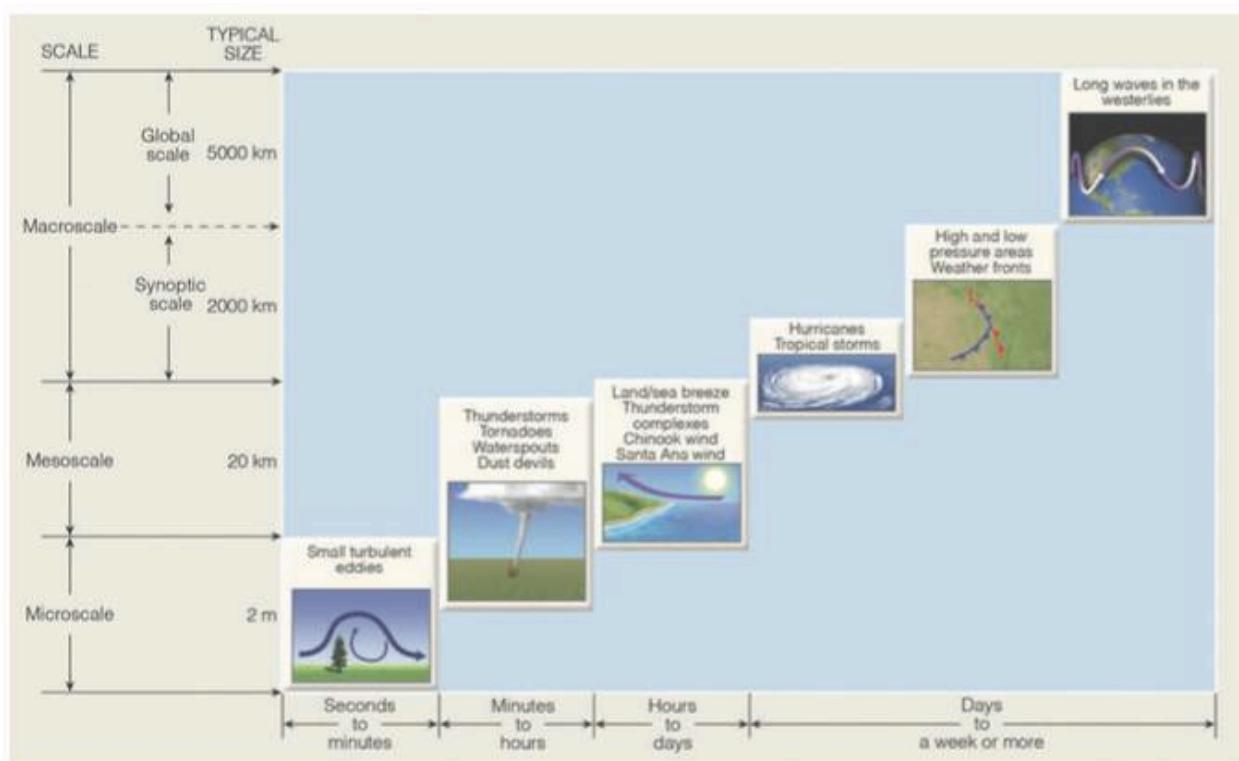
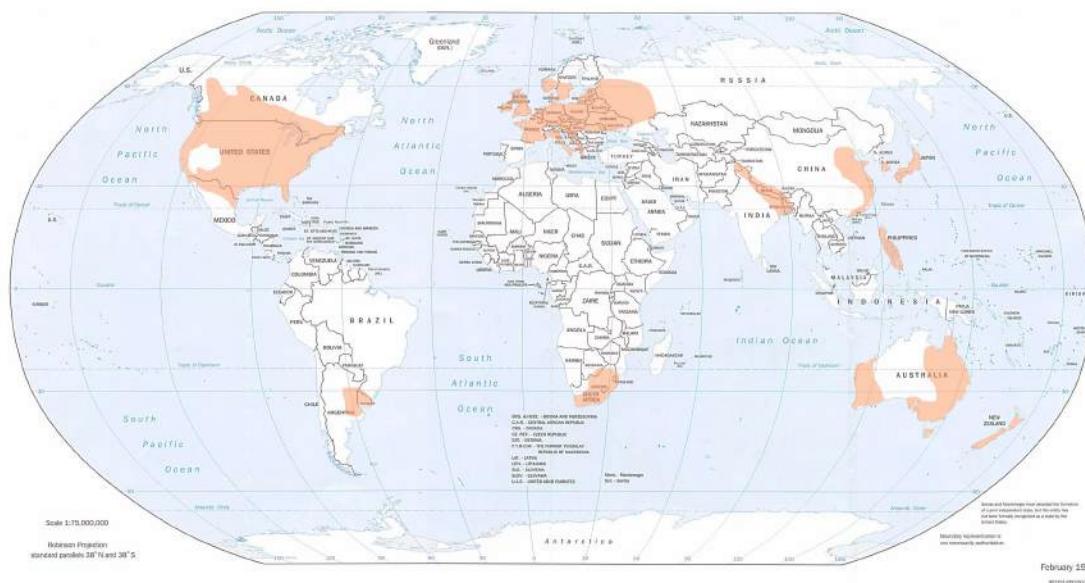


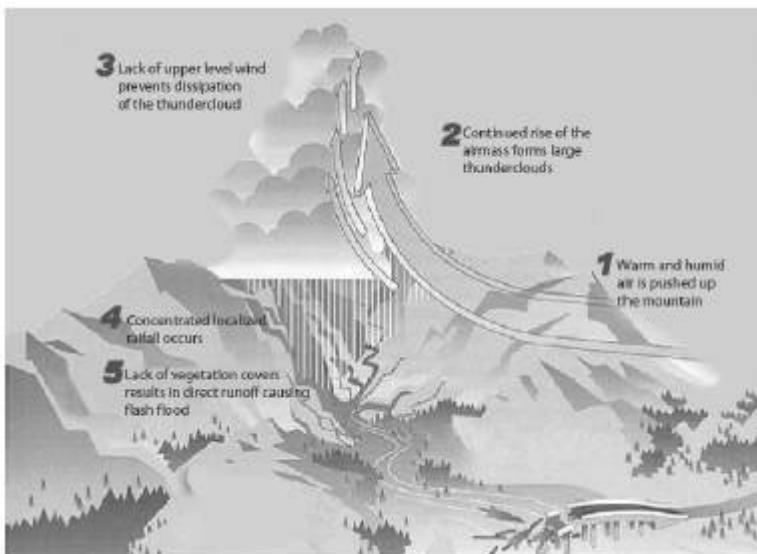
Dissipating Stage

- Downdrafts, downward flowing air, dominate the storm
- Rainfall decreases in intensity
- Can still produce a burst of strong winds
- Lightning remains a danger

Figure 33 – three stages in the development of a thunderstorm: (a) cumulus stage; (b) Mature stage;
(c) Dissipating stage







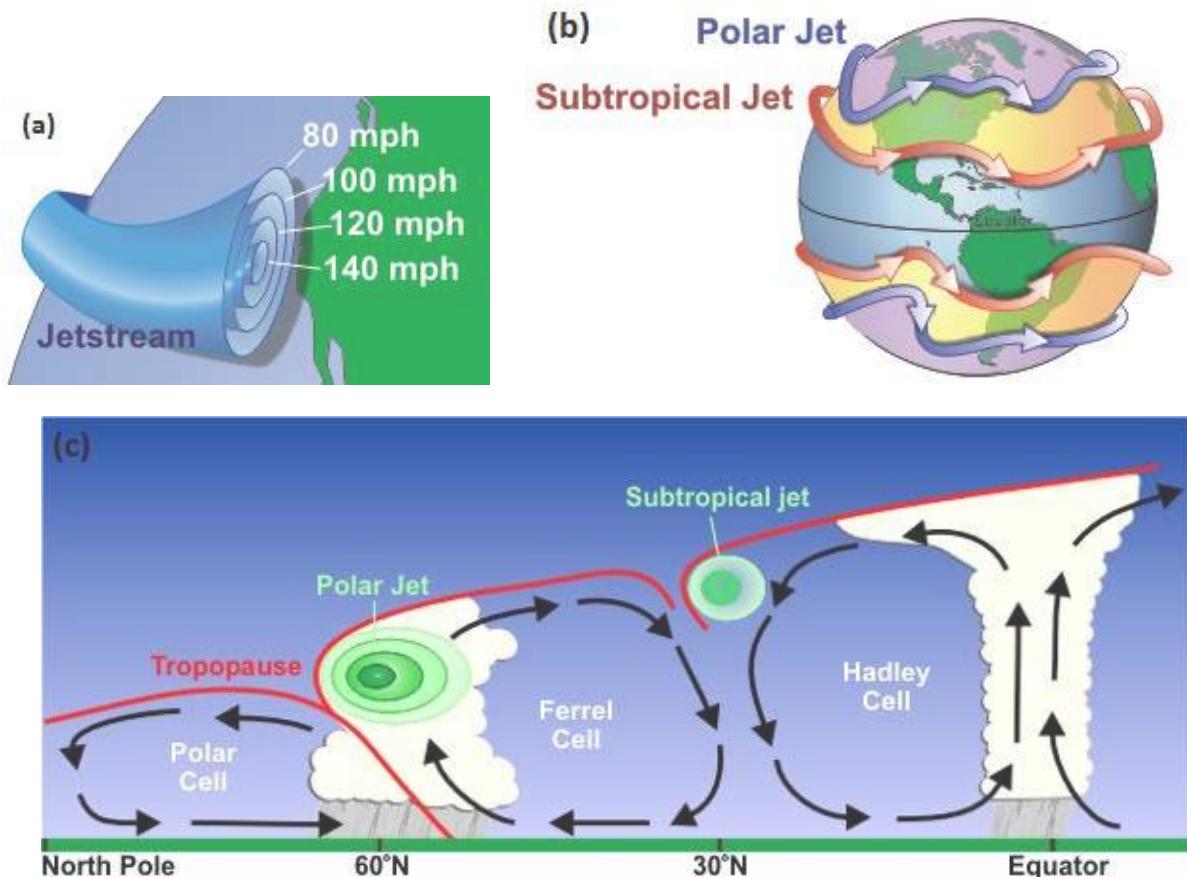


Figure 22 – jet streams: (a) maximum speed at centre; (b) Polar and subtropical jetstreams in both hemispheres; (c) cross-sectional view of jet streams

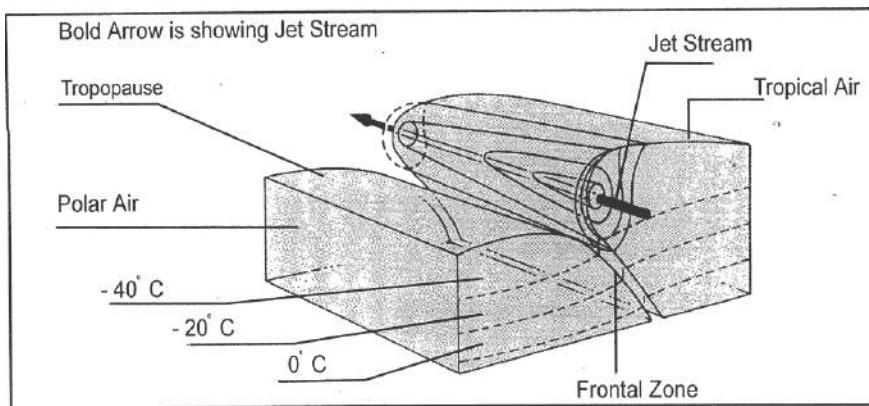
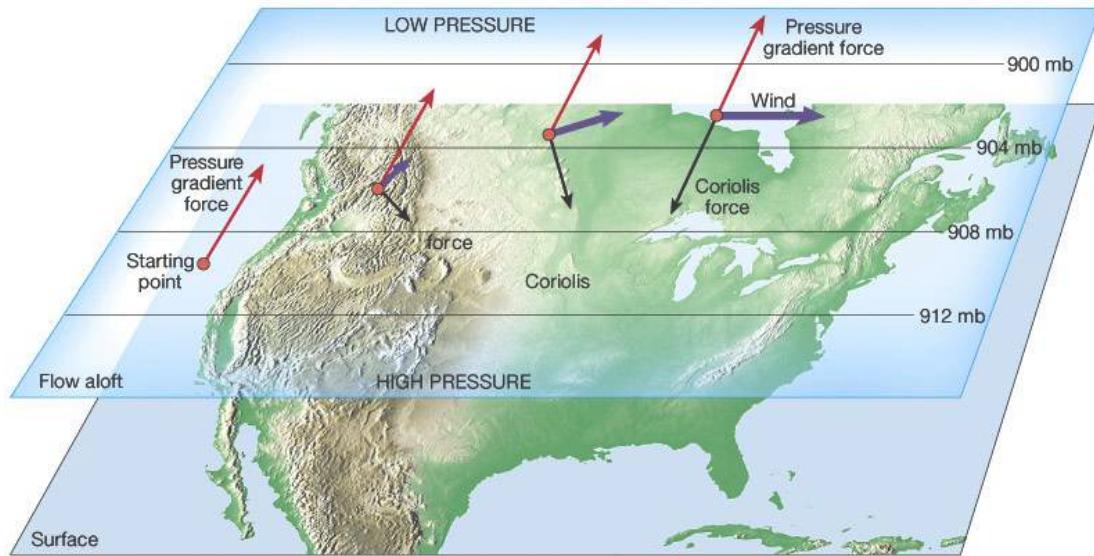
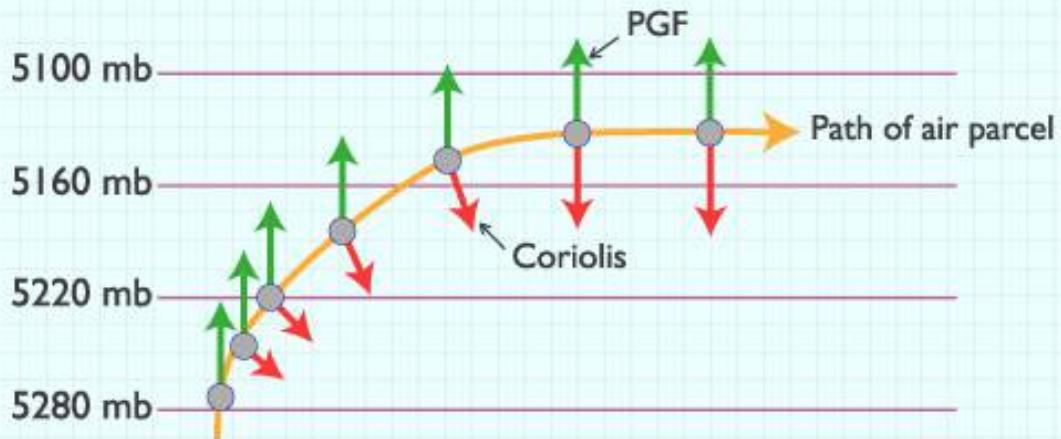
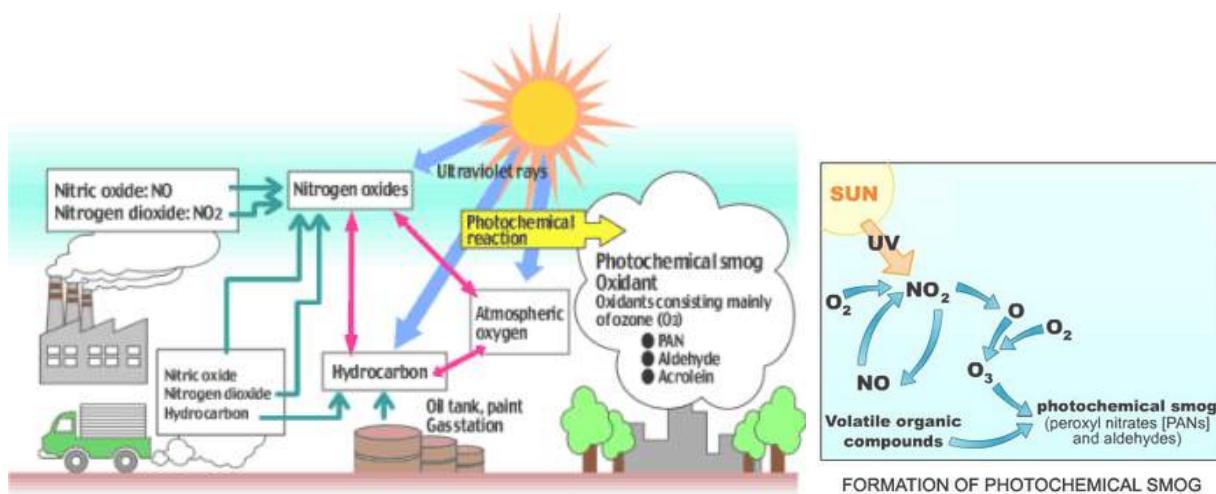
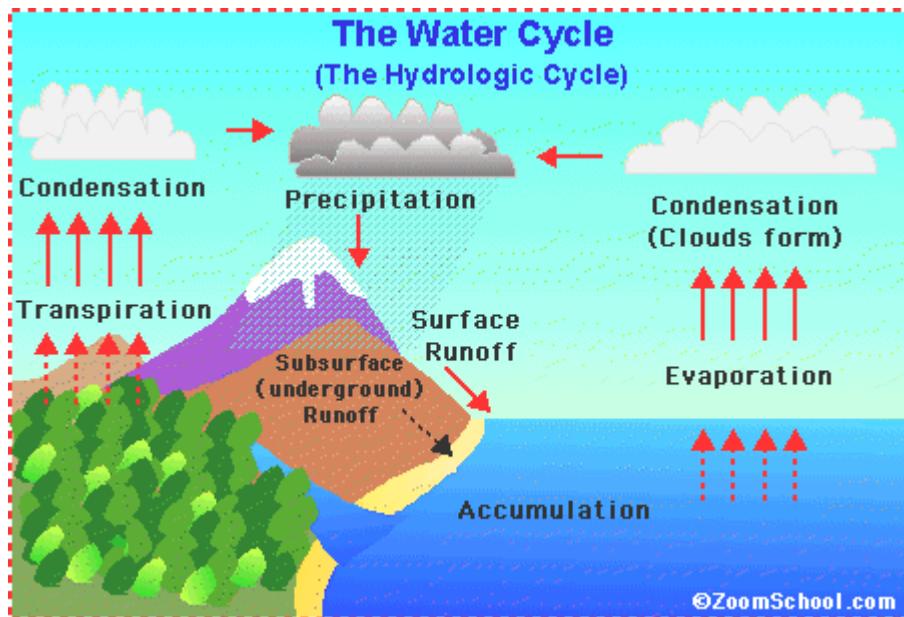
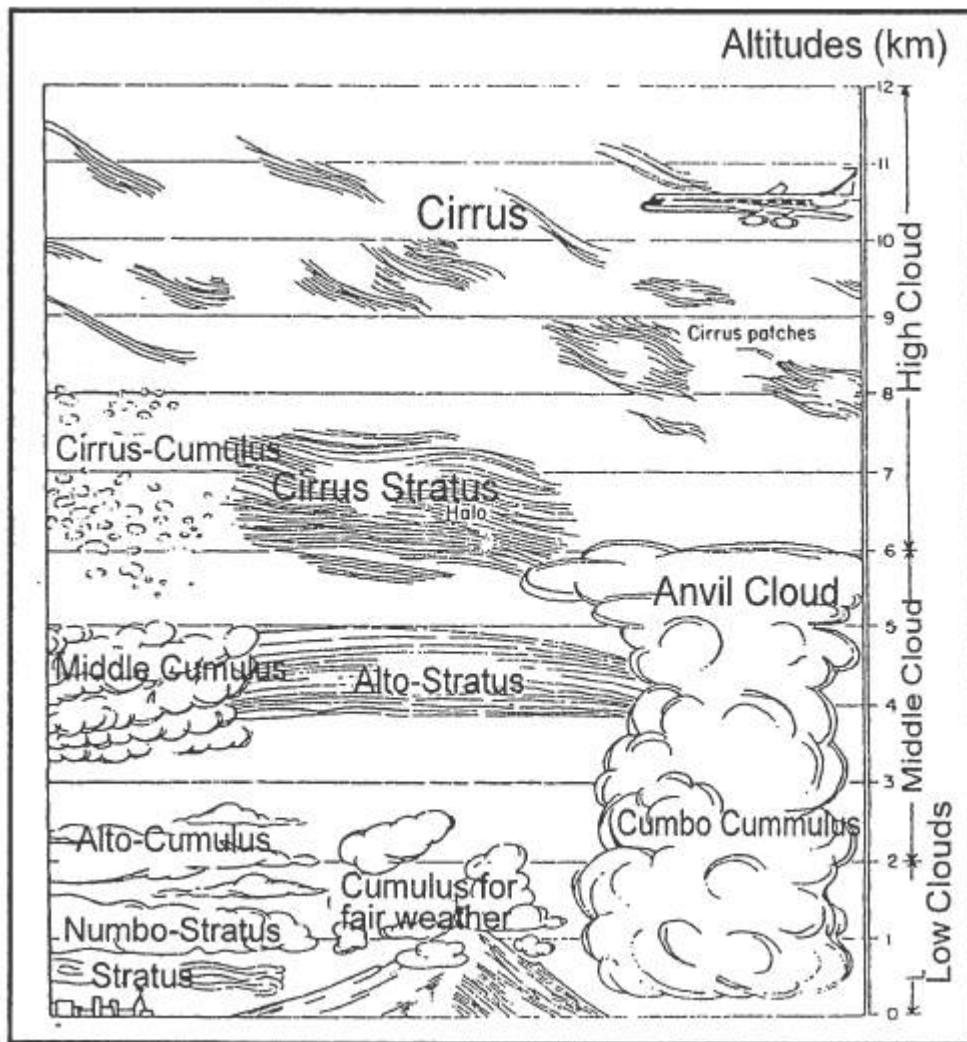


Figure 23 – origin of the Polar front Jet stream at polar front zone

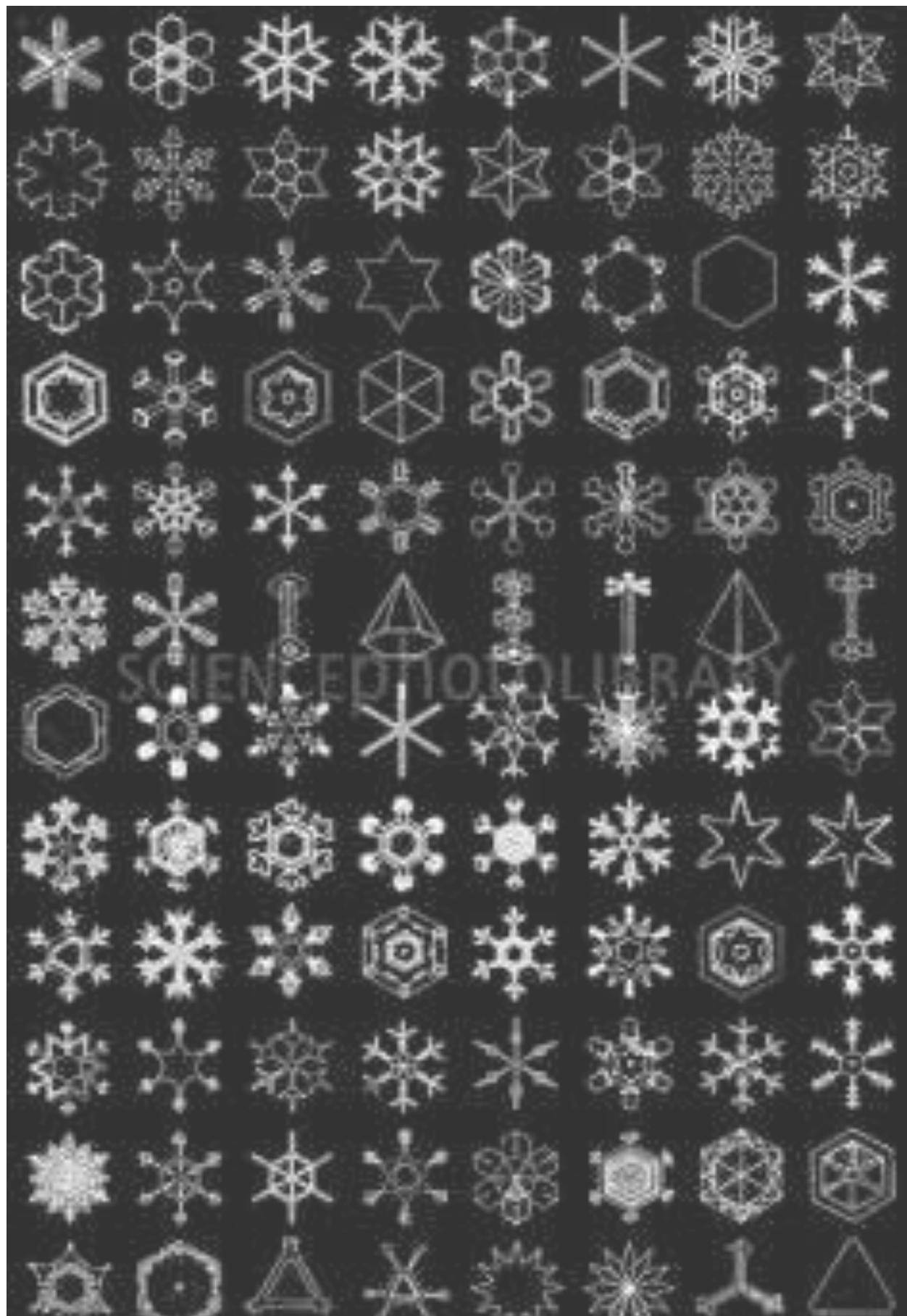
Geostrophic Wind

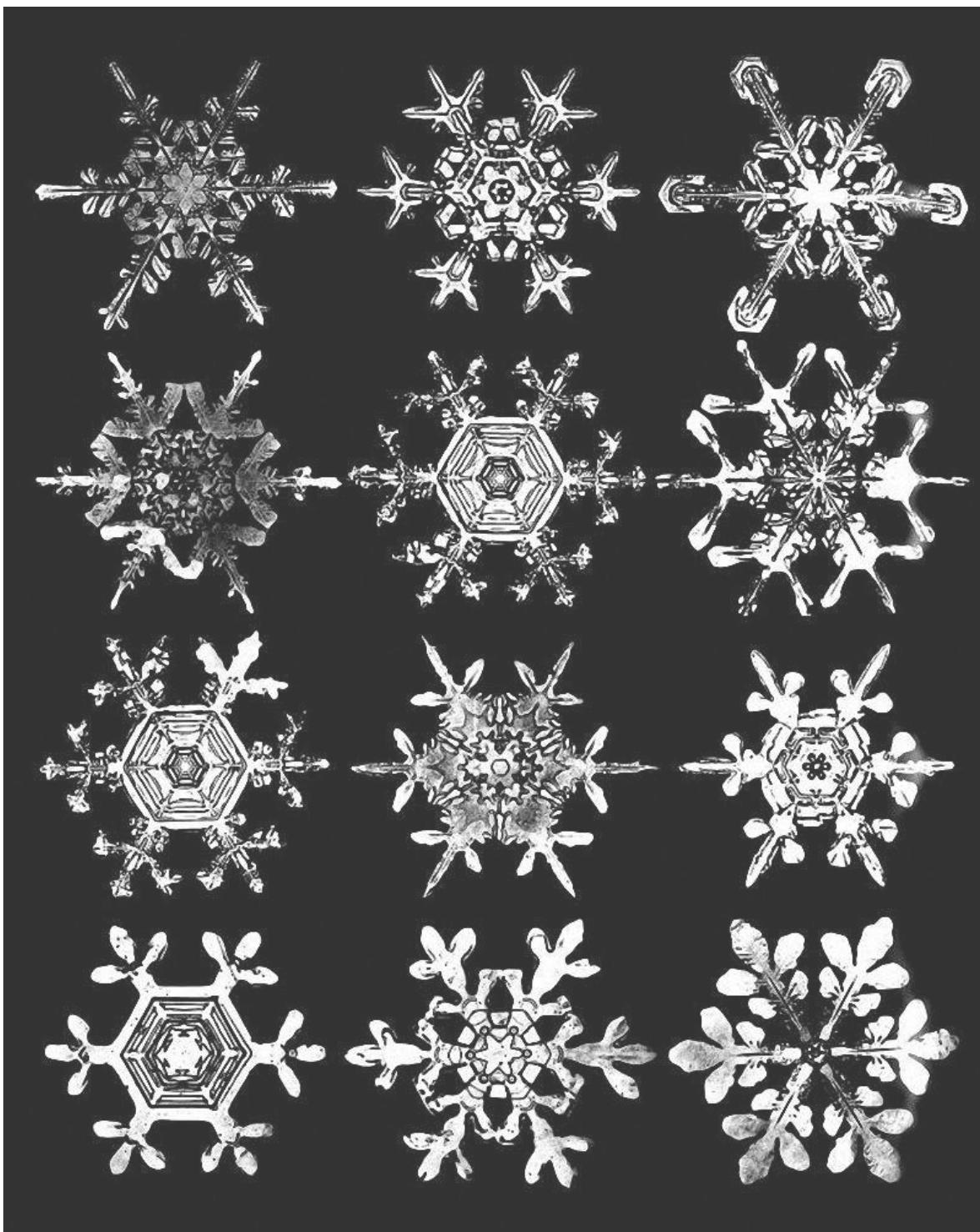






- Ice crystals condense around a tiny particle
- Condensing water forms a prism with facets
- Branching can begin, depending on conditions
- Facets can form on branches, depending on conditions
- And so on...





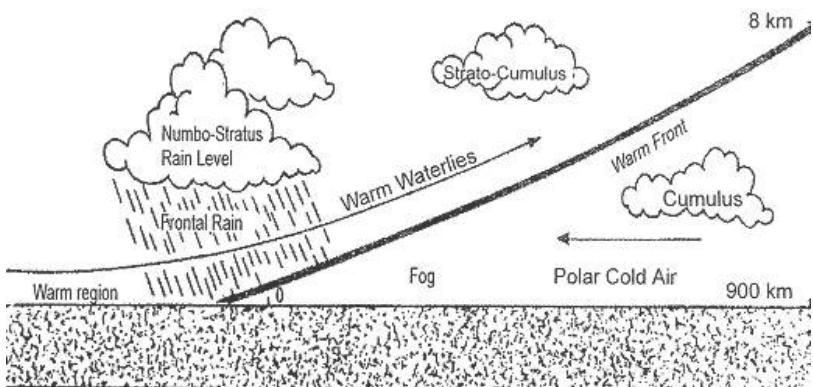
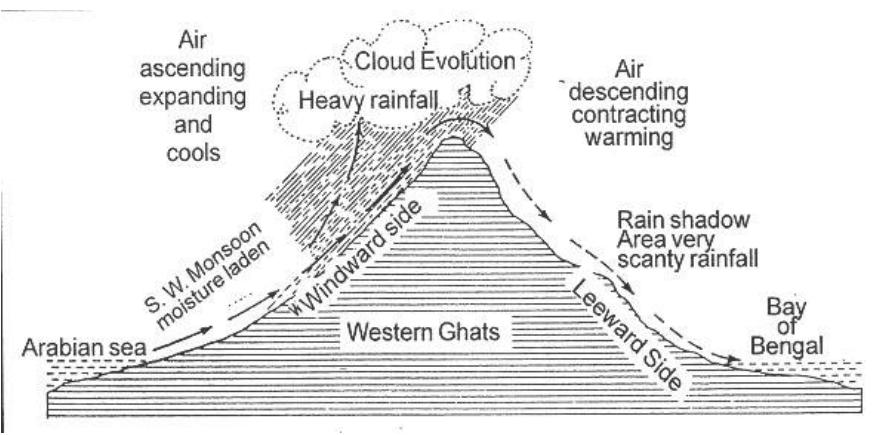
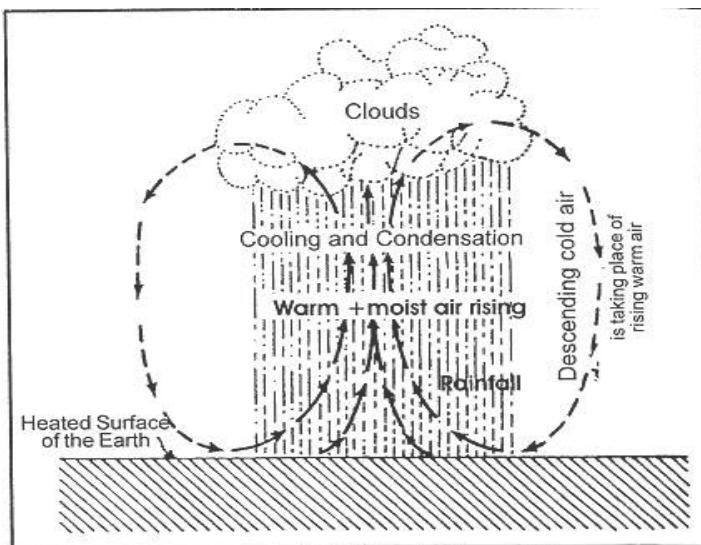


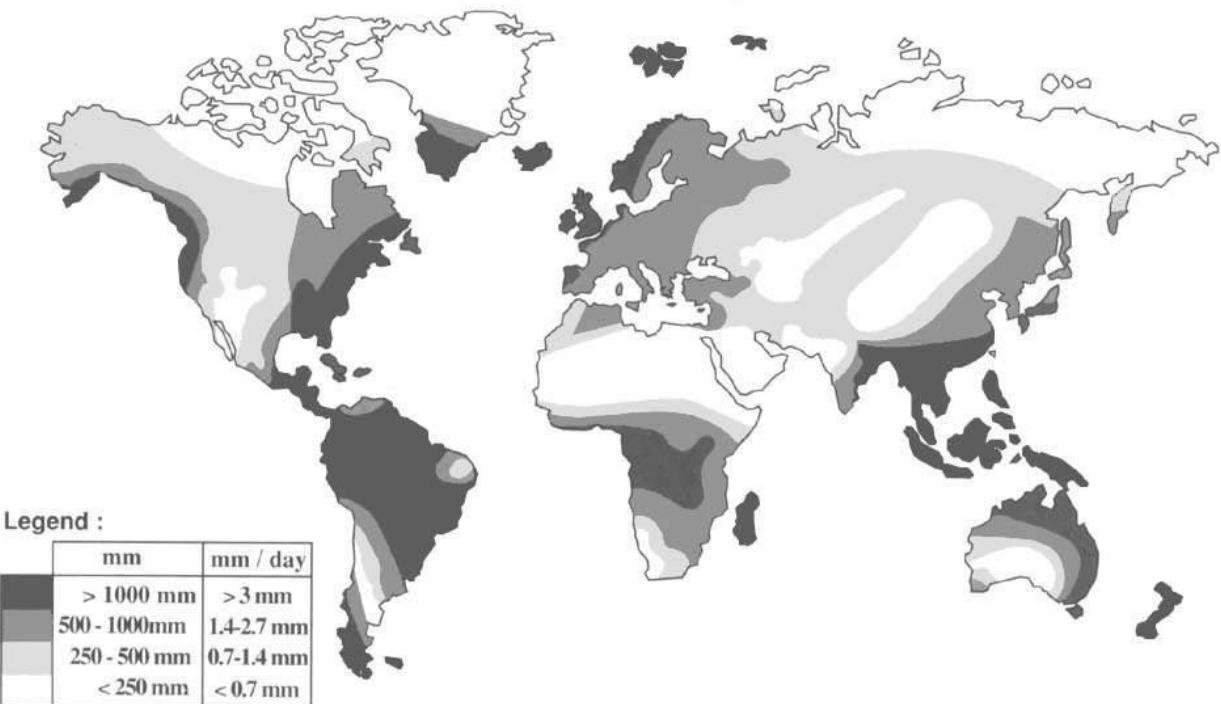


sleet

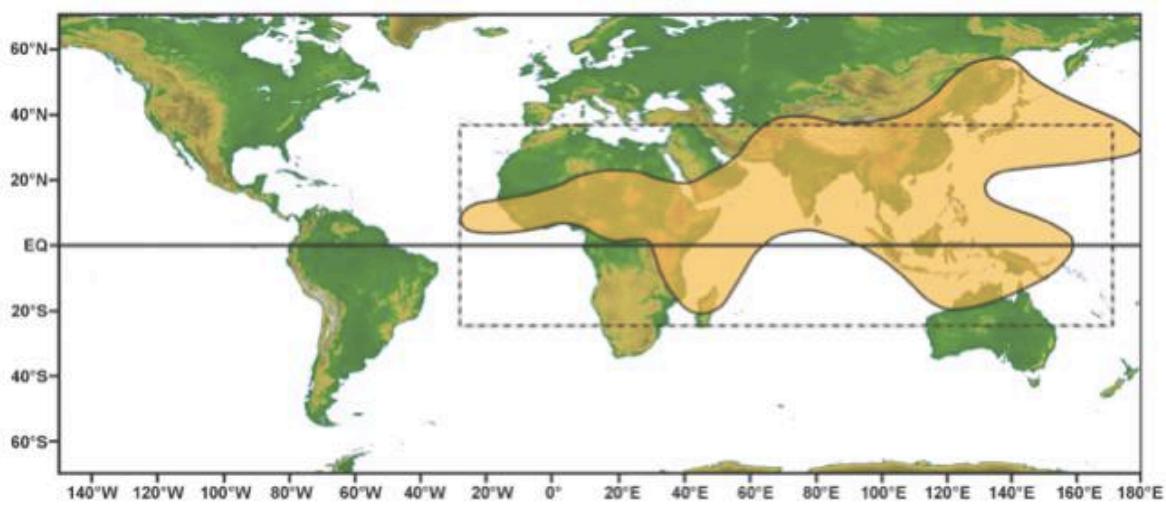


hail or hailsotne

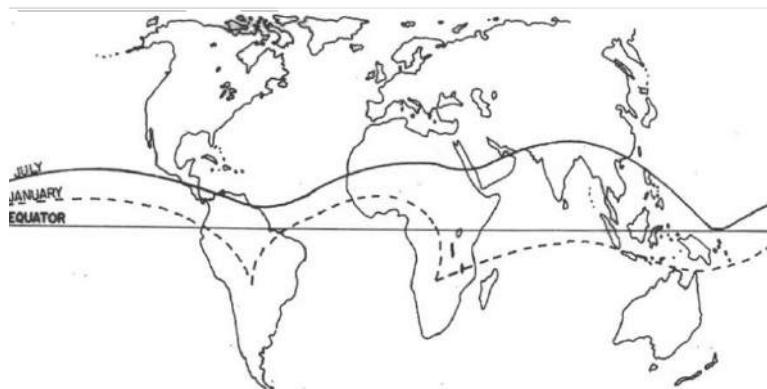


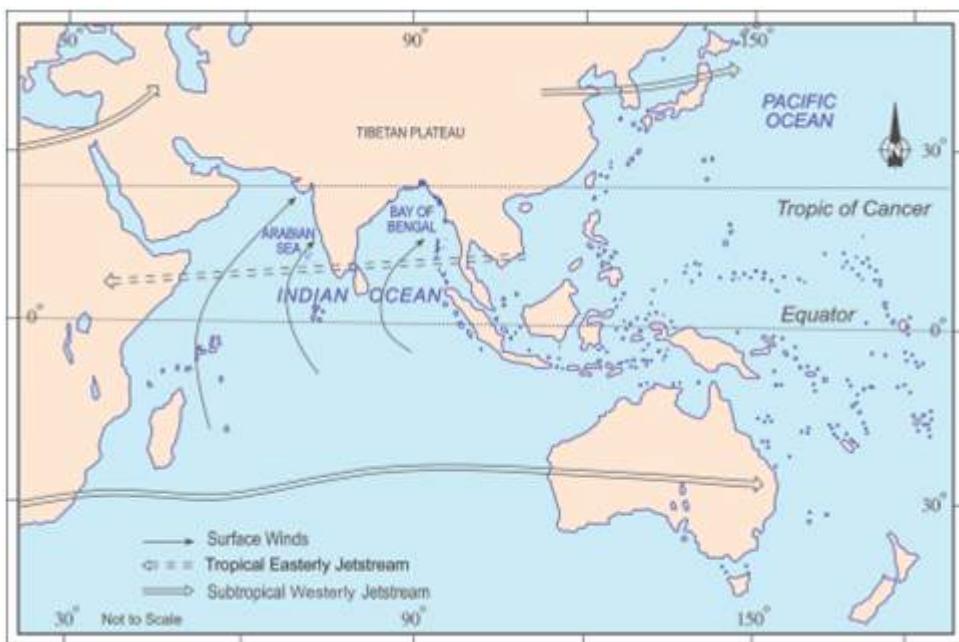
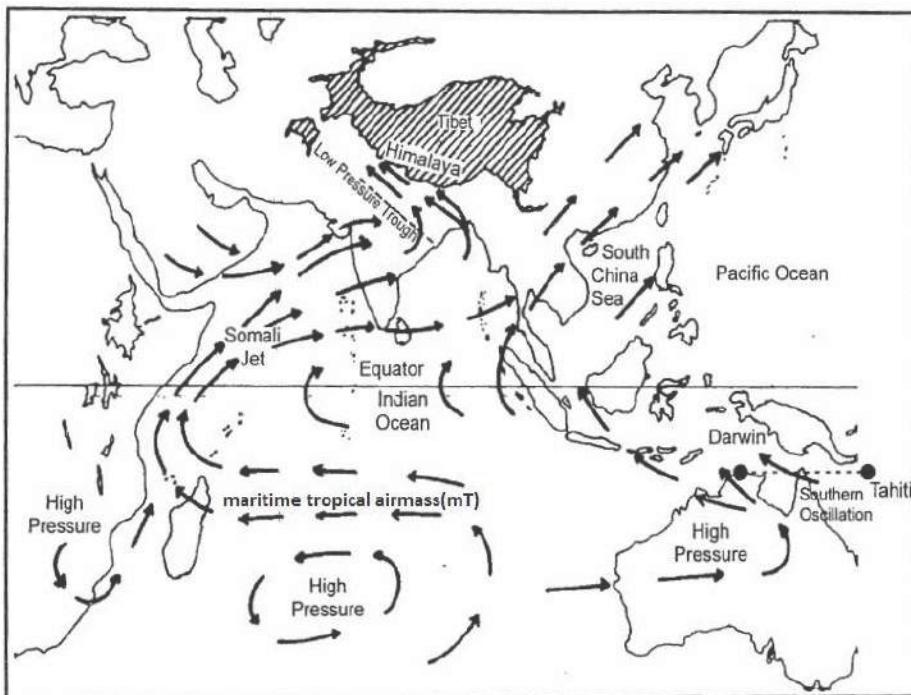


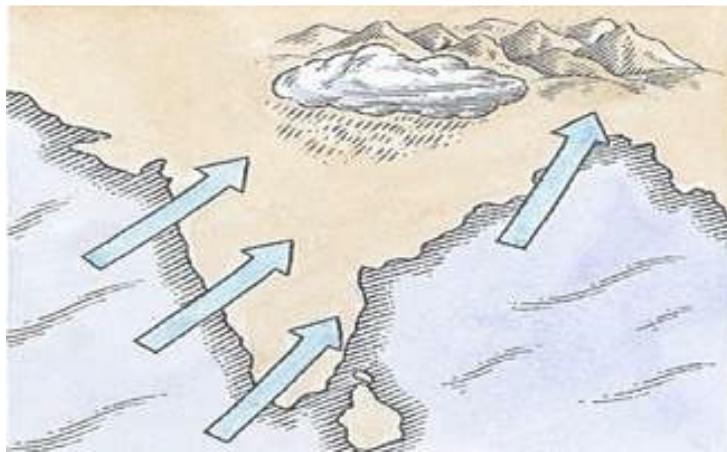
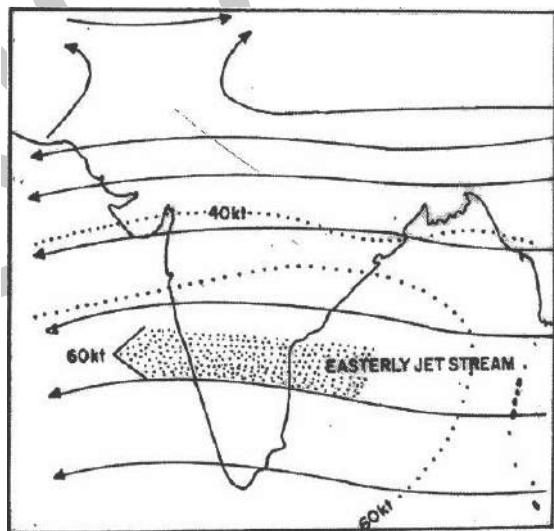
Classic Monsoon Region

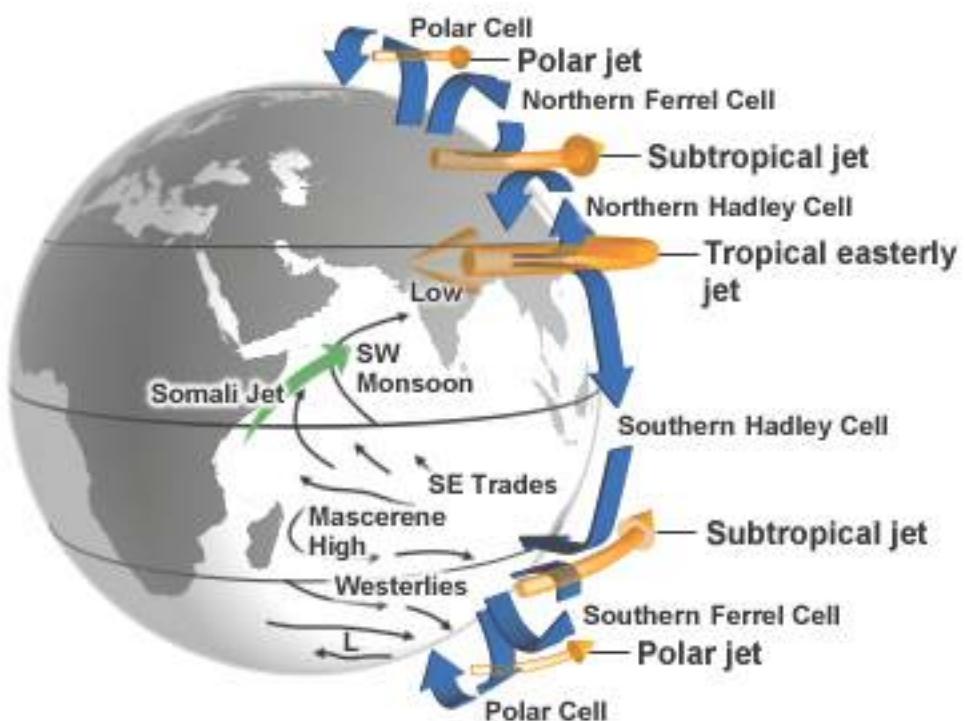


©The COMET Program

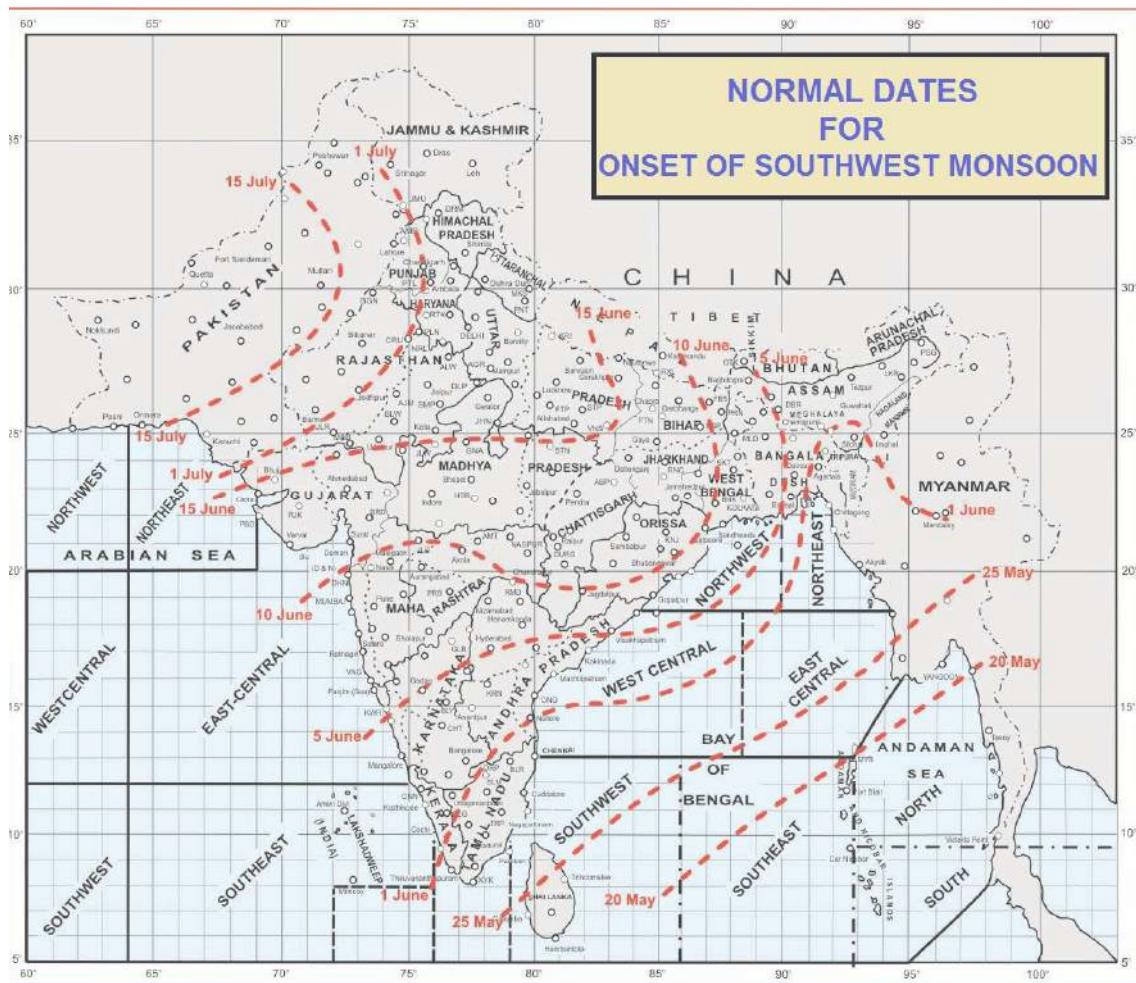


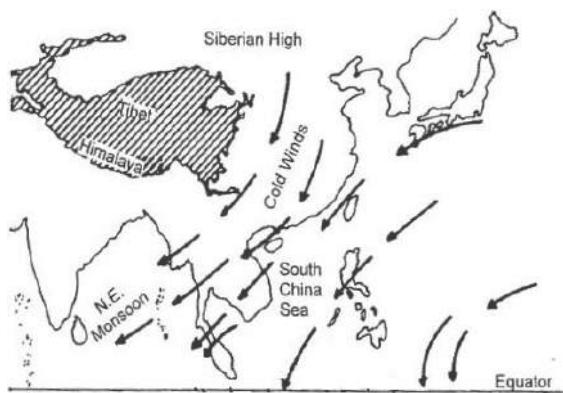
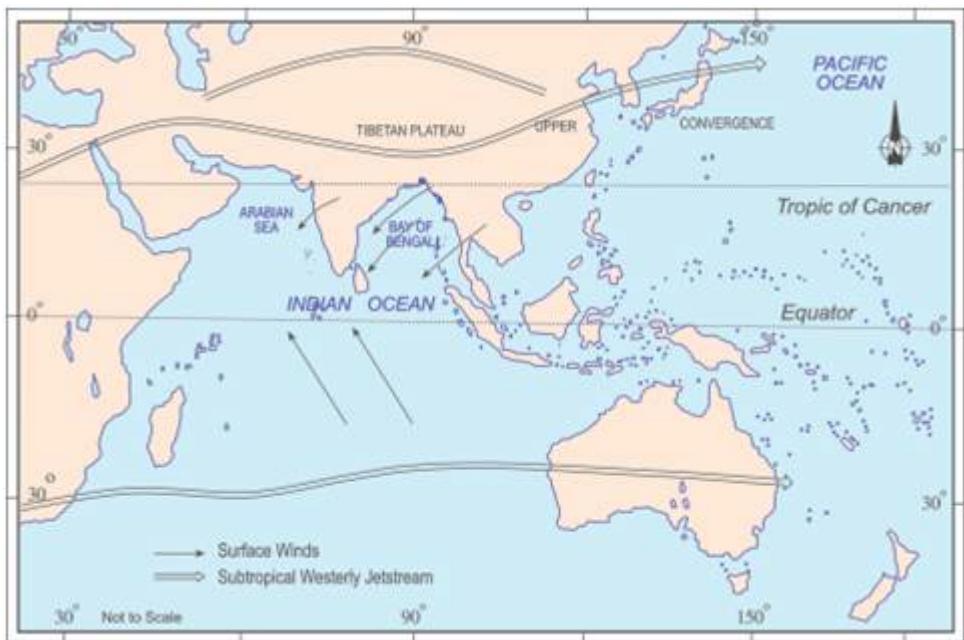


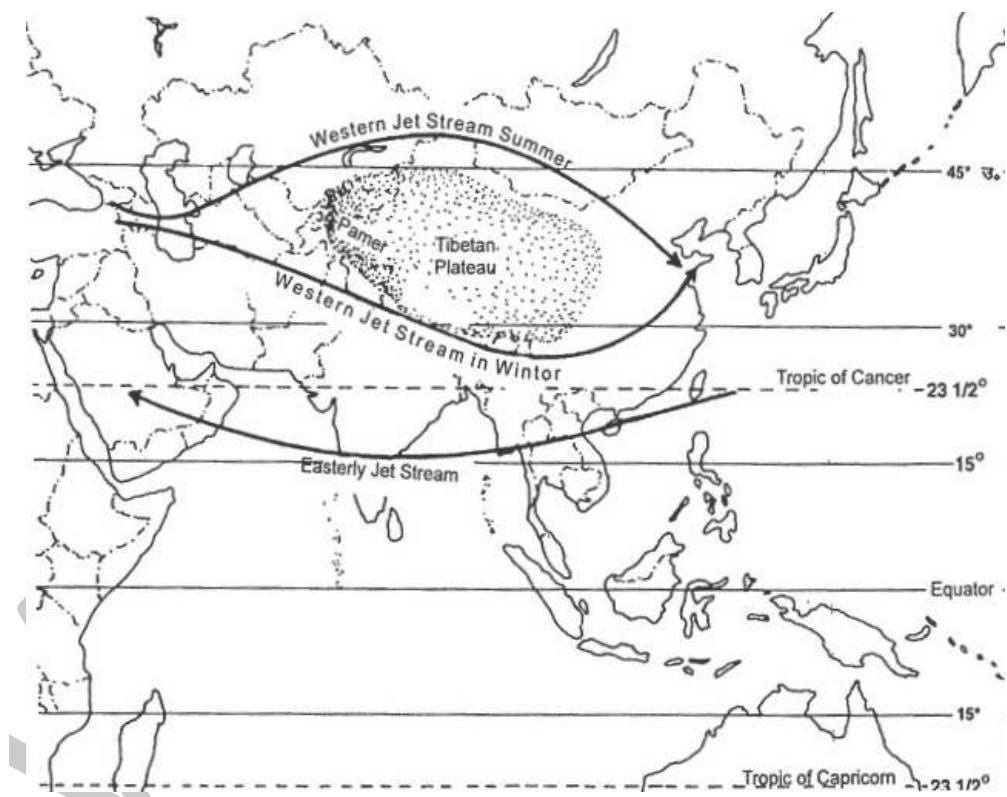
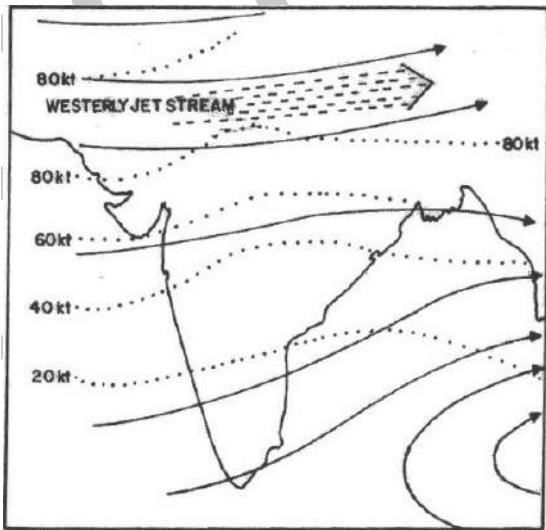


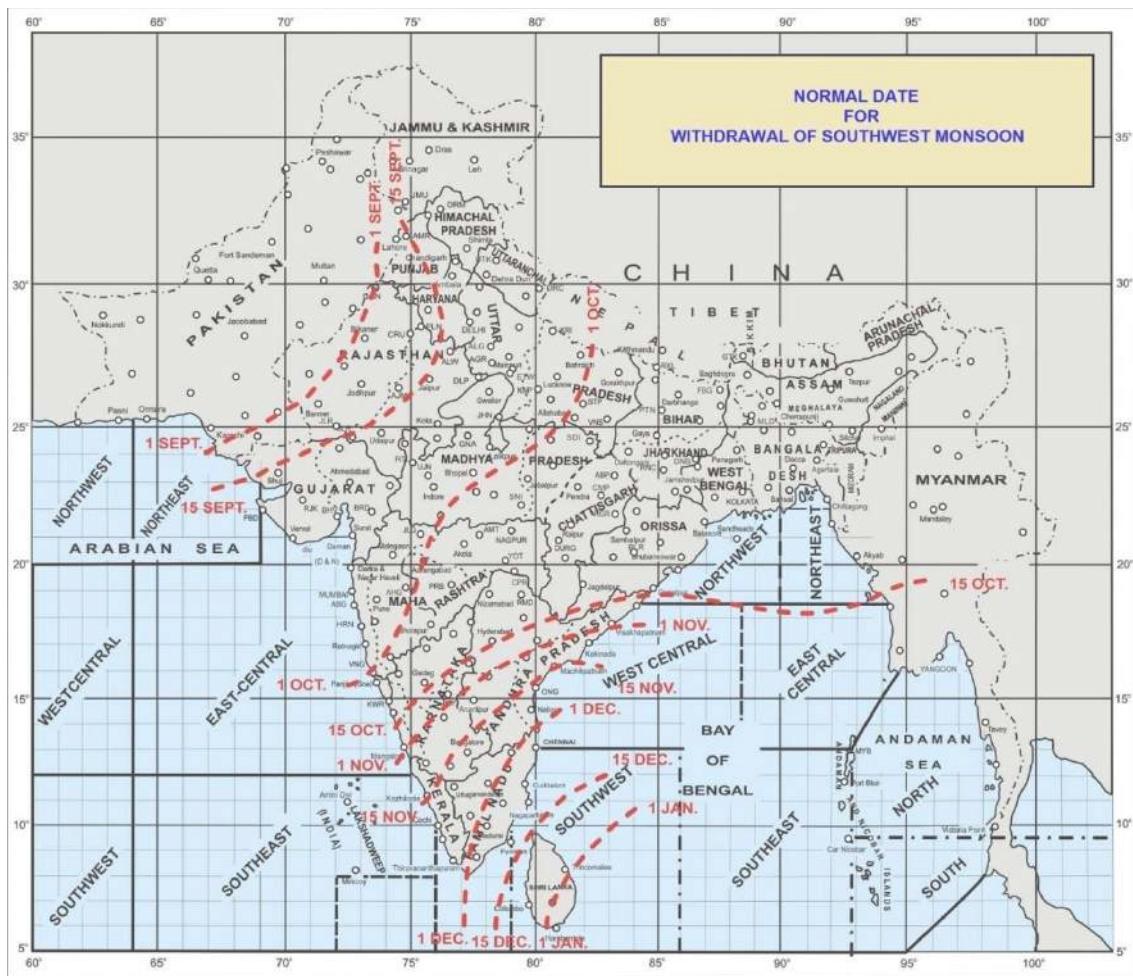


NCAR / The COMET Program

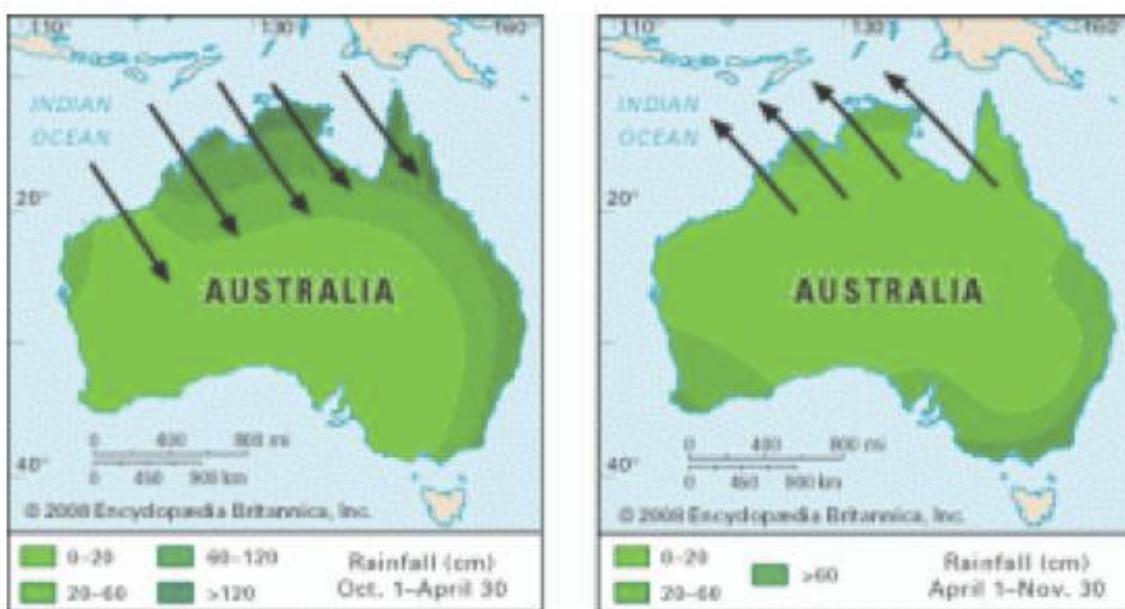








Other monsoon regions in world



Schematic of the North American monsoon

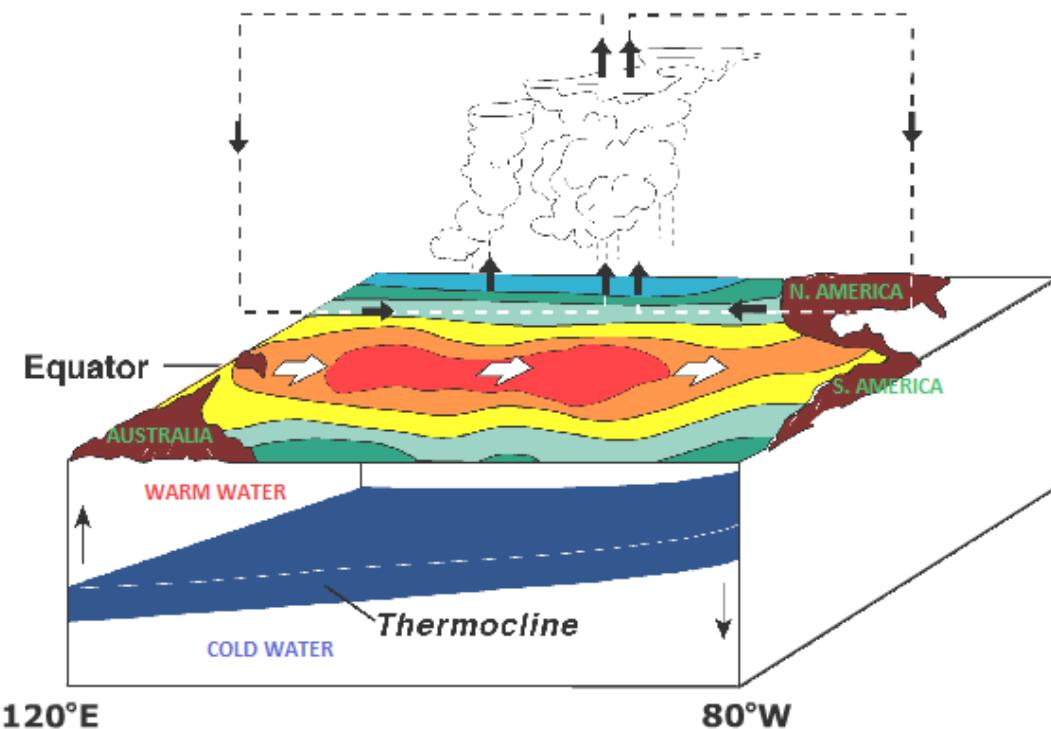


Figure 1 – El Niño conditions: Warm water pool approaches the South American coast. The absence of cold upwelling increases warming.

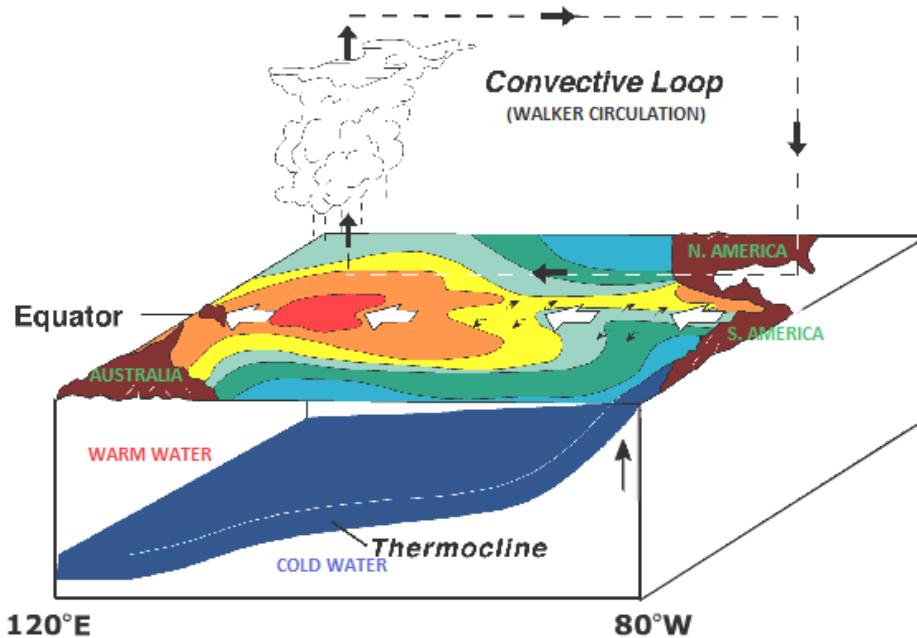
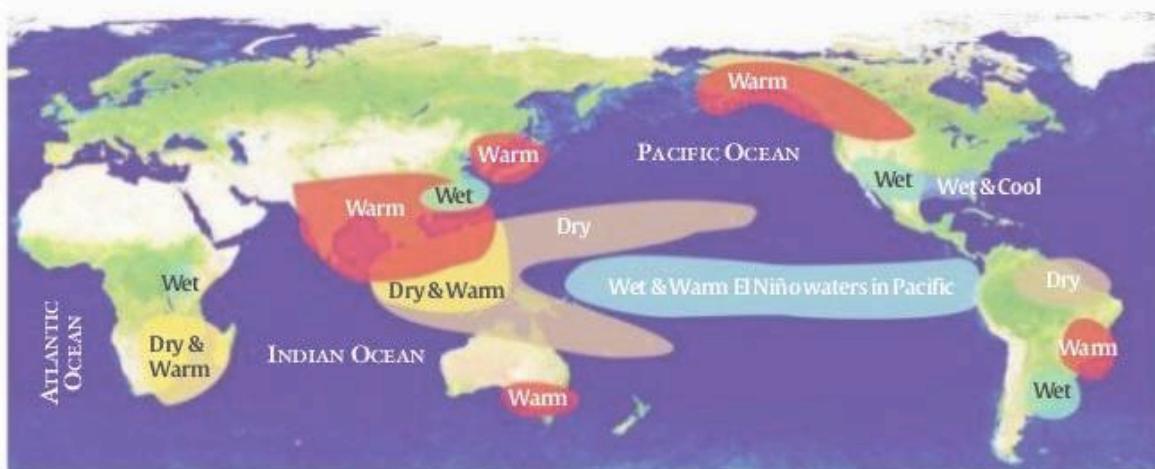


Figure 2 – Normal Pacific pattern: Equatorial winds gather warm water pool toward the west. Cold

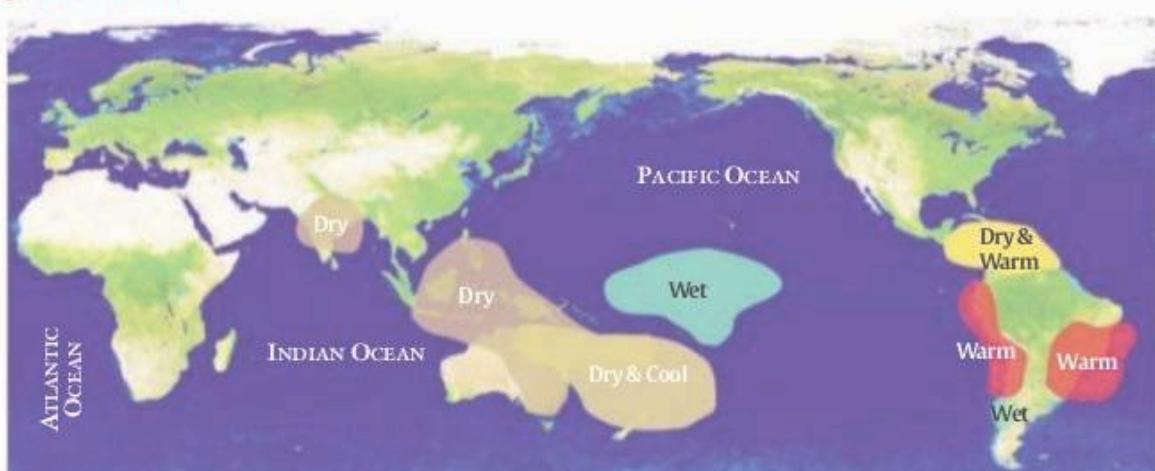
El Niño and its impact across the globe

Images from the US National Oceanic and Atmospheric Administration show El Niño's influence on weather worldwide. It's having a warming effect over India now, and may lead to a dry first half of the monsoon season

DECEMBER-FEBRUARY

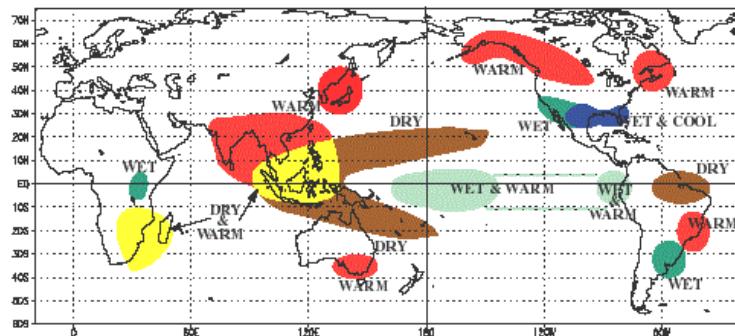


JUNE-AUGUST



Adapted from NOAA maps

WARM EPISODE RELATIONSHIPS DECEMBER - FEBRUARY



WARM EPISODE RELATIONSHIPS JUNE - AUGUST

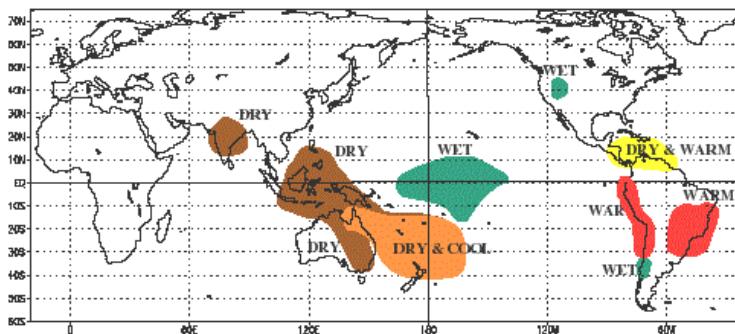
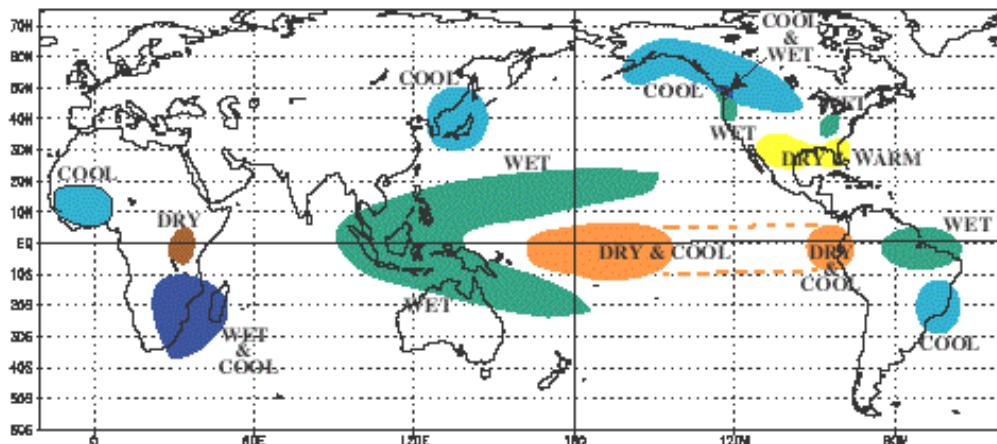


Figure 3 – global precipitation pattern during El Nino

COLD EPISODE RELATIONSHIPS DECEMBER - FEBRUARY



COLD EPISODE RELATIONSHIPS JUNE - AUGUST

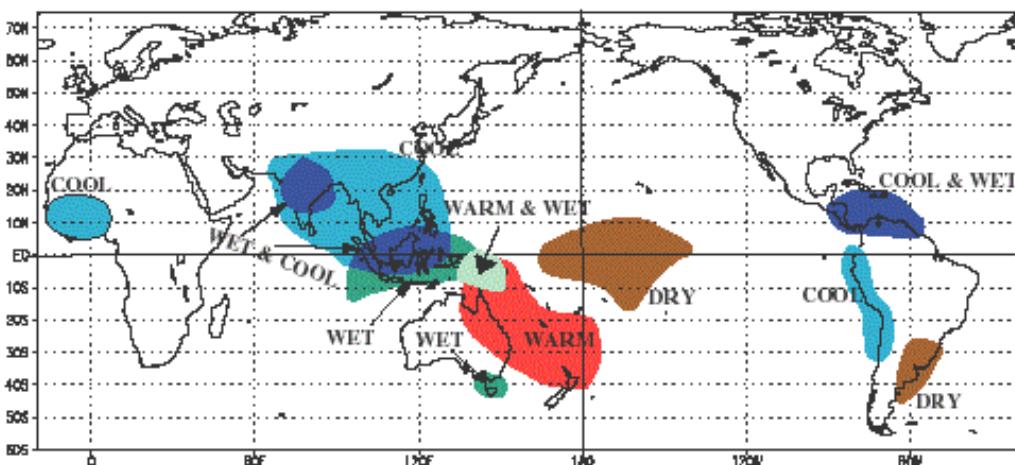


Figure 4 – global precipitation pattern during La Nina

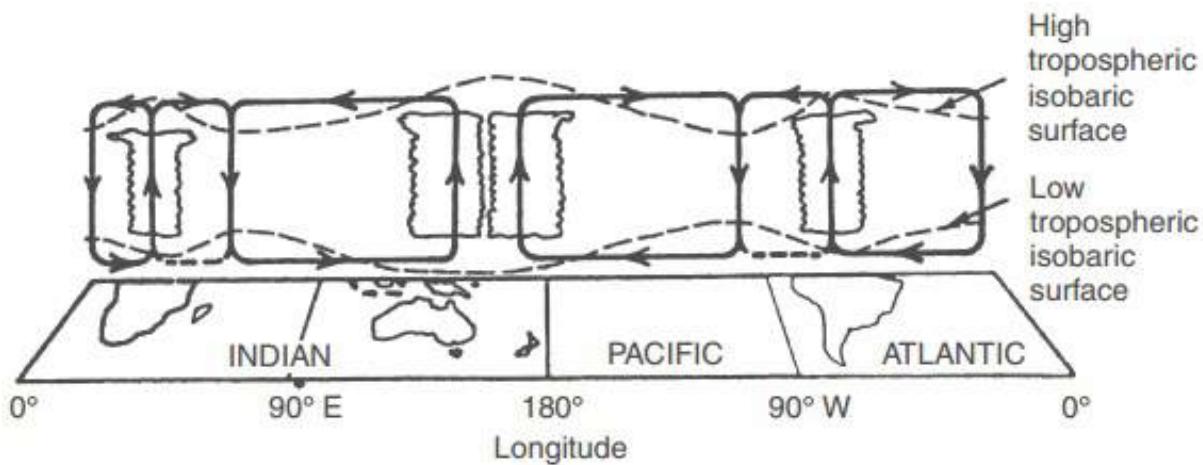
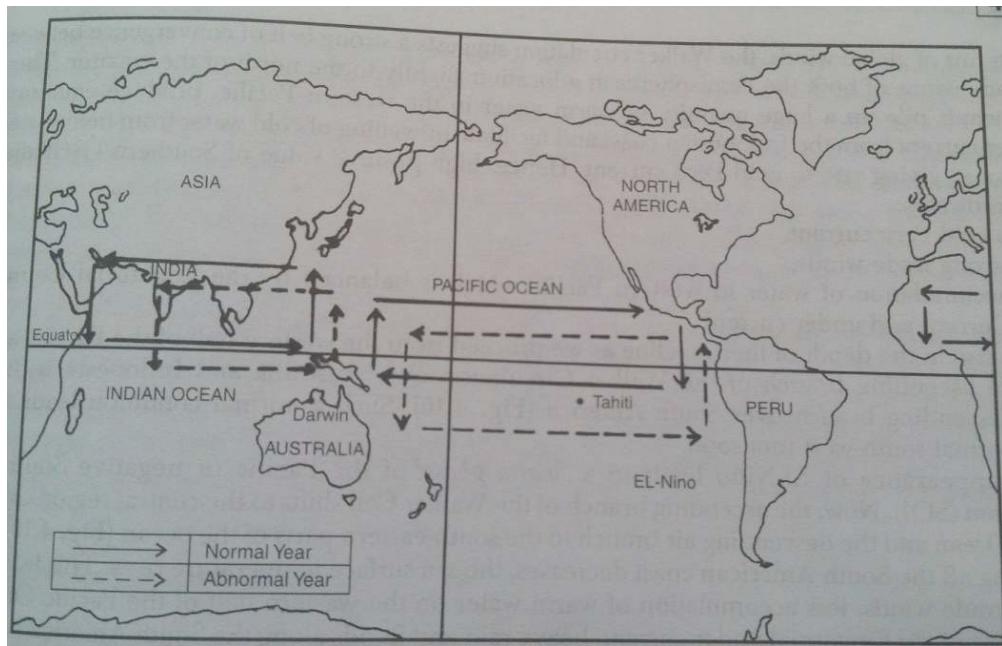
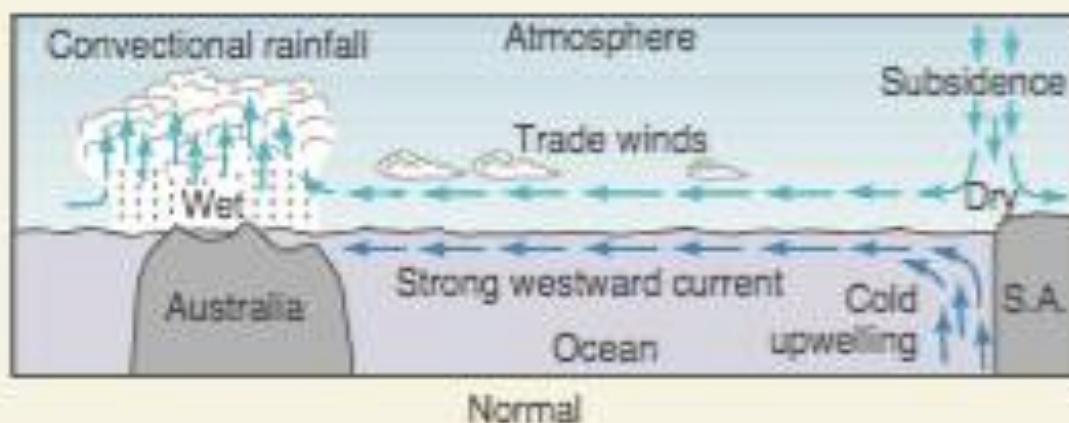
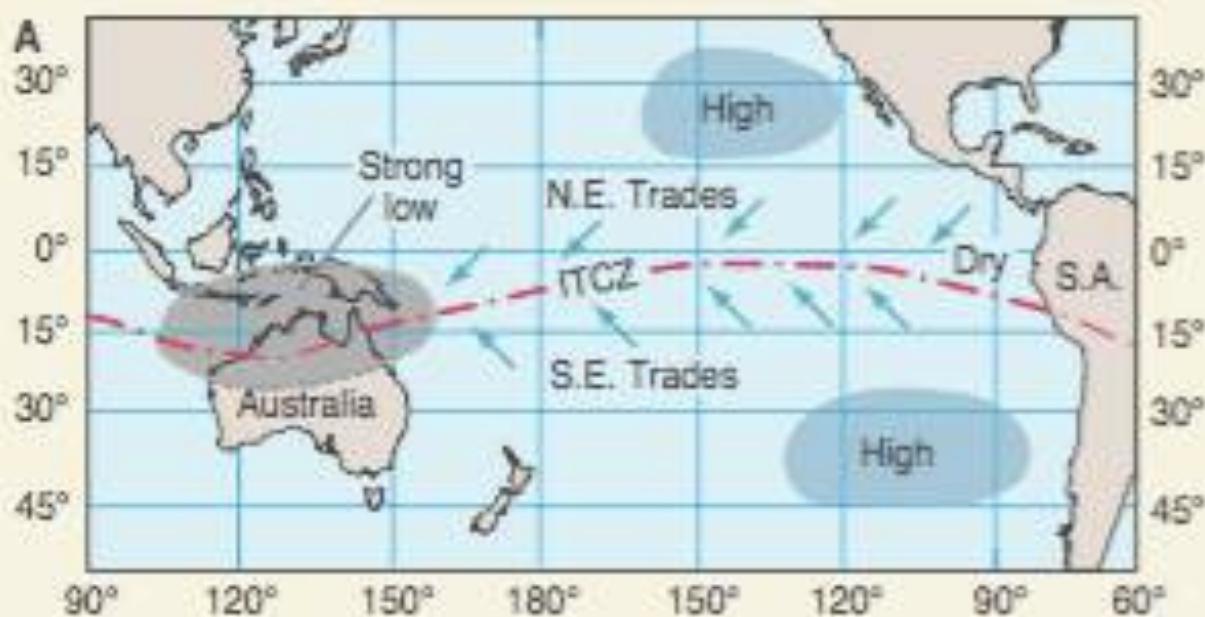
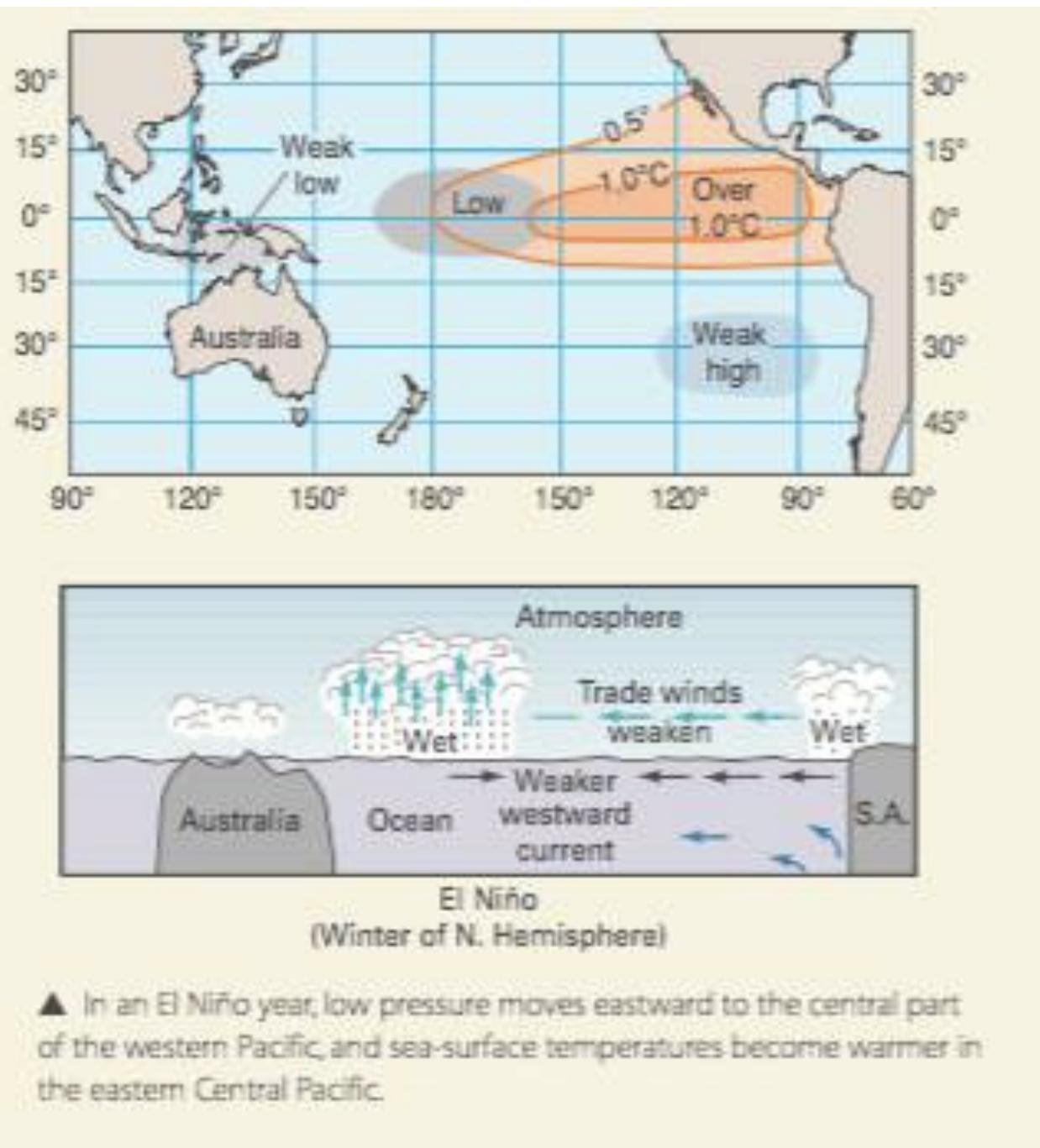


Figure 5 - east–west atmospheric circulation along the longitude–height plane over the Equator.
 The cell over the Pacific Ocean is referred to as the Walker Circulation.

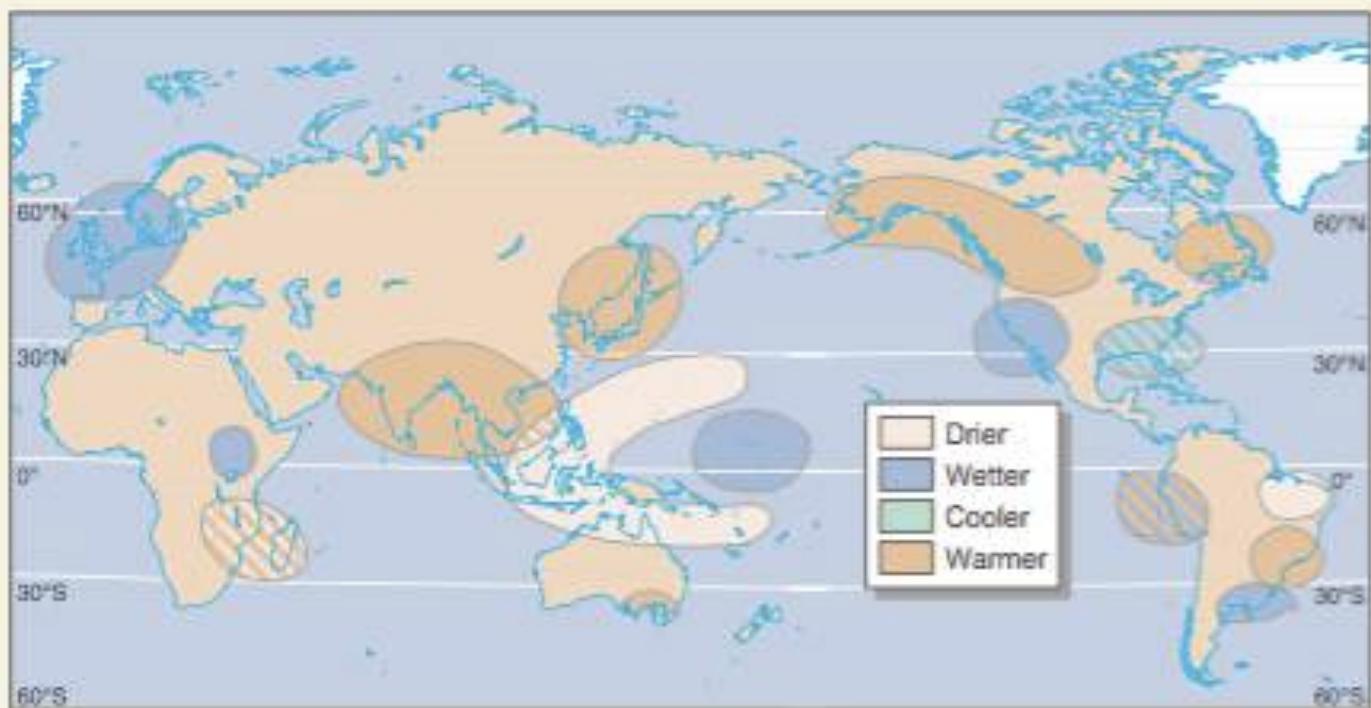




▲ In a normal year, low pressure dominates in Malaysia and northern Australia.

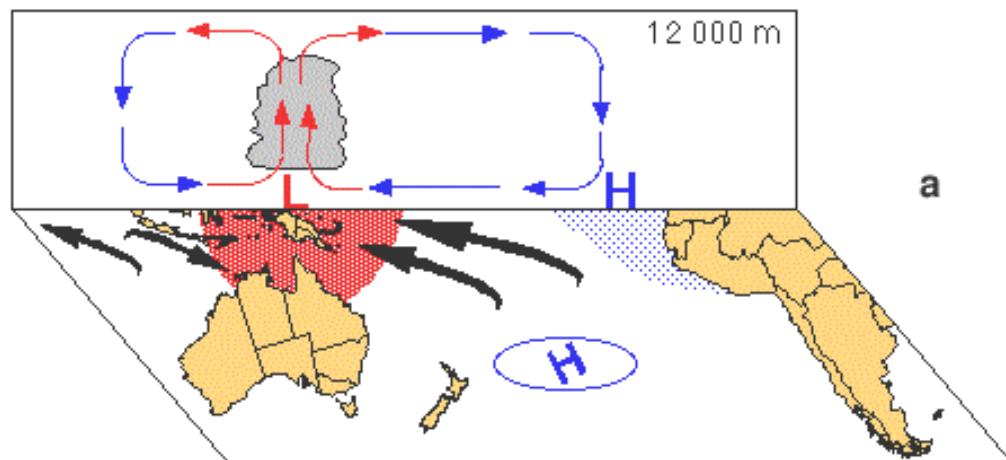


5.33 El Niño–ENSO

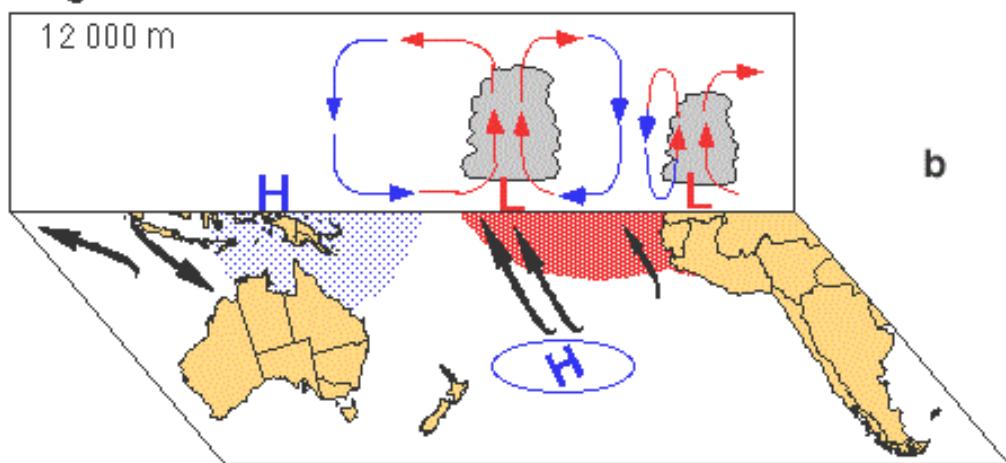


▲ El Niño–ENSO events drastically alter the climate, even in many areas far from the Pacific Ocean. As a result, some areas are drier, some wetter, some cooler, and some warmer than usual. Typically, northern areas of the contiguous United States are warmer during the winter, whereas southern areas are cooler and wetter.

Positive SOI - La Niña



Negative SOI - El Niño



Sea temperatures

- Warmer
- Cooler

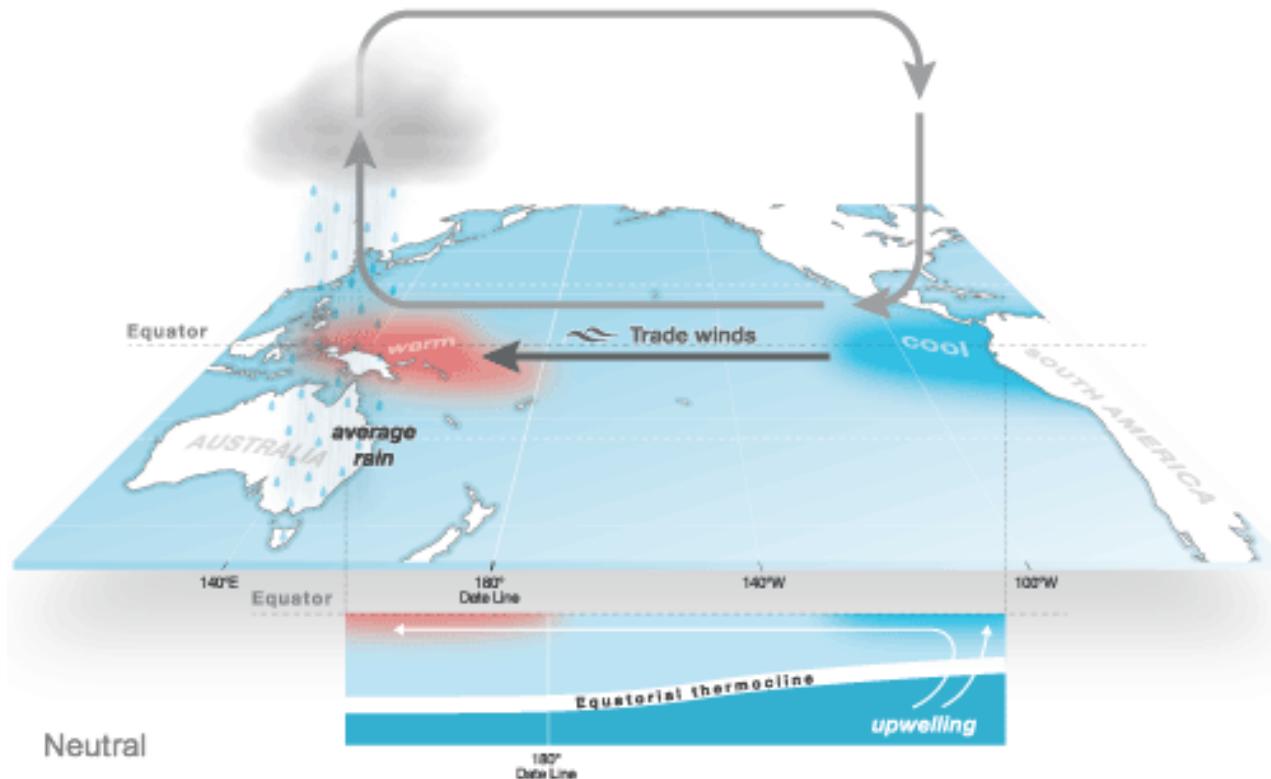
Air pressure

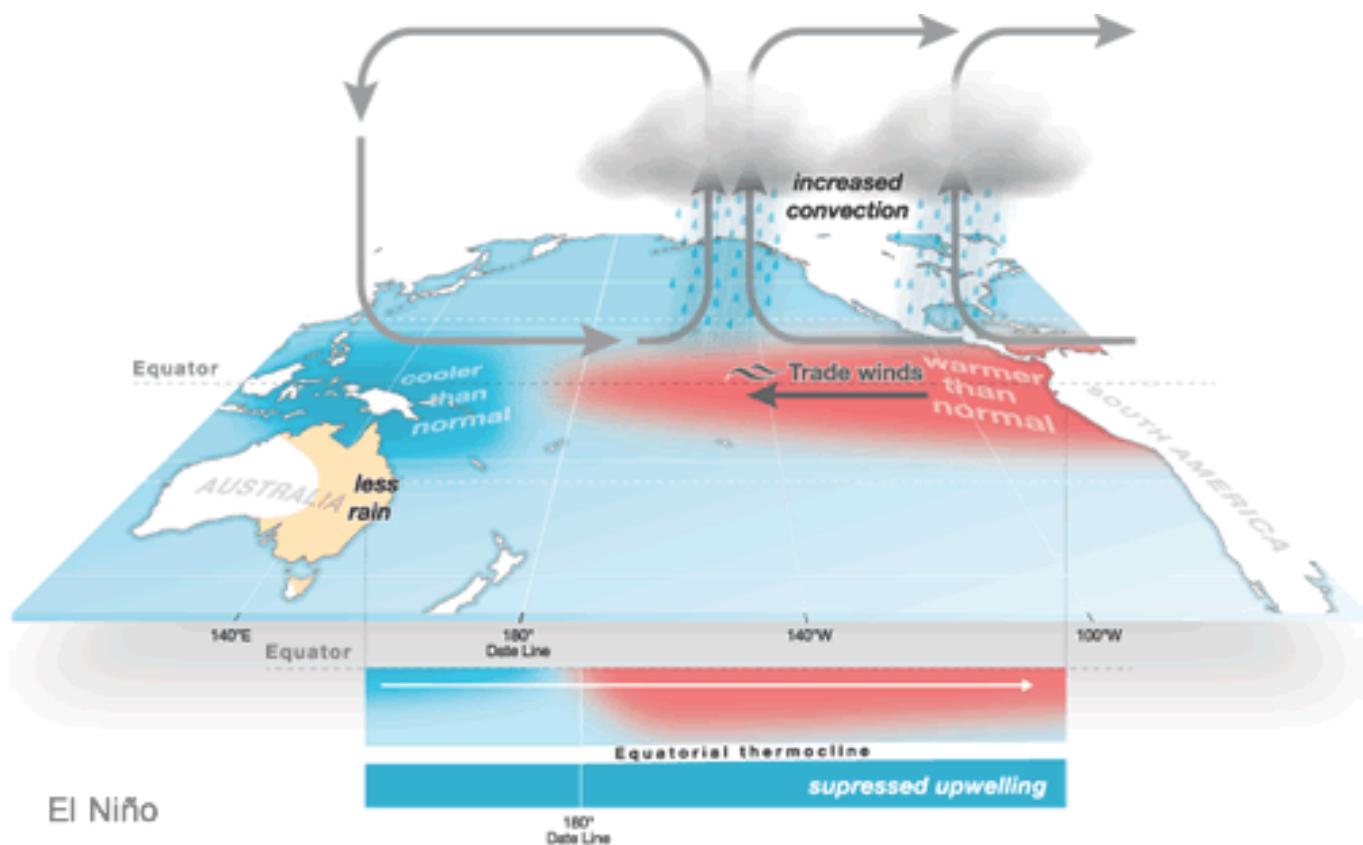
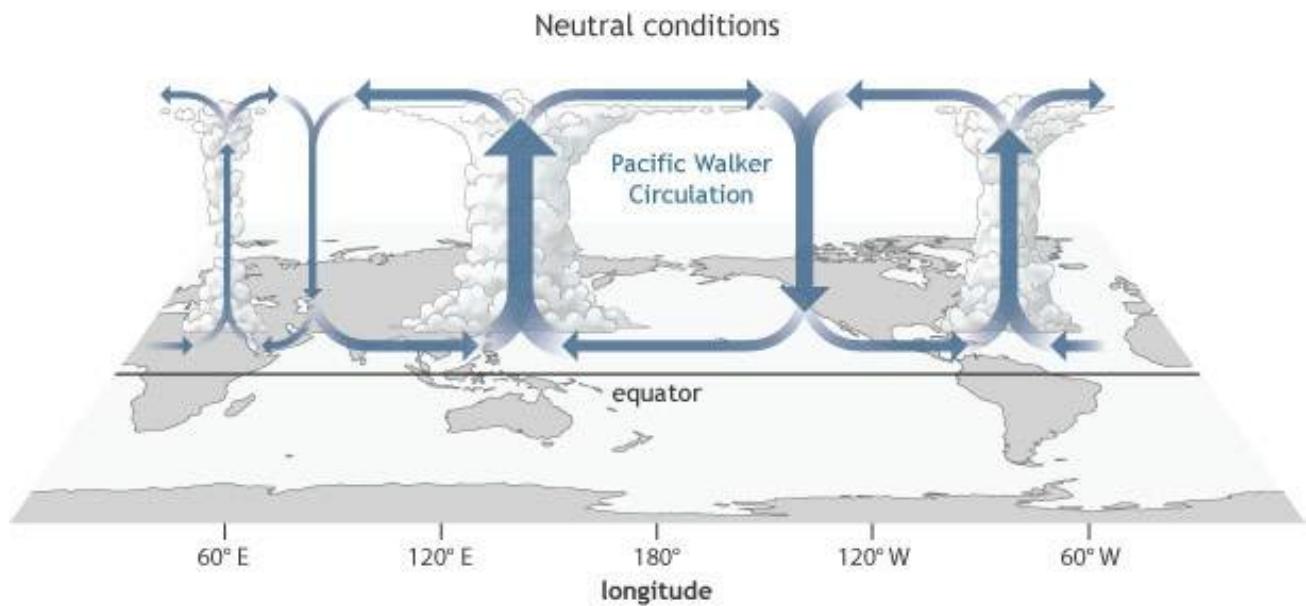
- L Lower
- H Higher

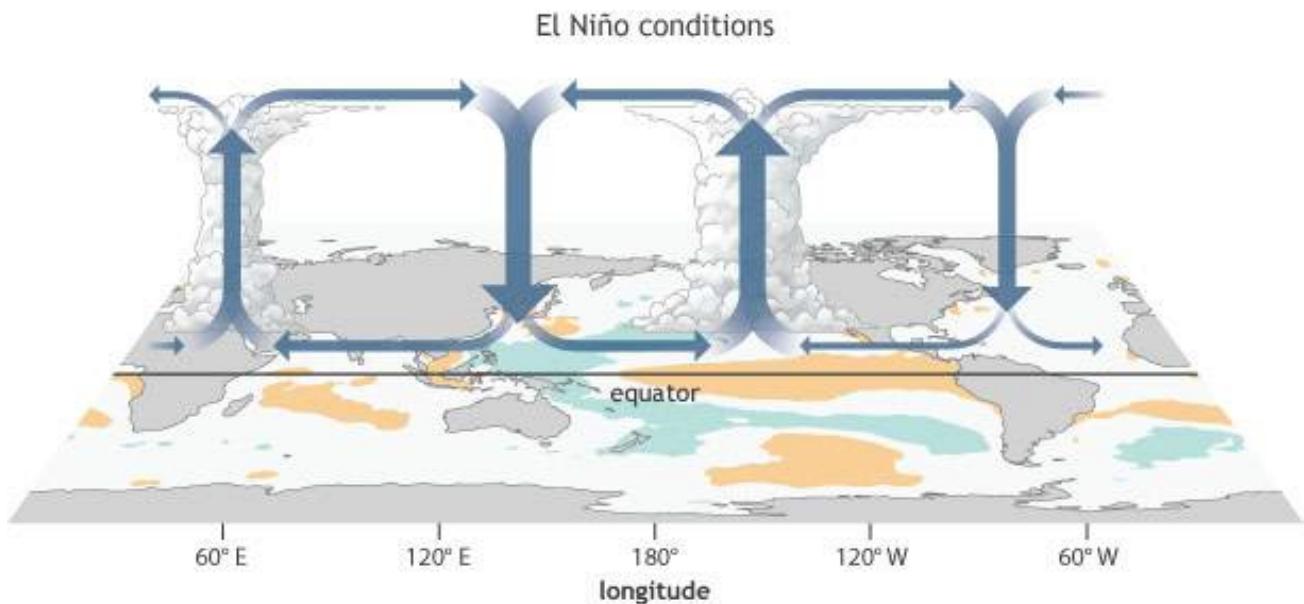
Surface winds



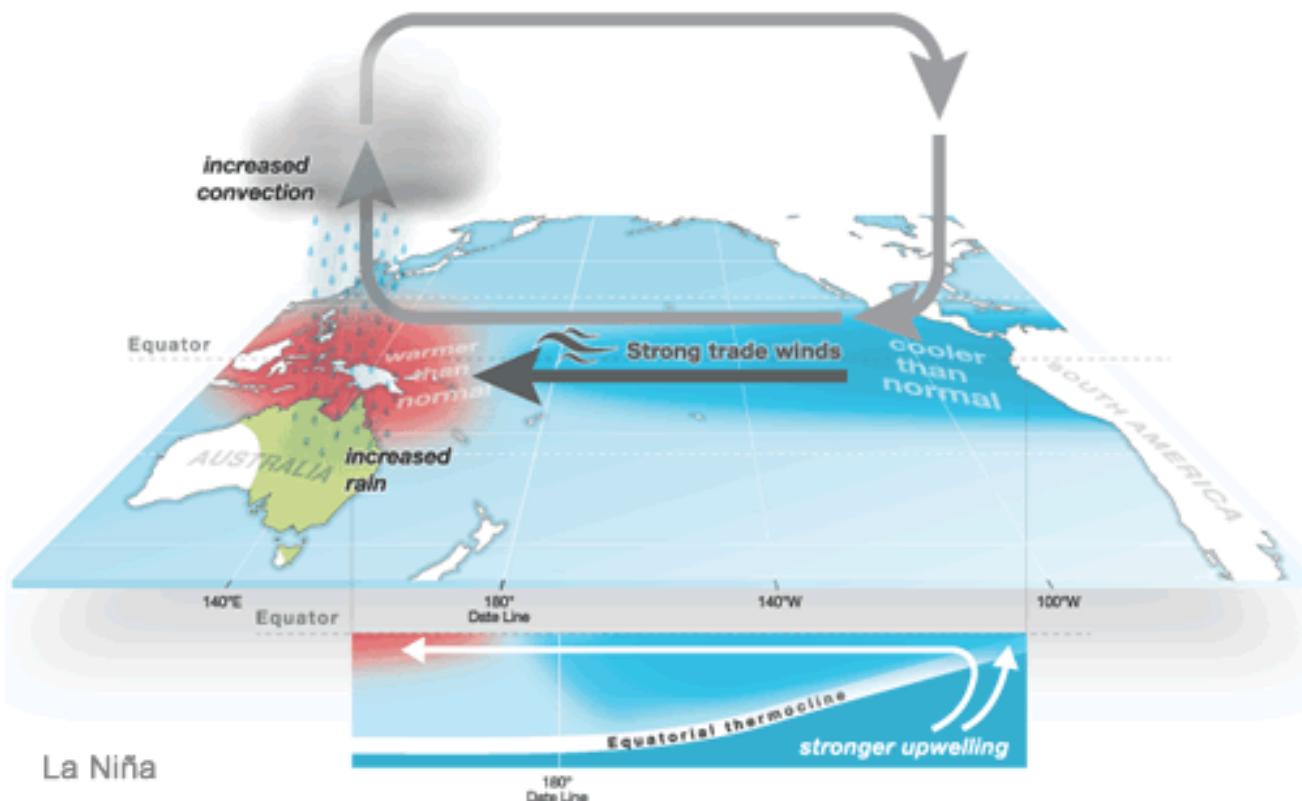
Figure 6 – Walker circulation during La Niña and El Niño



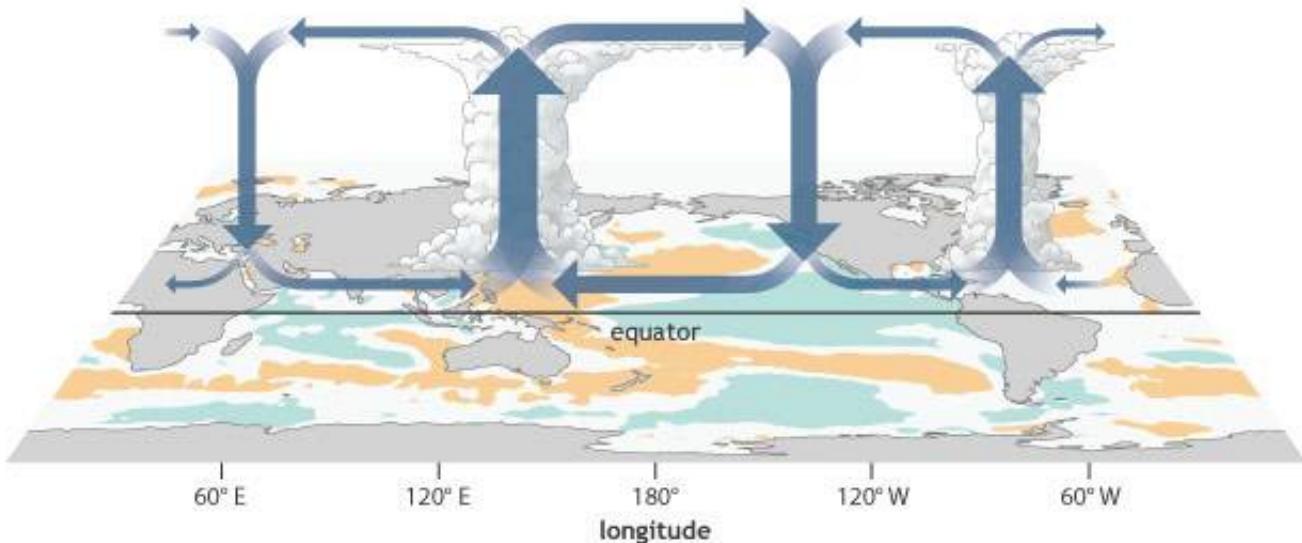




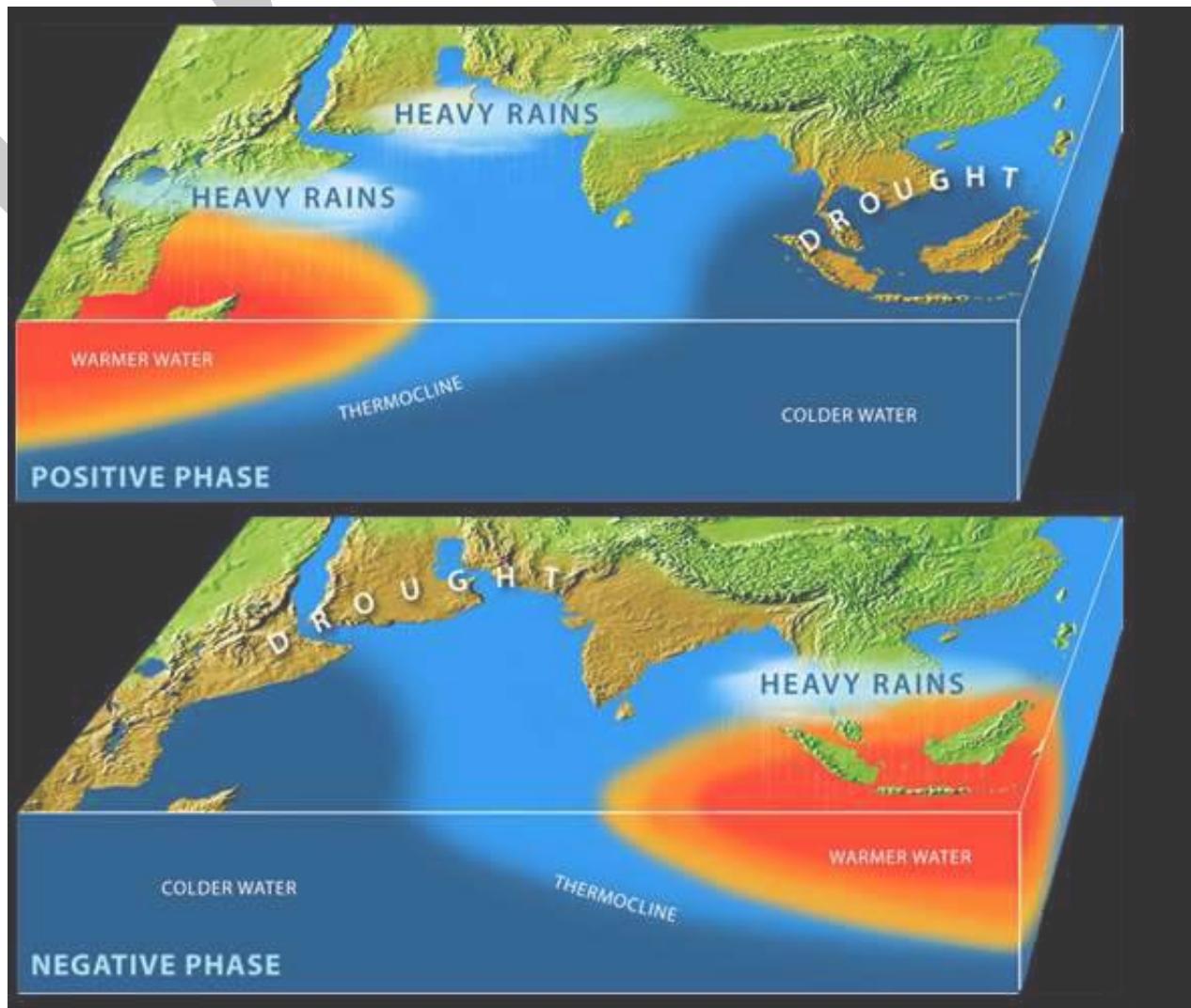
NOAA.Climate.gov



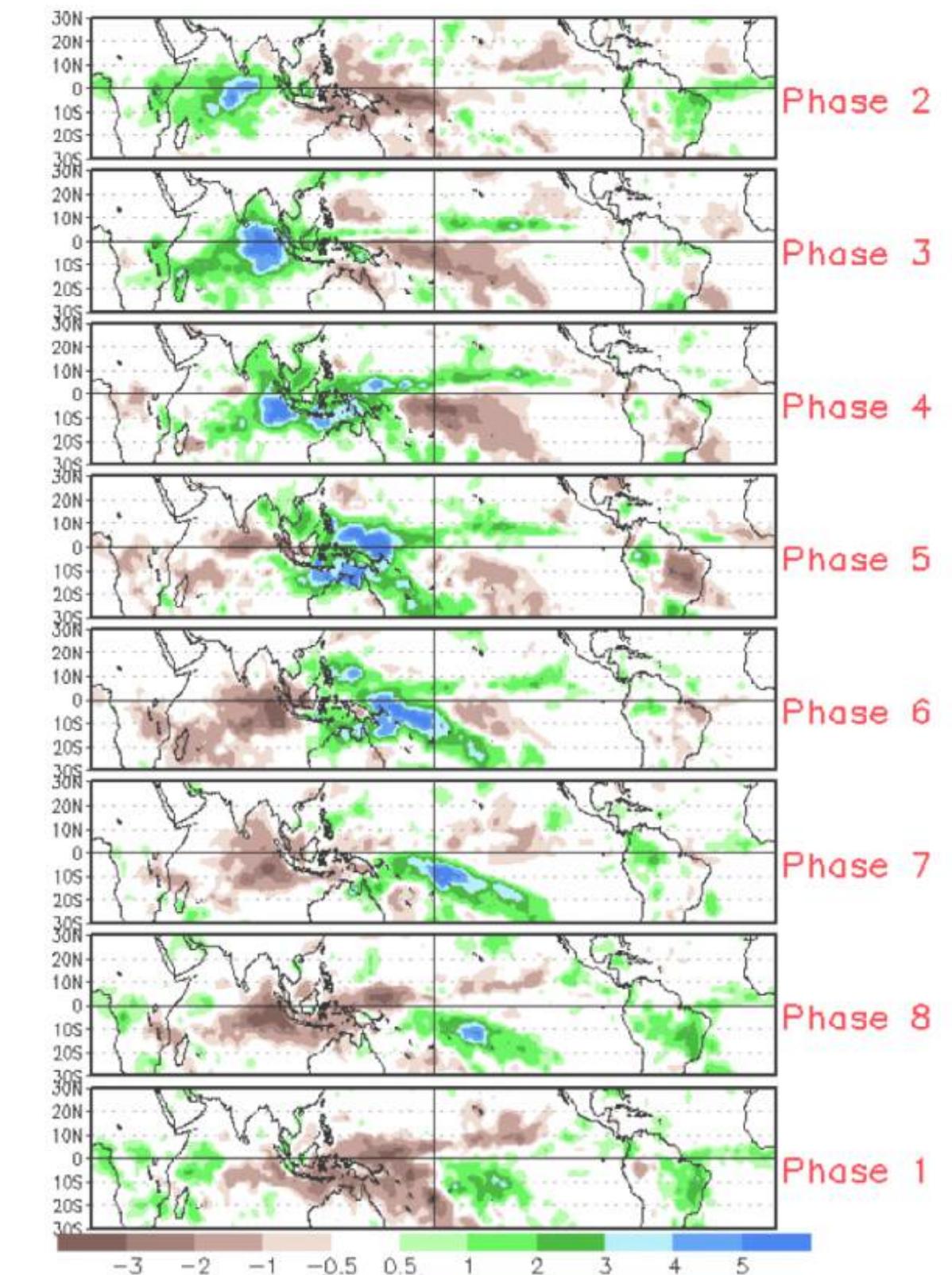
La Niña conditions



NOAA Climate.gov



madden Julian oscliation



Madden-Julian Oscillation

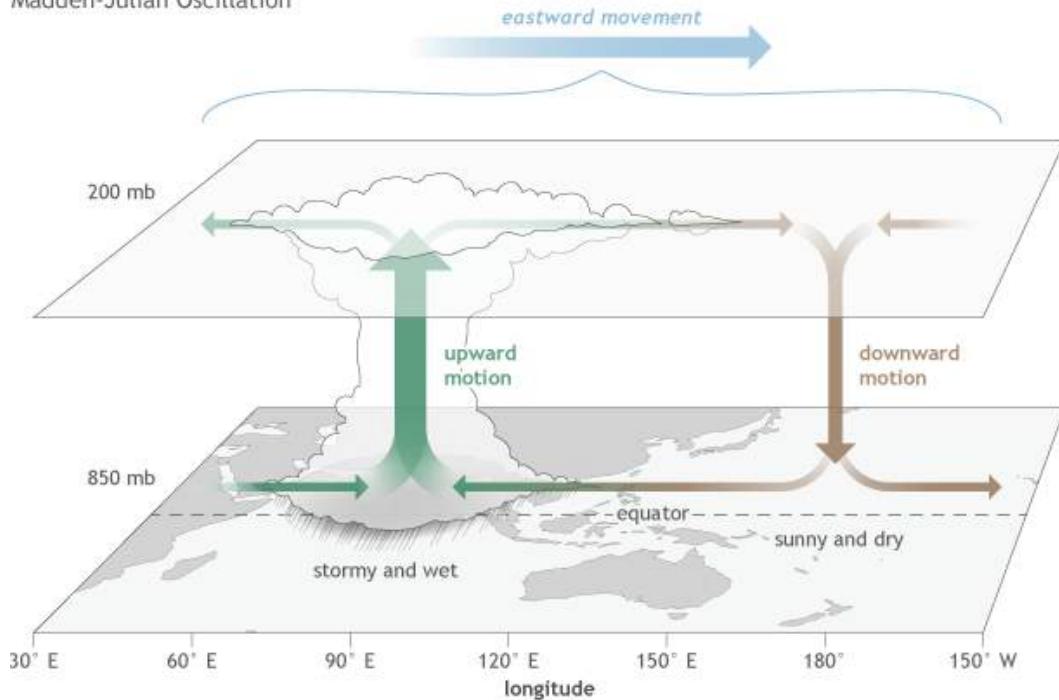


Figure 3: The surface and upper-atmosphere structure of the MJO for a period when the enhanced convective phase (thunderstorm cloud) is centered across the Indian Ocean and the suppressed convective phase is centered over the west-central Pacific Ocean. Horizontal arrows pointing left represent wind departures from average that are easterly, and arrows pointing right represent wind departures from average that are westerly. The entire dipole shifts eastward over time, eventually circling the globe and returning to its point of origin.
Climate.gov drawing by Fiona Martin.

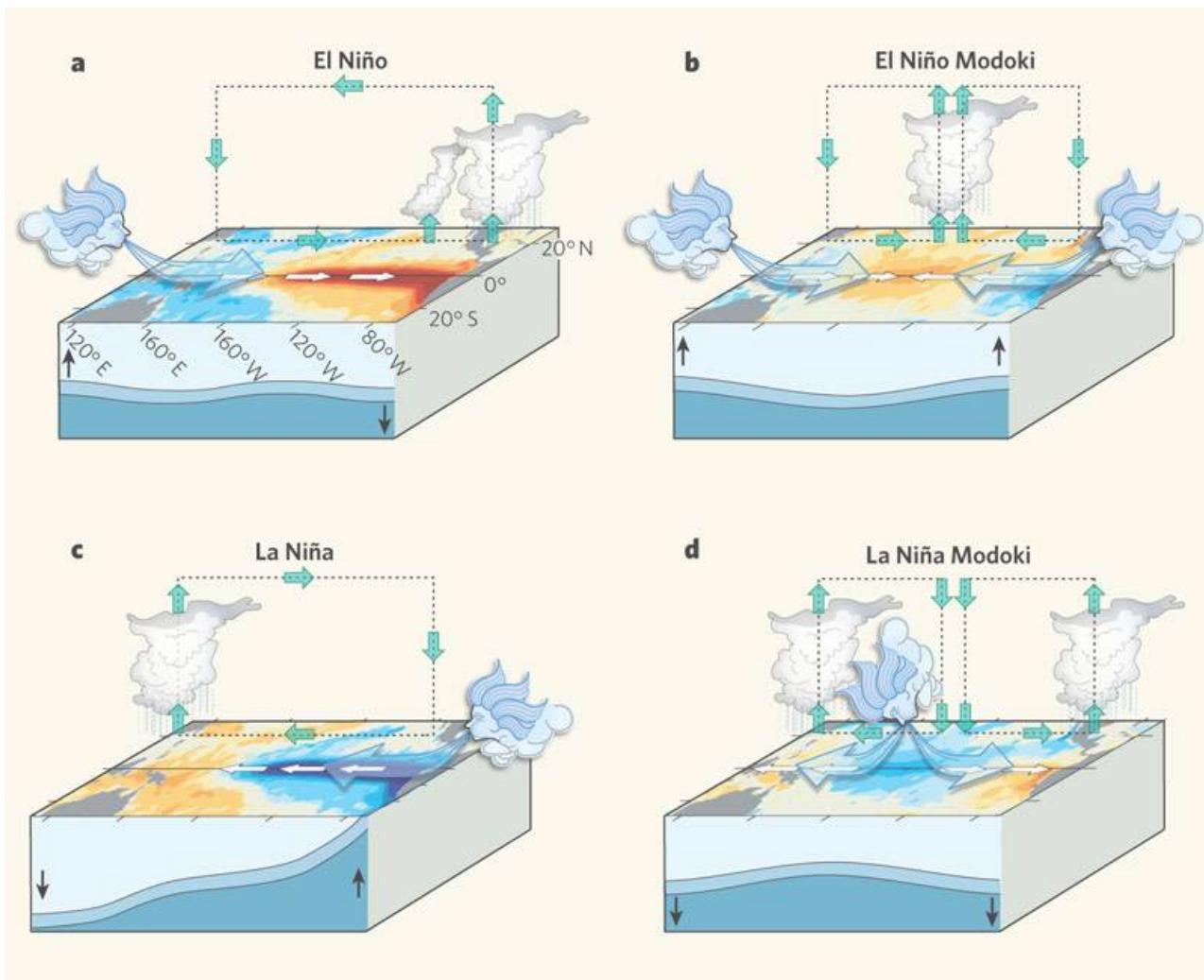


Figure 7 – El Niño Modoki and La Niña Modoki

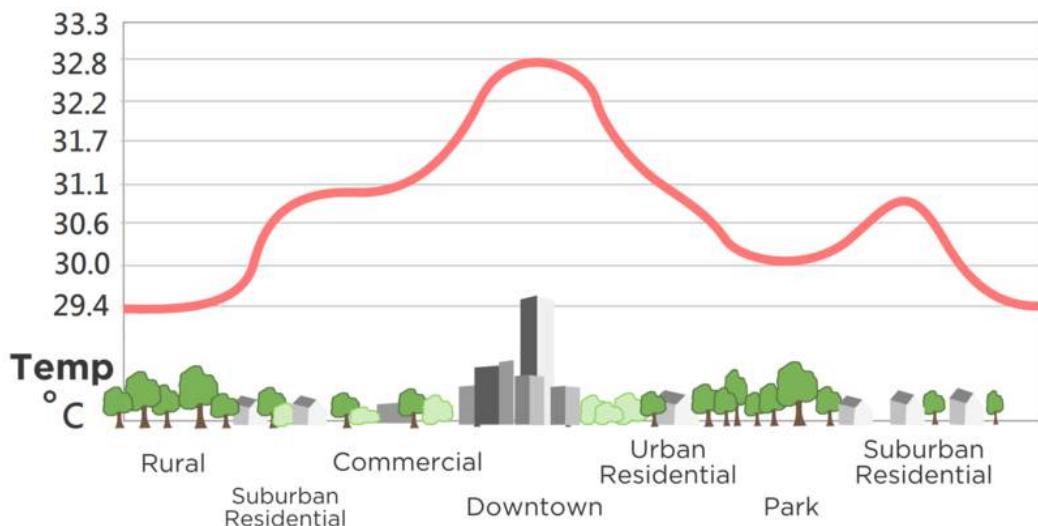
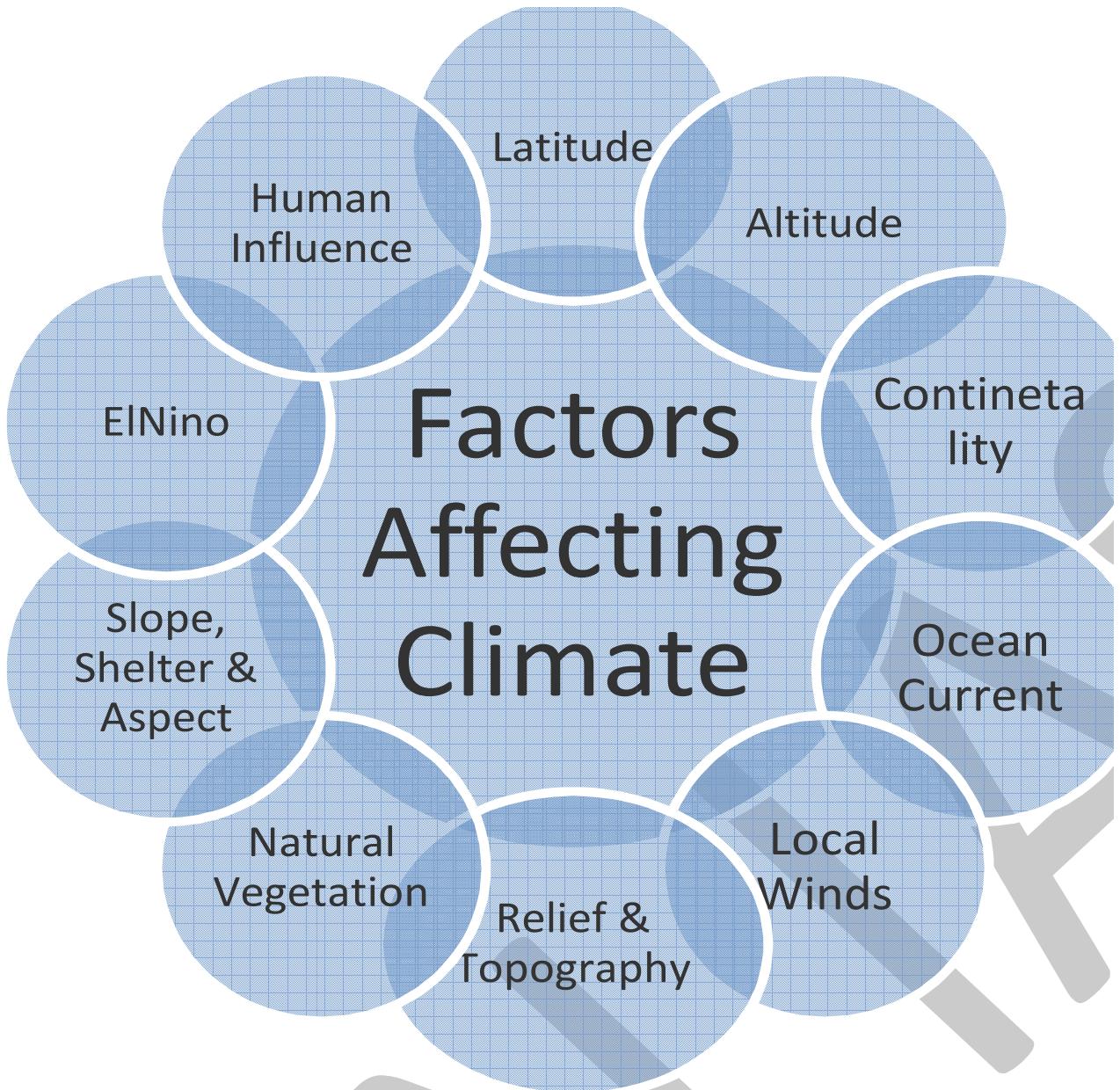
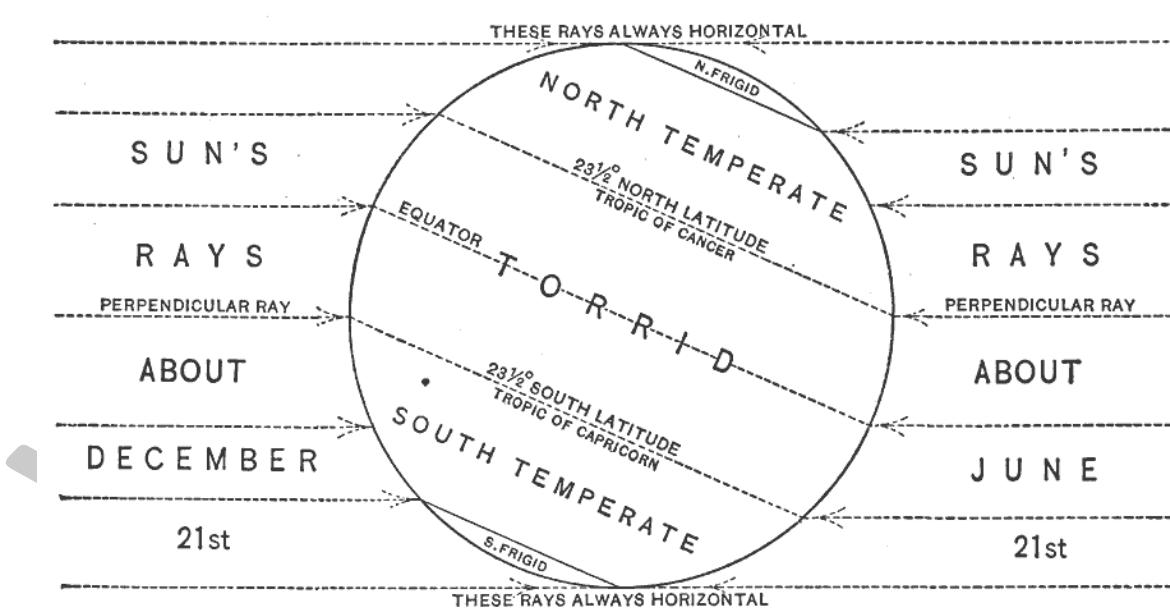


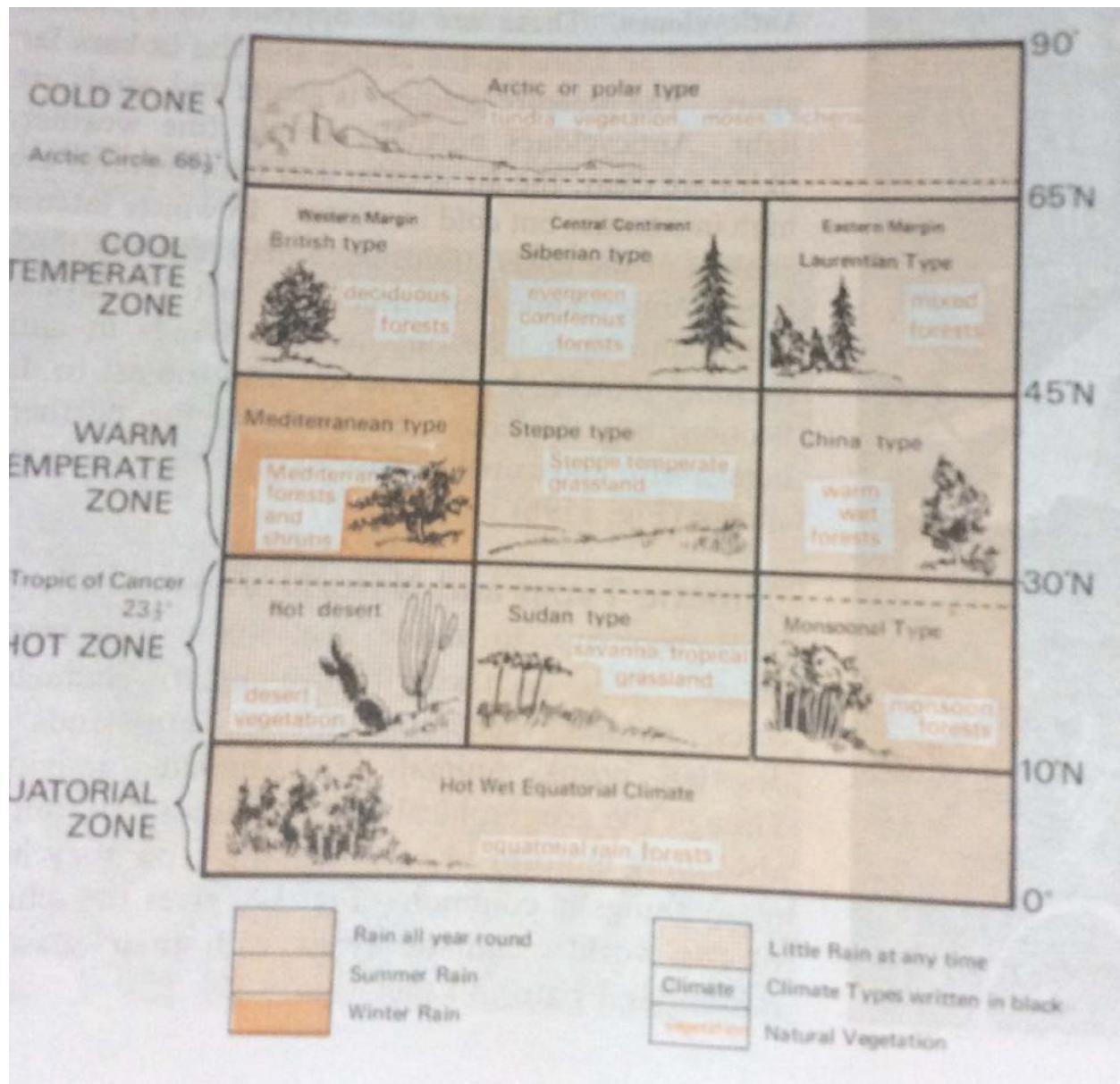
Figure 8 – Urban Heat Island Profile

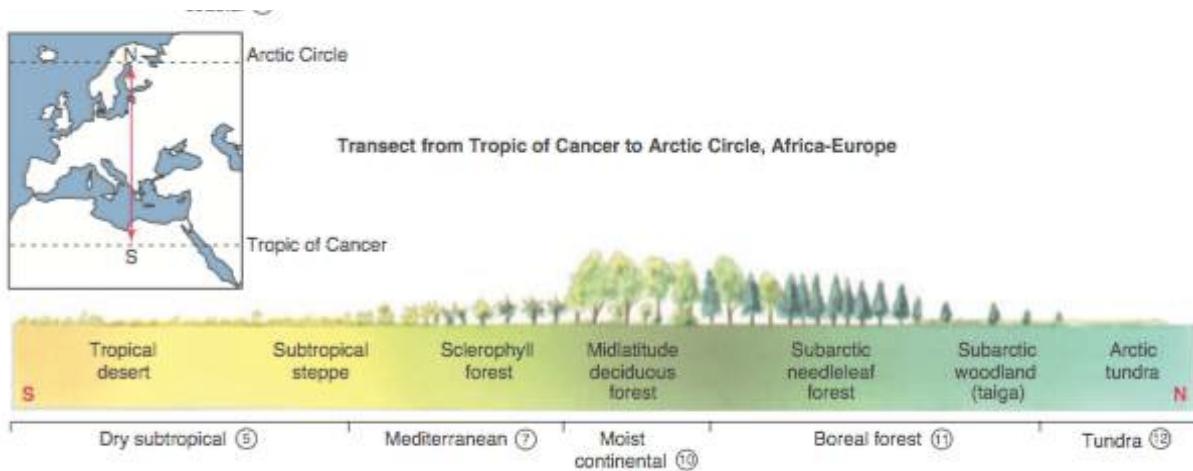
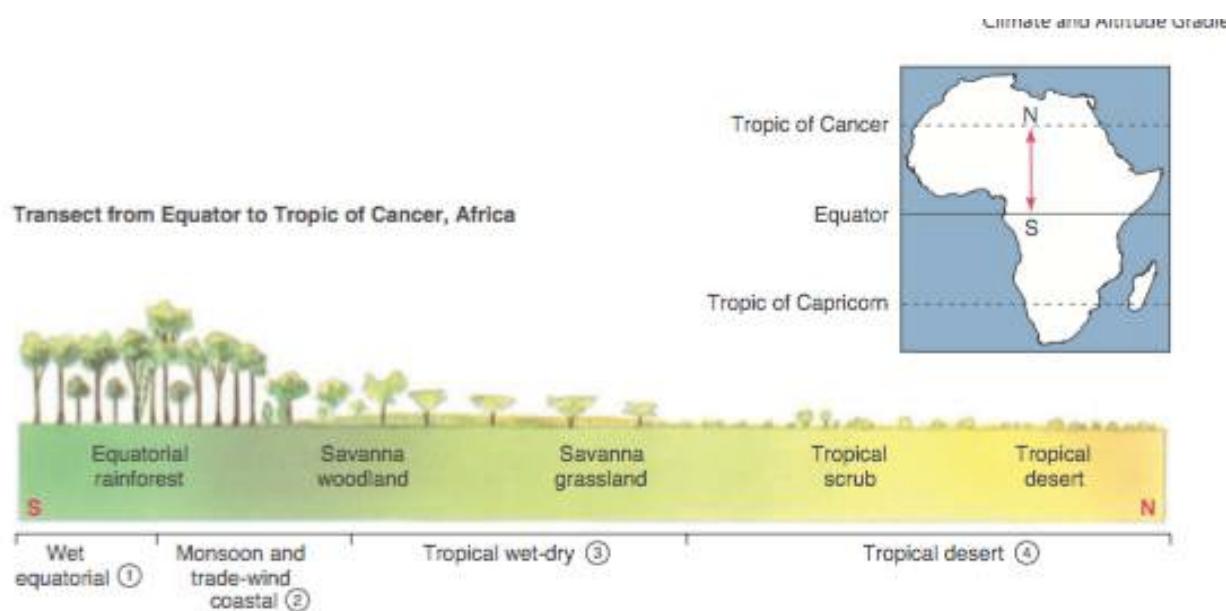


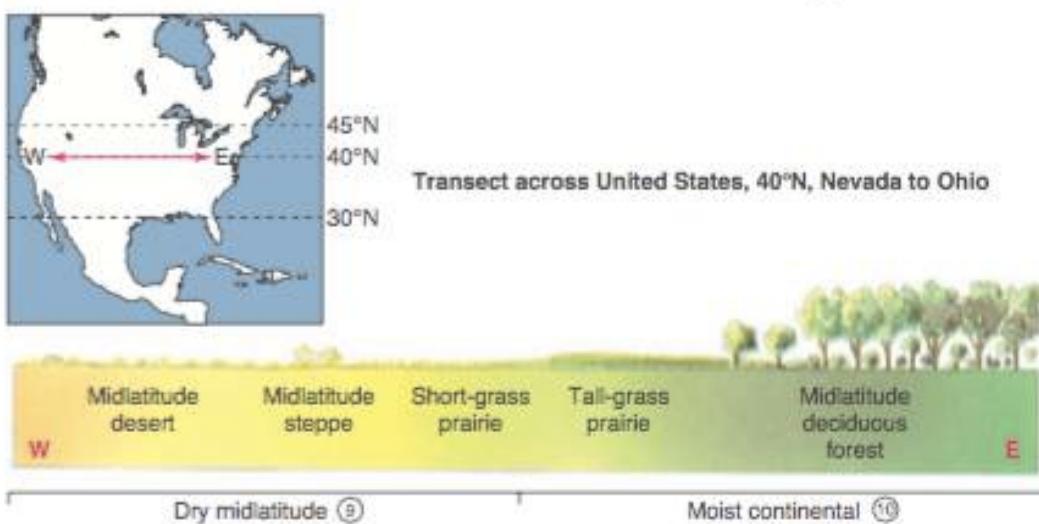
Figure 9 – green roof





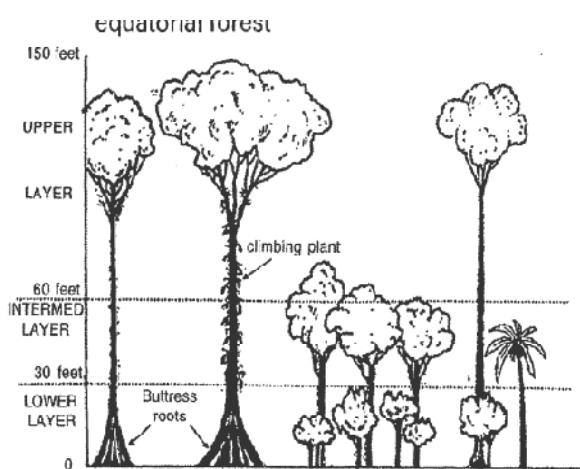
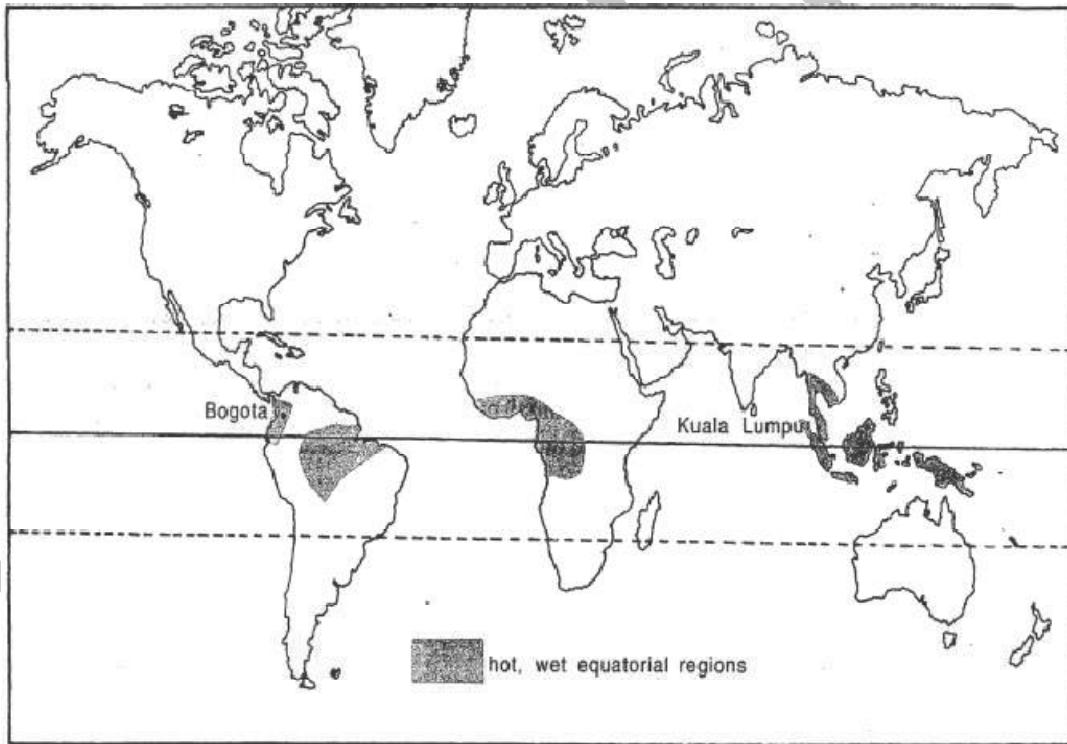


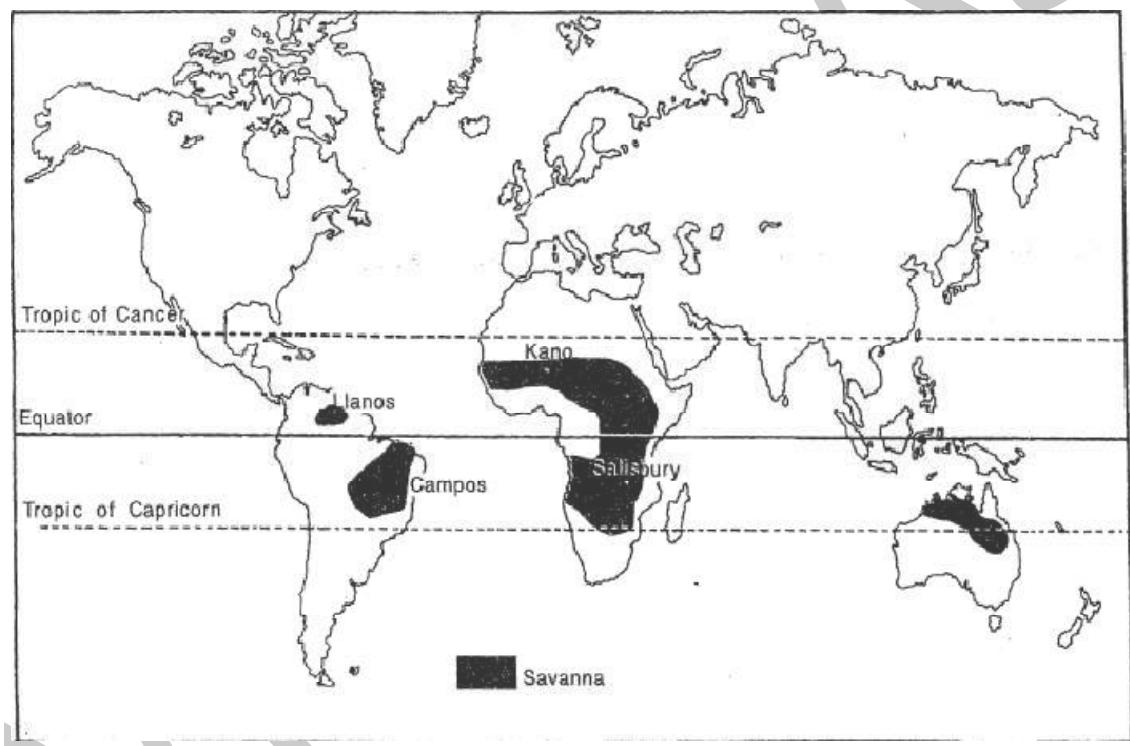
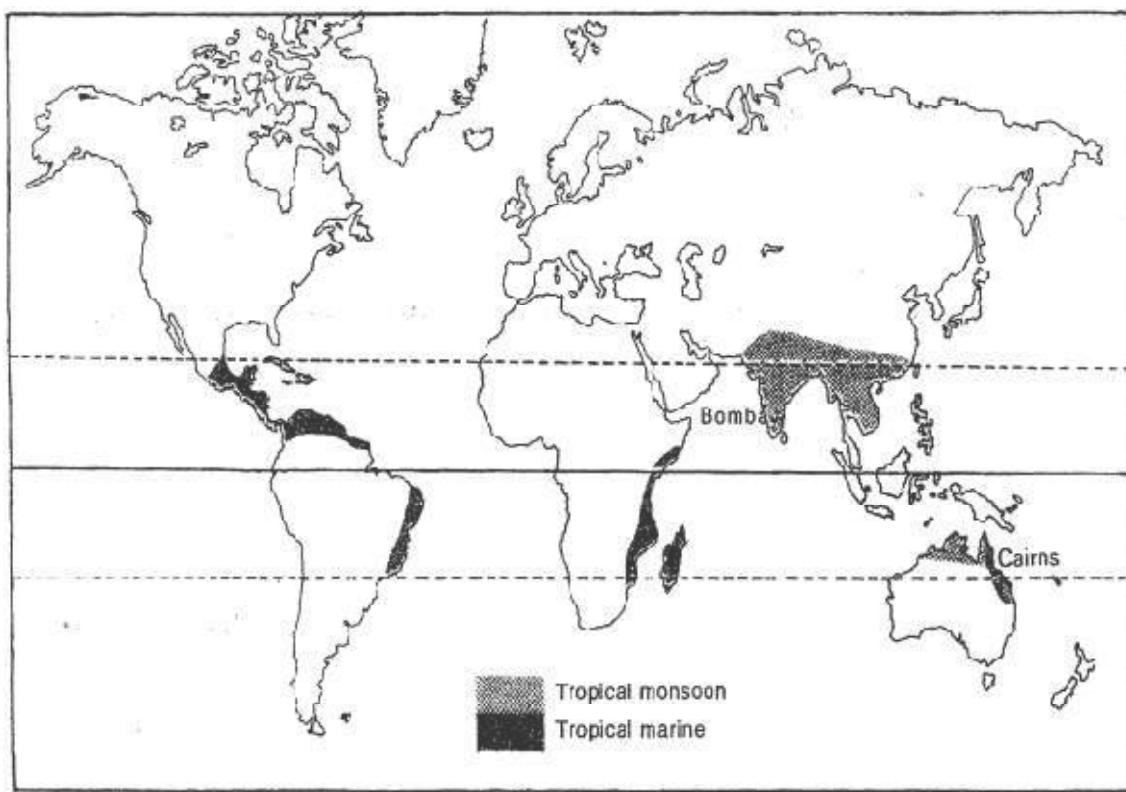


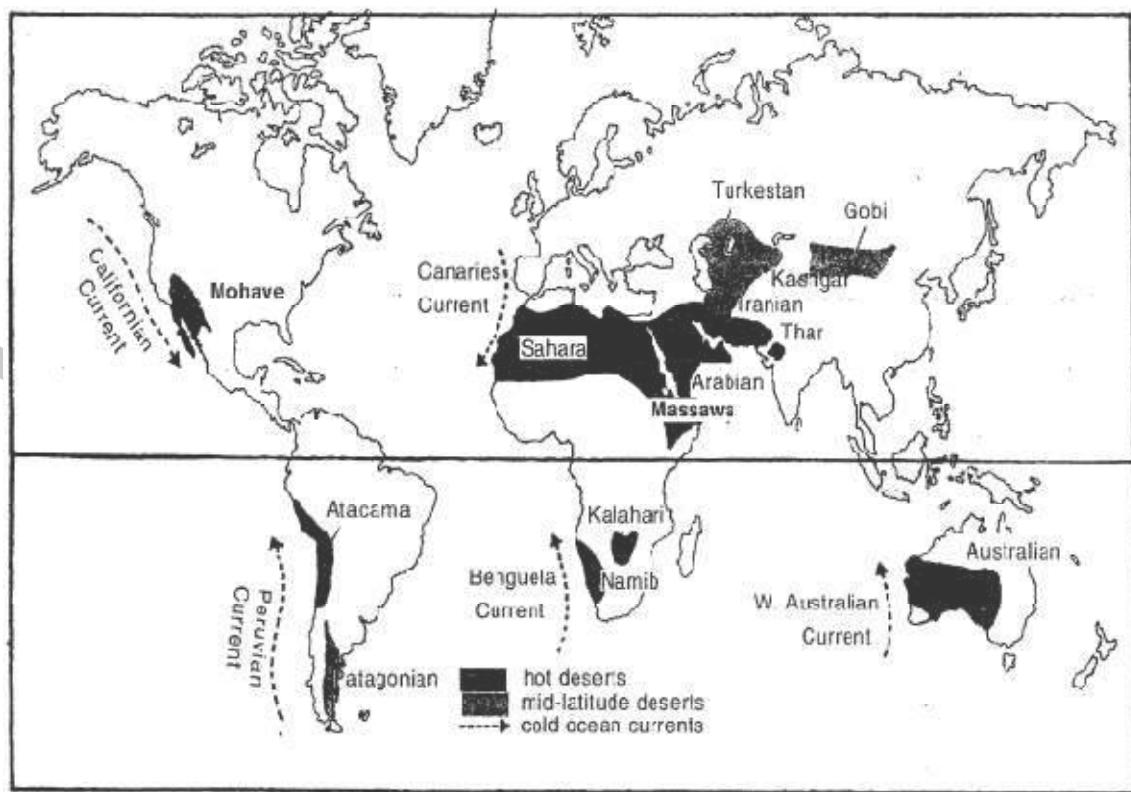


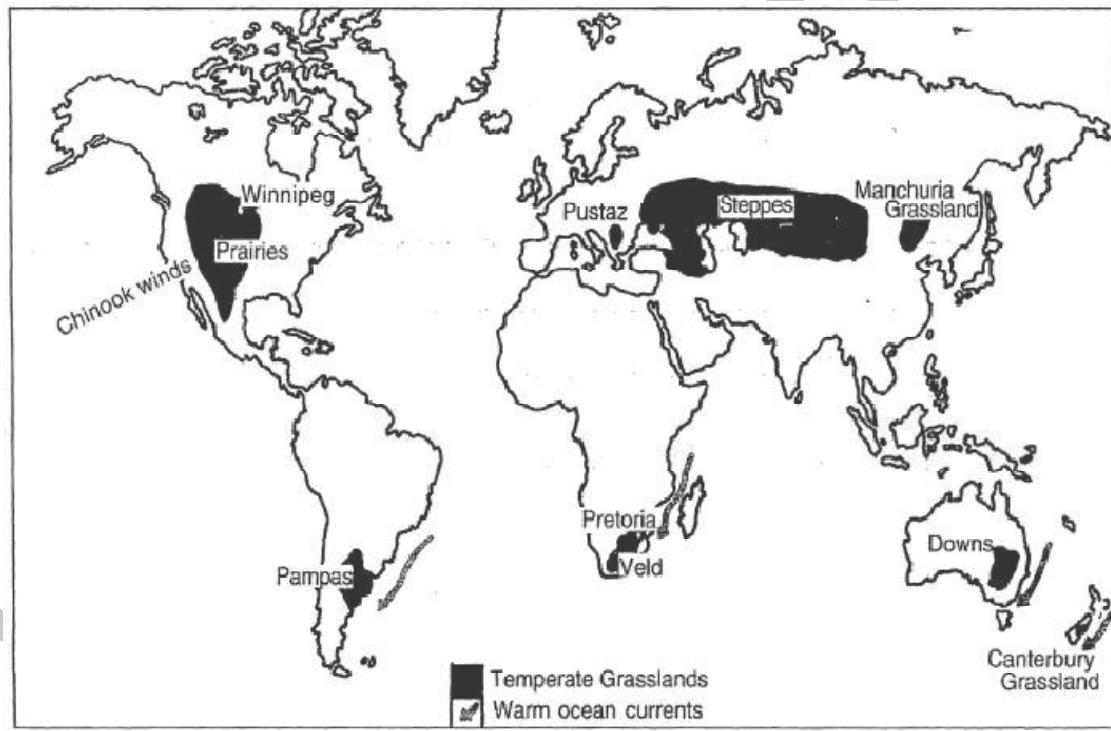
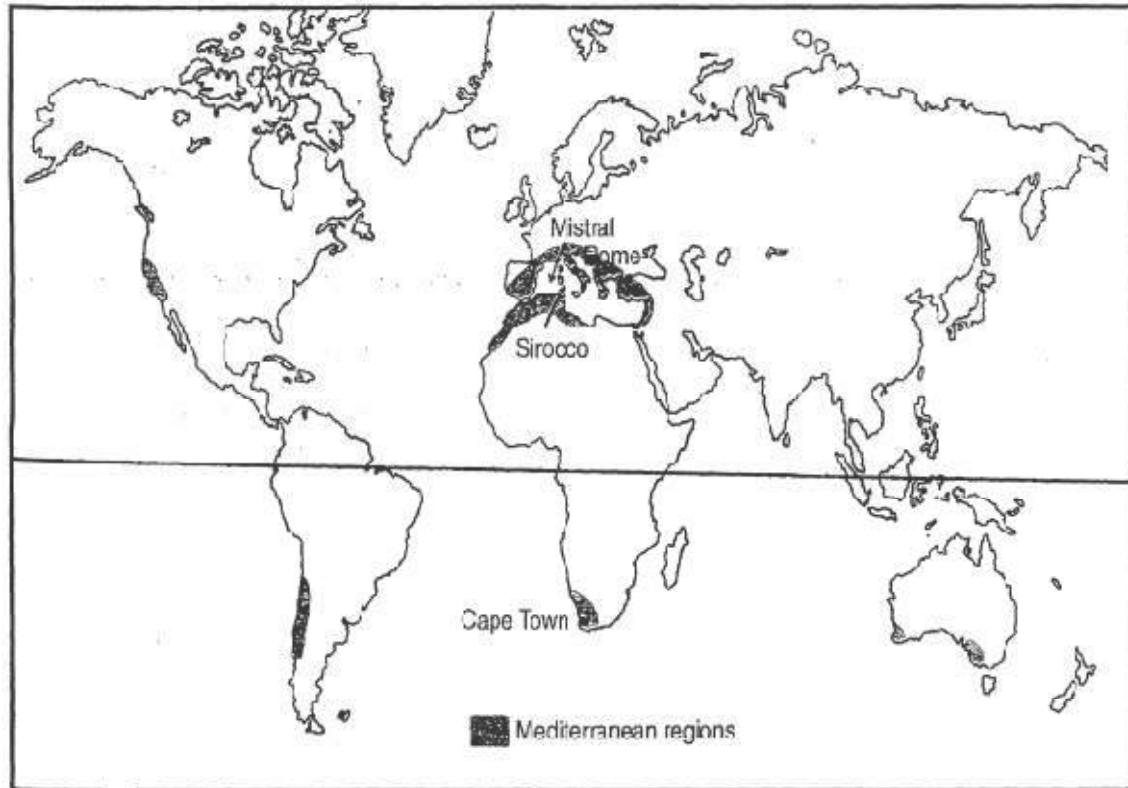
9.34 Vegetation transects

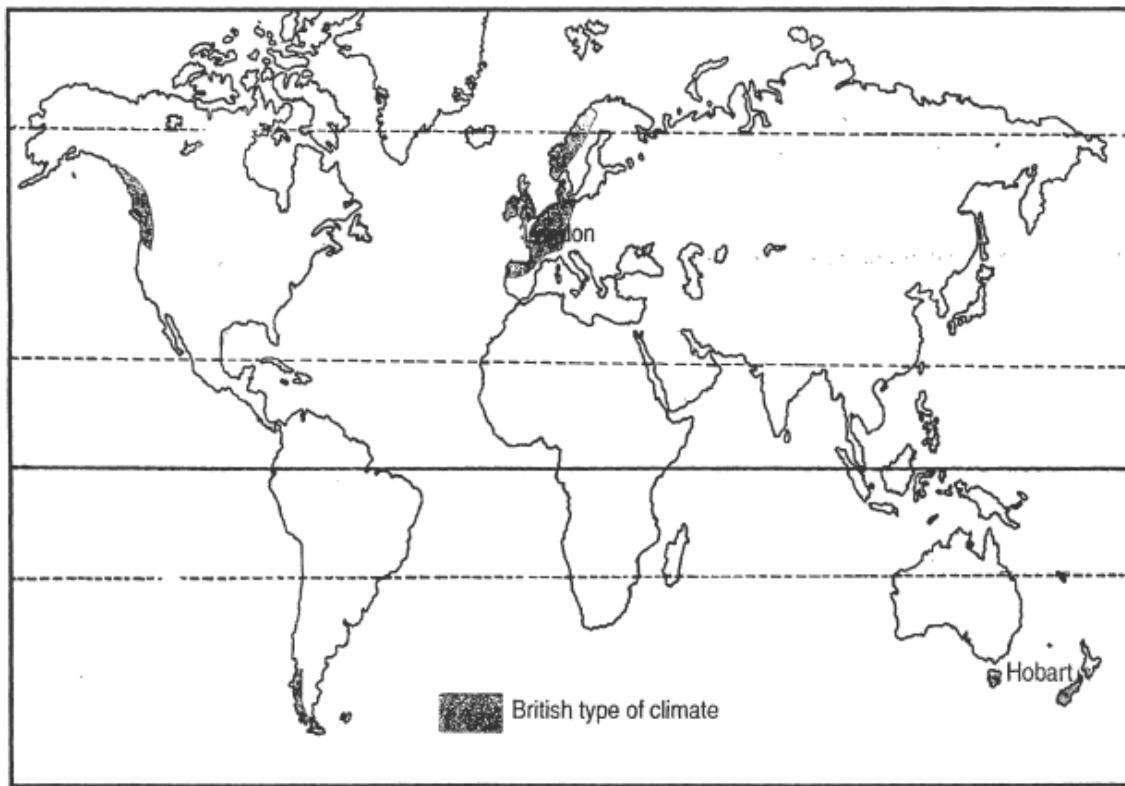
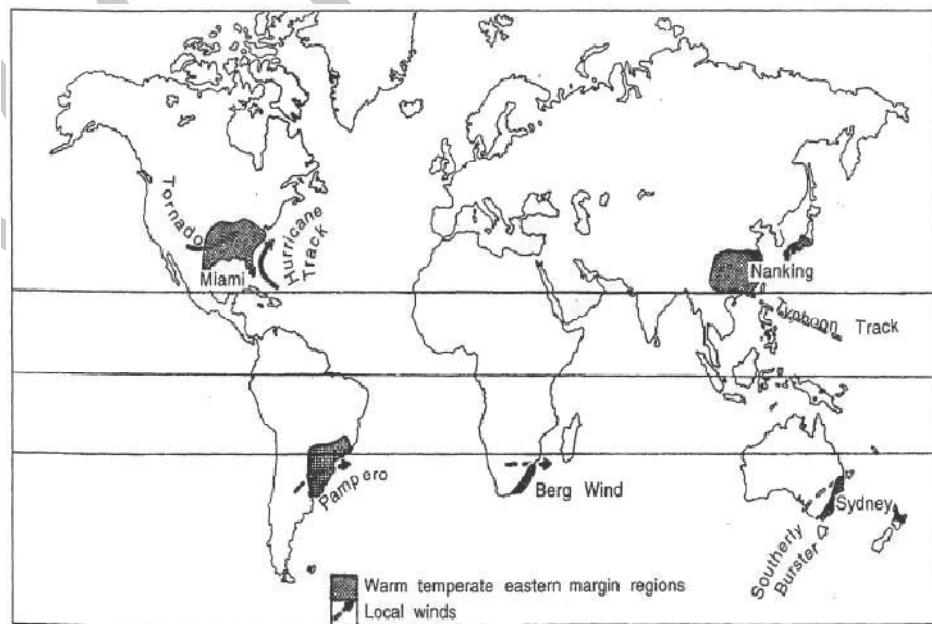
Three continental transects showing the sequence of plant formation classes across climatic gradients. Effects of mountains or highland regions are not shown.

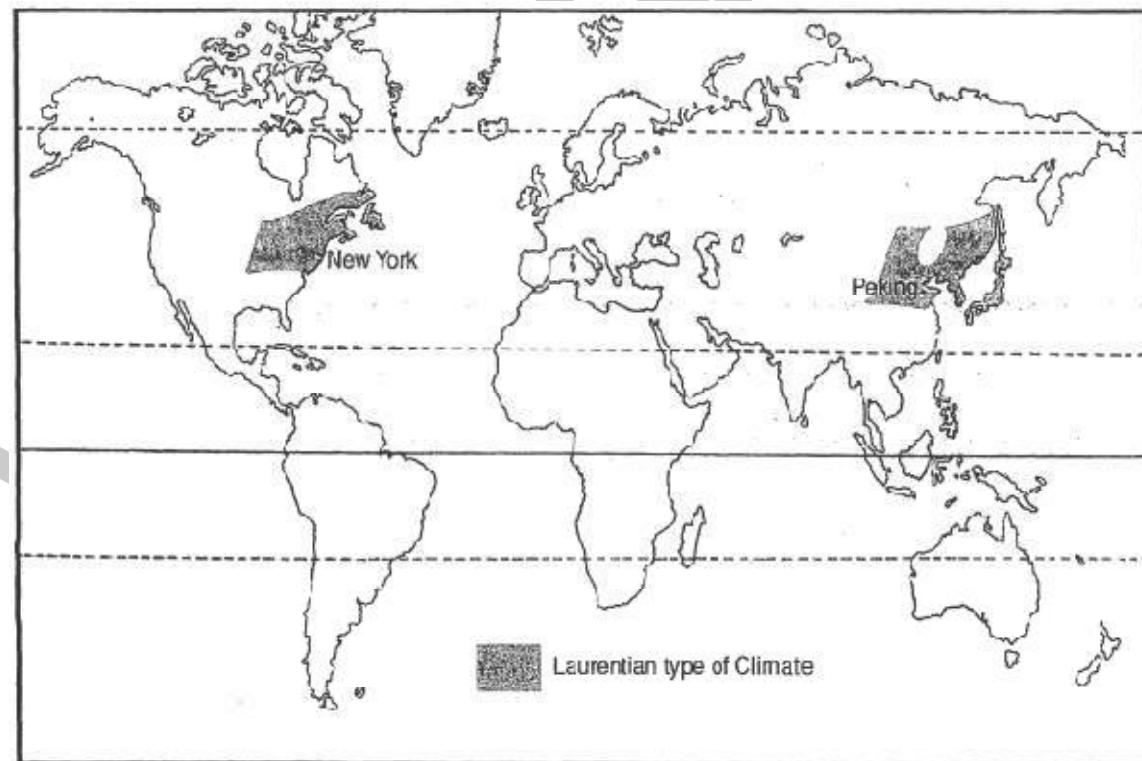
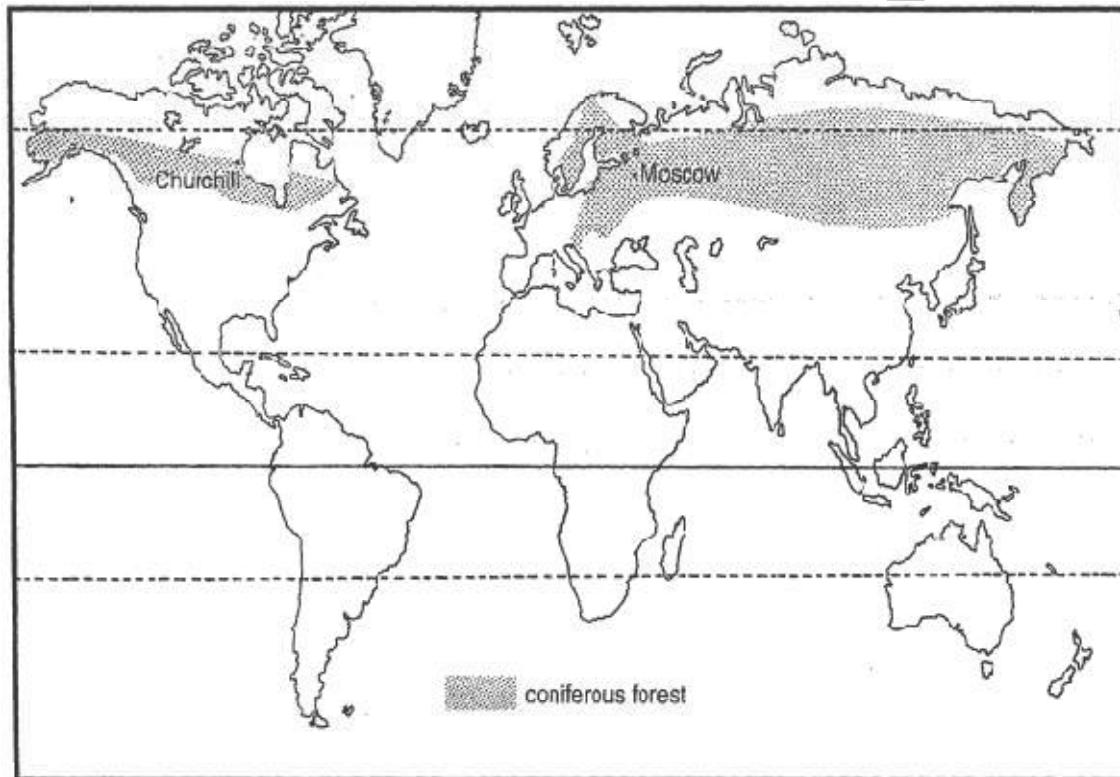


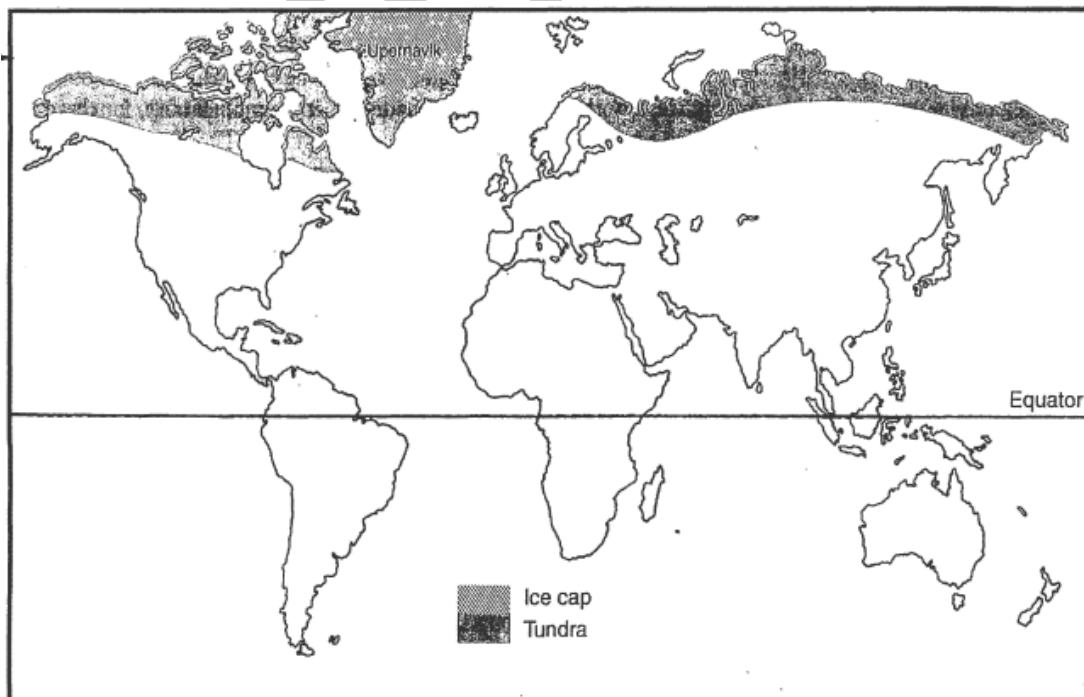


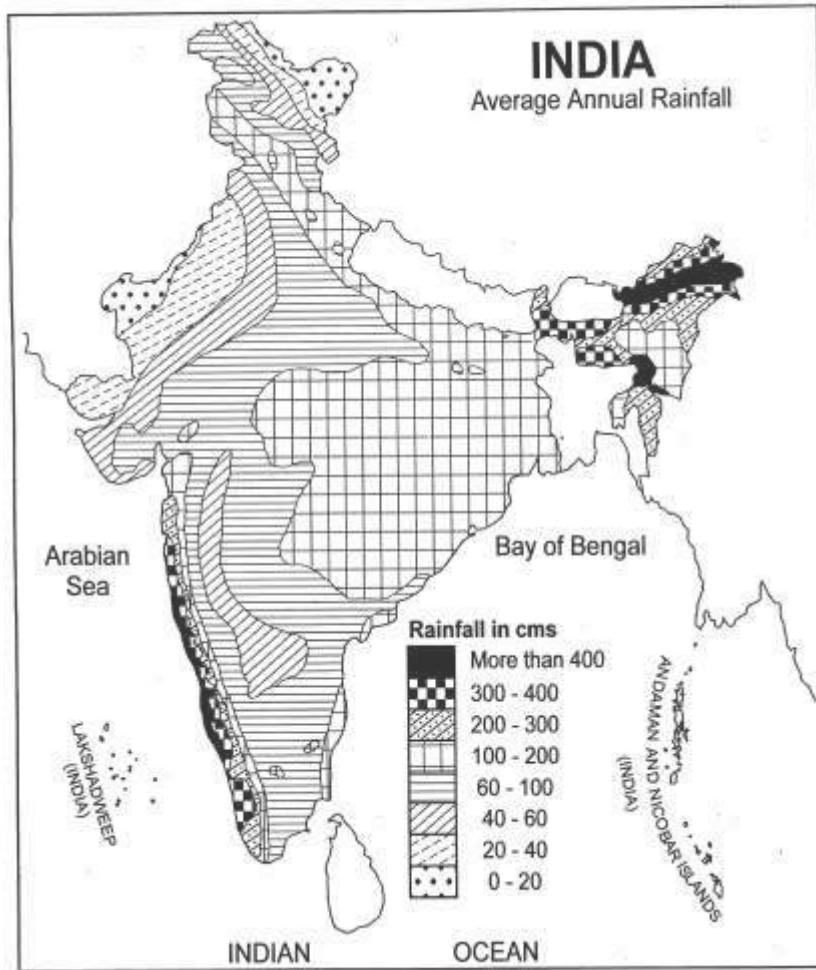


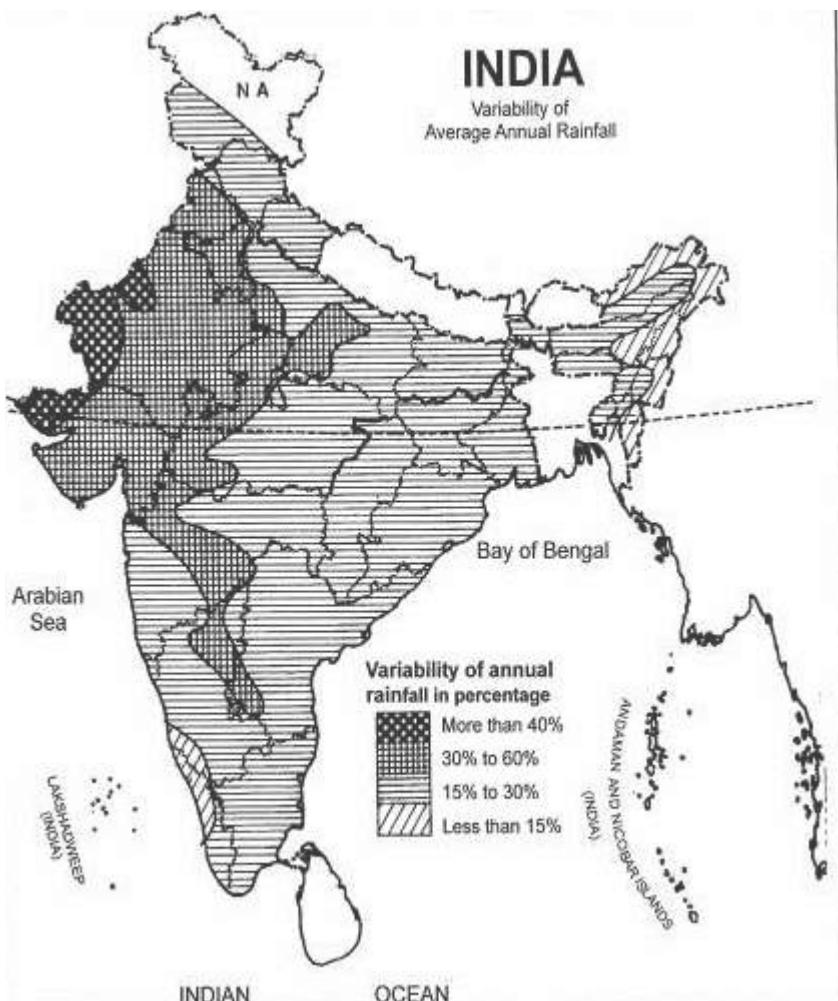




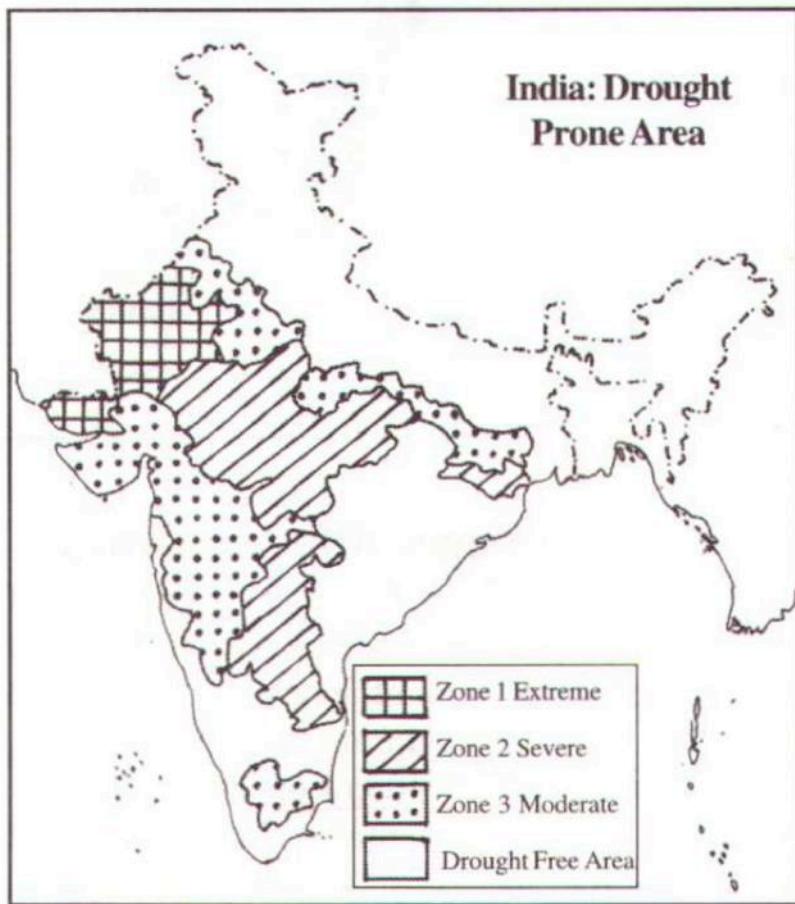




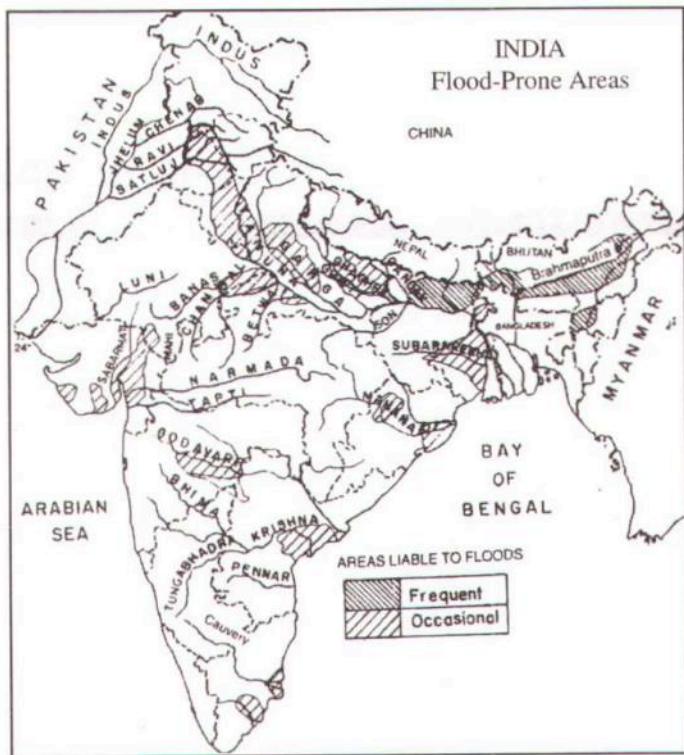




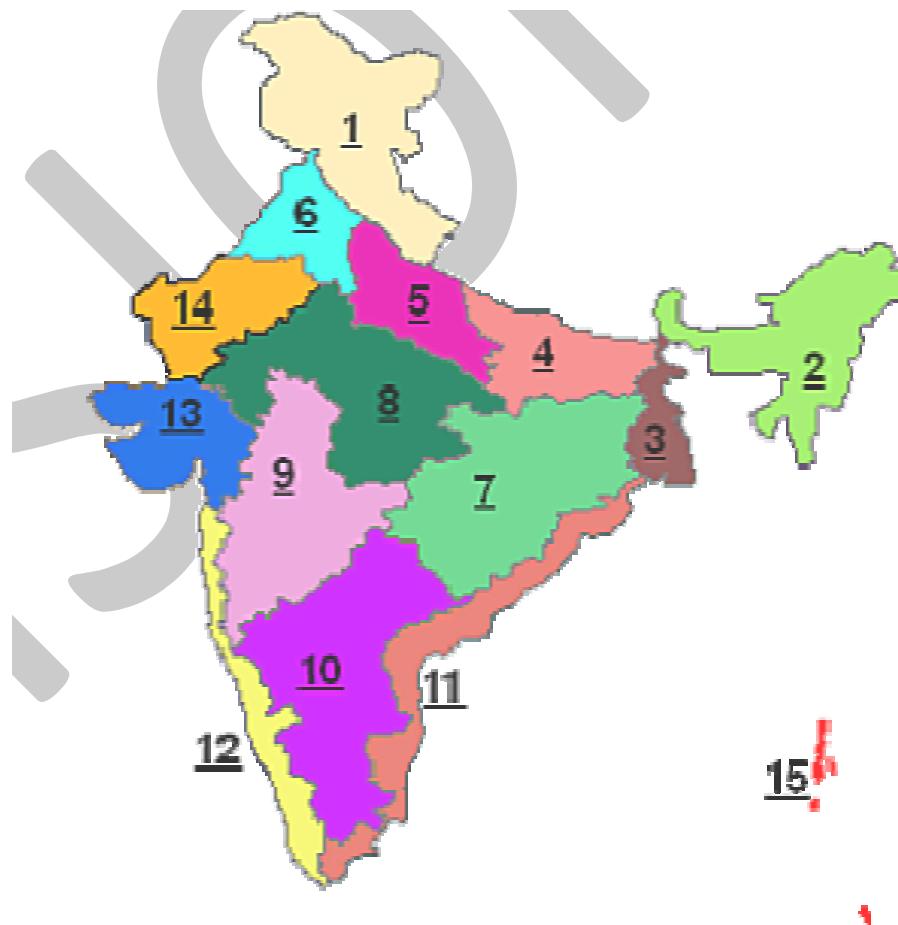




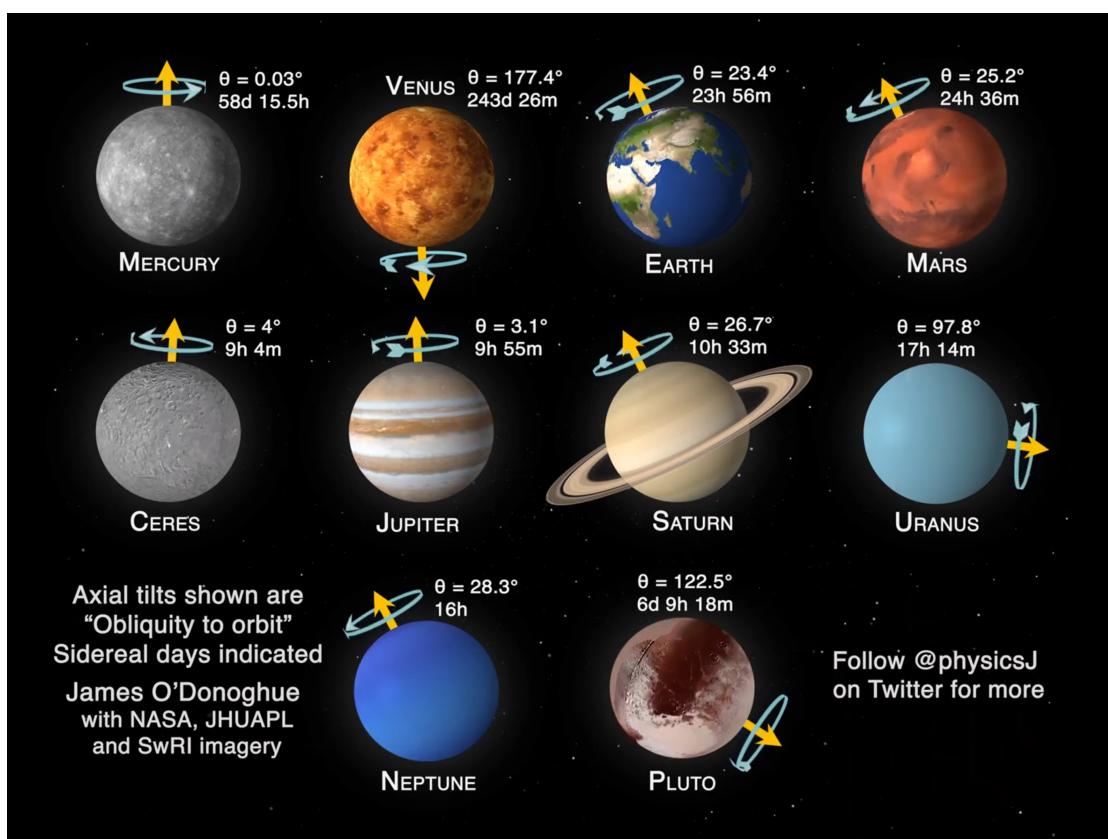
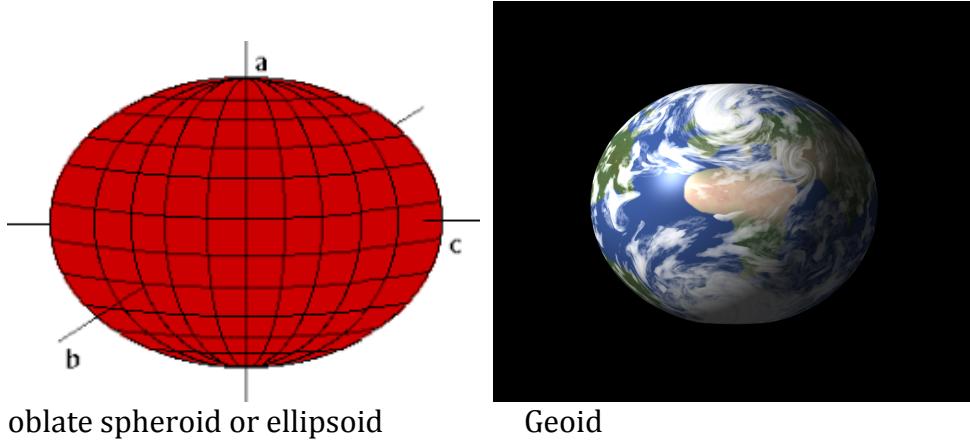
mb- diag. of drought regions



mb – flood regions

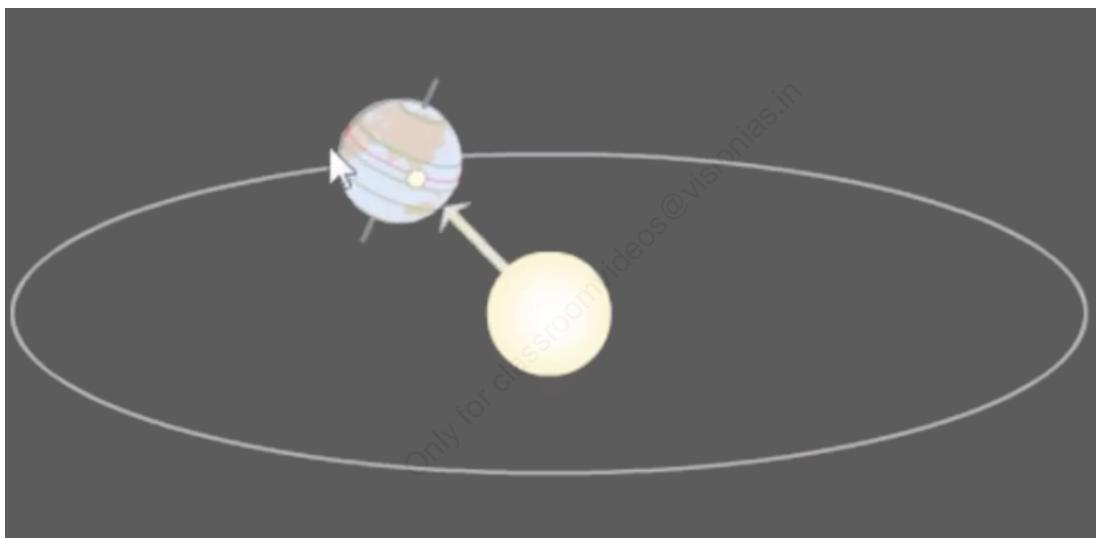
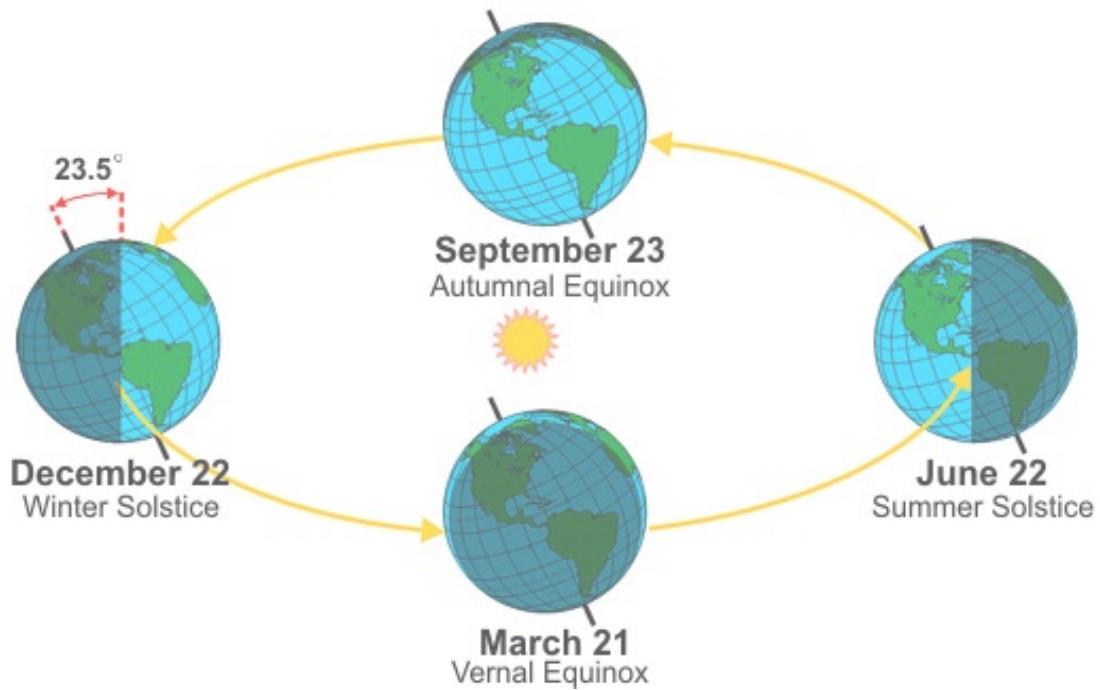


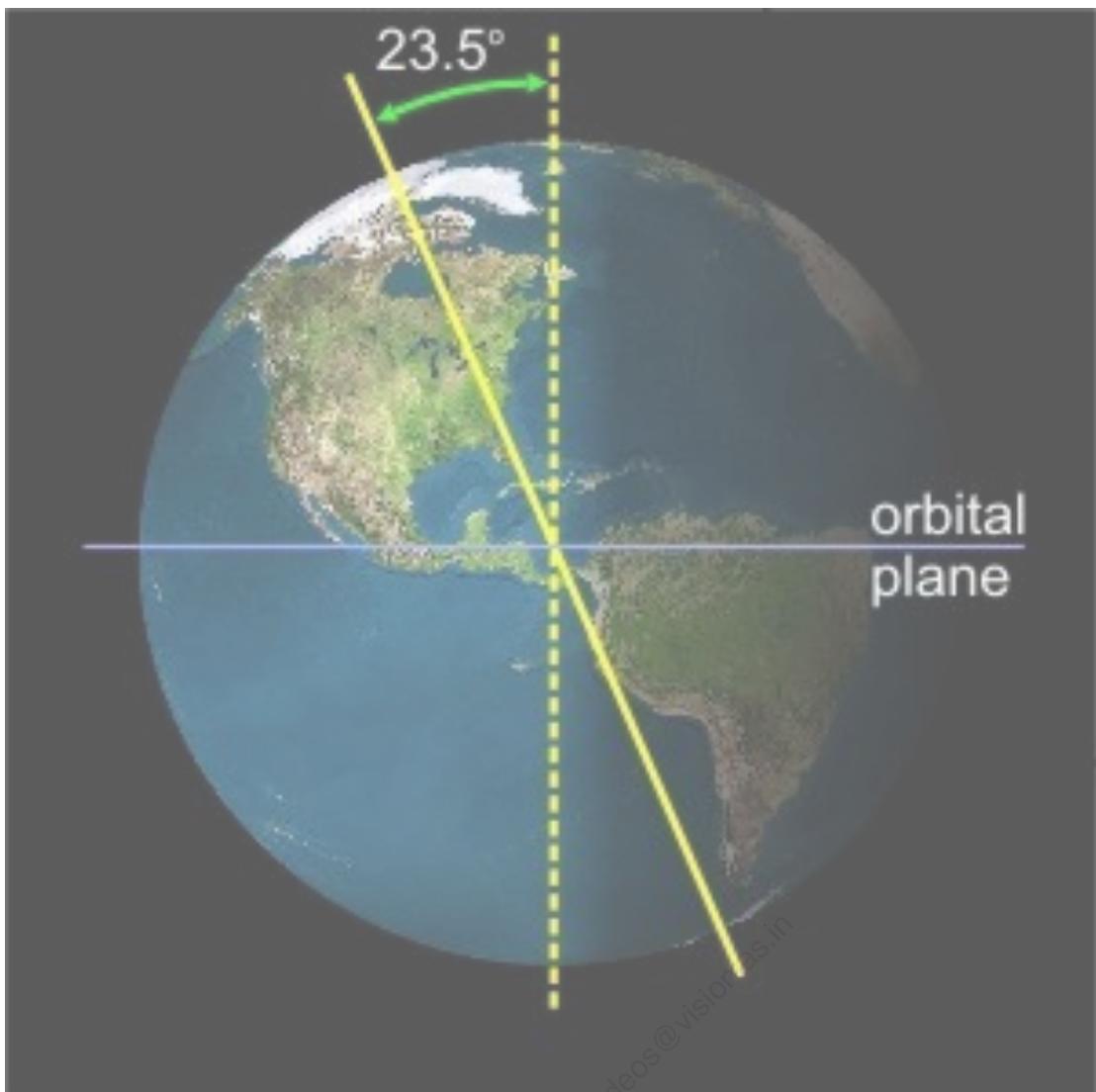
Agro climatic zones of India :- (Planning commission 1989)



Earth and other planets rotating. See the DIRECTION and TILT

Below diagrams for understanding orbit and Orbital plane and earth's tilt

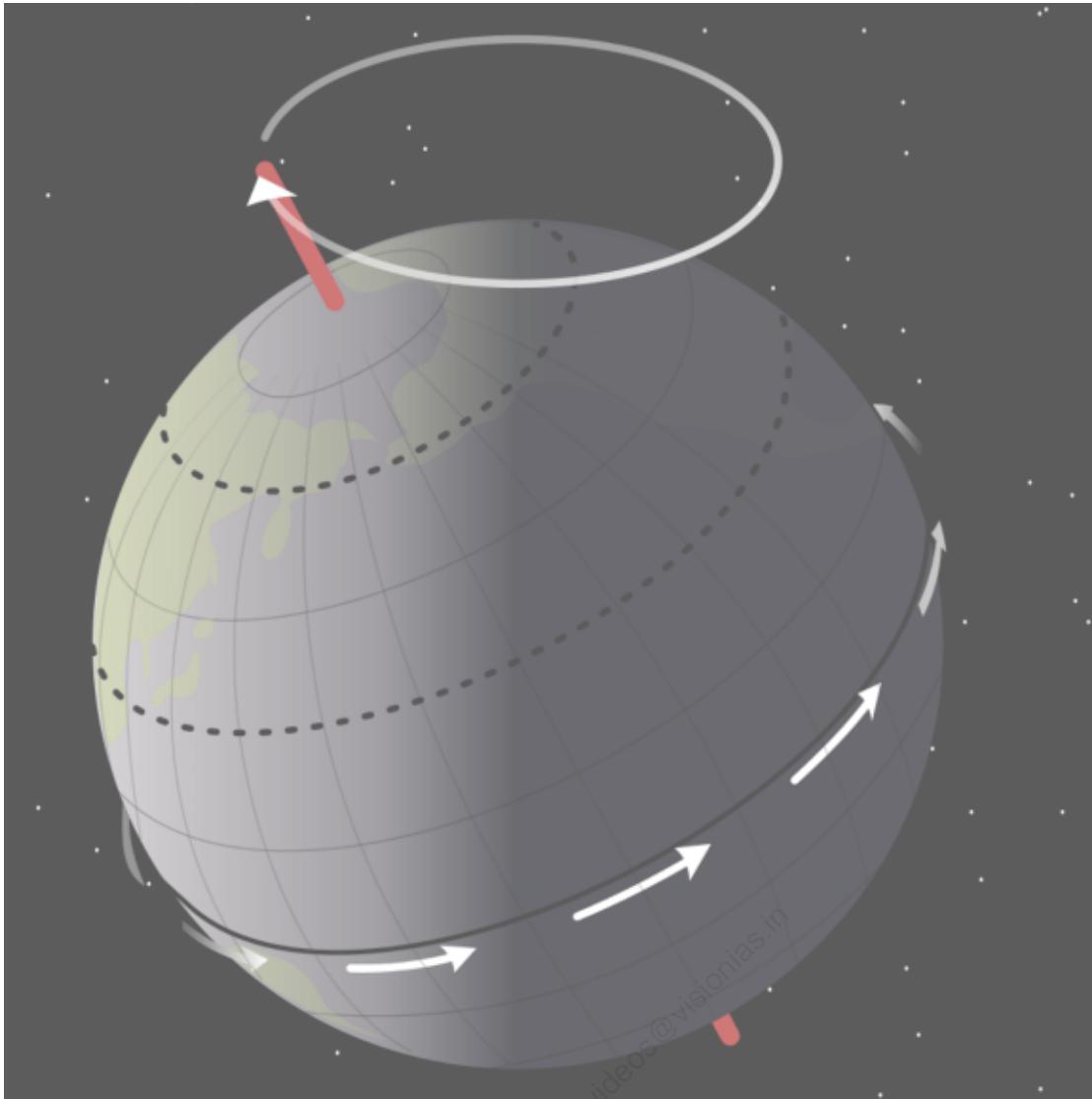




Only for classroomvideos@visionsias.in

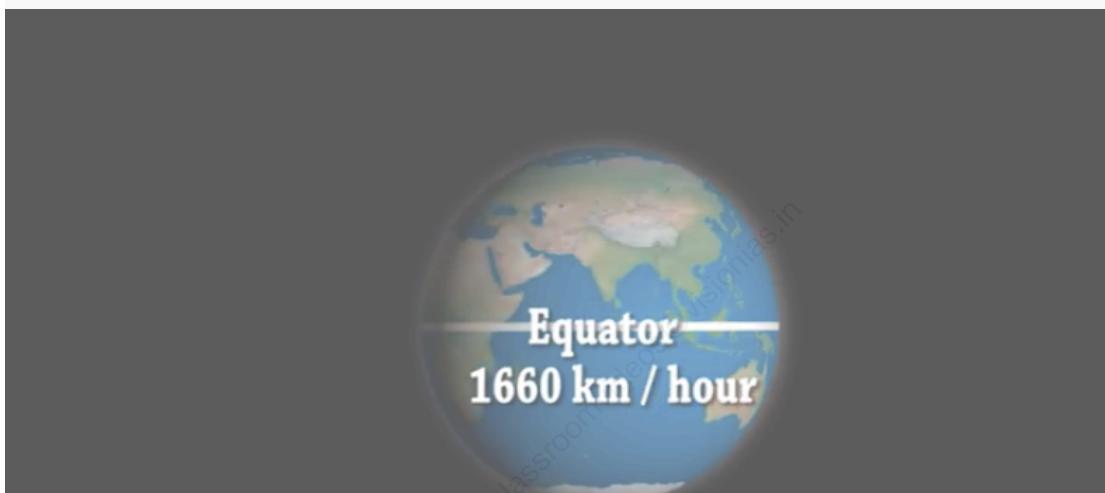
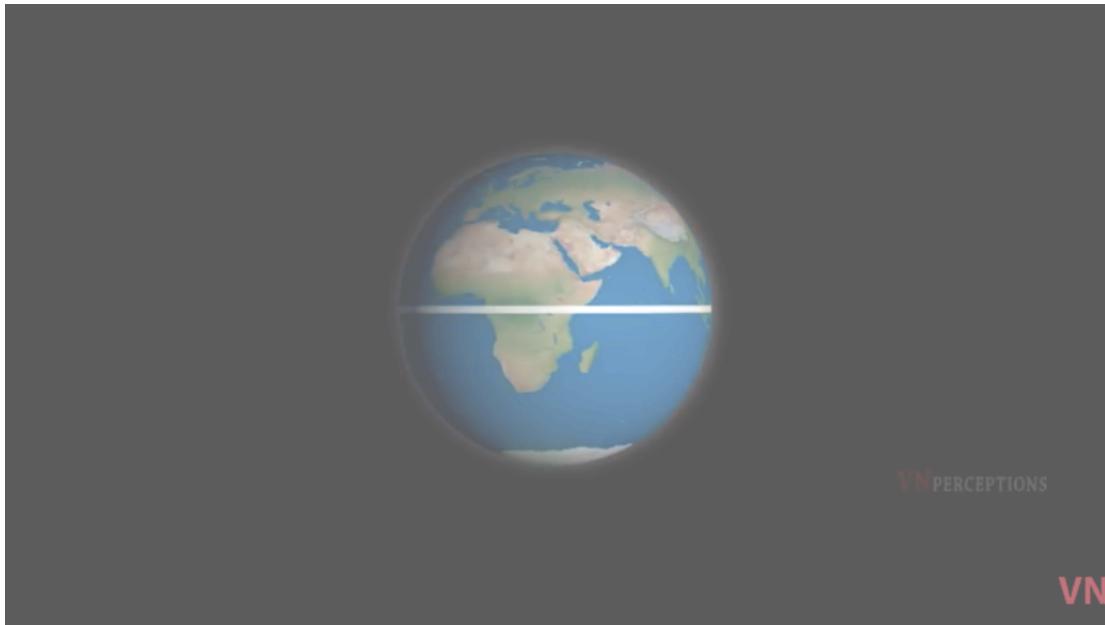
Direction of rotation

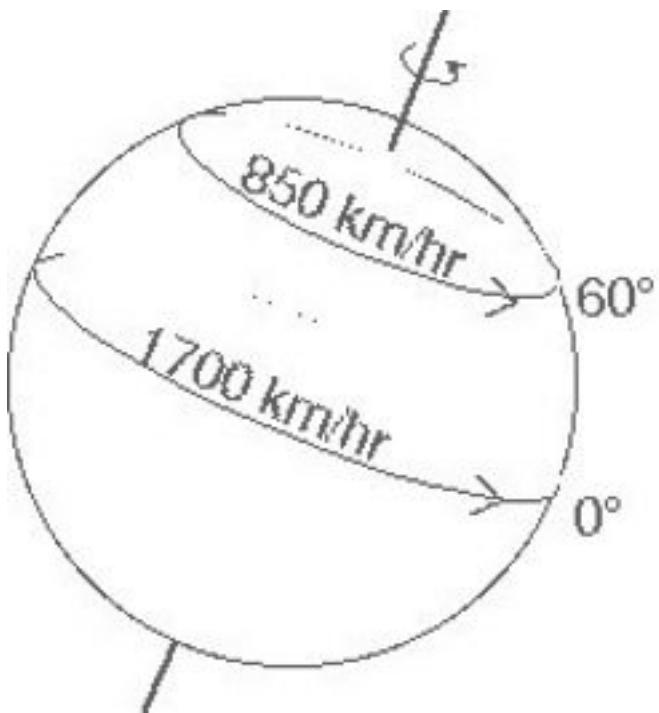




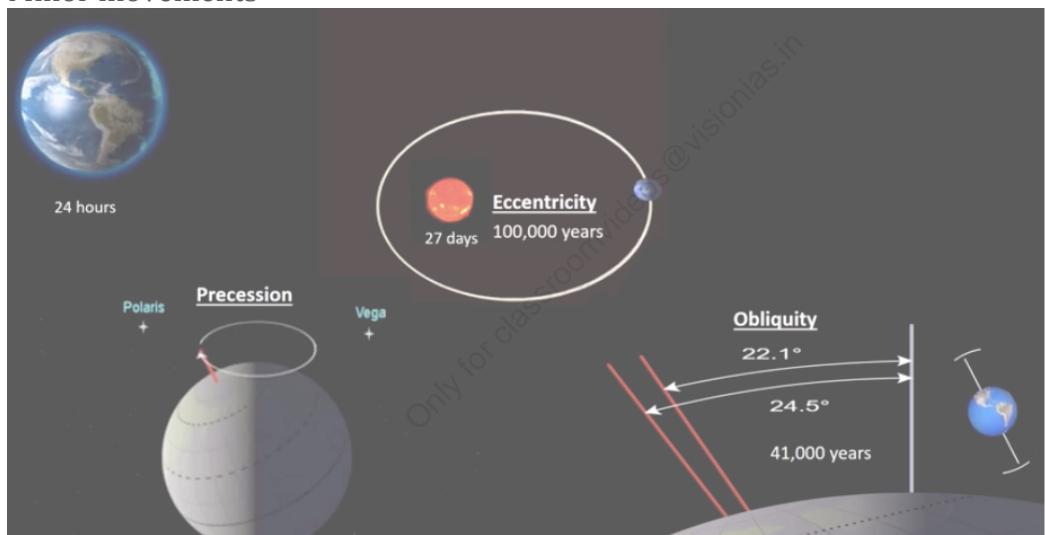
Only for classroom videos@visionias.in

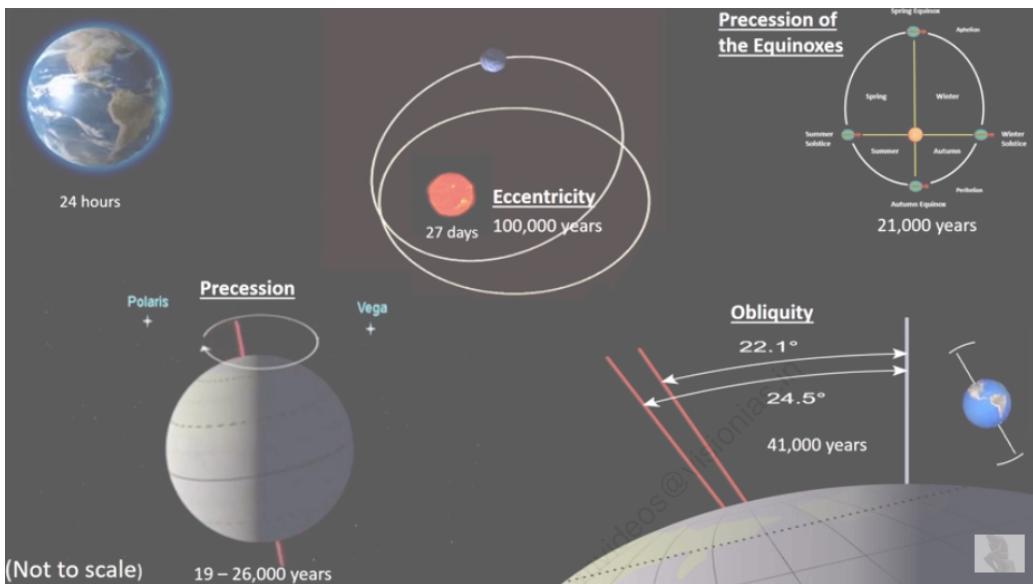
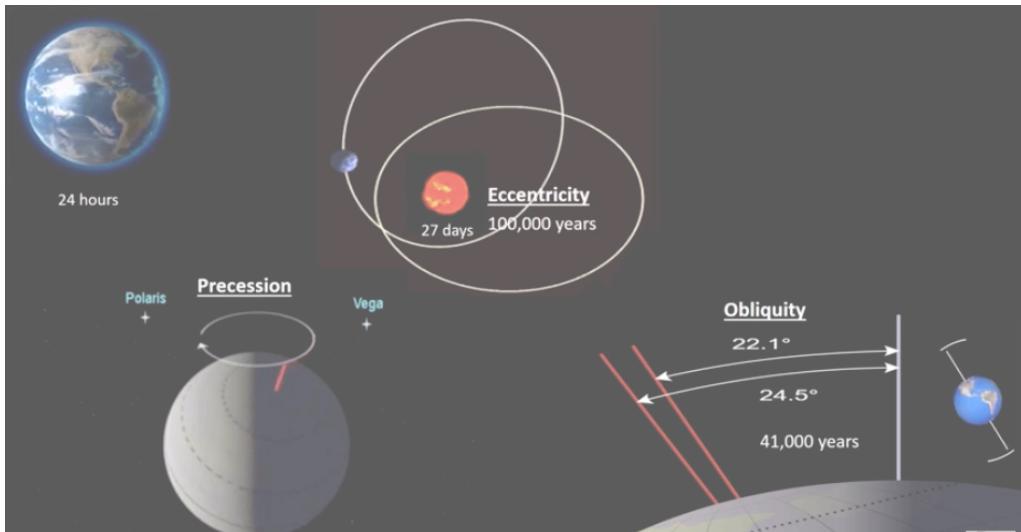
Speed of rotation





Minor movements

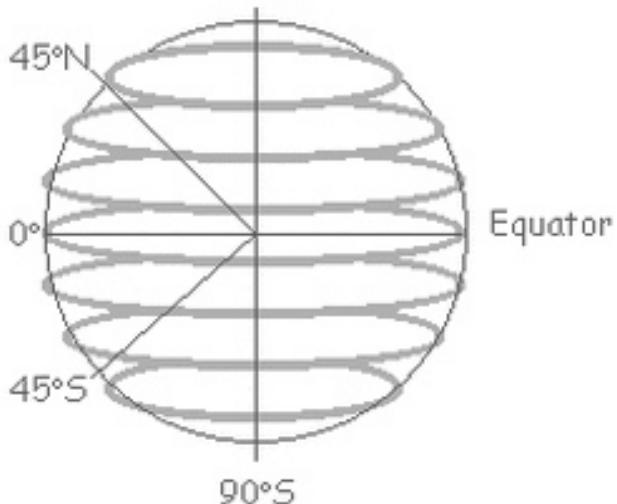




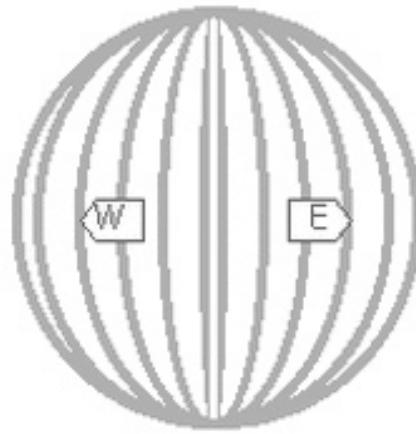
Right now, the Earth's rotation axis happens to be pointing almost exactly at **Polaris**. But about 13,000 years from now the precession of the rotation axis will mean that the bright star **Vega** will be the **North Star**.

**Latitude
(North/South)**

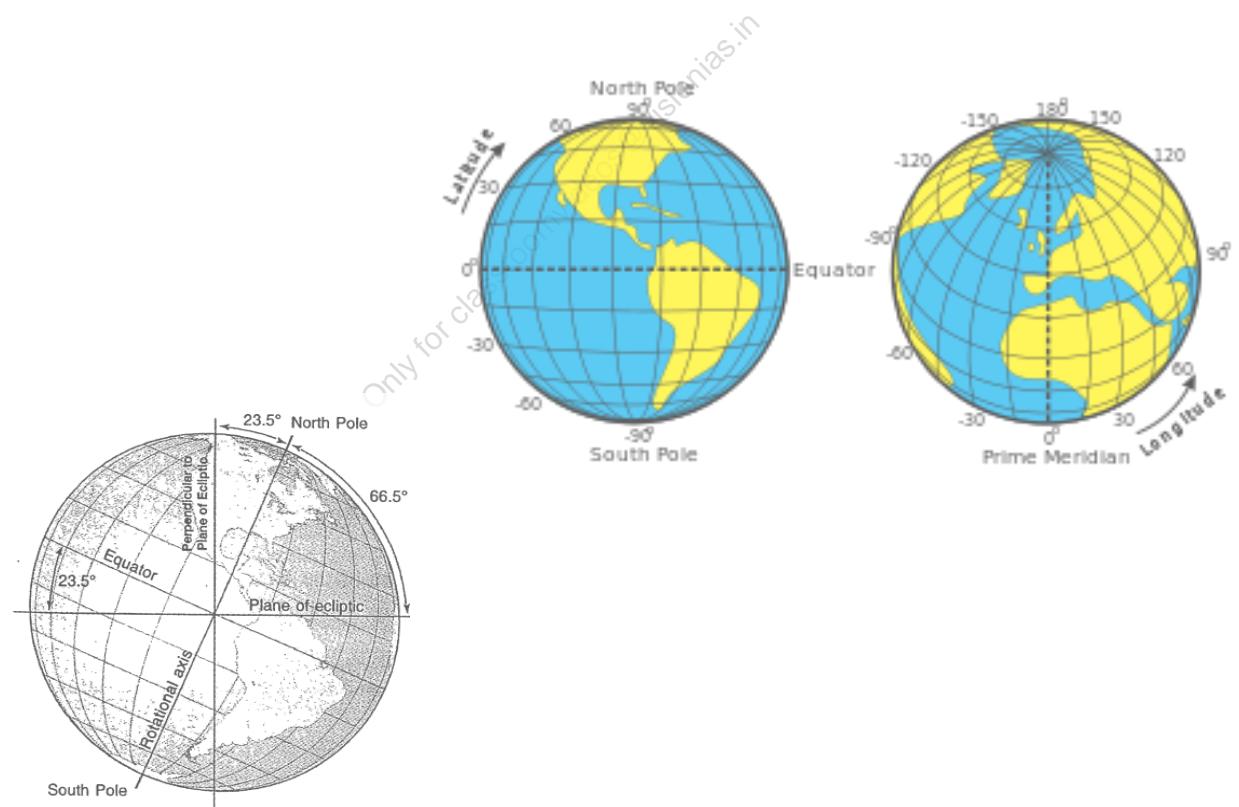
**Longitude
(West/East)**

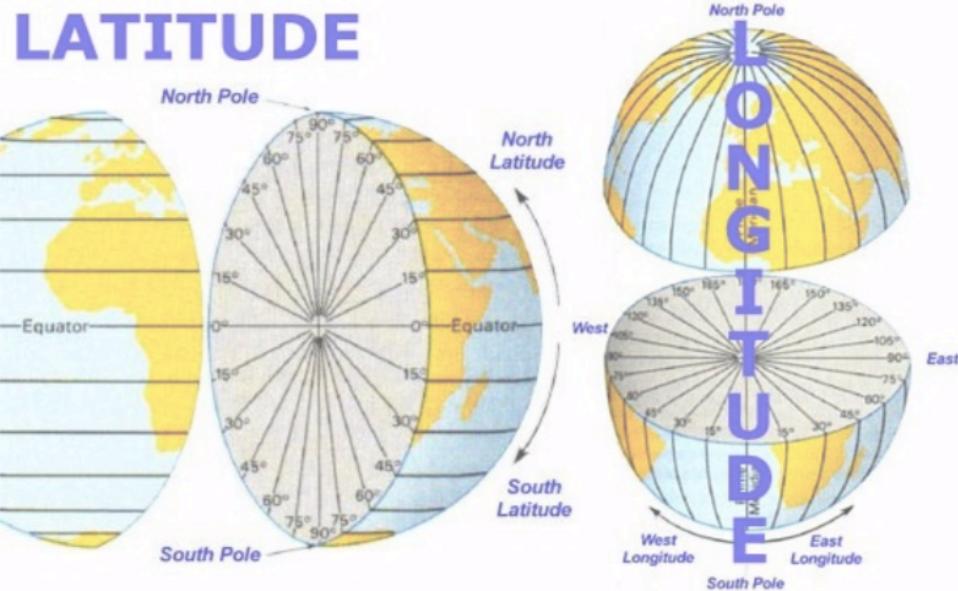


Latitude varies from 0° at the equator to 90° North and South at the poles

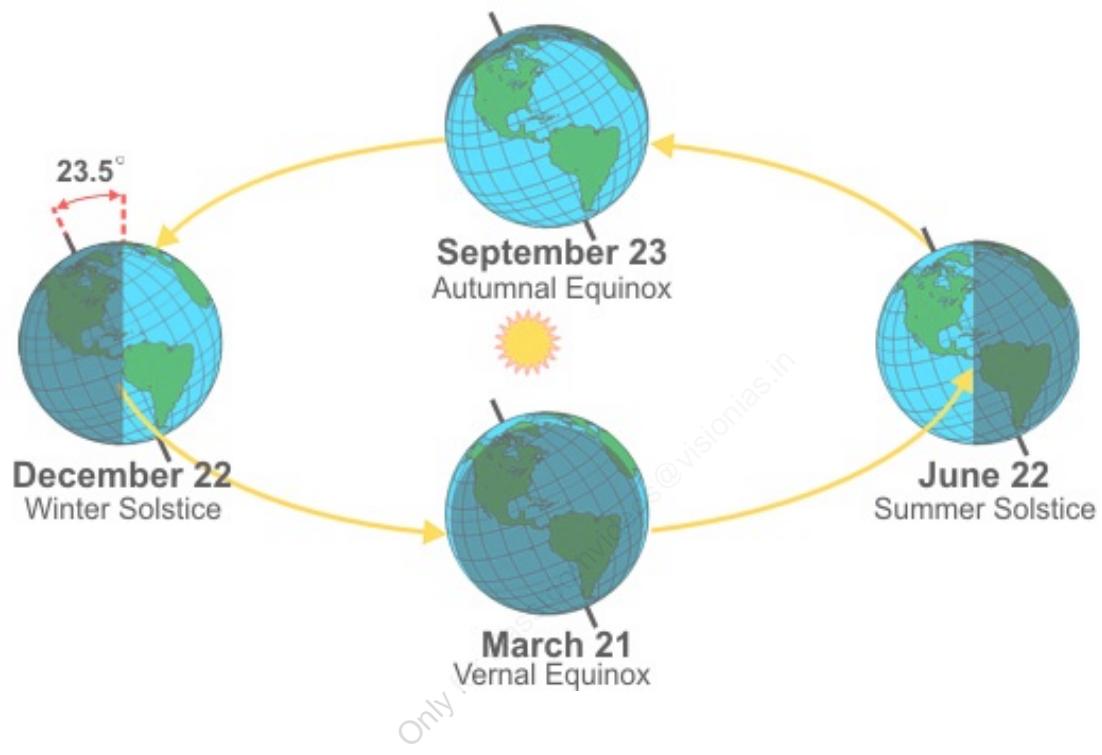
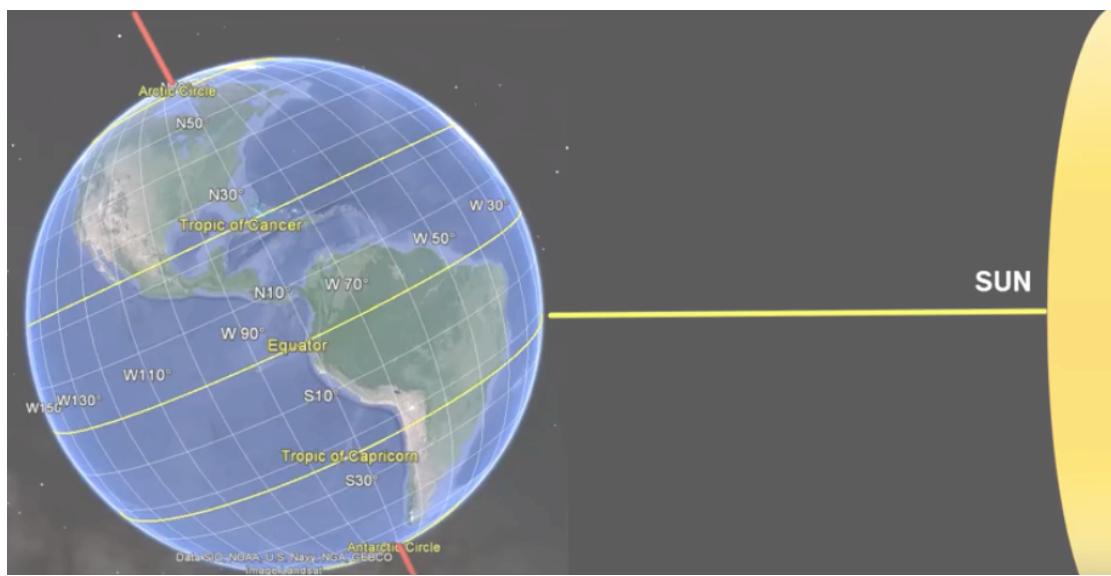


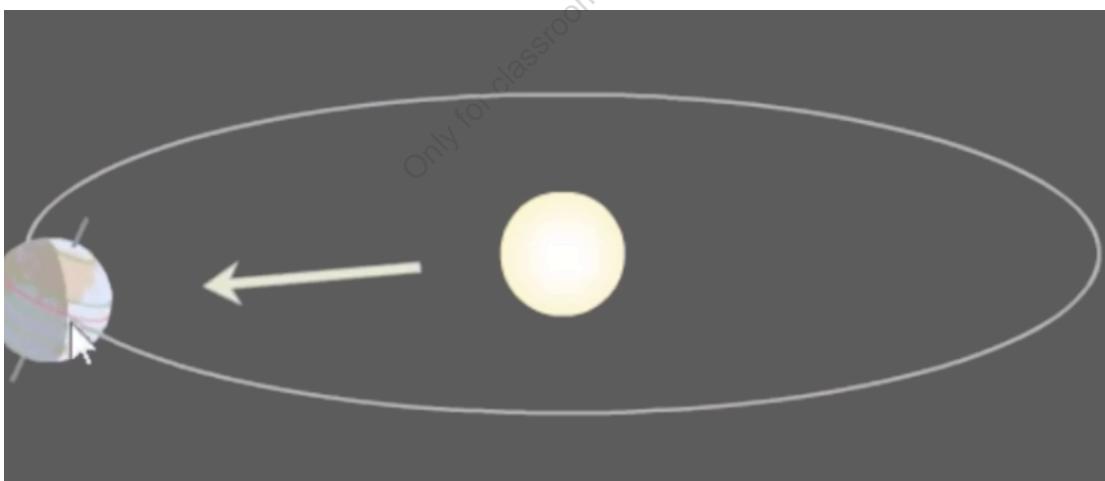
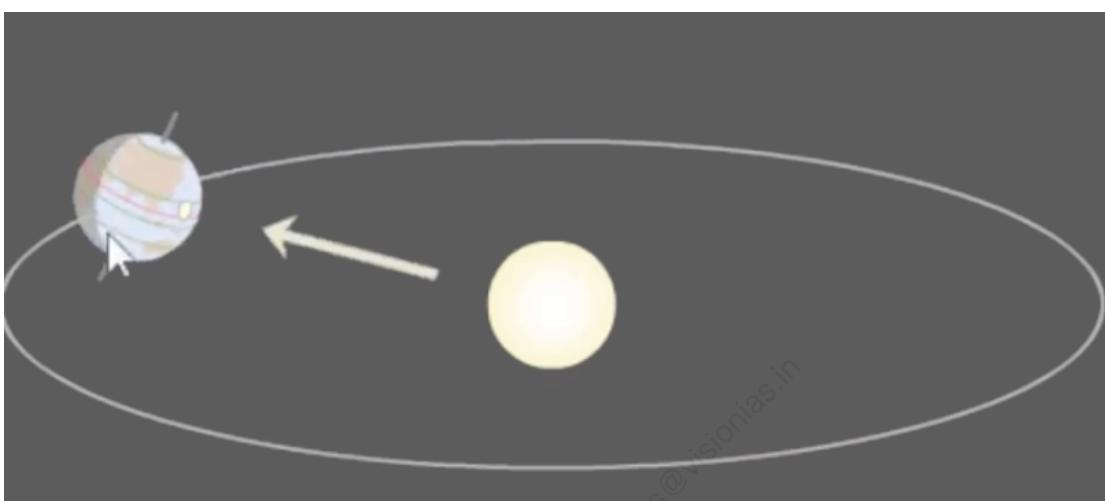
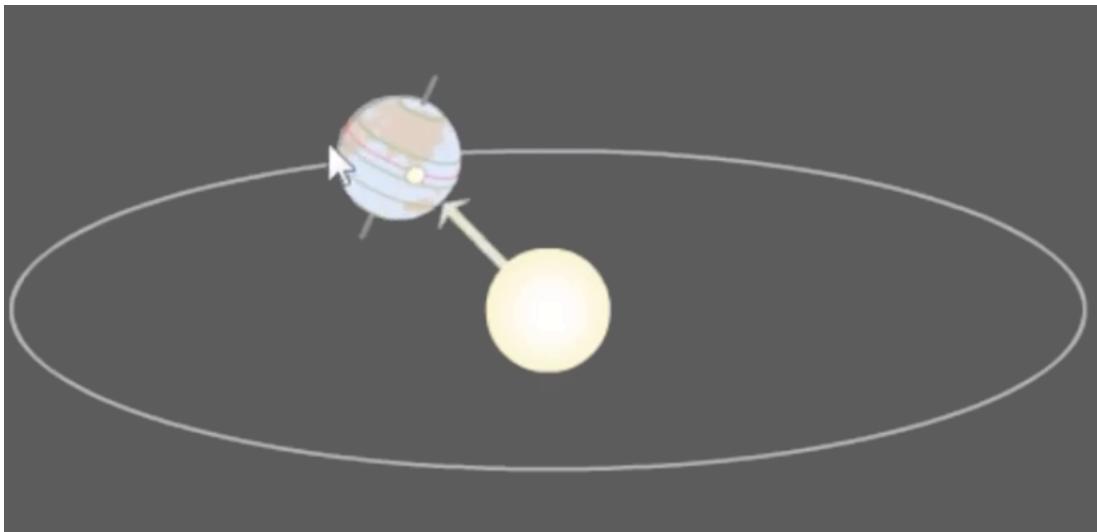
Longitude varies from 0° at Greenwich to 180° East and West

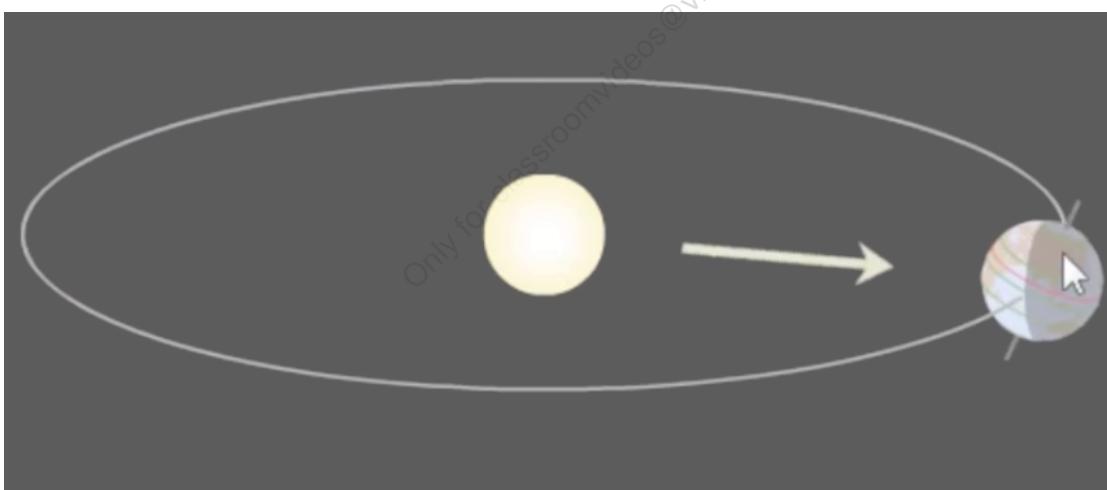
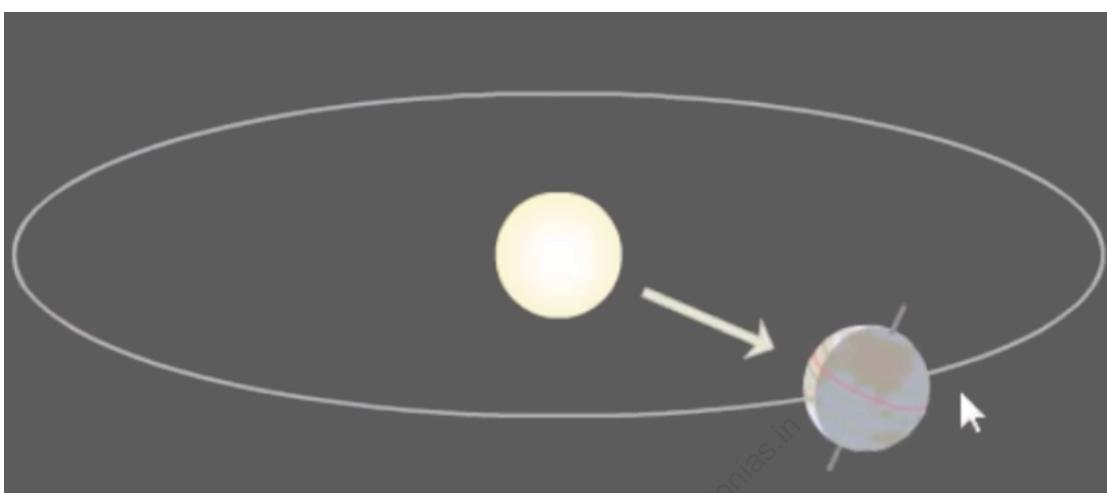
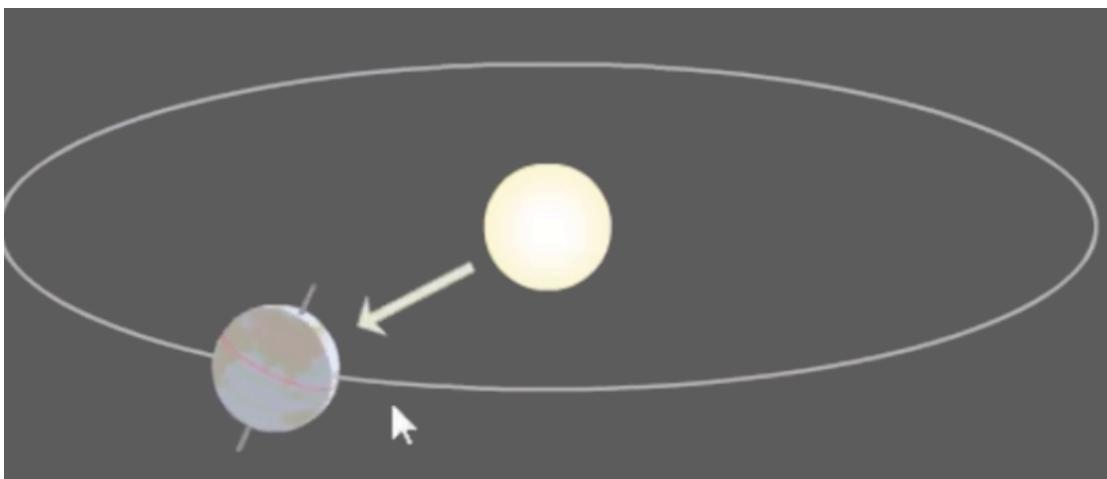


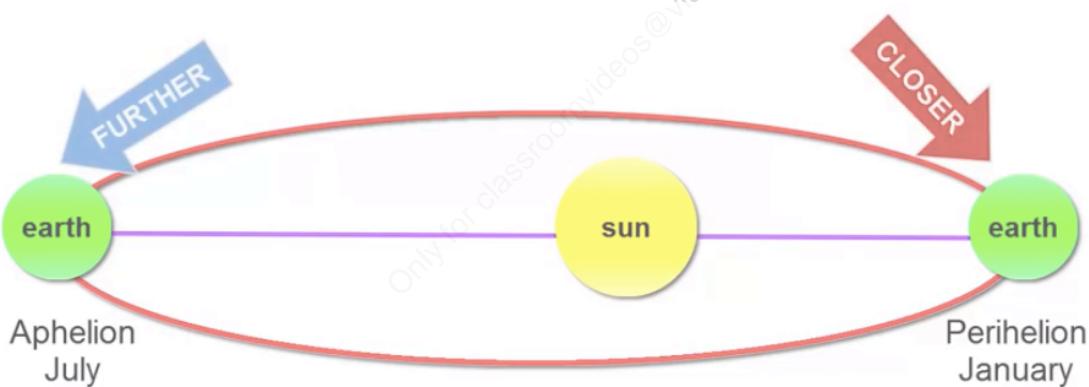
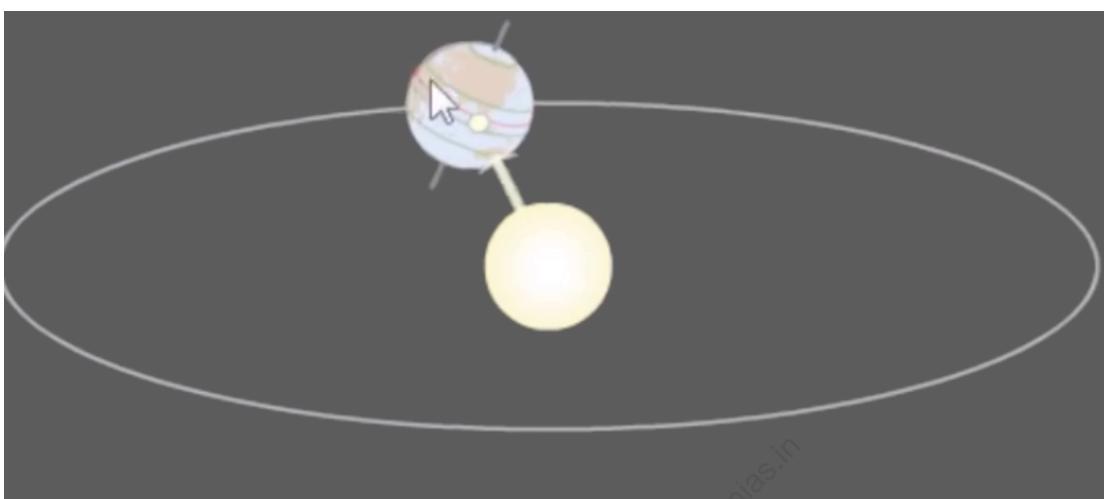
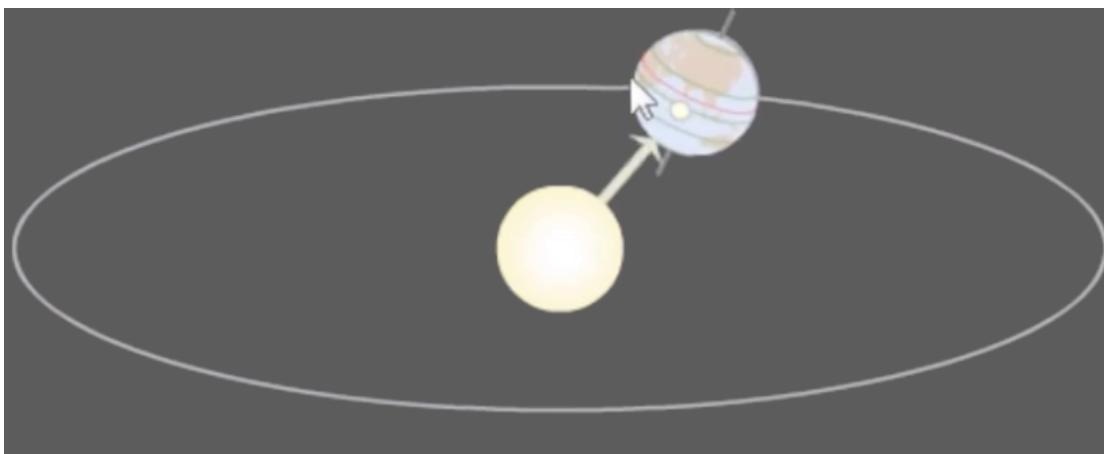


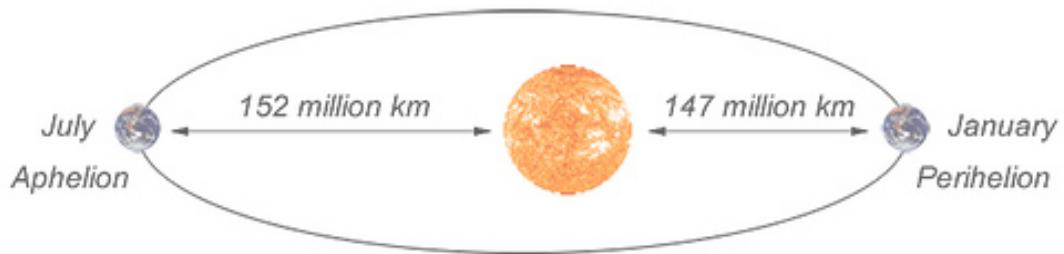
Only for classroomvideos@visionias.in



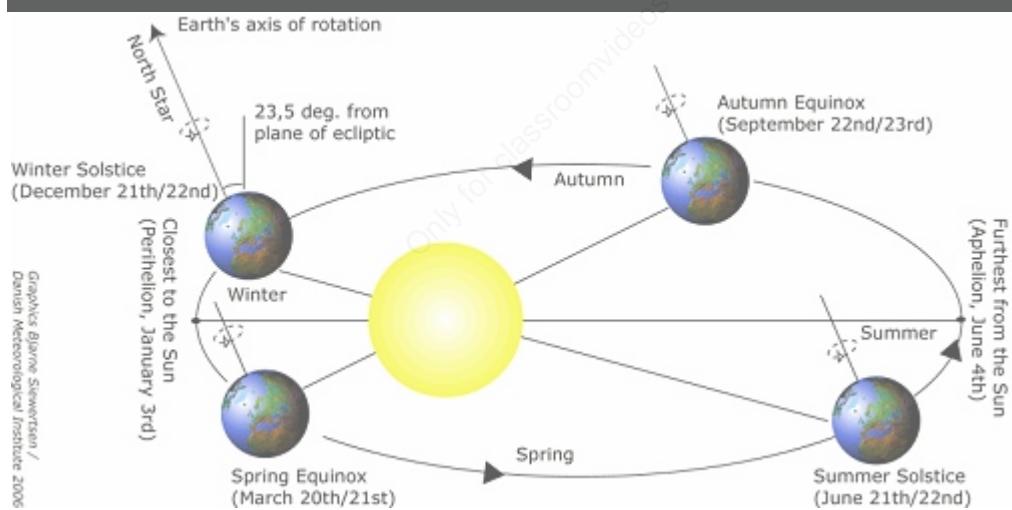
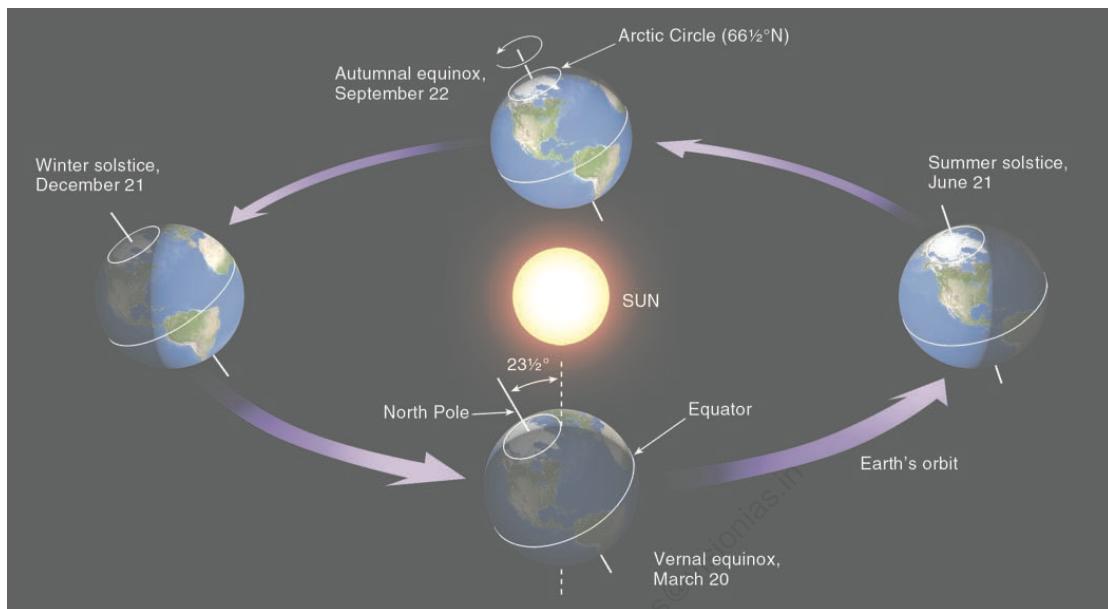


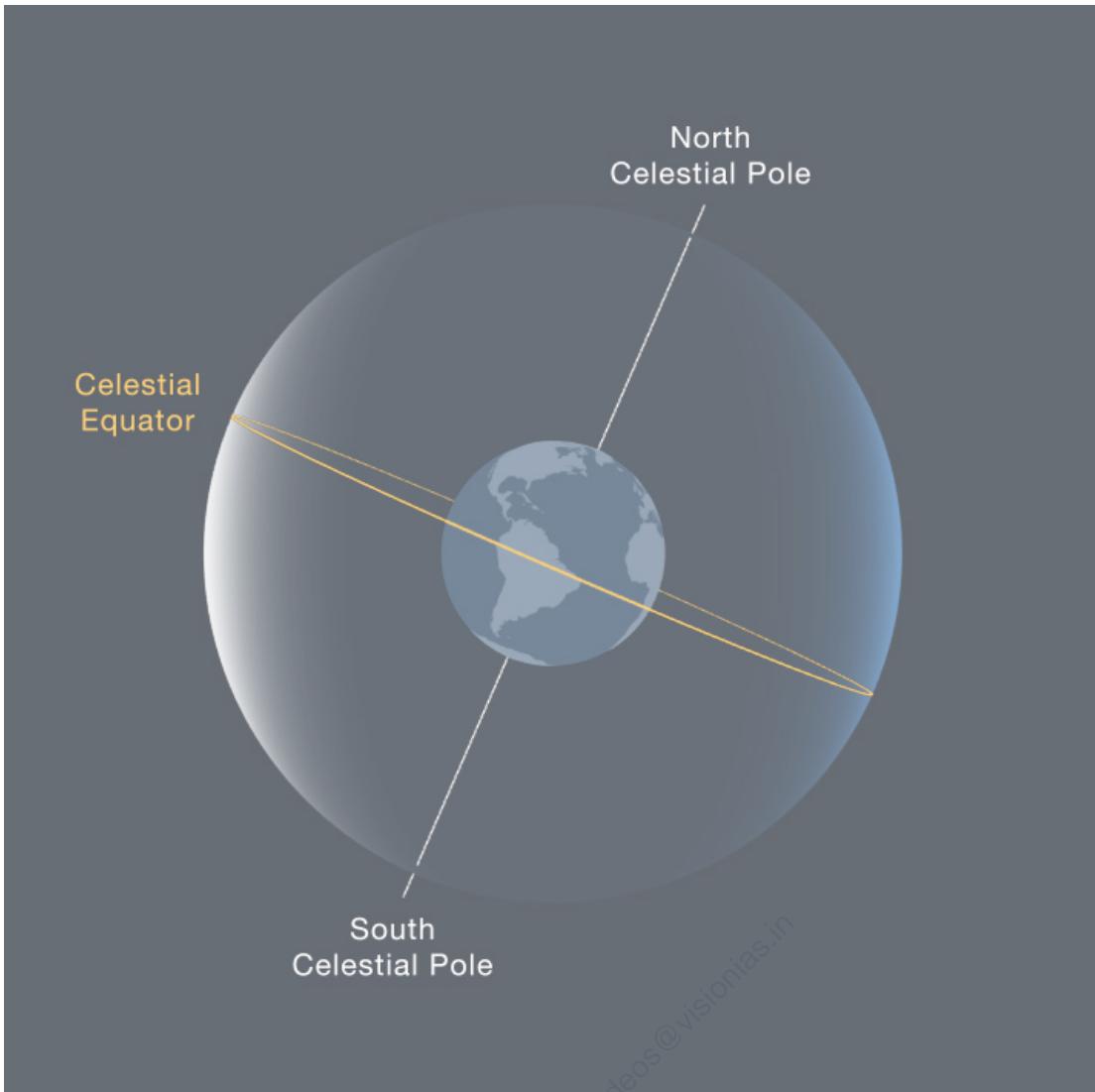




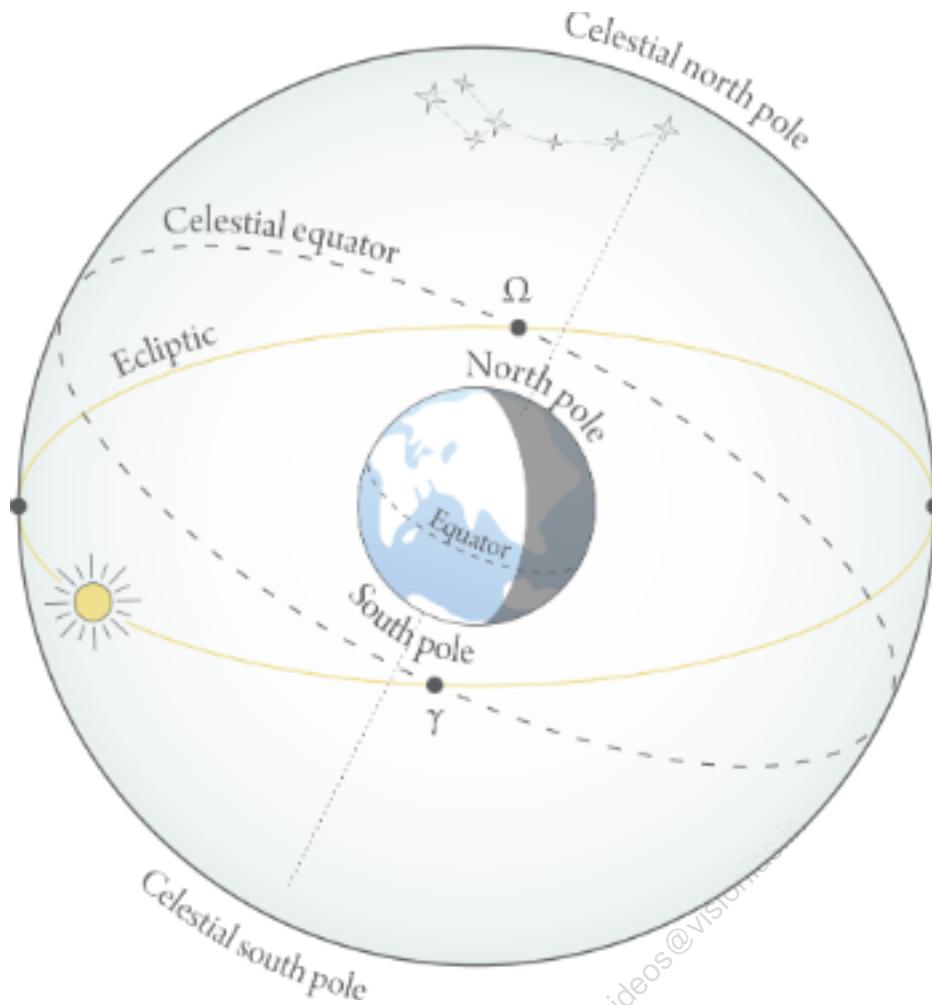


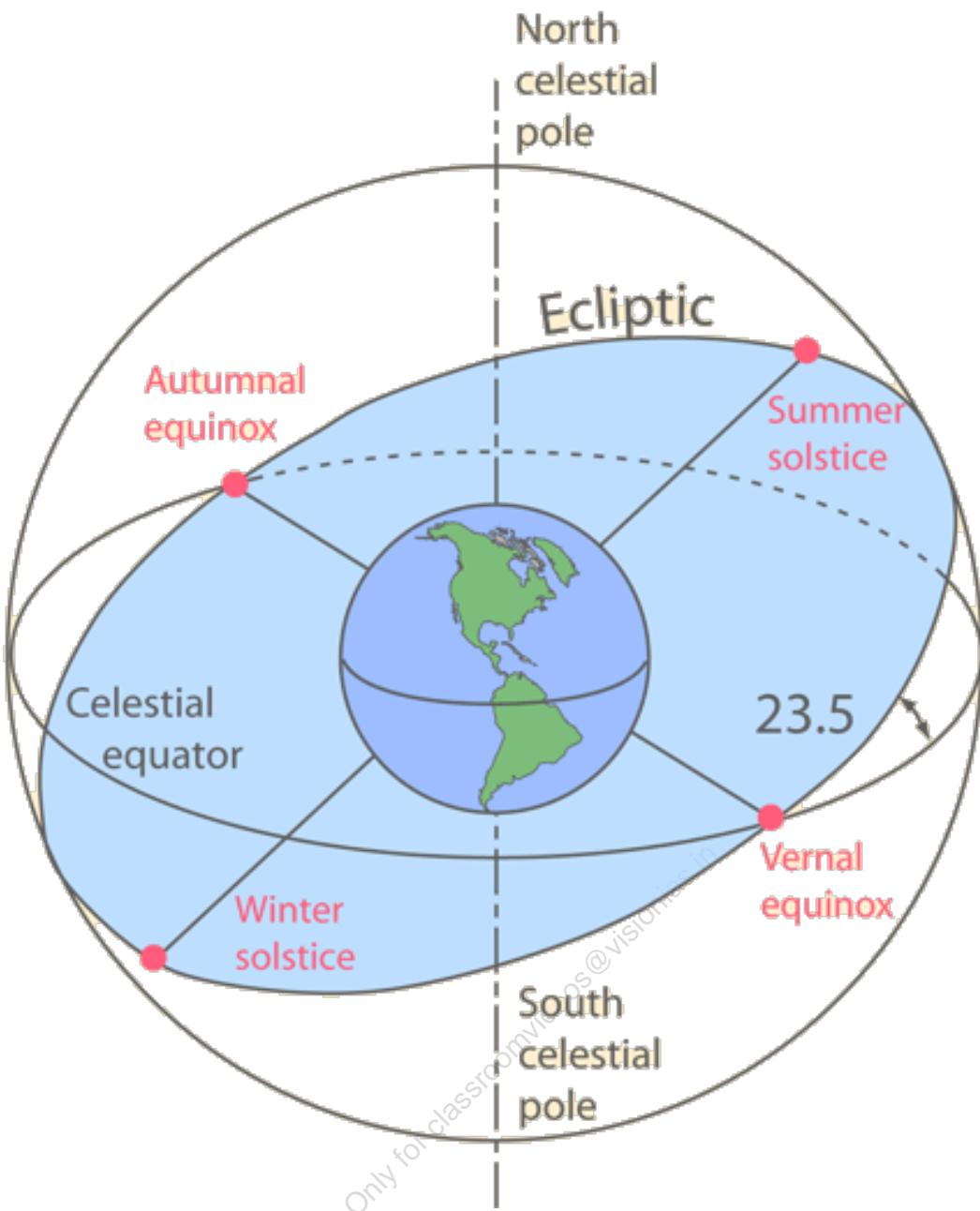
Not to scale



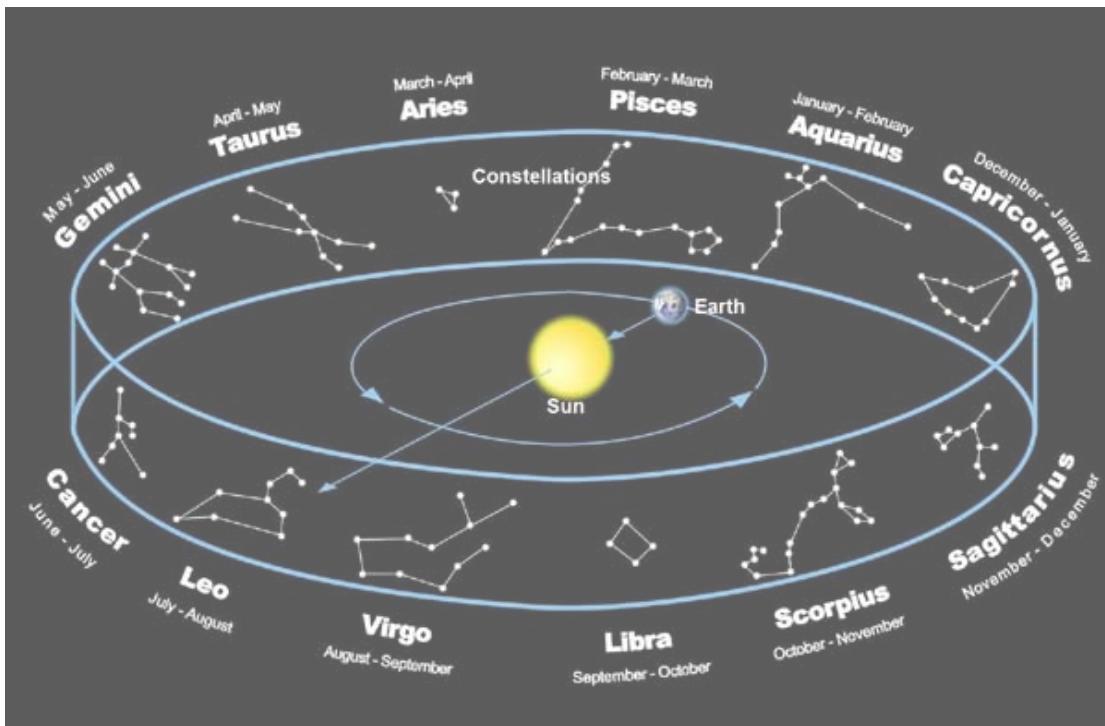


plane of ecliptic

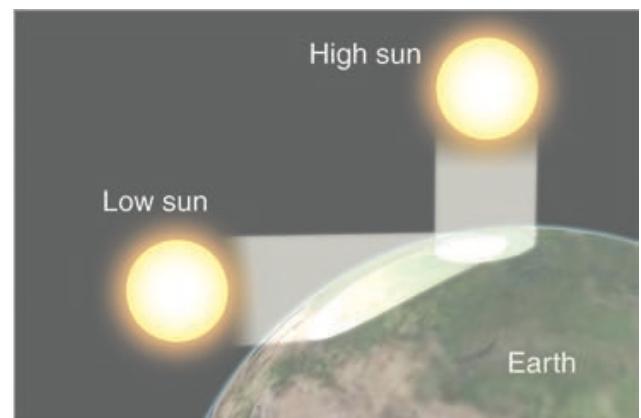
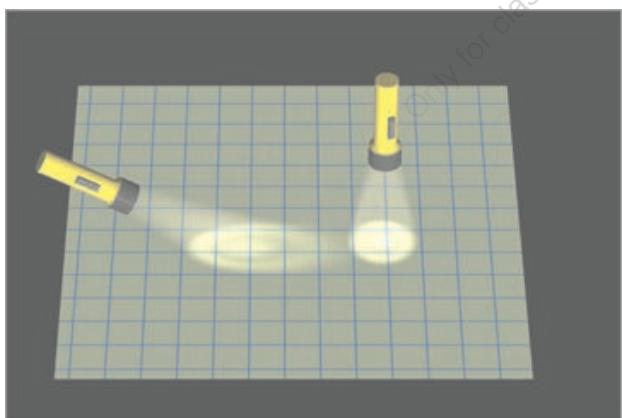
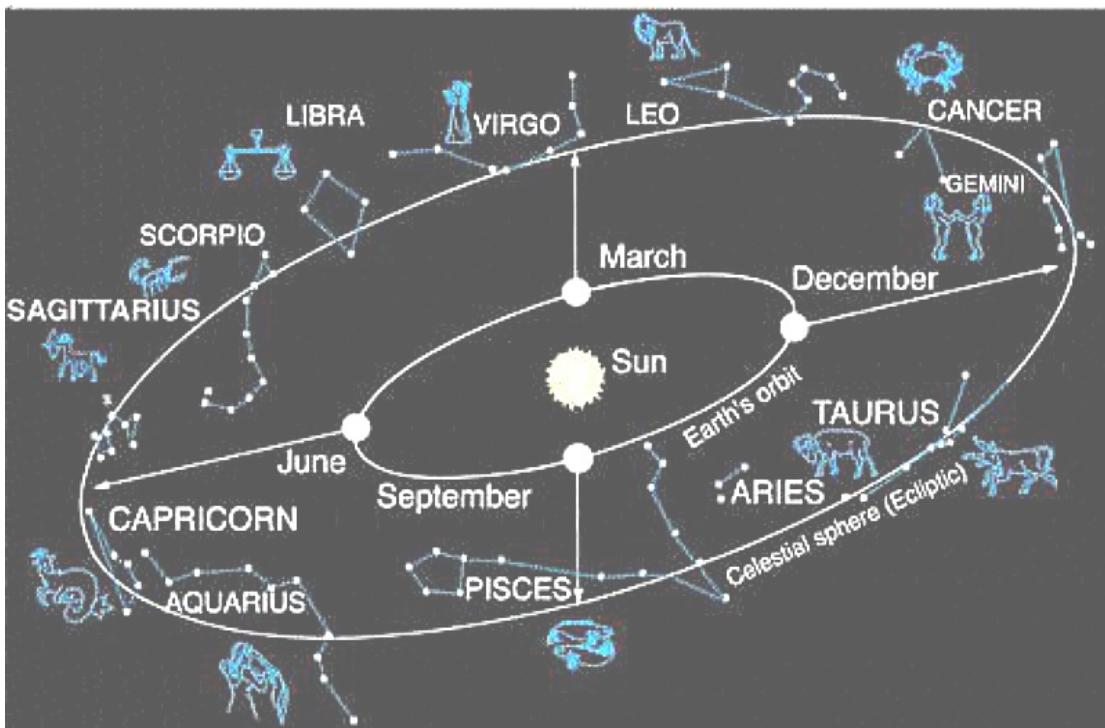


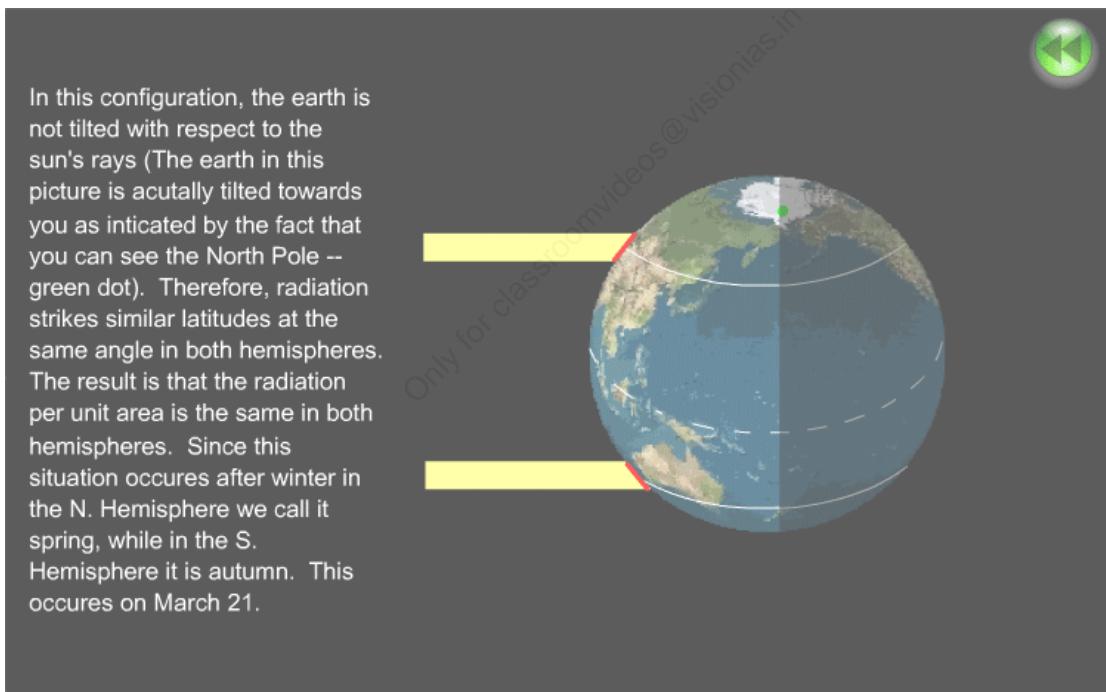
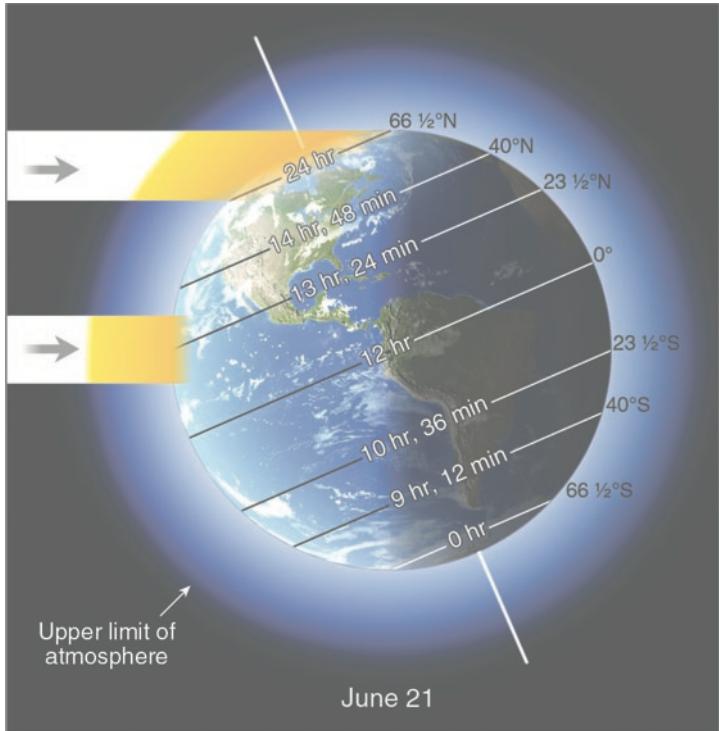


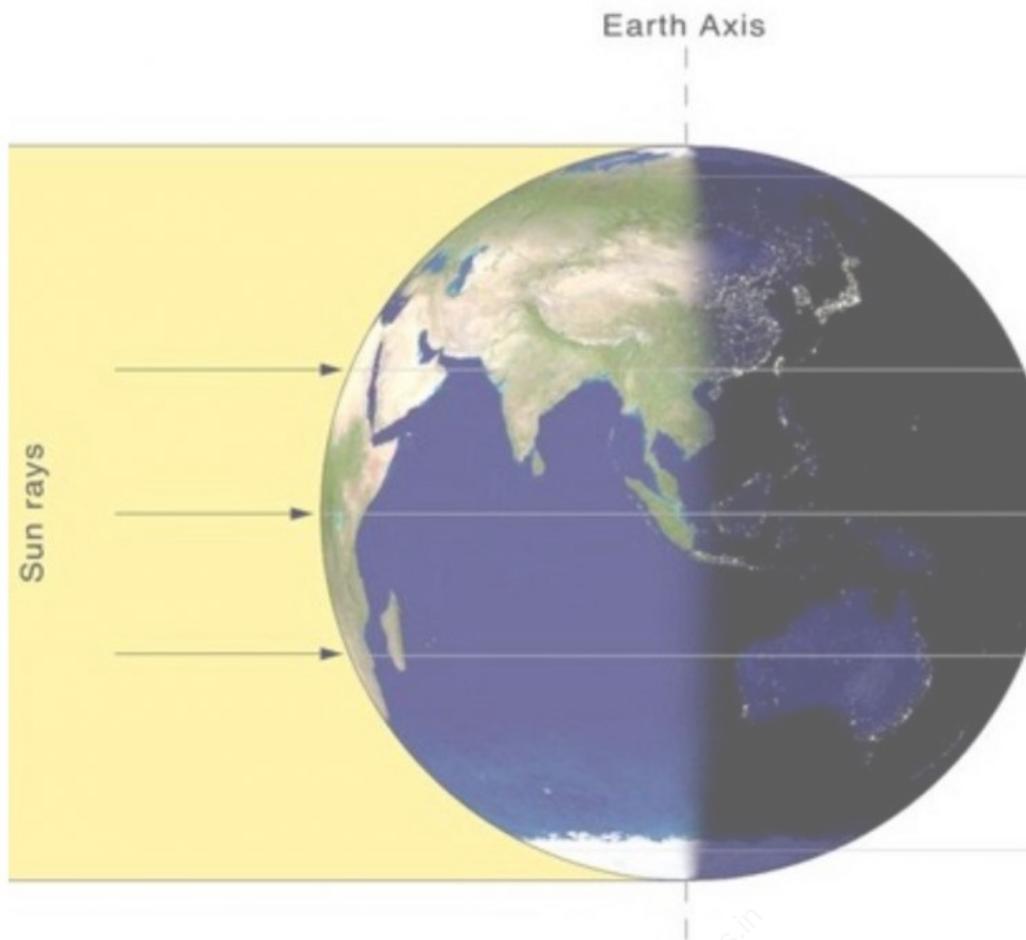
Effects of rotation and revolution



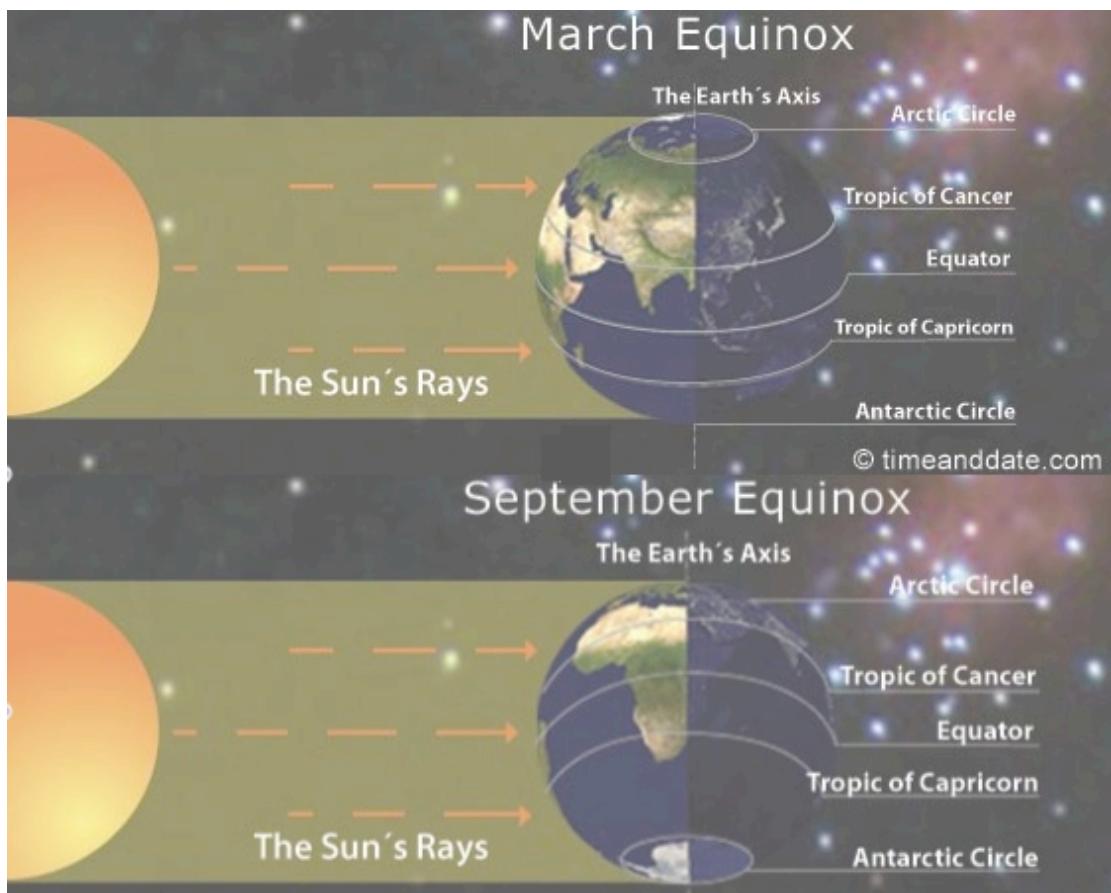
Only for classroomvideos@visionias.in



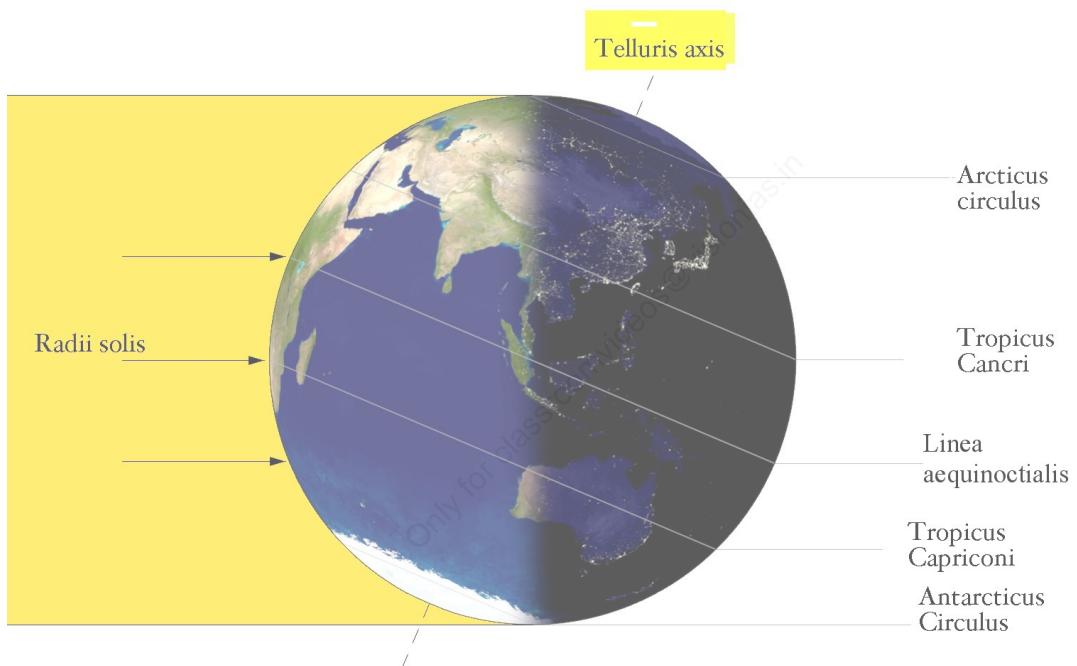
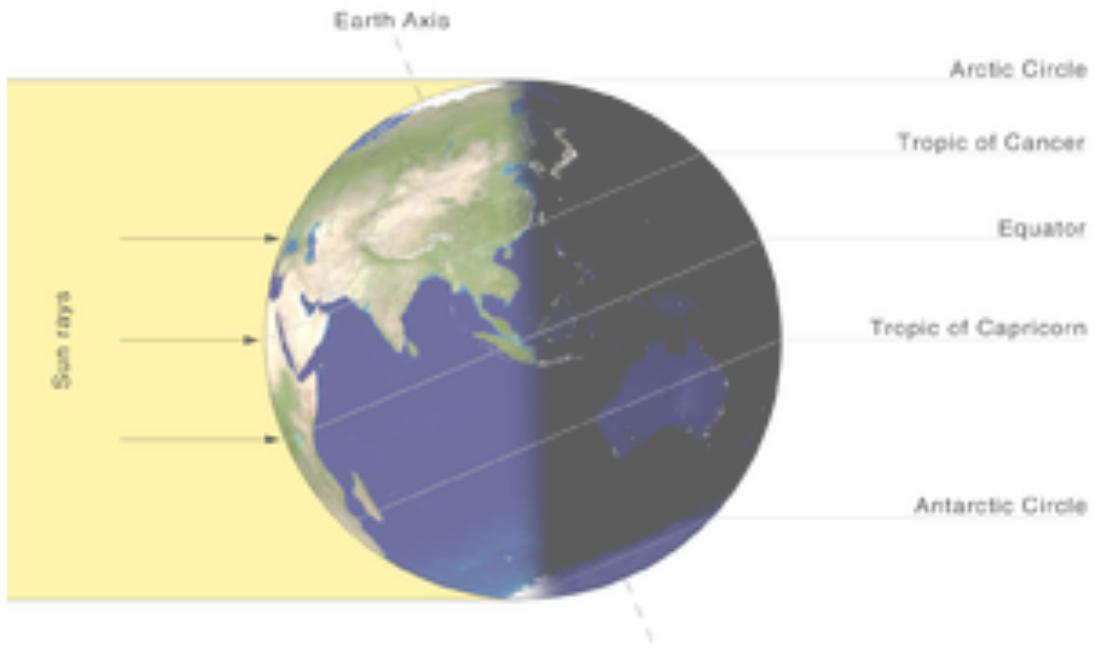


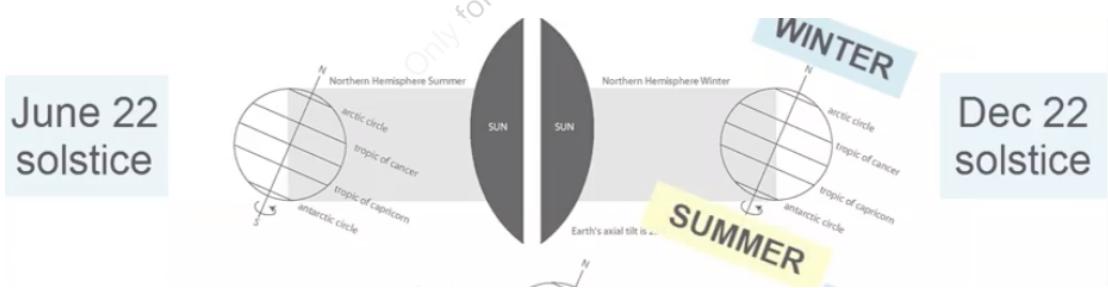
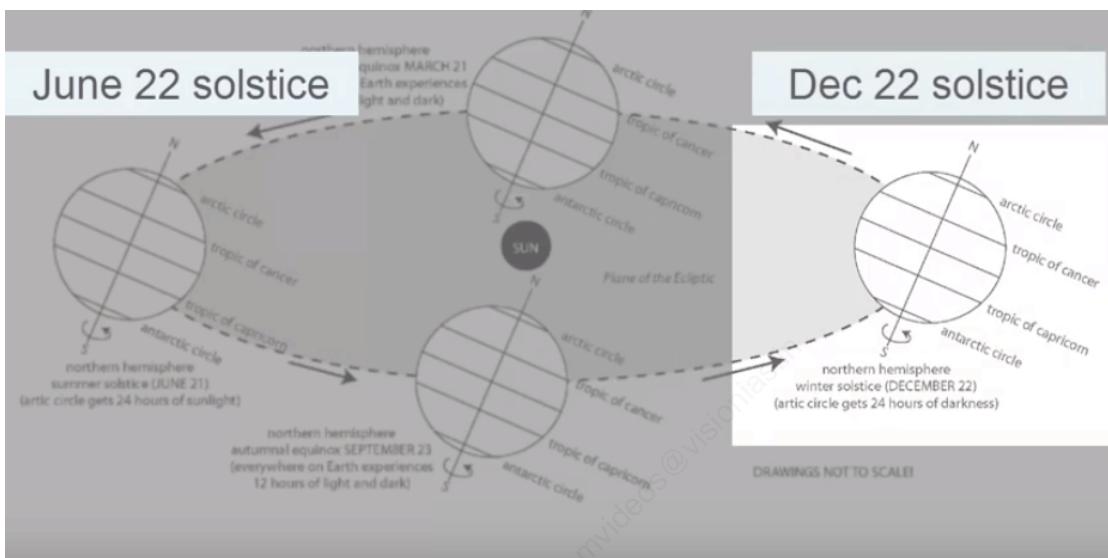
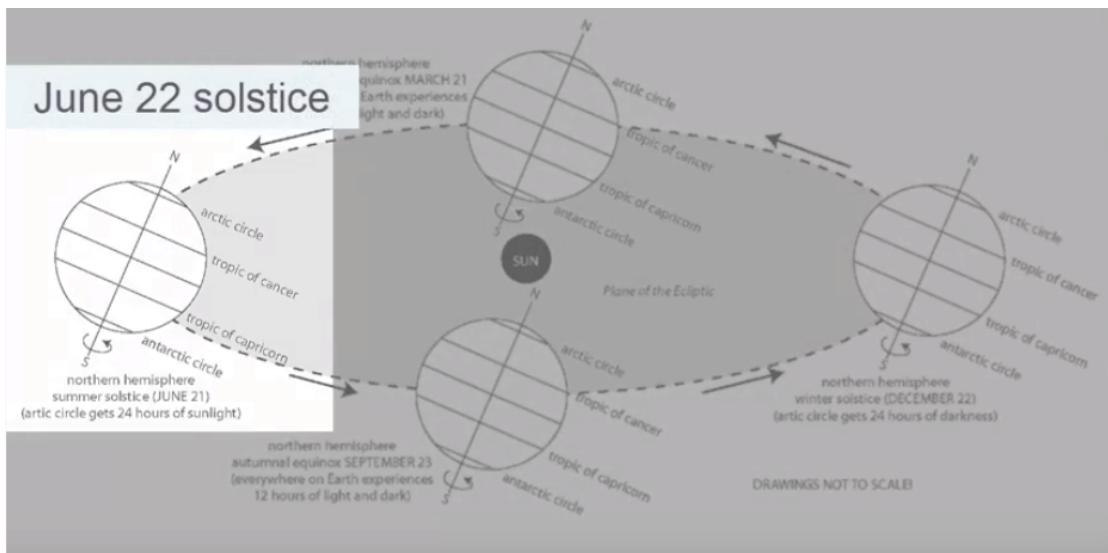


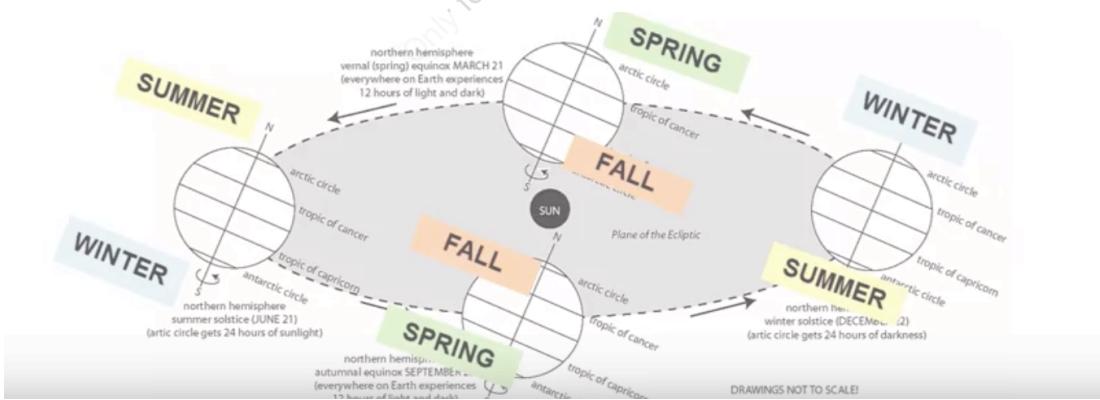
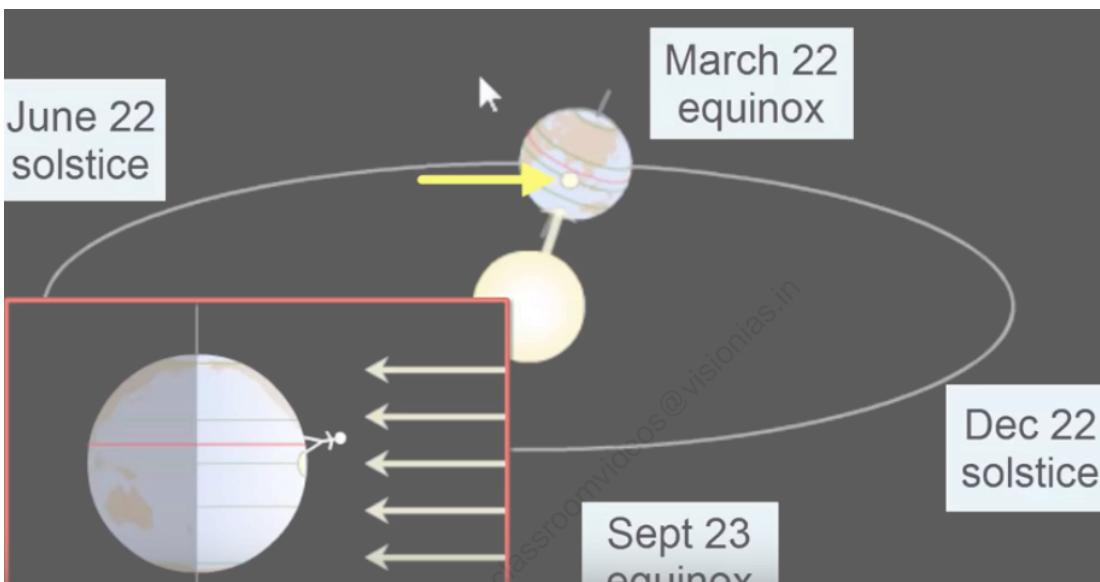
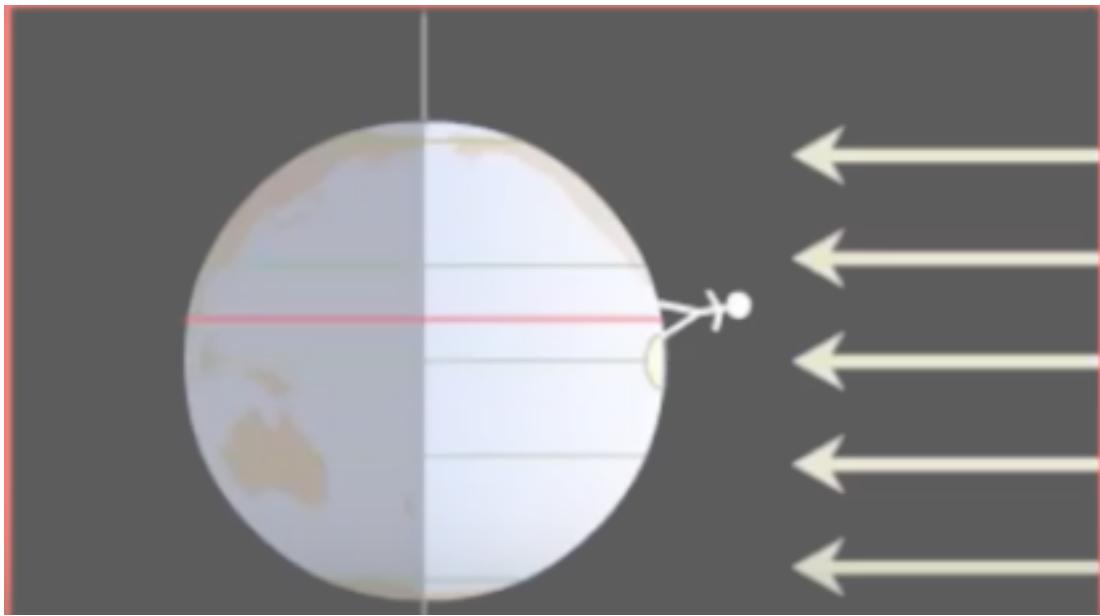
Only for classroomvideos@visionias.in

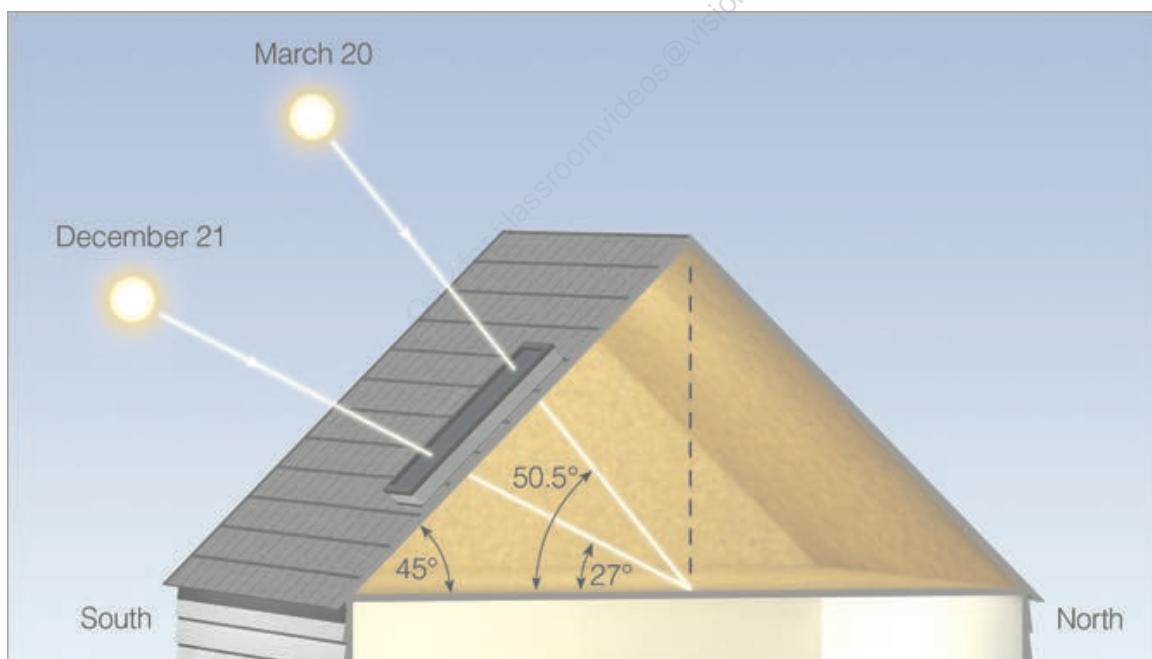
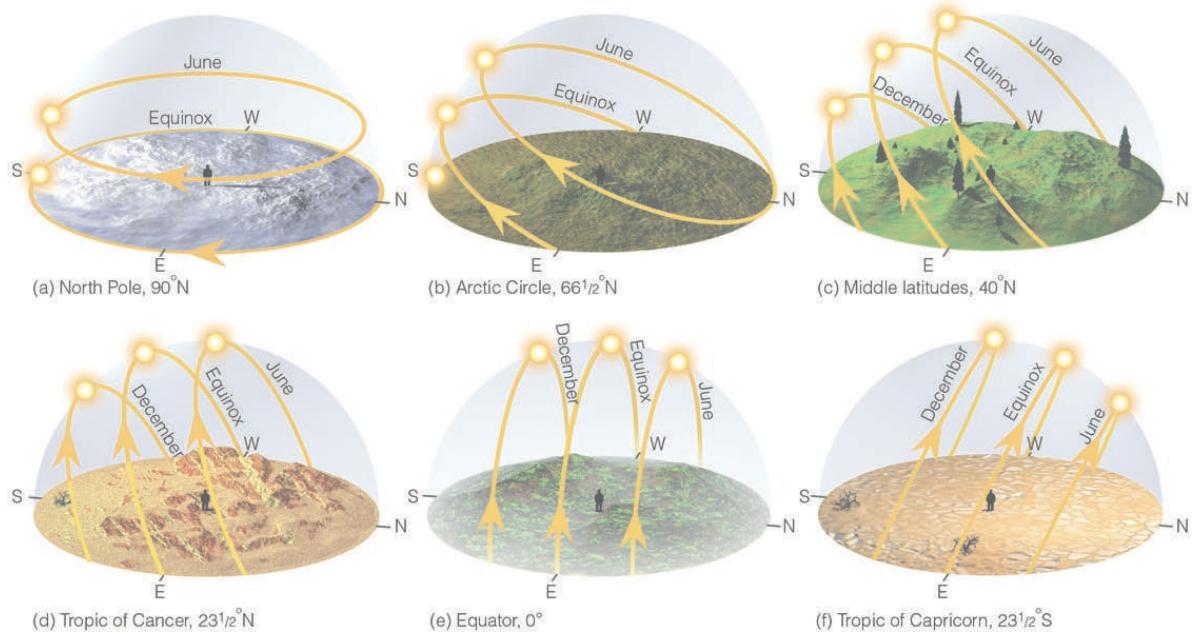


Only for classroomvideos@visionias.in



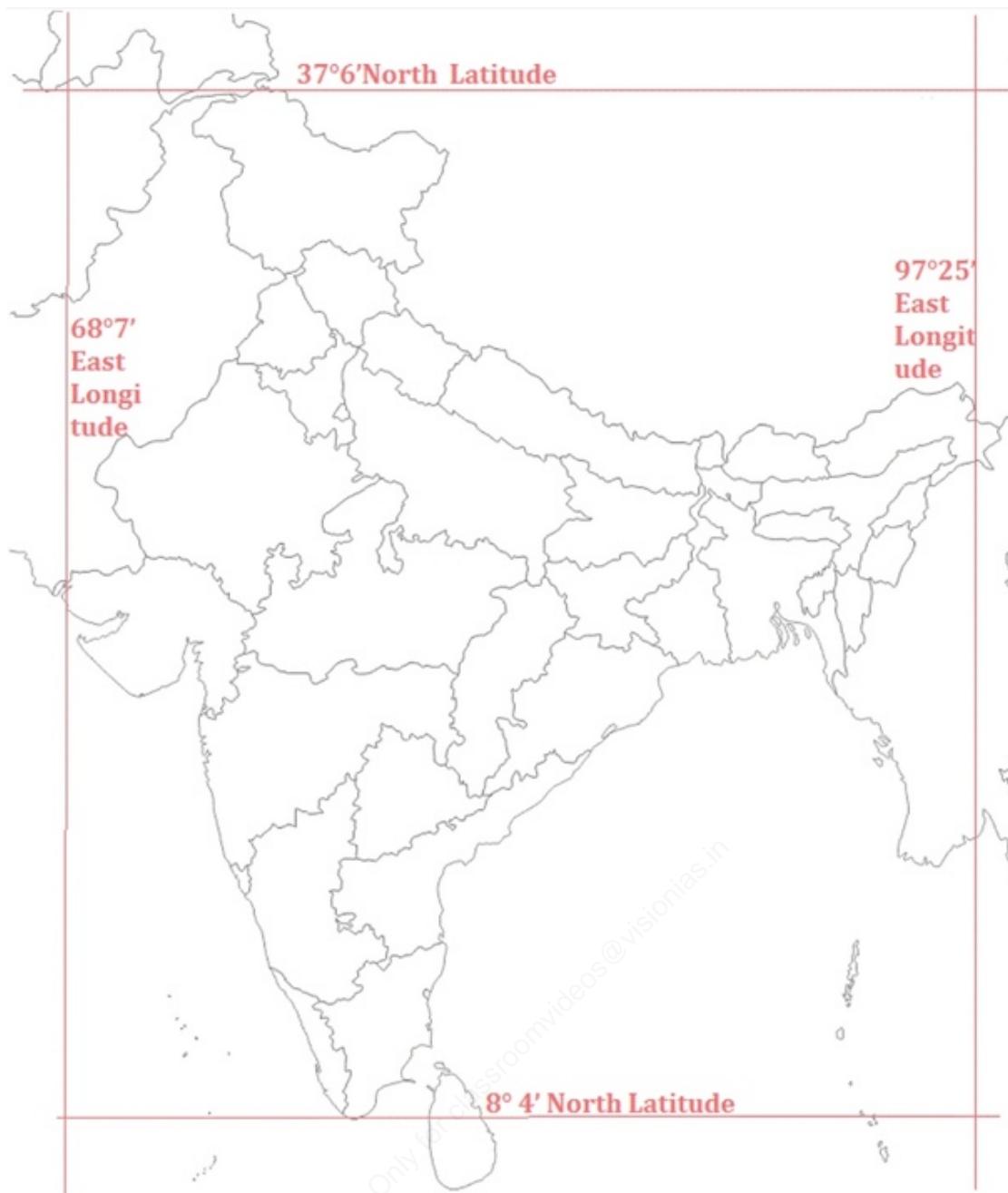




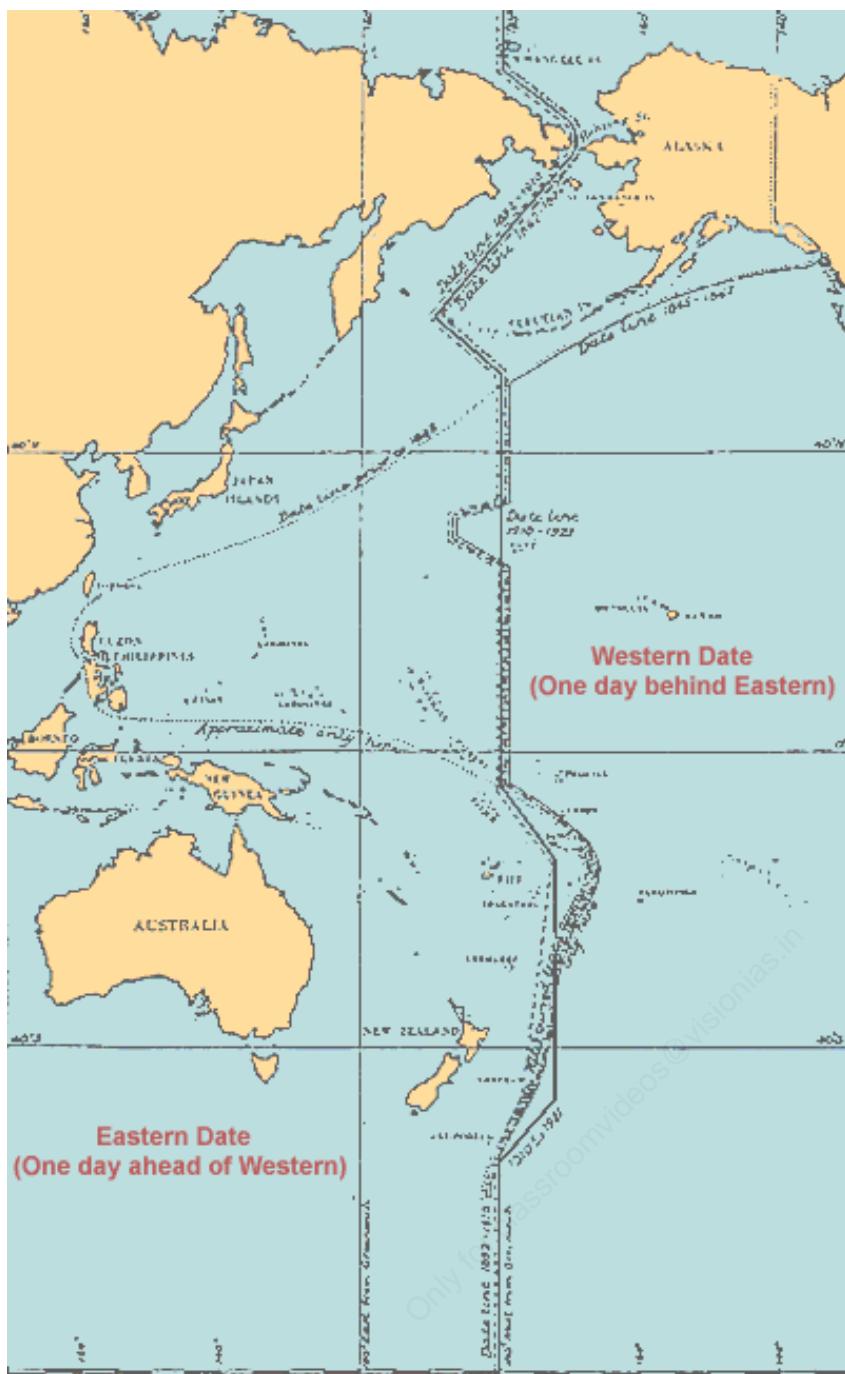


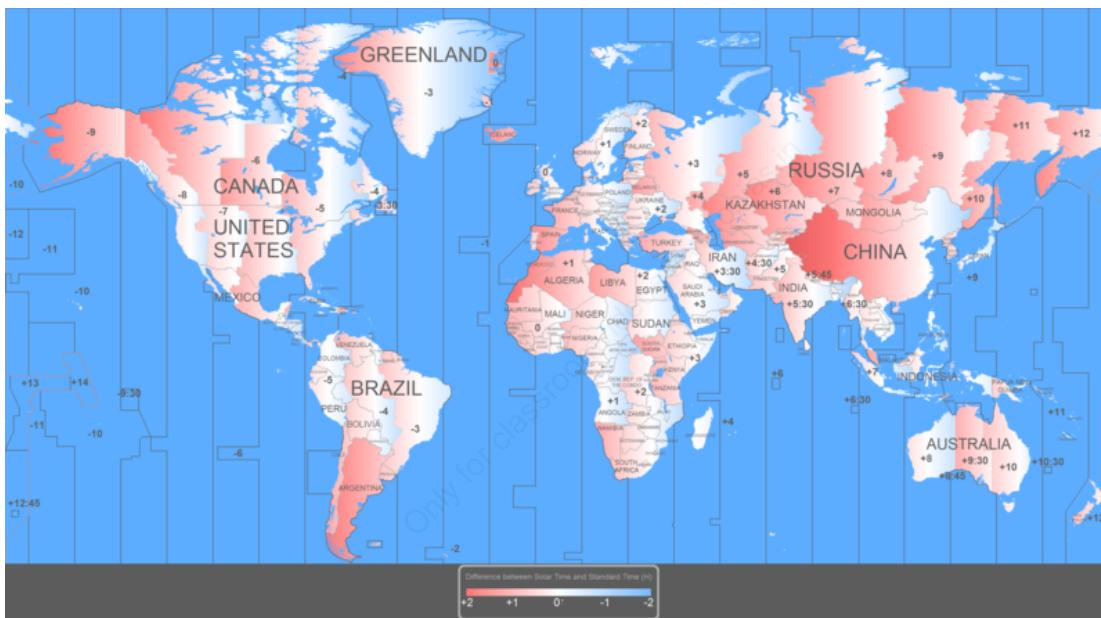
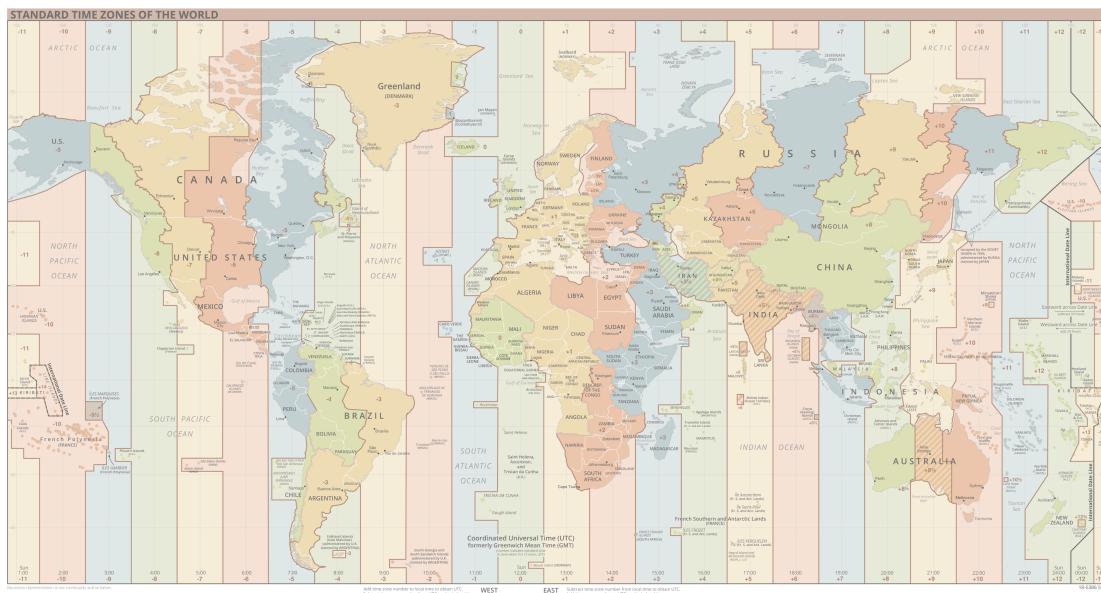


Only for classroomvideos@visionias.in

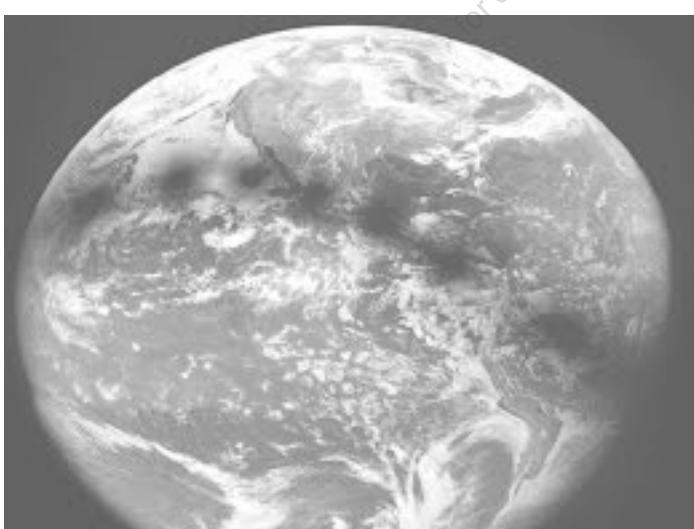
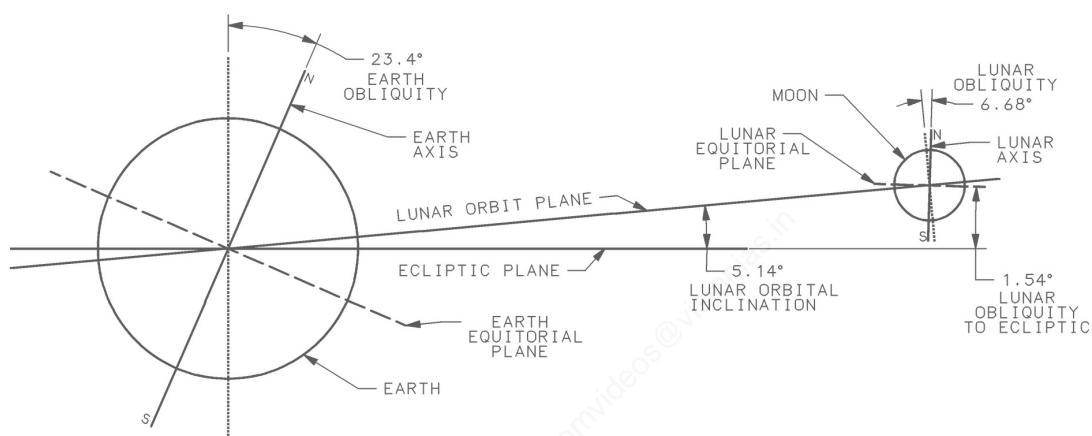
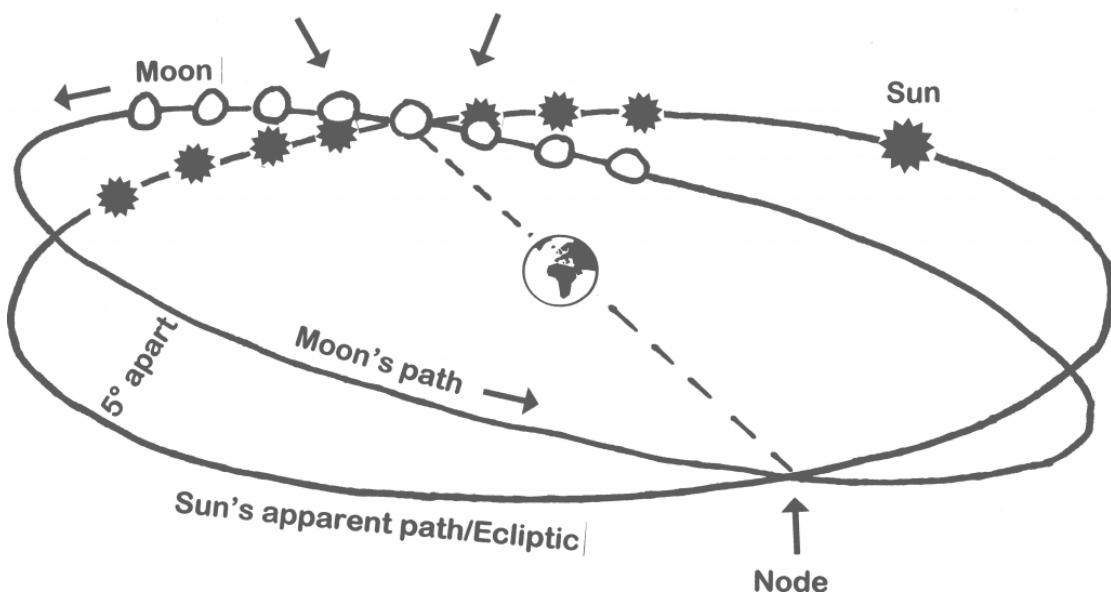


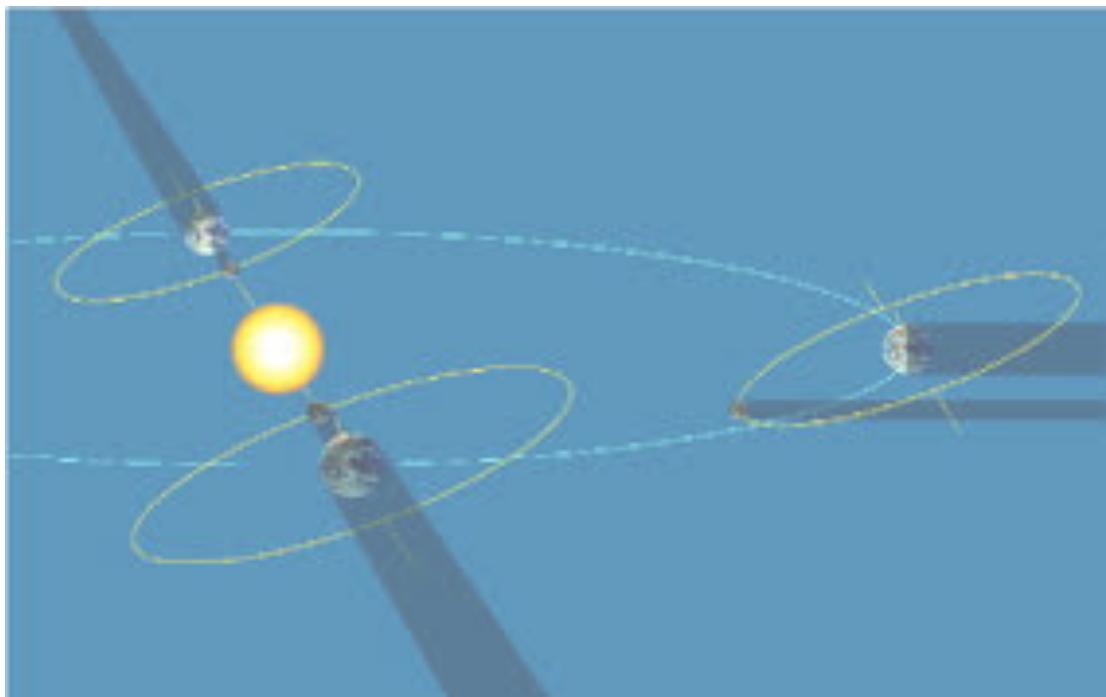






Eclipses can only happen near the Nodes





Only for classroomvideos@visionias.in

Geomorphology

Origin and evolution of Earth

Geological Time Scale

Interior of the Earth

Types of Rocks

Earth movements

Continental Drift Theory

Sea Floor spreading

Plate Tectonics theory

Vulcanism

Geomagnetism

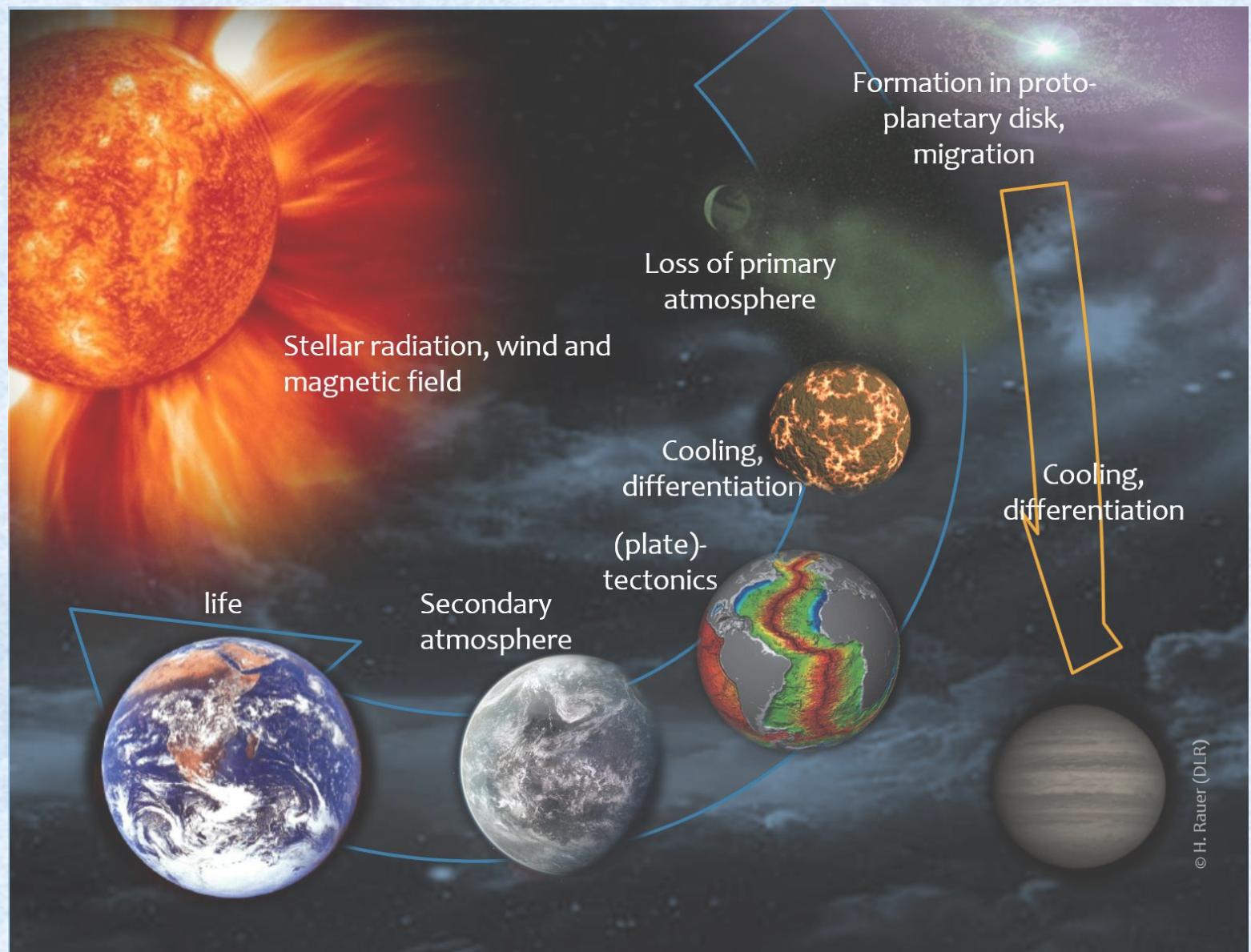
Earthquakes

Tsunamis

Exogenic movements

Landforms

Origin and Evolution of Earth



© H. Rauer (DLR)

<https://www.youtube.com/watch?v=HCDVN7DCzYE>

Origin and Evolution of Earth

Hot and volatile

Density separation

Condensation

Differentiation

Early atmosphere

Degassing

Volcanic eruptions

Condensation of water vapour

Formation of oceans

Blue Green Algae

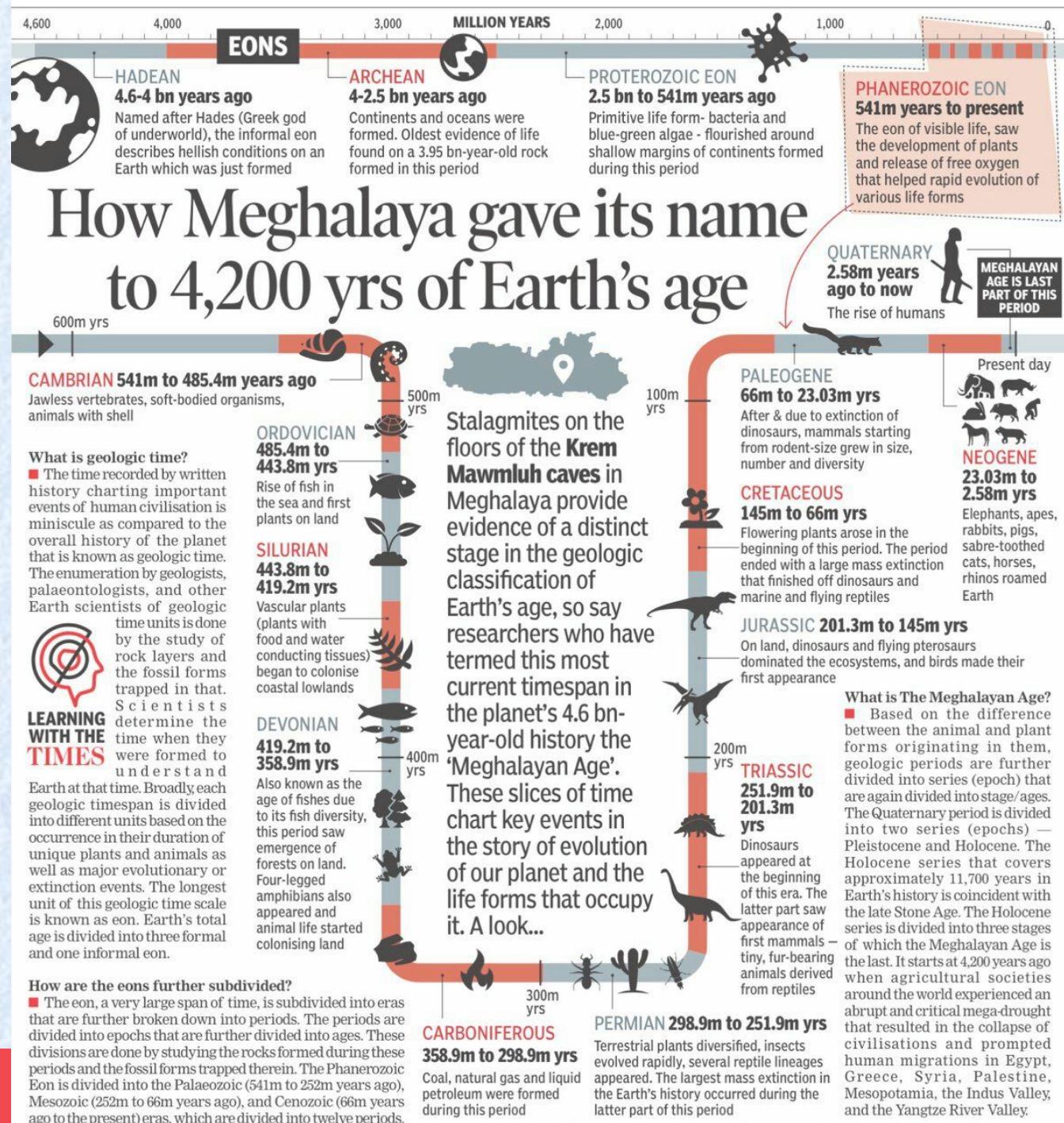
Flooding of atmosphere with Oxygen

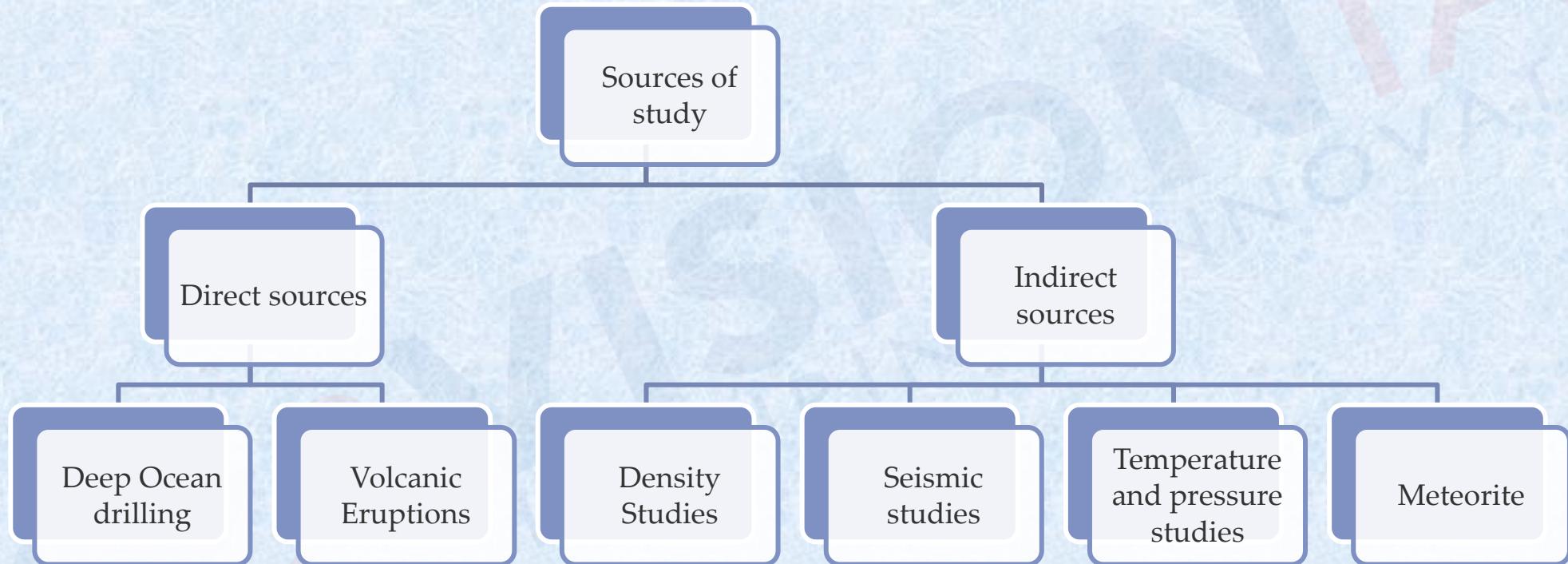
Geological Time Scale

Geological Time Scale

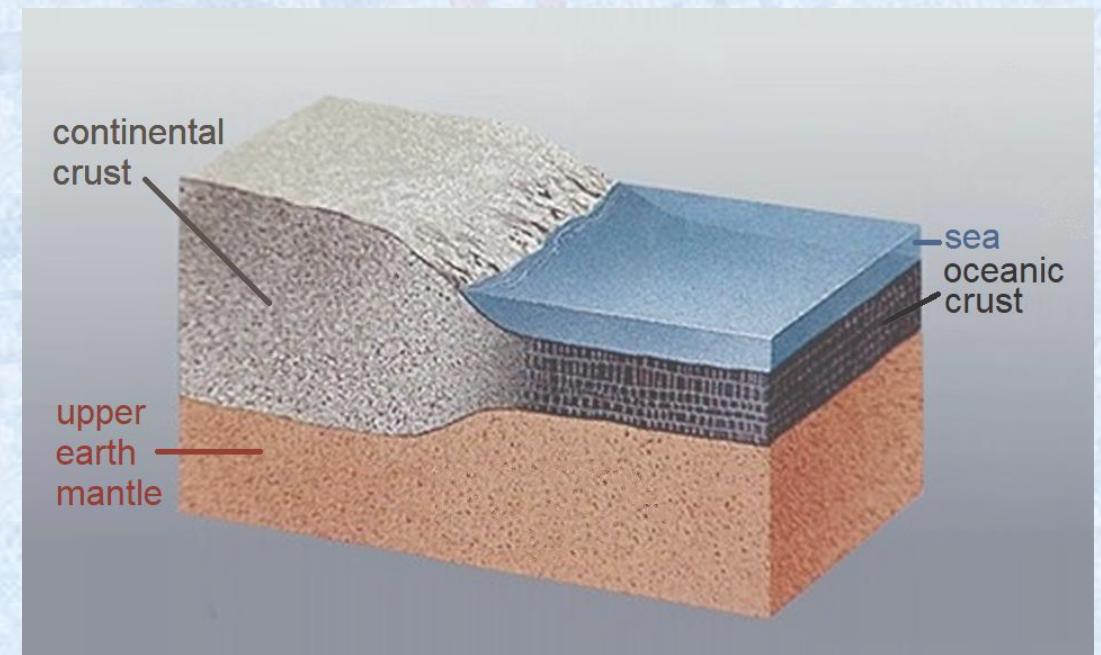
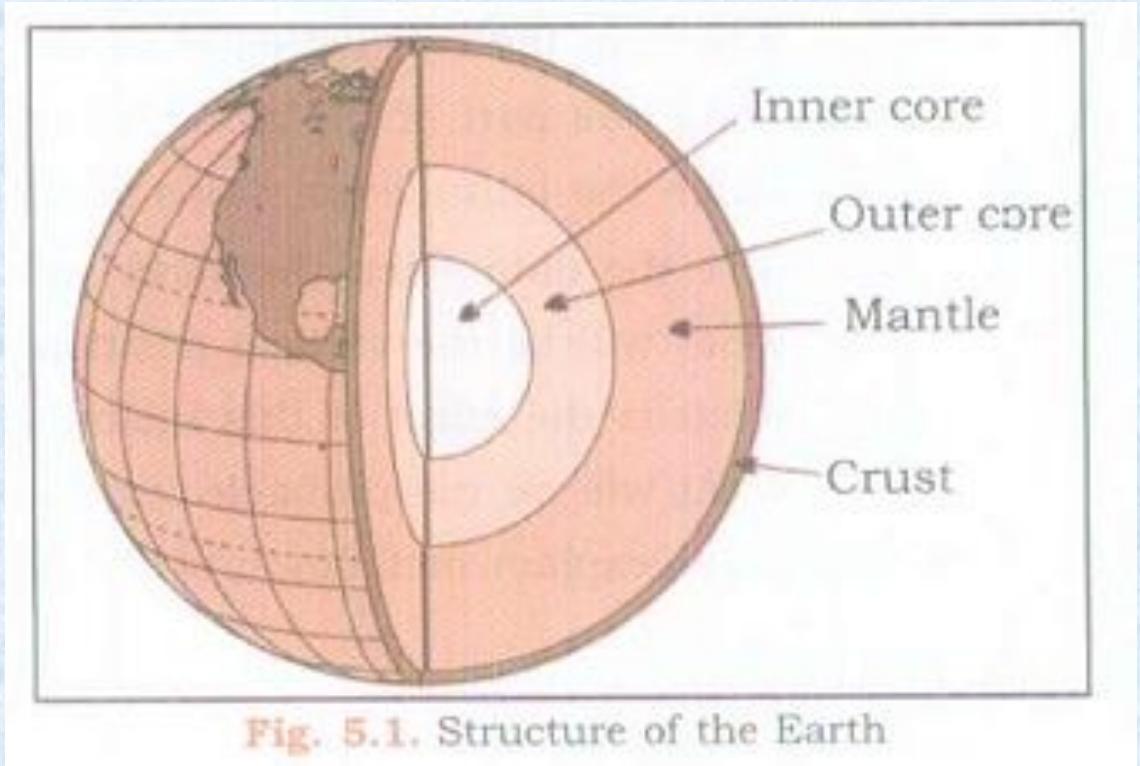
Eons	Era	Period	Epoch	Age/ Years Before Present	Life/ Major Events
	Cainozoic (From 65 million years to the present times)	Quaternary	Holocene Pleistocene	0 - 10,000 10,000 - 2 million	Modern Man Homo Sapiens
		Tertiary	Pliocene Miocene Oligocene Eocene Palaeocene	2 - 5 million 5 - 24 million 24 - 37 Ma 37 - 58 Million 57 - 65 Million	Early Human Ancestor Ape: Flowering Plants and Trees Anthropoid Ape Rabbits and Hare Small Mammals : Rats – Mice
	Mesozoic 65 - 245 Million Mammals	Cretaceous Jurassic Triassic		65 - 144 Million 144 - 208 Million 208 - 245 Million	Extinction of Dinosaurs Age of Dinosaurs Frogs and turtles
	Palaeozoic 245 - 570 Million	Permian Carboniferous Devonian Silurian Ordovician Cambrian		245 - 286 Million 286 - 360 Million 360 - 408 Million 408 - 438 Million 438 - 505 Million 505 - 570 Million	Reptile dominate-replace amphibians First Reptiles: Vertebrates: Coal beds Amphibians First trace of life on land: Plants First Fish No terrestrial Life : Marine Invertebrate
Proterozoic Archean Hadean	Pre-Cambrian 570 Million - 4,800 Million			570 - 2,500 Million 2,500 - 3,800 Million 3,800 - 4,800 Million	Soft-bodied arthropods Blue green Algae: Unicellular bacteria Oceans and Continents form – Ocean and Atmosphere are rich in Carbon dioxide
Origin of Stars Supernova Big Bang	5,000 - 13,700 Million			5,000 Million 12,000 Million 13,700 Million	Origin of the sun Origin of the universe

Geological Time Scale



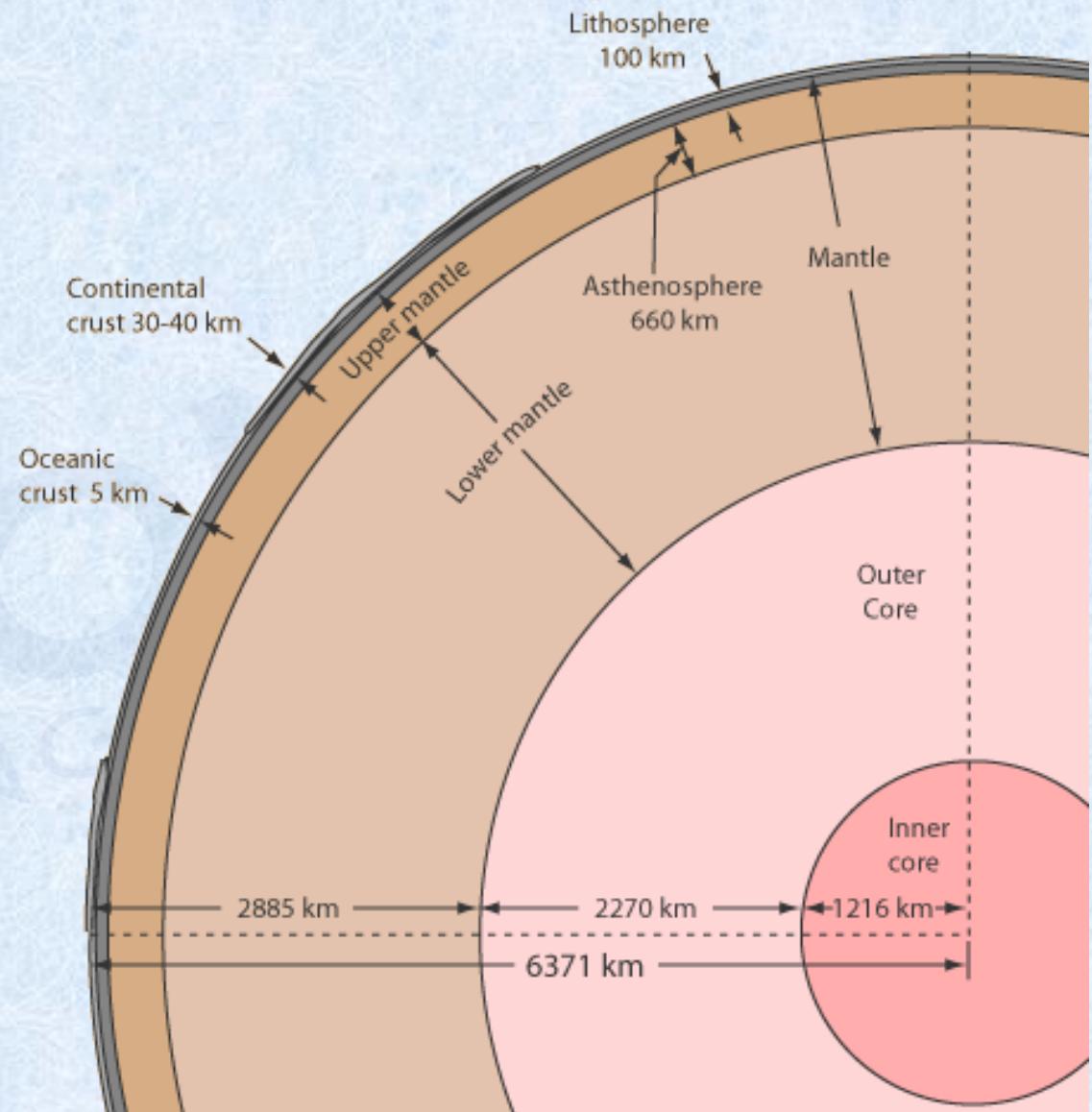
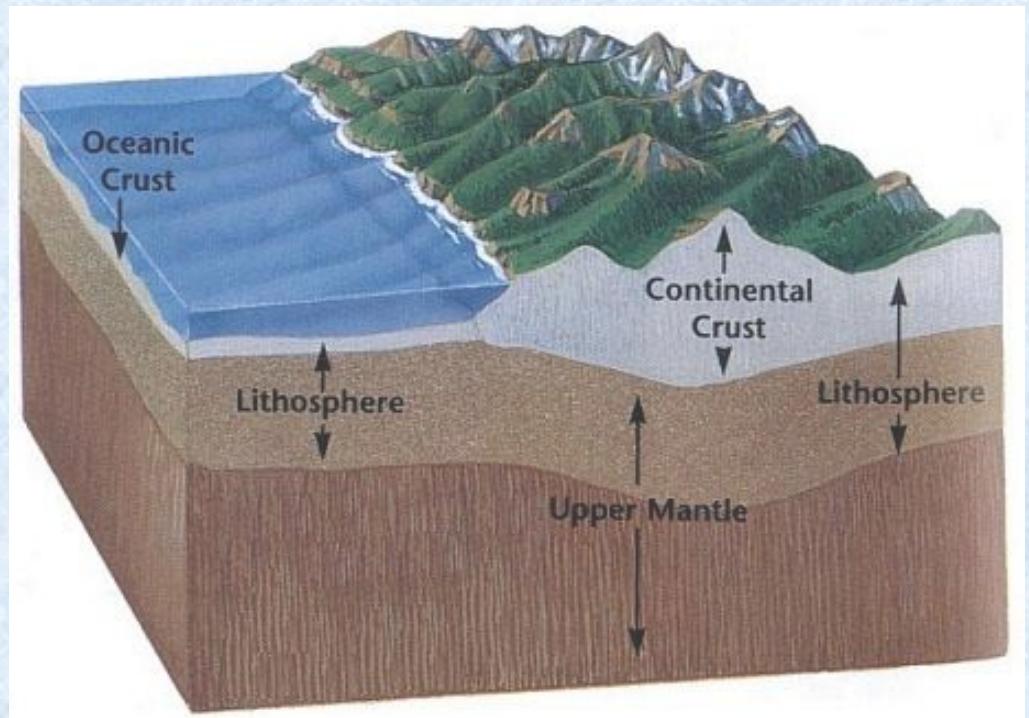


Interior of the Earth



Chemical divisions

Interior of the Earth

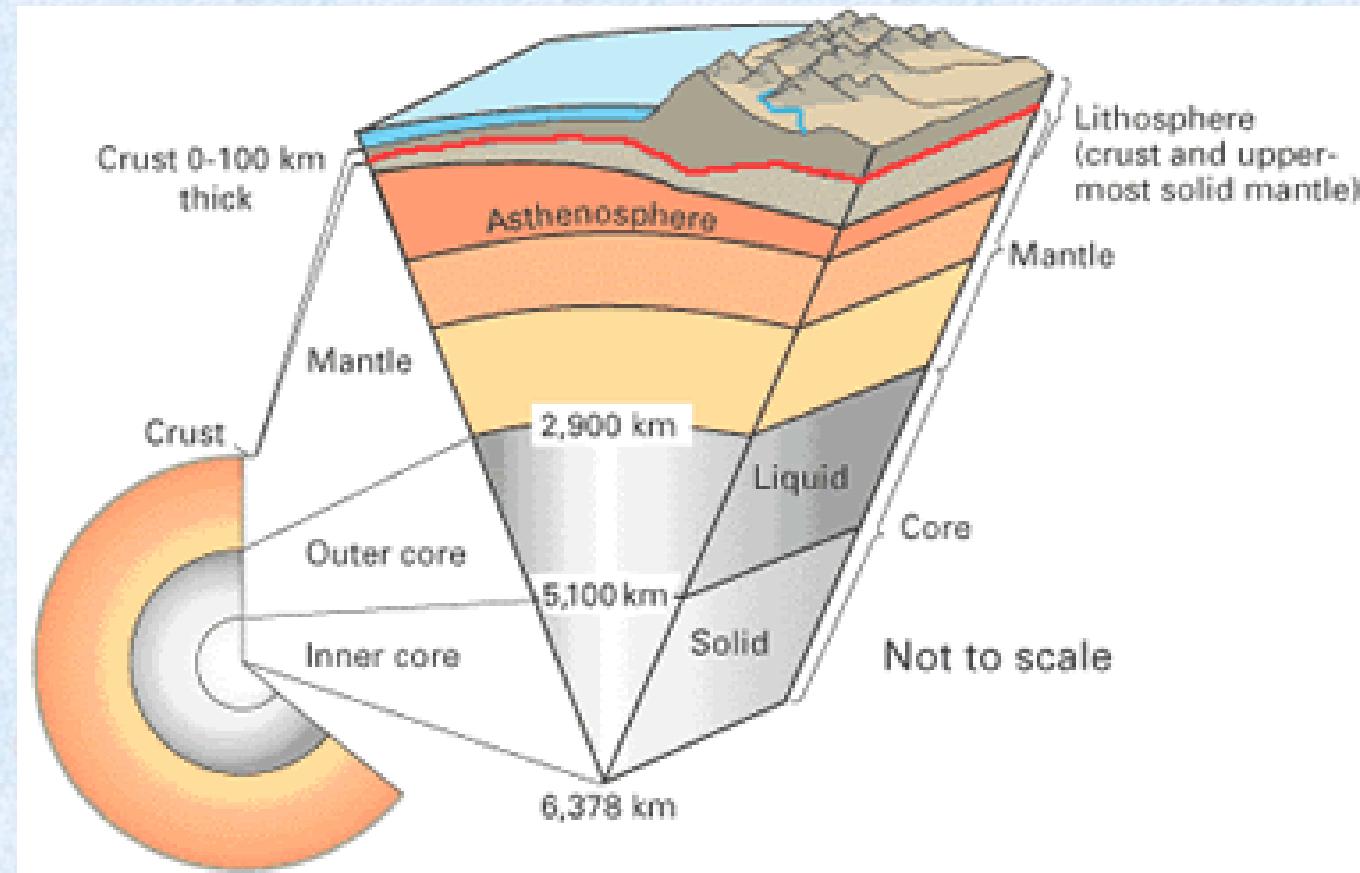


Physical divisions

Table 5.1 : The Major Elements of the Earth's Crust

Sl. No.	Elements	By Weight(%)
1.	Oxygen	46.60
2.	Silicon	27.72
3.	Aluminium	8.13
4.	Iron	5.00
5.	Calcium	3.63
6.	Sodium	2.83
7.	Potassium	2.59
8.	Magnesium	2.09
9.	Others	1.41

Element (Entire earth)	%
Iron	35
Oxygen	30
Silicon	15
Magnesium	13
Nickel	
Sulphur	



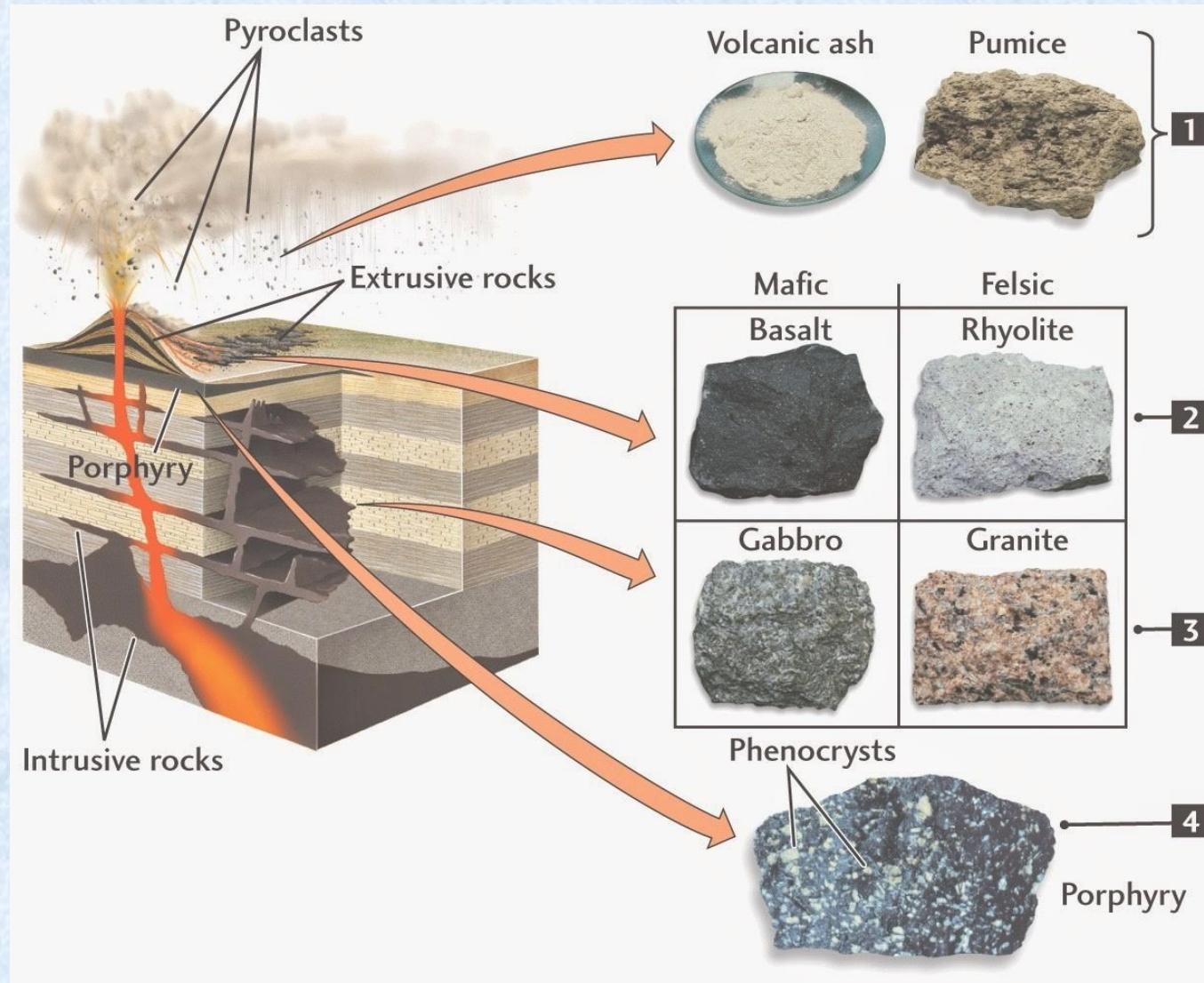
Discontinuities

2009	In the structure of planet Earth, below the mantle, the core is mainly made up of which one of the following? (a) Aluminum (b) Chromium (c) Iron (d) Silicon
------	--

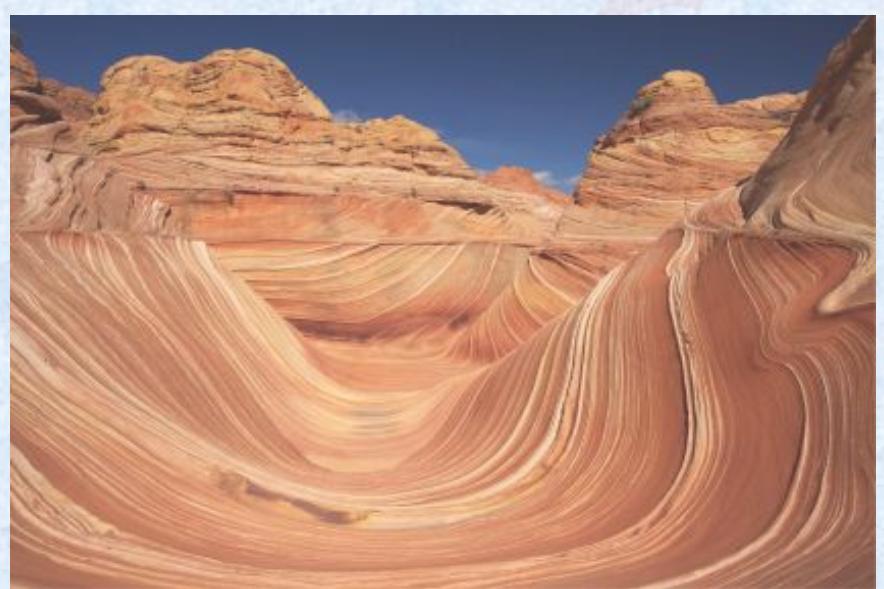
Table 7.1. Difference between Rocks and Minerals

Rocks	Minerals
<ol style="list-style-type: none">1. Rocks are aggregates of mineral elements.2. A rock has no definite chemical composition.3. Minerals are organised to form rocks.4. Three chief types of rocks are <i>Igneous</i>, <i>Sedimentary</i> and <i>Metamorphic</i>.5. Basalt, granite, sandstone, slate and quartz are some important types of rocks.	<ol style="list-style-type: none">1. Minerals are solid inorganic substances occurring naturally.2. Minerals have a definite chemical composition.3. Elements are organised to form compounds which are known as minerals. An element is a pure substance.4. Four chief mineral groups are <i>silicates</i>, <i>carbonates</i>, <i>sulphides</i> and <i>metallic minerals</i>.5. Iron, silicon, magnesium, nickel, calcium, potassium, sodium are abundant minerals of the earth.

Types of Rocks

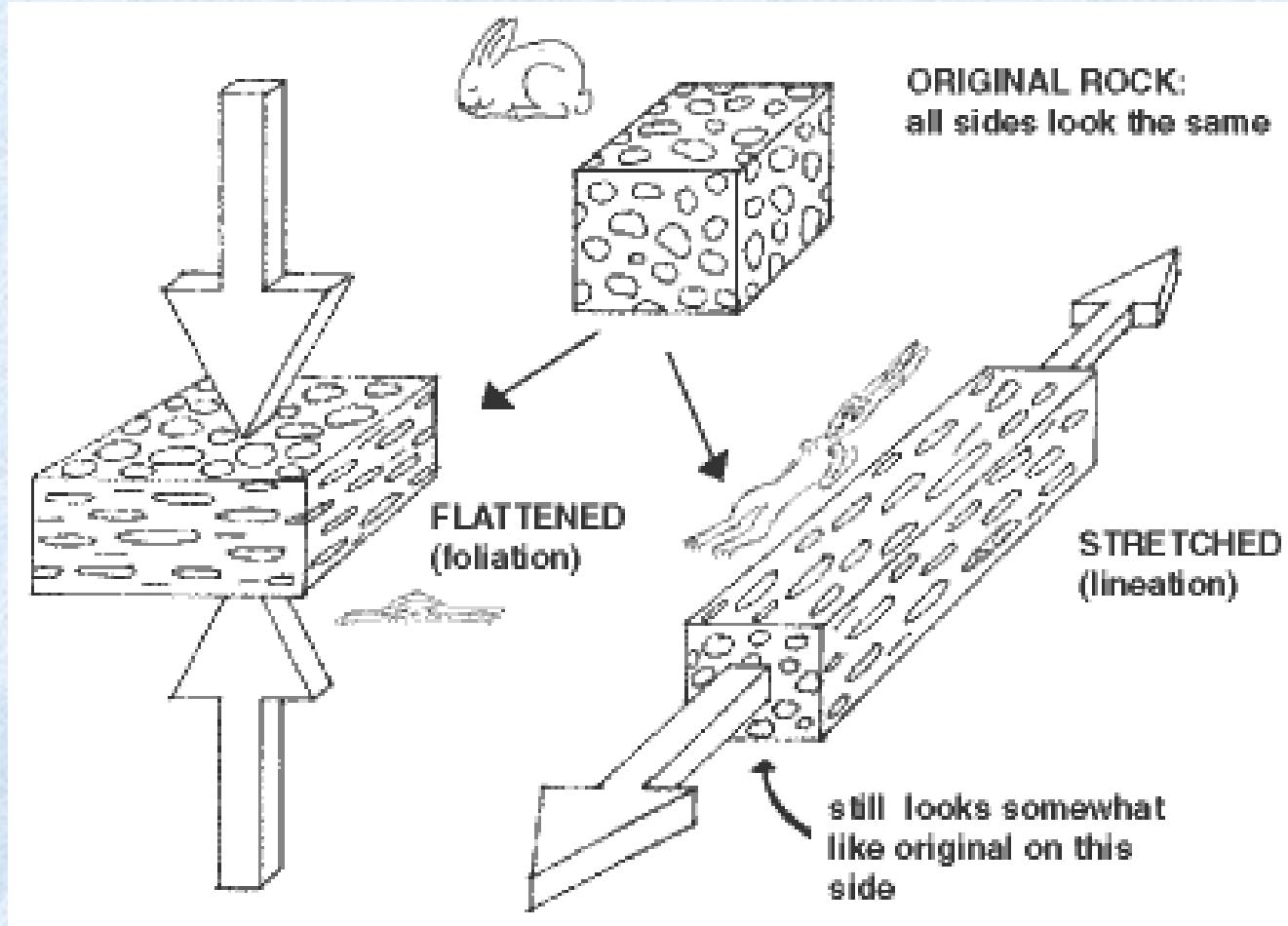


Types of Rocks



Sedimentary Rocks

Types of Rocks



Types of Rocks



Lineation Quartz



Non foliated Quartz

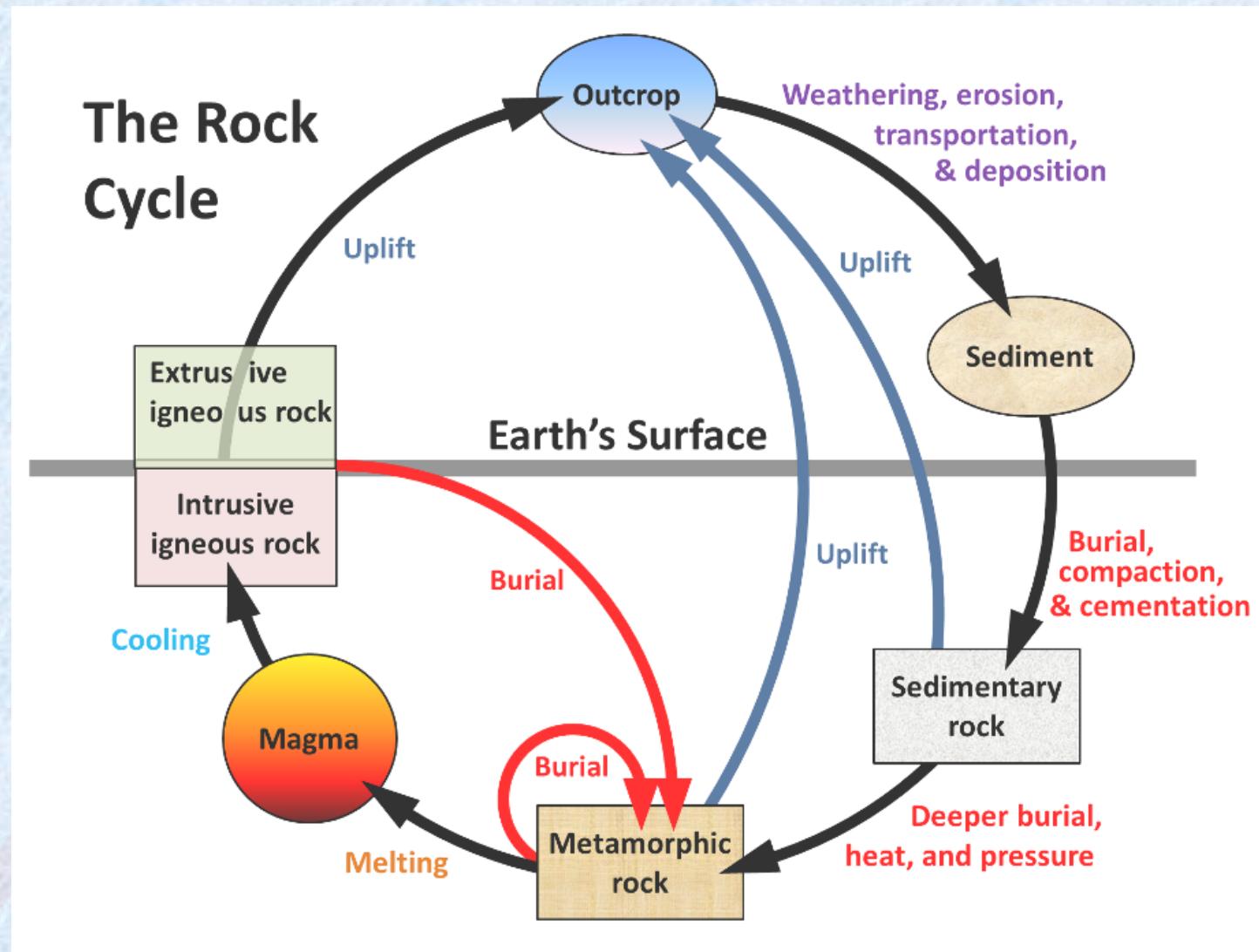


Foliated Gneiss

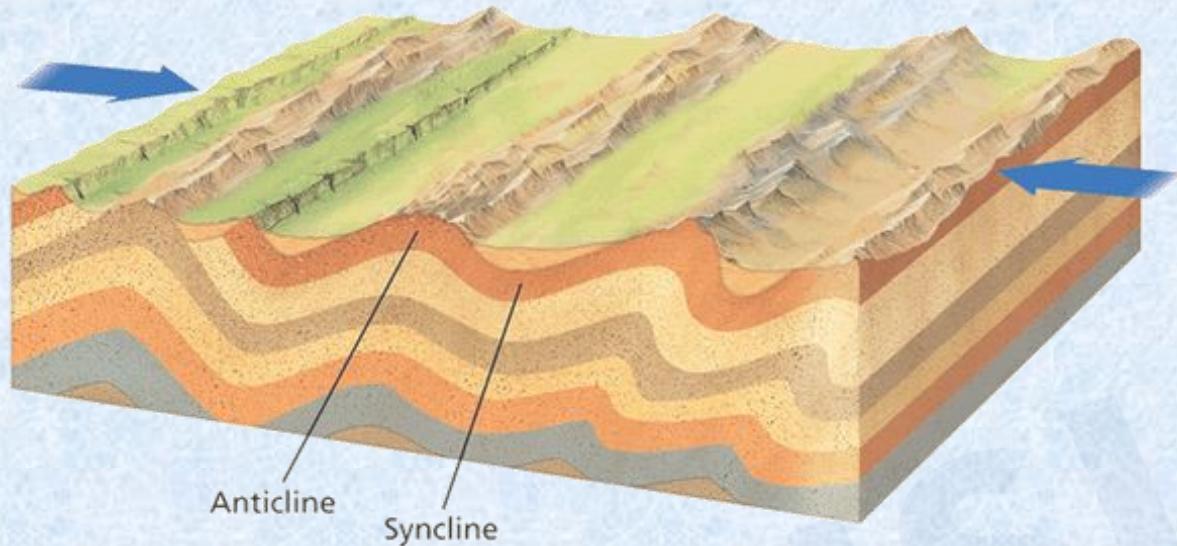
Types of Rocks



© geology.com



Earth's Movements



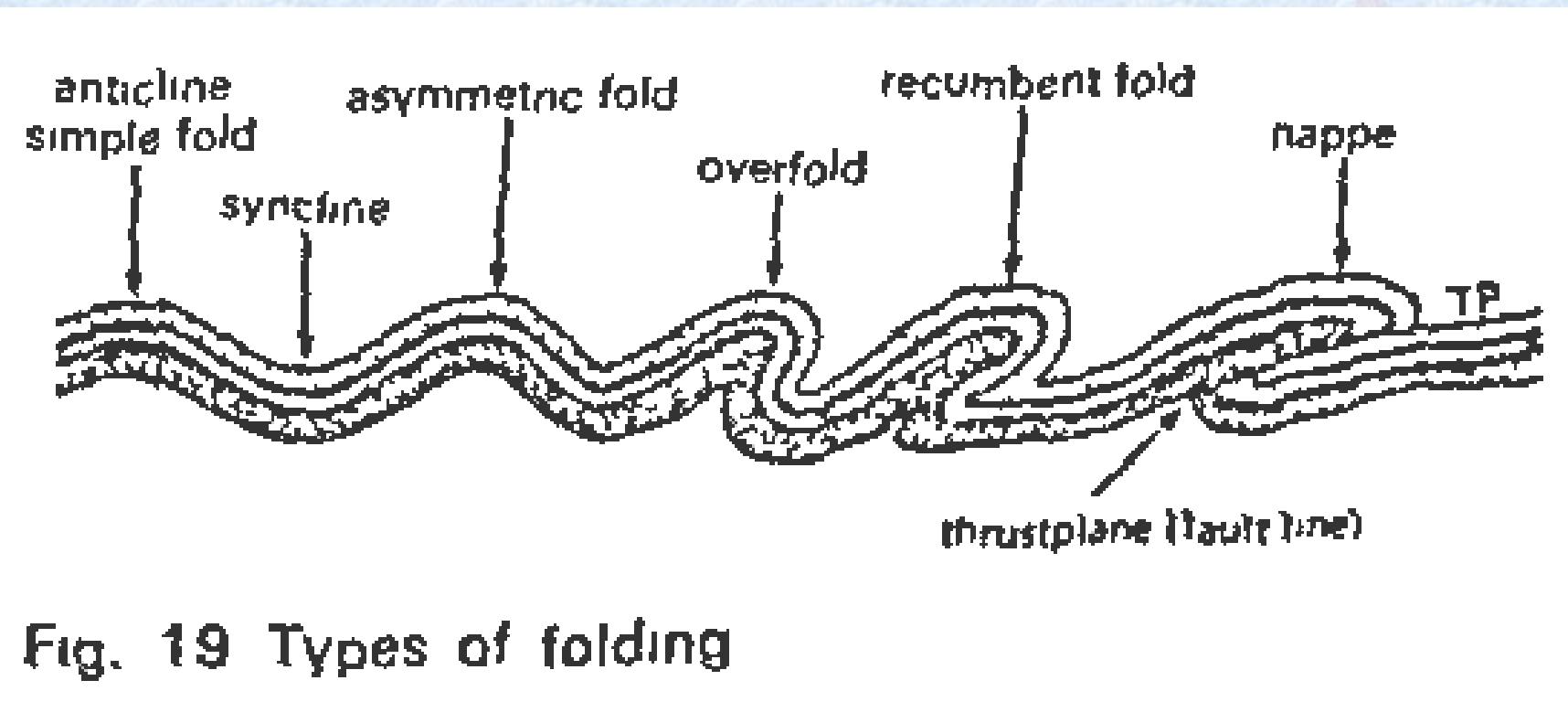
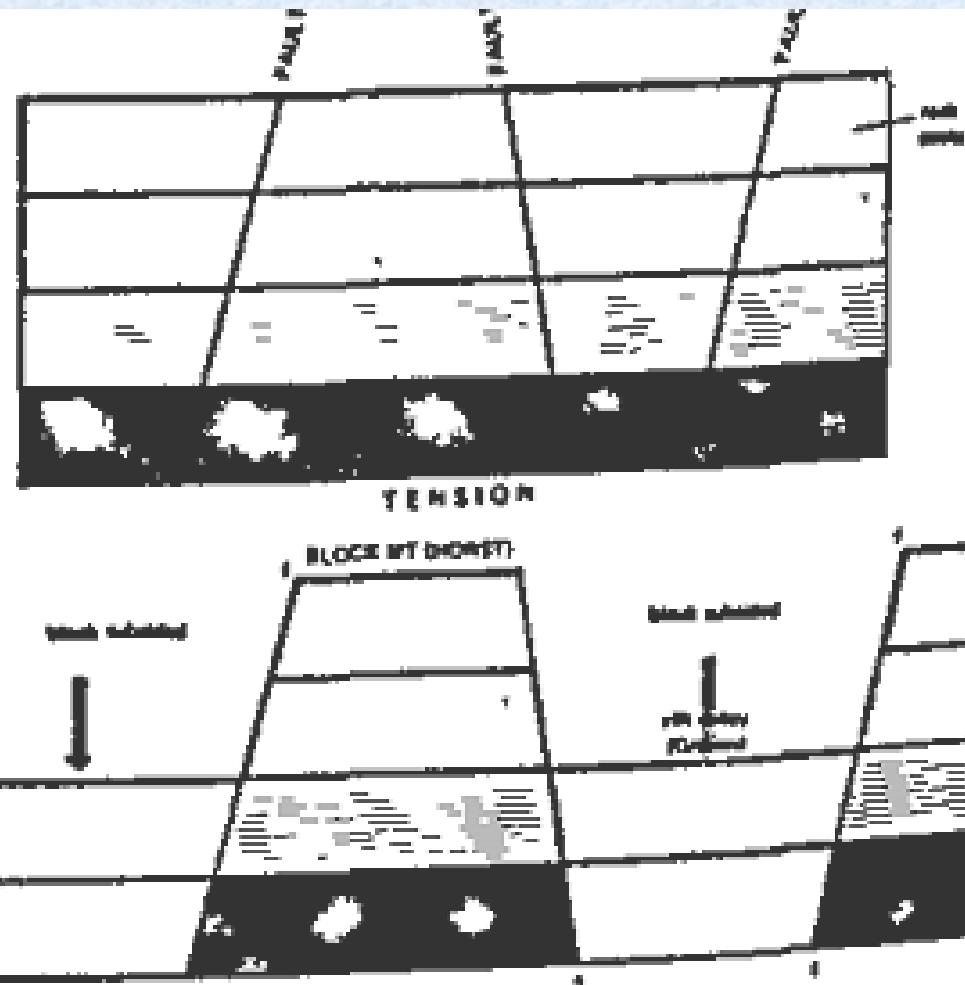
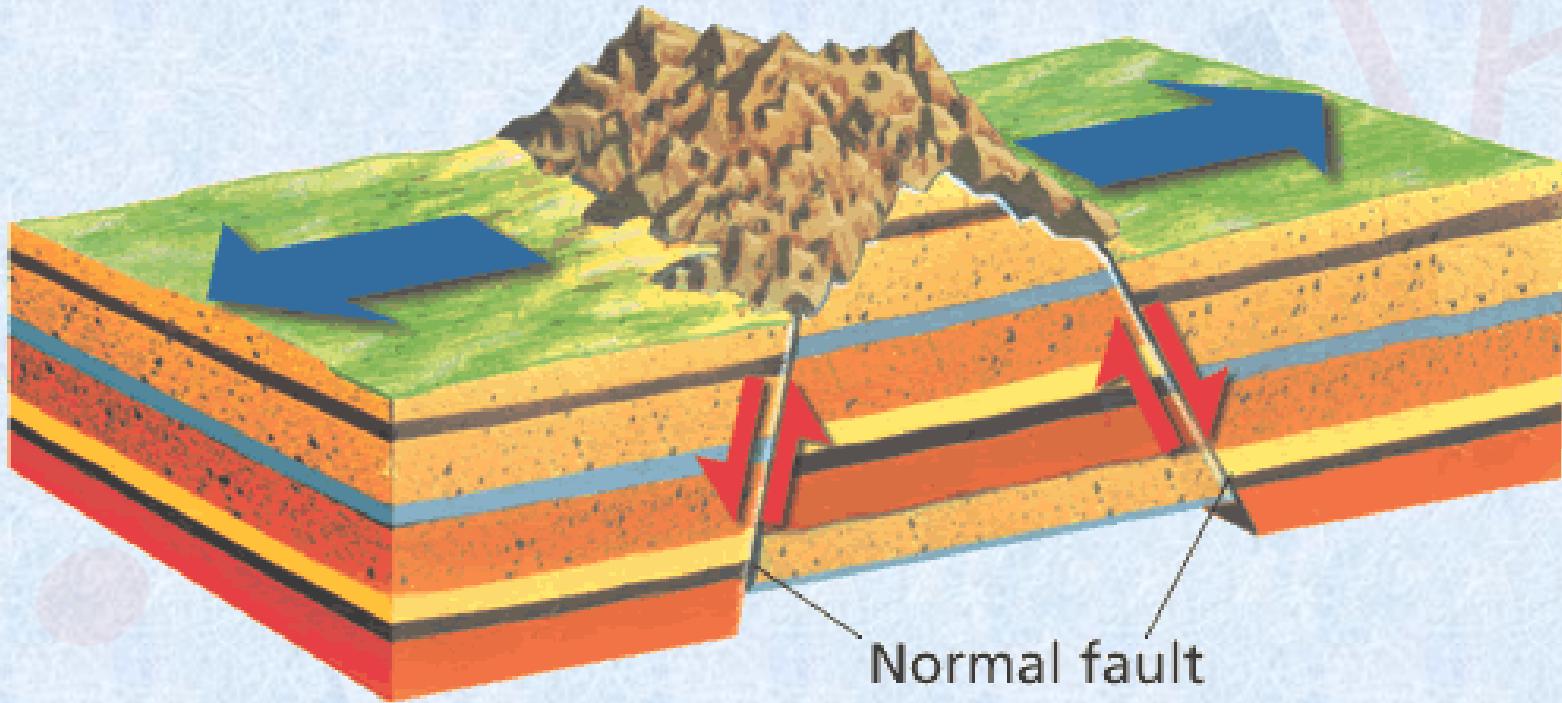


Fig. 19 Types of folding



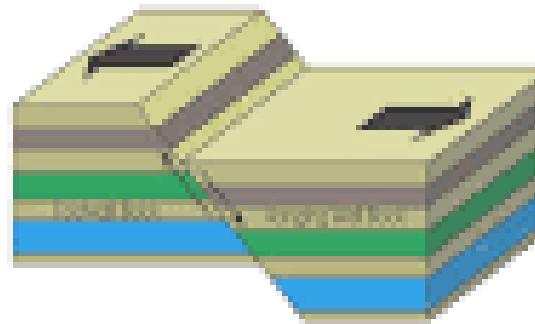
21 (a) Block mountain (horst) formed by tension when faults develop

Fault-Block Mountain

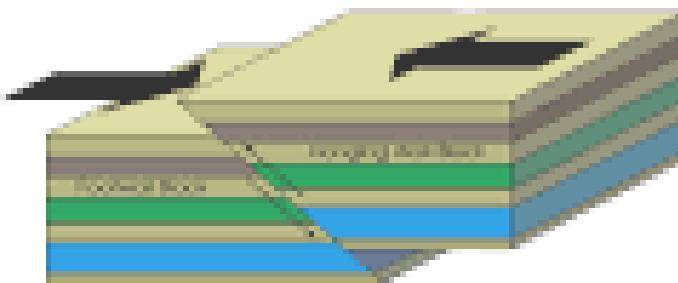




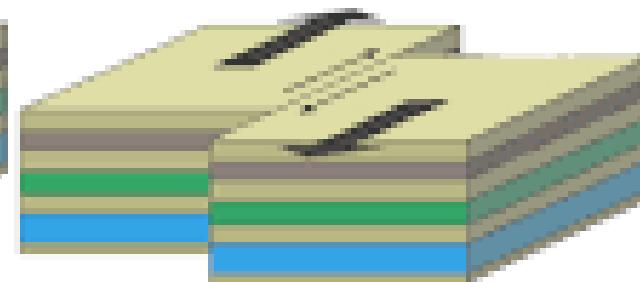
What are the three main types of faults?



Normal fault



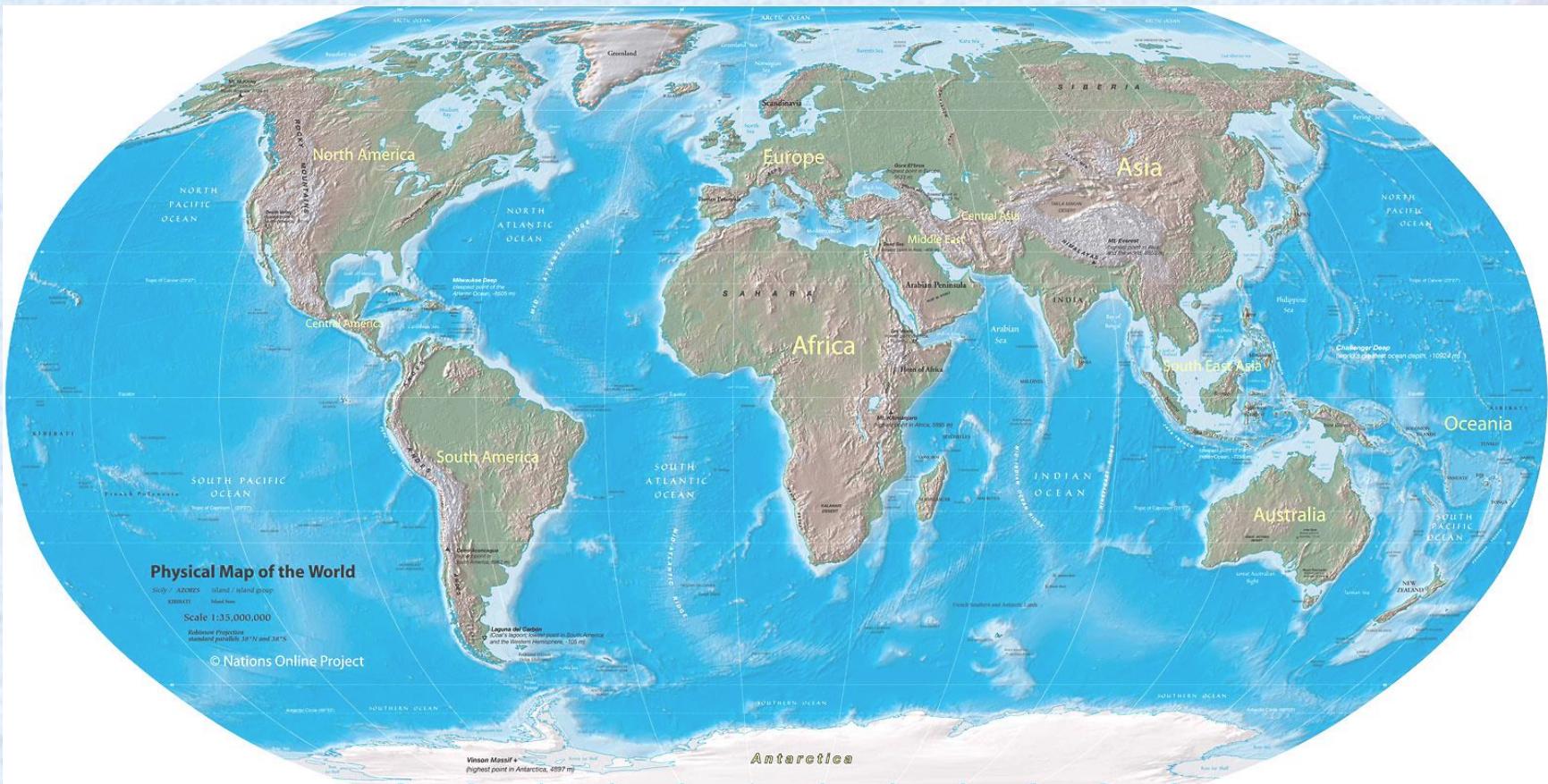
Reverse fault



Strike-slip fault

www.GeologyPage.com

Continental Drift Theory



CONTINENTAL DRIFT OF PLATES



225 Million Years Ago



150 Million Years Ago

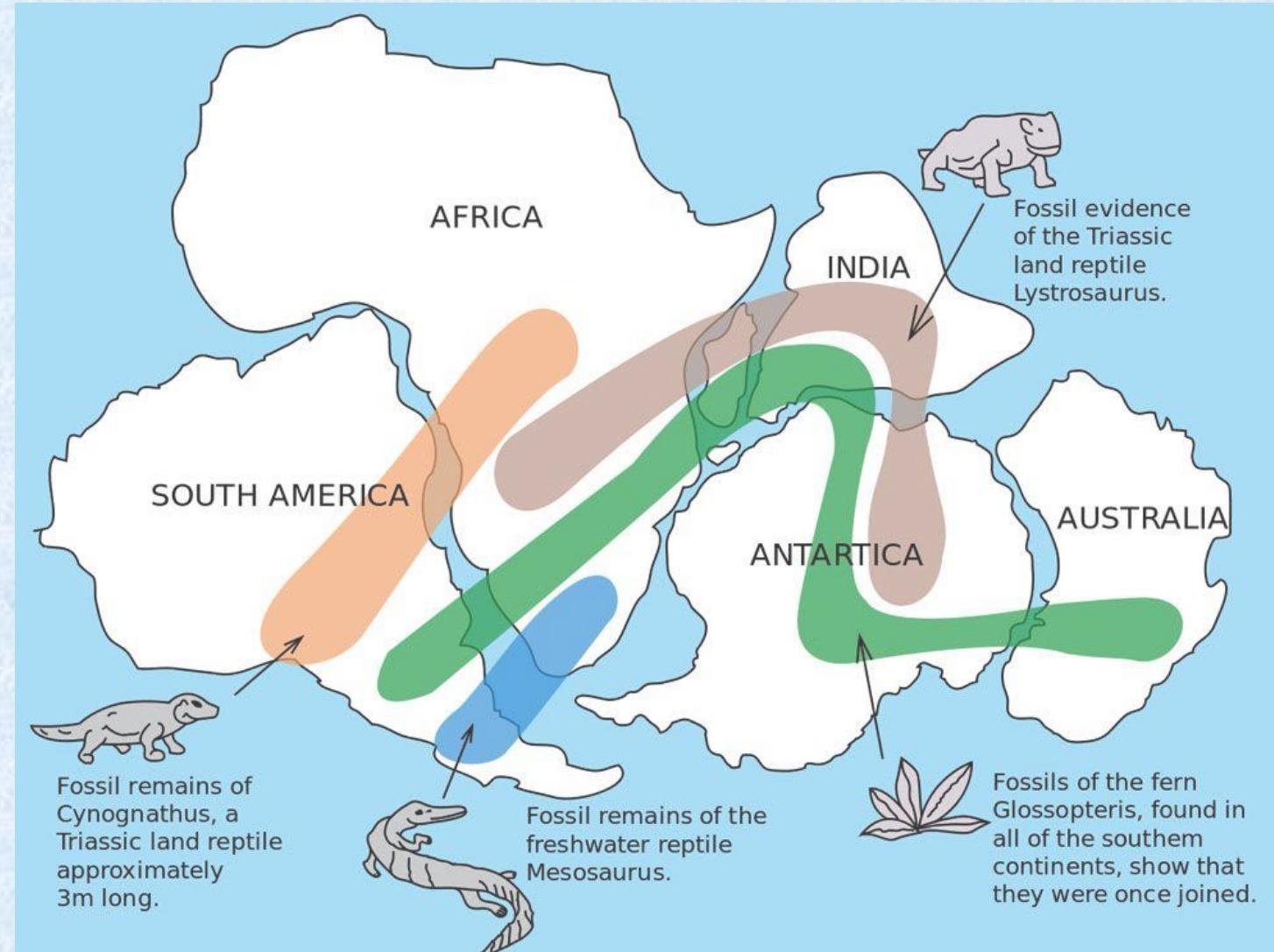


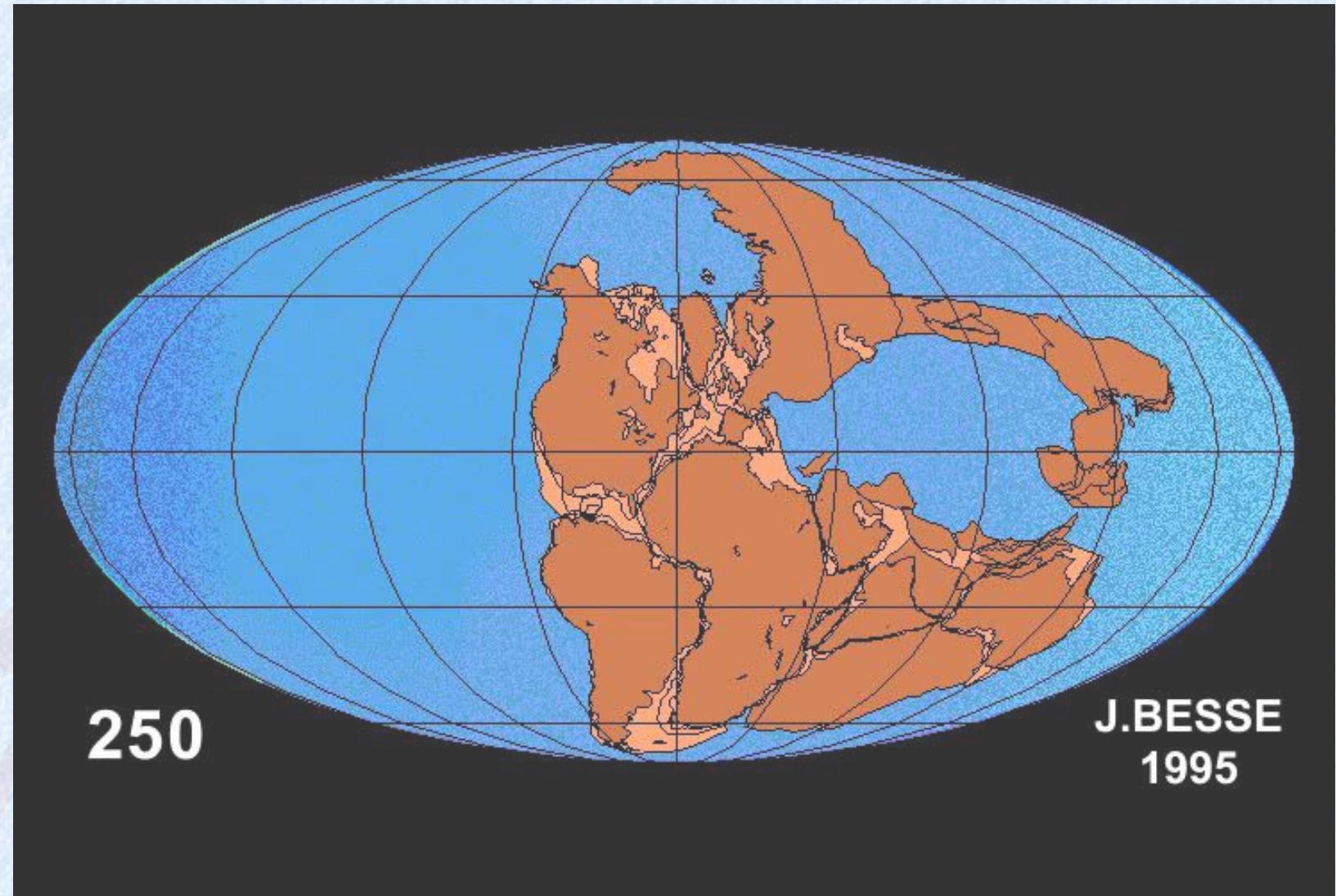
100 Million Years Ago



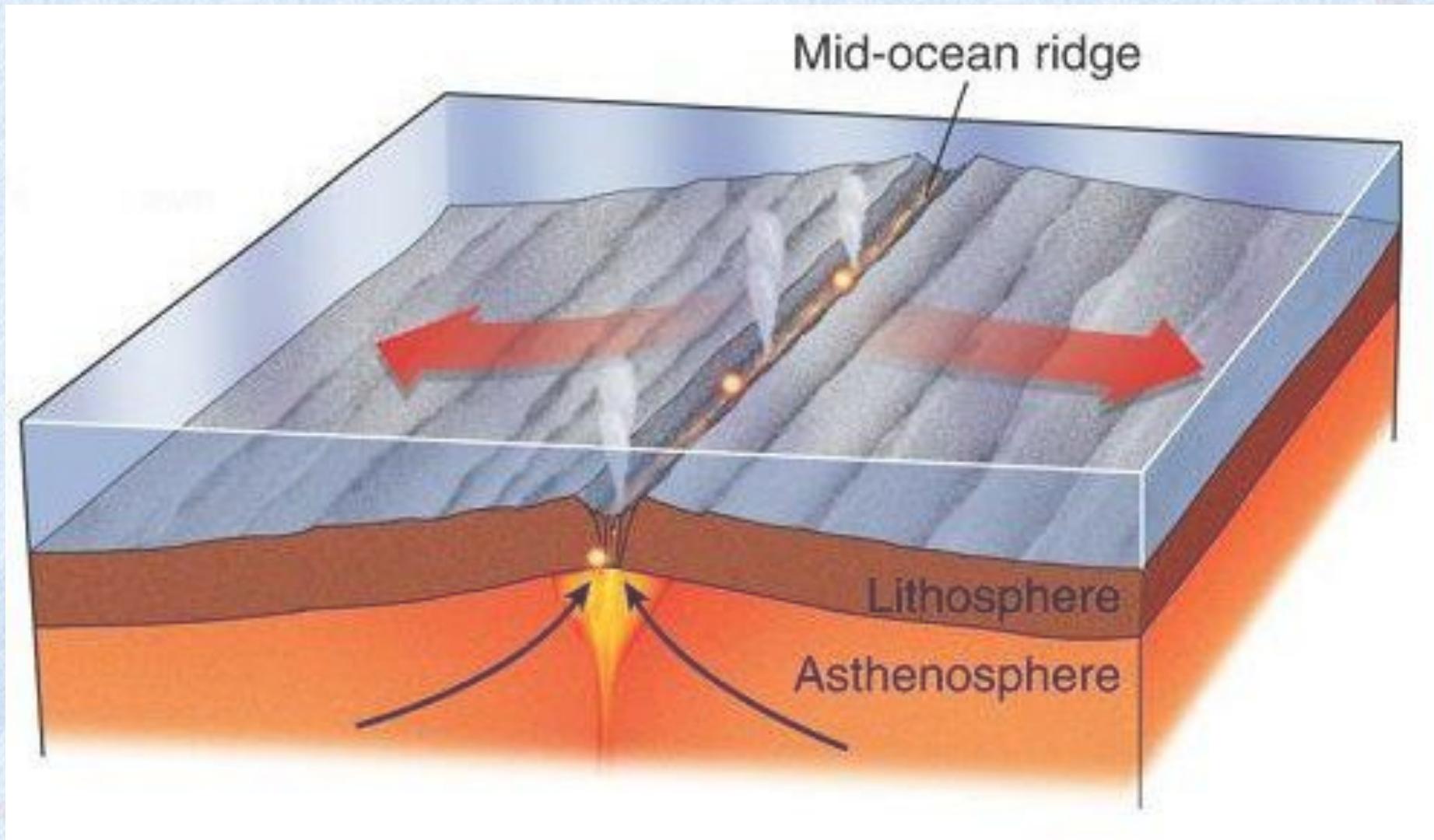
Earth Today

Continental Drift Theory

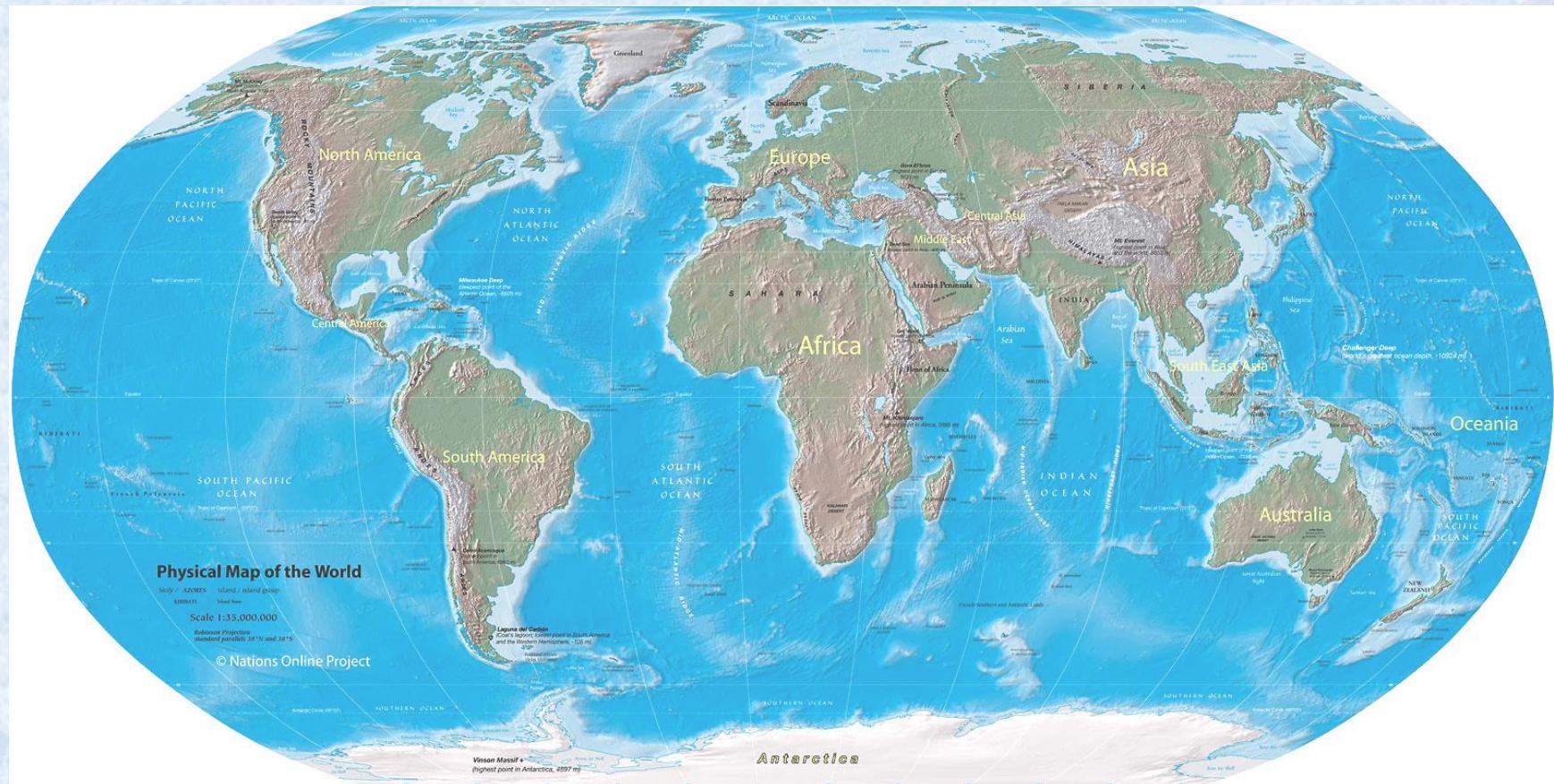




Sea floor spreading



Sea floor spreading



https://www.youtube.com/watch?v=k-_Z6p5cjKg

Plate Tectonics Theory

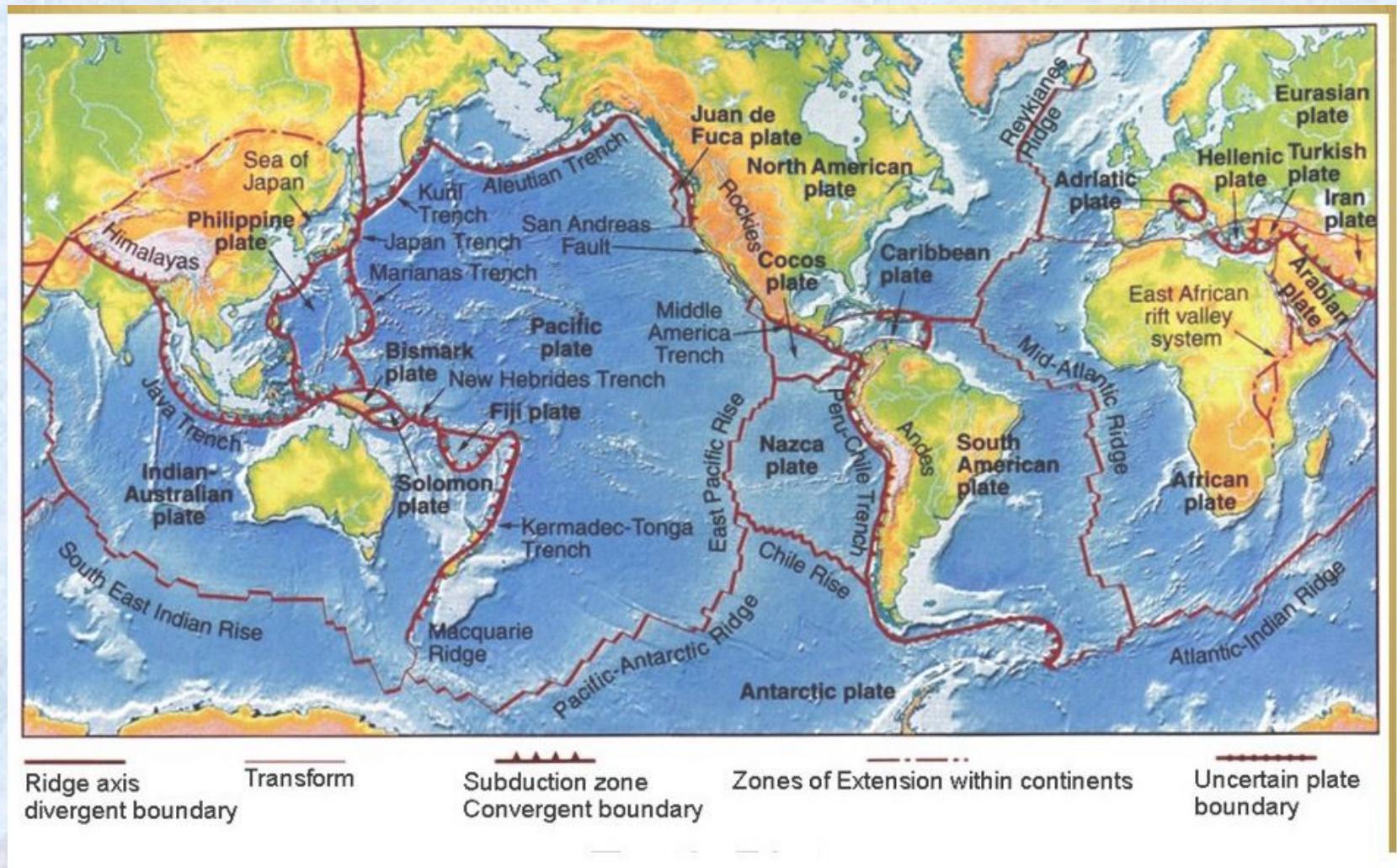


Plate Tectonics Theory

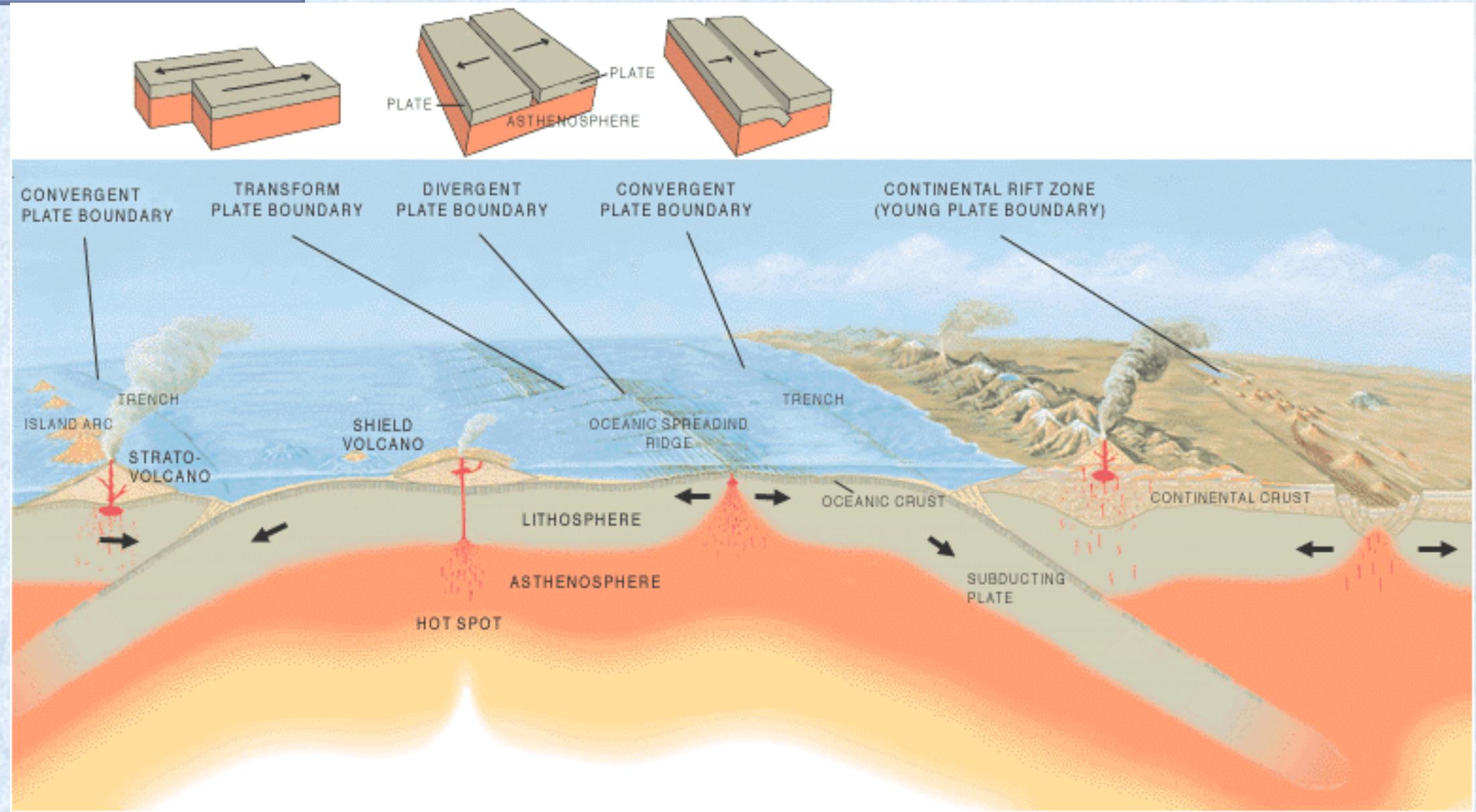
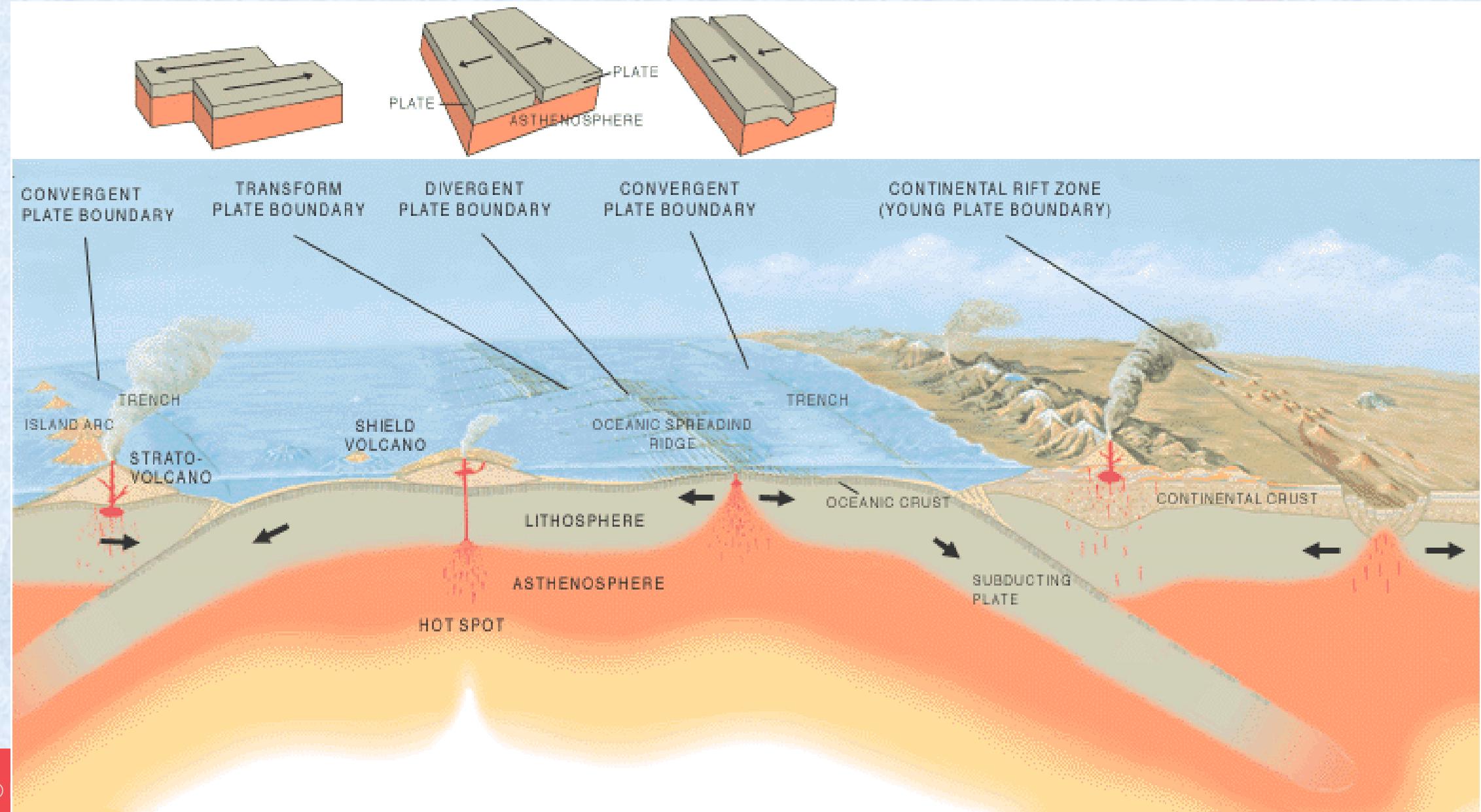
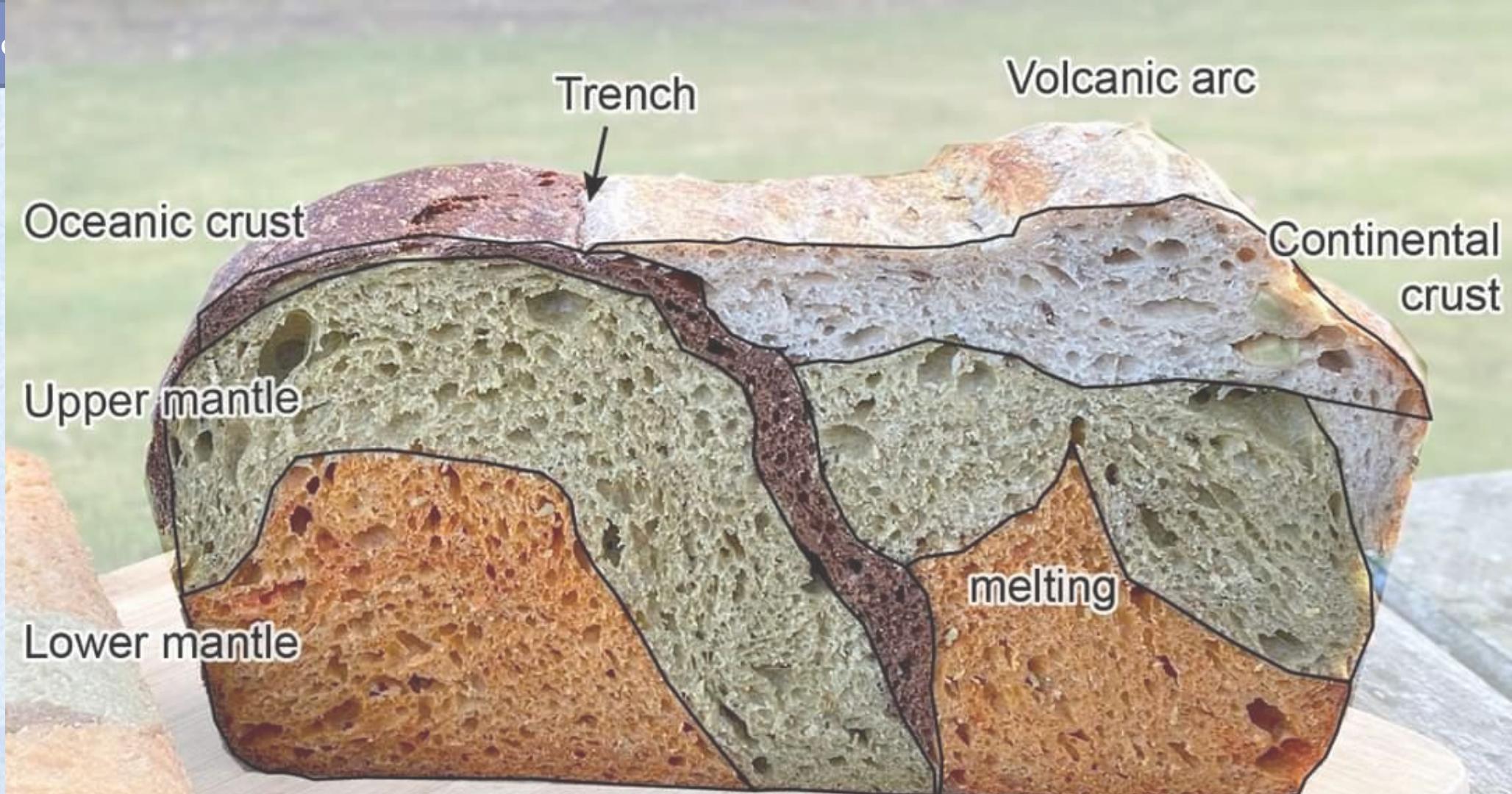


Plate Tectonics Theory



Plate Tectonics Theory





Sourdough flavors:

orange asthenosphere: paprika and pumpkin

green upper mantle: spinach and basil

brown oceanic crust: unsweetened cocoa

white cont. crust: roasted garlic and caraway

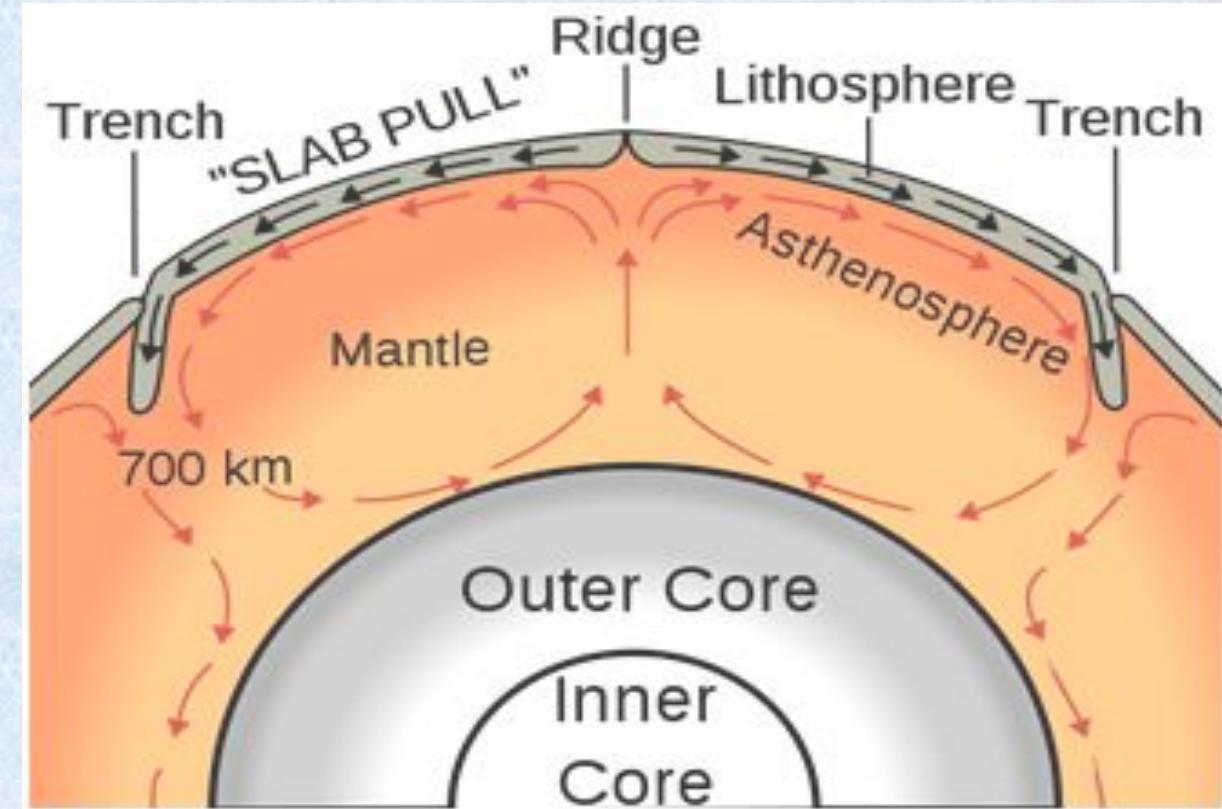


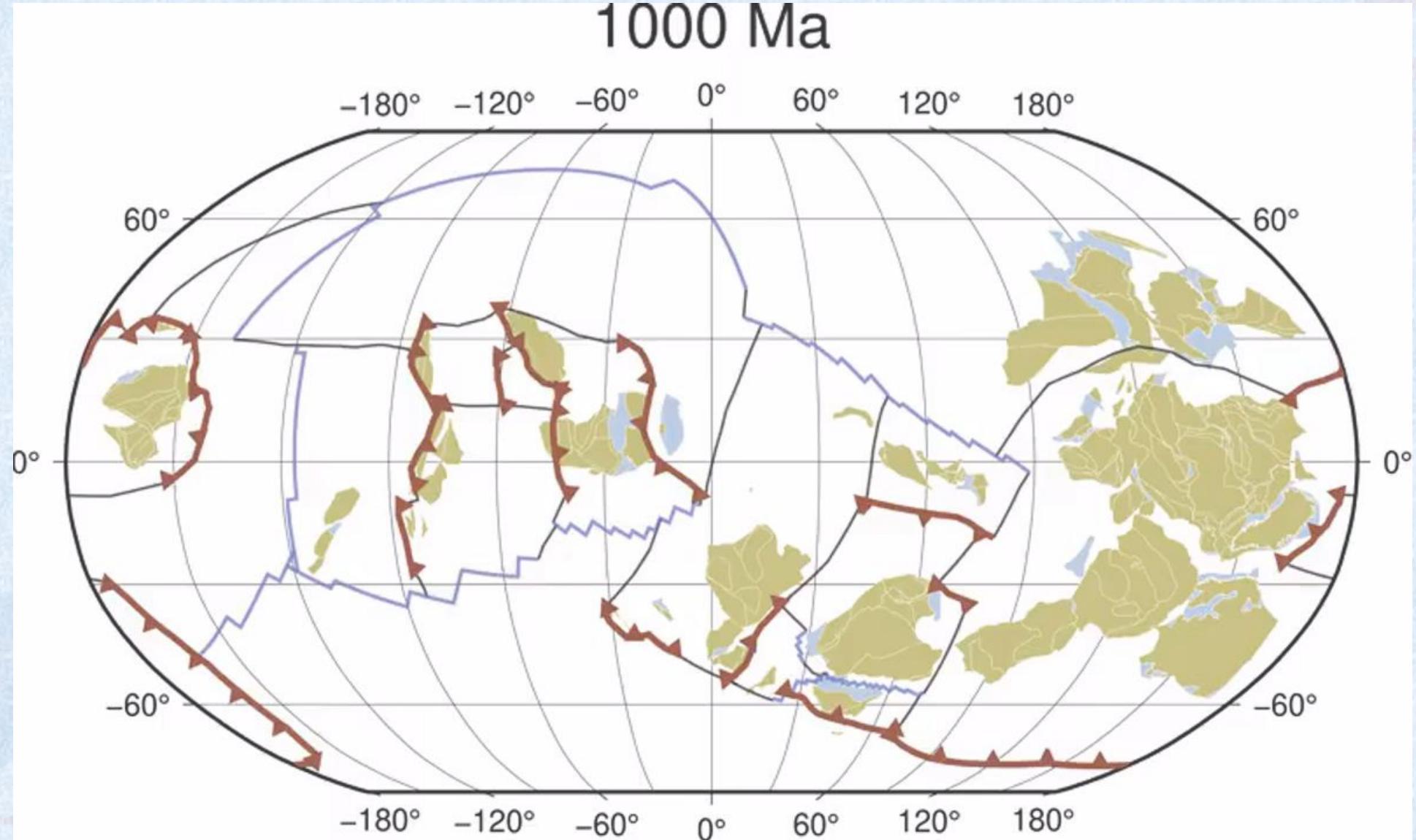
Plate Tectonics Theory



Rajesh Govindaraj

https://www.youtube.com/watch?v=1-HwPR_4mP4

<https://www.youtube.com/watch?v=fzhPmemffII>



2014	Why are the world's fold mountain systems located along the margins of continents? Bring out the association between the global distribution of fold mountains and the earthquakes and volcanoes.	10
2014	Explain the formation of thousands of islands in Indonesian and Philipines archipelagos.	10
2018	Define mantle plume and explain its role in plate tectonics.	10

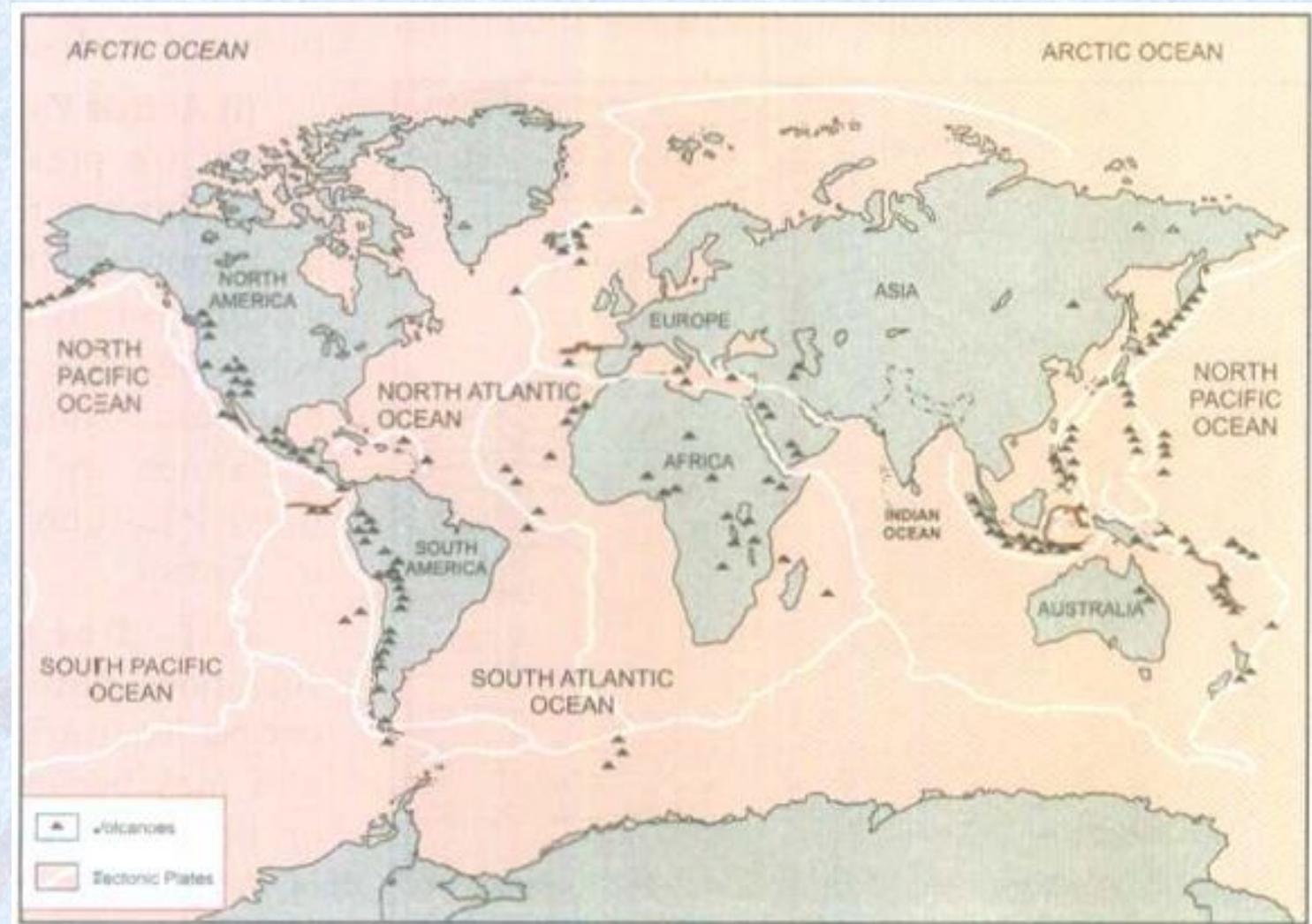


Fig. 8.1. Tectonic plates and distribution of volcanoes

<https://www.youtube.com/watch?v=VNGUdObDoLk>

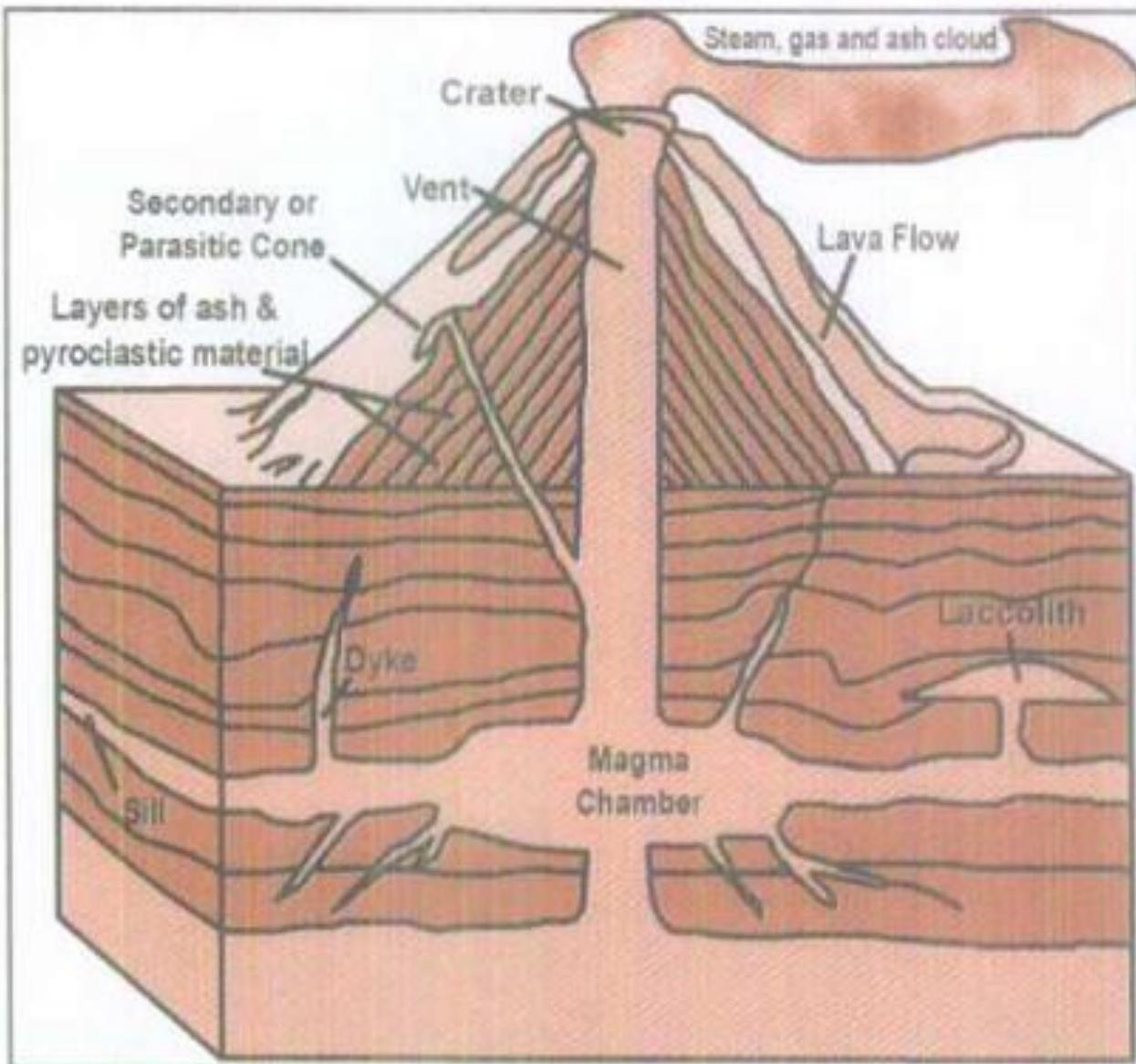
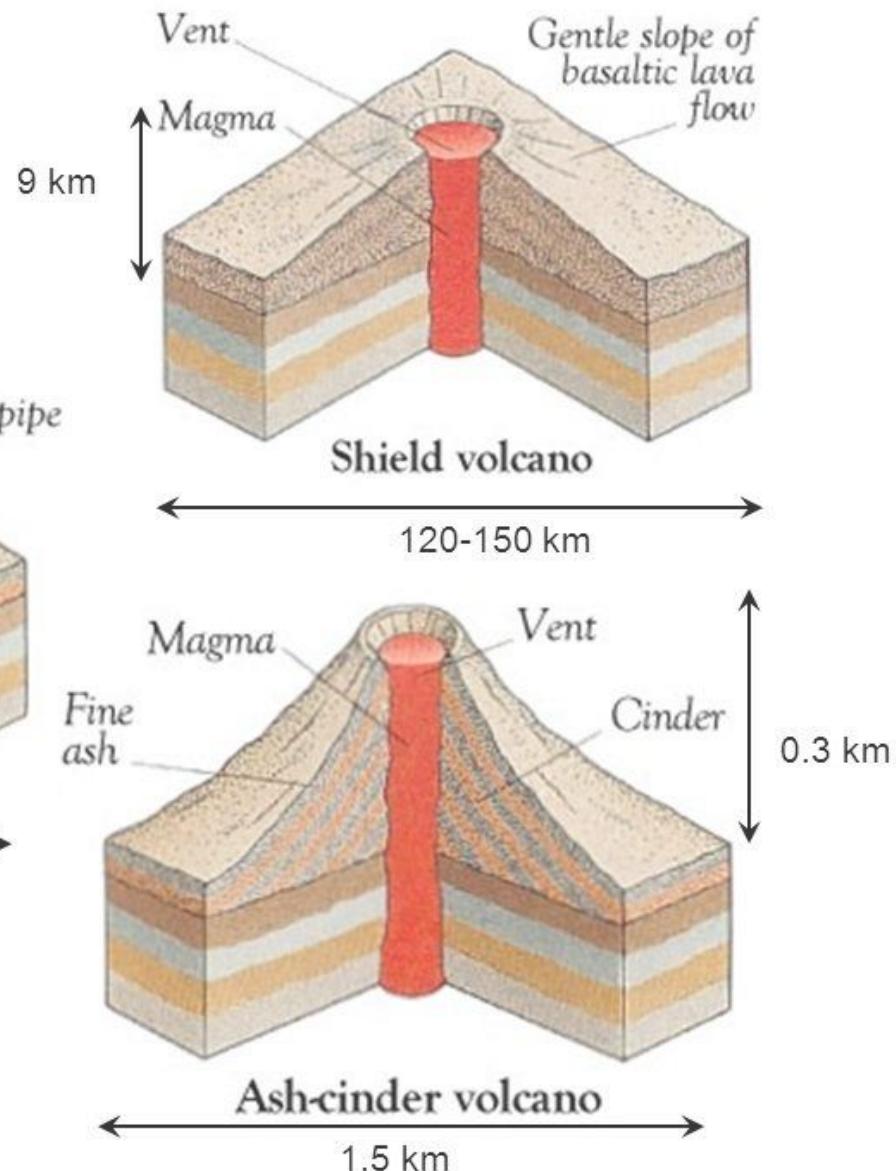
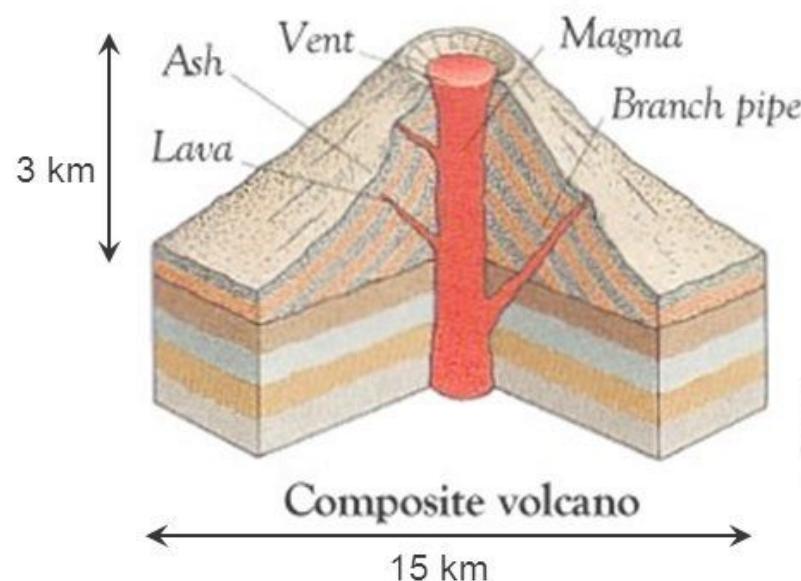


Fig. 8.2. Structure of a volcano

3 types of volcanoes



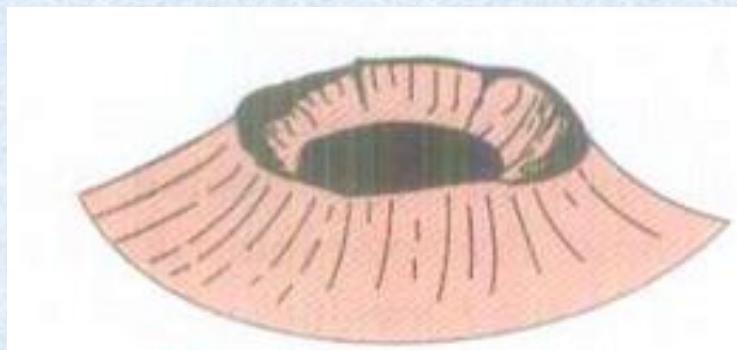


Fig. 8.4. Crater Lake

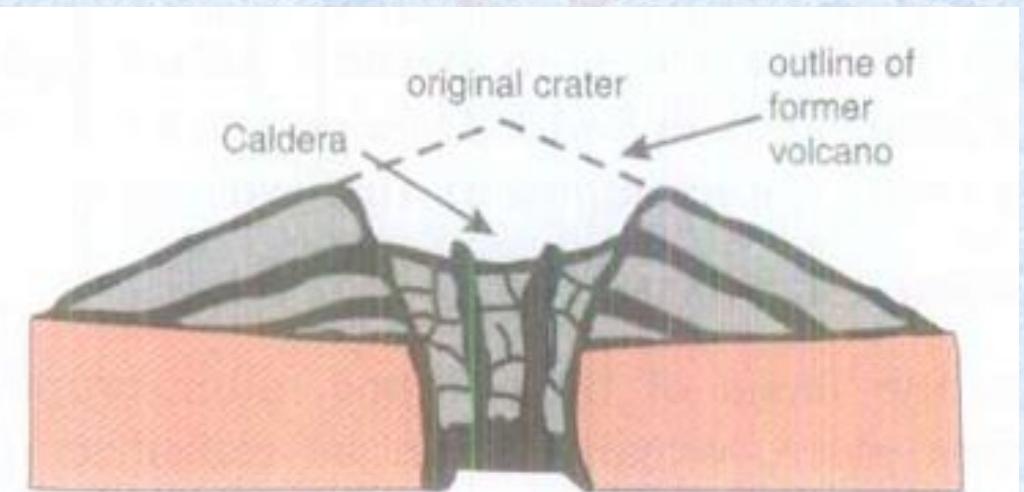


Fig. 8.6. A caldera

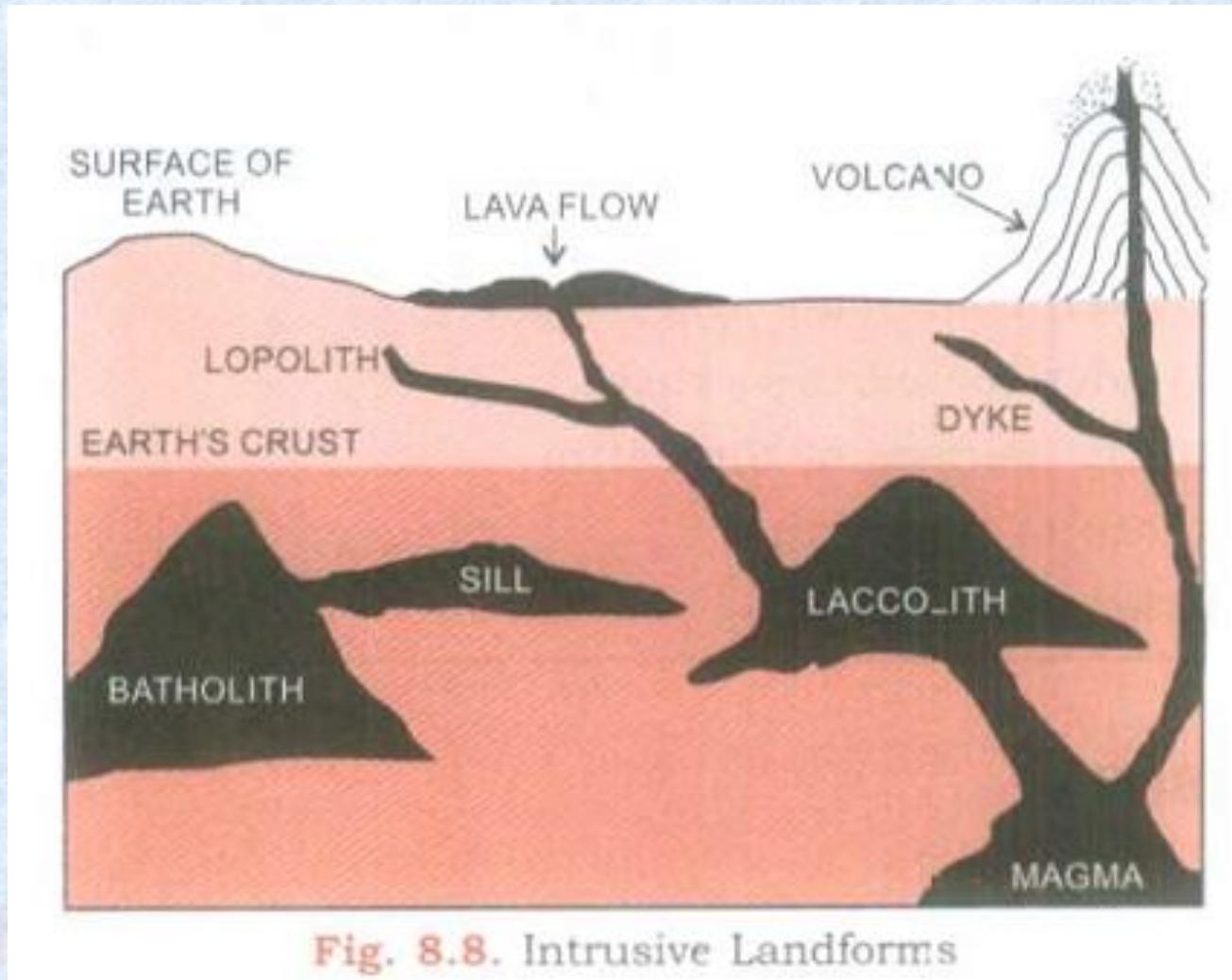
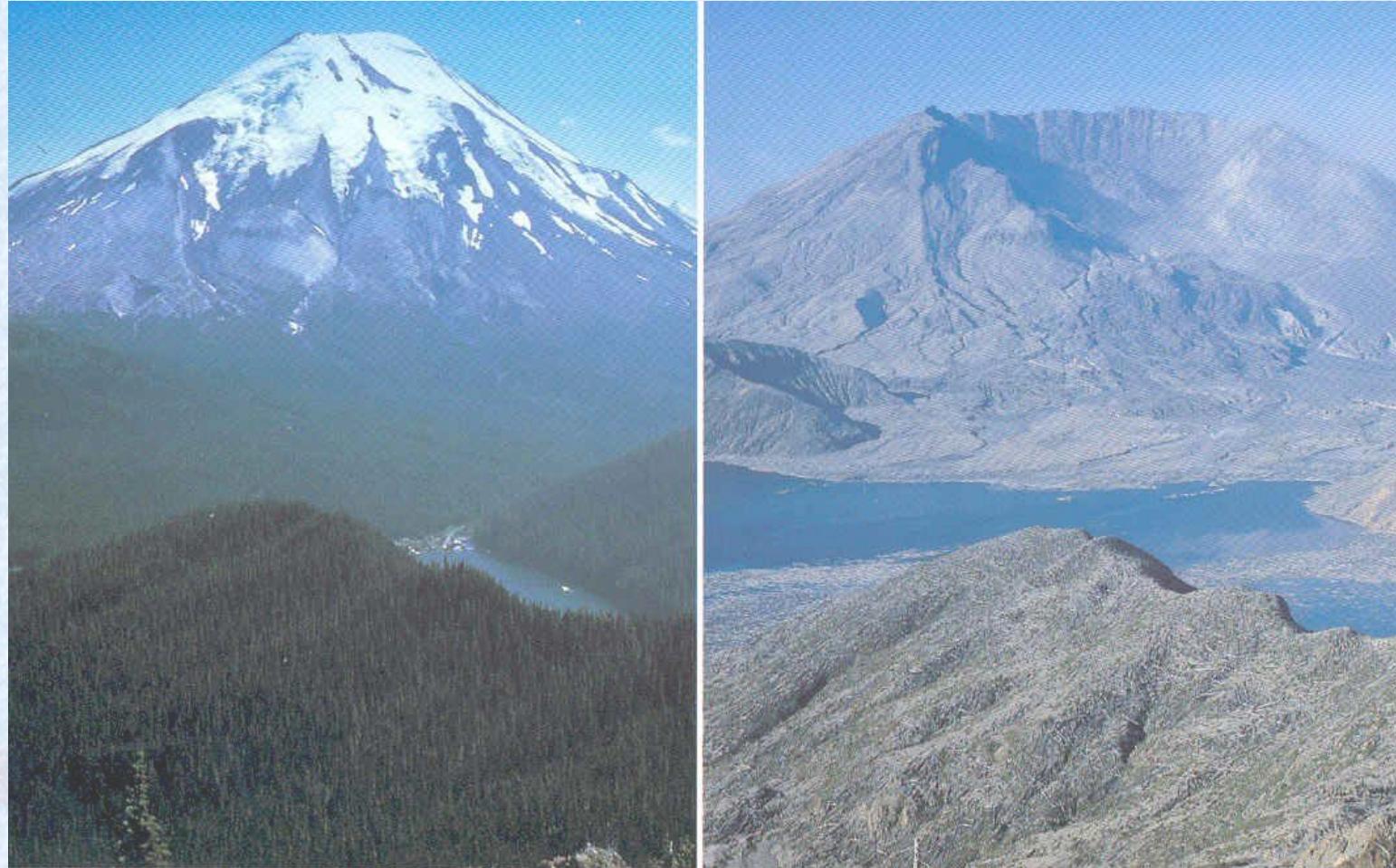


Fig. 8.8. Intrusive Landforms

Vulcanism

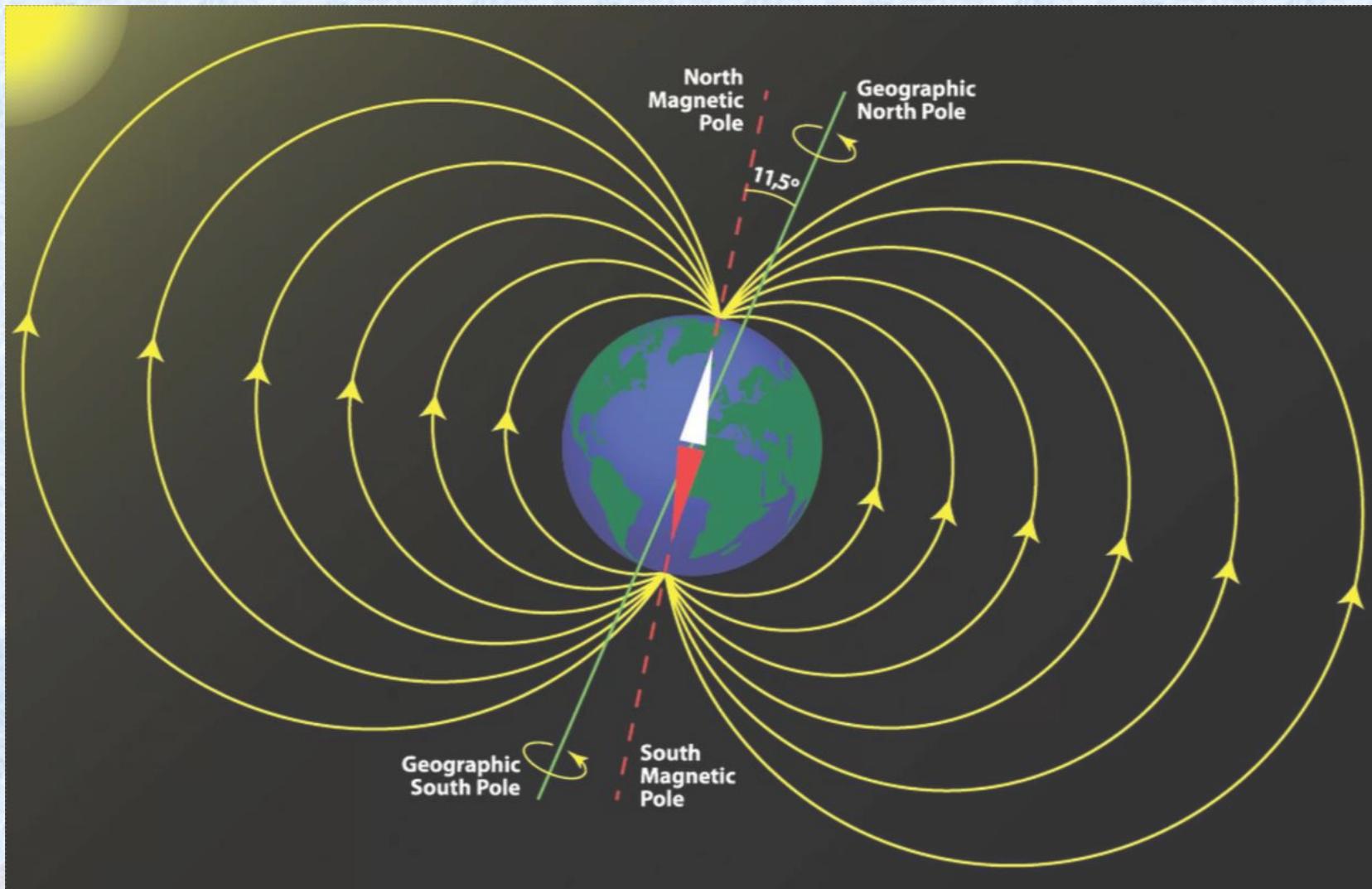




<https://www.youtube.com/watch?v=AYla6q3is6w>



krakatoa eruption 1883

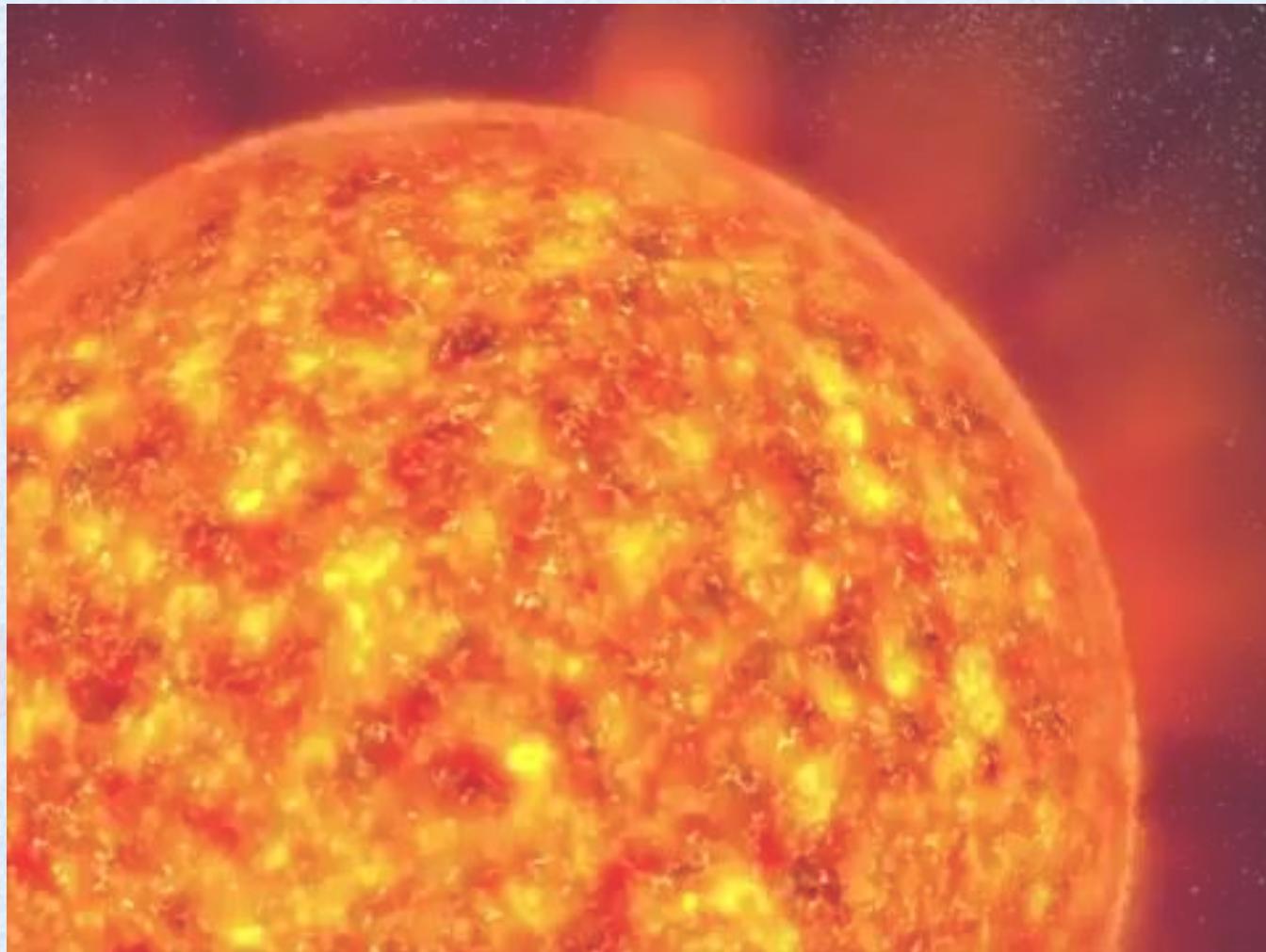


12	Geomorphology	2018	<p>Consider the following statements:</p> <ol style="list-style-type: none">1. The Earth's magnetic field has reversed every few hundred thousand years.2. When the Earth was created more than 4000 million years ago, there was 54% oxygen and no carbon dioxide.3. When living organisms originated, they modified the early atmosphere of the Earth. <p>Which of the statements given above is/are correct?</p> <p>(a) 1 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2 and 3</p>
----	---------------	------	--

Geomagnetism



S
S
S



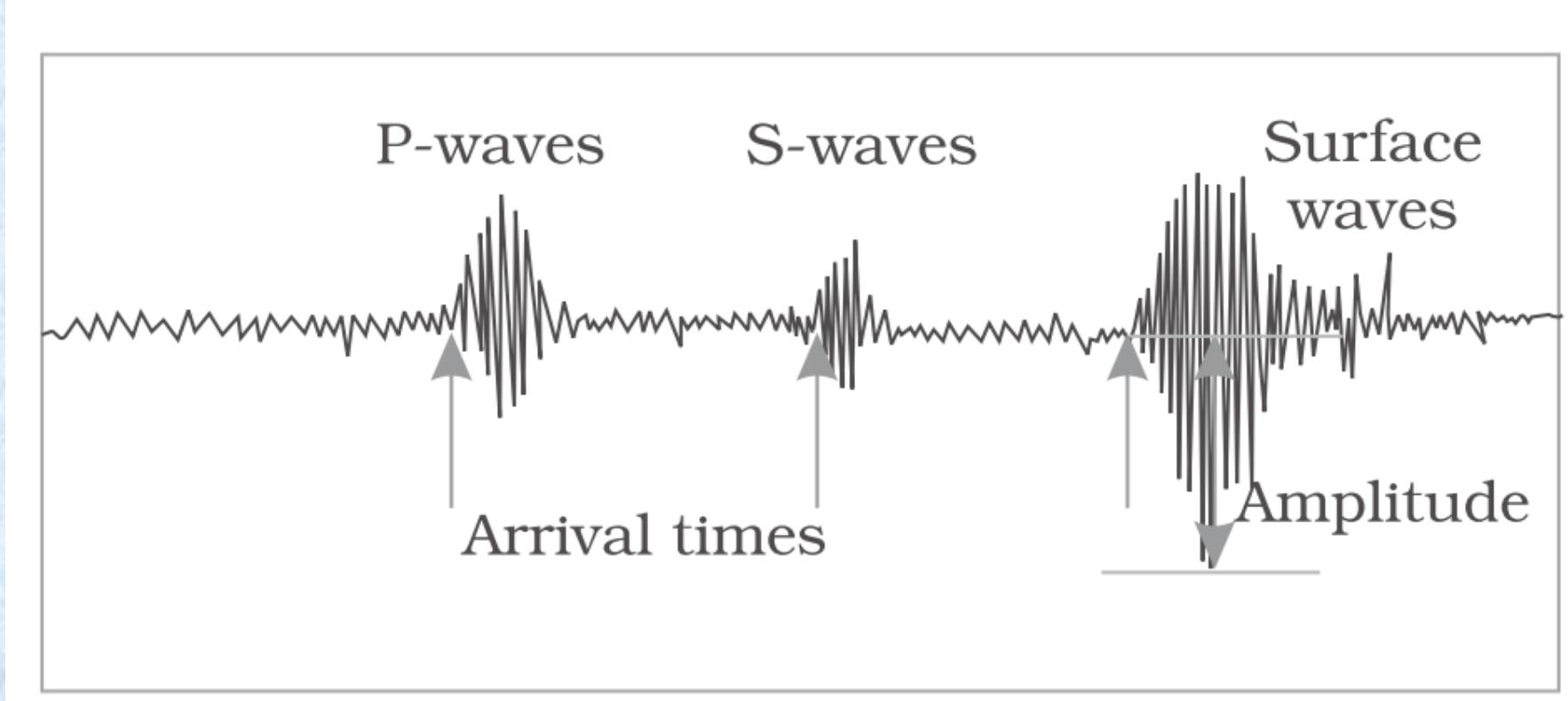


Figure 3.1 : Earthquake Waves

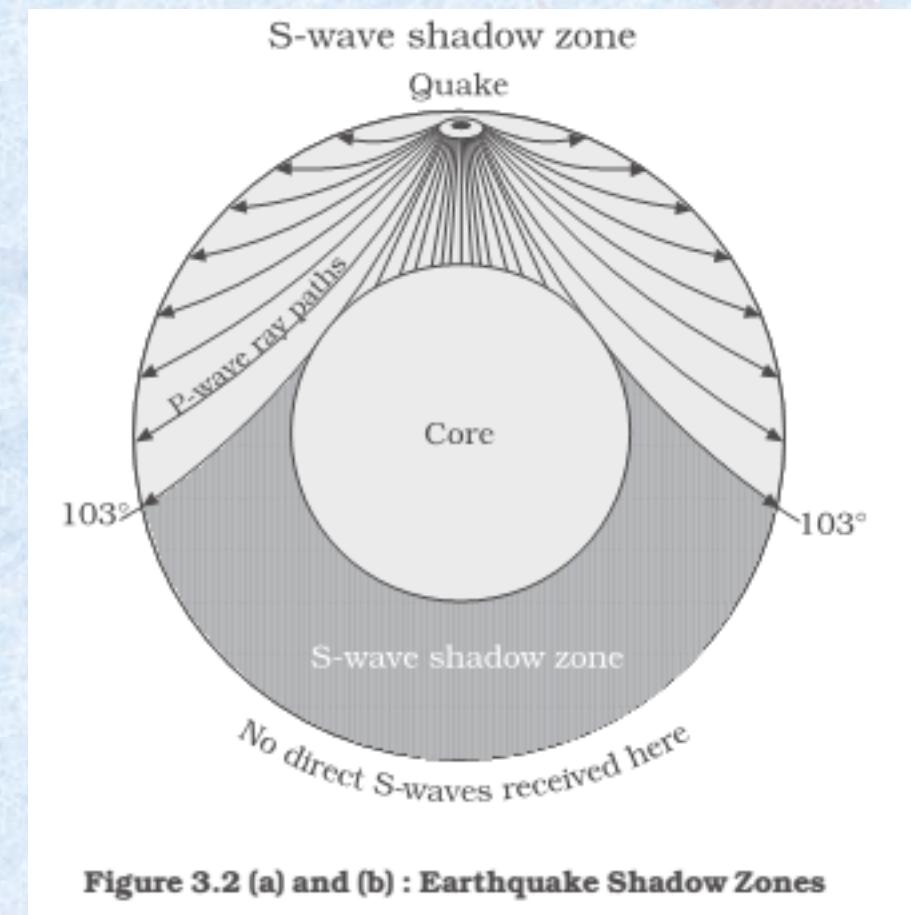
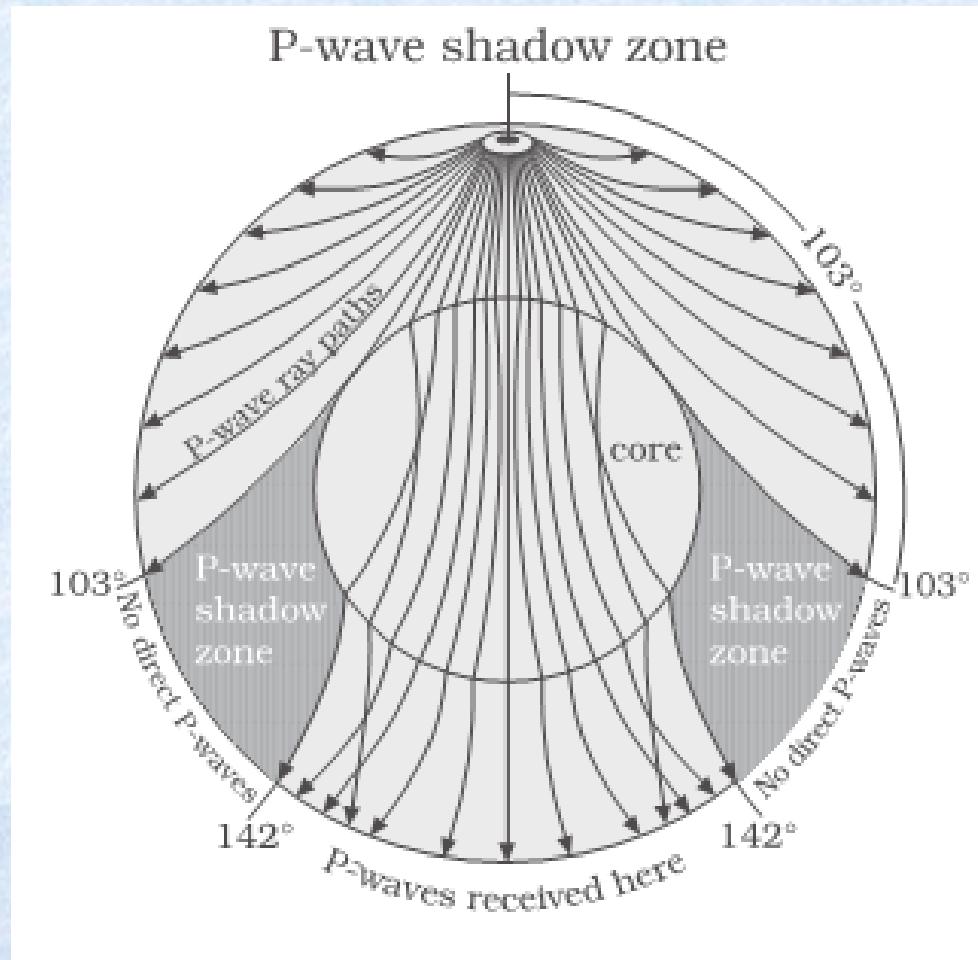
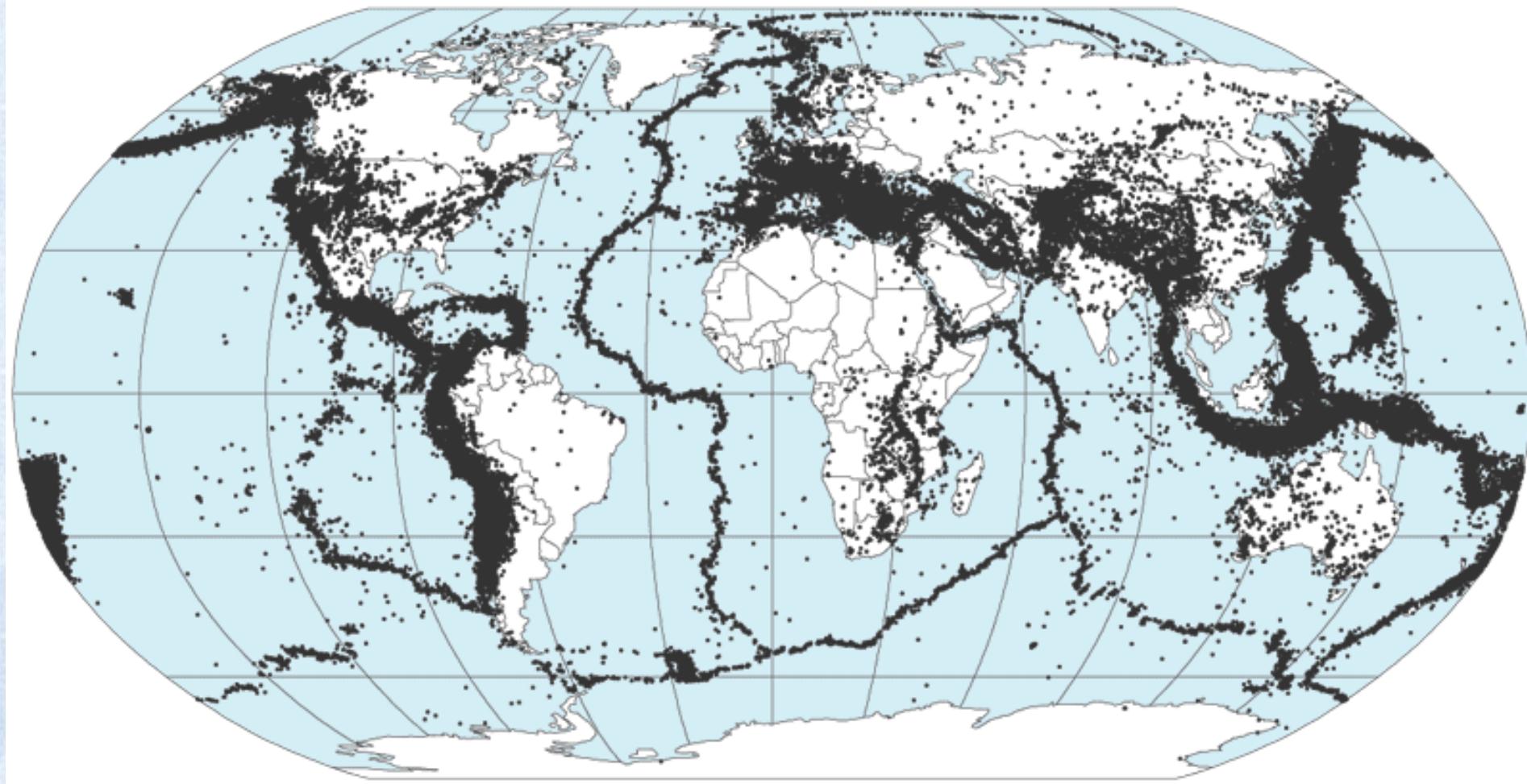
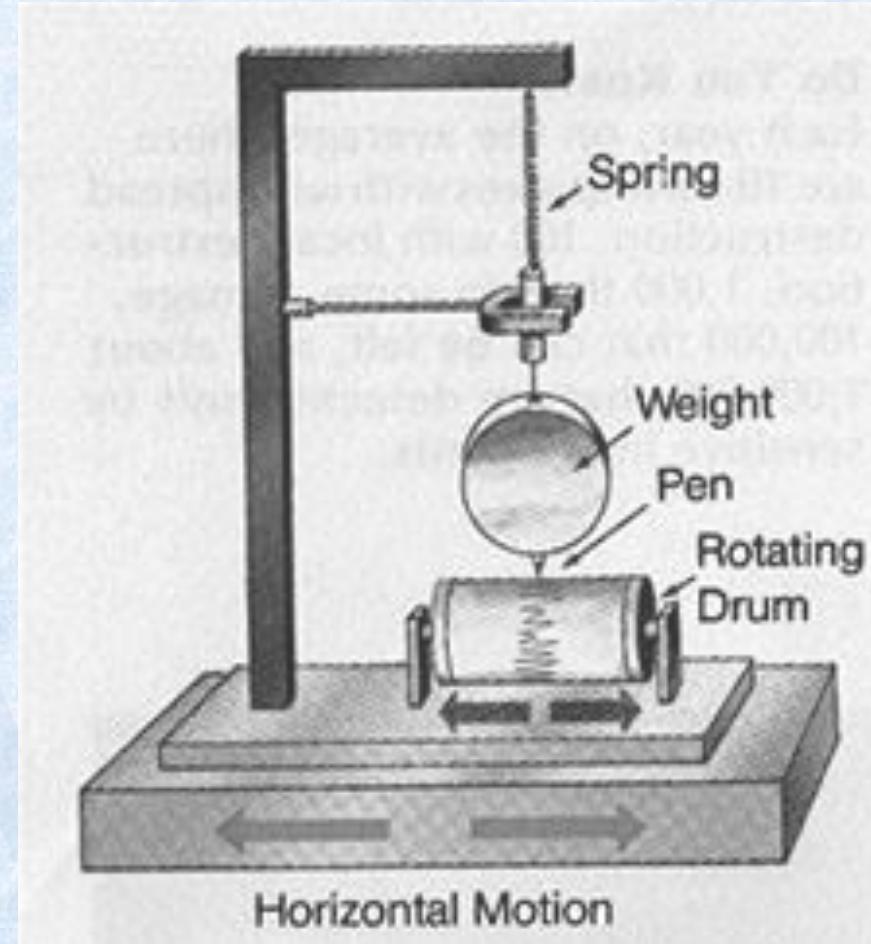


Figure 3.2 (a) and (b) : Earthquake Shadow Zones

Preliminary Determination of Epicenters

358,214 Events, 1963 - 1998





https://www.youtube.com/watch?v=_r_nFT2m-Vg

<https://www.youtube.com/watch?v=T0AEtX-uPLA>

https://www.youtube.com/watch?v=_oPb_9gOdn4

<https://www.youtube.com/watch?v=xyKgamjegtQ>

Indian Ocean Tsunami

<https://www.youtube.com/watch?v=oMhVHM6WwWQ&t=219s>

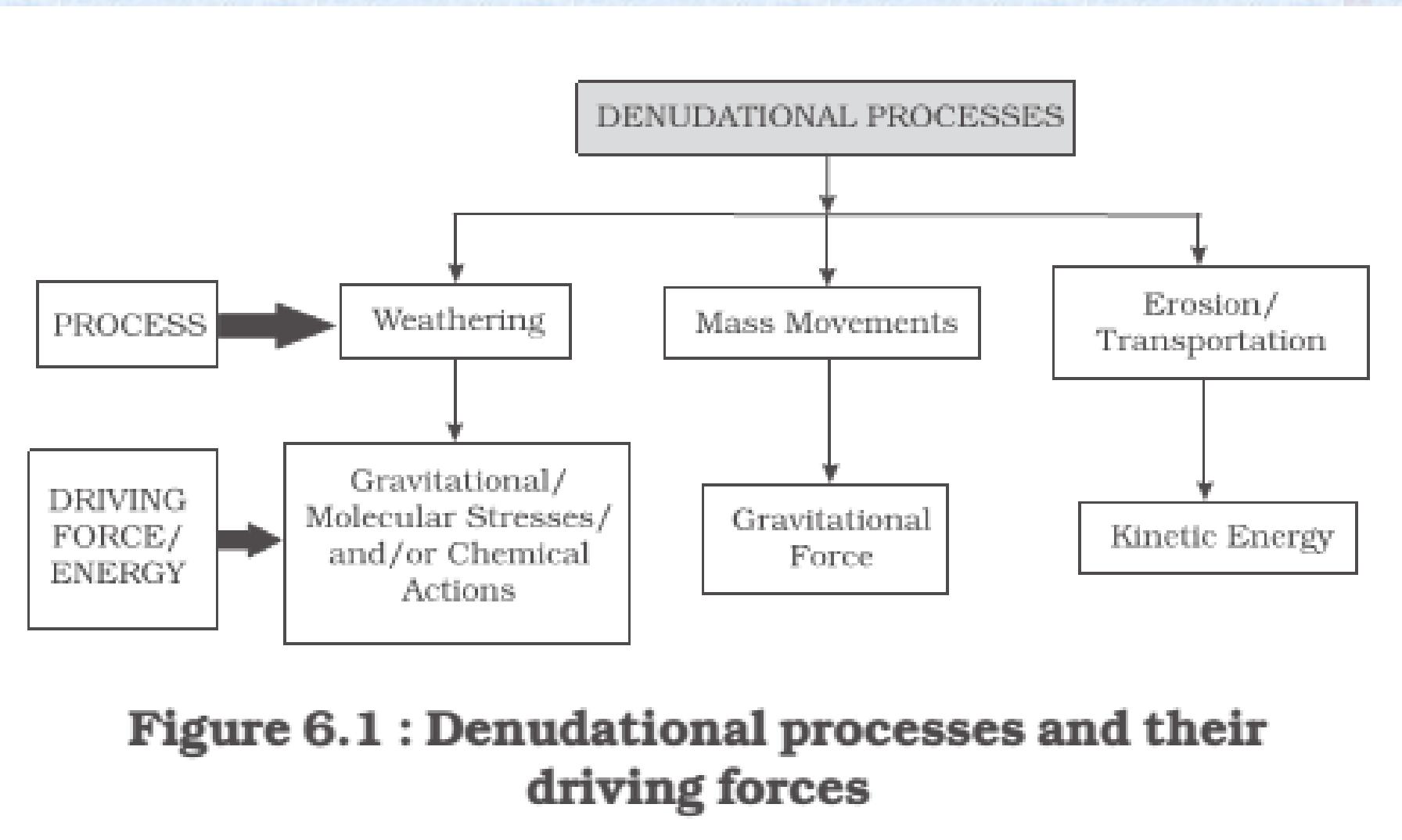


Figure 6.1 : Denudational processes and their driving forces

Table 11.1. Difference between Mechanical and Chemical Weathering.

Mechanical (Physical) Weathering	Chemical Weathering
<ol style="list-style-type: none"> 1. Disintegration of rocks take place without any change in chemical constituents of rocks. 2. Factors such as temperature, moisture, frost action and wind cause physical break-up of rocks. 3. It is more rapid in desert climates. 4. Rocks are affected to great depths. 5. Its agents are temperature and moisture. 	<ol style="list-style-type: none"> 1. Decomposition of rocks take place with changes in the chemical constituents of rocks. 2. Temperature, moisture, etc., cause minerals in rocks to either dissolve in water or change their composition. 3. It occurs in moist and cold climates 4. It mostly takes place near the surface of the earth. 5. Its agents are water, oxygen, carbon and various organic acids.

Exogenic Movements

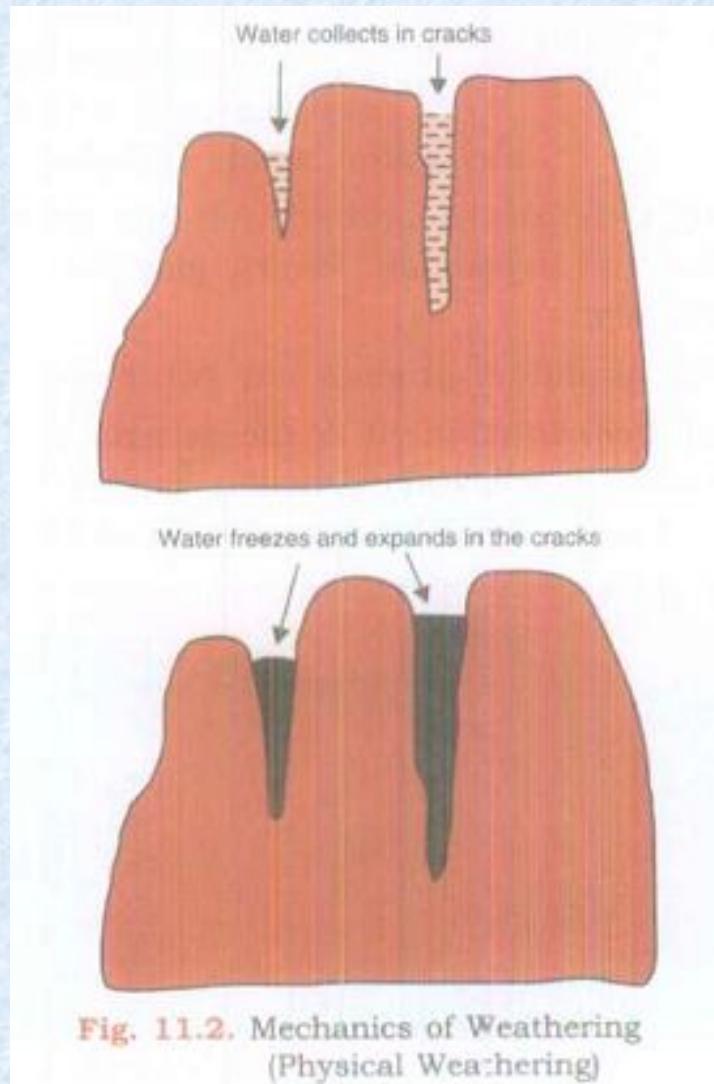
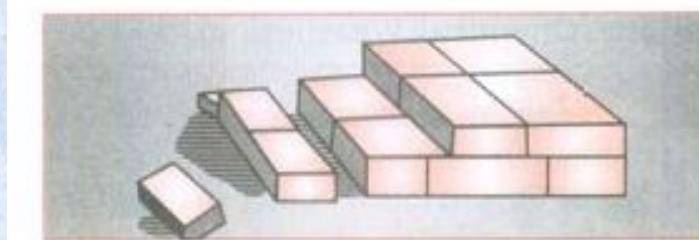


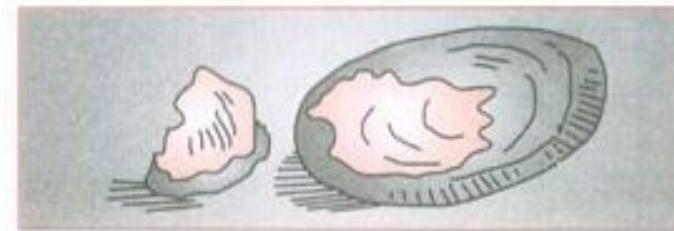
Fig. 11.2. Mechanics of Weathering
(Physical Weathering)



Frost shattering



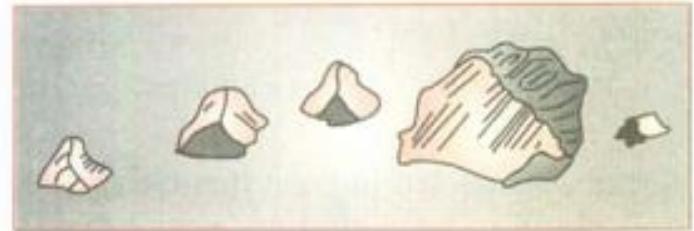
(a) Block disintegration



(c) Exfoliation



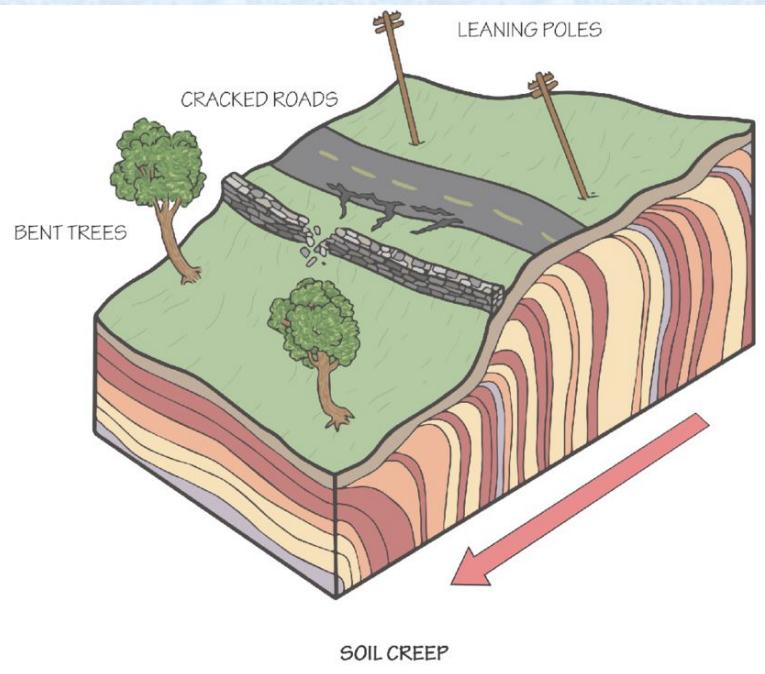
(b) Granular disintegration



(d) Frost Action

Fig. 11.3. Types of Mechanical Weathering

Exogenic Movements



Solifluction

Exogenic Movements



Land slide



Earth flow



Mud flow

Exogenic Movements

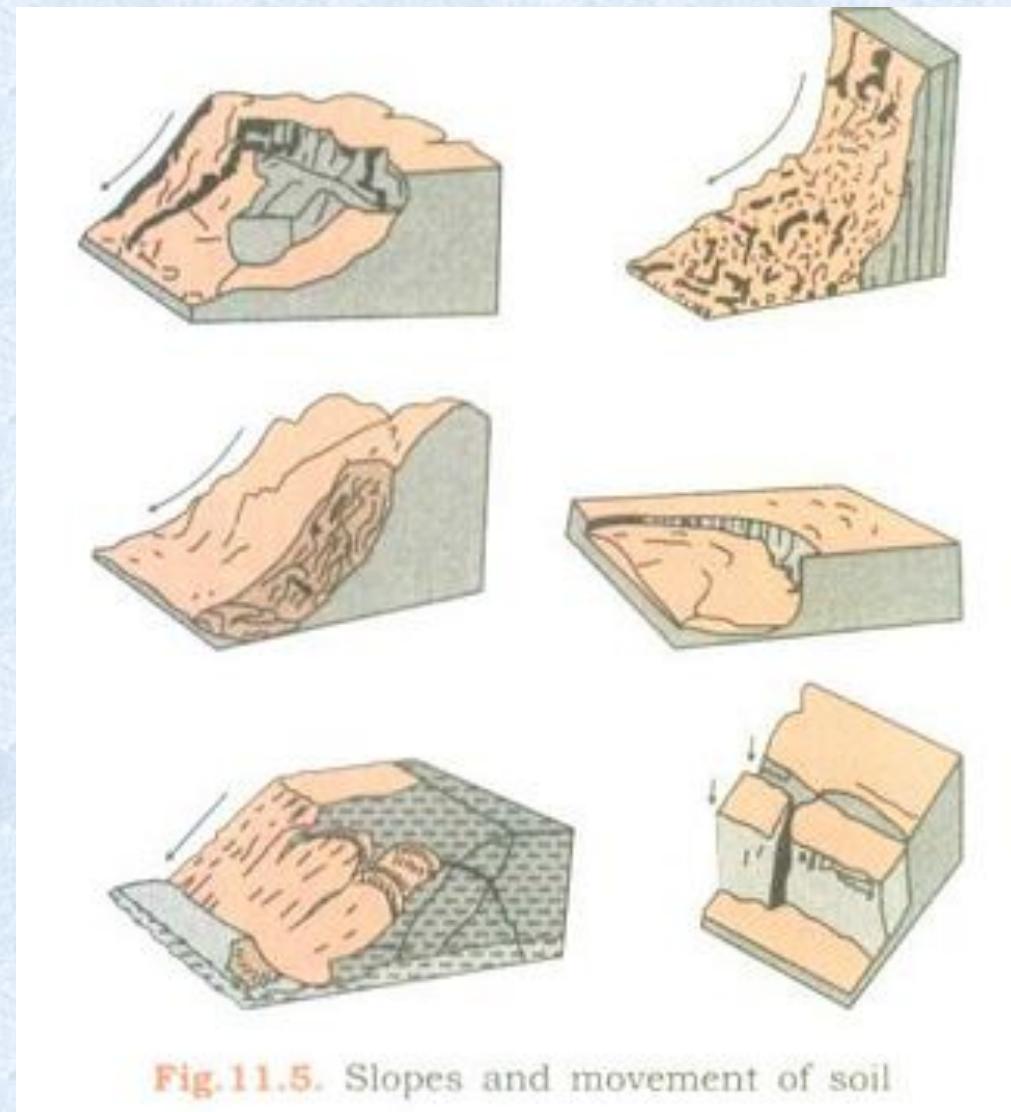
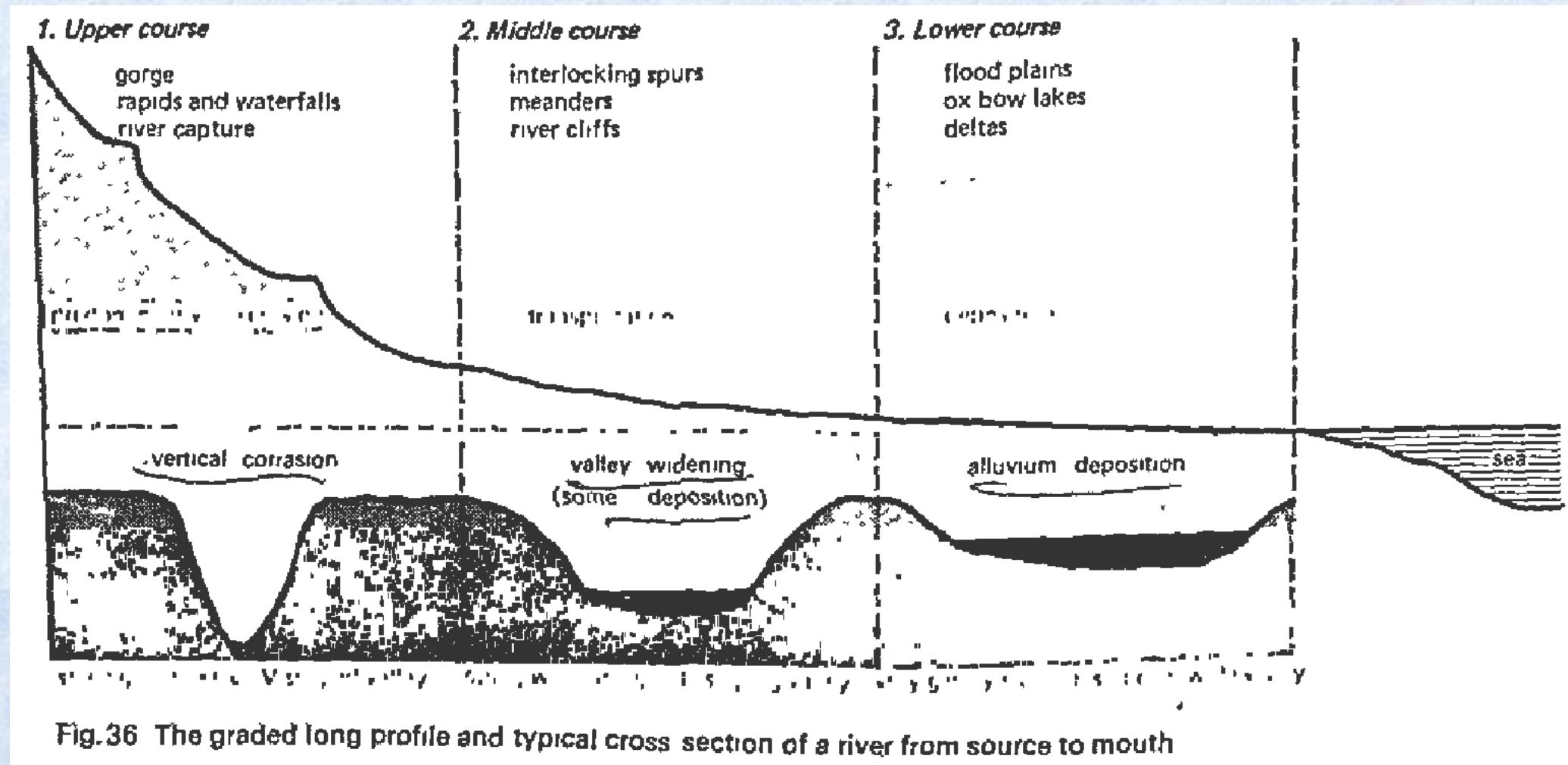


Fig.11.5. Slopes and movement of soil

Exogenic Movements





Landforms





Figure 7.1 : The Valley of Kaveri river near Hogenekal, Dharmapuri district, Tamilnadu in the form of gorge



Figure 7.2 : An entrenched meander loop of river Colorado in USA showing step-like side slopes of its valley typical of a canyon

Landforms



Landforms

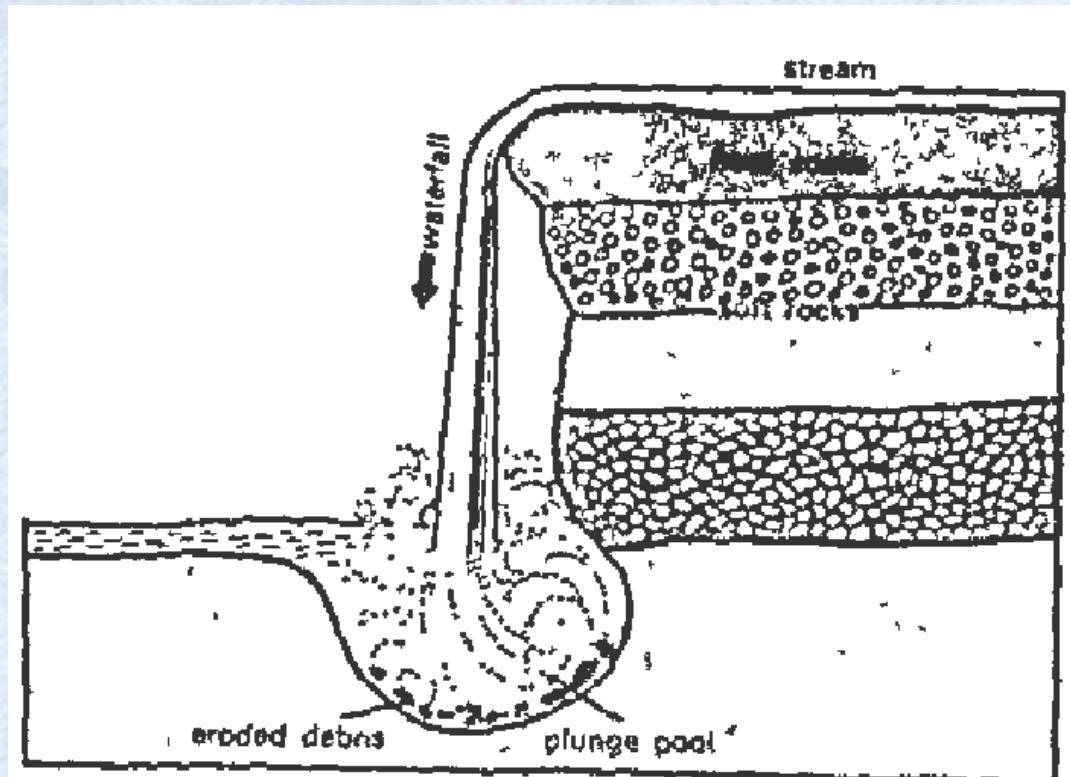
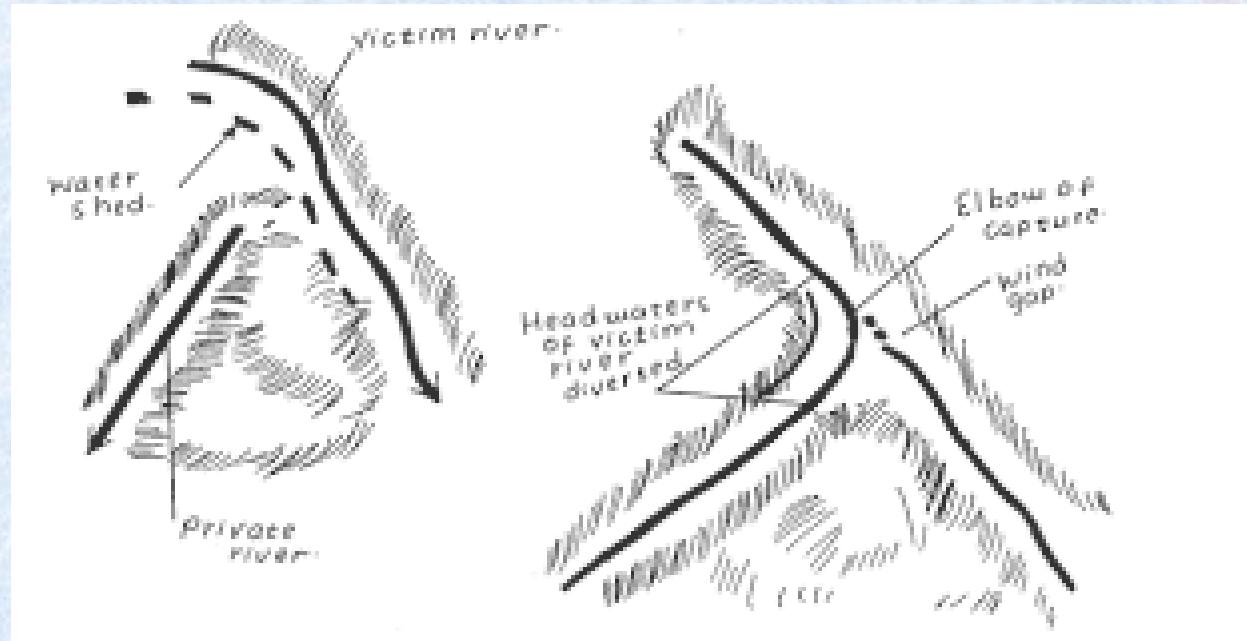


Fig 39 A waterfall with plunge pool

Rajesh Govinadraij



Landforms



Landforms

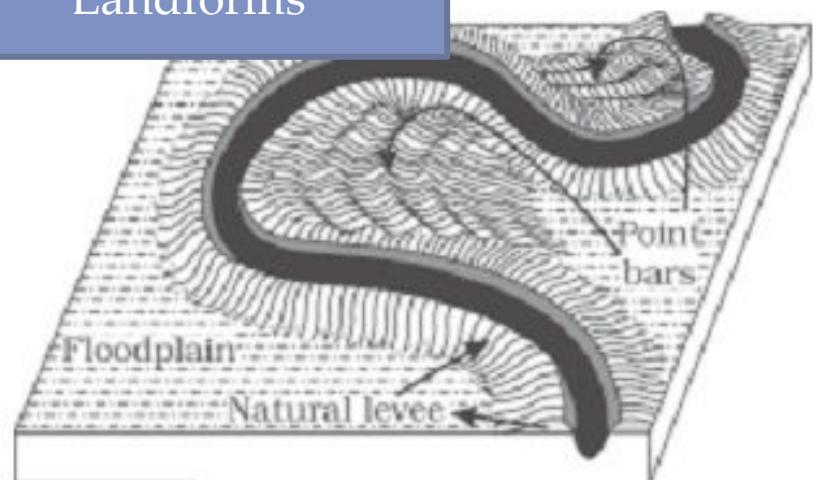


Figure 7.6 : Natural levee and point bars

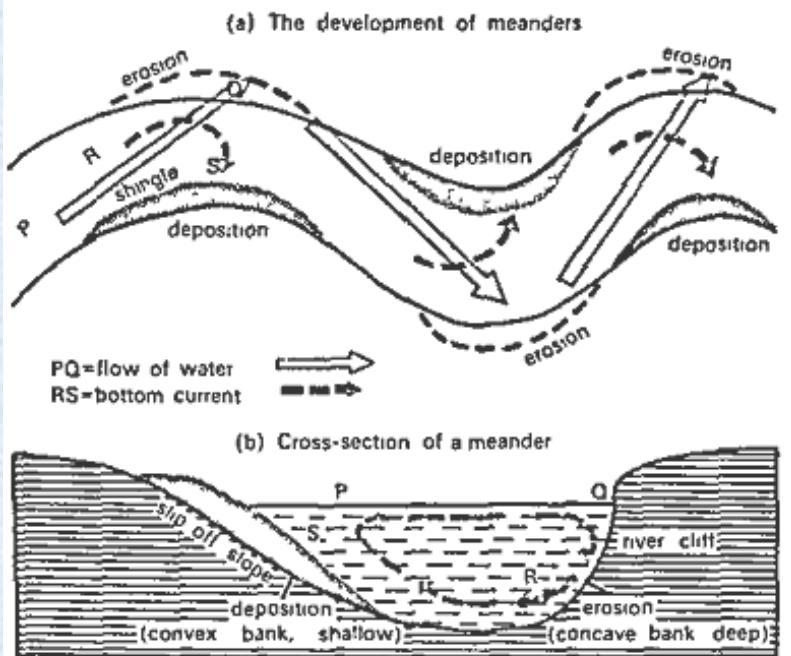


Fig 41 Meanders

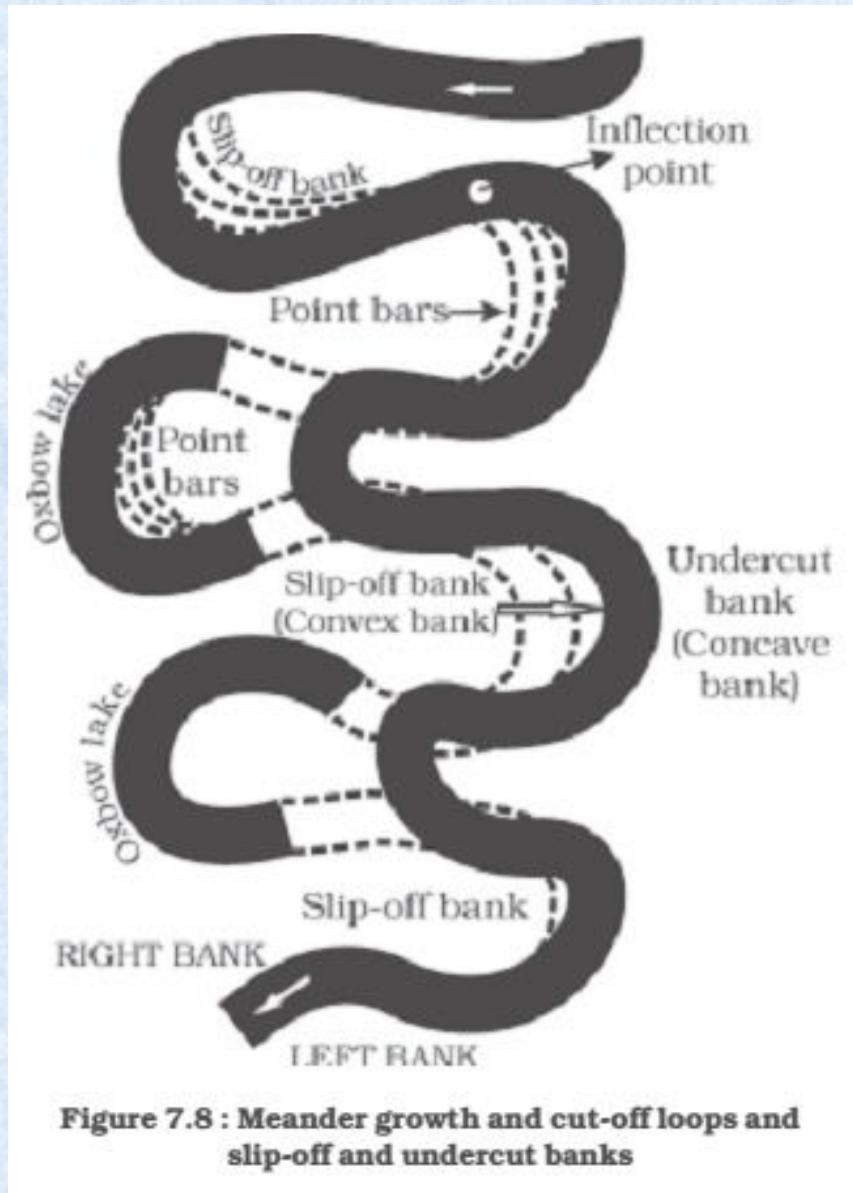


Figure 7.8 : Meander growth and cut-off loops and slip-off and undercut banks

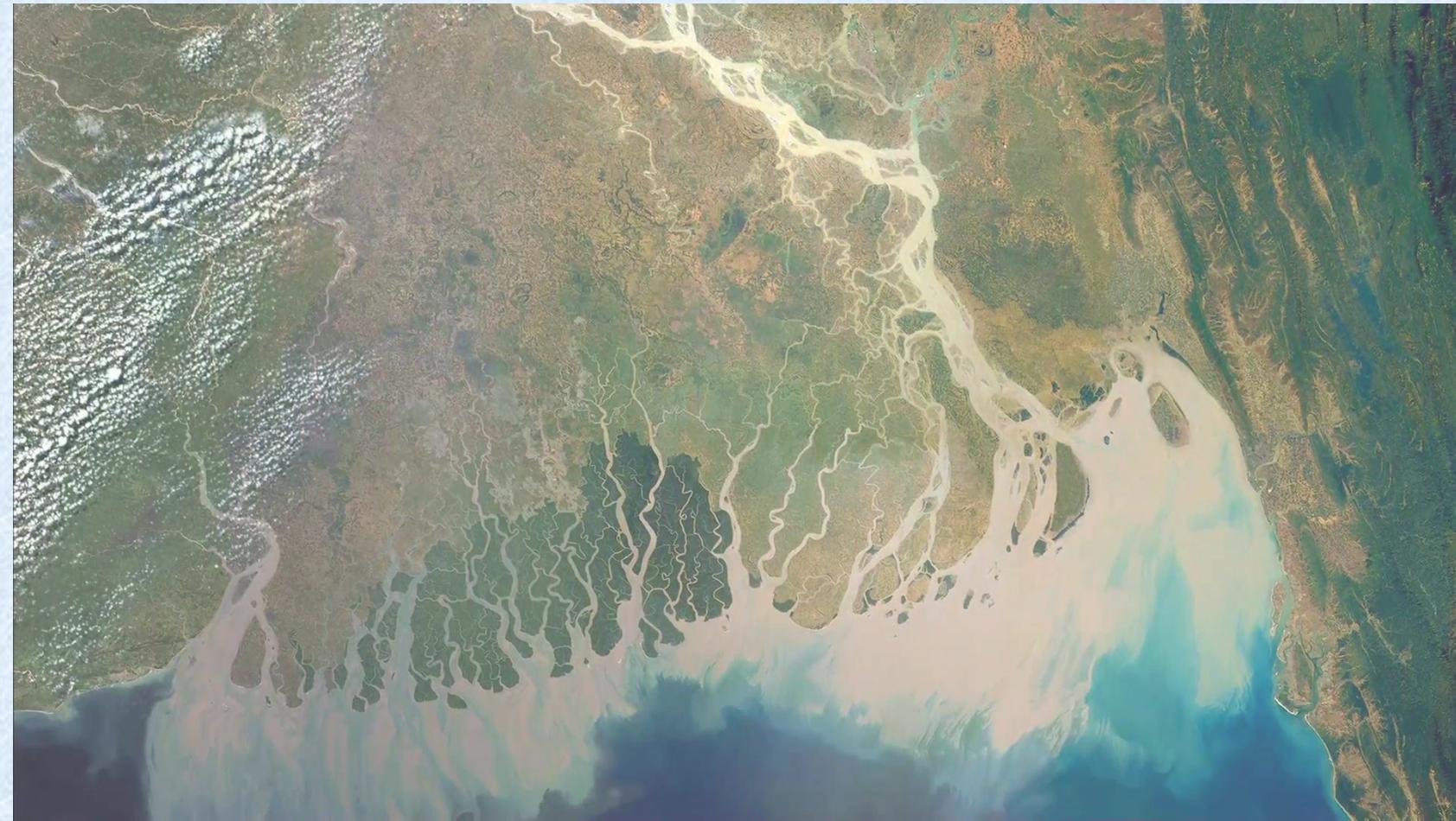


Figure 7.4 : An alluvial fan deposited by a hill stream on the way to Amarnath, Jammu and Kashmir



Figure 7.5 : A satellite view of part of Krishna river delta, Andhra Pradesh

Landforms



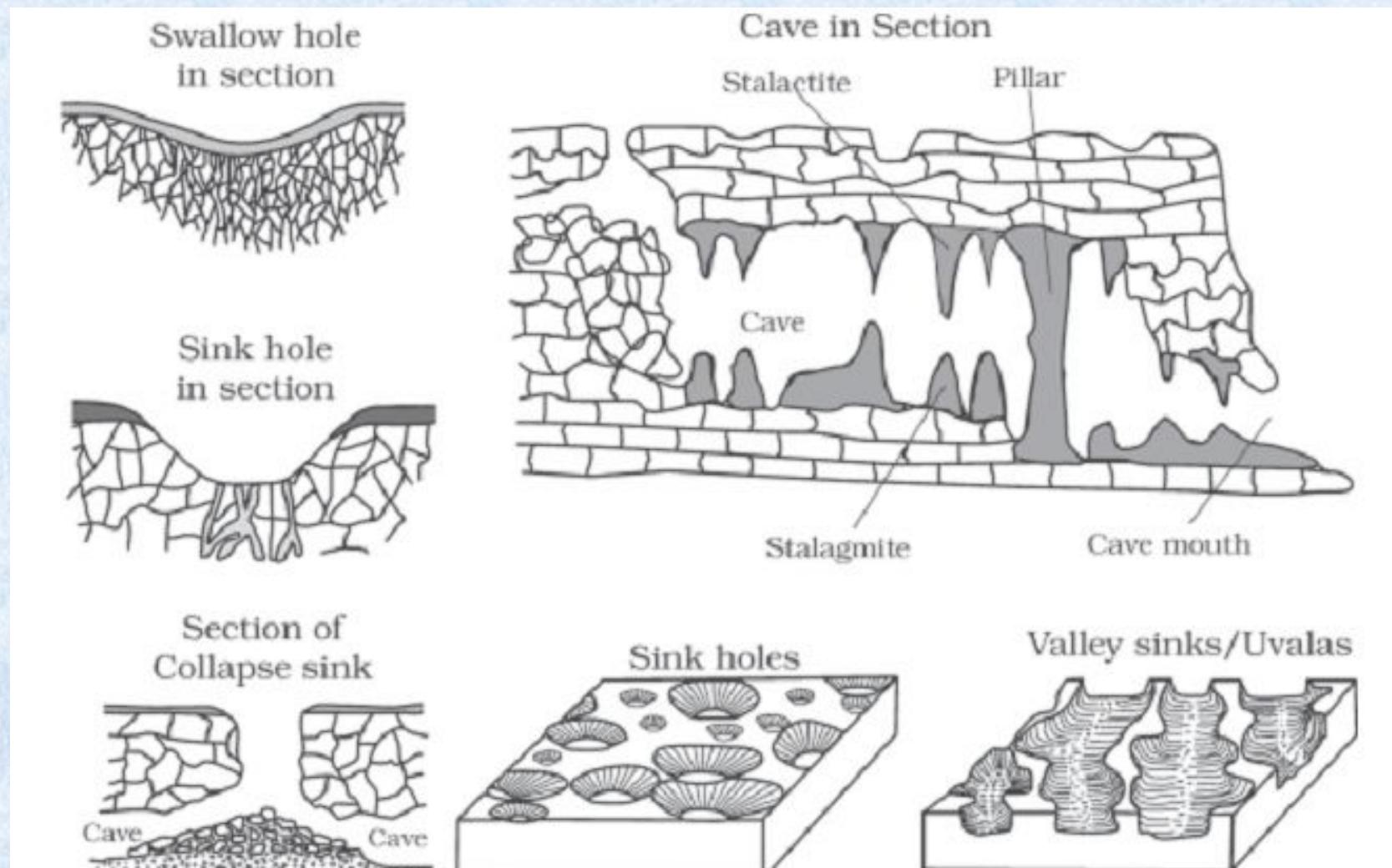
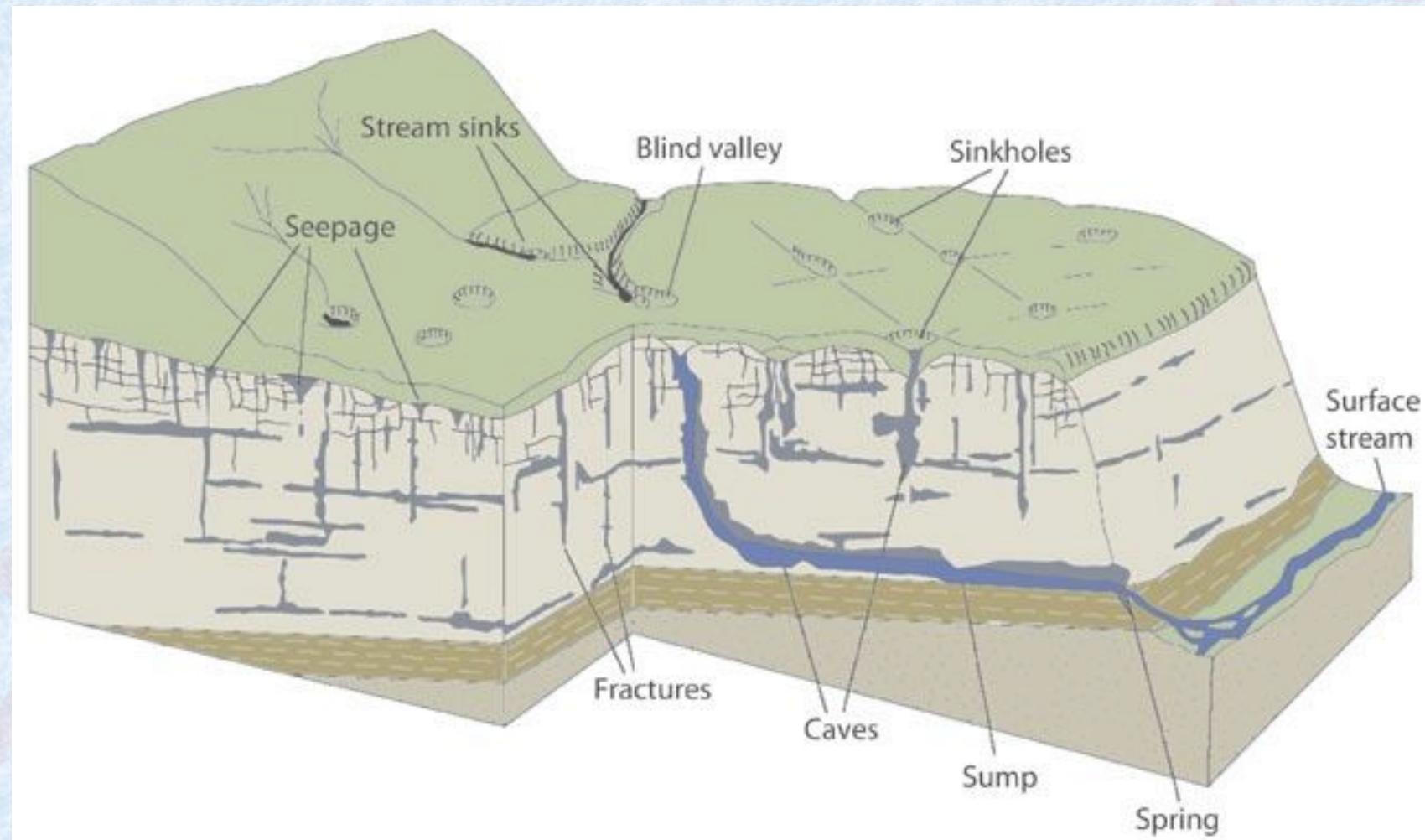


Figure 7.10 : Various karst features





Landforms



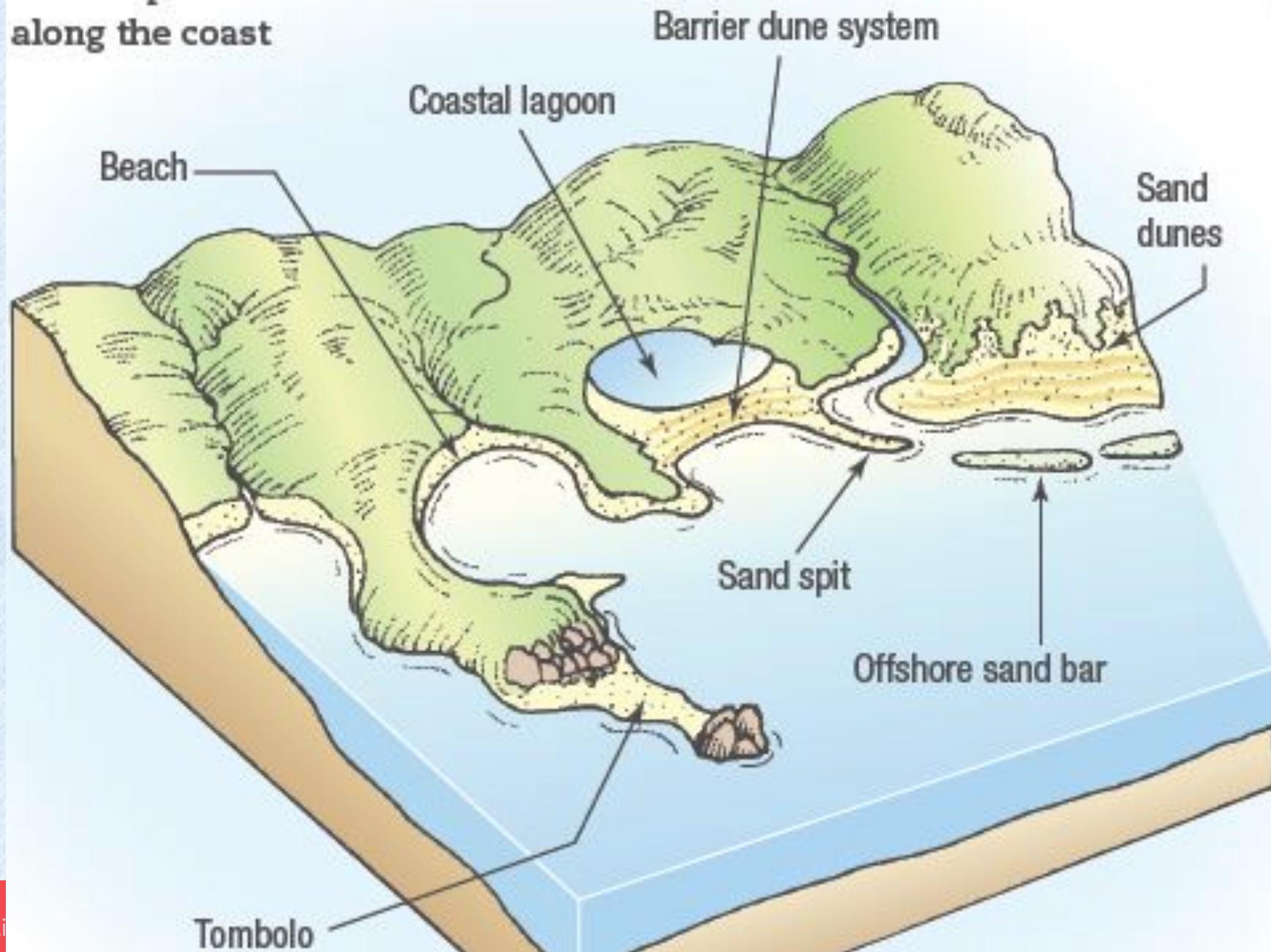
Landforms





MRKSB.COM

7.13 Depositional landforms along the coast



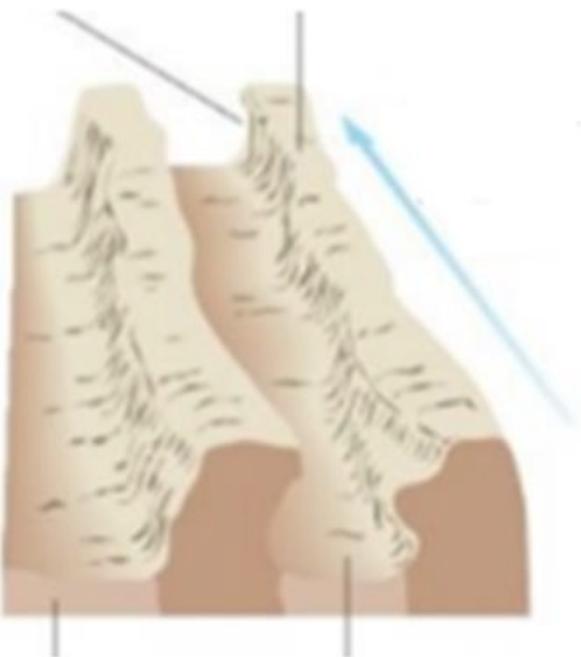
Landforms



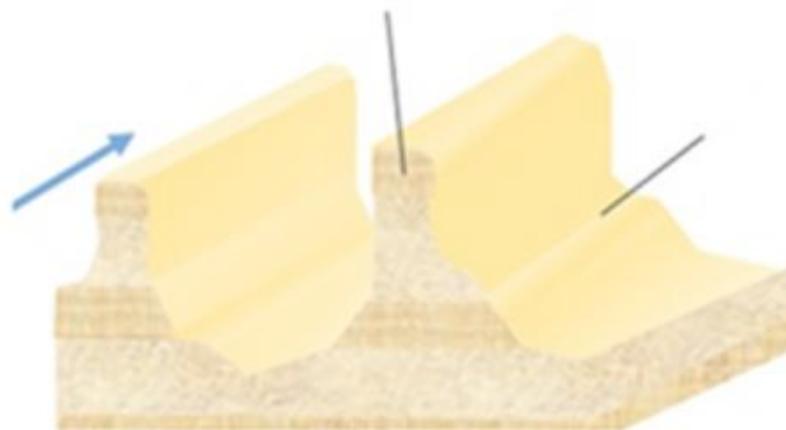
Landforms



Zeugen



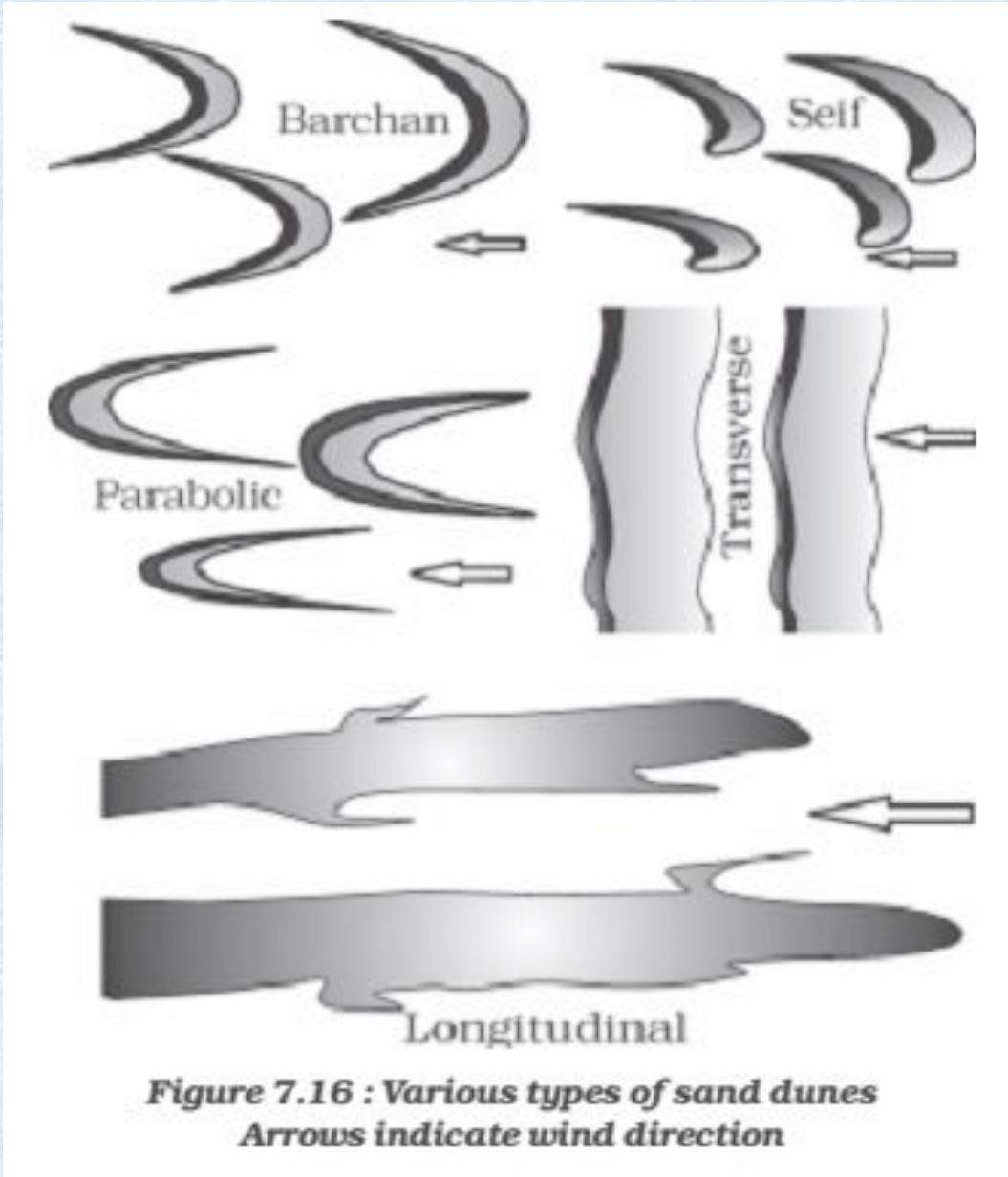
Yardang



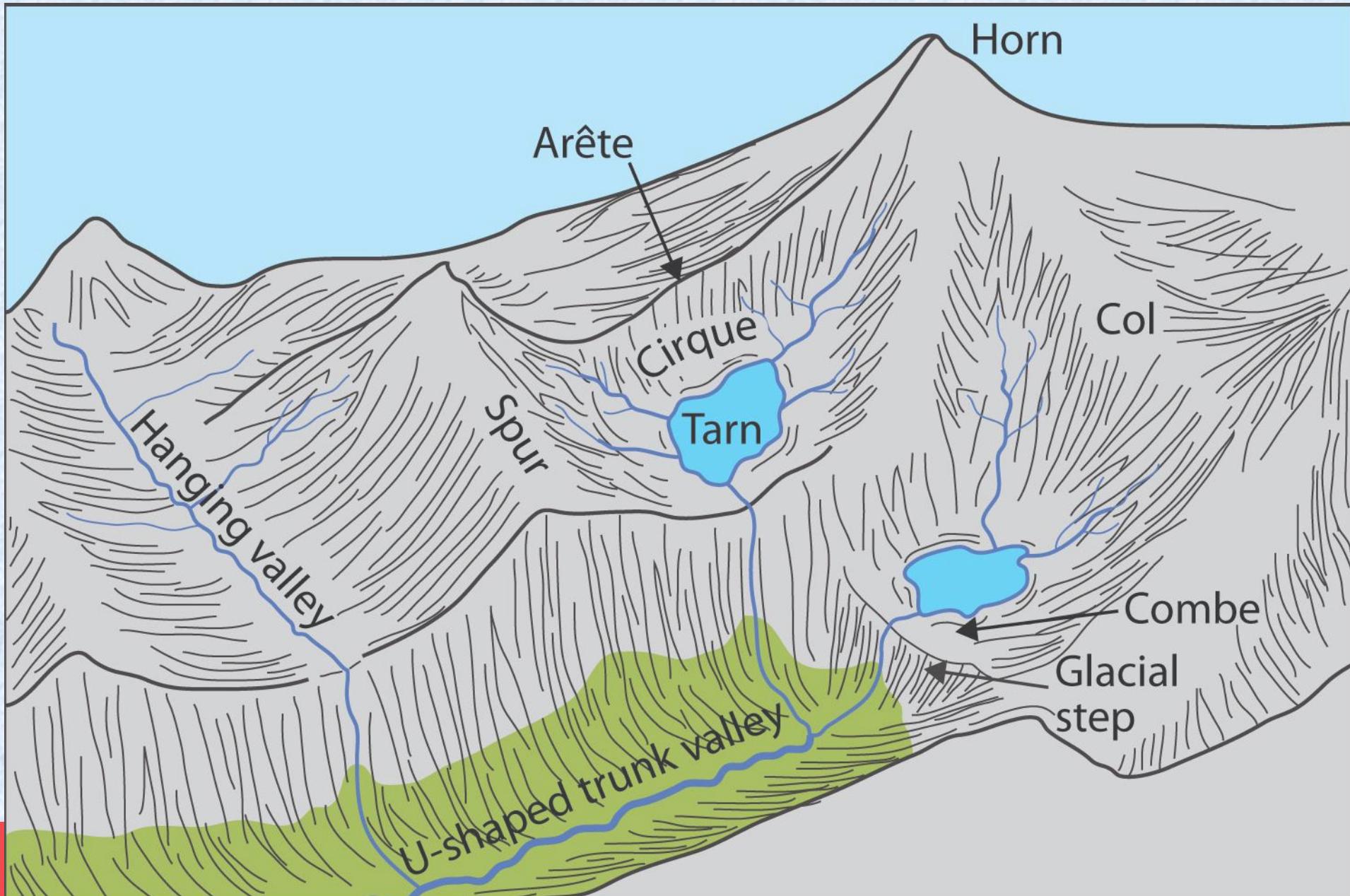
Landforms



S
G



*Figure 7.16 : Various types of sand dunes
Arrows indicate wind direction*

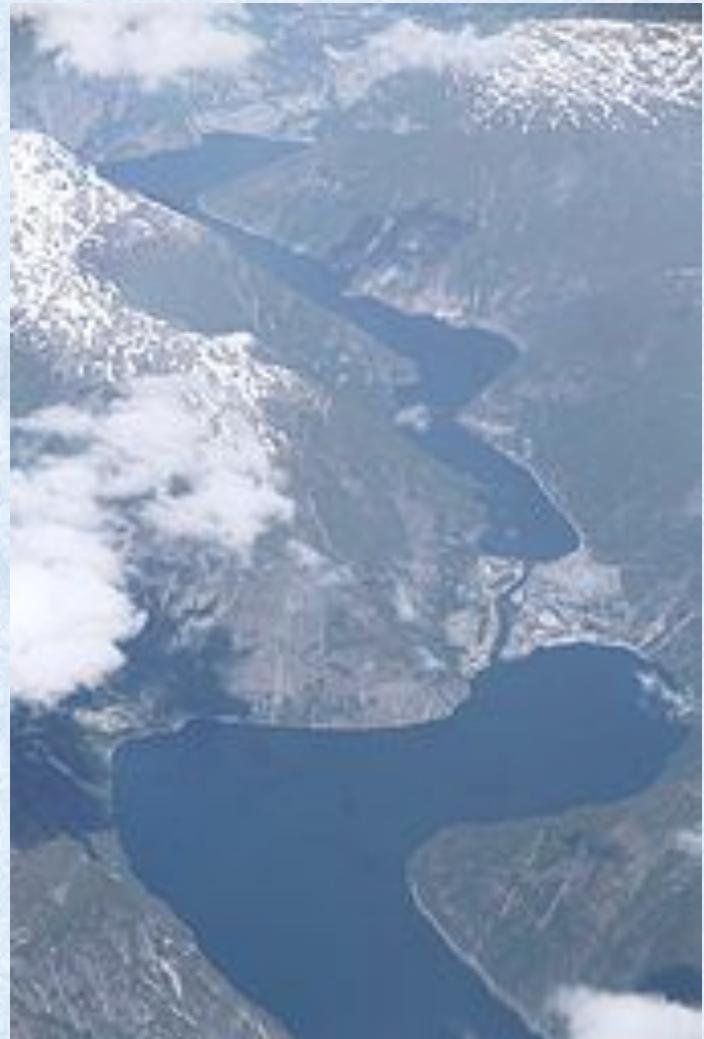




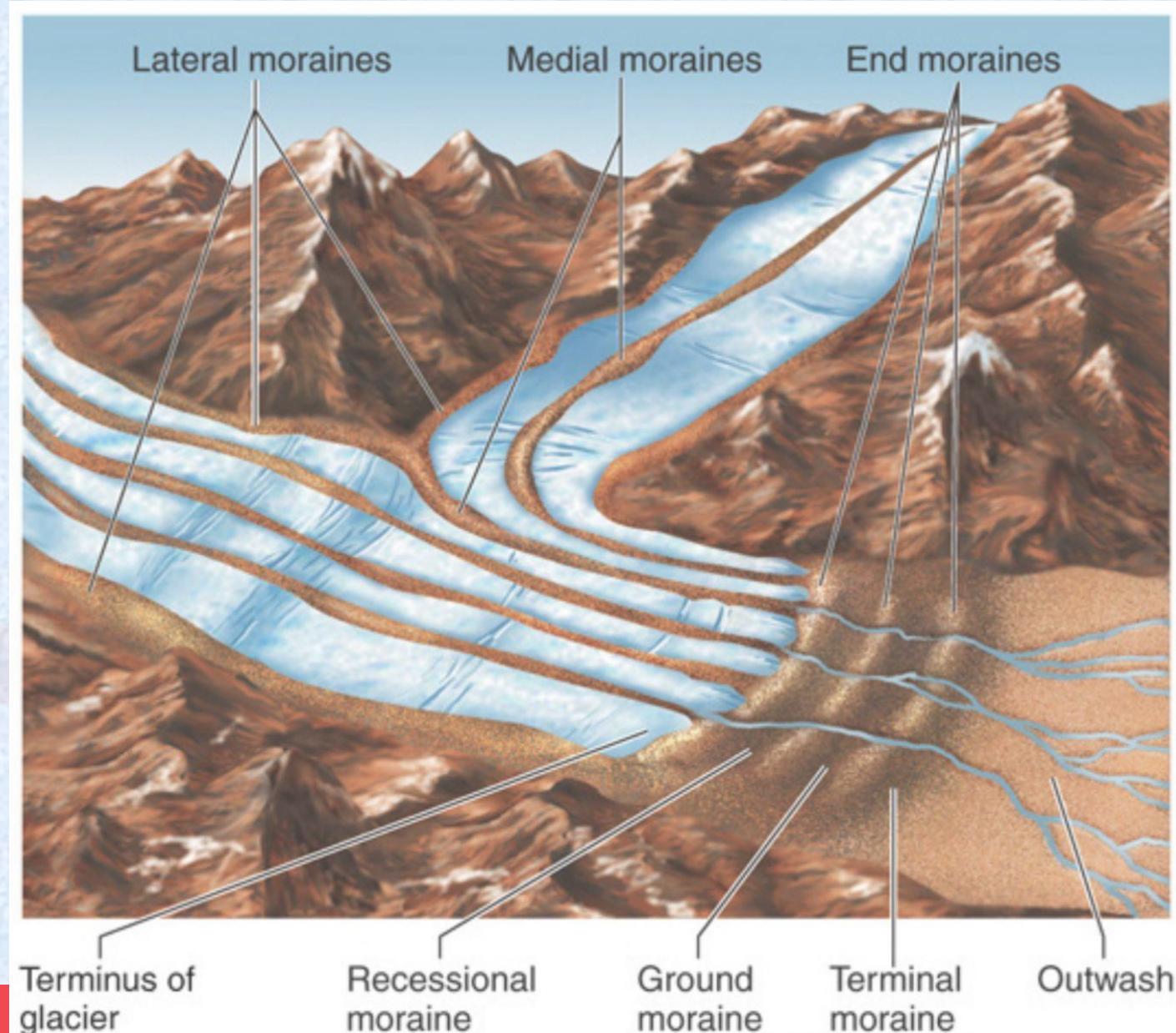


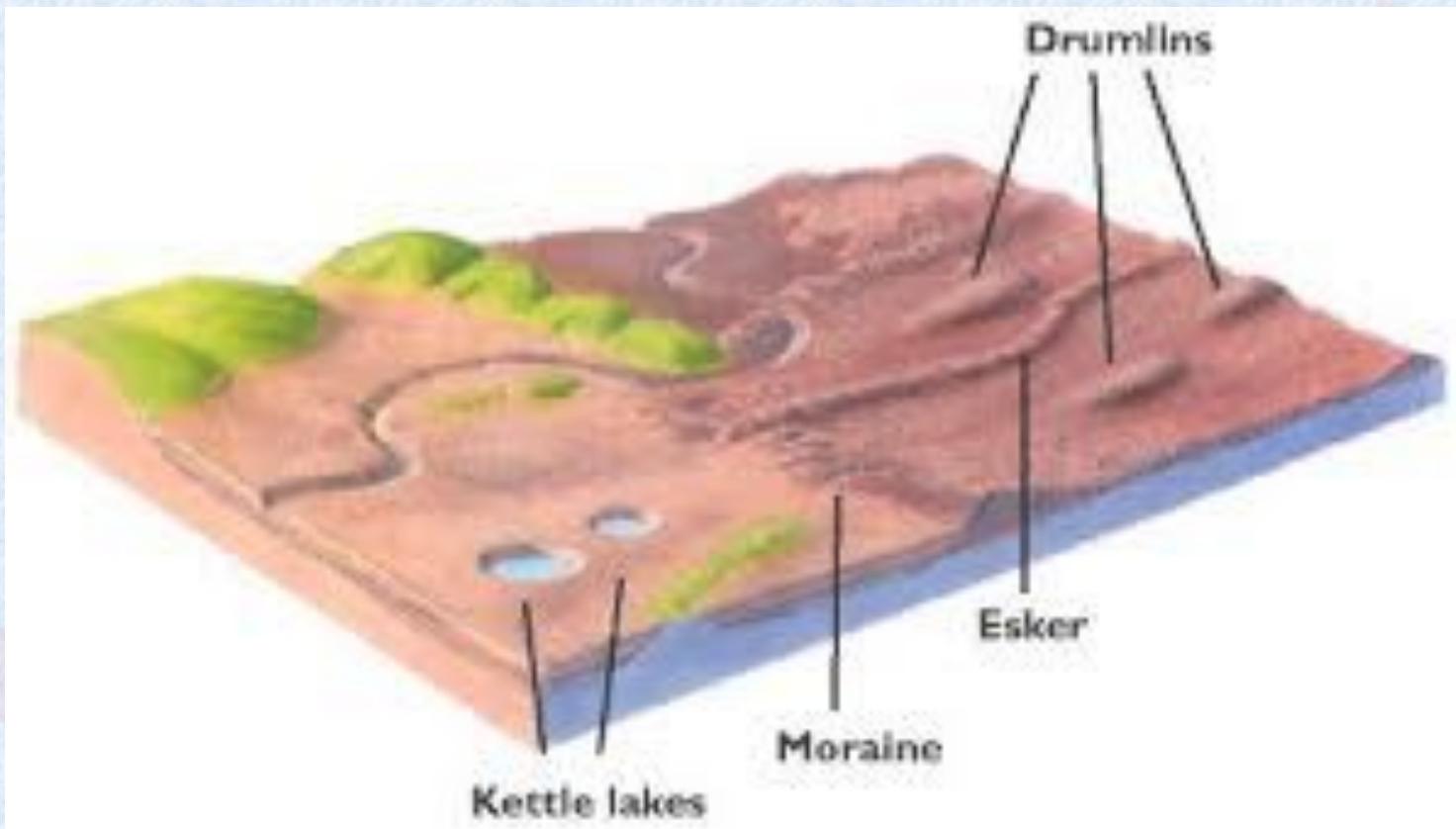
S
C
O
D
E

Landforms









28.	Geomorphology	2013	<p>Consider the following:</p> <ol style="list-style-type: none">1. Electromagnetic radiation2. Geothermal energy3. Gravitational force4. Plate movements5. Rotation of the earth6. Revolution of the earth <p>Which of the above are responsible for bringing dynamic changes on the surface of the earth?</p> <p>(a) 1, 2, 3 and 4 only (b) 1, 3, 5 and 6 only (c) 2, 4, 5 and 6 only (d) 1, 2, 3, 4, 5 and 6</p>
29.	Geomorphology	2014	<p>Which of the following phenomena might have influenced the evolution of organisms?</p> <ol style="list-style-type: none">1. Continental drift2. Glacial cycles <p>Select the correct answer using the code given below.</p> <p>(a) 1 only (b) 2 only (c) Both 1 and 2 (d) Neither 1 nor 2</p>

Questions??



- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

INITIAL REGIONAL POLITICAL ORGANISATIONS

Land Holders society (Bengal):

Founders- Dwarkanath Tagore and Radhakant Deb

The purpose of the organization was to safeguard the rights of Zamindars

British India Society of Bengal(1843):

Founder: George Thompson

Purpose: To safeguard the rights of common people

British India Association(1851):

Founder: Radhakant Deb

Purpose: To safeguard the rights of both Zamindars and common people

The merger of the above two organization

Bombay Association(1852):

Founder: Dadabhai Naoroji

Purpose: Demand of Legislative Councils for Indians

East India Association(1866) in London:

Founder: Dadabhai Naoroji

It calculated Drain of Wealth

Indian Association of Calcutta (1876):

Founders: Surendranath Banerjee and Anand Mohan Bose

Purpose: To protest against the reactionary measures taken by Viceroy Lytton

Madras Mahajan Sabha(1884):

Founders: M V Raghavachariar, T Anandcharyulu, G Subrahmanyam Iyer

Purpose: To Demand more political rights for Indians and an Increased number of Indian members in legislative councils

Bombay Presidency Association(1885):

Founders: Pheroz Shah Mehta, K T Telang, Badruddin Tyabji

Purpose: To Increase the numbers Of Indian numbers in legislative councils

Climatology

Weather and climate

Composition of atmosphere

Structure of atmosphere

Insolation, Heat Budget & Albedo

Temperature & Inversion of temperature

Pressure

Planetary winds

Seasonal winds & Local winds

Humidity, Evaporation & Condensation

Types of clouds & Precipitation

Jet Streams

Air masses

Temperate Cyclones & Tropical Cyclones

Climatic regions

Table 8.1 : Permanent Gases of the Atmosphere

<i>Constituent</i>	<i>Formula</i>	<i>Percentage by Volume</i>
Nitrogen	N_2	78.08
Oxygen	O_2	20.95
Argon	Ar	0.93
Carbon dioxide	CO_2	0.036
Neon	Ne	0.002
Helium	He	0.0005
Krypto	Kr	0.001
Xenon	Xe	0.00009
Hydrogen	H_2	0.00005

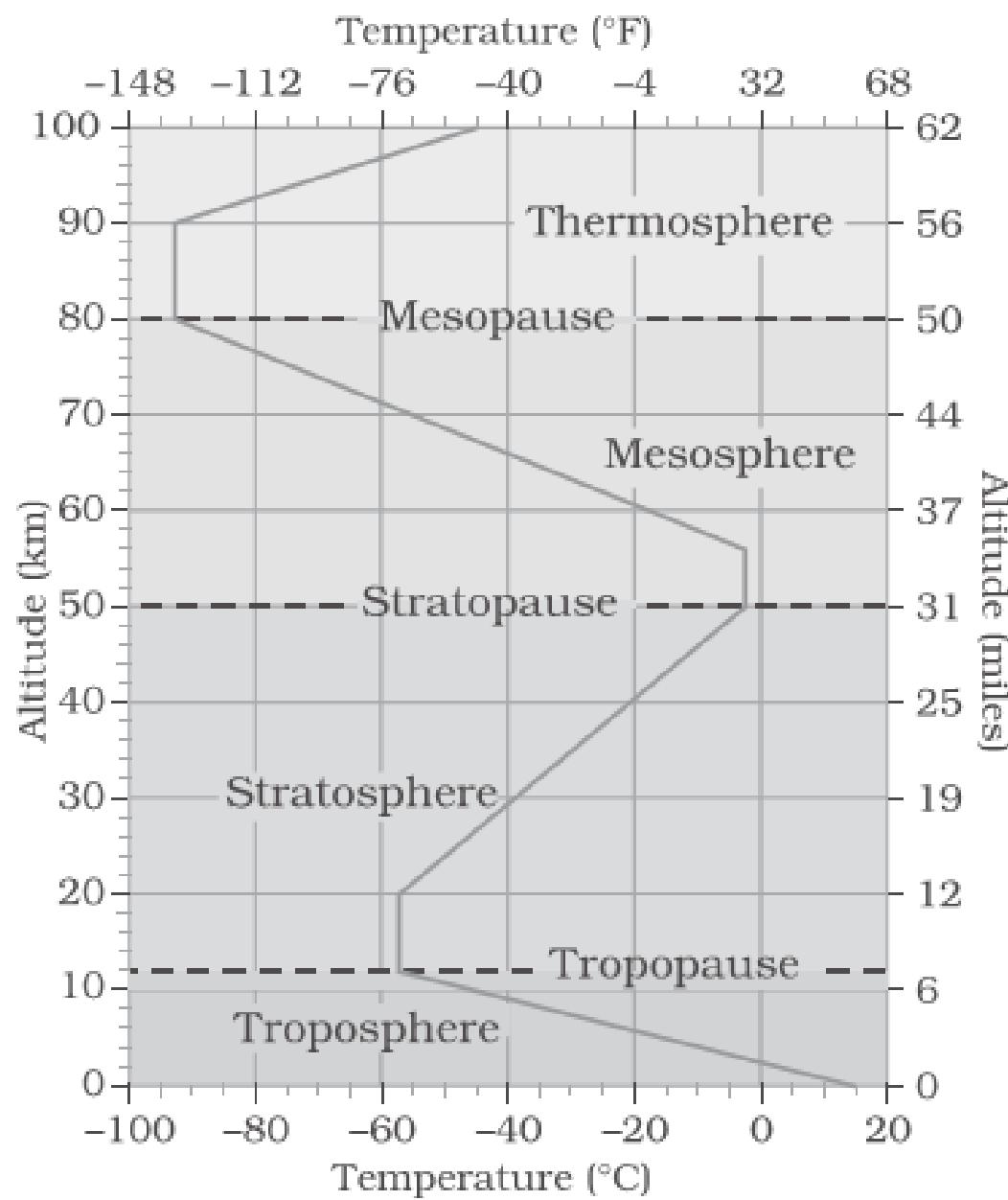


Figure 8.1 : Structure of atmosphere

2011

The jet aircrafts fly very easily and smoothly in the lower stratosphere. What could be the appropriate explanation?

1. There are no clouds or water vapour in the lower stratosphere.
2. There are no vertical winds in the lower stratosphere.

Which of the statements given above is/are correct in this context?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

2011

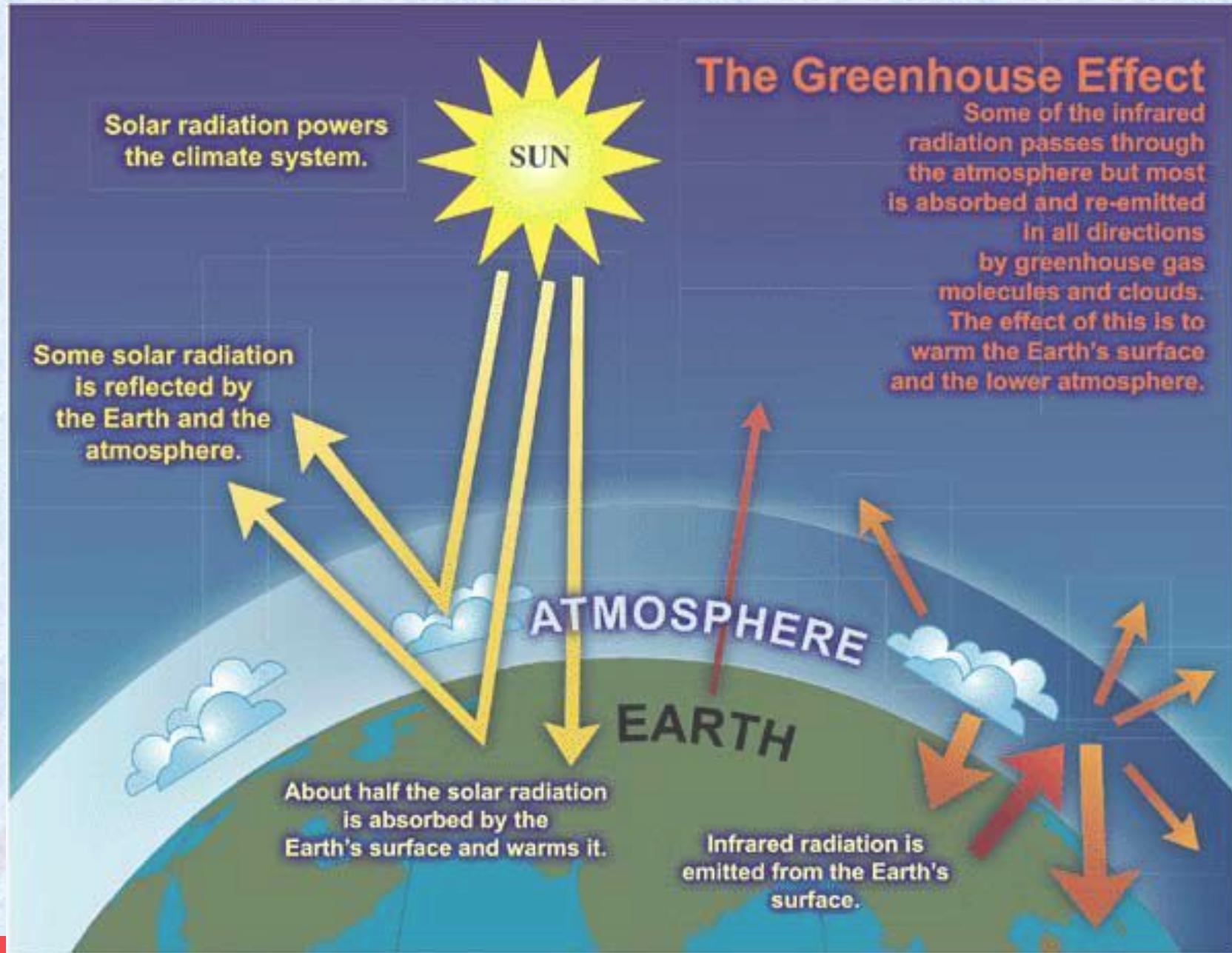
A layer in the Earth's atmosphere called Ionosphere facilitates radio communication.

Why?

1. The presence of ozone causes the reflection of radio waves to Earth.
2. Radio waves have a very long wavelength.

Which of the statements given above is/are correct?

- (a) 1only (b) 2only
- (c) Both 1 and 2 (d) Neither 1 nor 2



2010

Consider the following which can be found in the ambient atmospheres:

1. Soot
2. Sulphur hexafluoride
3. Water vapour

Select the correct answer using the code given below.

- (a) 1 and 2 only
- (b) 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3 only

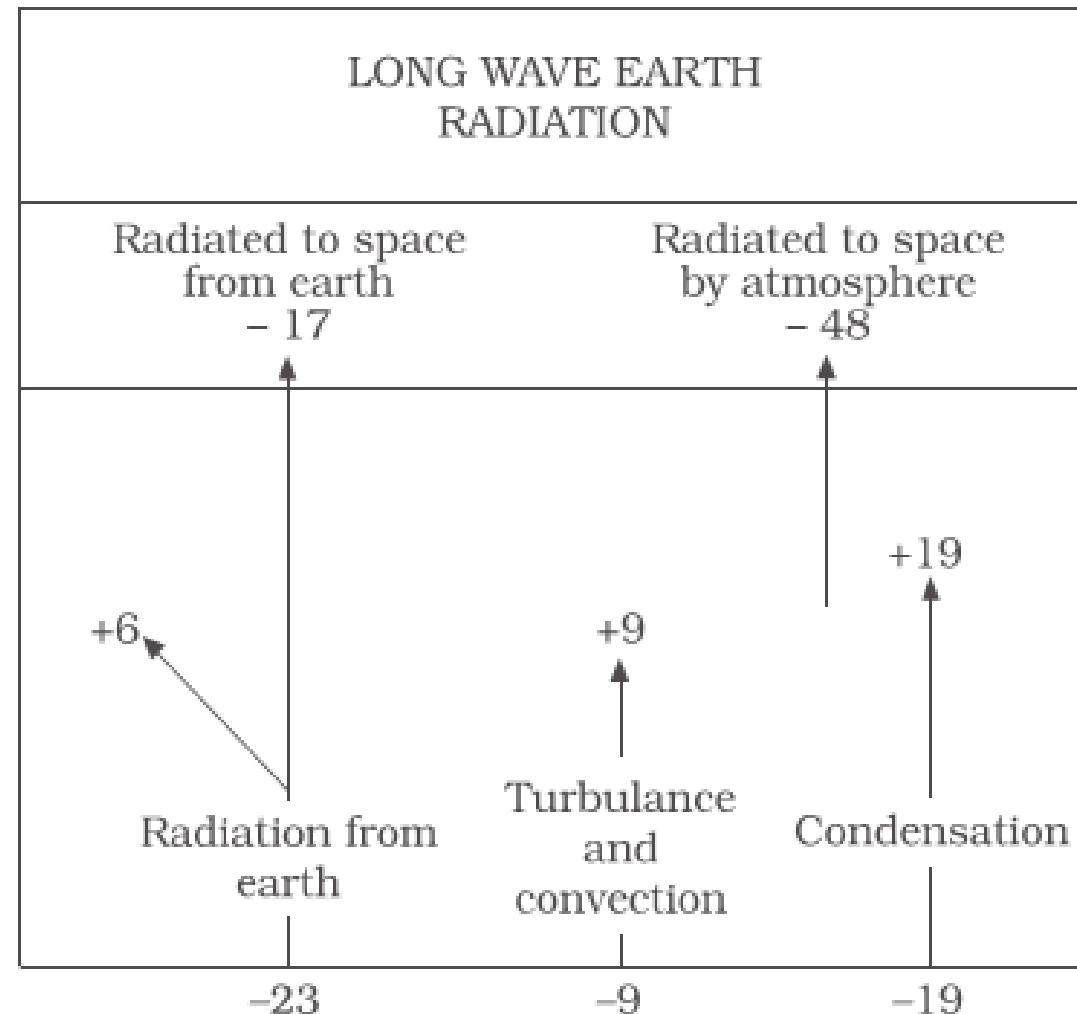
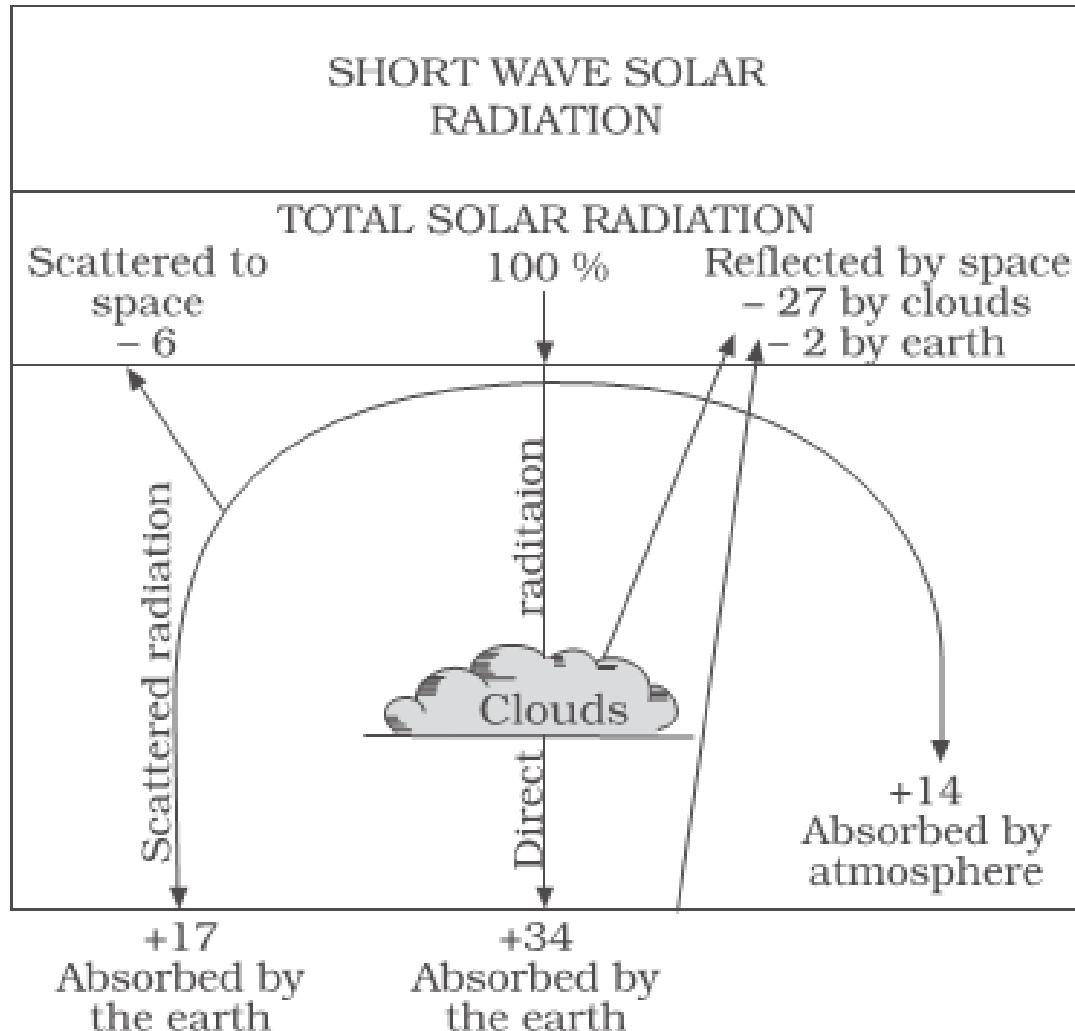


Figure 9.2 : Heat budget of the earth

Sample Albedos of Earth

<u>Surface</u>	<u>Typical albedo</u>
Fresh asphalt	0.04
Open ocean	0.06
Worn asphalt	0.12
Conifer forest (Summer)	0.08, 0.09 to 0.15
Deciduous trees	0.15 to 0.18
Bare soil	0.17
Green grass	0.25
Desert sand	0.4
New concrete	0.55
Ocean ice	0.5–0.7
Fresh snow	0.80–0.90

2010	<p>Which one of the following reflects back more sunlight as compared to other three?</p> <ul style="list-style-type: none">(a) Sand desert(b) Paddy crop land(c) Land covered with fresh snow(d) Prairie land
------	---

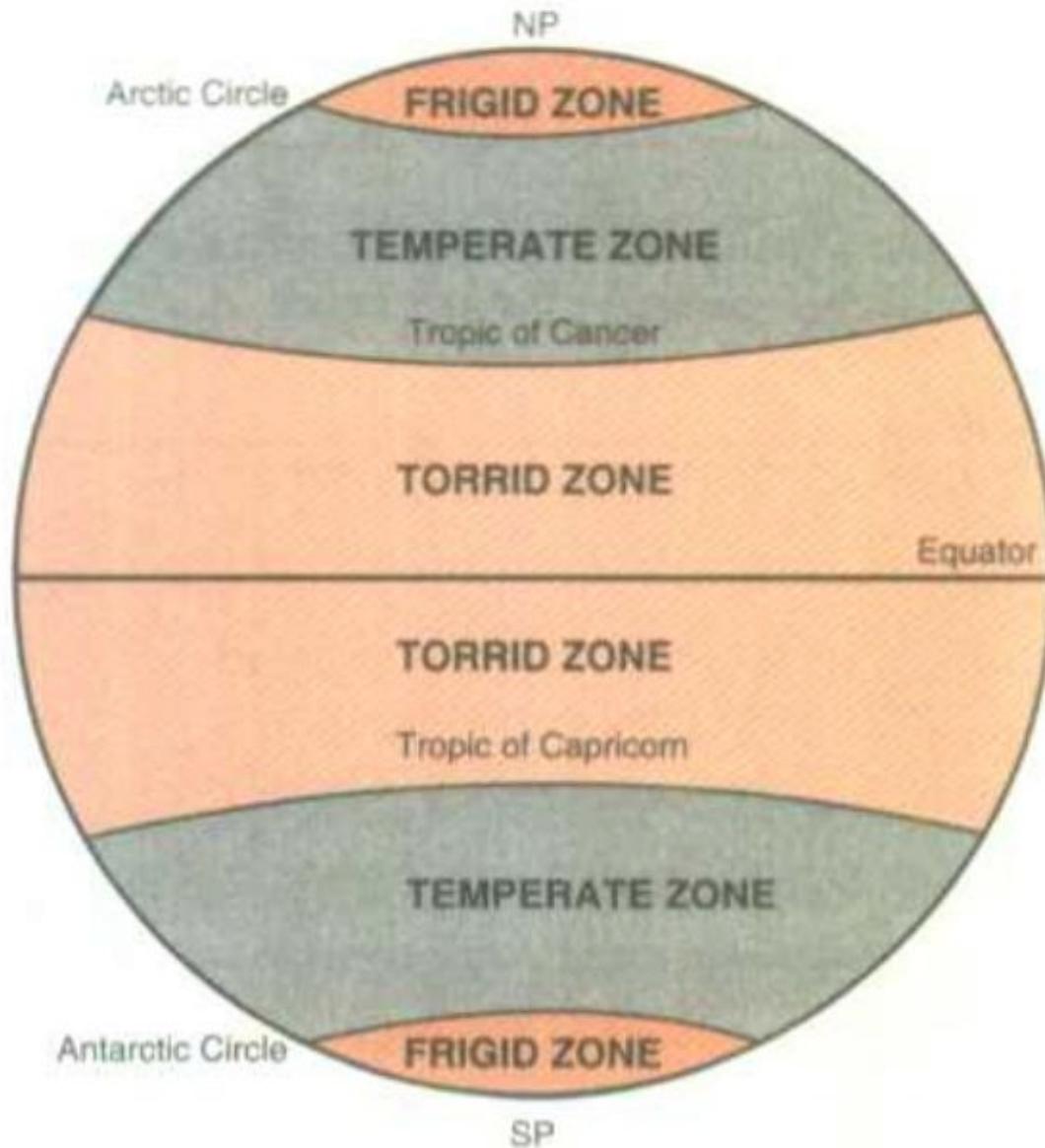
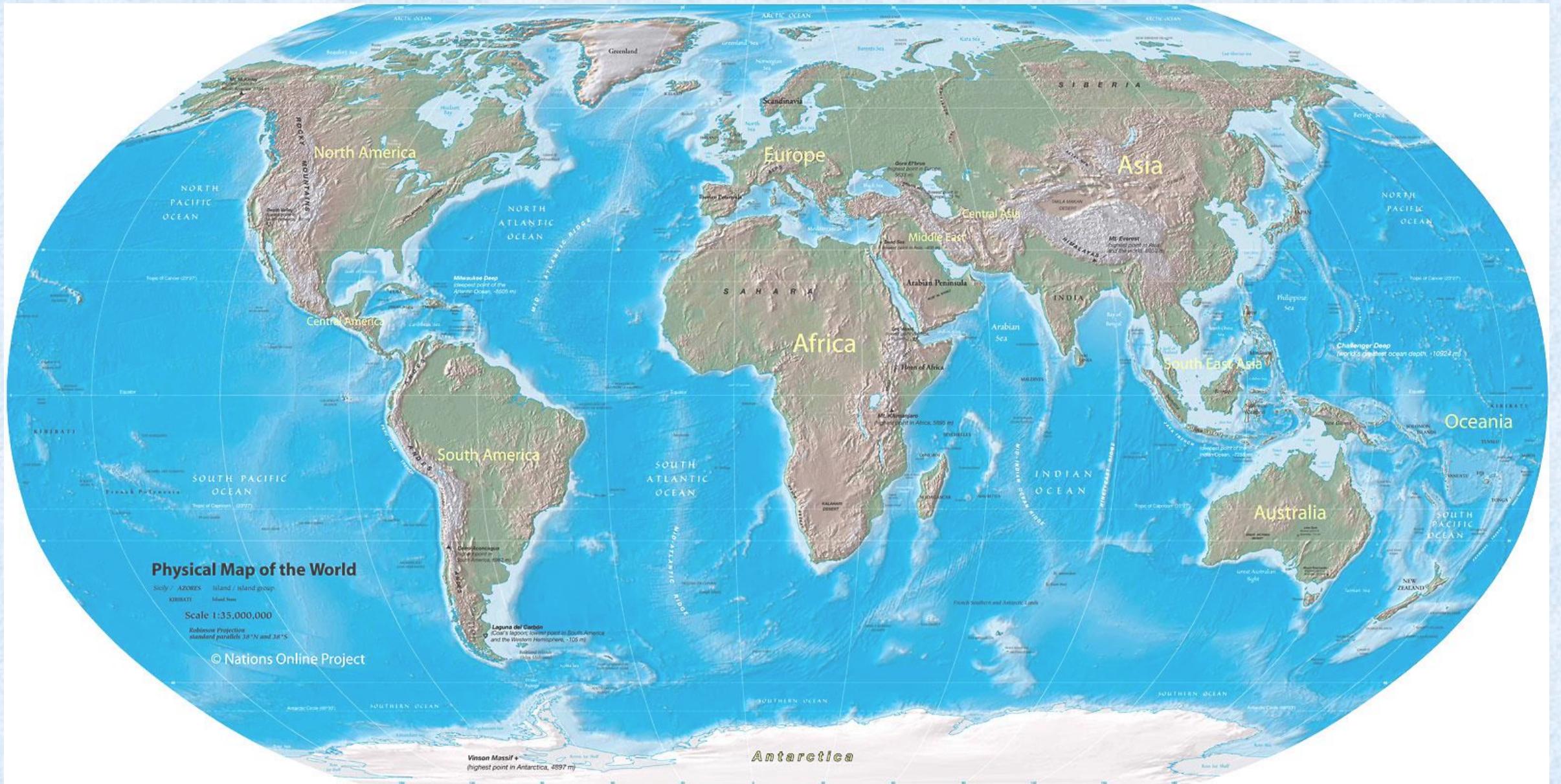


Fig. 15.3. Heat Zones



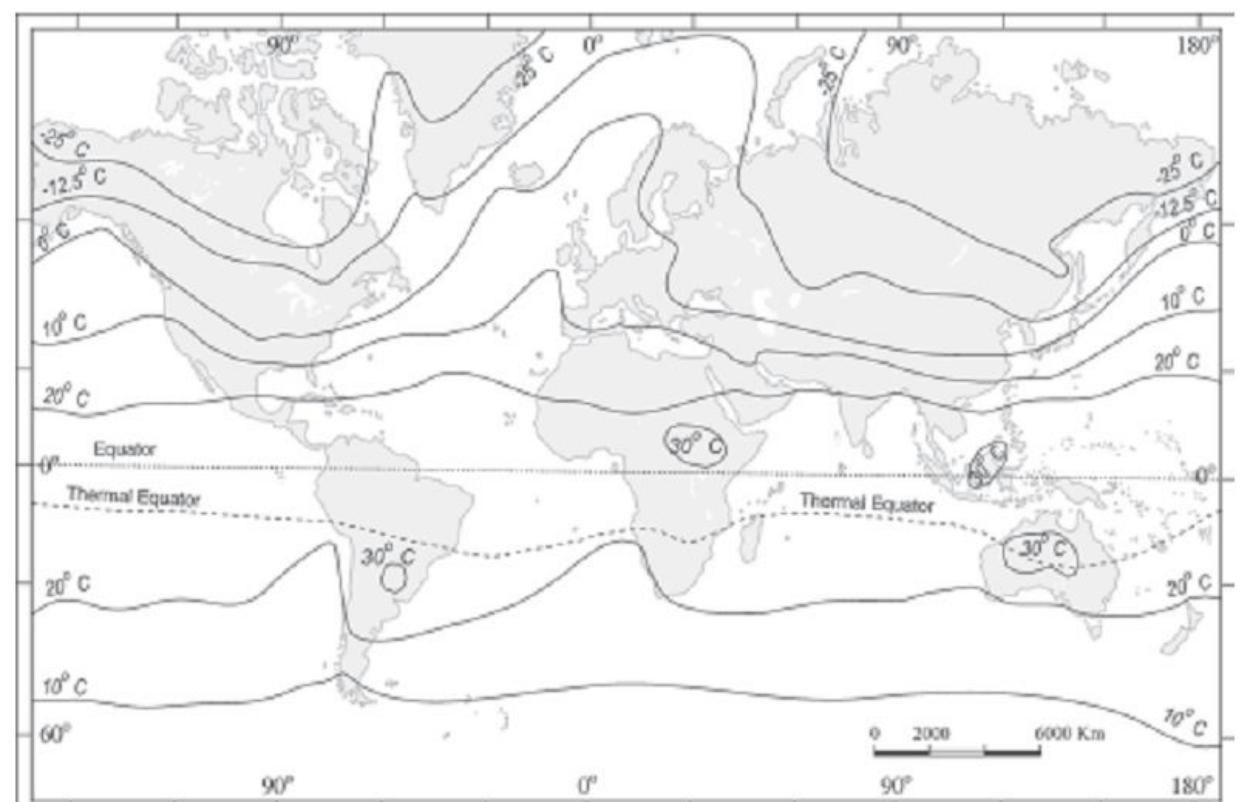


Figure 9.4 (a) : The distribution of surface air temperature in the month of January

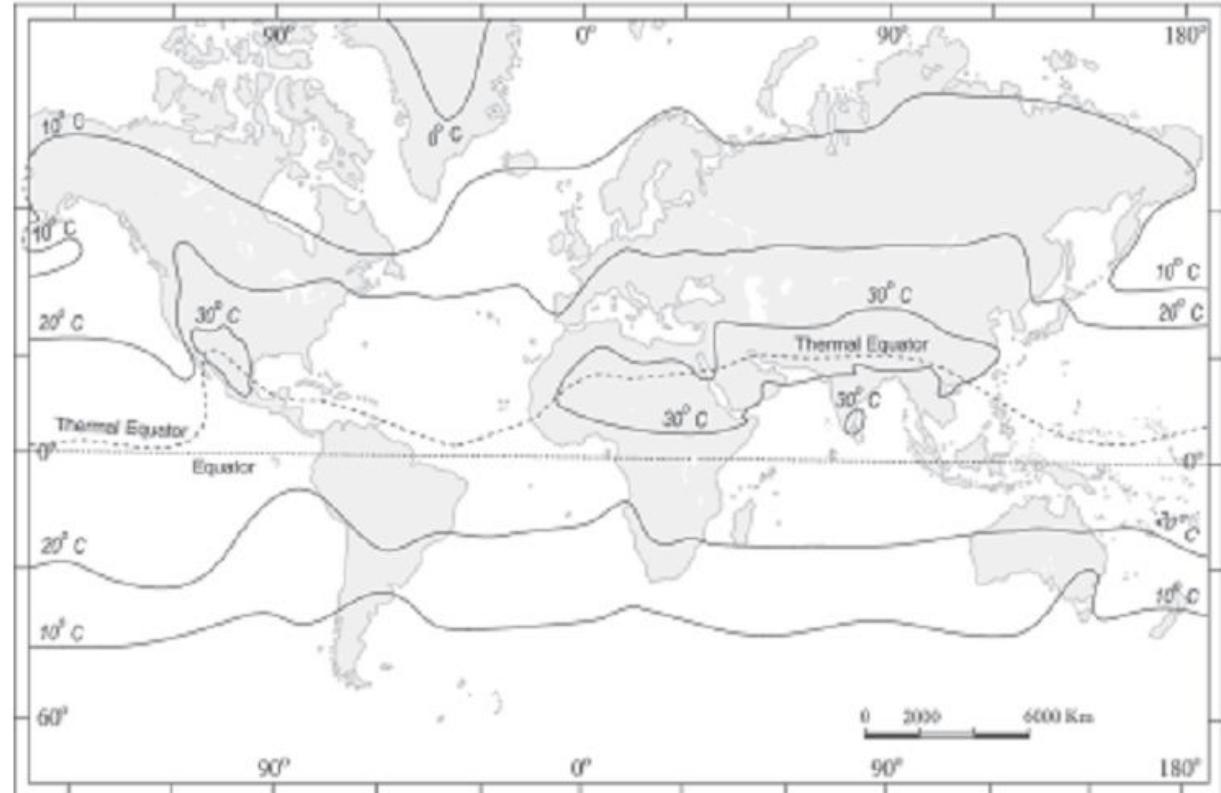


Figure 9.4 (b) : The distribution of surface air temperature in the month of July

2012

Normally, the temperature decreases with the increase in height from the Earth's surface, because:

1. The atmosphere can be heated upwards only from the Earth's surface.
2. There is more moisture in the upper atmosphere.
3. The air is less dense in the upper atmosphere.

Select the correct answer using the codes given below:

- (a) 1 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

(Q) **Q. DRY AND WET SEASONS**

2013

The annual range of temperature in the interior of the continents is high as compared to coastal areas. What is/are the reason/reasons?

1. Thermal difference between land and water.
2. Variation in altitude between continents and oceans.
3. Presence of strong winds in the interior.
4. Heavy rains in the interior as compared to coasts.

Select the correct answer using the codes given below.

- (a) 1 only (b) 1 and 2 only
(c) 2 and 3 only (d) 1, 2, 3 and 4

Normal Conditions

Cold Air

Cooler Air

Warm Air



Temperature Inversion

Cold Air

Warm Air – Inversion Layer

Cooler Air

Smog



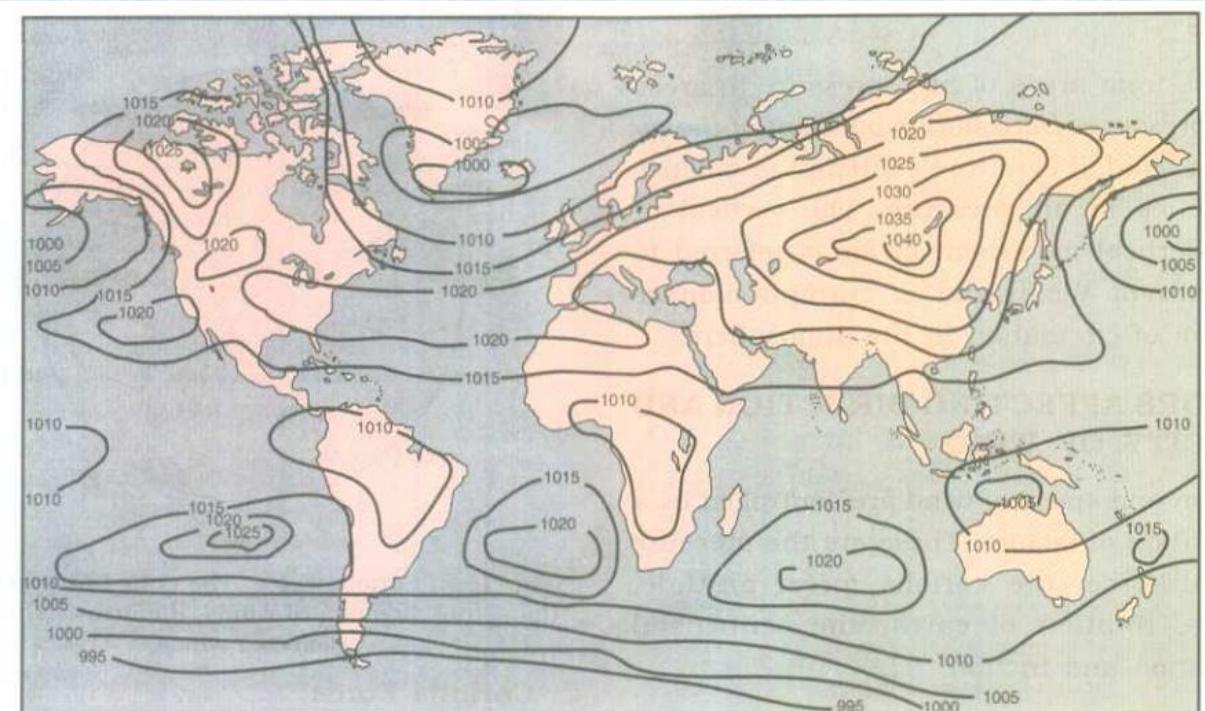


Fig. 16.5. World distribution of pressure in January (Figures are in millibars)

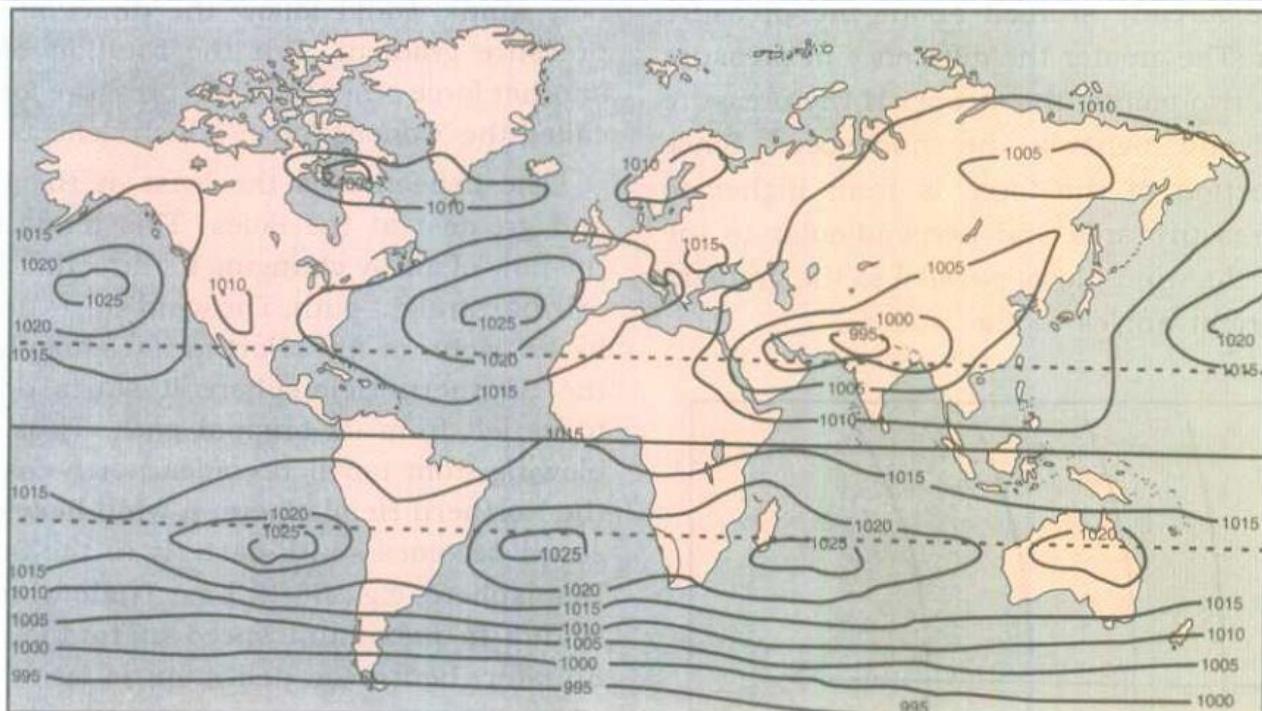
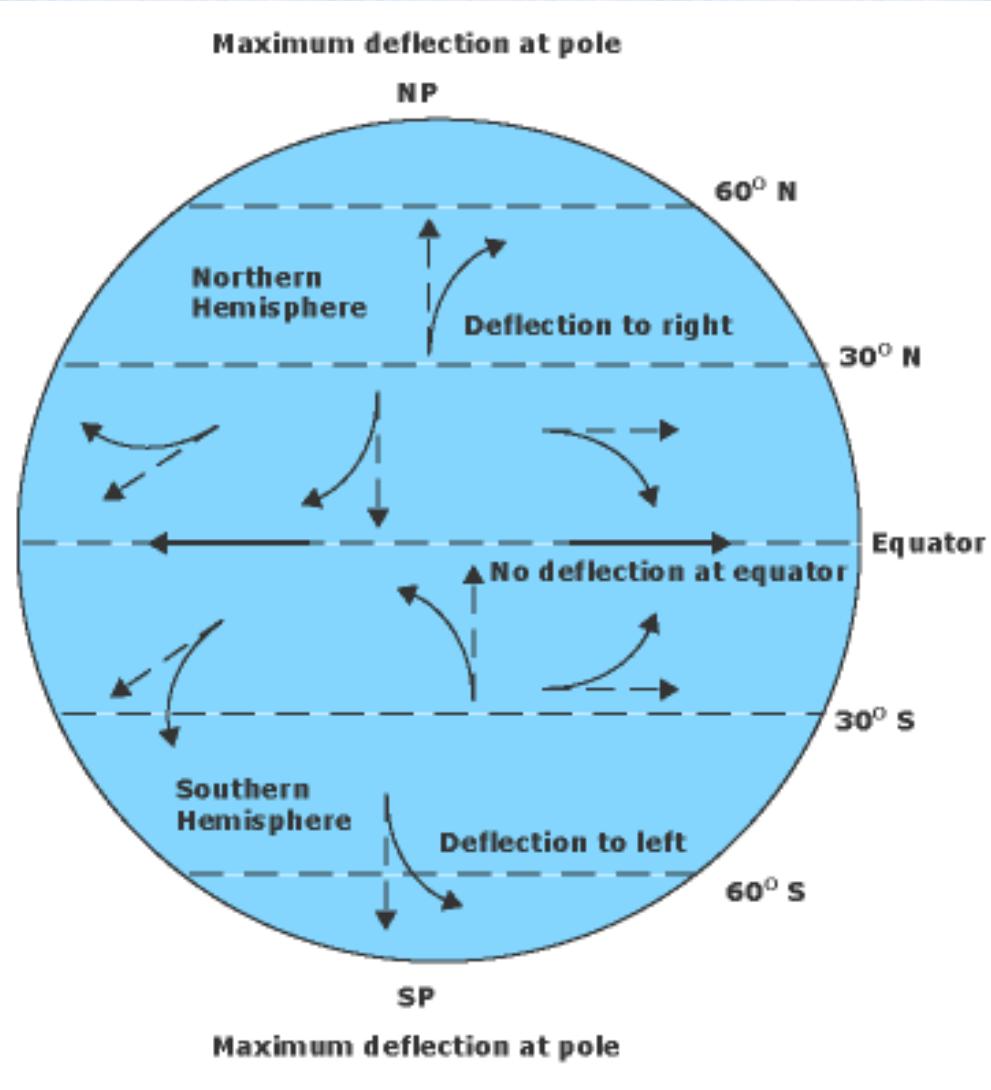


Fig. 16.6 World distribution of pressure in July (Figures are in millibars)



<https://www.youtube.com/watch?v=mPsLanVS1Q8>

2010

What causes wind to deflect toward left in the Southern hemisphere?

- (a) Temperature
- (b) Magnetic field
- (c) Rotation of the earth
- (d) Pressure

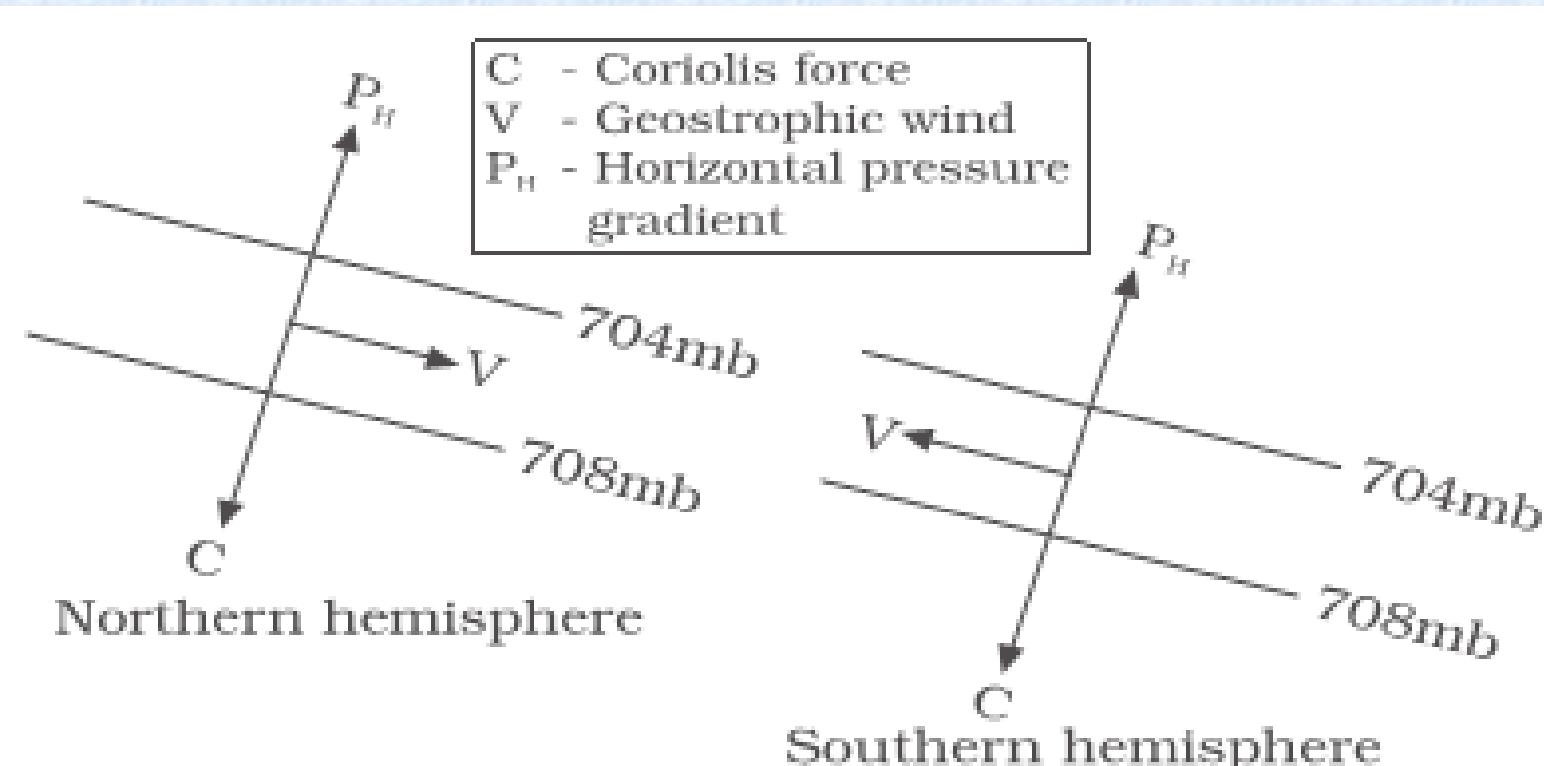


Figure 10.4 : Geostropic Wind

Table 10.2 : Pattern of Wind Direction in Cyclones and Anticyclones

Pressure System	Pressure Condition at the Centre	Pattern of Wind Direction	
		Northern Hemisphere	Southern Hemisphere
Cyclone	Low	Anticlockwise	Clockwise
Anticyclone	High	Clockwise	Anticlockwise

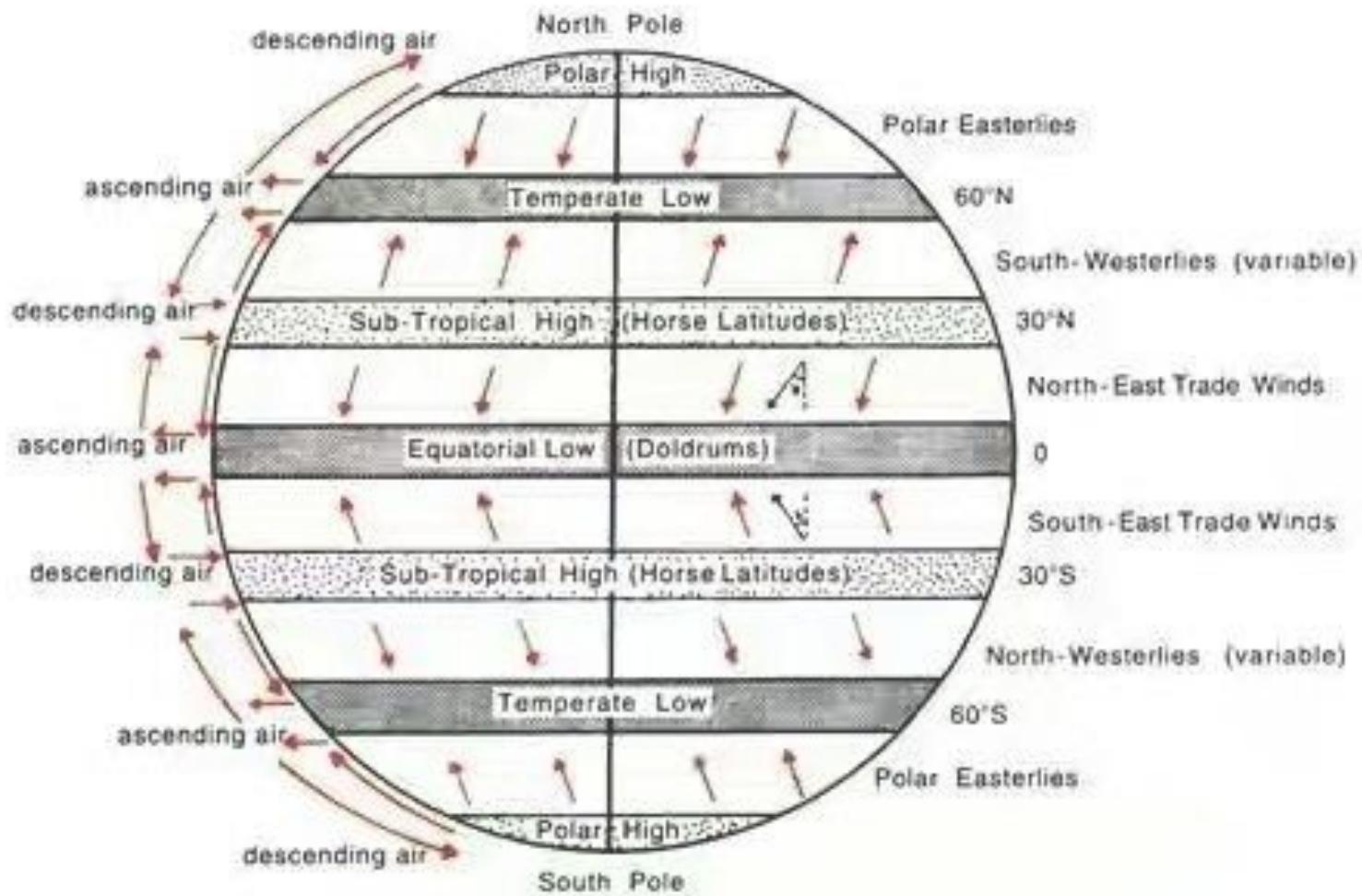
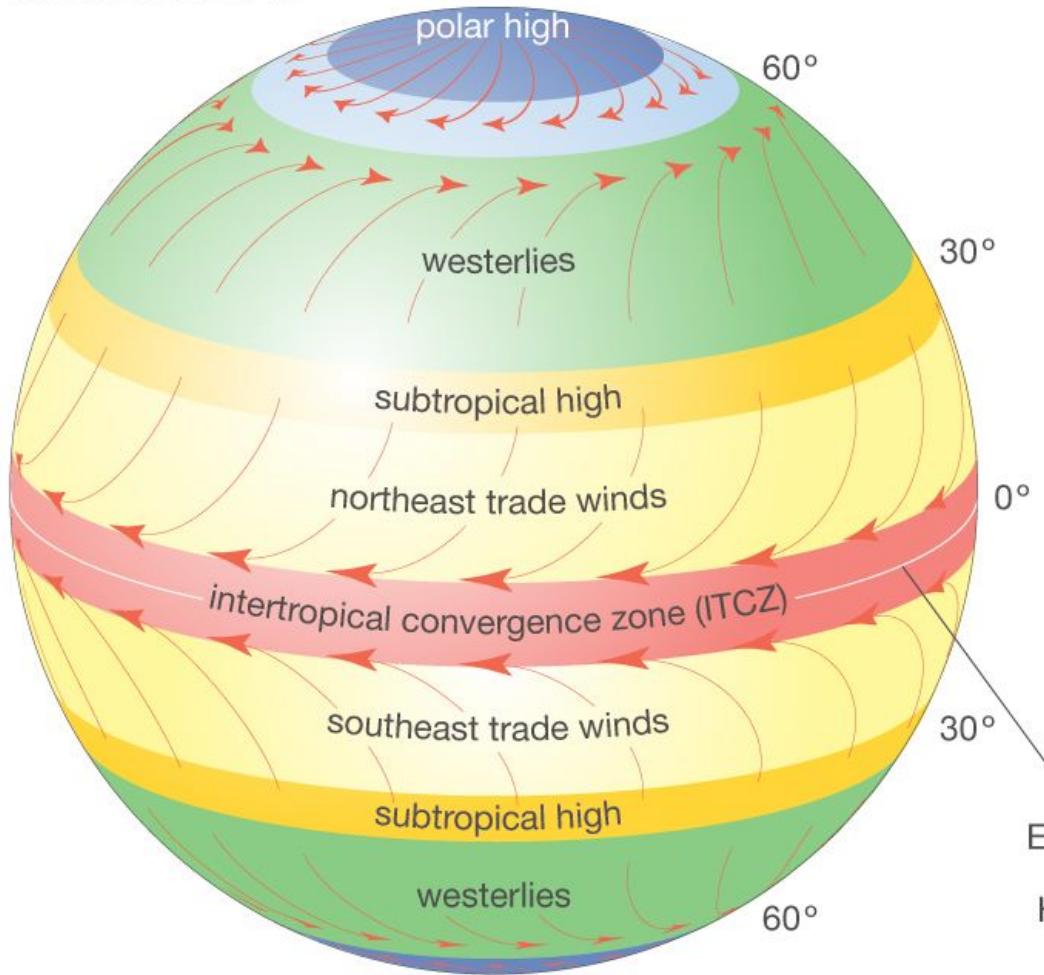


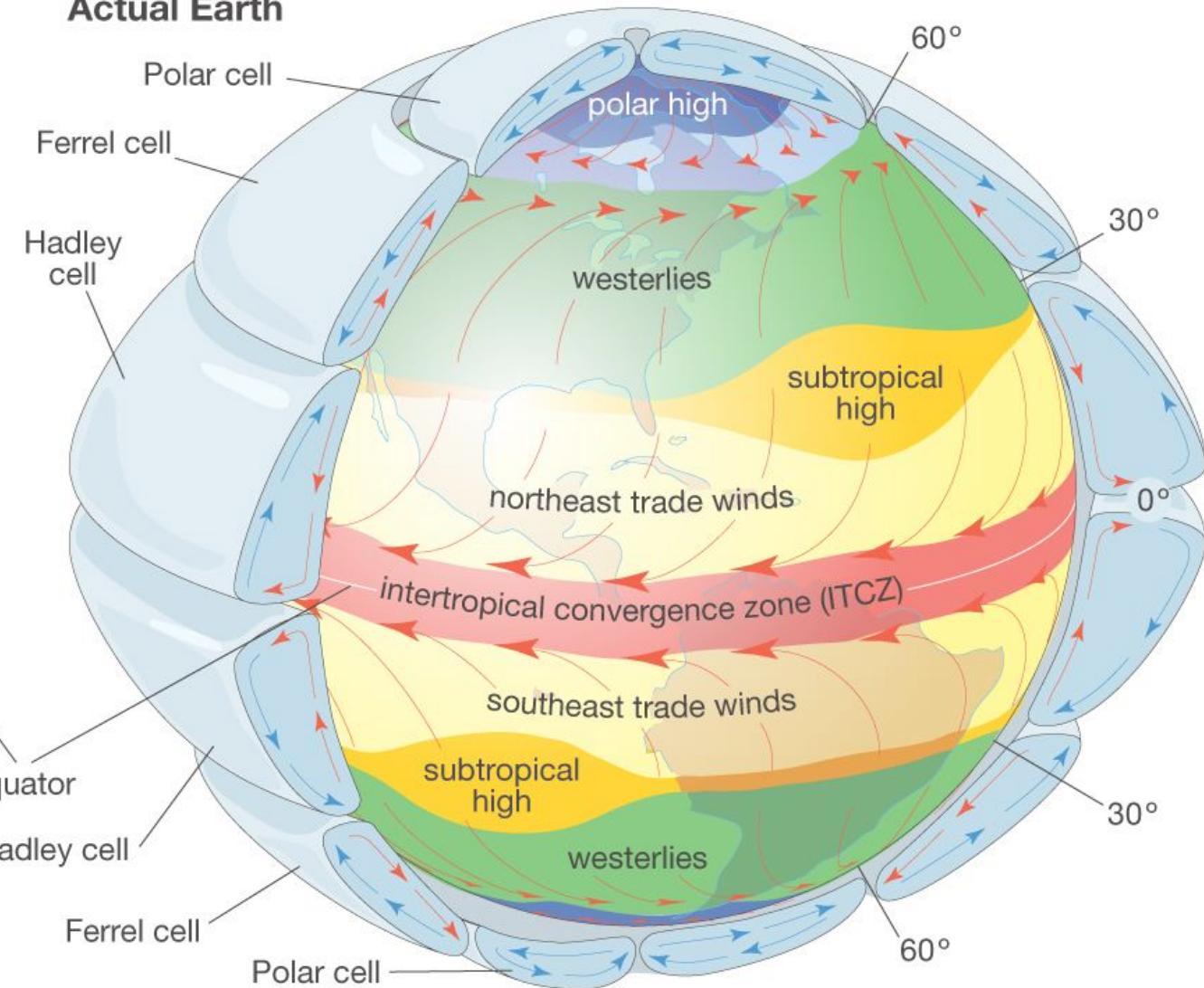
Fig. 115 The distribution of world pressure belts and planetary winds

Idealized Earth



© 2010 Encyclopædia Britannica, Inc.

Actual Earth



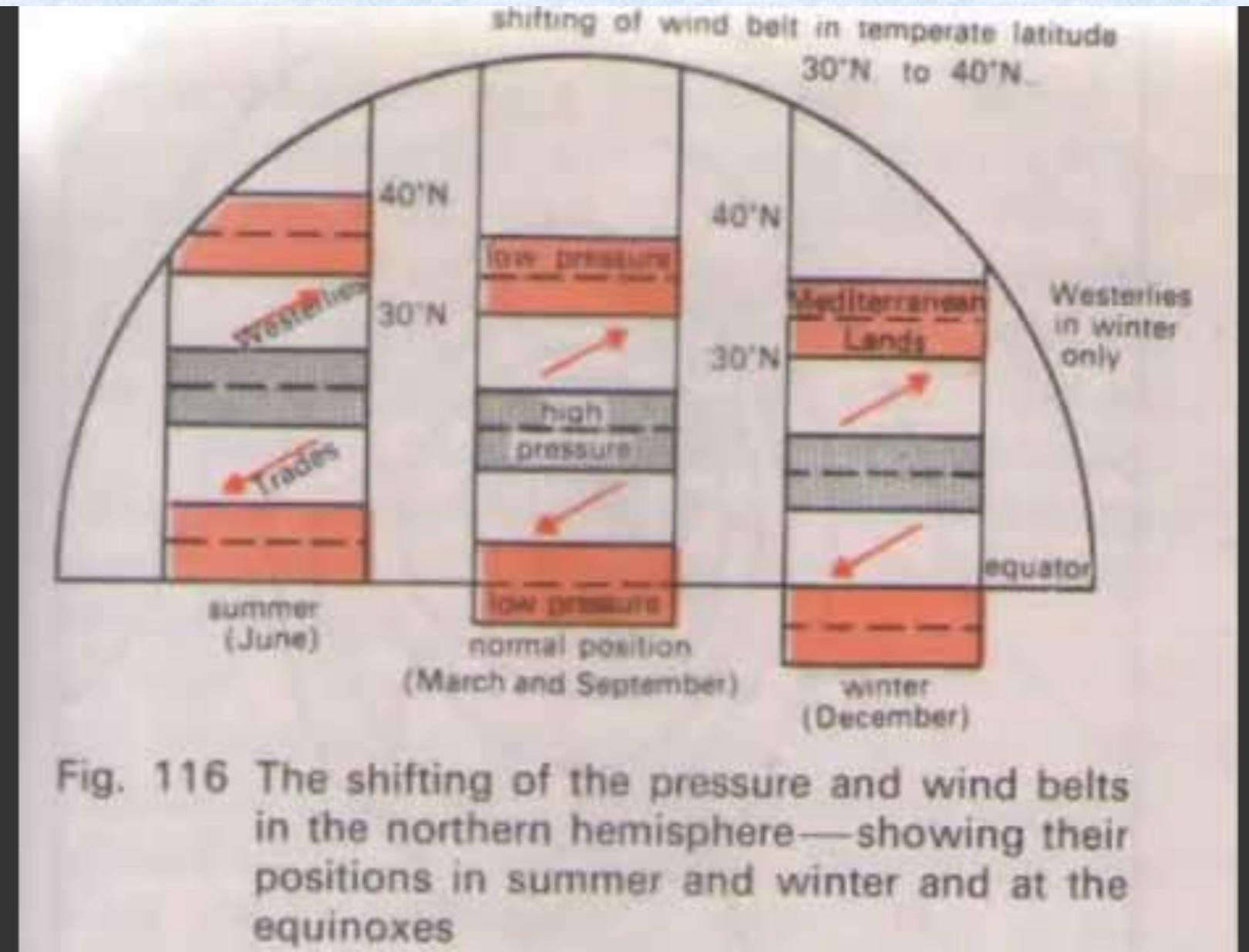


Fig. 116 The shifting of the pressure and wind belts in the northern hemisphere—showing their positions in summer and winter and at the equinoxes

2011	<p>Westerlies in southern hemisphere are stronger and persistent than in northern hemisphere. Why?</p> <p>1. Southern hemisphere has less landmass as compared to northern hemisphere.</p> <p>2. Coriolis force is higher in southern hemisphere as compared to northern hemisphere.</p> <p>Which of the statements given above is/are correct?</p> <p>(a) 1 only (b) 2 only (c) Both 1 and 2 (d) Neither 1 nor 2</p>
------	---

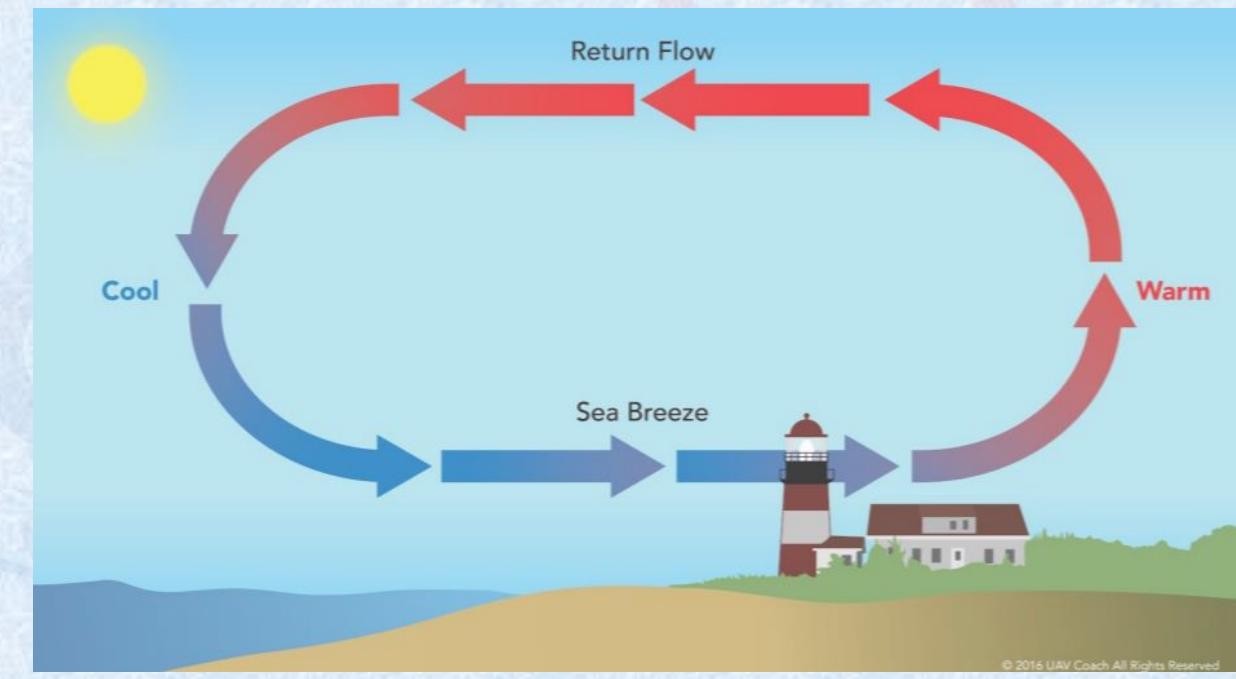
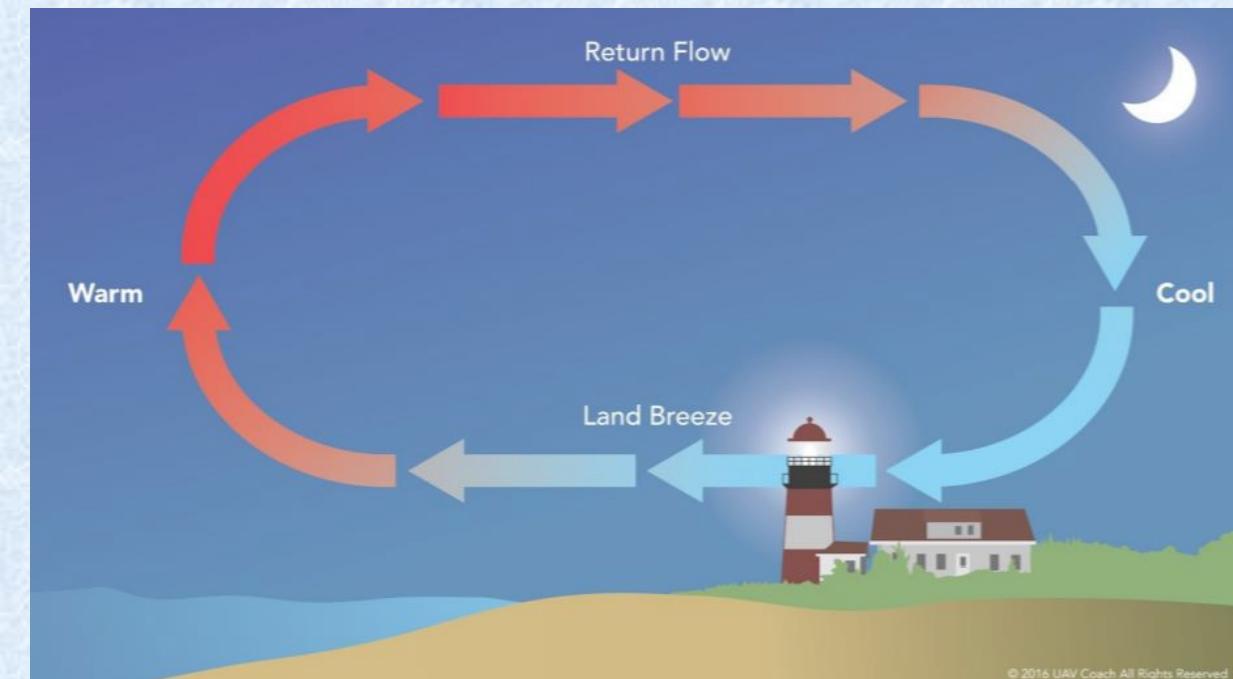
2015

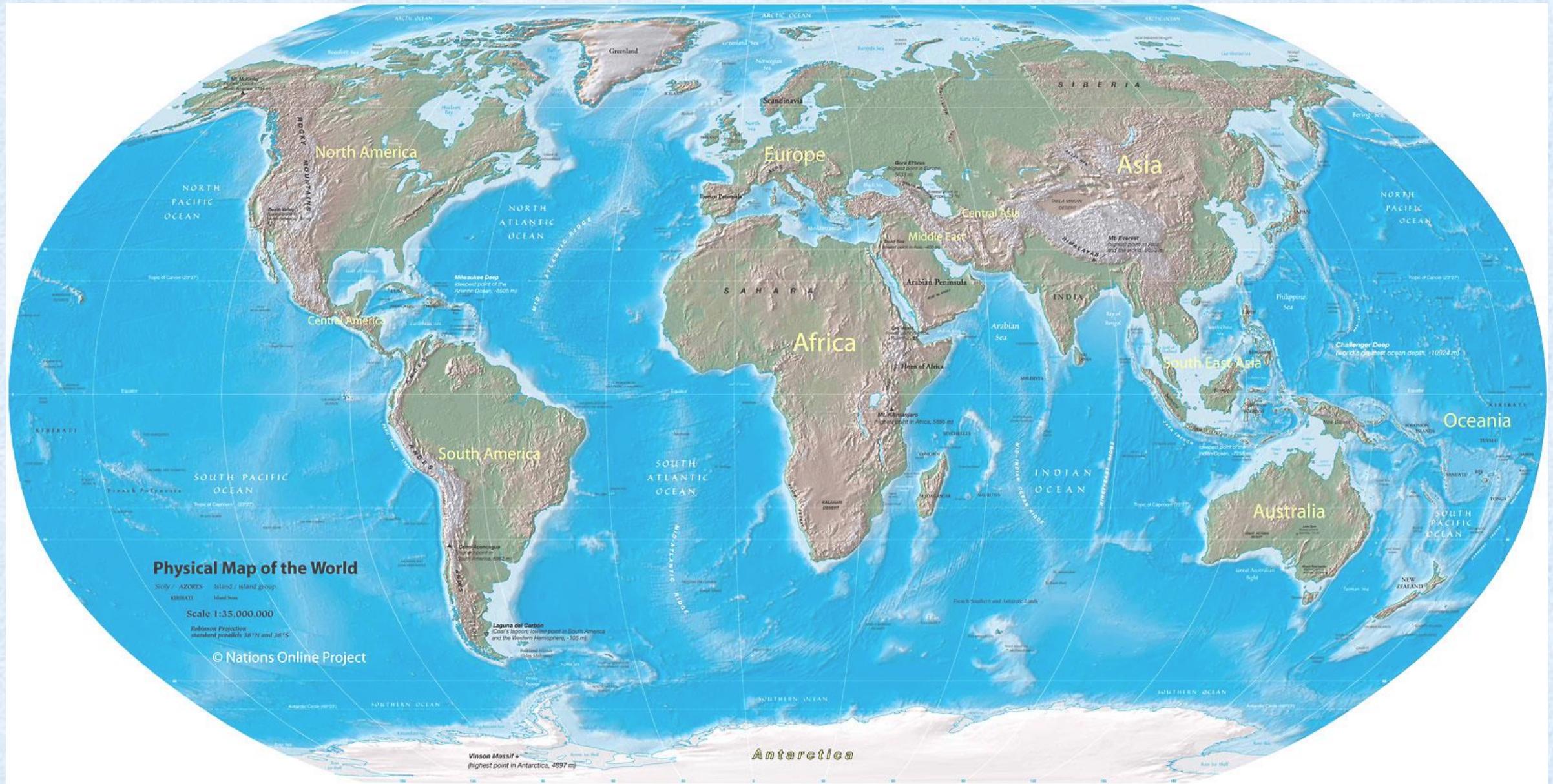
Consider the following statements:

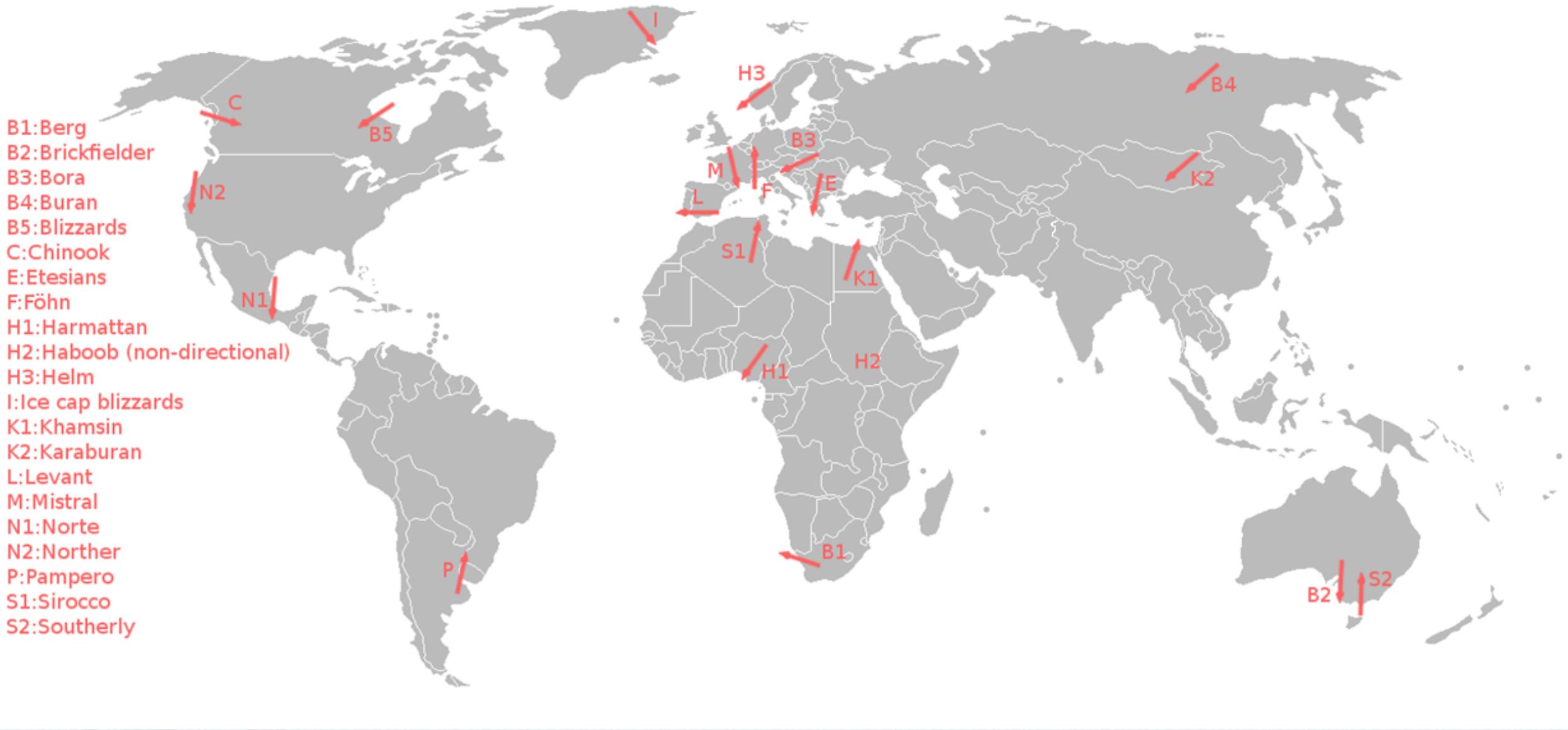
1. The winds which blow between 30° N and 60° S latitudes throughout the year are known as westerlies.
2. The moist air masses that cause winter rains in North-Western region of India are part of westerlies.

Which of the statements given above is/are correct?

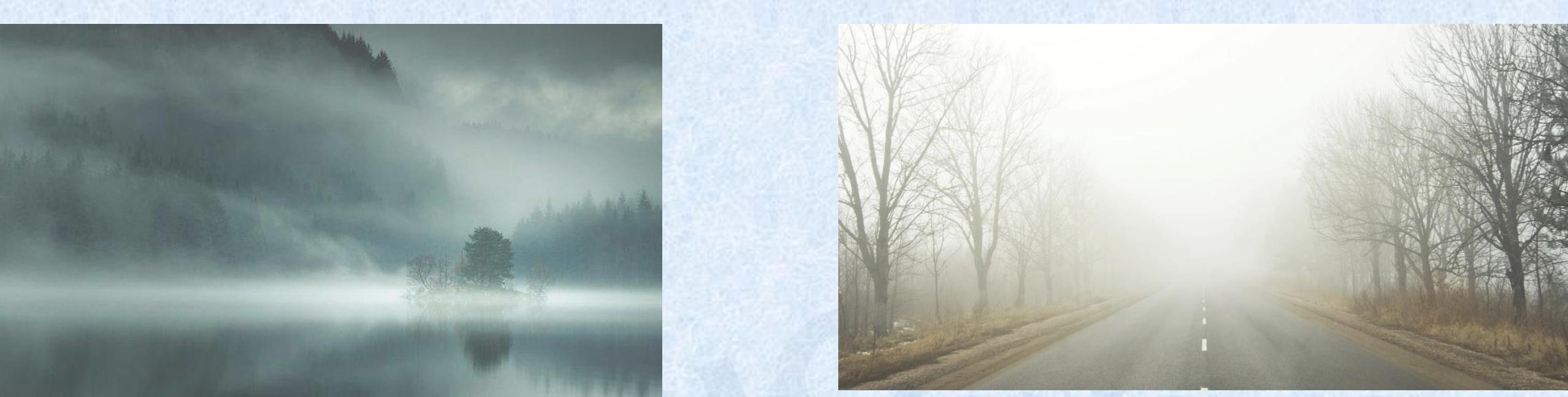
- (a) 1 only
- (c) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2





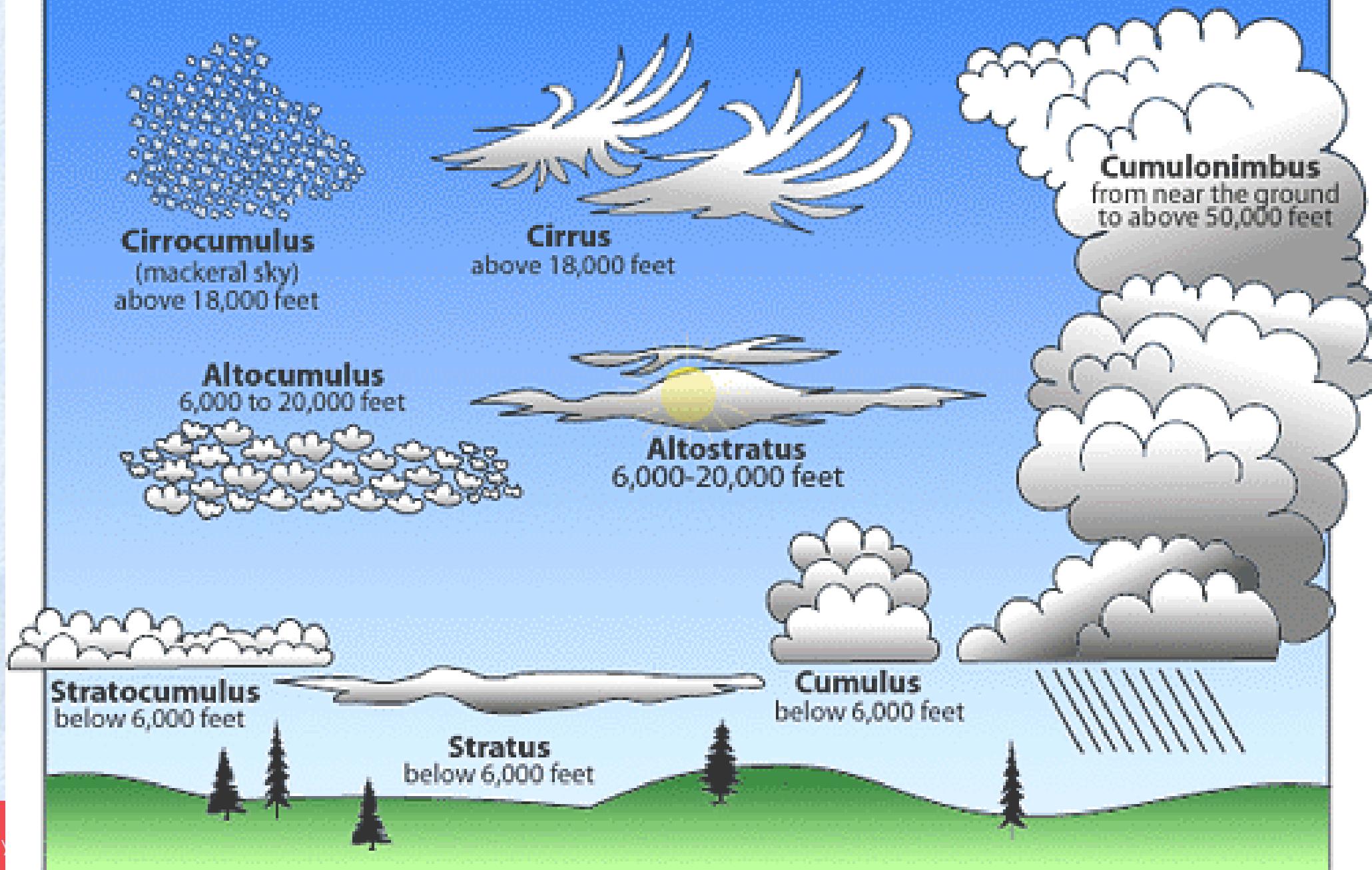






44	Climatology	2019	<p>Why are dewdrops not formed on a cloudy night?</p> <p>(a) Clouds absorb the radiation released from the Earth's surface.</p> <p>(b) Clouds reflect back the Earth's radiation.</p> <p>(c) The Earth's surface would have low temperature on cloudy nights.</p> <p>(d) Clouds deflect the blowing wind to ground level.</p>
----	-------------	------	---

Common types of clouds in the troposphere



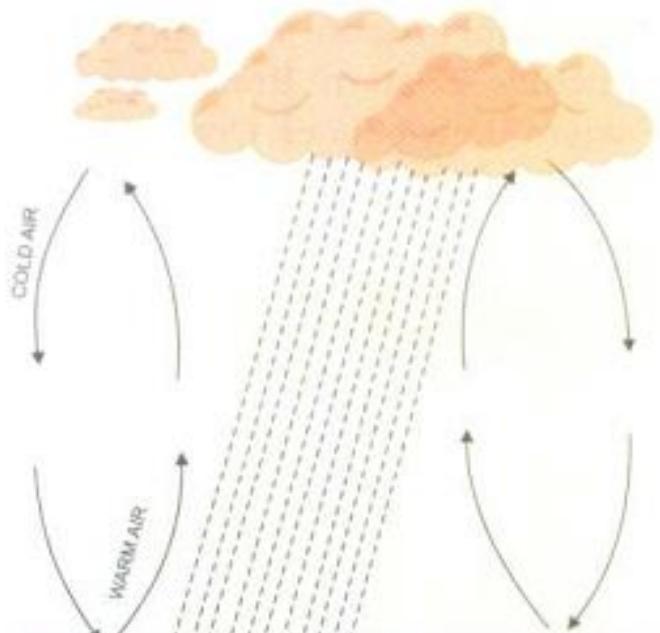


Fig. 17.7. Convectional rainfall

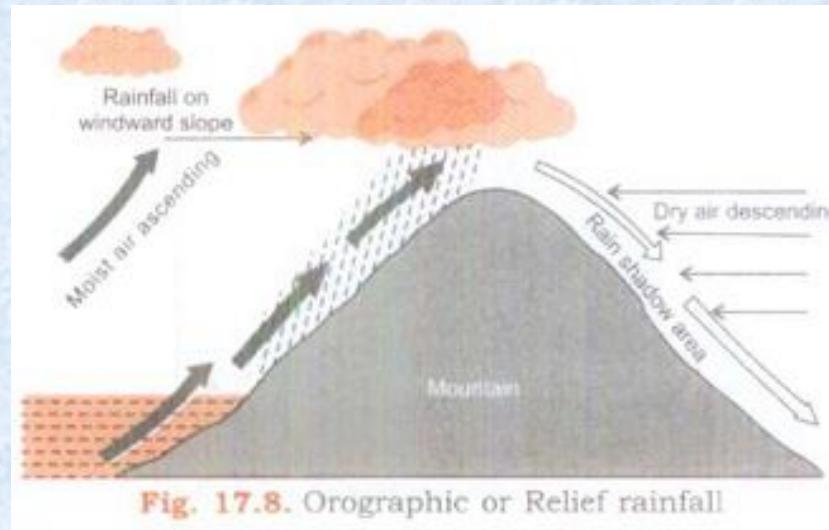


Fig. 17.8. Orographic or Relief rainfall

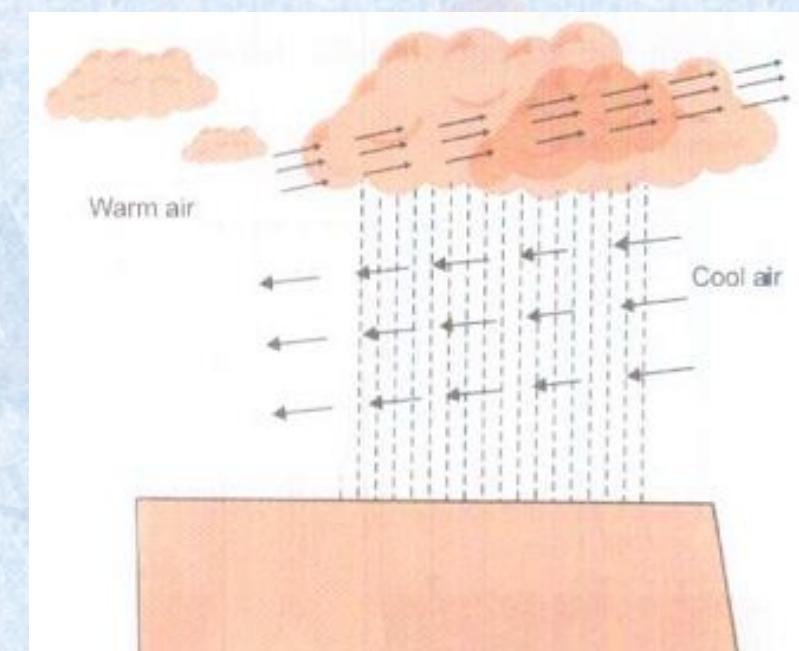


Fig. 17.9. Cyclonic or frontal rainfall

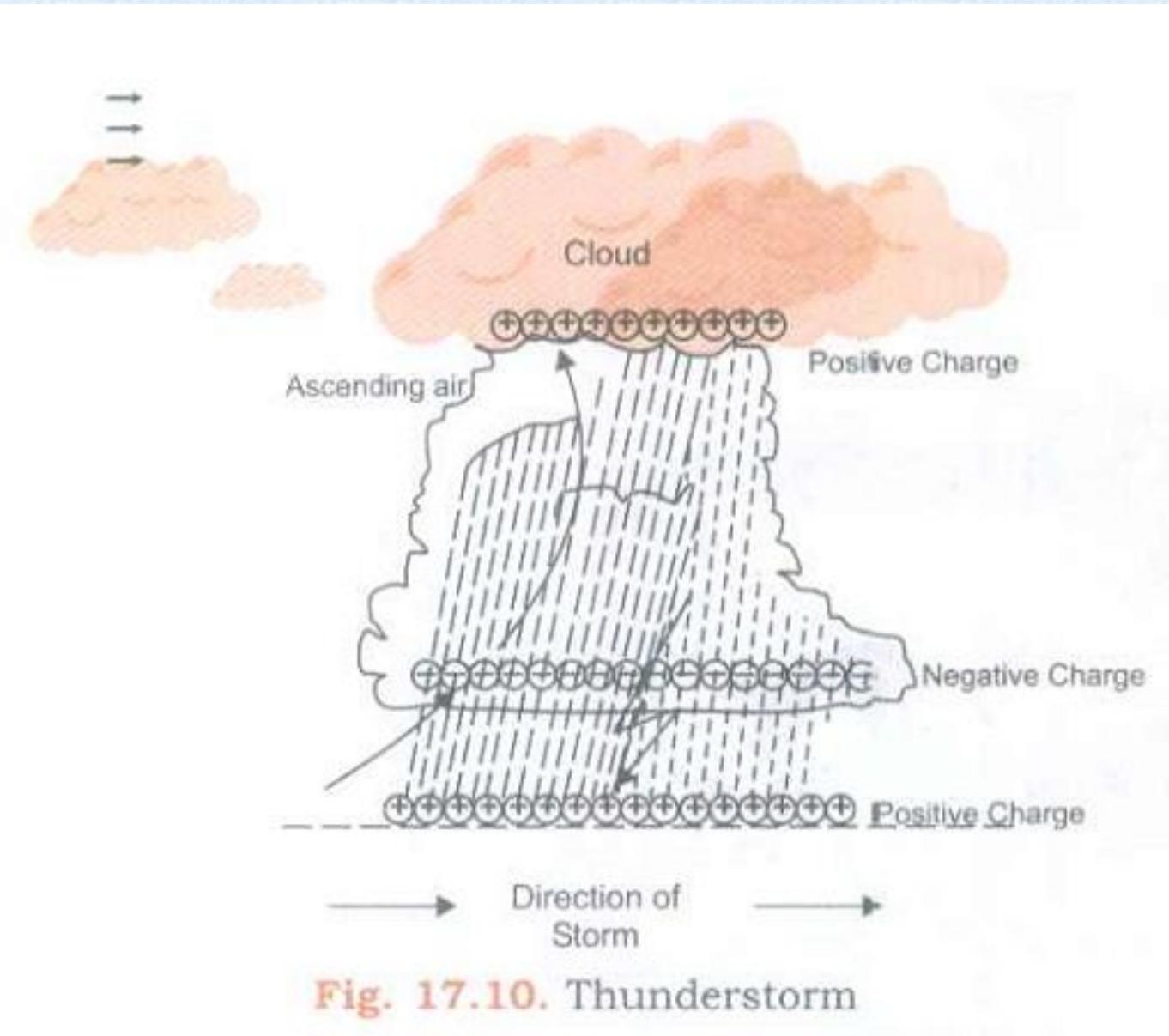


Fig. 17.10. Thunderstorm



2013

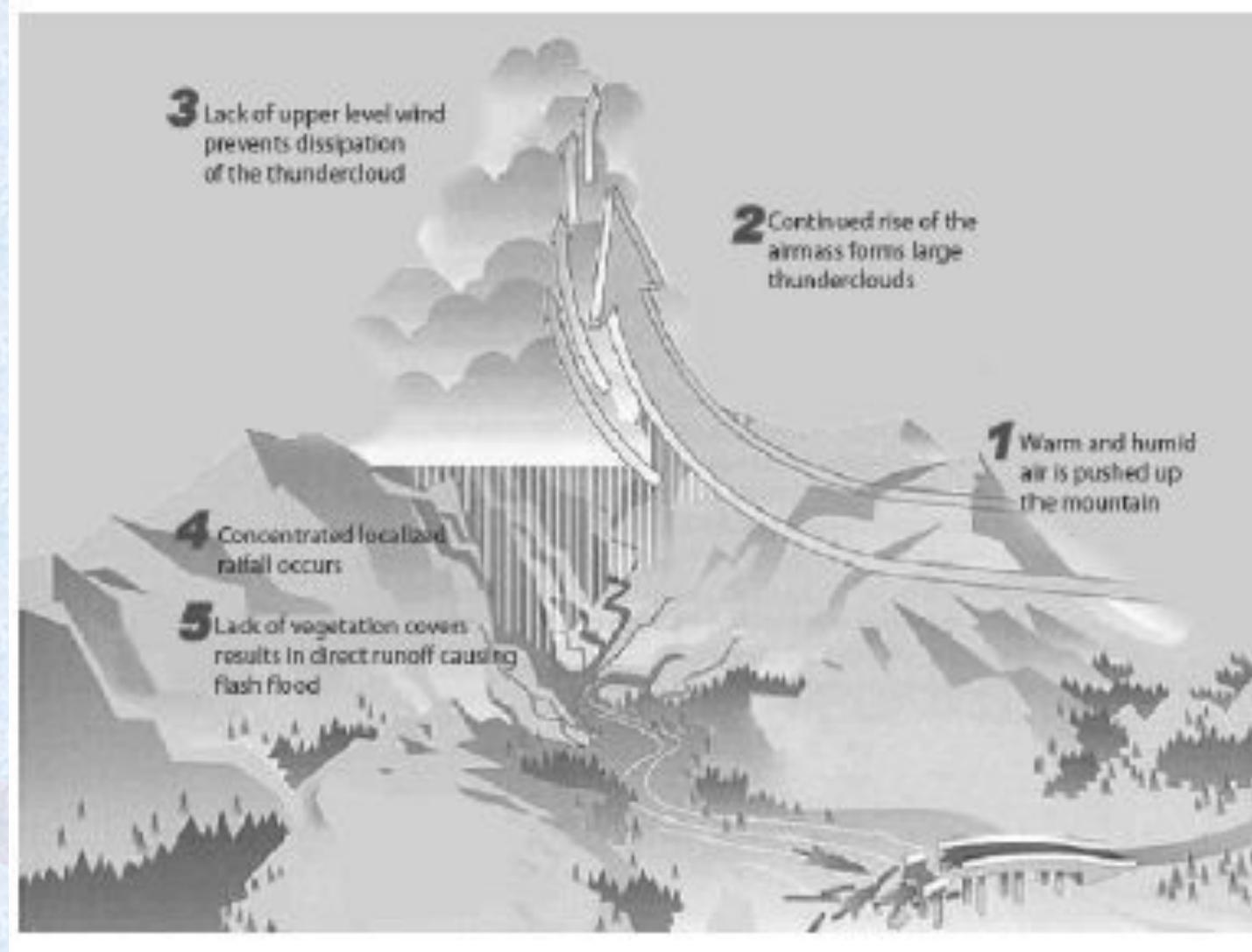
During a thunderstorm, the thunder in the skies is produced by the

1. Meeting of cumulonimbus clouds in the sky.
2. Lightening that separates the nimbus clouds.
3. Violent upward movement of air and water particles.

Select the correct answer using the codes given below.

- (a) 1 only
- (b) 2 and 3
- (c) 1 and 3
- (d) None of the above produces the thunder

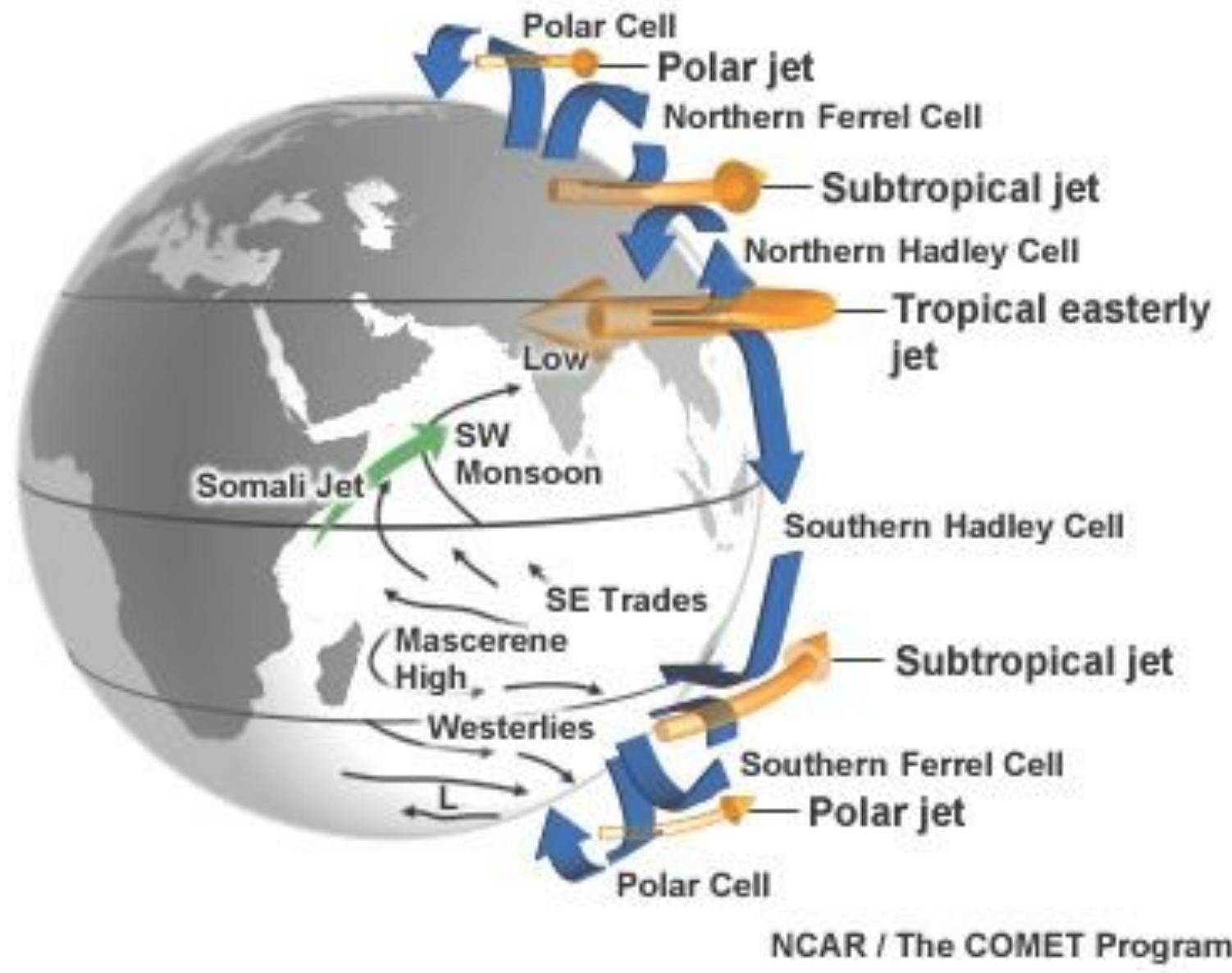




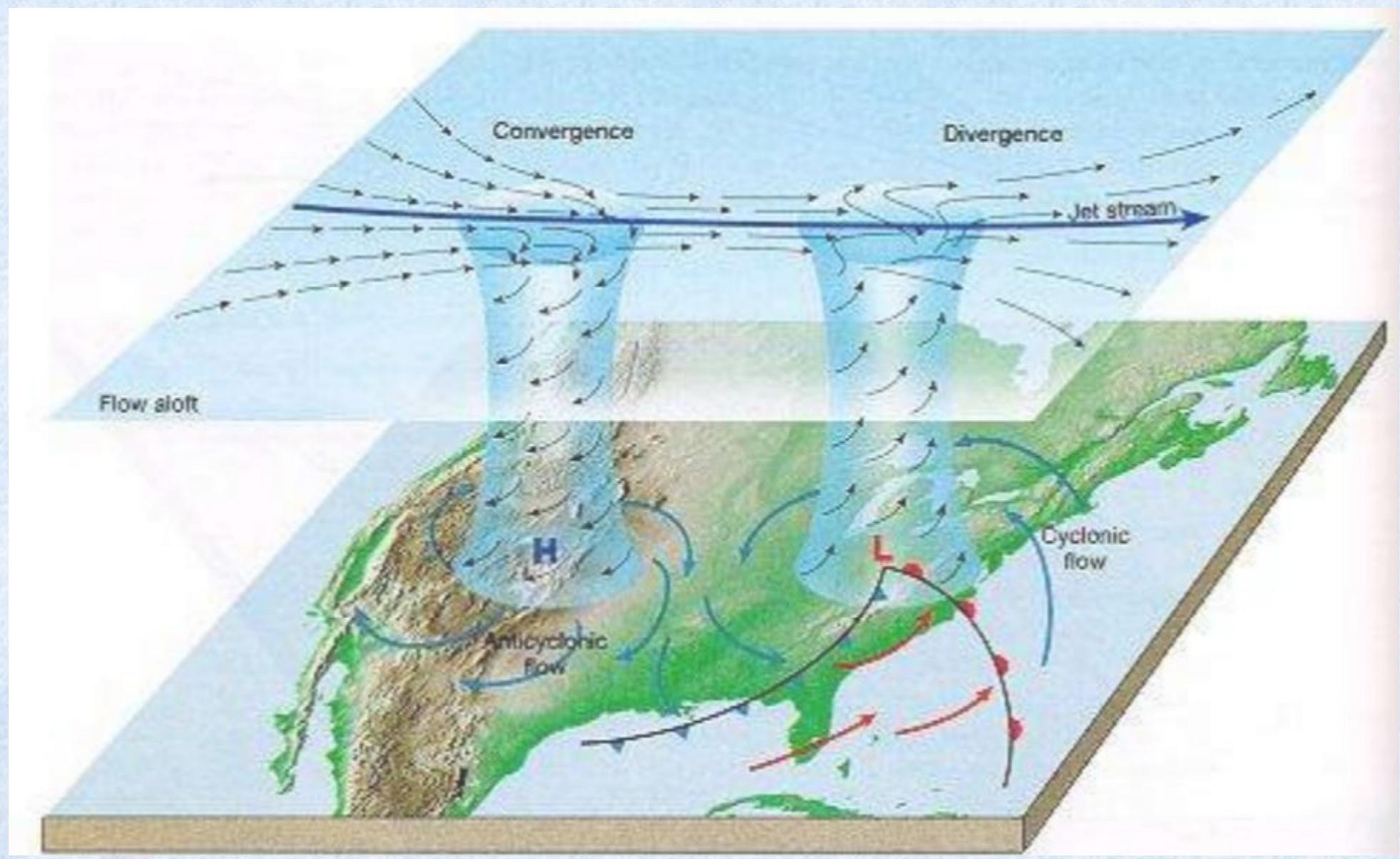
<https://www.youtube.com/watch?v=xiaXZwdroW4>



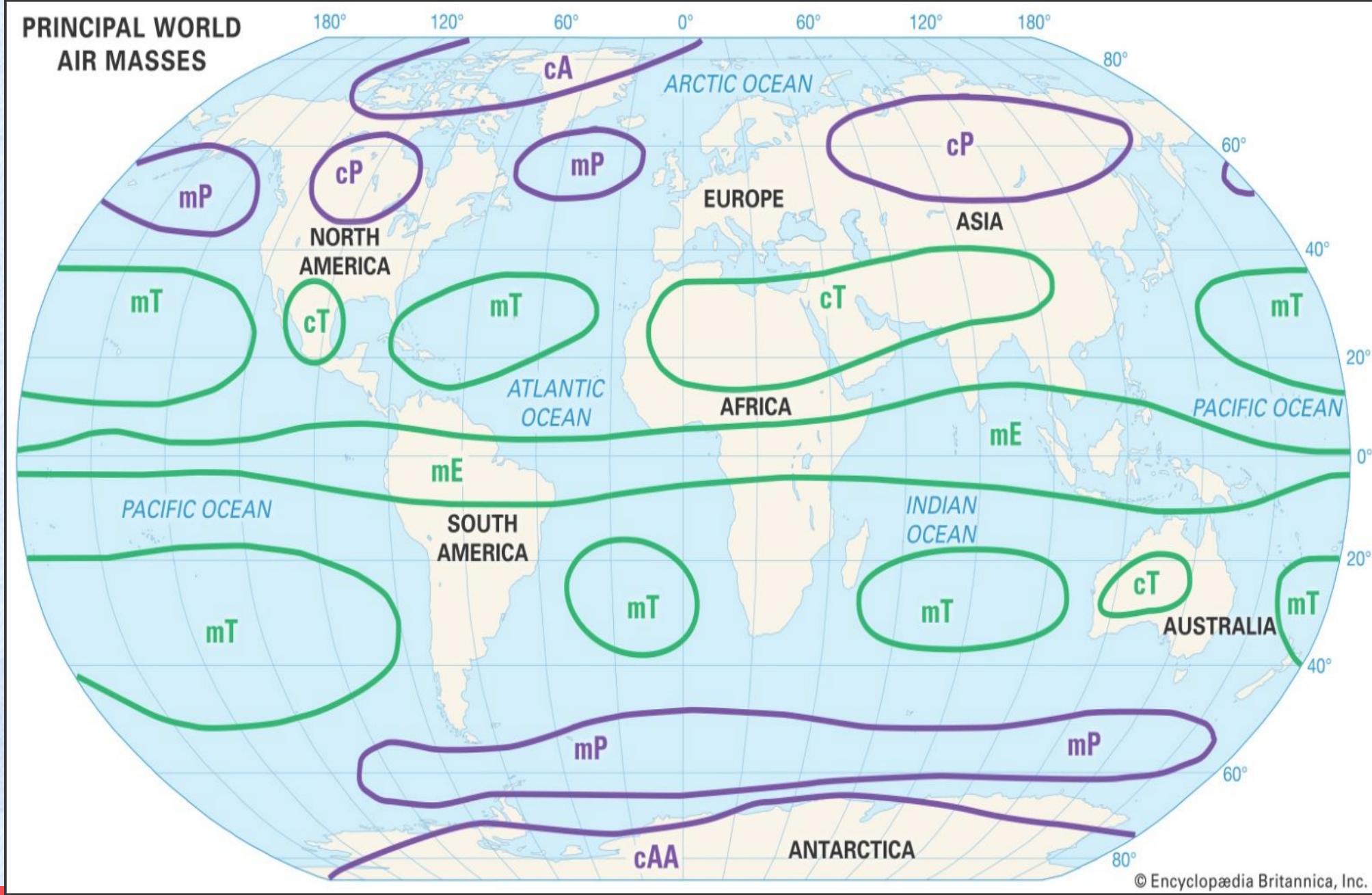




<https://www.youtube.com/watch?v=kefYlzHslVI>



PRINCIPAL WORLD AIR MASSES



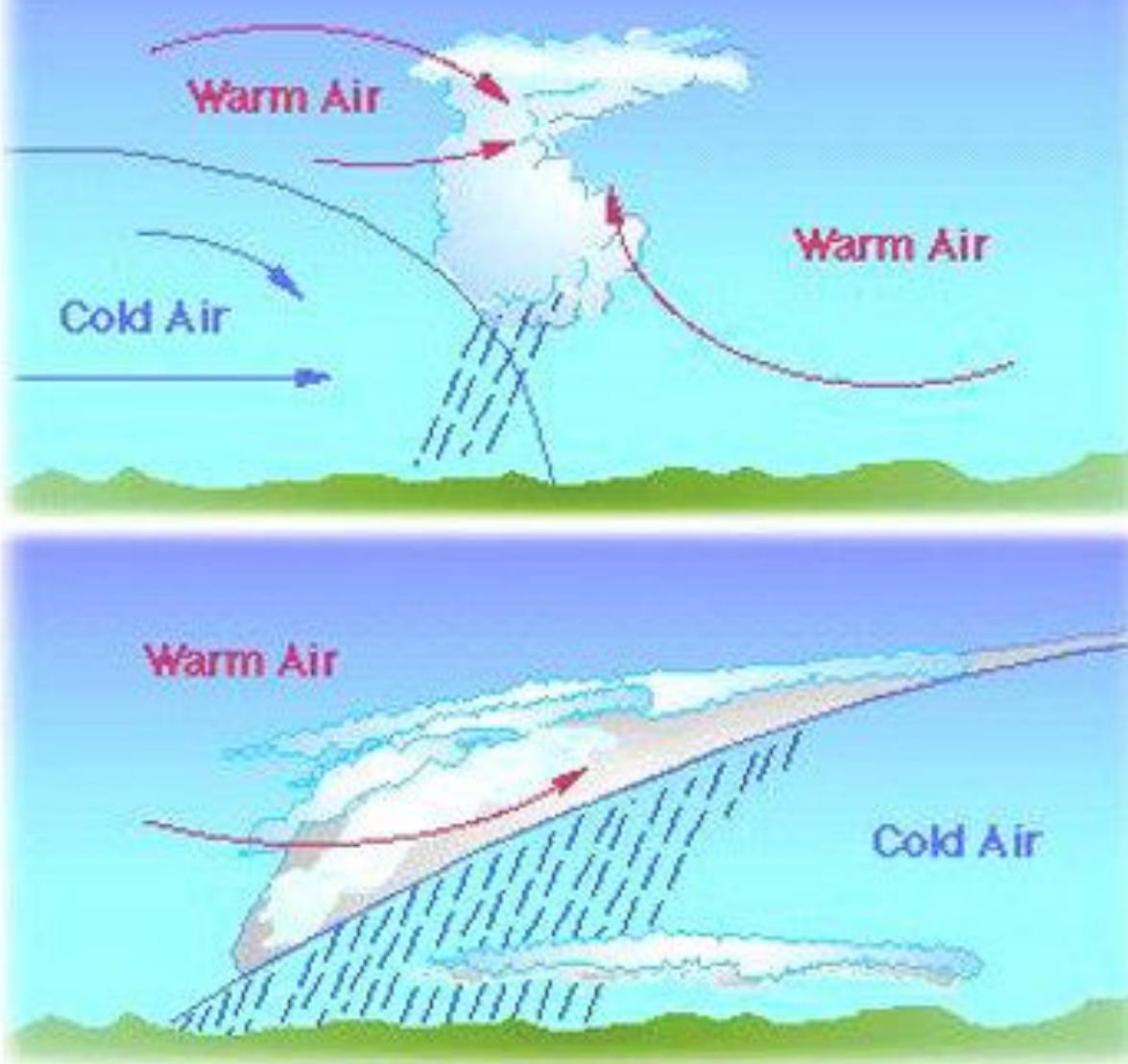
© Encyclopædia Britannica, Inc.

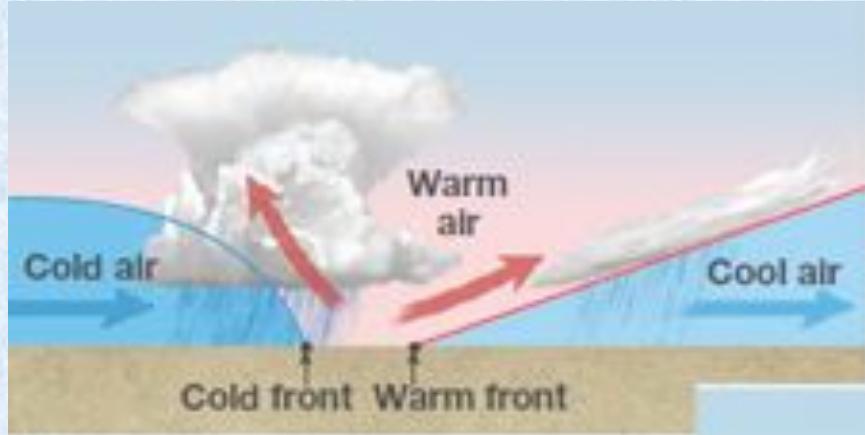
2016

Discuss the concept of air mass and explain its role in macro-climatic changes.

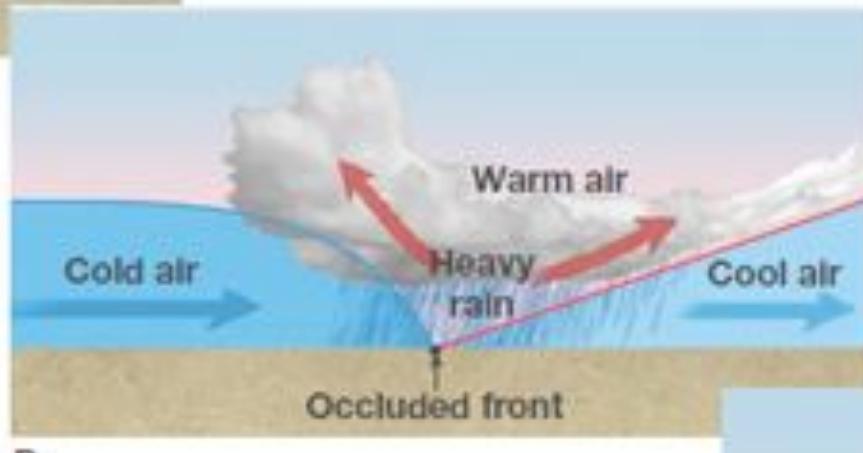
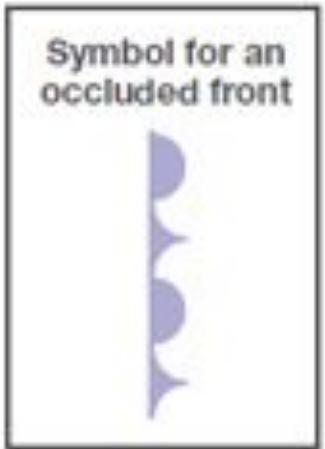
12.5

Warm and Cold Fronts

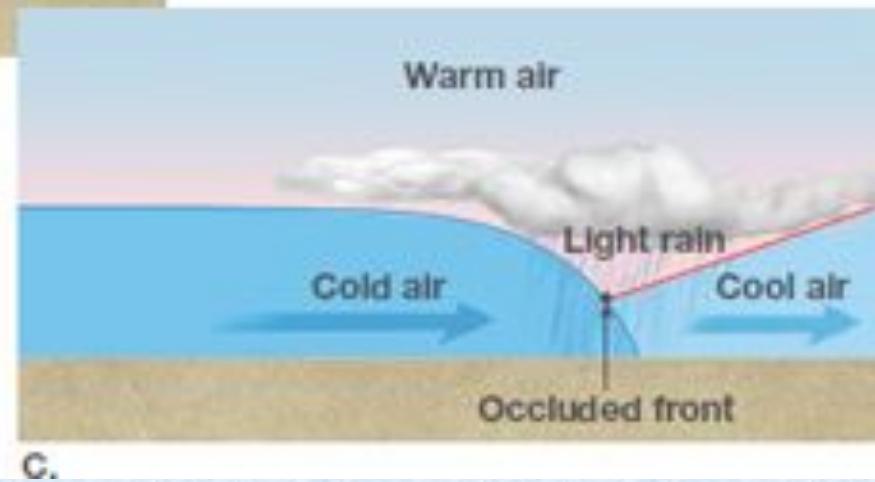




A.



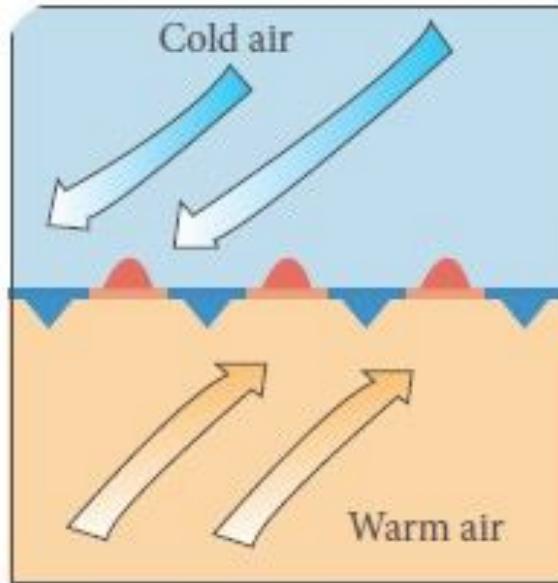
B.



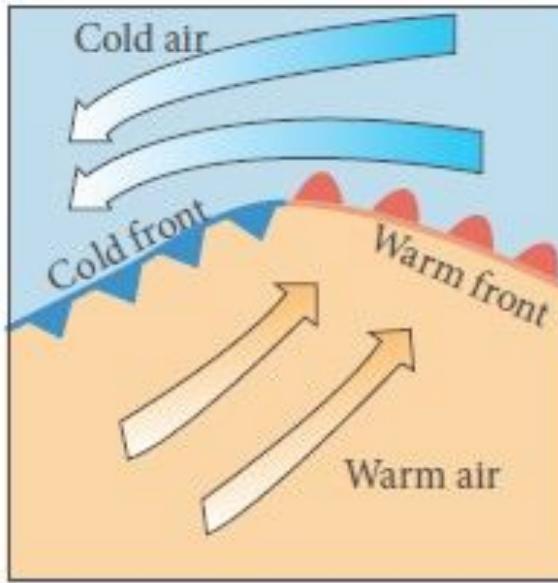
C.

<https://www.youtube.com/watch?v=jch-sxx71ko>

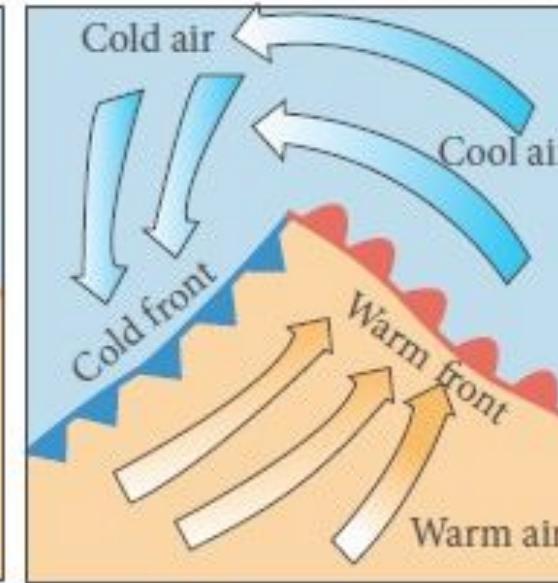
<https://www.youtube.com/watch?v=g5Md8HKDIws>



a)



b)



c)

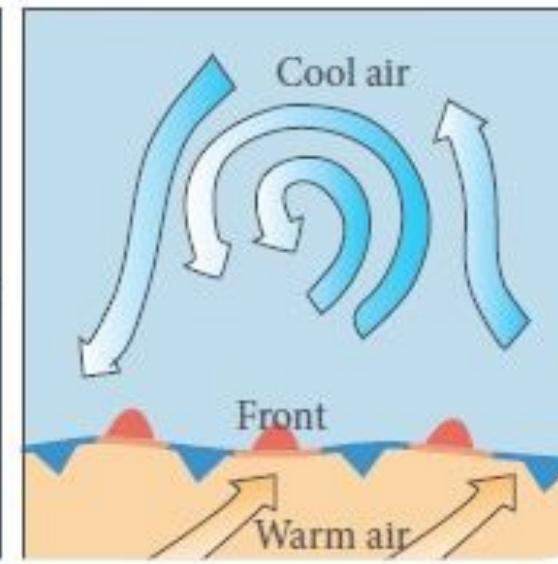
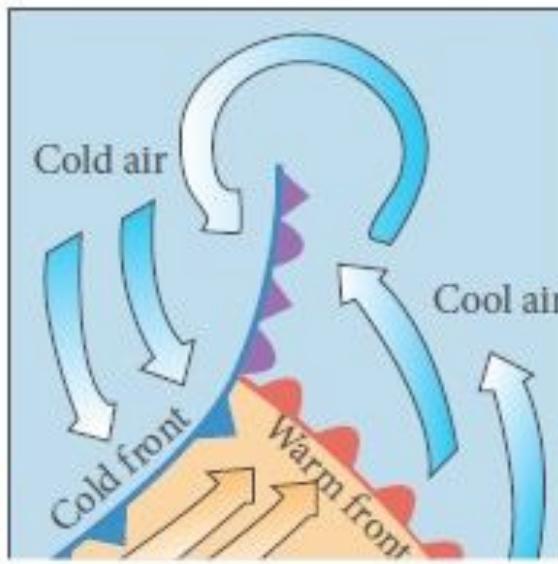
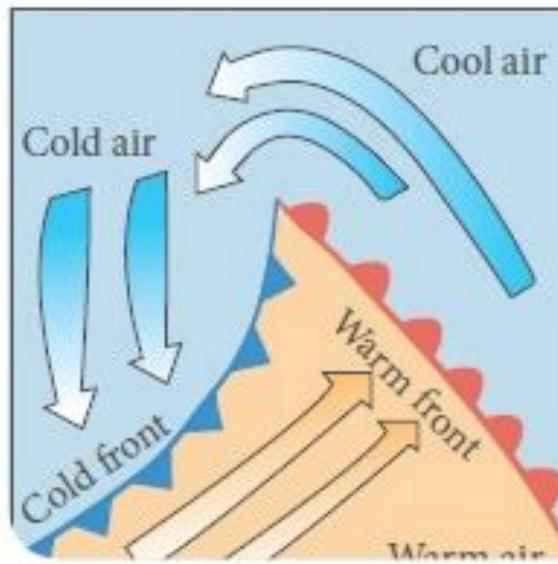
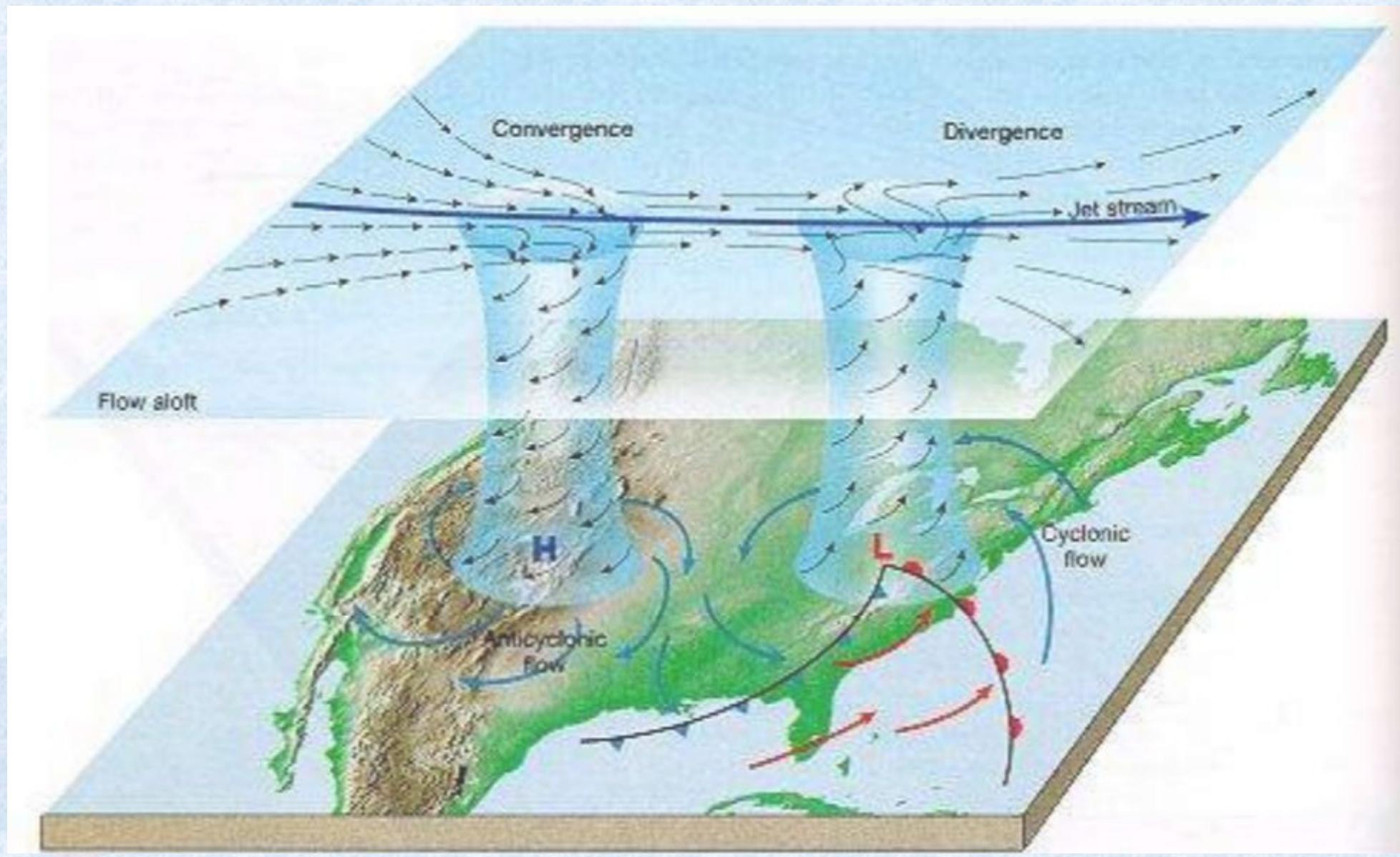


Figure 6.40 Development of Temperate cyclone





<https://www.youtube.com/watch?v=RAqZpjIaoKM>

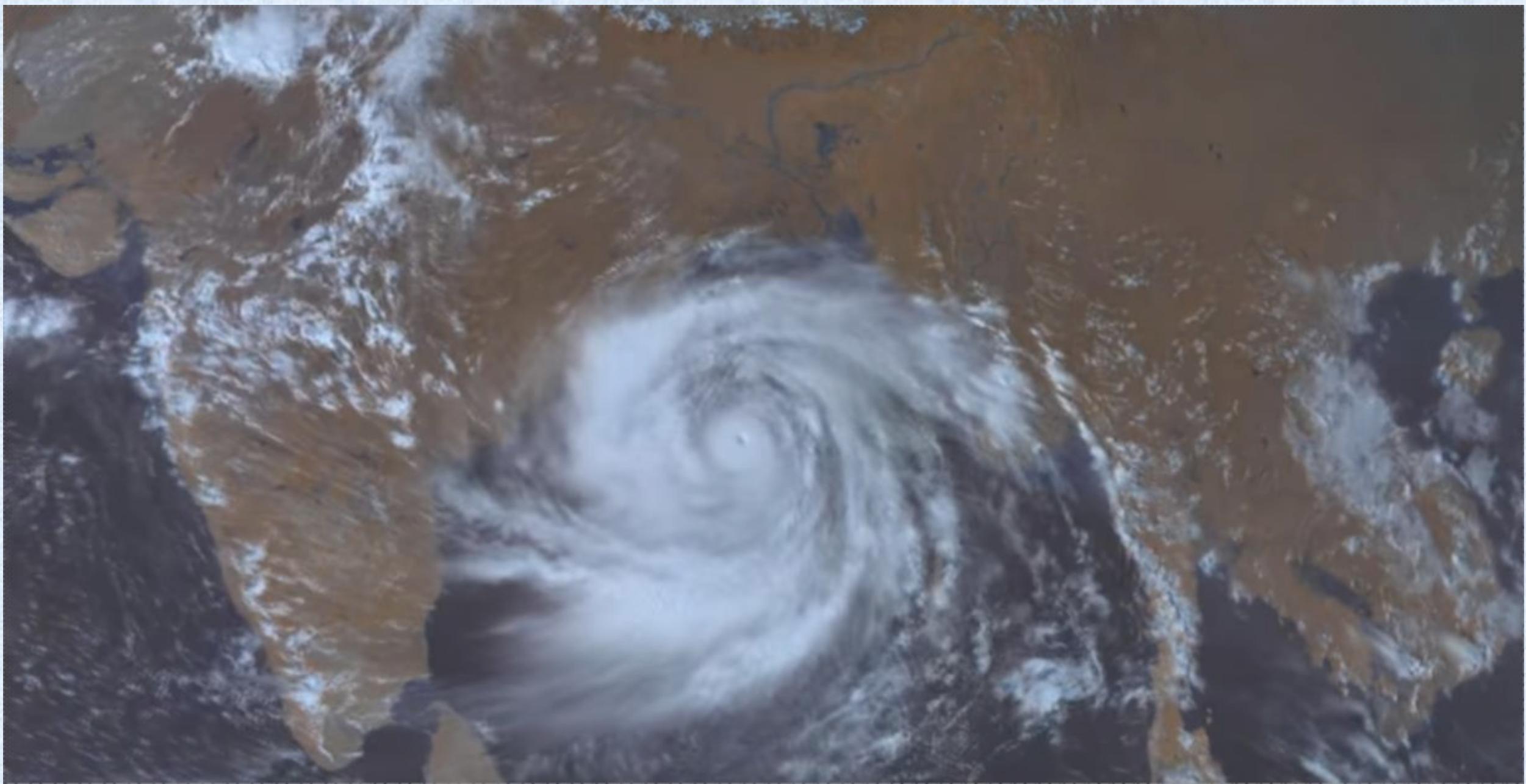
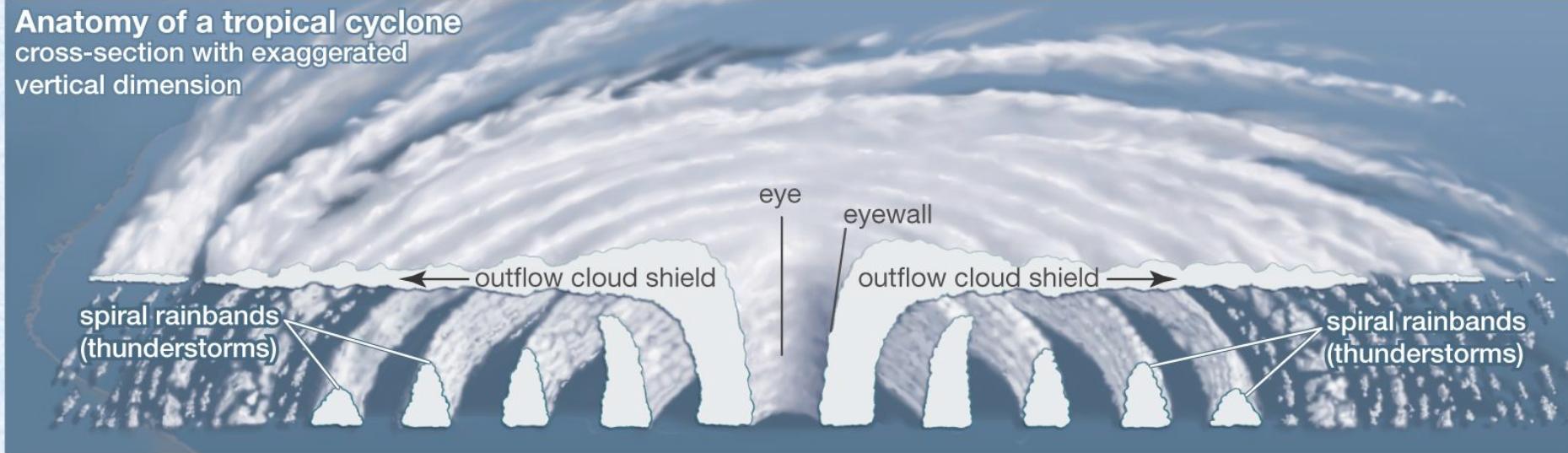


Table 2-2: Classification used in India for tropical cyclones

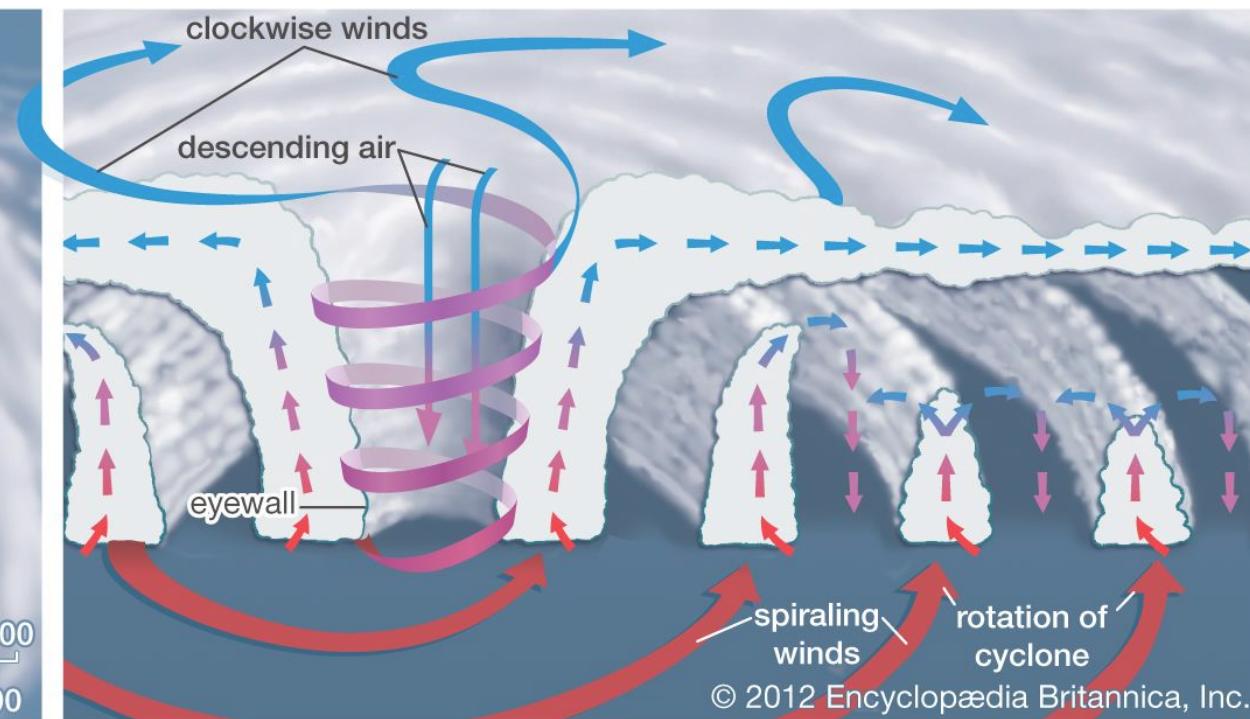
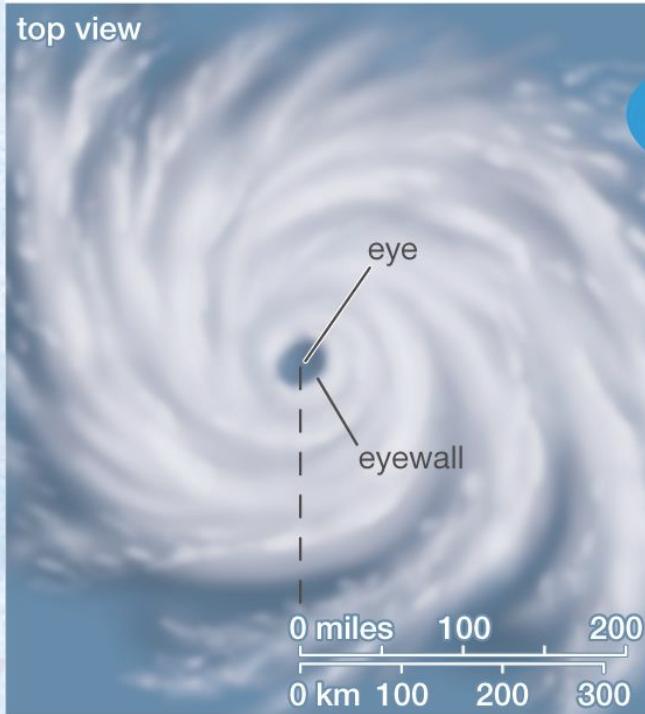
	Type	Wind Speed	
		<i>km per hour (kmph)</i>	<i>Knots</i>
1	Low Pressure area	Less than 31	Less than 17
2	Depression	31 to 49	17 to 27
3	Deep Depression	50 to 61	28 to 33
4	Cyclonic Storm	62 to 88	34 to 47
5	Severe Cyclonic Storm	89 to 118	48 to 63
6	Very Severe Cyclonic Storm	119 to 221	64 to 119
7	Super Cyclone	More than 221	More than 119

Note: One kmph = 0.54 knots; one knot = 1.852 kmph

Anatomy of a tropical cyclone
cross-section with exaggerated
vertical dimension



top view



© 2012 Encyclopædia Britannica, Inc.



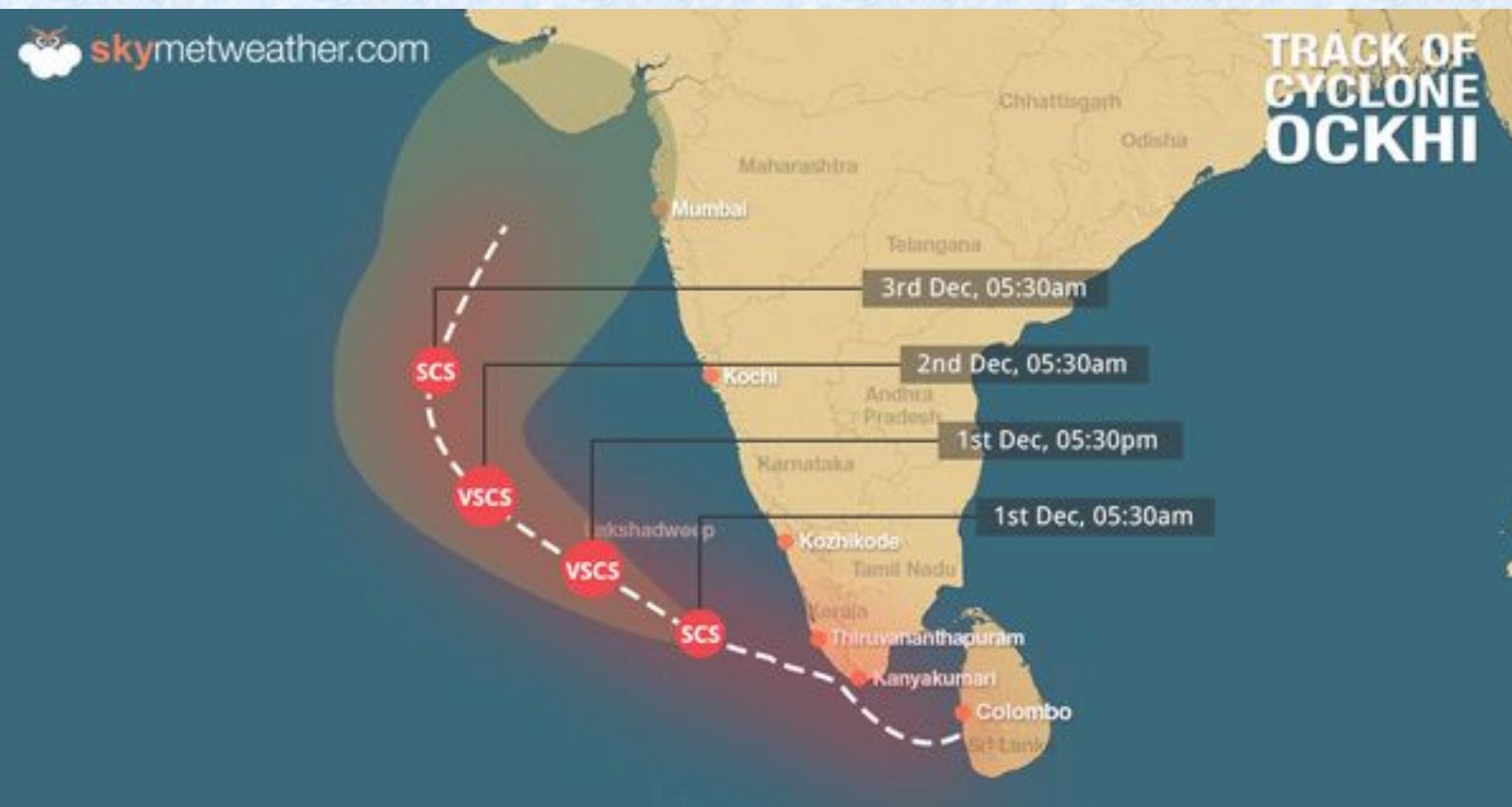
<https://www.youtube.com/watch?v=UKL9NIxLIIE>

List of Northern Indian Ocean tropical cyclone names

List	Contributing nation							
	Bangladesh	India	Maldives	Myanmar	Oman	Pakistan	Sri Lanka	Thailand
1	Onil	Agni	Hibaru	Pyarr	Baaz	Fanoos	Mala	Mukda
2	Ogni	Akash	Gonu	Yemyin	Sidr	Nargis	Rashmi	Khai-Muk
3	Nisha	Bijli	Aila	Phyan	Ward	Laila	Bandu	Phet
4	Giri	Jal	Keila	Thane	Murjan	Nilam	Viyaru	Phailin
5	Helen	Lehar	Madi	Nanauk	Hudhud	Nilofar	Ashobaa	Komen
6	Chapala	Megh	Roanu	Kyant	Nada	Vardah	Maarutha	Mora
7	Ockhi	Sagar	Mekunu	Daye	Luban	Titli	Gaja	Phethai
8	Fani	Vayu	Hikaa	Kyarr	Maha	Bulbul	Pawan	Amphan

List of Northern Indian Ocean tropical cyclone names (effective from 2020)

List	Contributing nation													
	Bangladesh	India	Iran	Maldives	Myanmar	Oman	Pakistan	Qatar	Saudi Arabia	Sri Lanka	Thailand	U.A.E.	Yemen	
1	Nisarga	Gati	Nivar	Burevi	Tauktae	Yaas	Gulab	Shaheen	Jawad	Asani	Sitrang	Mandous	Mocha	
2	Biparjoy	Tej	Hamoon	Midhili	Michaung	Remal	Asna	Dana	Fengal	Shakhti	Montha	Senyar	Ditwah	
3	Arnab	Murasu	Akvan	Kaani	Ngamann	Sail	Sahab	Lulu	Ghazeer	Gigum	Thianyot	Afoor	Diksam	
4	Upakul	Aag	Sepand	Odi	Kyarthit	Naseem	Afshan	Mouj	Asif	Gagana	Bulan	Nahhaam	Sira	
5	Barshon	Vyom	Booran	Kenau	Sapakyee	Muzn	Manahil	Suhail	Sidrah	Verambha	Phutala	Quffal	Bakhur	
6	Rajani	Jhar	Anahita	Endheri	Wetwun	Sadeem	Shujana	Sadaf	Hareed	Garjana	Aiyara	Daaman	Ghwysi	
7	Nishith	Probaho	Azar	Riyau	Mwaihout	Dima	Parwaz	Reem	Faid	Neeba	Saming	Deem	Hawf	
8	Urmi	Neer	Pooyan	Guruva	Kywe	Manjour	Zannata	Rayhan	Kaseer	Ninnada	Kraison	Gargoor	Balhaf	
9	Meghala	Prabhanjan	Arsham	Kurangi	Pinku	Rukam	Sarsar	Anbar	Nakheel	Viduli	Matcha	Khubb	Brom	
10	Samiron	Ghurni	Hengame	Kuredhi	Yinkaung	Watad	Badban	Oud	Haboob	Ogha	Mahingsa	Degl	Shuqra	
11	Pratikul	Ambud	Savas	Horangu	Linyone	Al-jarz	Sarrab	Bahar	Bareq	Salitha	Phraewa	Athmad	Fartak	
12	Sarobor	Jaladhi	Tahamtan	Thundi	Kyeekan	Rabab	Gulnar	Seef	Alreem	Rivi	Asuri	Boom	Darsah	
13	Mahanisha	Vega	Toofan	Faana	Bautphat	Raad	Waseq	Fanar	Wabil	Rudu	Thara	Saffar	Samhah	



Difference between Tropical Cyclones and Temperate Cyclones

Tropical Cyclones	Temperate Cyclones
1. Tropical cyclones are produced mainly over the sea.	1. Temperate cyclones are produced both on land and on sea.
2. They generally originate in the tropical region between 8° and 20° N and S.	2. They originate in the mid-latitudinal region between 35° latitude and 65° latitude.
3. They are limited to a small area.	3. They occupy areas measuring thousands of kilometres.
4. They travel from east to west.	4. They travel from west to east.
5. They are forecasted by high temperature and humidity but still air.	5. They are forecasted by fall in temperature and pressure, wind shifts and a halo around the sun and the moon.
6. They are associated with violent winds with great speed, dense clouds and heavy rains.	6. The wind speed is low and the rainfall is light, which continues for many days.
7. They are largely a summer phenomena.	7. They are most intense in winter.

2013 - The recent cyclone on the east coast of India was called 'Phailin'. How are the tropical cyclones named across the world? Elaborate. 5

2014

Tropical cyclones are largely confined to South China Sea, Bay of Bengal and Gulf of Mexico. Why?

10

2015

In the South Atlantic and South-Eastern Pacific regions in tropical latitudes, cyclone does not originate. What is the reason?

- (a) Sea surface temperatures are low
- (b) Inter-Tropical Convergence Zone seldom occurs
- (c) Coriolis force is too weak
- (d) Absence of land in those regions

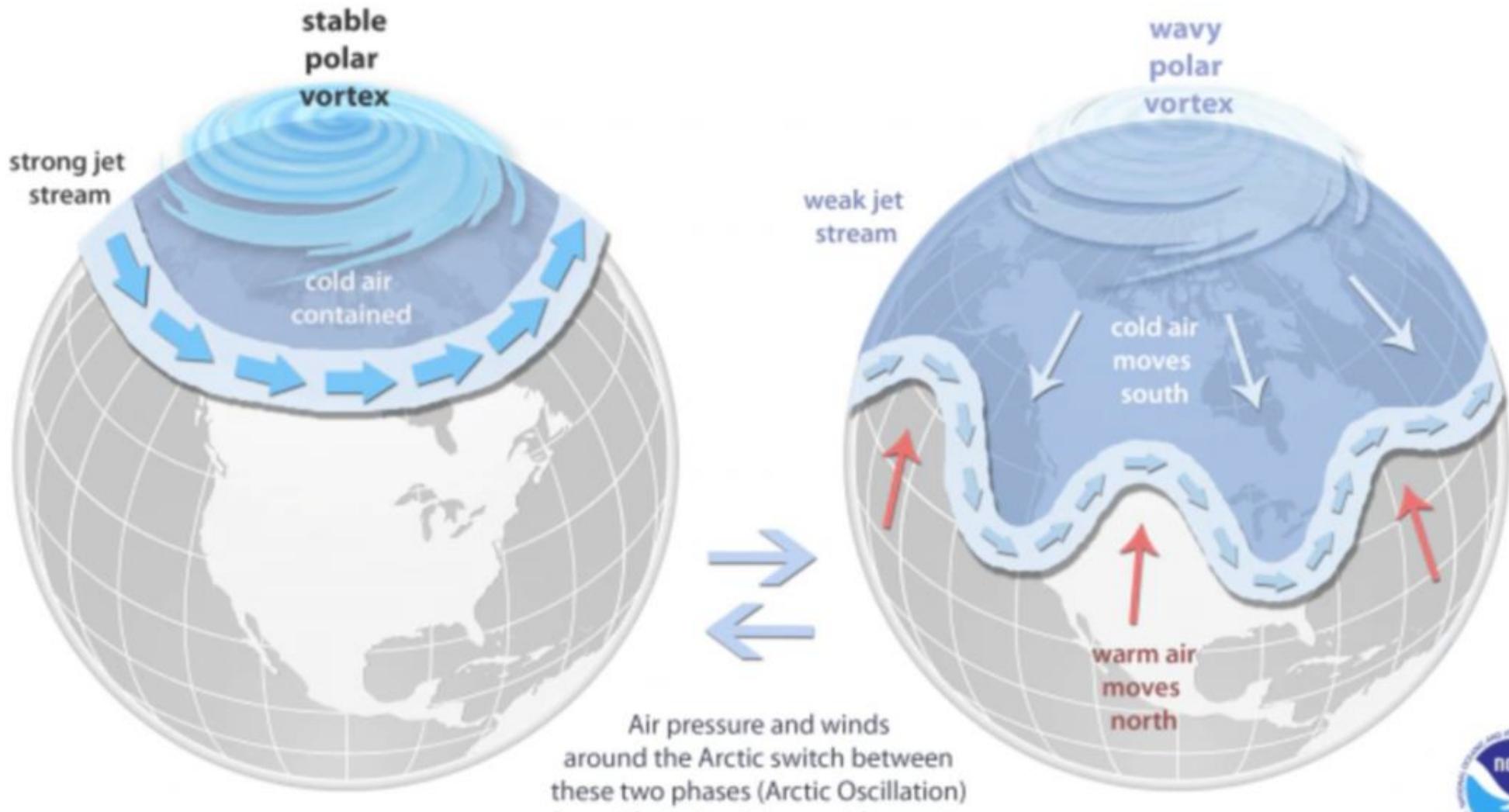
59. Consider the following statements:

1. Jet streams occur in the Northern Hemisphere only.
2. Only some cyclones develop an eye.
3. The temperature inside the eye of a cyclone is nearly 10°C lesser than that of the surroundings.

Which of the statements given above is/are correct?

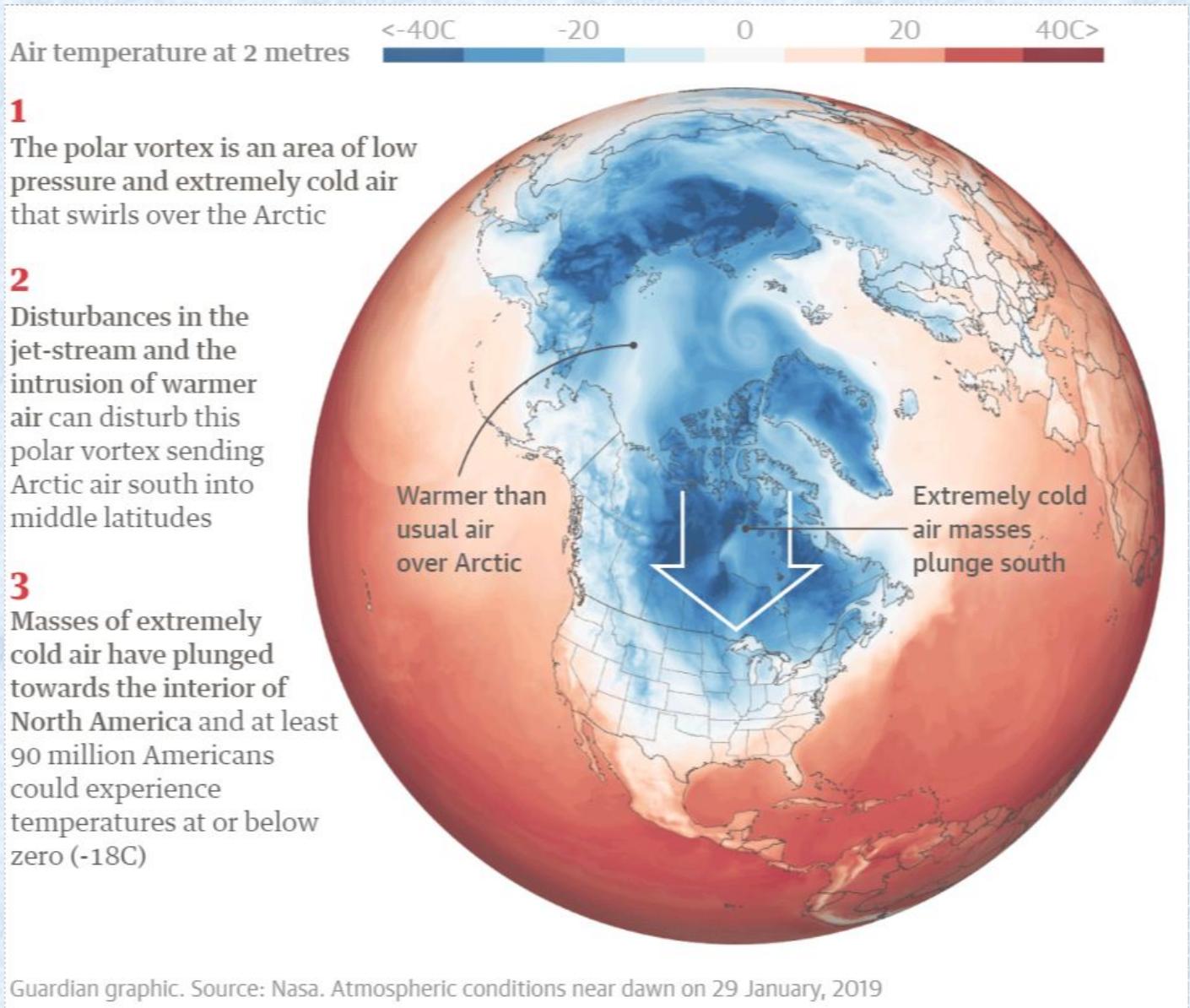
- (a) 1 only
- (b) 2 and 3 only
- (c) 2 only
- (d) 1 and 3 only

2020



The science behind the polar vortex.(Image: NOAA)







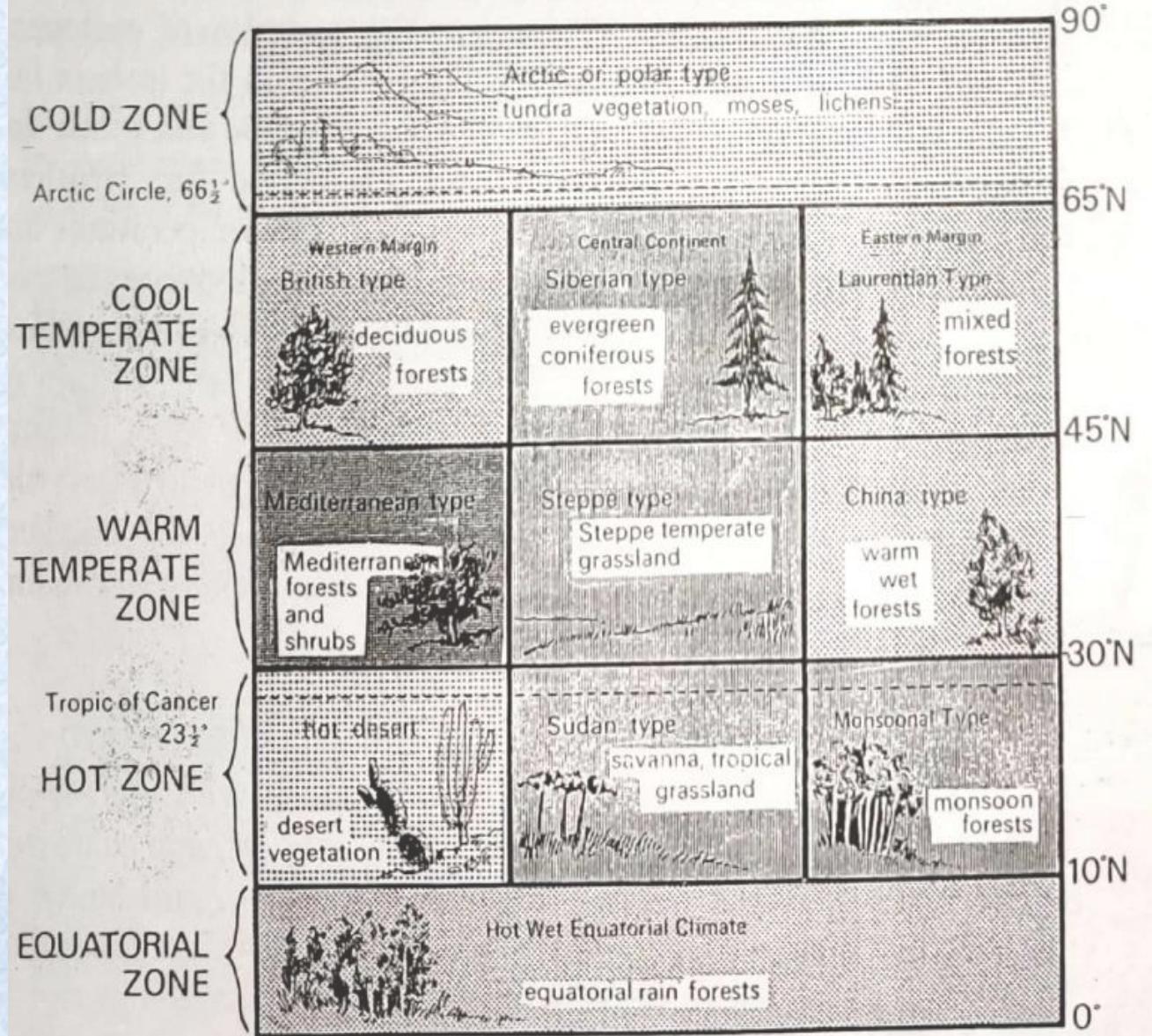


Fig. 120 Scheme of the world's climatic types (with seasonal rainfall and natural vegetation also indicated)

WORLD CLIMATIC TYPES

Climatic Zone	Latitude (approximate)	Climatic Type	Rainfall Regime (with approx. total)	Natural Vegetation
Equatorial Zone	0° – 10°N. and S.	1. Hot, wet equatorial	Rainfall all year round: 80 inches	Equatorial rain forests
Hot Zone	10° – 30°N. and S.	2. (a) Tropical Monsoon (b) Tropical Marine 3. Sudan Type 4. Desert: (a) Saharan type (b) Mid-latitude type	Heavy summer rain: 60 inches Much summer rain: 70 inches Rain mainly in summer: 30 inches Little rain : 5 inches	Monsoon forests Savanna (tropical grassland) Desert vegetation and scrub
Warm Temperate Zone	30° – 45°N. and S.	5. Western Margin (Mediterranean type) 6. Central Continental (Steppe type) 7. Eastern Margin: (a) China type (b) Gulf type (c) Natal type	Winter rain: 35 inches Light summer rain: 20 inches Heavier summer rain: 45 inches	Mediterranean forests and shrub Steppe or temperate grassland Warm, wet forests and bamboo
Cool Temperate Zone	45° – 65°N. and S.	8. Western Margin (British type) 9. Central Continental (Siberian type) 10. Eastern Margin (Laurentian type)	More rain in autumn and winter: 30 inches Light summer rain: 25 inches Moderate summer rain: 40 inches	Deciduous forests Evergreen coniferous forests Mixed forests (coniferous and deciduous)
Cold Zone	65° – 90°N. and S.	11. Arctic or Polar 12. Mountain climate	Very light summer rain: 10 inches Heavy rainfall (variable)	Tundra, mosses, lichens Alpine pastures, conifers, fern, snow.
Alpine Zone				

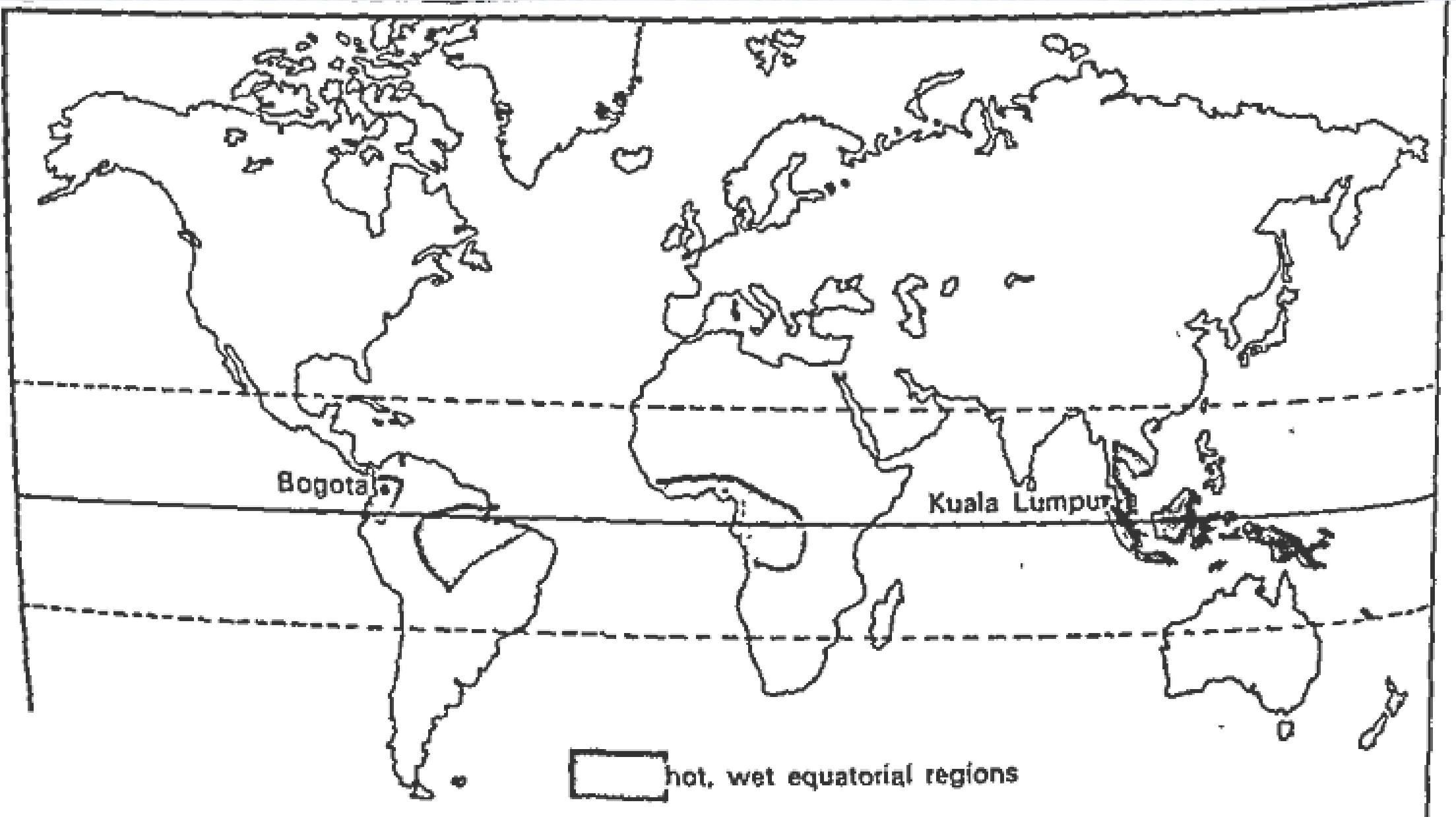
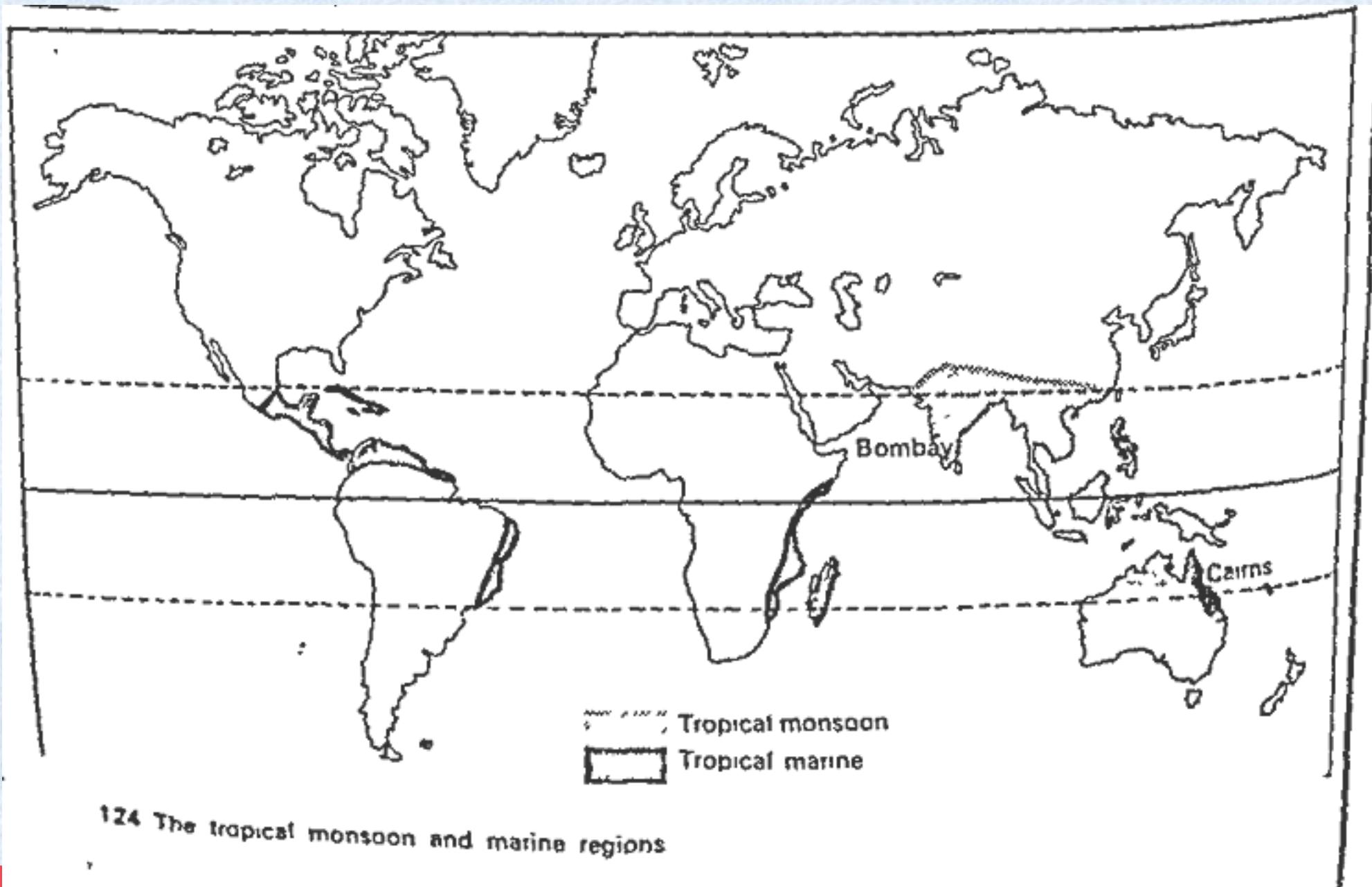
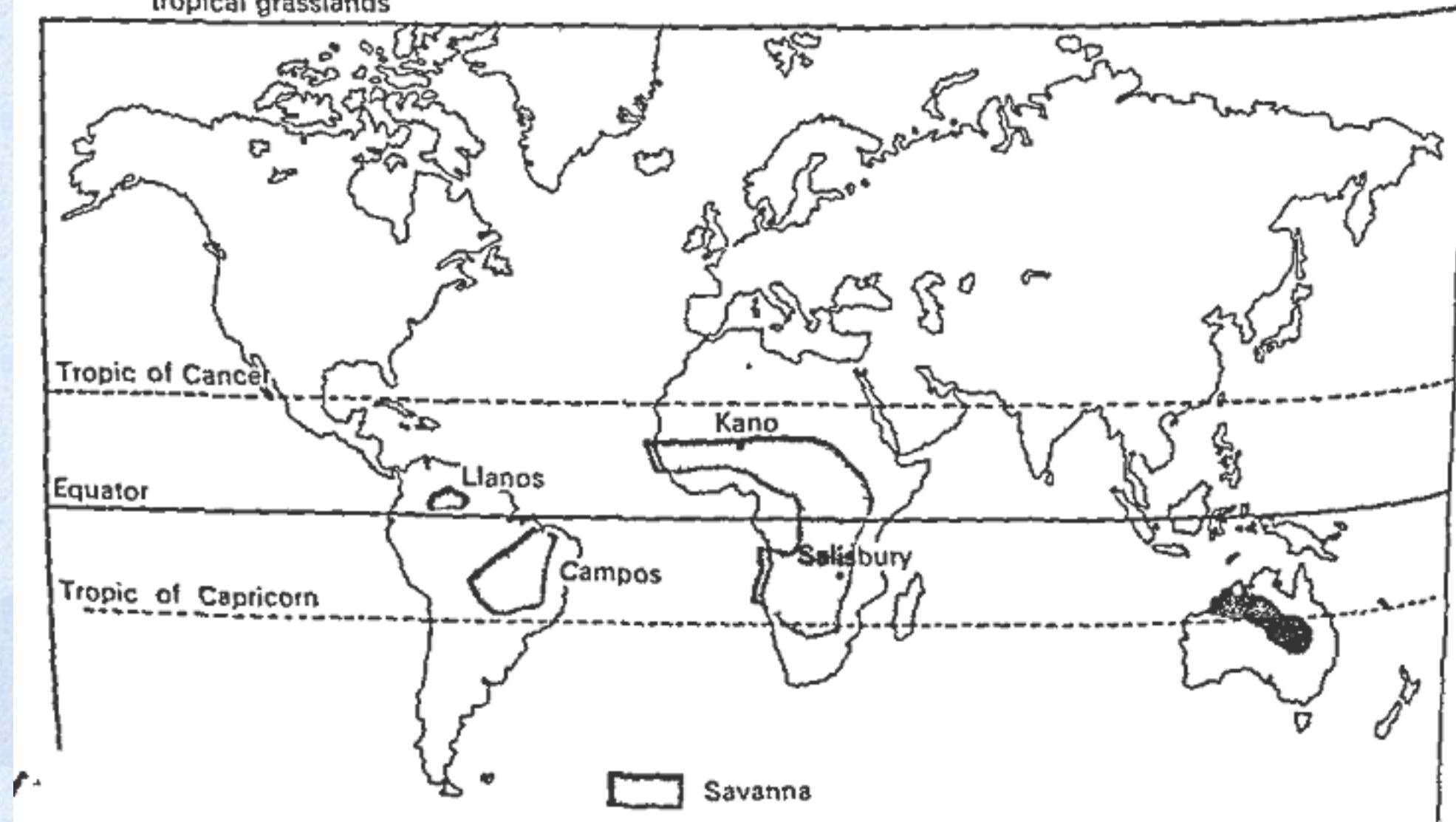


Fig 121 The hot, wet equatorial regions



124 The tropical monsoon and marine regions

Fig 128 Regions of Sudan Climate with savanna or tropical grasslands



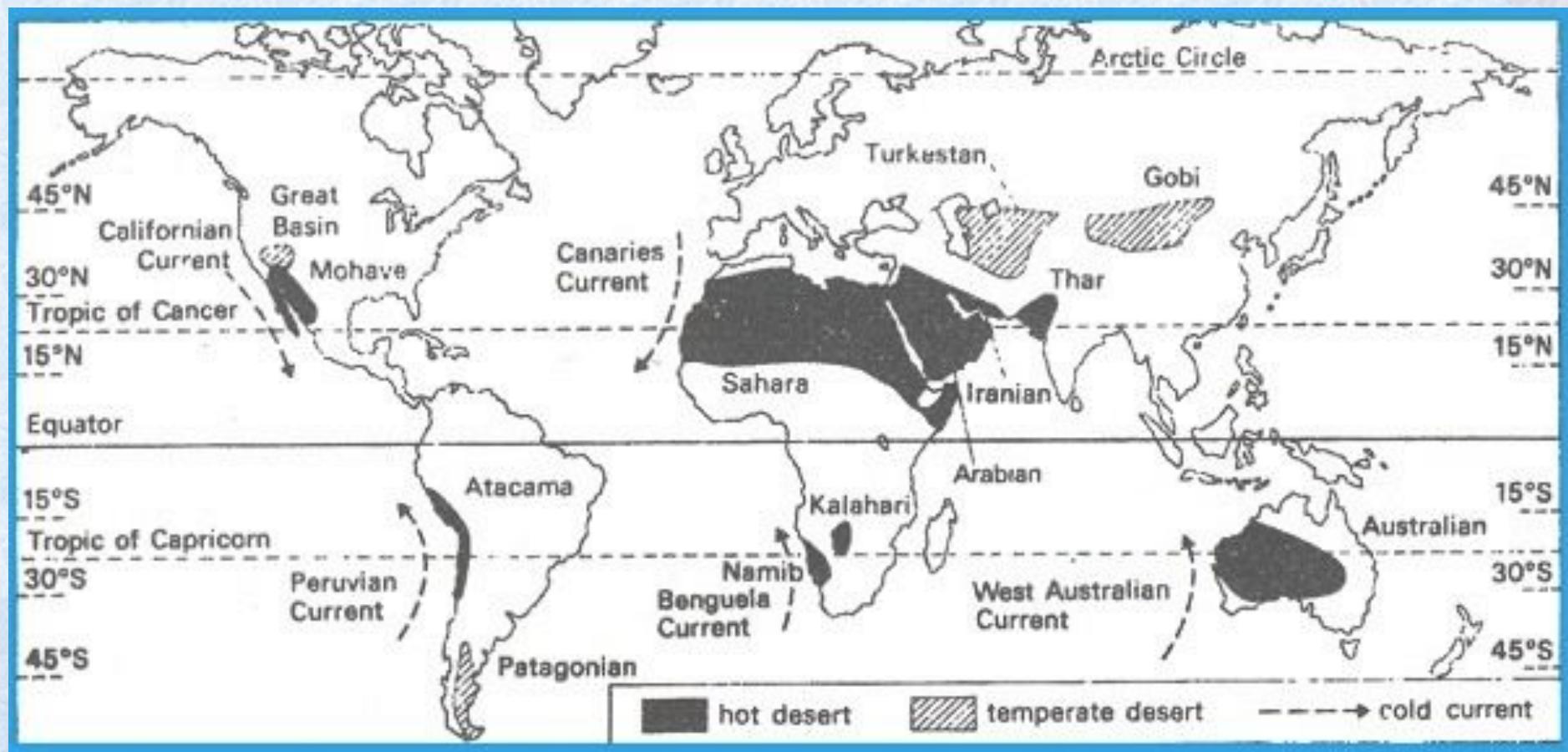
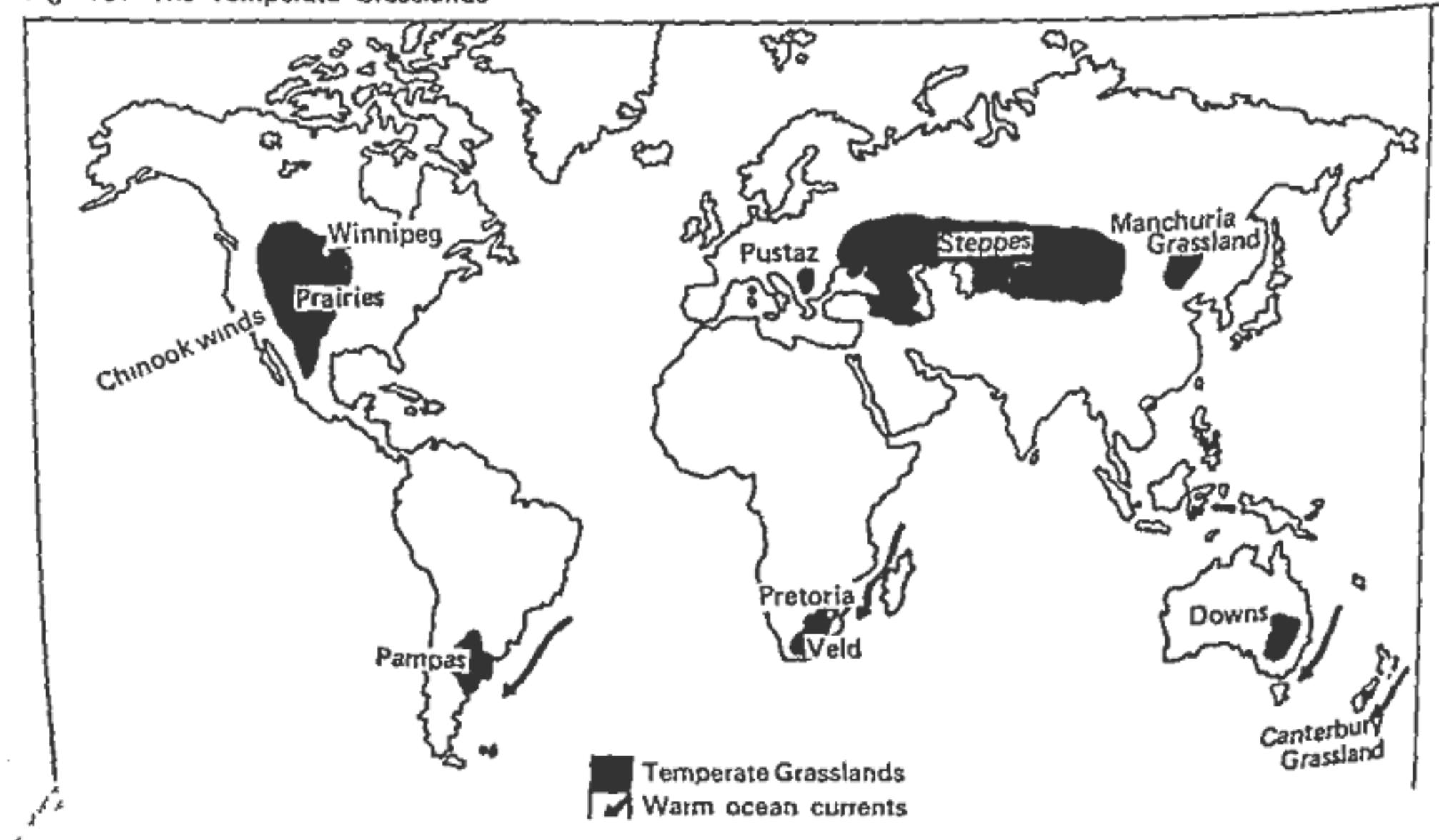
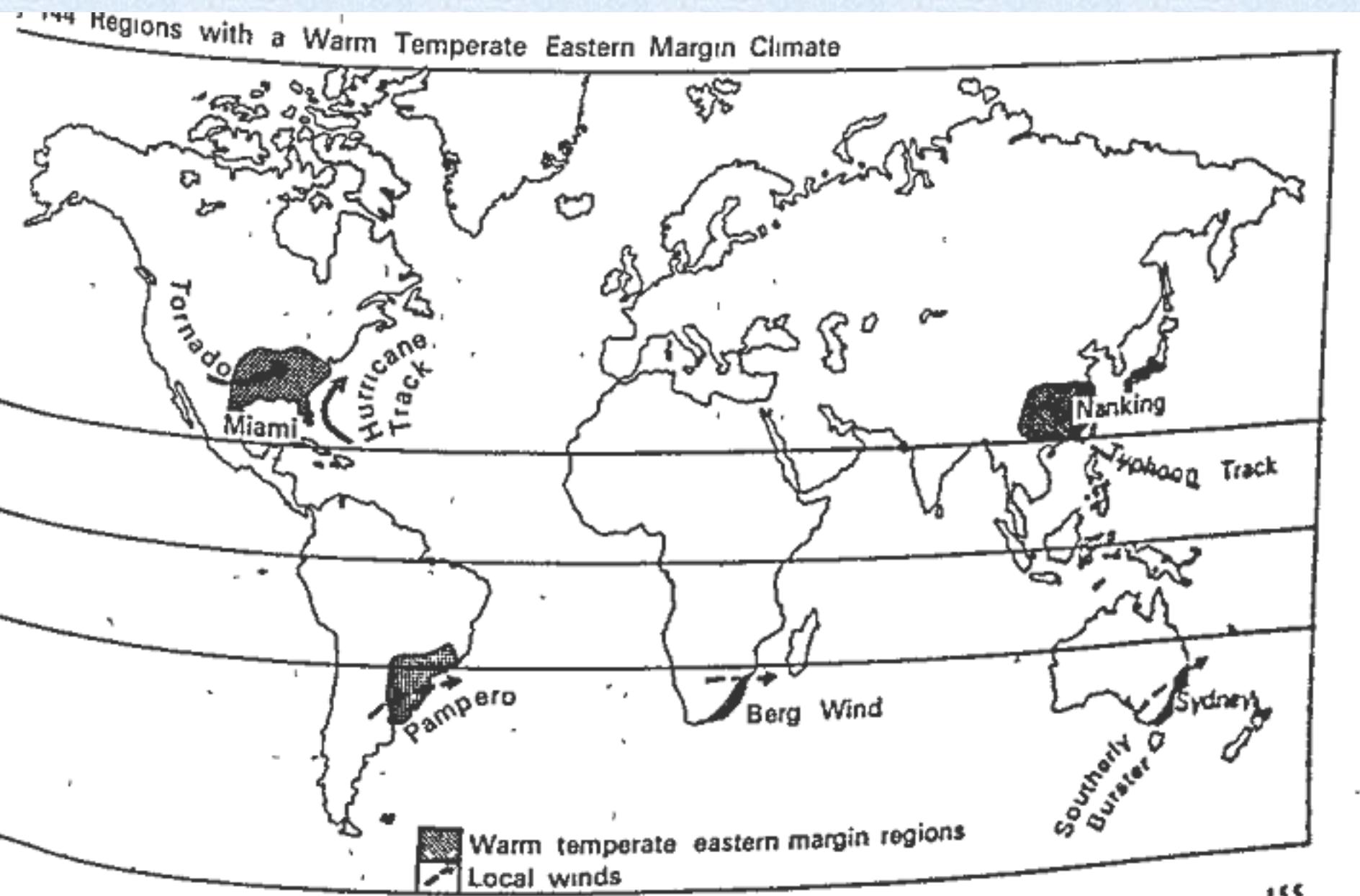




Fig 137 The Temperate Grasslands





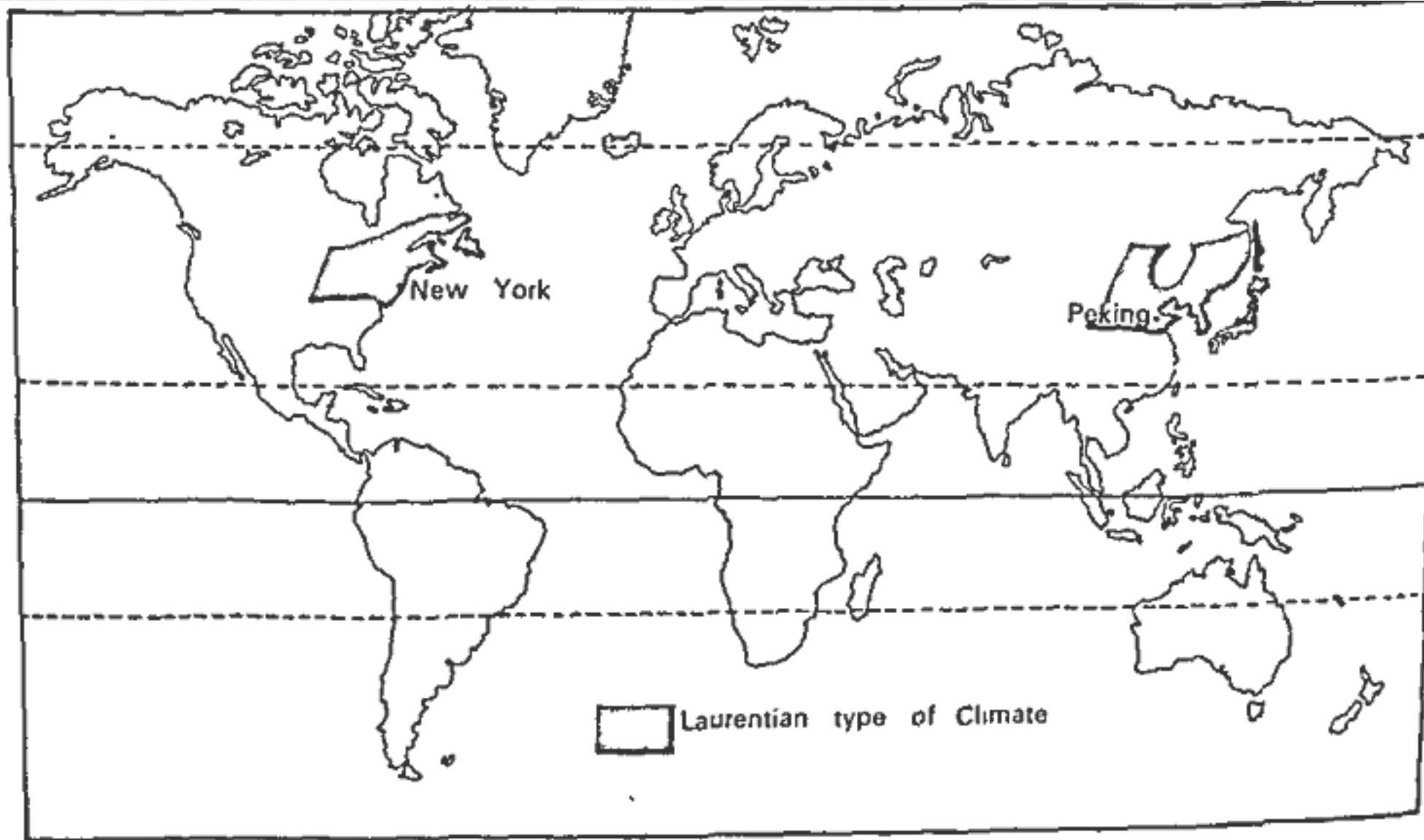


Fig. 153 Regions with a Cool Temperate Eastern Margin Climate (Laurentian type)

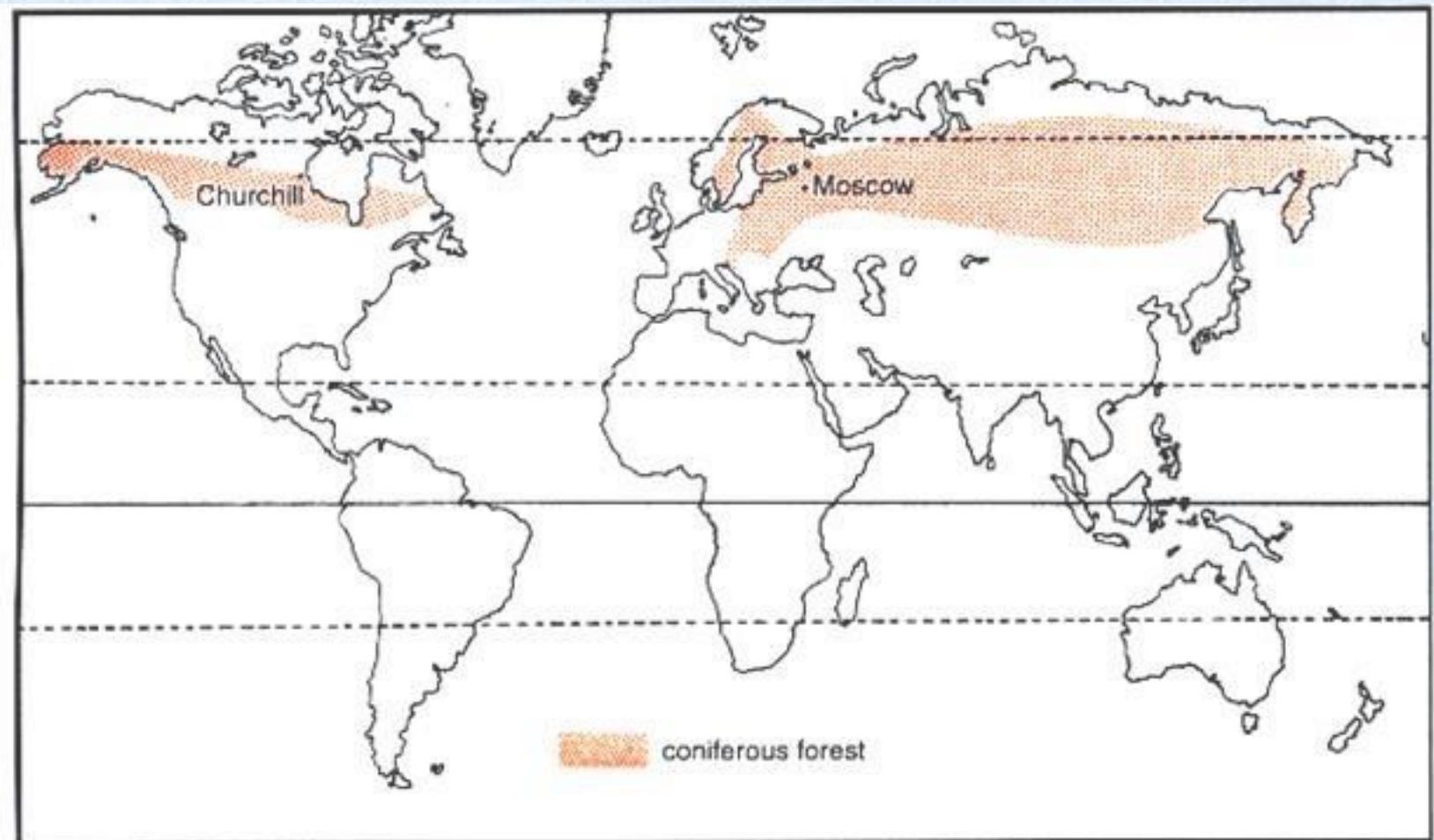
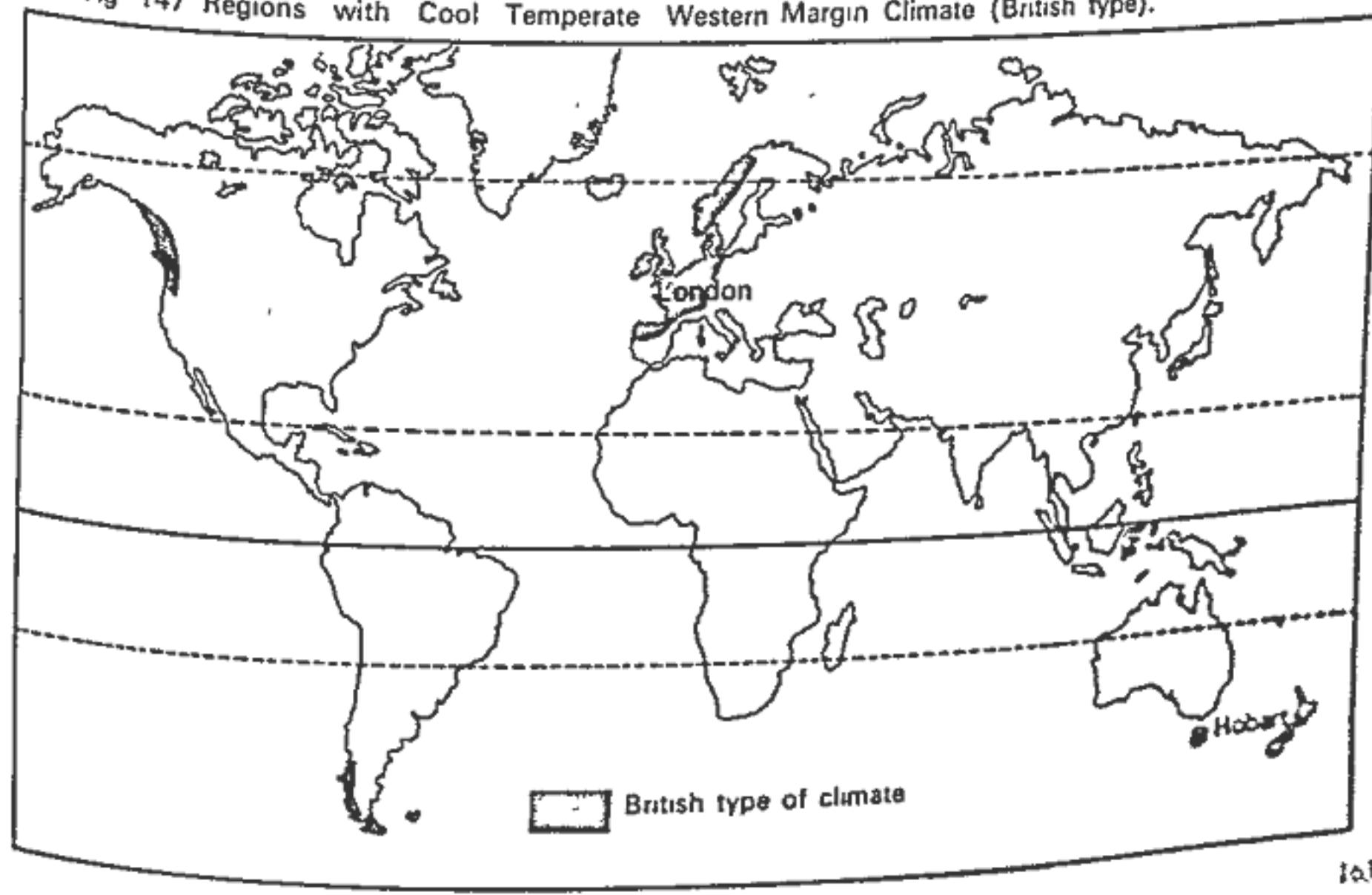


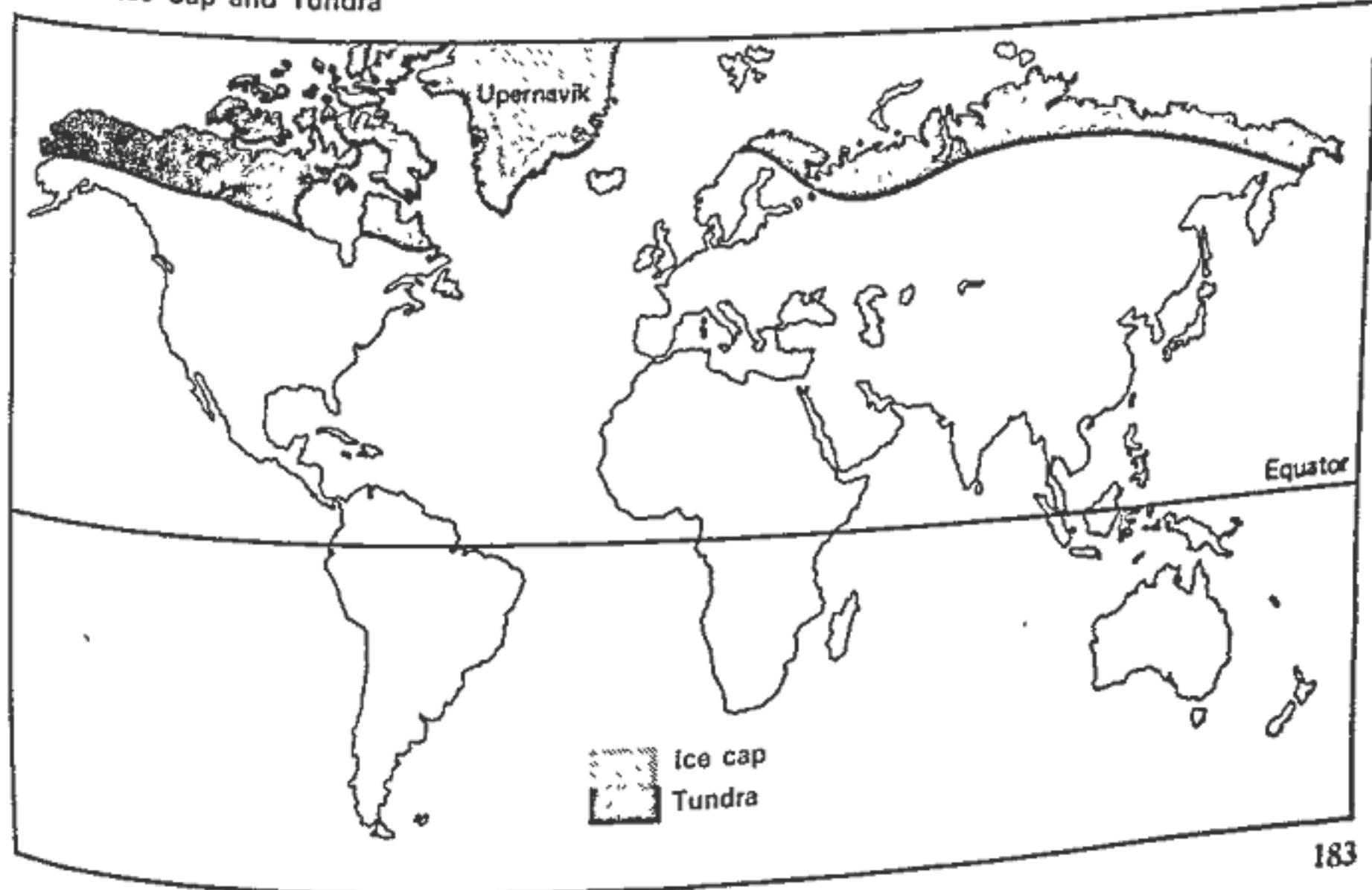
Fig. 150 The cool temperate coniferous forest

Fig 147 Regions with Cool Temperate Western Margin Climate (British type).



101

Fig 156 Ice Cap and Tundra



2017

How does the cryosphere affect global climate? (150 words)

10

2015

"Each day is more or less the same, the morning is clear and bright with a sea breeze; as the Sun climbs high in the sky, heat mounts up, dark clouds form, then rain comes with thunder and lightning. But rain is soon over.

"Which of the following regions is described in the above passage?

- (a) Savannah (b) Equatorial
- (c) Monsoon (d) Mediterranean

2014

The seasonal reversal of winds is the typical characteristic of
(a) Equatorial climate (b) Mediterranean climate
(c) Monsoon climate (d) All of the above climates

2013	<p>"Climate is extreme, rainfall is scanty and the people used to be nomadic herders."</p> <p>The above statement best describes which of the following regions?</p> <ul style="list-style-type: none">(a) African Savannah(b) Central Asian Steppe(c) North American Prairie(d) Siberian Tundra
------	---

2012

Which one of the following is the characteristic climate of the Tropical Savannah Region?

- (a) Rainfall throughout the year
- (b) Rainfall in winter only
- (c) An extremely short dry season
- (d) A definite dry and wet season

2011

If a tropical rain forest is removed, it does not regenerate quickly as compared to a tropical deciduous forest. This is because

- (a) the soil of rain forest is deficient in nutrients.
- (b) propagules of the trees in a rain forest have poor viability.
- (c) the rain forest species are slow growing.
- (d) exotic species invade the fertile soil of rain forest.

2011

What could be the main reason/reasons of the formation of African and Eurasian desert belt?

1. It is located in the sub-tropical high pressure cells.
2. It is under the influence of warm ocean currents.

Which of the statements given above is/are correct in this context?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

2010

A geographic area with an altitude of 400 metres has following characteristics:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Average maximum temp °C	31	31	31	31	30	30	29	28	29	29	30	31
Average minimum temp °C	21	21	21	21	21	21	20	20	20	20	20	20
Rainfall (mm)	51	85	188	158	139	121	134	168	185	221	198	86

If this geographic area were to have a natural forest, which one of the following would it most likely be?

- (a) Moist temperate coniferous forest
- (b) Montane subtropical forest
- (c) Temperate forest
- (d) Tropical rain forest

2010

A geographic region has the following distinct characteristics:

1. Warm and dry climate
2. Mild and wet winter
3. Evergreen oak trees

The above features are the distinct characteristics of Which one of the following regions?

- (a) Mediterranean
- (b) Eastern China
- (c) Central Asia
- (d) Atlantic coast of North America

Table 12.1 : Climatic Groups According to Koeppen

<i>Group</i>	<i>Characteristics</i>
A - Tropical	Average temperature of the coldest month is 18° C or higher
B - Dry Climates	Potential evaporation exceeds precipitation
C - Warm Temperate	The average temperature of the coldest month of the (Mid-latitude) climates years is higher than minus 3°C but below 18°C
D - Cold Snow Forest Climates	The average temperature of the coldest month is minus 3° C or below
E - Cold Climates	Average temperature for all months is below 10° C
H - High Land	Cold due to elevation

Table 12.2 : Climatic Types According to Koeppen

<i>Group</i>	<i>Type</i>	<i>Letter Code</i>	<i>Characteristics</i>
A-Tropical Humid Climate	Tropical wet	Af	No dry season
	Tropical monsoon	Am	Monsoonal, short dry season
	Tropical wet and dry	Aw	Winter dry season
B-Dry Climate	Subtropical steppe	BSh	Low-latitude semi arid or dry
	Subtropical desert	BWh	Low-latitude arid or dry
	Mid-latitude steppe	BSk	Mid-latitude semi arid or dry
	Mid-latitude desert	BWk	Mid-latitude arid or dry
C-Warm temperate (Mid-latitude) Climates	Humid subtropical	Cfa	No dry season, warm summer
	Mediterranean	Cs	Dry hot summer
	Marine west coast	Cfb	No dry season, warm and cool summer
D-Cold Snow-forest Climates	Humid continental	Df	No dry season, severe winter
	Subarctic	Dw	Winter dry and very severe
E-Cold Climates	Tundra	ET	No true summer
	Polar ice cap	EF	Perennial ice
H-Highland	Highland	H	Highland with snow cover

Questions??



- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

Oceanography

Ocean bottom topography

Ocean temperature

Salinity

Oceanic deposits

Coral reefs

Oceanic currents & circulations

El Nino and related phenomena

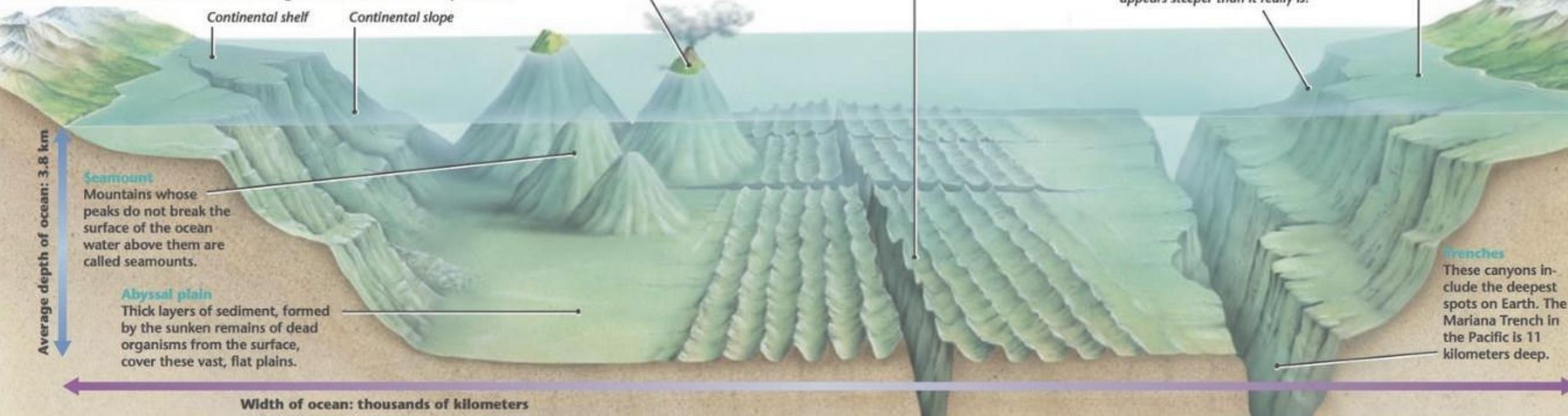
Tides



<https://www.youtube.com/watch?v=UwVNkfCov1k>

EXPLORING the Ocean Floor

Earth's oceans are thousands of kilometers wide. To show the width of the ocean floor in this illustration, the vertical and horizontal scales are not the same. The vertical scale, showing depth, has been stretched. The horizontal scale, showing distances, has been squeezed.



Volcanic Island

When volcanoes on the ocean floor erupt, they can create mountains so high that their peaks break the surface of the ocean. As the lava cools and hardens, an island forms.

Continental slope

A steady incline marks the continental slope. Continental slopes in the Pacific Ocean are steeper than those in the Atlantic Ocean. Note: Because the vertical scale is exaggerated, the continental slope in this illustration appears steeper than it really is.

Continental shelf

This gradually sloping area borders each continent. Its width varies from just a few kilometers to as much as 1,300 kilometers from shore.

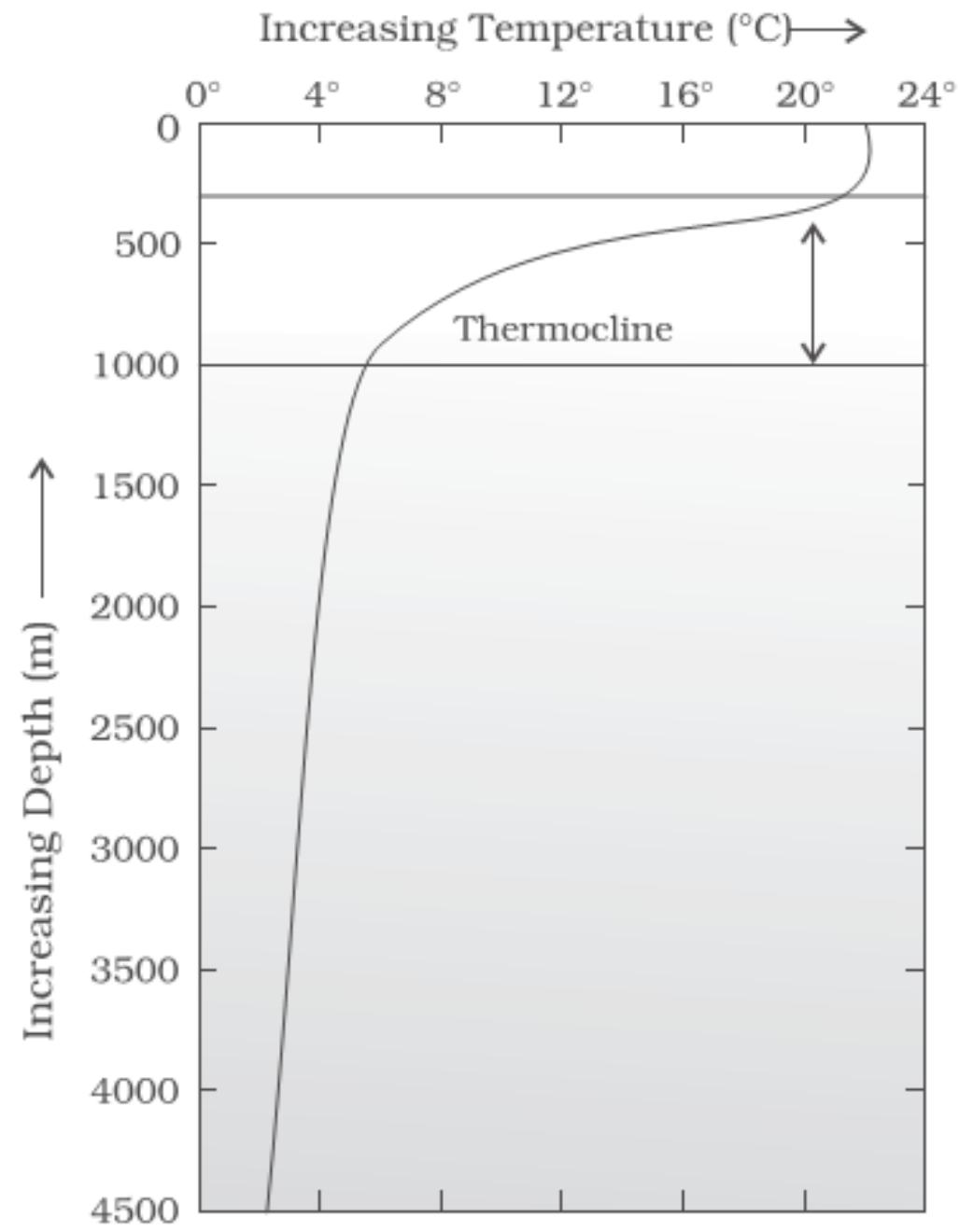


Figure 13.3 : Thermocline

**Table 13.4 : Dissolved Salts in Sea Water
(gm of Salt per kg of Water)**

Chlorine	18.97
Sodium	10.47
Sulphate	2.65
Magnesium	1.28
Calcium	0.41
Potassium	0.38
Bicarbonate	0.14
Bromine	0.06
Borate	0.02
Strontium	0.01

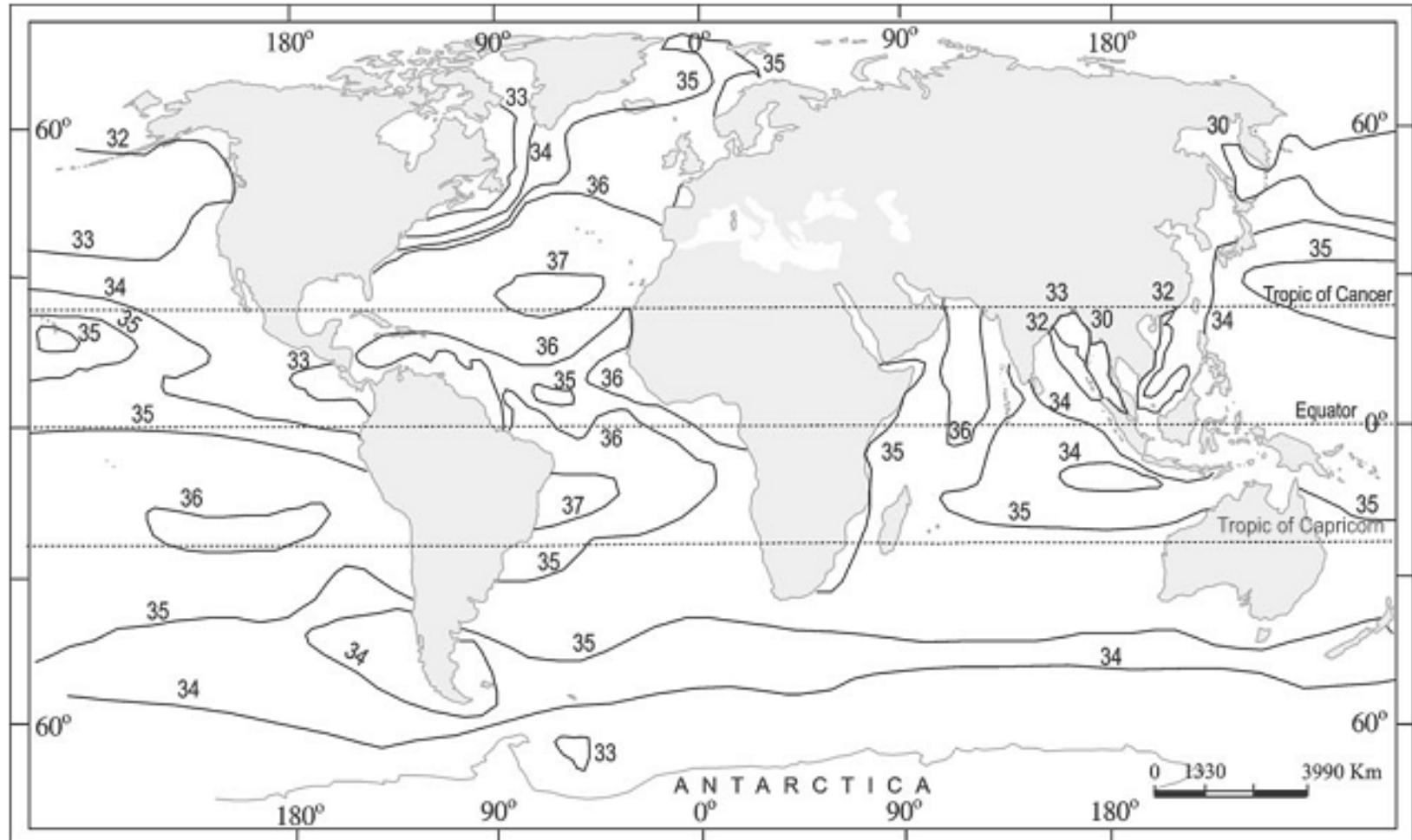


Figure 13.5 : Surface salinity of the World's Oceans



Types of coral reefs

- **Fringing reef**- directly attached to a shore or borders it with an intervening shallow channel or lagoon

Eg: [Greater Caribbean region](#)



- **Barrier reef**- separated from a mainland or island shores by deep channel or lagoon Eg: [Great Barrier Reef](#)

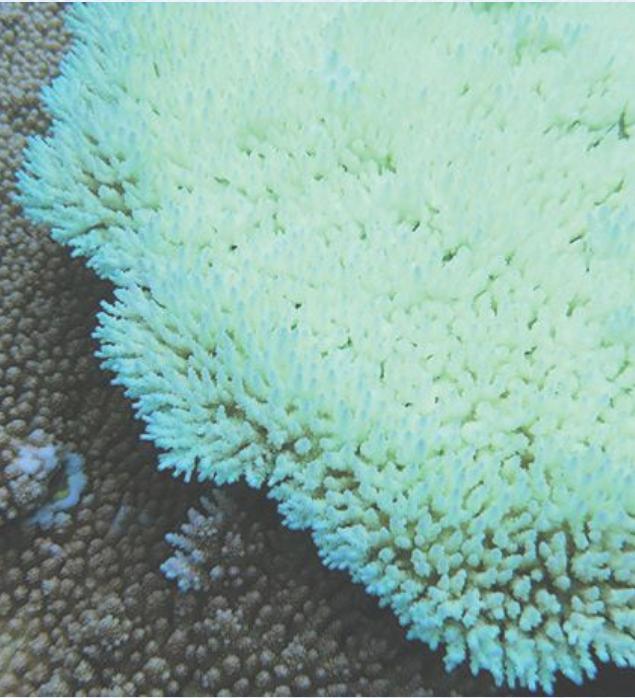


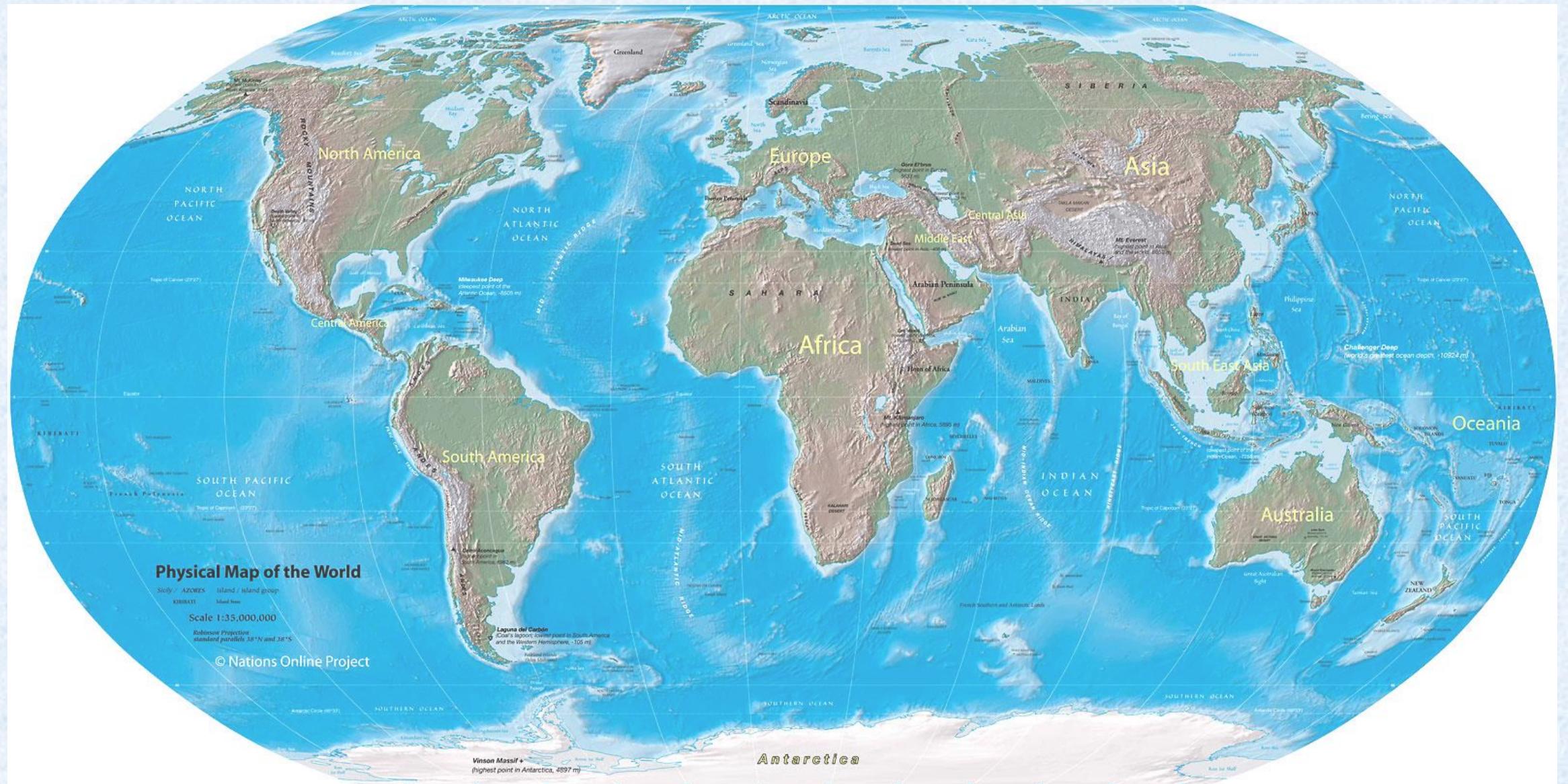
- **Atoll reef**- more or less circular or continuous barrier reefs extends all the way around a lagoon without a central island Eg: [The Pacific Ocean](#)

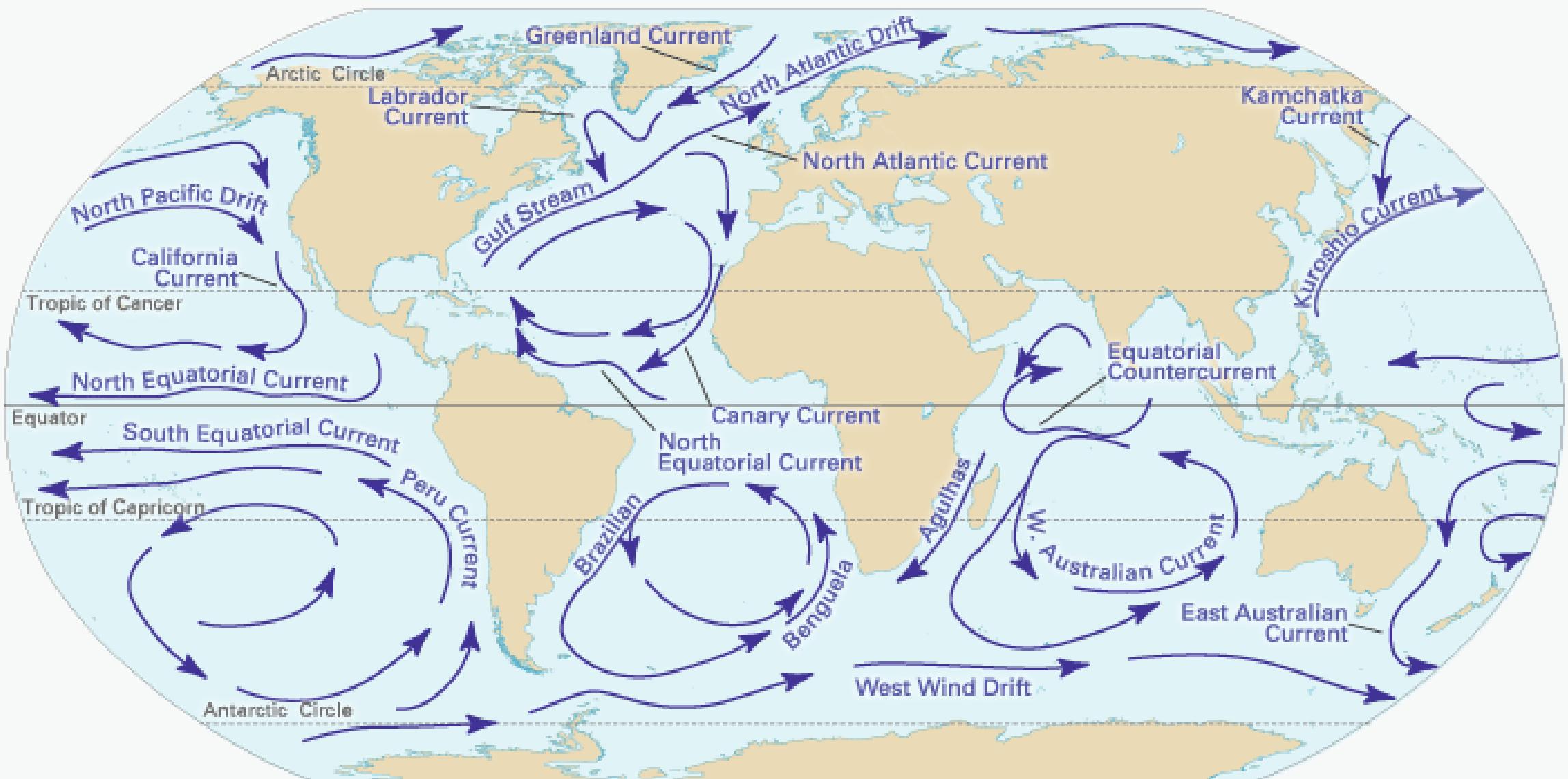




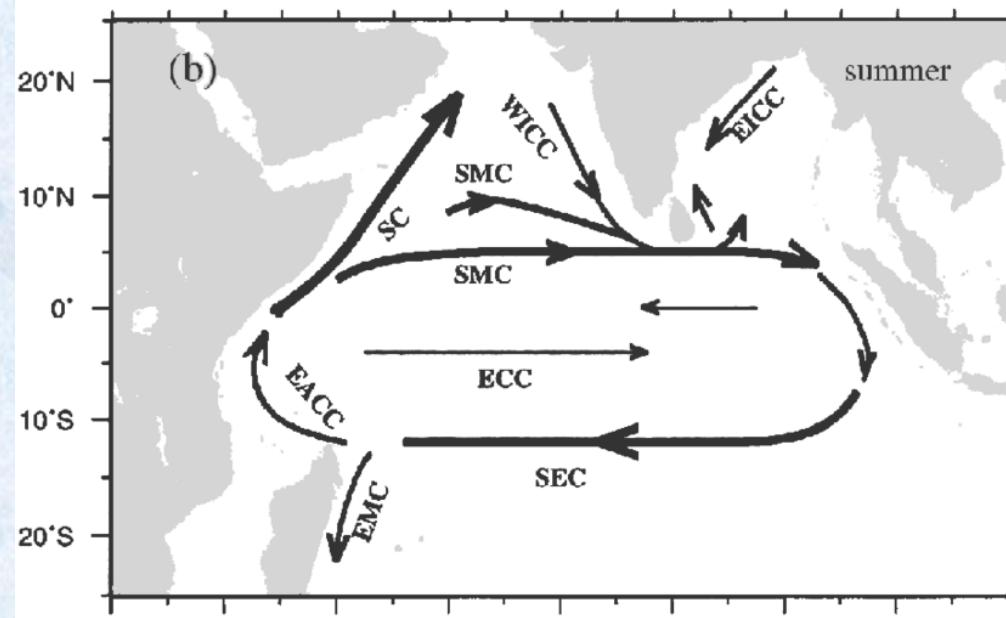
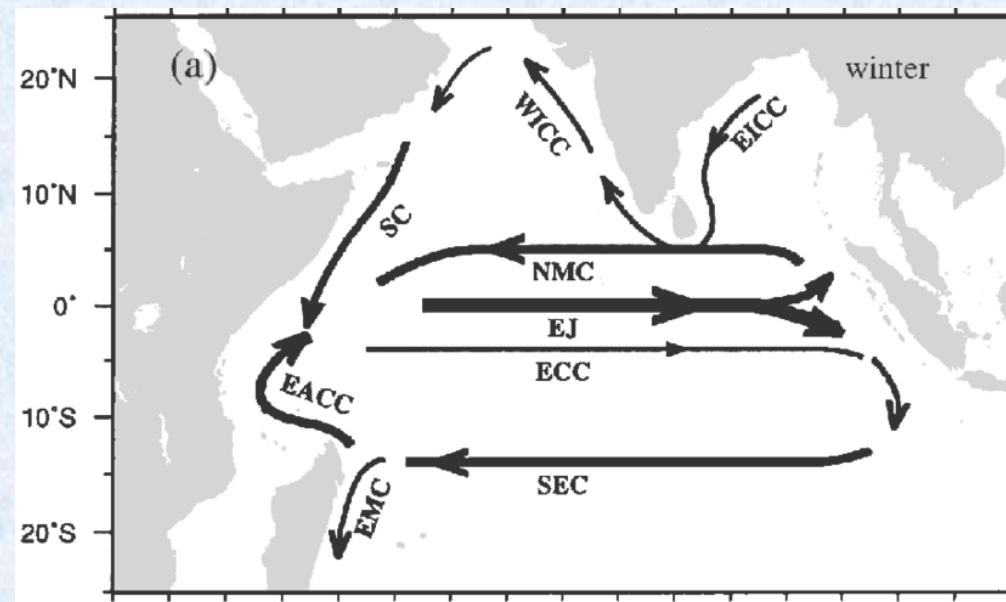
<https://www.youtube.com/watch?v=ZiULxLLP32s>







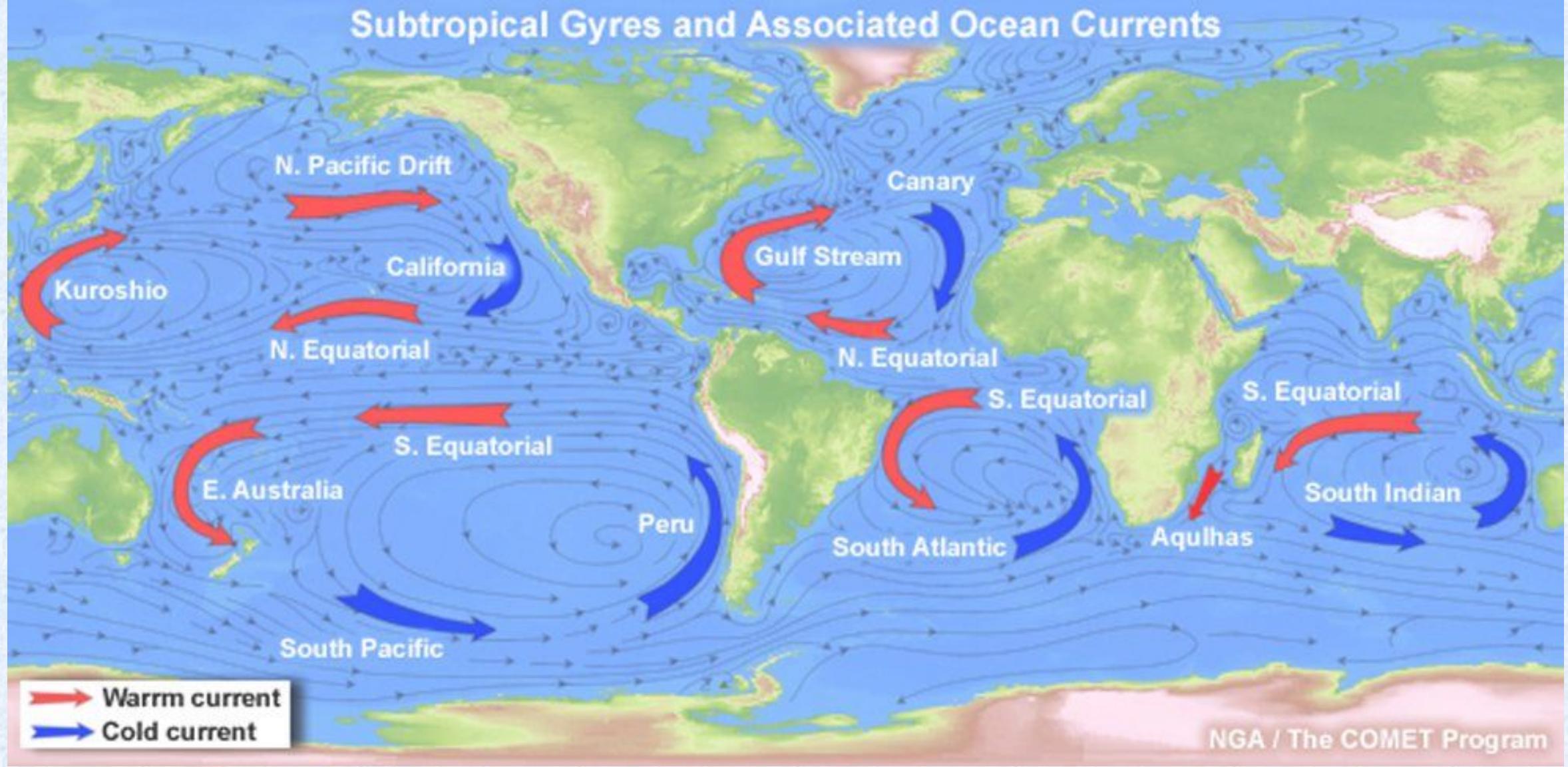
© 2007 Encyclopædia Britannica, Inc. <https://www.youtube.com/watch?v=p4pWafuvdrY&t=191s>

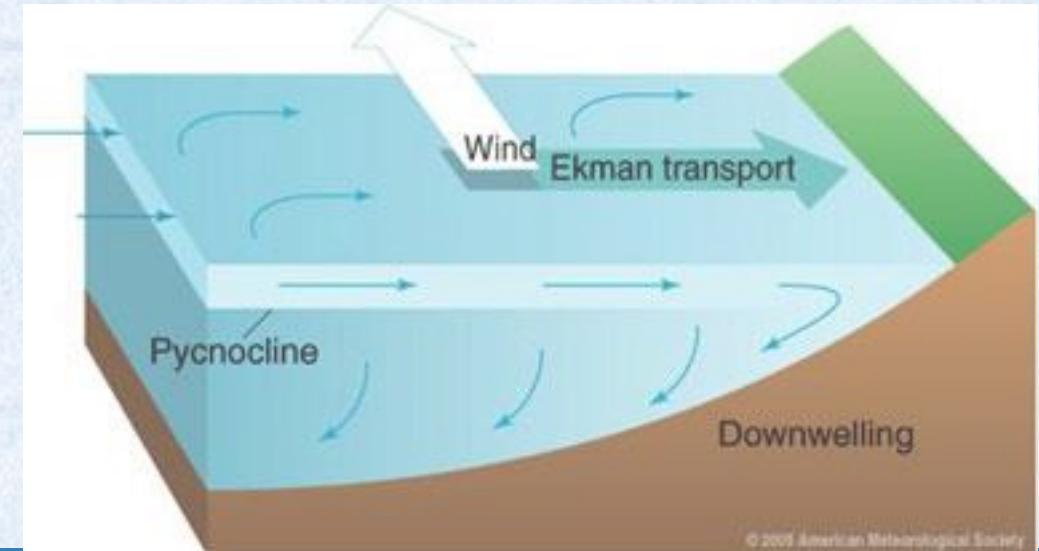
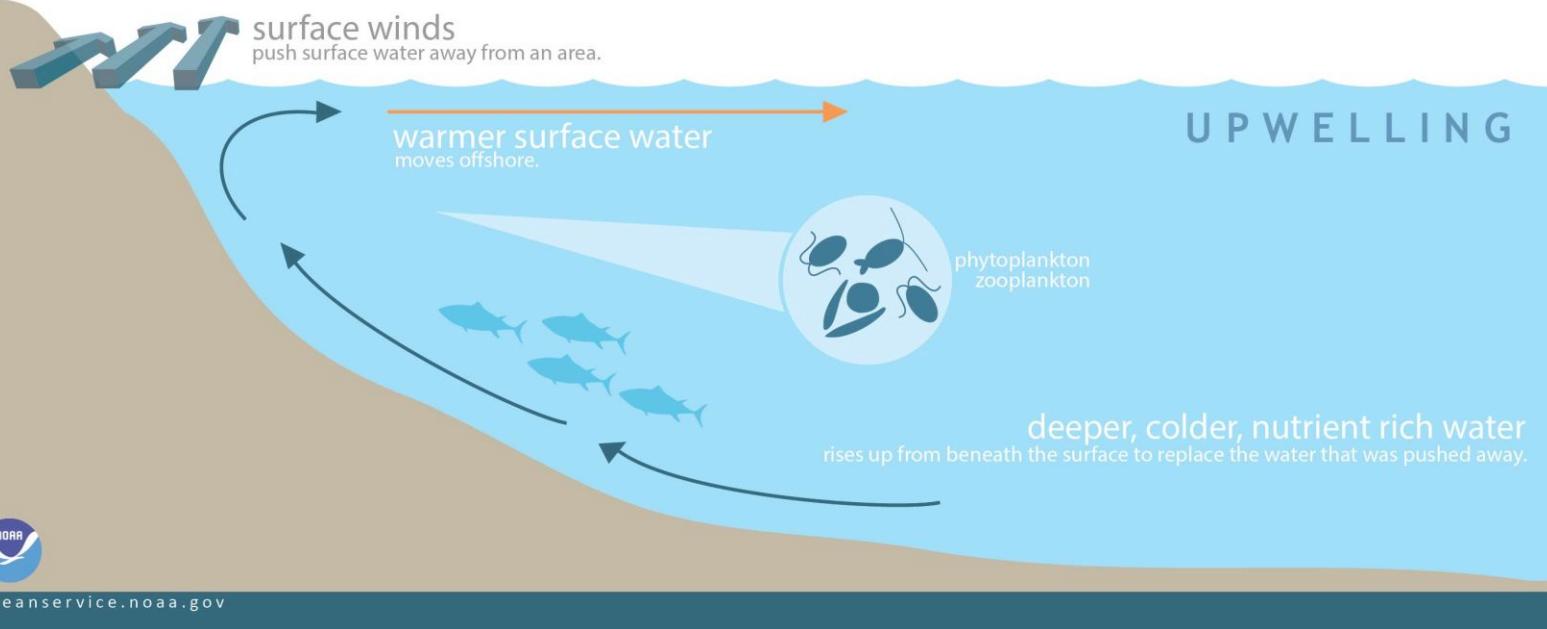


<https://www.youtube.com/watch?v=KhB9zLIN6BQ>

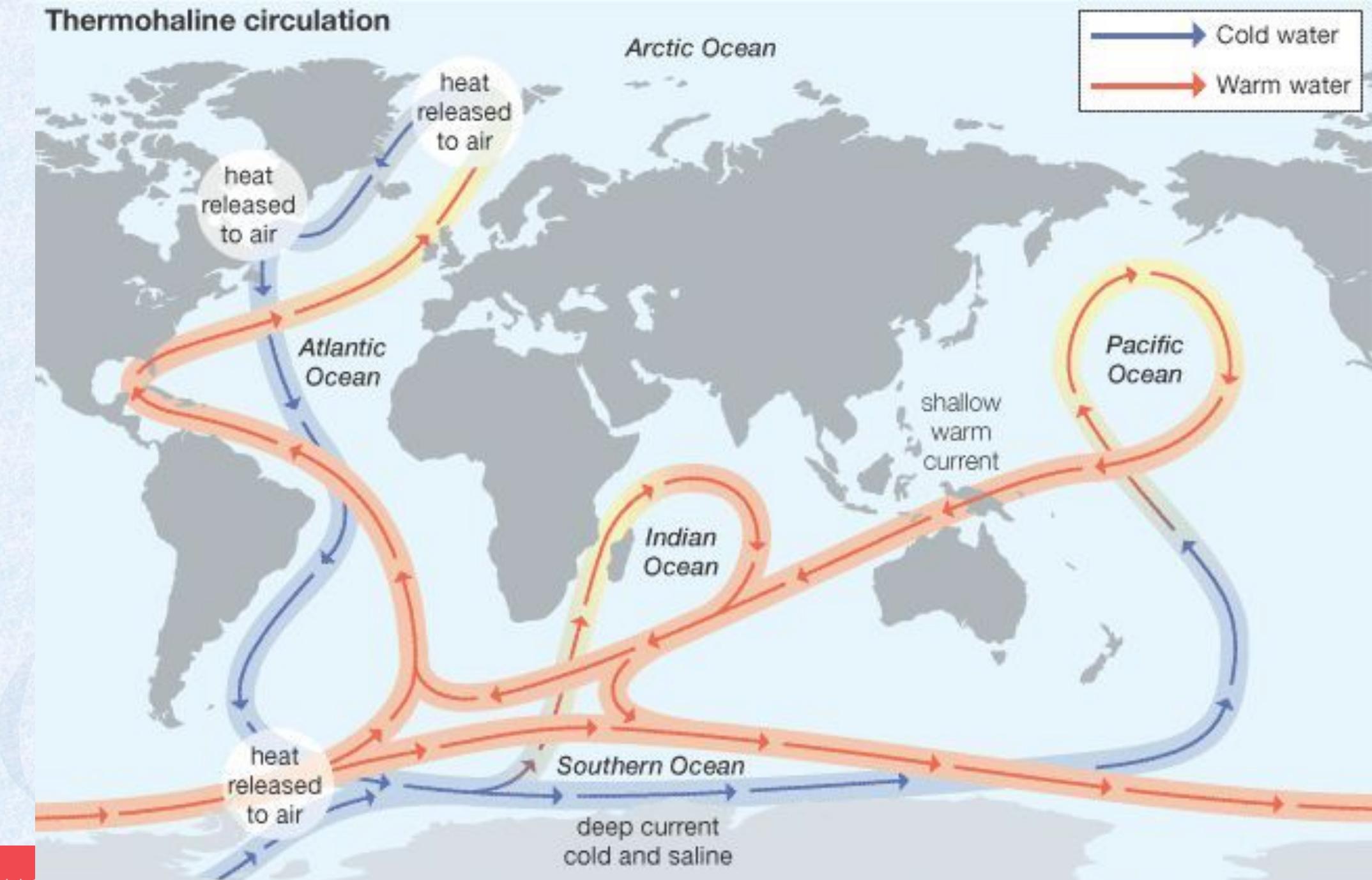
<https://earth.nullschool.net>

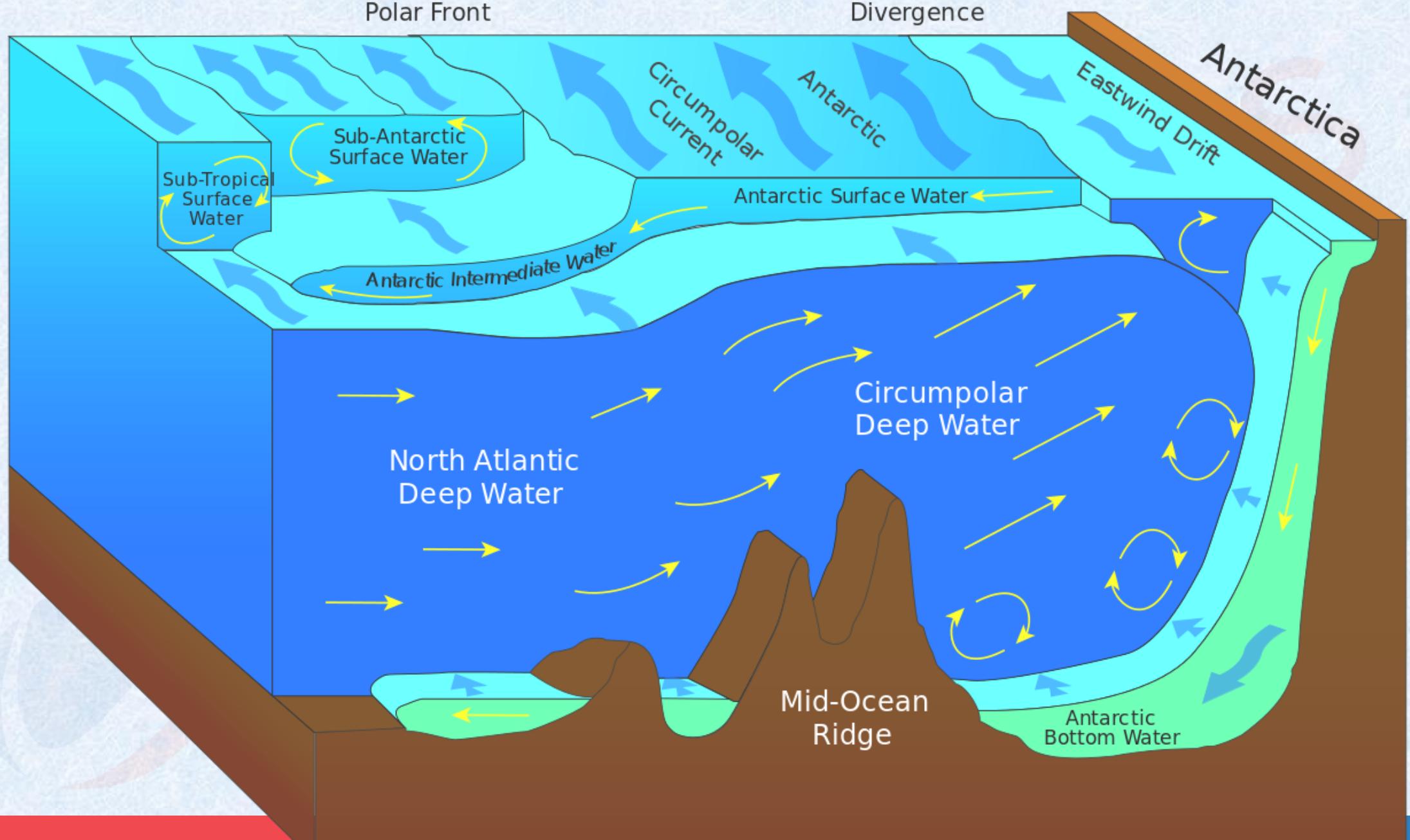
Subtropical Gyres and Associated Ocean Currents





Thermohaline circulation





2015

Explain the factors responsible for the origin of ocean currents. How do they influence regional climates, fishing and navigation?

12.5

2011

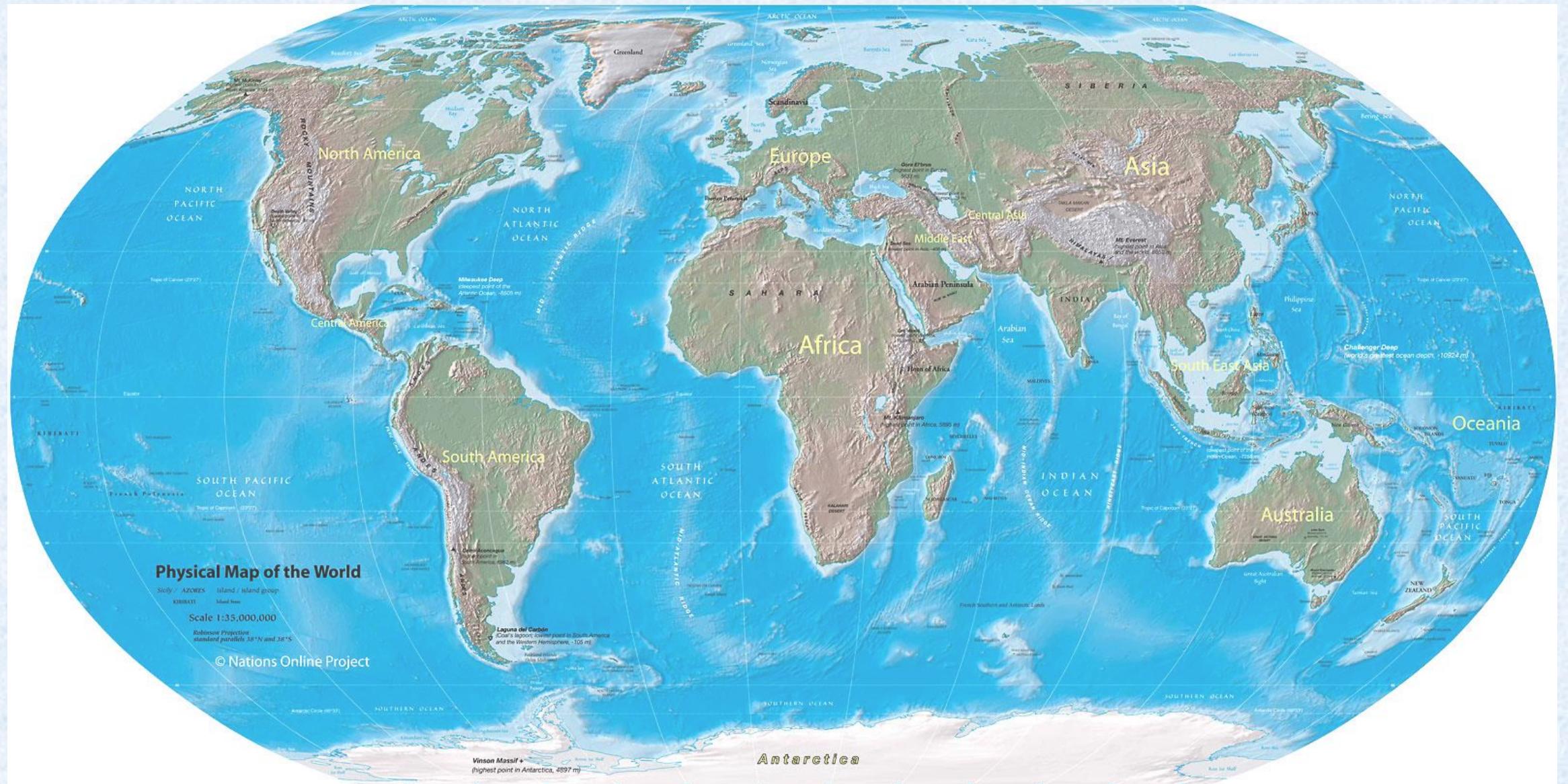
In the context of ecosystem productivity, marine upwelling zones are important as they increase the marine productivity by bringing the

1. Decomposer microorganism to the surface.
2. Nutrients to the surface.
3. Bottom-dwelling organisms to the surface.

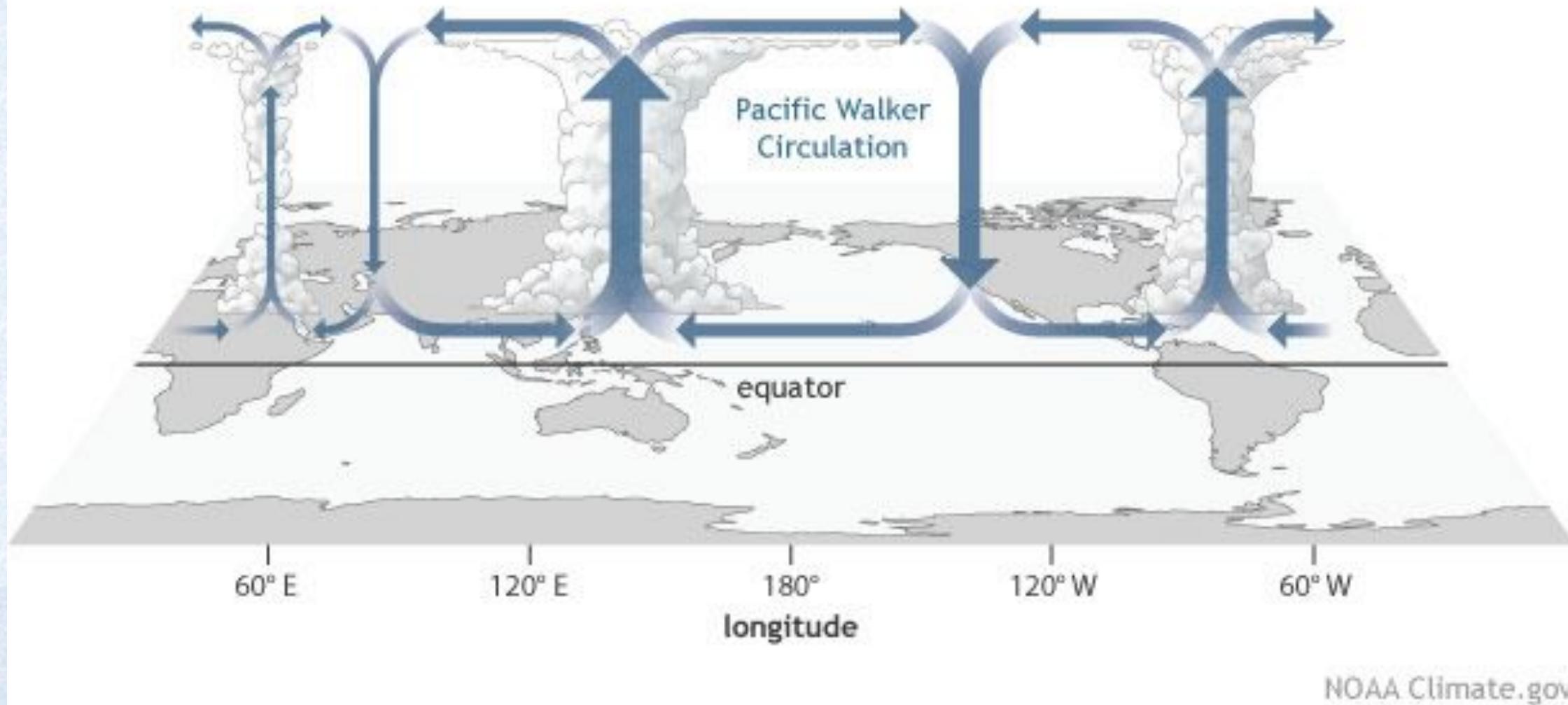
Which of the statements given above is/are correct?

(a) 1 and 2 (b) 2 only
(c) 2 and 3 (d) 3 only

2012	<p>Consider the following factors:</p> <ol style="list-style-type: none">1. Rotation of the Earth2. Air pressure and wind3. Density of ocean water4. Revolution of the Earth <p>Which of the above factors influence the ocean currents?</p> <p>(a) 1 and 2 only (b) 1, 2 and 3 (c) 1 and 4 (d) 2, 3 and 4</p>
2015	<p>What explains the eastward flow of the equatorial counter-current?</p> <p>(a) The Earth's rotation on its axis (b) Convergence of the two equatorial currents (c) Difference in salinity of water (d) Occurrence of the belt of calm near the equator</p>

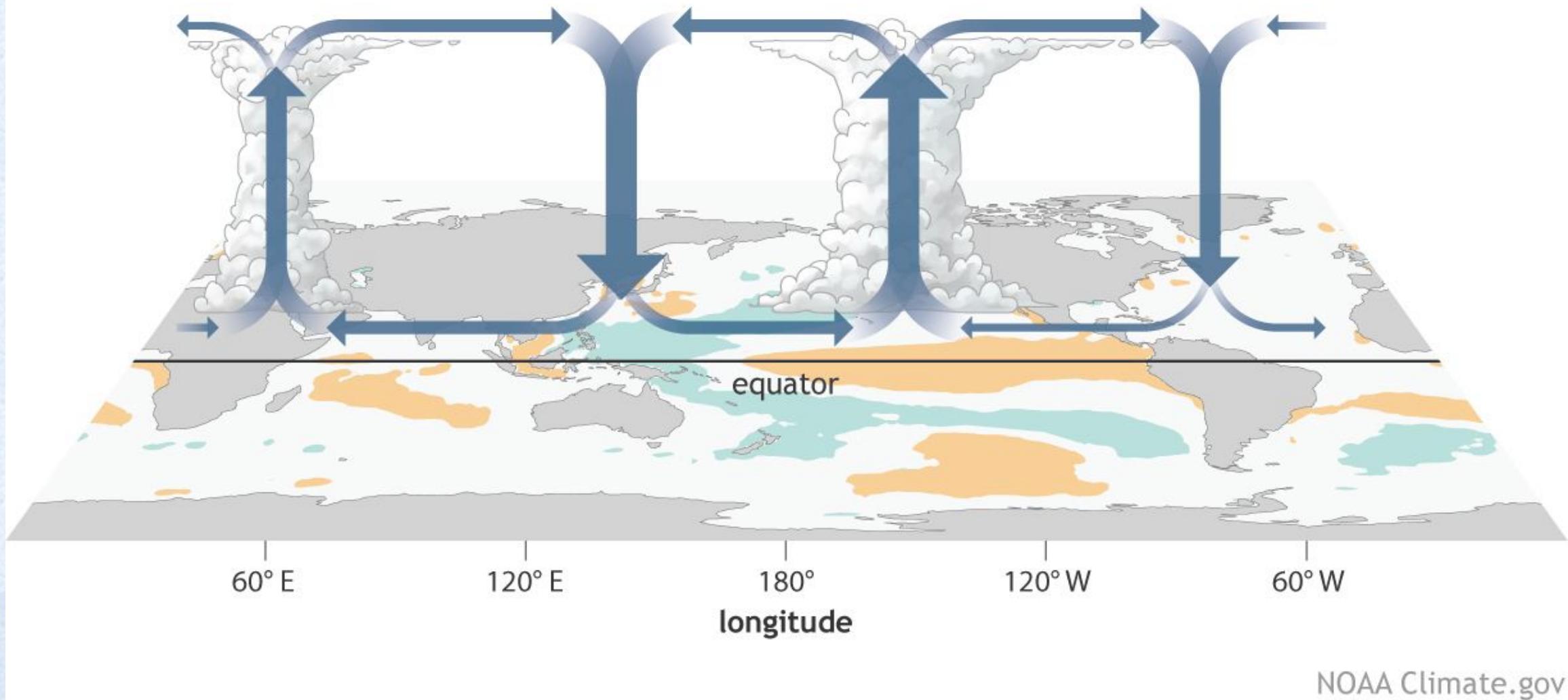


Neutral conditions



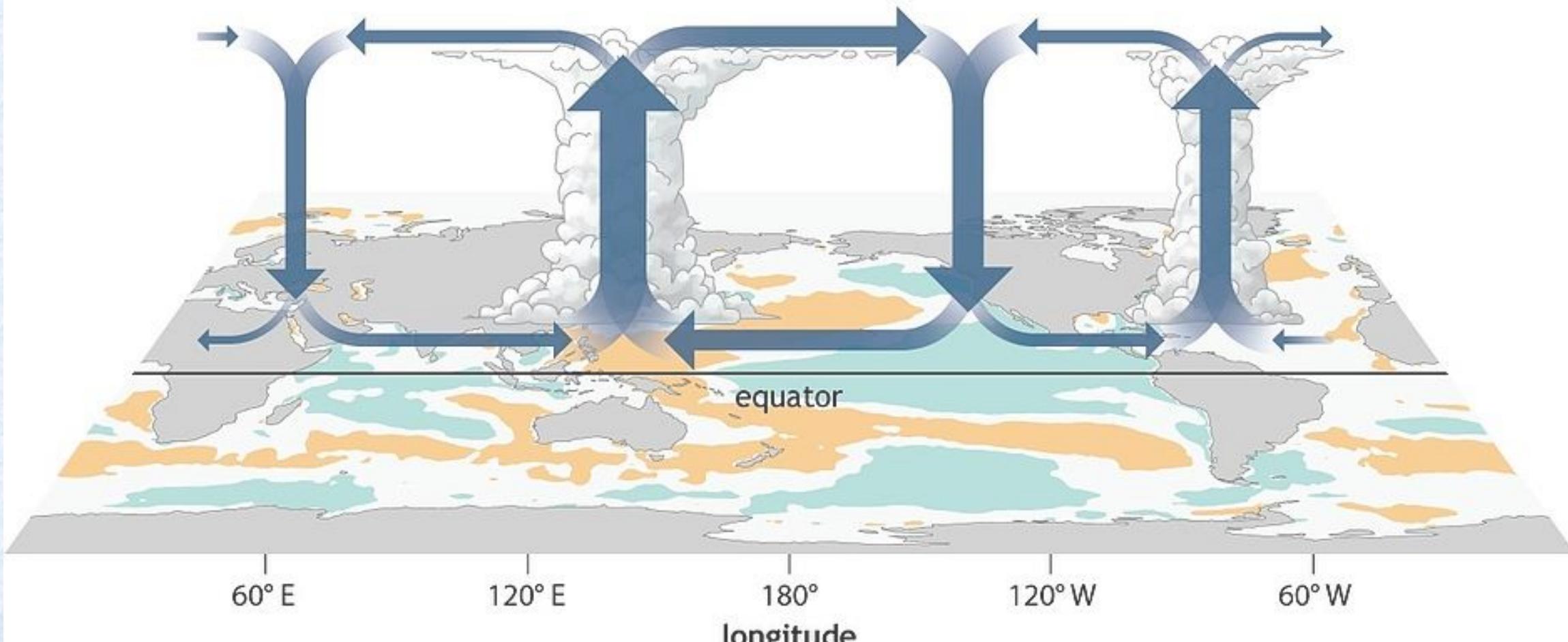
NOAA Climate.gov

El Niño conditions



NOAA Climate.gov

La Niña conditions



NOAA Climate.gov

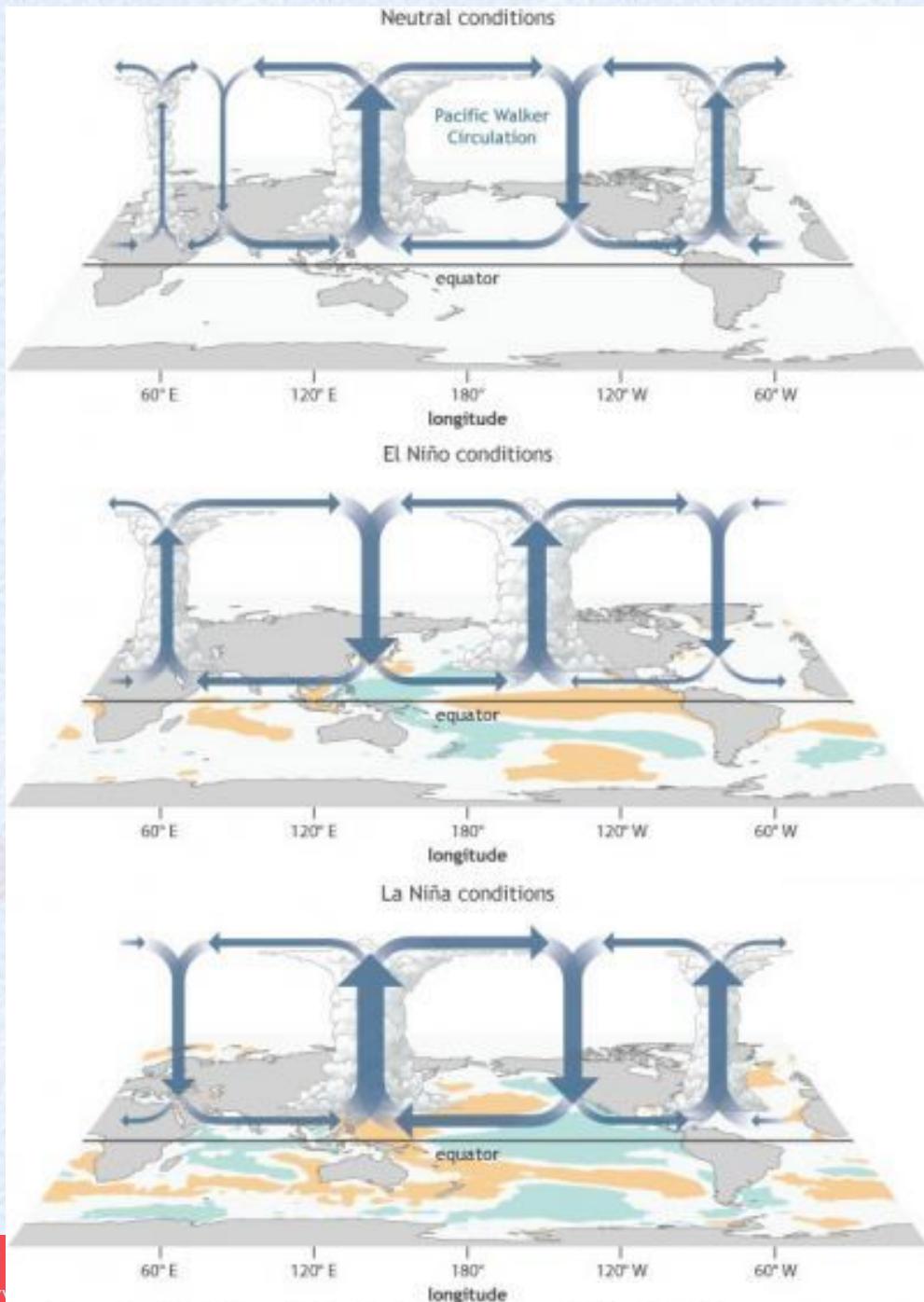


Figure 1: Global Atmospheric Circulation Patterns - Walker Circulation

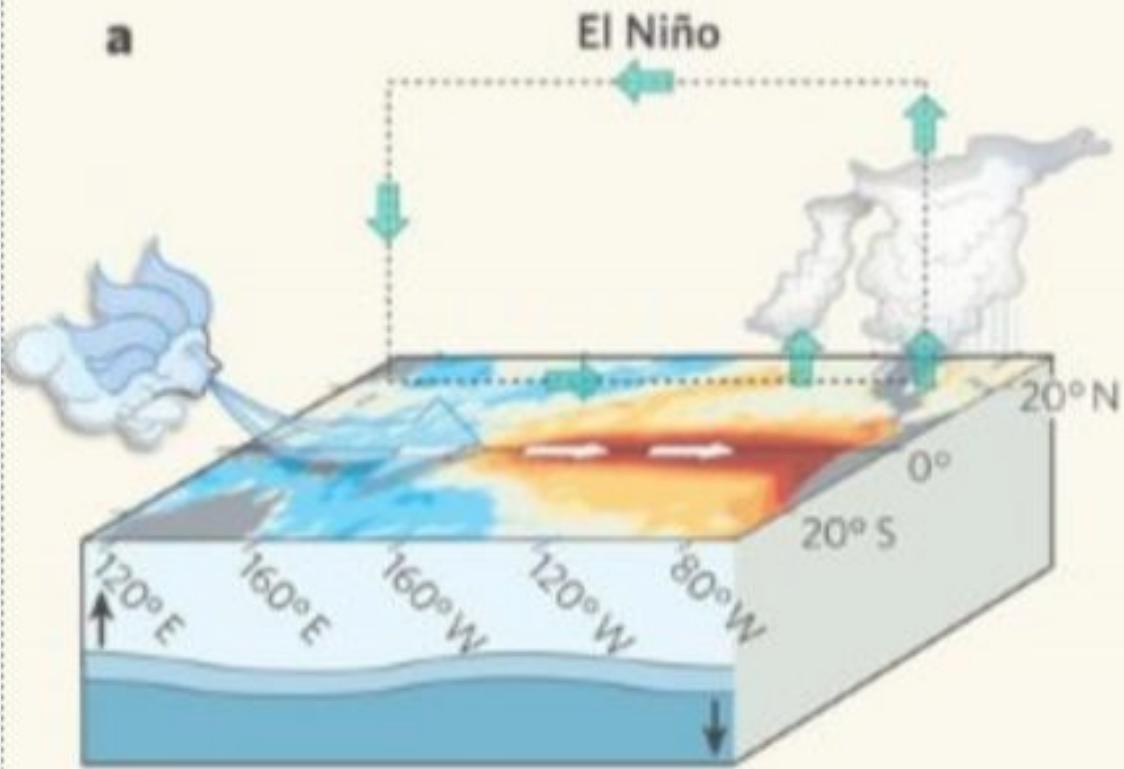
NOAA Climate.gov

https://www.youtube.com/watch?v=tyPq86yM_lc

<https://www.youtube.com/watch?v=d6s0T0m3F8s>

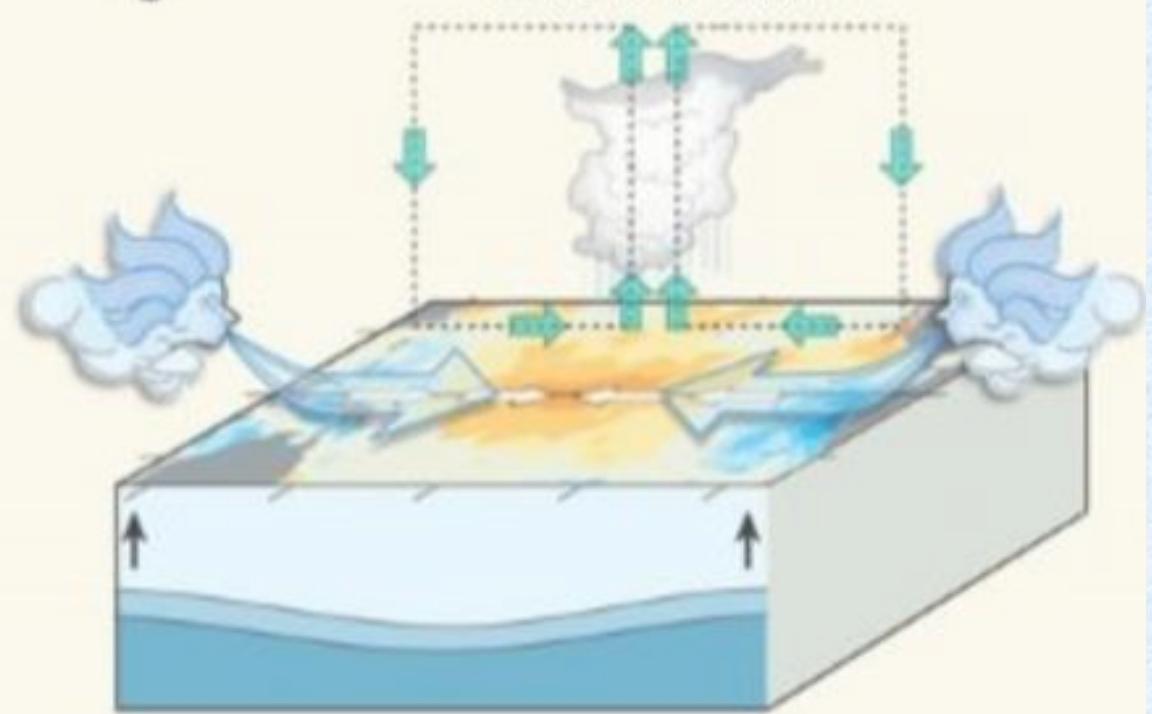
a

El Niño

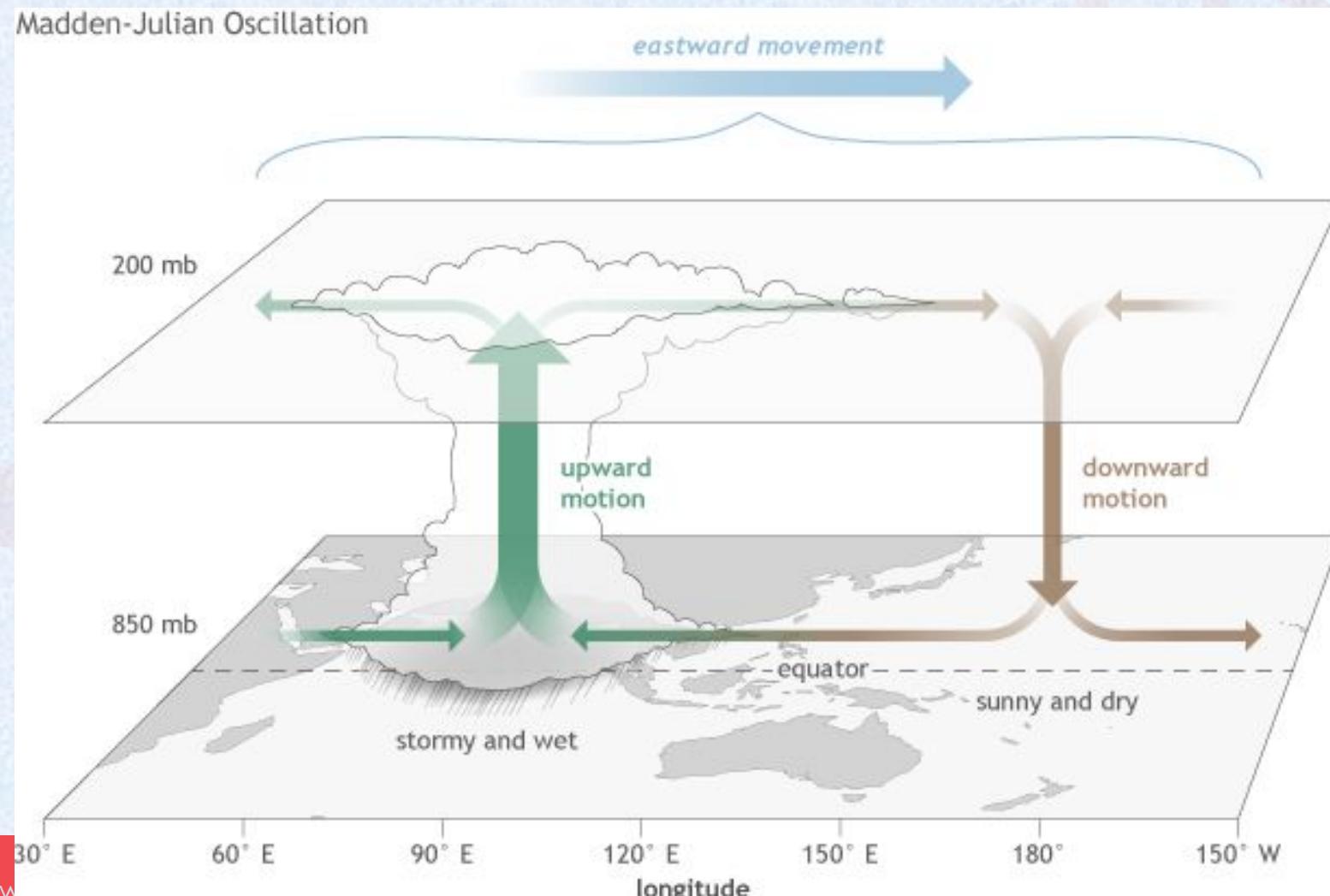


b

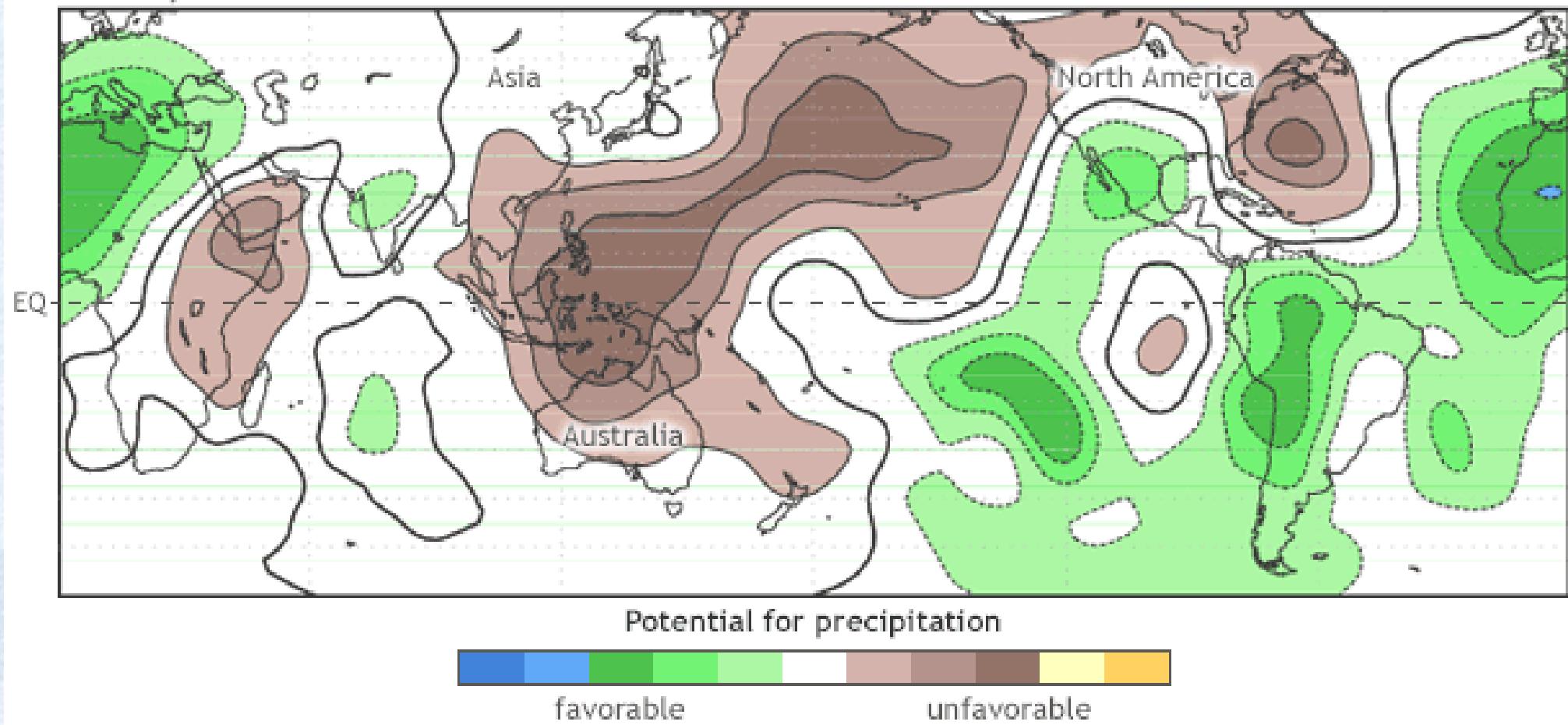
El Niño Modoki



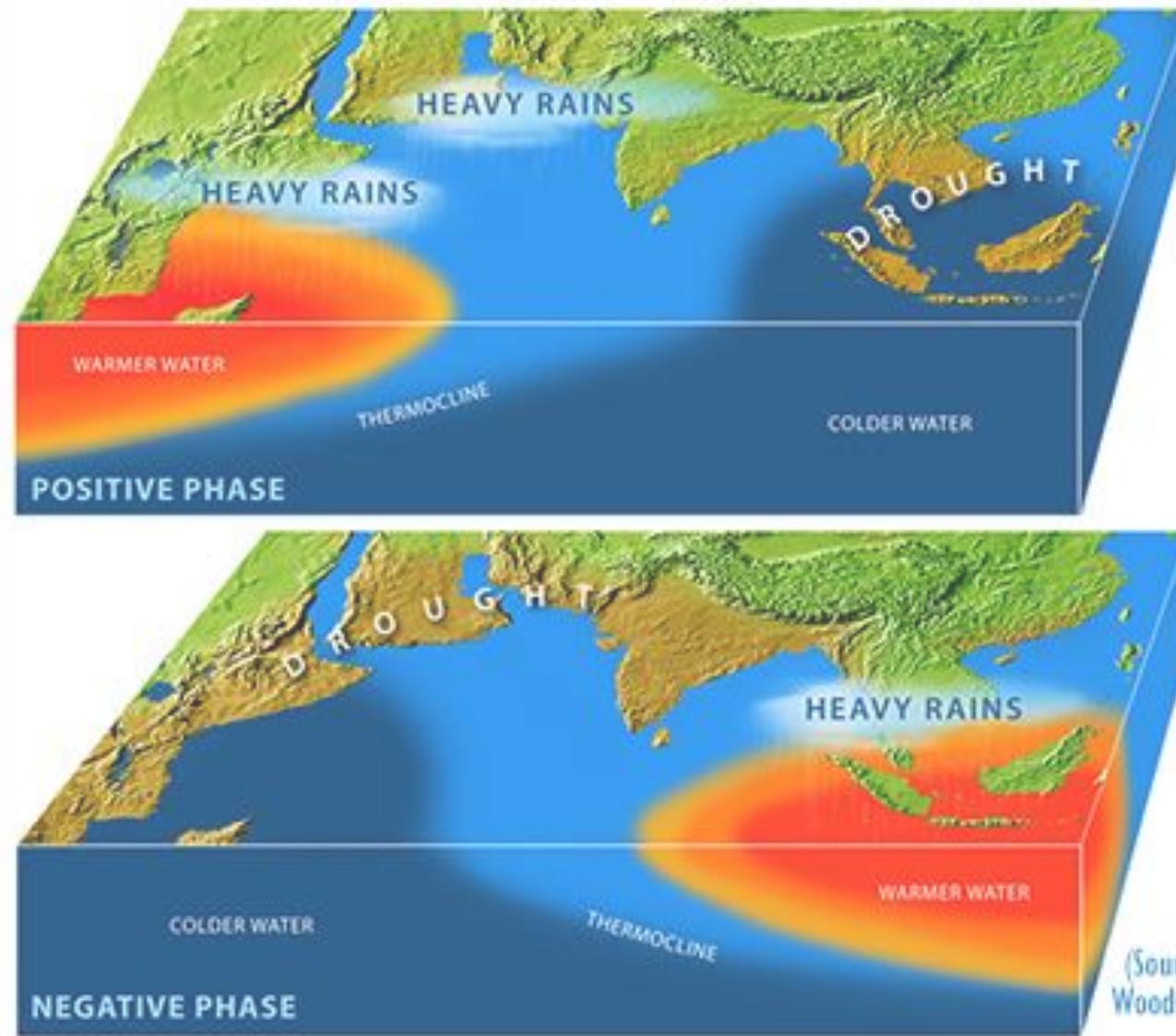
eastward moving disturbance of clouds, rainfall, winds, and pressure that traverses the planet in the tropics and returns to its initial starting point in 30 to 60 days, on average



Feb 22, 2005



Indian Ocean Dipole



(Source: Paul Oberlander,
Woods Hole Oceanographic Institution)

2014

Most of the unusual climatic happenings are explained as an outcome of the El-Nino effect. Do you agree?

10

2010

A new type of El Nino called El Nino Modoki appeared in the news. In this context, consider the following statements:

1. Normal El Nino forms in the Central Pacific ocean whereas El Nino Modoki forms in Eastern Pacific ocean.

2. Normal El Nino results in diminished hurricanes in the Atlantic ocean but El Nino Modoki results in a greater number of hurricanes with greater frequency.

Which of the statements given above is/are correct ?.

- (a) 1 only (b) 2 only
- (c) Both 1 and 2 (d) Neither 1 nor 2

2011

La Nina is suspected to have caused recent floods in Australia. How is La Nina different from El Nino?

1. La Nina is characterised by unusually cold ocean temperature in equatorial Indian Ocean whereas El Nino is characterised by unusually warm ocean temperature in the equatorial Pacific Ocean.
2. El Nino has adverse effect on south-west monsoon of India, but La Nina has no effect on monsoon climate.

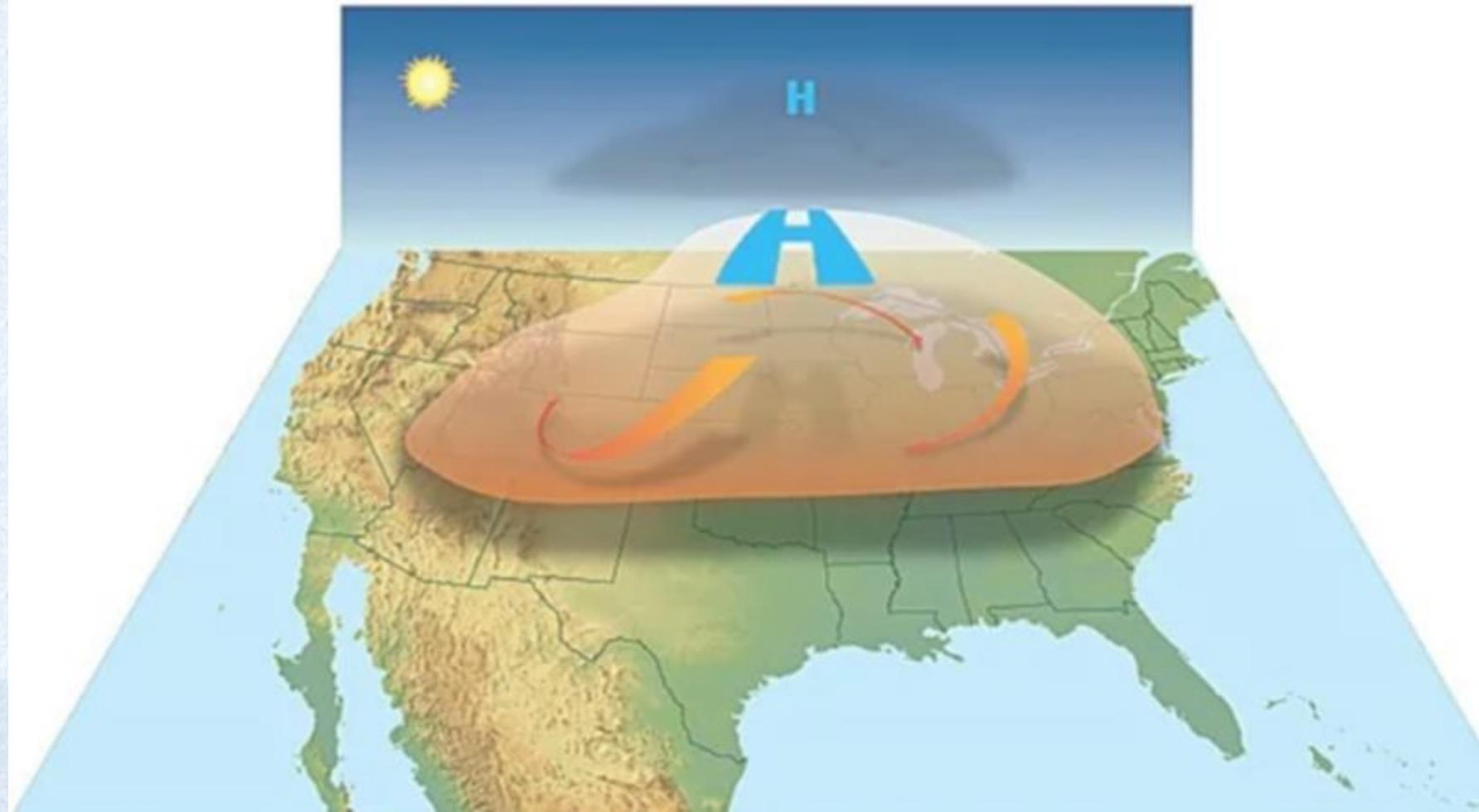
Which of the statements given above is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

2017

With reference to “Indian Ocean Dipole (IOD)” sometimes mentioned in the news while forecasting Indian monsoon, which of the following statements is/are correct?

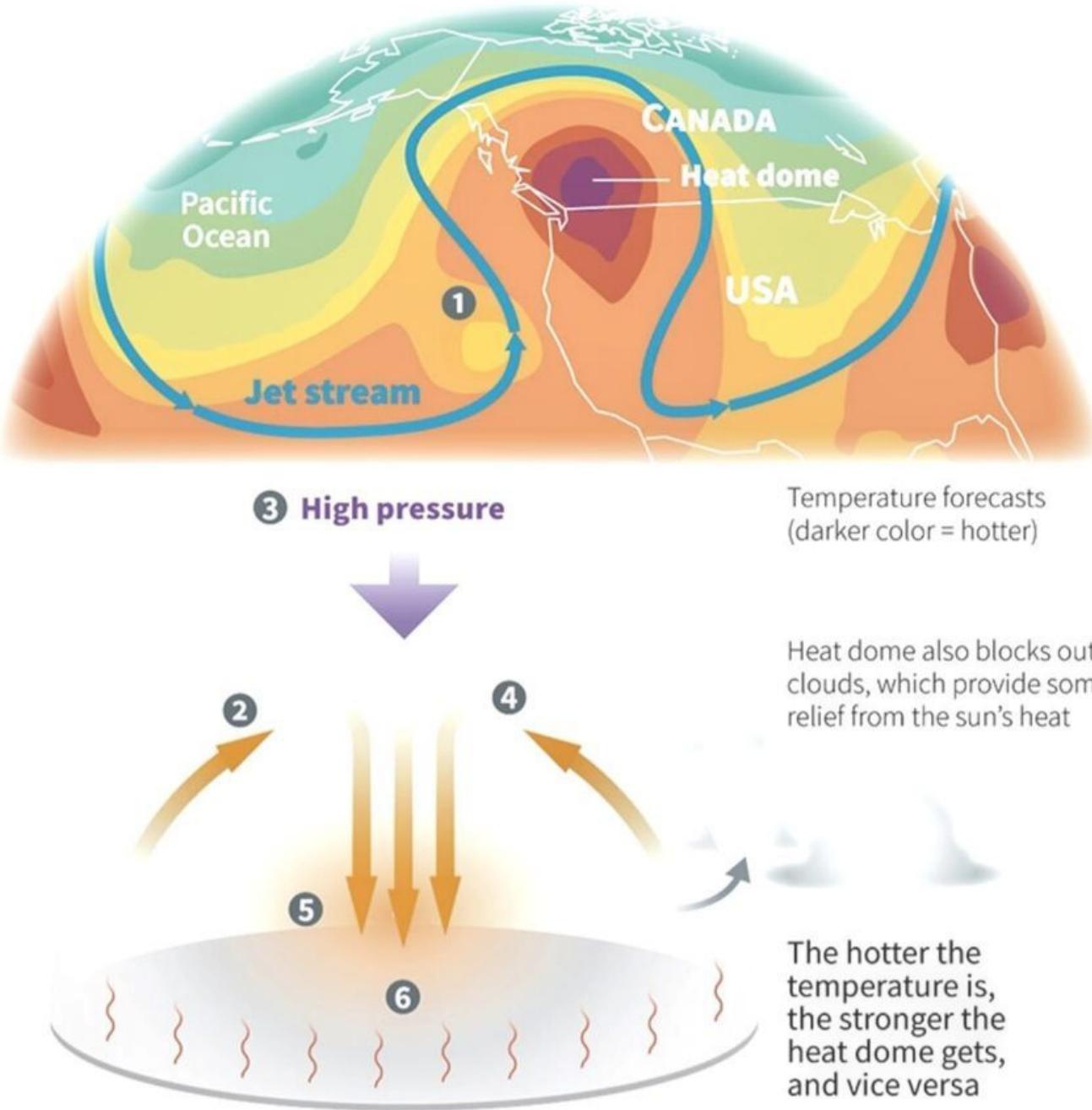
1. IOD phenomenon is characterised by a difference in sea surface temperature between tropical Western Indian Ocean and tropical Eastern Pacific Ocean.
2. An IOD phenomenon can influence an El Nino’s impact on the monsoon. Select the correct answer using the code given below:
(a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2



The ‘heat dome’

Occurs when the atmosphere traps hot ocean air like a lid or cap

- 1 In summer, the **jet stream** (which moves the air) shifts northward
- 2 **Hot** and stagnant **air expands** upwards
- 3 Strong and **high-pressure** atmospheric conditions combine with influences from La Niña act like a dome or cap
- 4 In a process known as **convection**, hot air attempts to escape but high pressure pushes it back down
- 5 Under the dome, the air sinks and **compresses**, releasing more heat
- 6 As winds move the hot air east, the jet stream traps the air where it sinks, resulting in **heat waves**



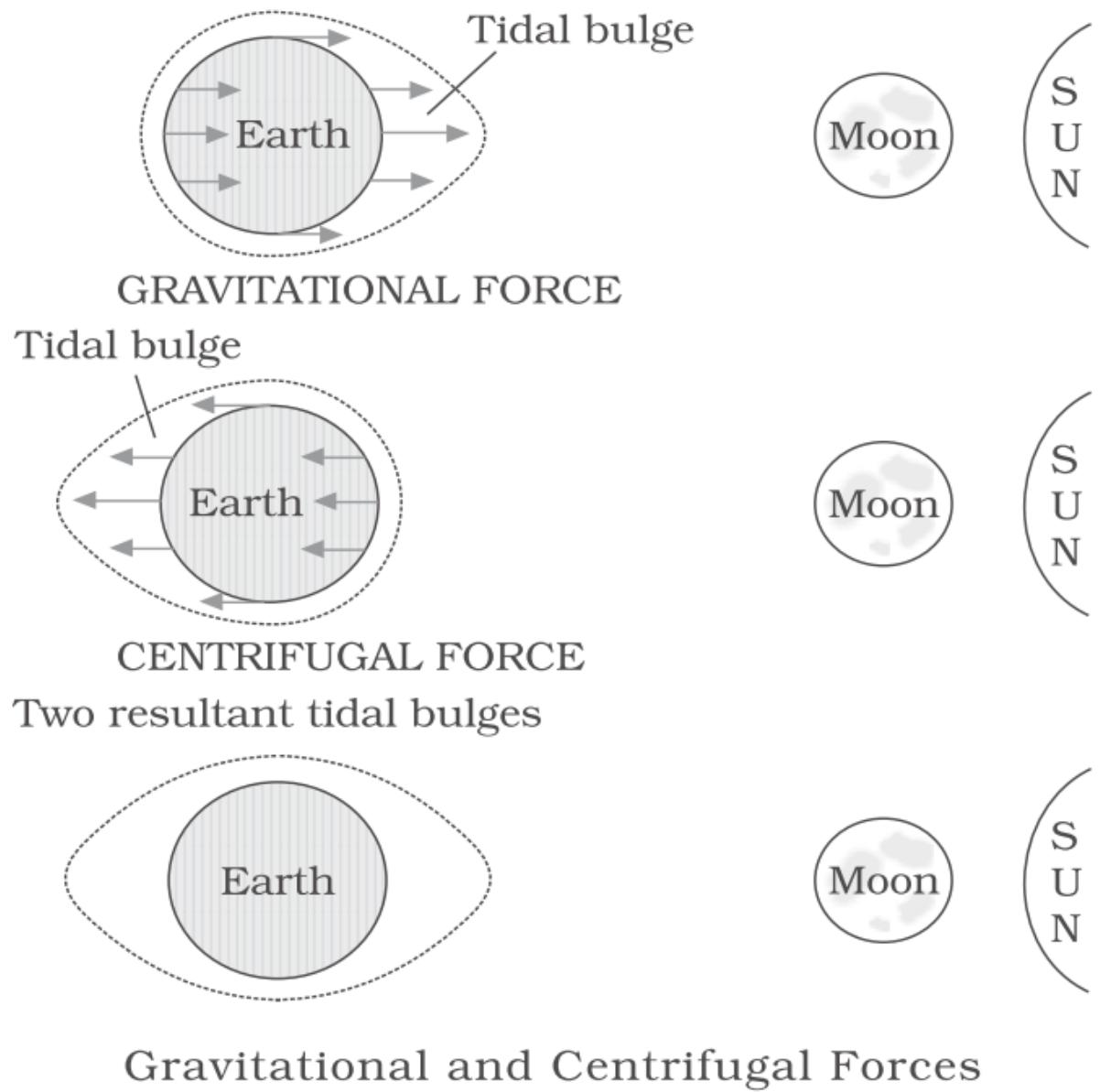
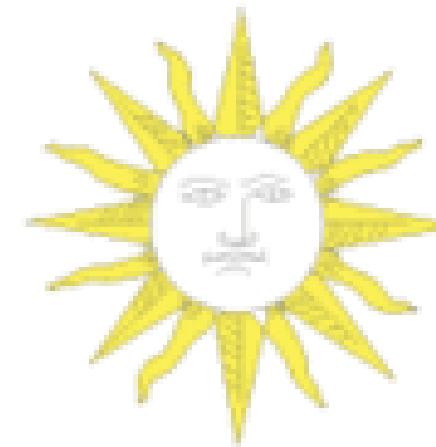
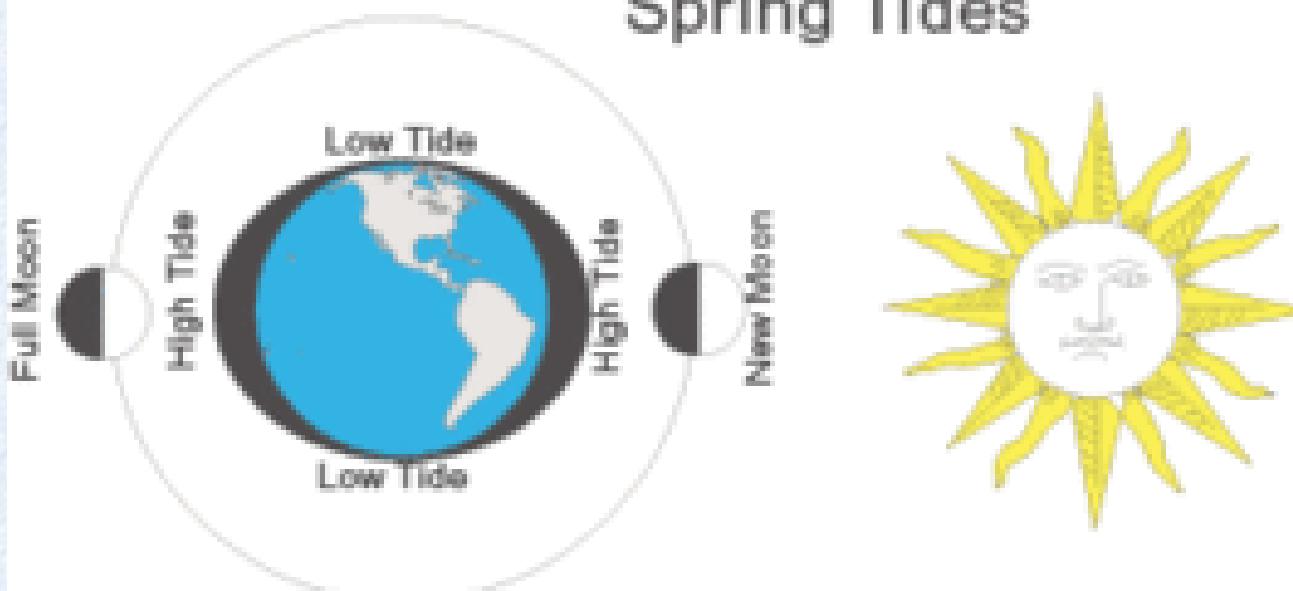
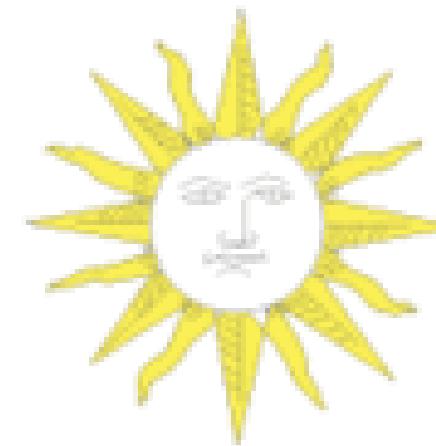


Figure 14.2 : Relation between gravitational forces and tides

Spring Tides



Neap Tides



<https://www.youtube.com/watch?v=NqDEaFjIXPw>

<https://www.youtube.com/watch?v=8bSXuxjlACU>

<https://www.youtube.com/watch?v=glbw2MsxGQ>

2015

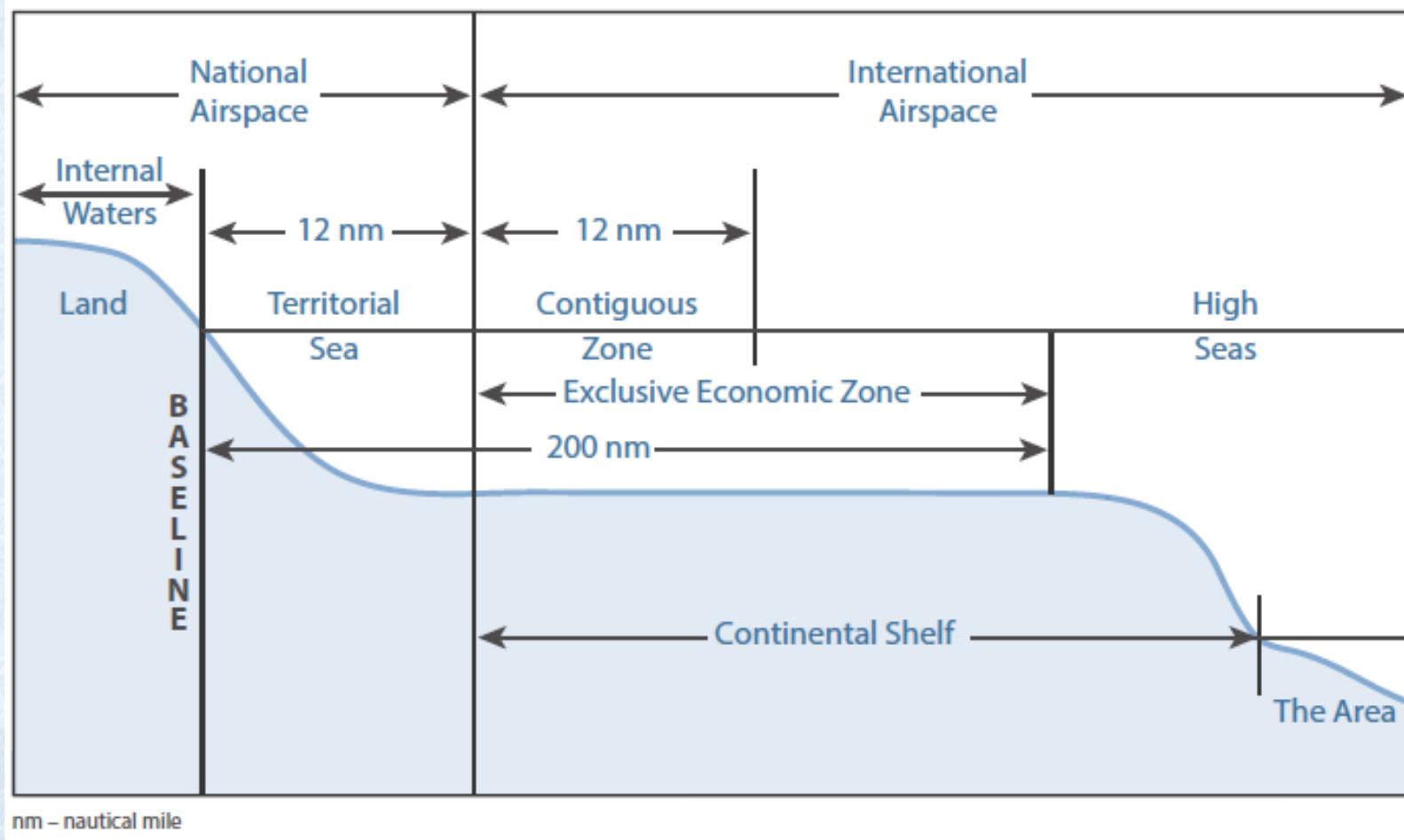
Tides occur in the oceans and seas due to which among the following?

1. Gravitational force of the Sun
2. Gravitational force of the Moon
3. Centrifugal force of the Earth

Select the correct answer using the code given below.

- (a) 1 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

Legal Boundaries of the Oceans and Airspace





Questions??



- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

Biogeography

Terms related to soil

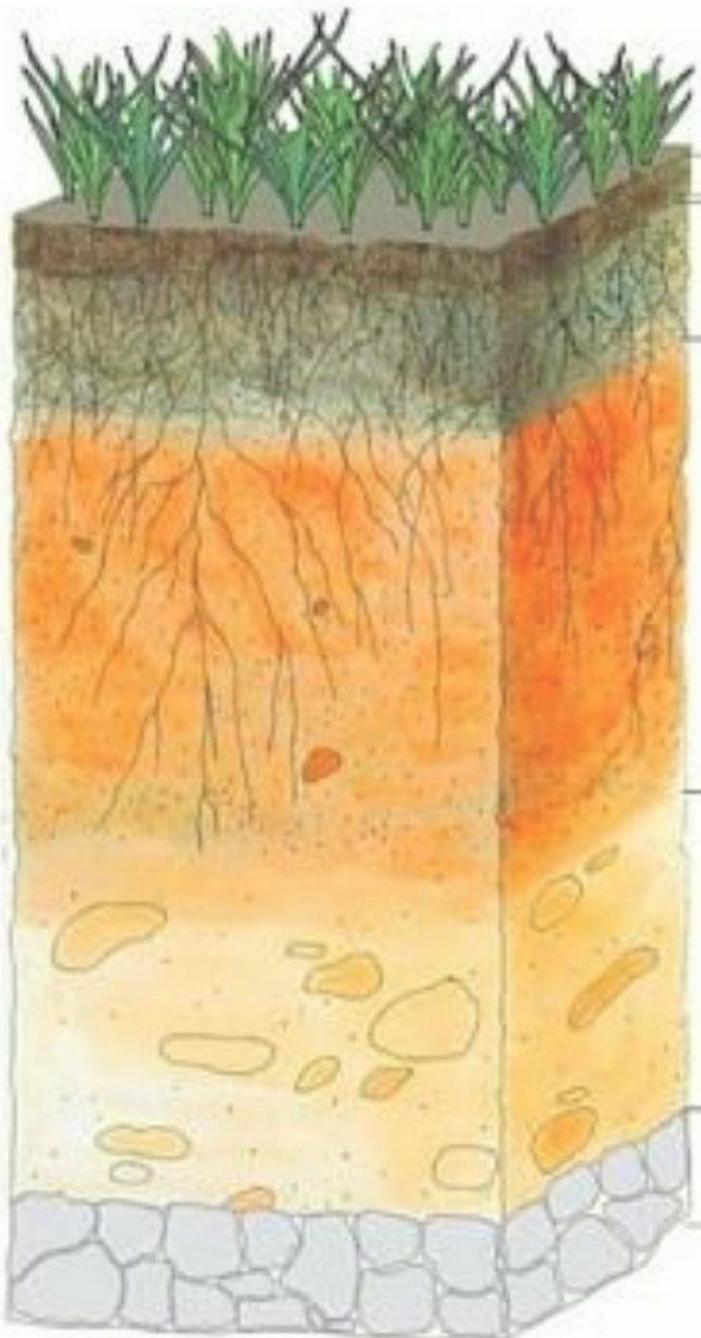
Soil profile

Soil Genesis – Factors affecting

Soil formation processes

Types of soil





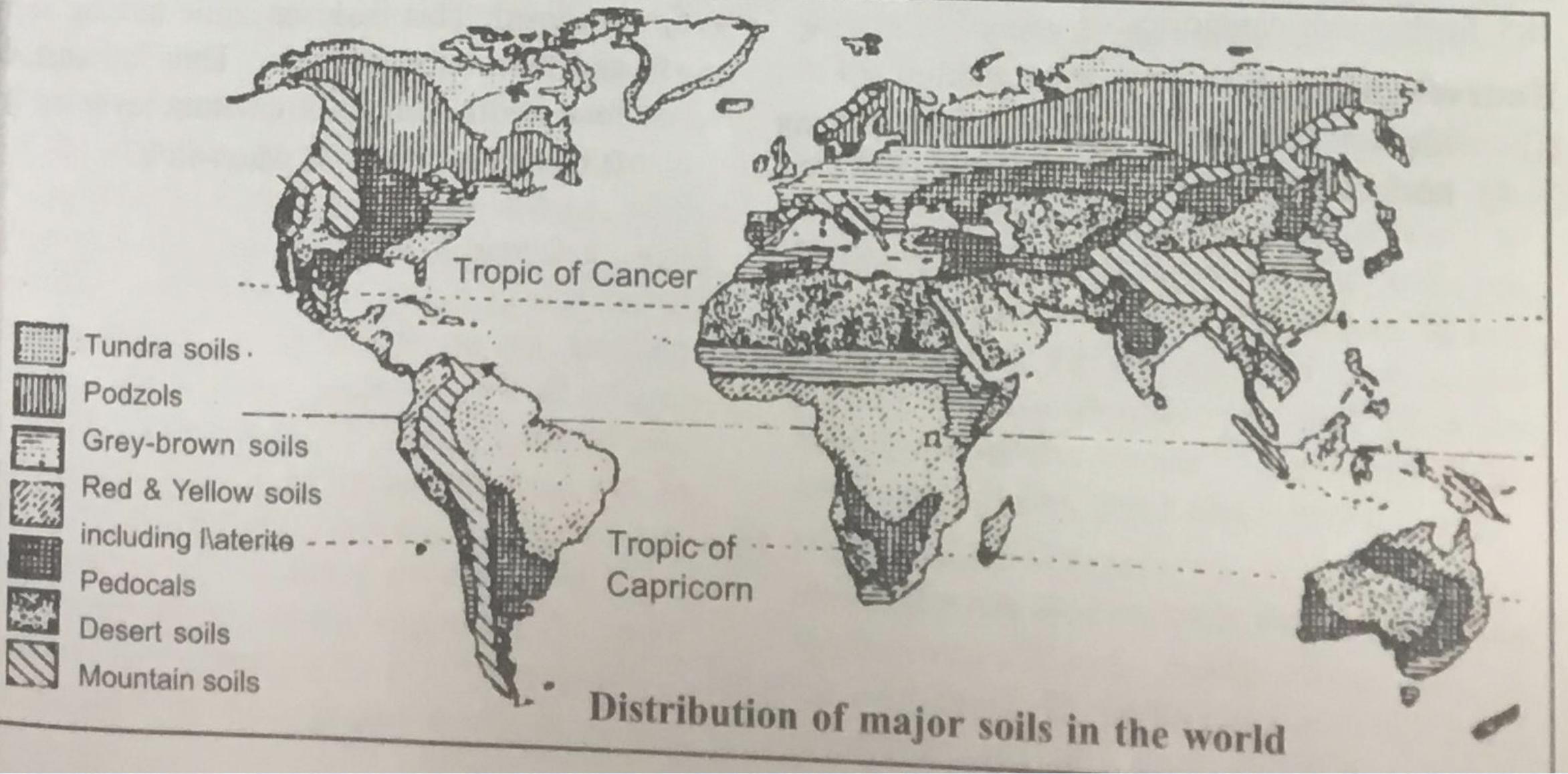
O-Horizon (Humus or organic)

A-Horizon (Topsoil)

B-Horizon (Subsoil)

C-Horizon (Parent material)

R-Horizon (Bedrock)



Soil type (as per USDA taxonomy)	Meaning
Entisol	Fresh alluvial
Inceptisol	Old alluvial, volcanic soil
Spodosol	Podzol soil
ALFIsol	Leached soil with Al & Fe
Ultisol	Laterite soil
Oxisol	Top layer strongly weathered with rich Al & Fe
Vertisol	Black soil
Histosol	Peaty soil rich in organic matter
Mollisol	Prairie soil
Aridisol	Desert soil

2011	<p>Salinization occurs when the irrigation water accumulated in the soil evaporates, leaving behind salts and minerals.</p> <p>What are the effects of salinization on the irrigated land?</p> <ul style="list-style-type: none">(a) It greatly increases the crop production.(b) It makes some soils impermeable.(c) It raises the water table.(d) It fills the air spaces in the soil with water
------	---



Questions??



- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

India – Physical

Physiography

Drainage System

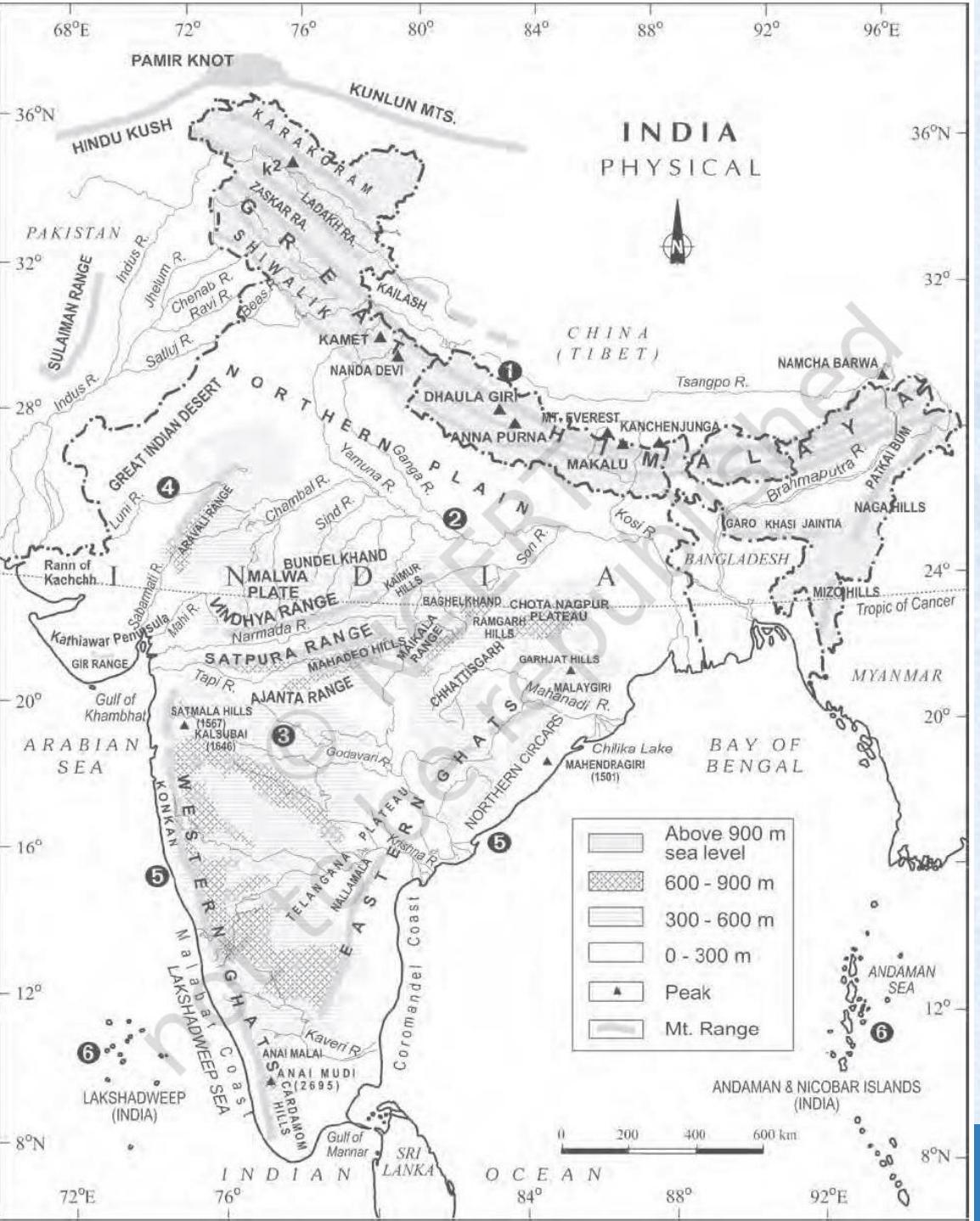
Climate

Soil

INDIA

States and Union Territories

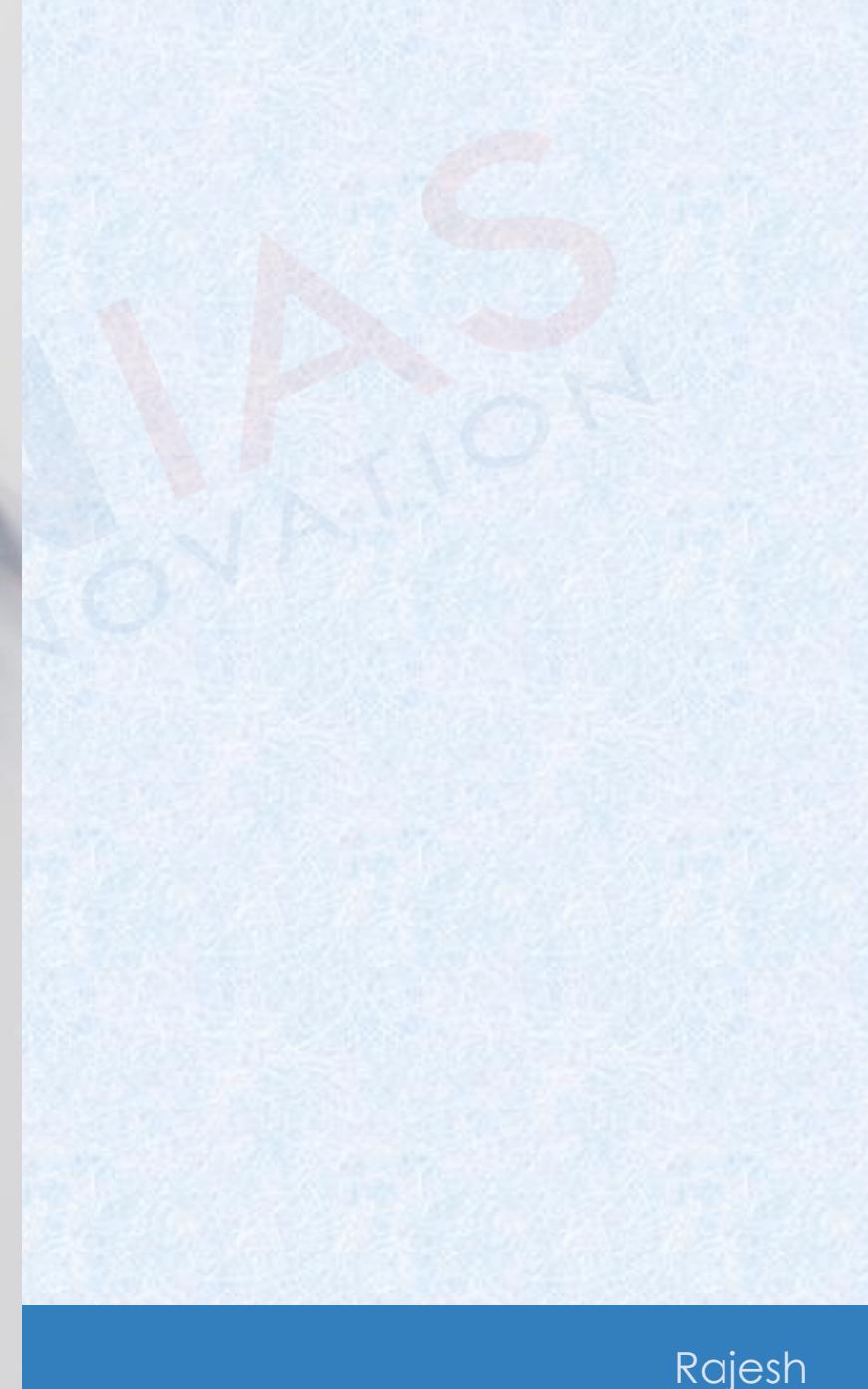
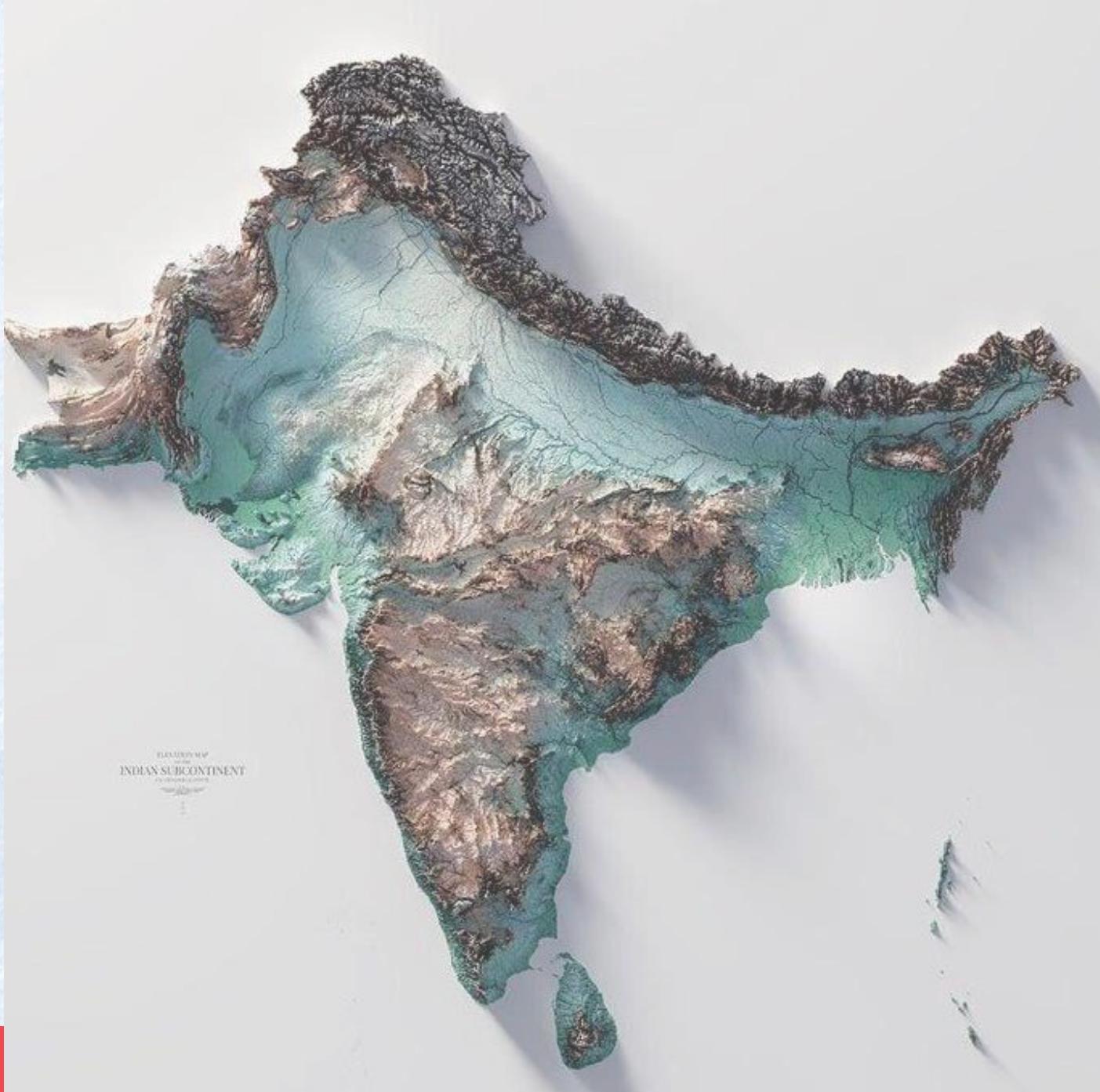


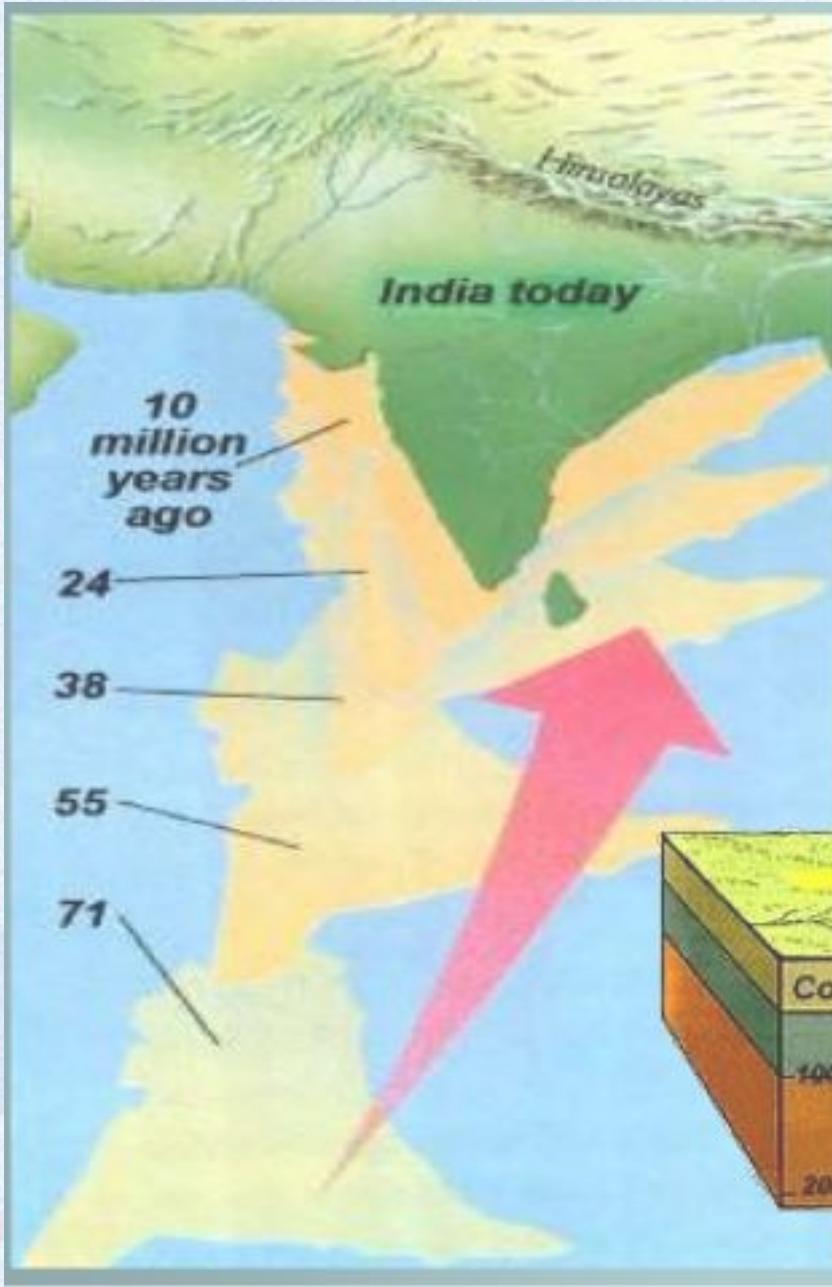




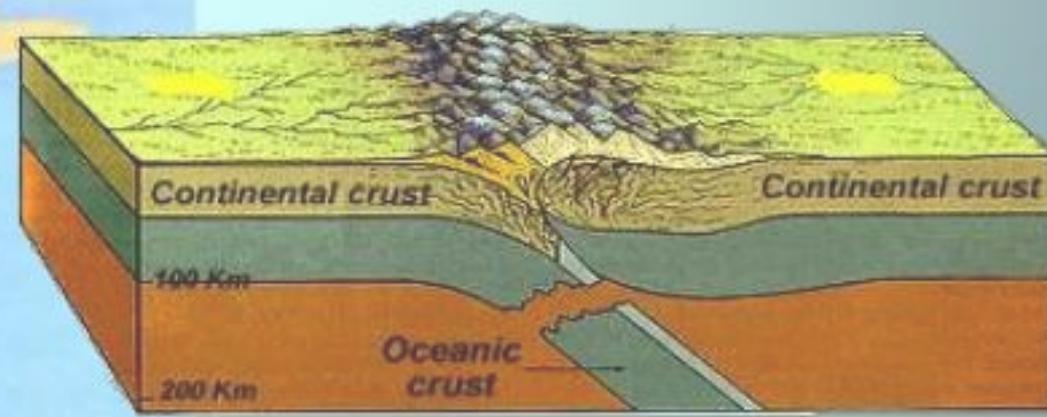
Orient BlackSwan

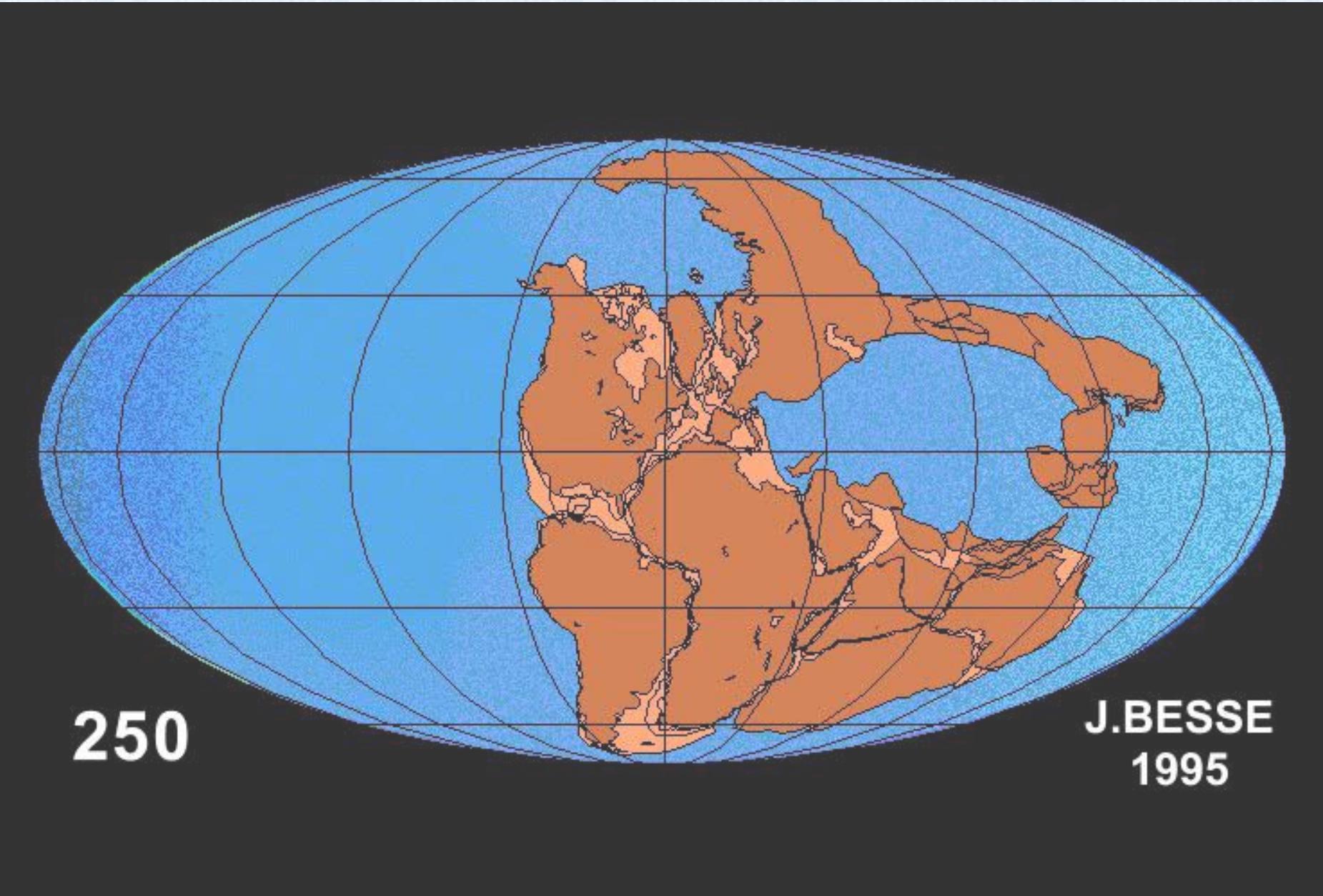






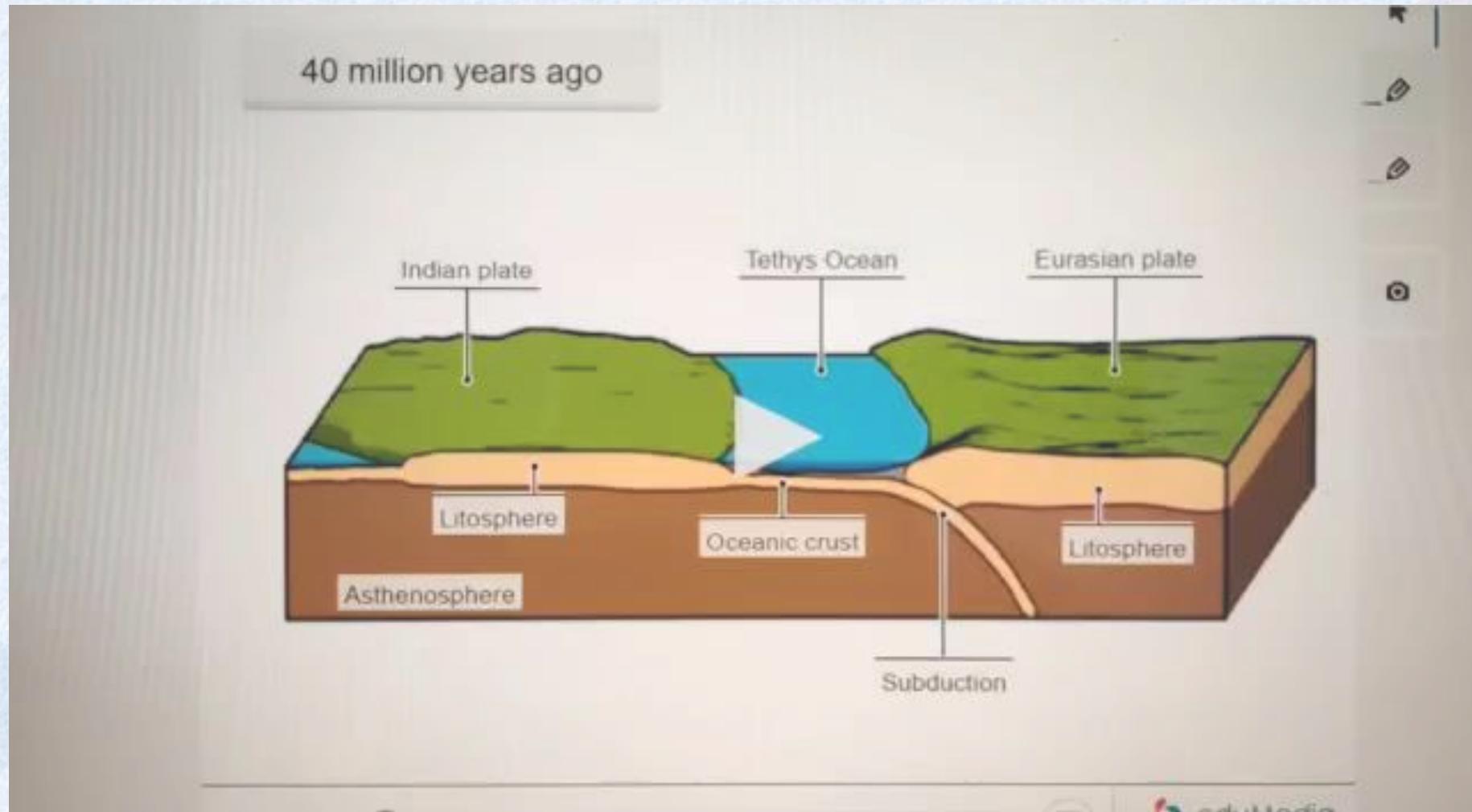
Formation of Himalayas

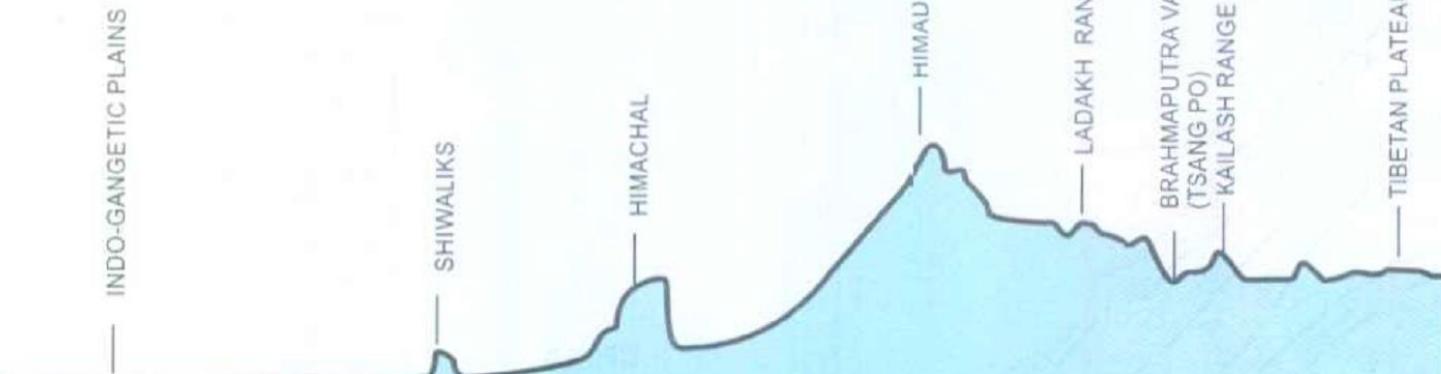




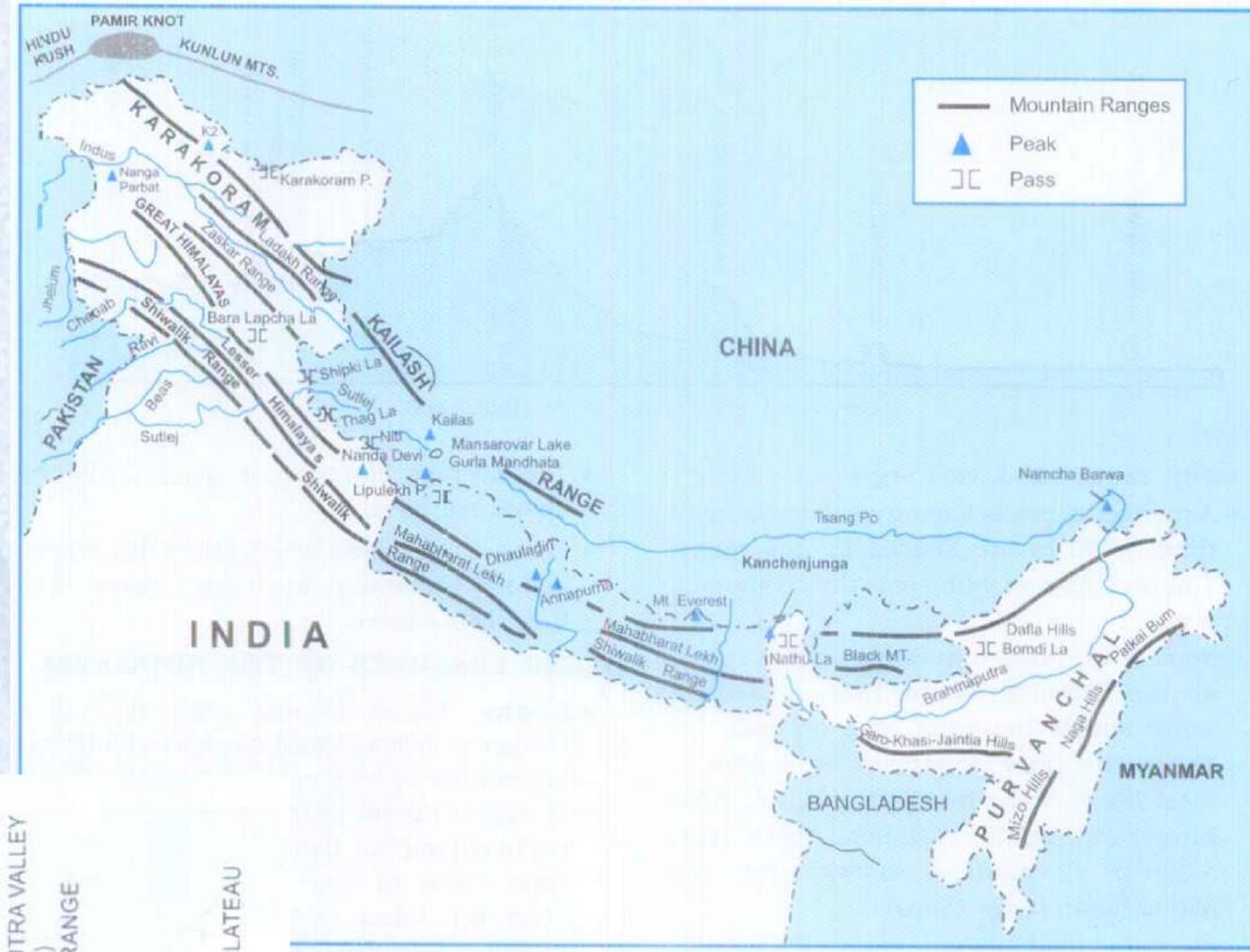
250

J.BESSE
1995





Cross-Sectional Division of the Himalayas

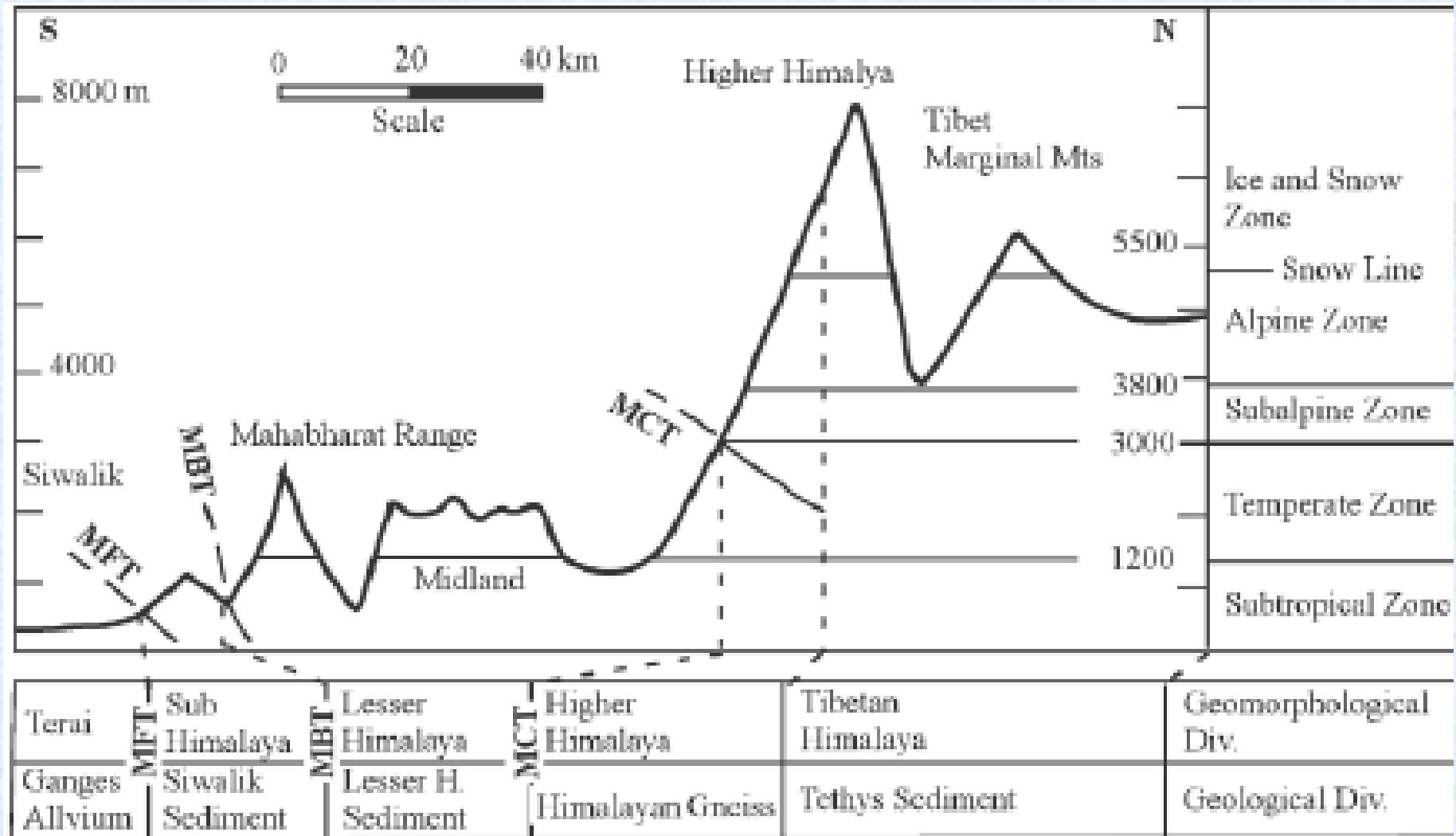


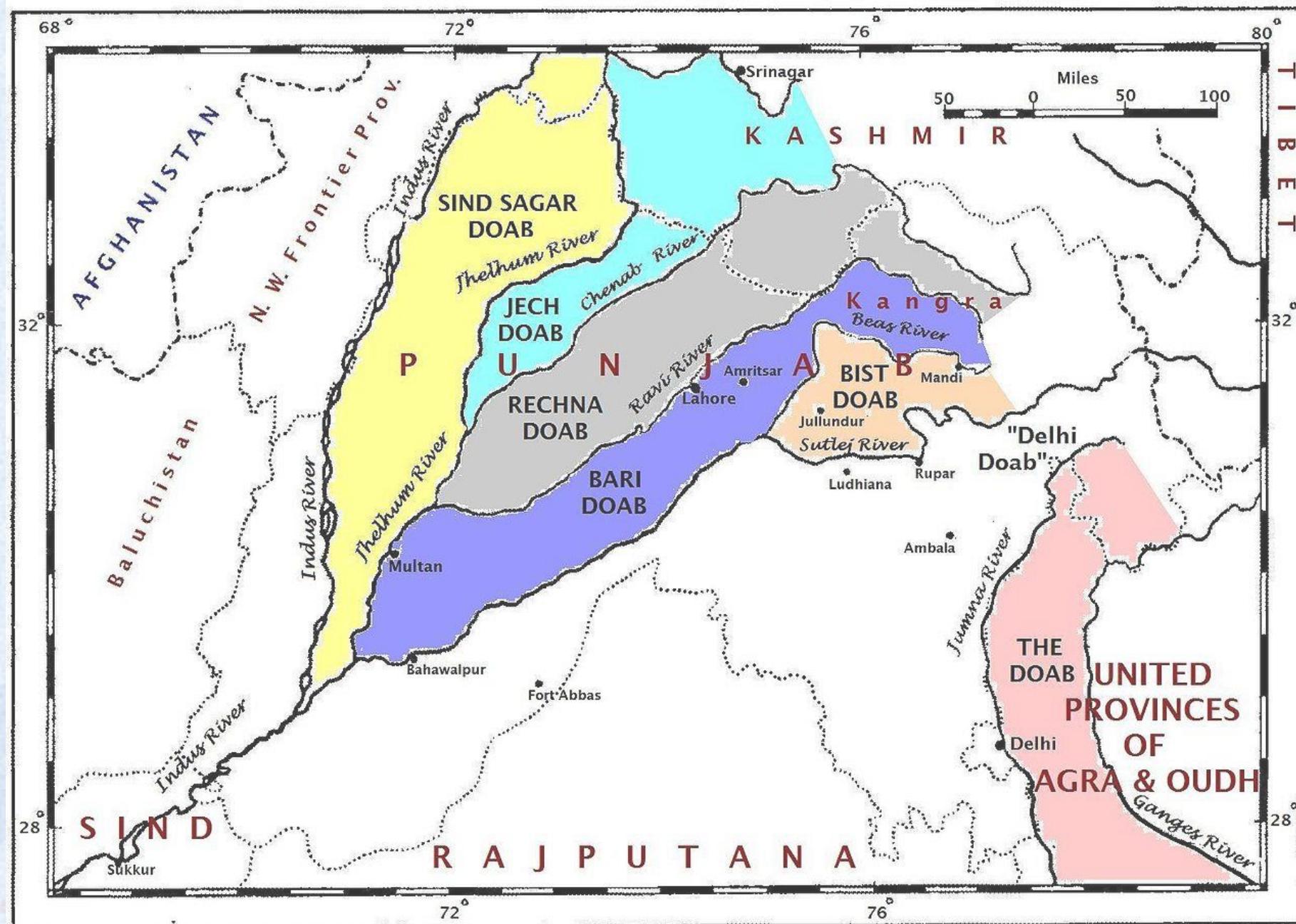
Rajesh





S
O







Imagery ©2015 Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Landsat, Map data ©2015 Google, ORION-ME, ZENRIN

IAS

2010

If there were no Himalayan ranges, what would have been the most likely geographical impact on India?

1. Much of the country would experience the cold waves from Siberia.
2. Indo-gangetic plain would be devoid of such extensive alluvial soils.
3. The pattern of monsoon would be different from what it is at present.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 1 and 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3 only

2012

When you travel in Himalayas, you will see the following?

1. Deep gorges
2. U-turn river courses
3. Parallel mountain ranges
4. Steep gradients causing land-sliding

Which of the above can be said to be the evidence for Himalayas being young fold mountains?

- (a) 1 and 2 only
- (b) 1, 2 and 4 only
- (c) 3 and 4 only
- (d) 1, 2, 3 and 4

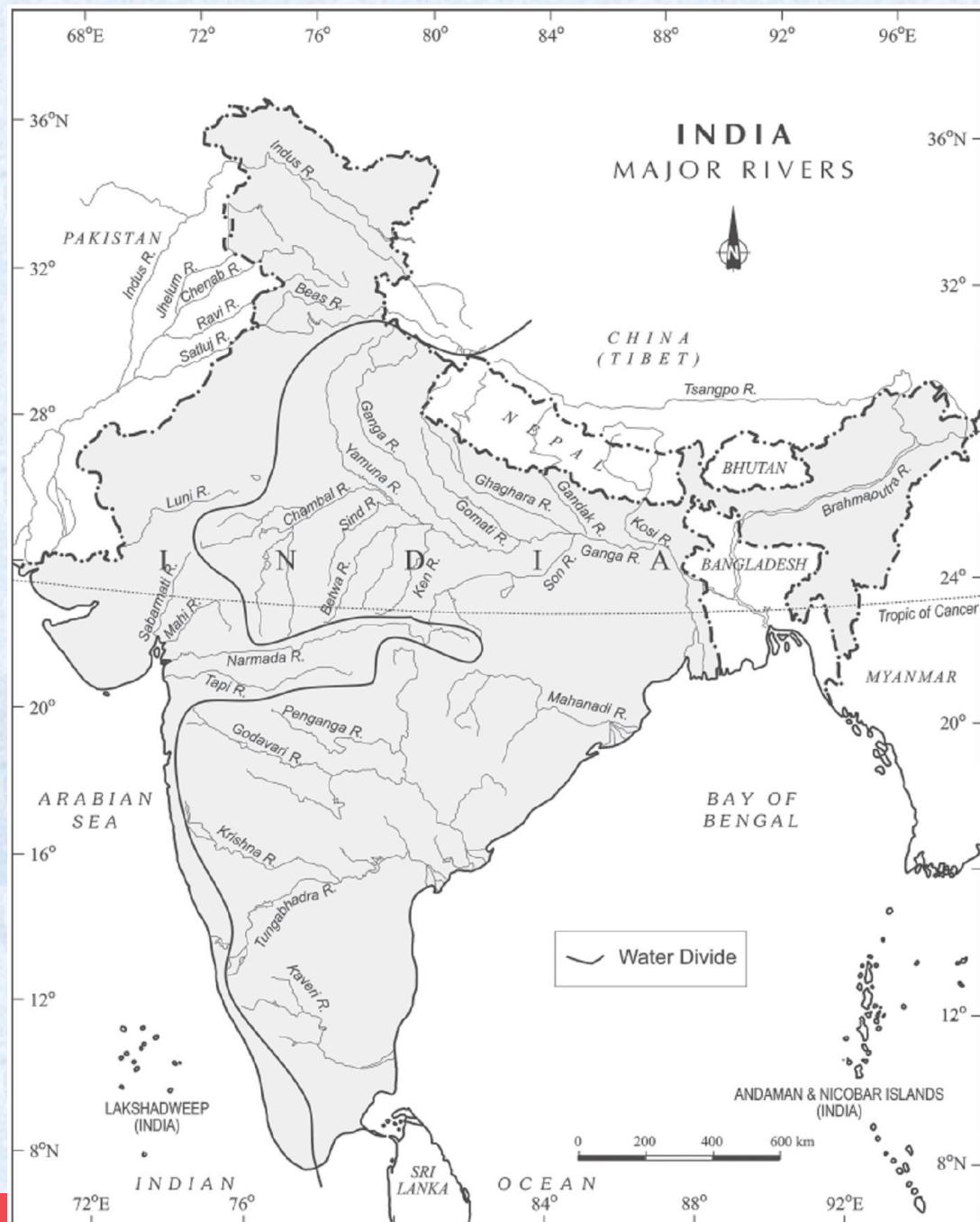
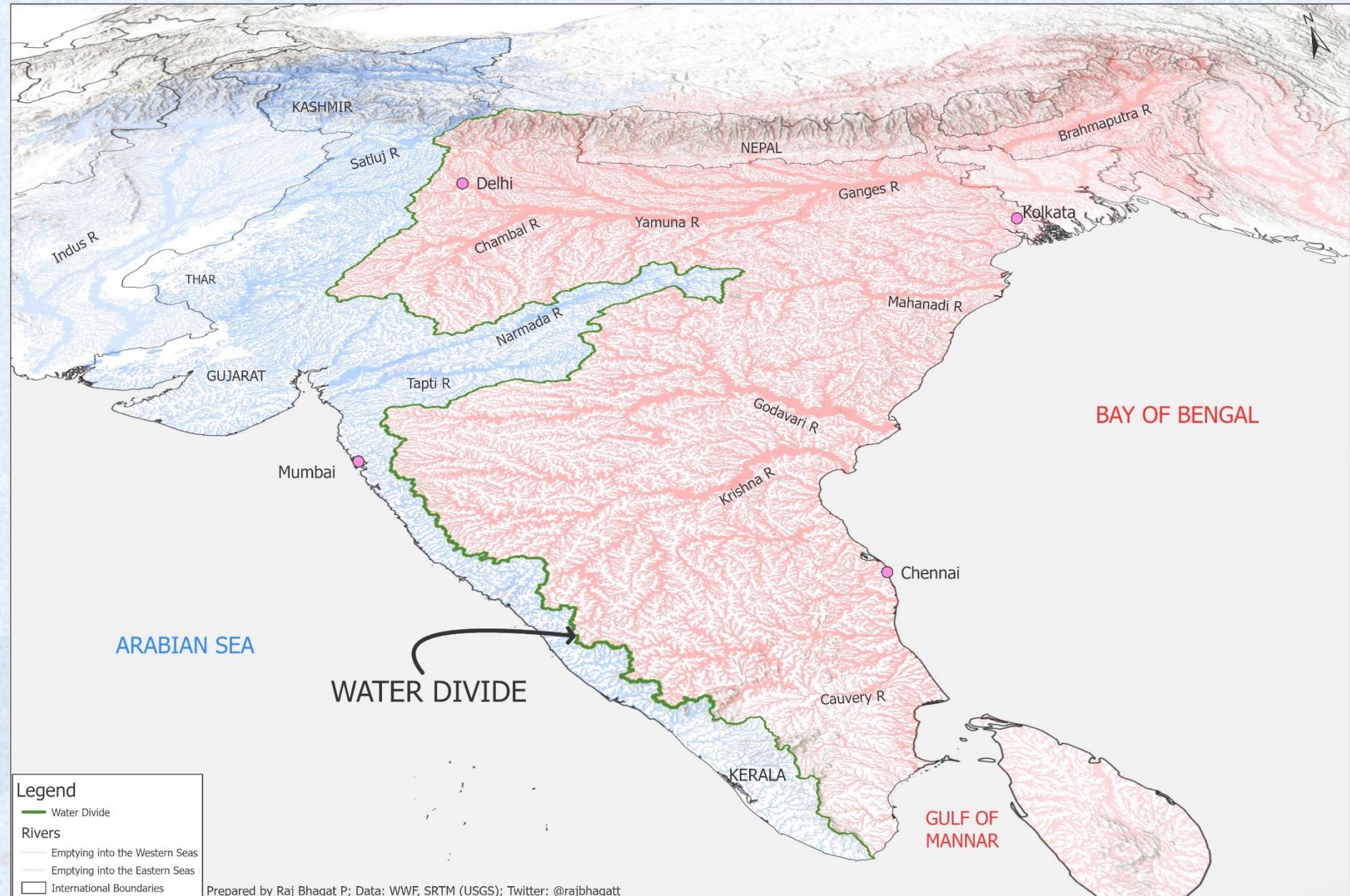
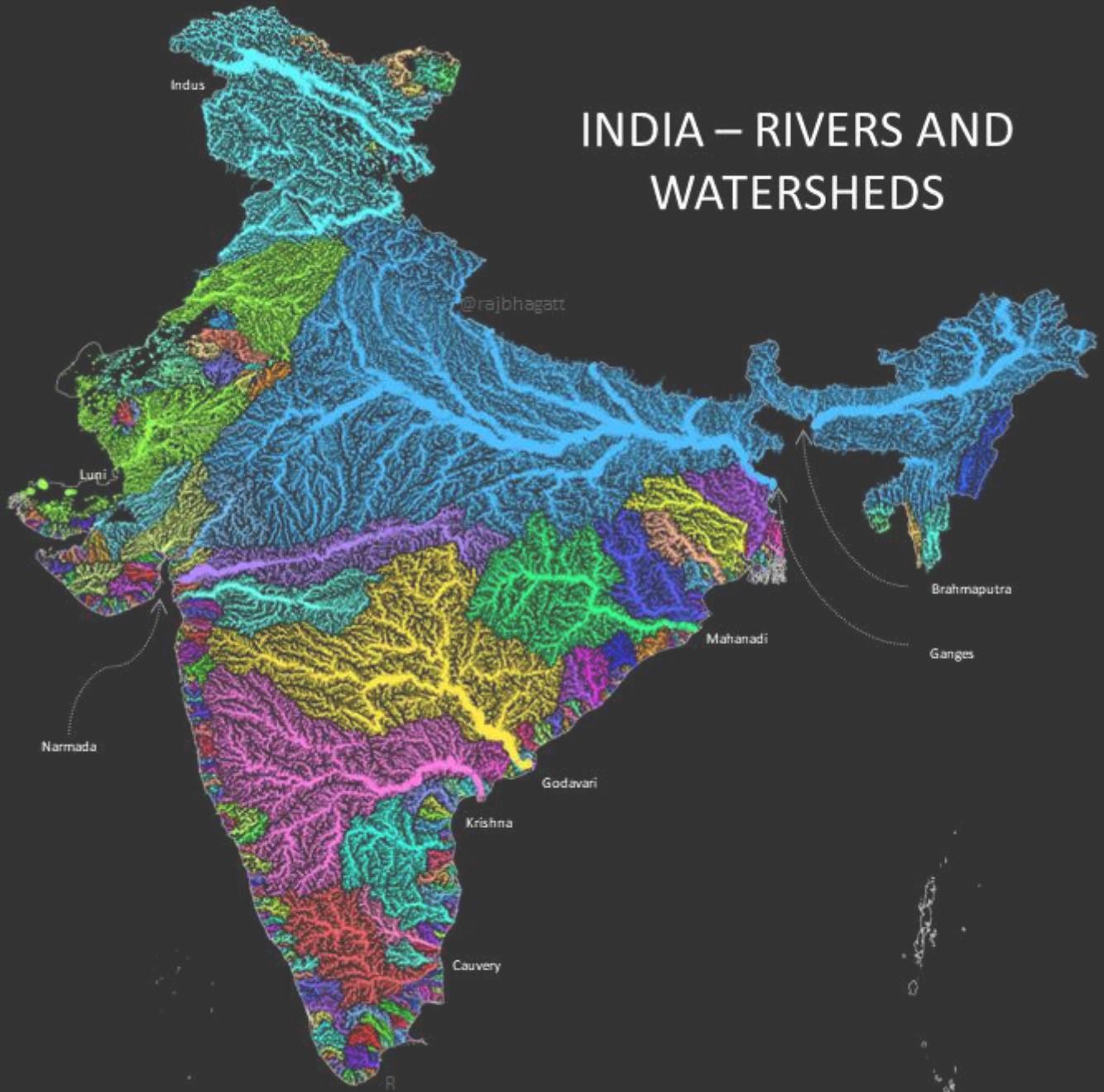
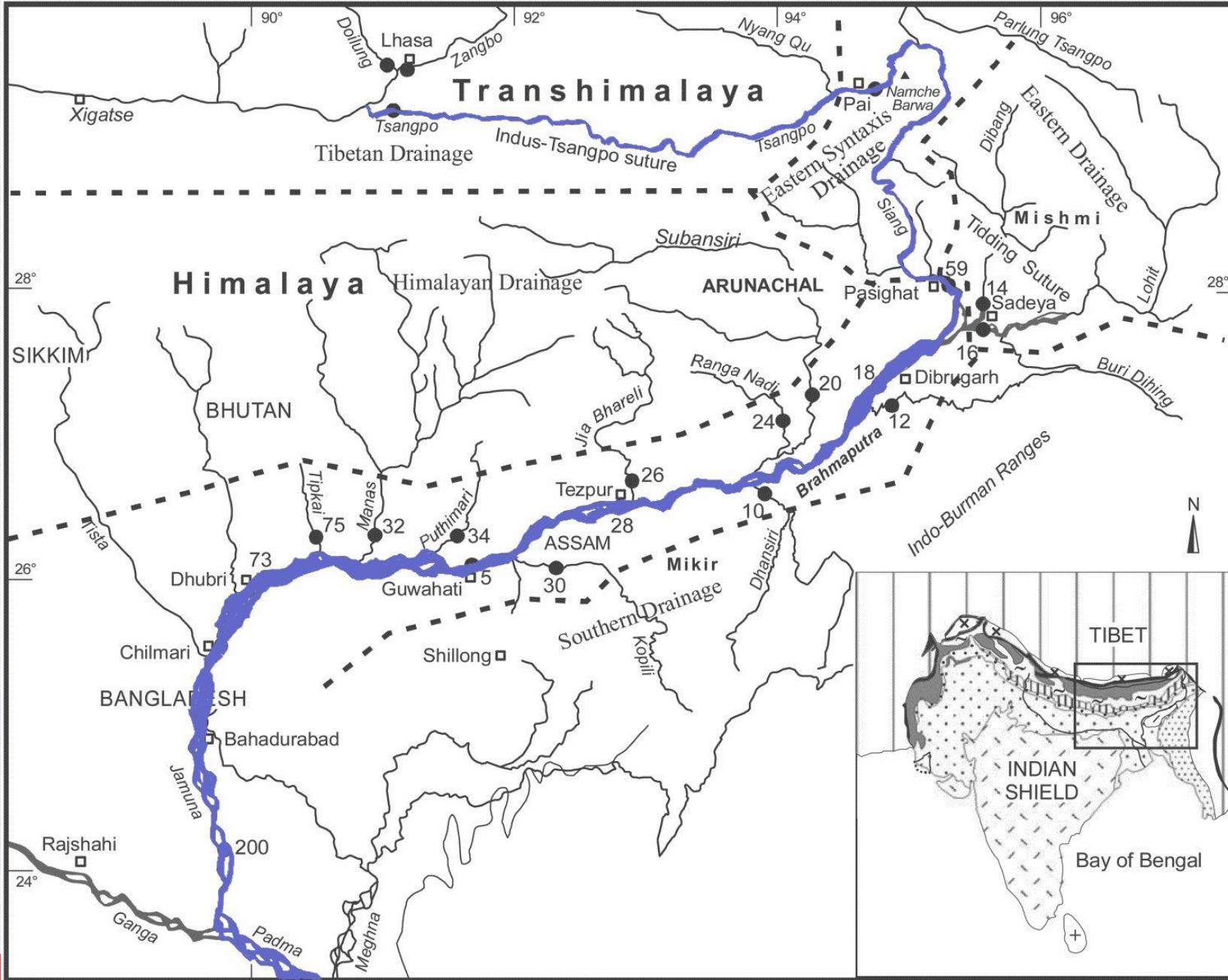


Figure 3.2 : Major Rivers of India



INDIA – RIVERS AND WATERSHEDS





INDIA

Rivers & Dams



2011

The Brahmaputra, Irrawady and Mekong rivers originate in Tibet and flow through narrow and parallel mountain ranges in their upper reaches. Of these rivers, Brahmaputra makes a "U" turn in its course to flow into India. This "U" turn is due to:

- (a) Uplift of folded Himalayan series.
- (b) Syntaxial bending of geologically young Himalayas.
- (c) Geo-Tectonic disturbance in the tertiary folded mountain chains.
- (d) Both a and b above

21.	River system	2009	<p>Consider the following statements :</p> <ol style="list-style-type: none">1. There are no east flowing rivers in Kerala.2. There are no west flowing rivers in Madhya Pradesh. <p>Select the correct answer using the code given below.</p> <p>(a) 1 only (b) 2 only (c) Both 1 and 2 (d) Neither 1 nor 2</p>
22.	River system	2009	<p>Which one of the following rivers does not originate in India?</p> <p>(a) Beas (b) Chenab (c) Ravi (d) Sutlej</p>

28.

River system

2009

At which one of the following places do two important rivers of India originate; while one of them flows towards north and merges with another important river flowing towards Bay of Bengal, the other one flows towards Arabian Sea?

- (a) Amarkantak
- (b) Badrinath
- (c) Mahabaleshwar
- (d) Nasik

30.	River system	2010	<p>Rivers that pass through Himachal Pradesh are?</p> <p>(a) Beas and Chenab only (b) Beas and Ravi only (c) Chenab, Ravi and Satluj only (d) Beas, Chenab, Ravi, Satluj and Yamuna</p>															
31.	River system	2010	<p>With reference to the river Luni, which one of the following statements is correct?</p> <p>(a) It flows into Gulf of Khambhat (b) It flows into Gulf of Kuchchh (c) It flows into Pakistan and merges with a tributary of Indus (d) It is lost in the marshy land of the Rann of Kuchchh</p>															
32.	River system	2010	<p>Which one of the following pairs is not correctly matched?</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; width: 40%;">Dam/Lake</th> <th style="text-align: center; width: 10%;">:</th> <th style="text-align: center; width: 50%;">River</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">(a) Govind Sagar</td> <td style="text-align: center;">:</td> <td style="text-align: center;">Satluj</td> </tr> <tr> <td style="text-align: center;">(b) Kolleru Lake</td> <td style="text-align: center;">:</td> <td style="text-align: center;">Krishna</td> </tr> <tr> <td style="text-align: center;">(c) Ukai Reservoir</td> <td style="text-align: center;">:</td> <td style="text-align: center;">Tapi</td> </tr> <tr> <td style="text-align: center;">(d) Wular Lake</td> <td style="text-align: center;">:</td> <td style="text-align: center;">Jhelum</td> </tr> </tbody> </table>	Dam/Lake	:	River	(a) Govind Sagar	:	Satluj	(b) Kolleru Lake	:	Krishna	(c) Ukai Reservoir	:	Tapi	(d) Wular Lake	:	Jhelum
Dam/Lake	:	River																
(a) Govind Sagar	:	Satluj																
(b) Kolleru Lake	:	Krishna																
(c) Ukai Reservoir	:	Tapi																
(d) Wular Lake	:	Jhelum																

35.	River system	2013	<p>The Narmada river flows to the west, while most other large peninsular rivers flow to the east. Why?</p> <ol style="list-style-type: none"> 1. It occupies a linear rift valley. 2. It flows between the Vindhya and the Satpuras. 3. The land slopes to the west from Central India. <p>Select the correct answer using the code given below.</p> <p>(a) 1 only (b) 2 and 3 only (c) 1 and 3 only (d) None</p>
36.	River system	2014	<p>Consider the following rivers:</p> <ol style="list-style-type: none"> 1. Barak 2. Lohit 3. Subansiri <p>Which of the above flows/flow through Arunachal Pradesh?</p> <p>(a) 1 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2 and 3 only</p>

37.	River system	2014	<p>Consider the following pairs:</p> <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top; width: 50%;">Wetlands</td><td style="vertical-align: top; width: 50%;">Confluence of rivers</td></tr> <tr> <td>1. Harike Wetlands</td><td>: Beas and Sutlej</td></tr> <tr> <td>2. Keoladeo Ghana National Park</td><td>: Banas and Chambal</td></tr> <tr> <td>3. Kolleru Lake</td><td>: Musi and Krishna</td></tr> </table> <p>Which of the above pairs is/are correctly matched?</p> <p>(a) 1 only (b) 2 and 3 only (c) 1 and 3 only (d) 1, 2 and 3 only</p>	Wetlands	Confluence of rivers	1. Harike Wetlands	: Beas and Sutlej	2. Keoladeo Ghana National Park	: Banas and Chambal	3. Kolleru Lake	: Musi and Krishna
Wetlands	Confluence of rivers										
1. Harike Wetlands	: Beas and Sutlej										
2. Keoladeo Ghana National Park	: Banas and Chambal										
3. Kolleru Lake	: Musi and Krishna										
38.	River system	2015	<p>Consider the following rivers:</p> <ul style="list-style-type: none"> 1. Vamsadhara 2. Indravati 3. Pranahita 4. Pennar <p>Which of the above is/are tributaries of Godavari?</p> <p>(a) 1, 2 and 3 (b) 2, 3 and 4 (c) 1, 2 and 4 (d) 2 and 3 only</p>								

2016	<p>Which of the following is/are tributary/ tributaries of Brahmaputra?</p> <ol style="list-style-type: none"> 1. Dibang 2. Kameng 3. Lohit <p>Select the correct answer using the code given below.</p> <p>(a) 1 only (b) 2 and 3 only (c) 1 and 3 only (d) 1,2 and 3</p>
2016	<p>Recently, linking of which of the following rivers was undertaken?</p> <p>(a) Cauvery and Tungabhadra (b) Godavari and Krishna (c) Mahanadi and Son (d) Narmada and Tapti</p>
2017	<p>With reference to river Teesta, consider the following statements:</p> <ol style="list-style-type: none"> 1. The source of river Teesta is the same as that of Brahmaputra but it flows through Sikkim. 2. River Rangeet originates in Sikkim and it is a tributary of river Teesta. 3. River Teesta flows into Bay of Bengal on the border of India and Bangladesh. <p>Which of the statements given above is/are correct?</p> <p>(a) 1 and 3 only (b) 2 only (c) 2 and 3 only (d) 1, 2 and 3</p>

2019

Consider the following pairs:

Famous Place River

1. Pandharpur : Chandrabhaga
2. Tiruchirappalli : Cauvery
3. Hampi : Malaprabha

Which of the pairs given above are correctly matched?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

2019

Consider the following pairs:

Glacier River

1. Bandarpunch : Yamuna
2. Bara Shigri : Chenab
3. Milam : Mandakini
4. Siachen : Nubra
5. Zemu Manas

Which of the pairs given above are correctly matched?

- (a) 1, 2 and 4
- (b) 1, 3 and 4
- (c) 2 and 5
- (d) 3 and 5

- 56.** Siachen Glacier is situated to the
- (a) East of Aksai Chin
 - (b) East of Leh
 - (c) North of Gilgit
 - (d) North of Nubra Valley

2020

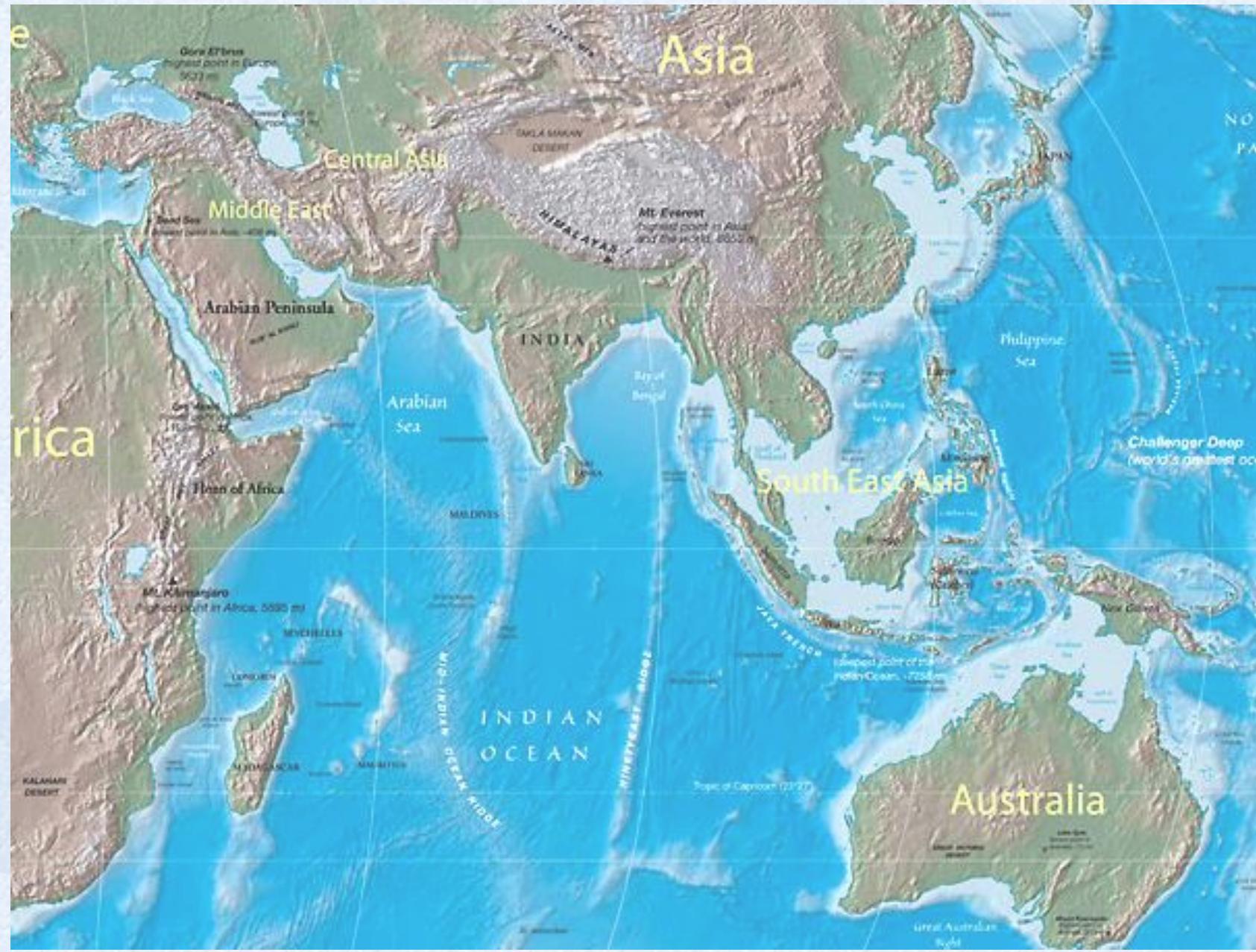
93. Which of the following Protected Areas are located in Cauvery basin?

1. Nagarhole National park
2. Papikonda National Park
3. Sathyamagalam Tiger Reserve
4. Wayanand Wildlife Sanctuary

Select the correct answer using the code given below:

- (a) 1 and 2 only
- (b) 3 and 4 only
- (c) 1, 3 and 4 only
- (d) 1, 2, 3 and 4

2020



IAS
O

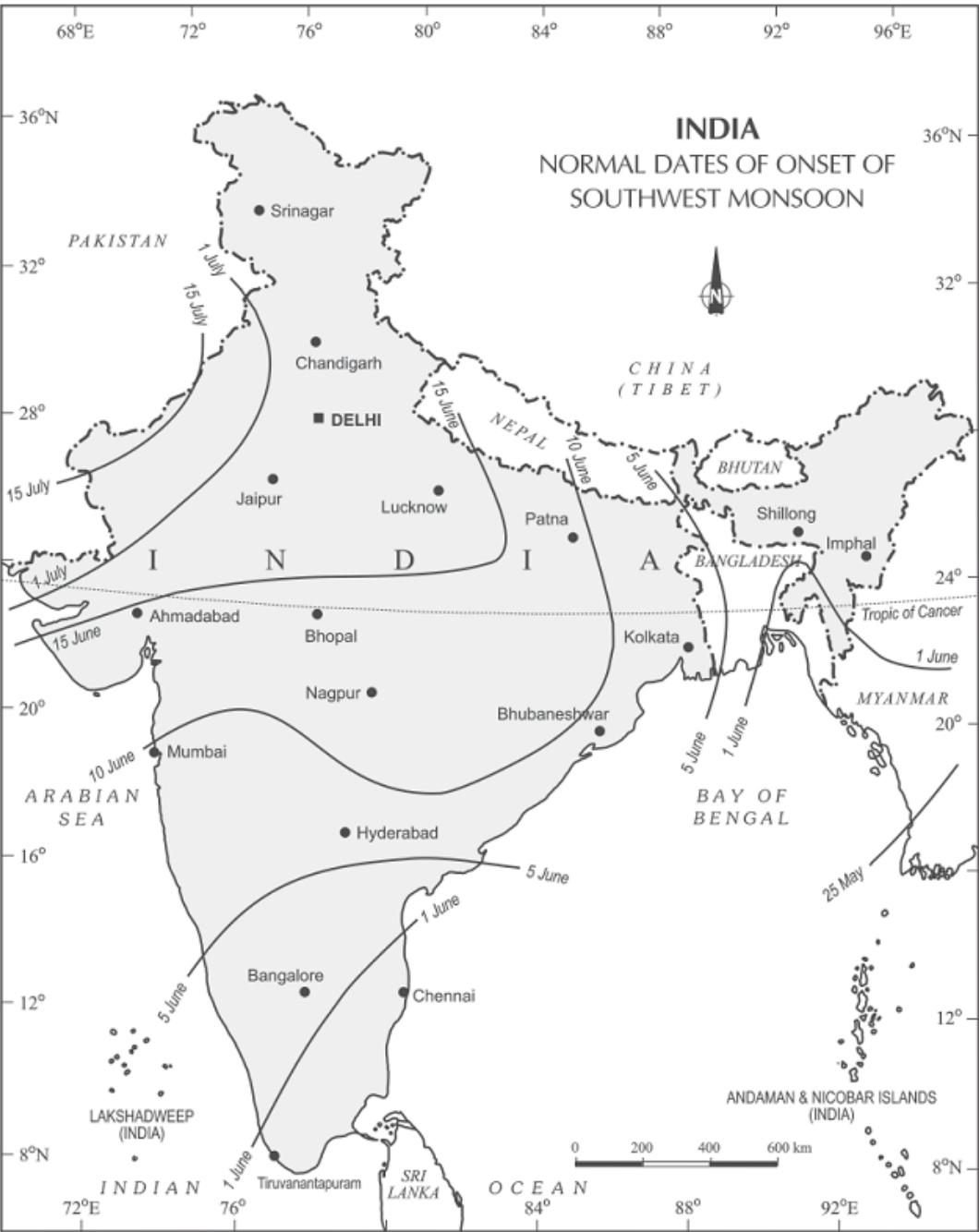
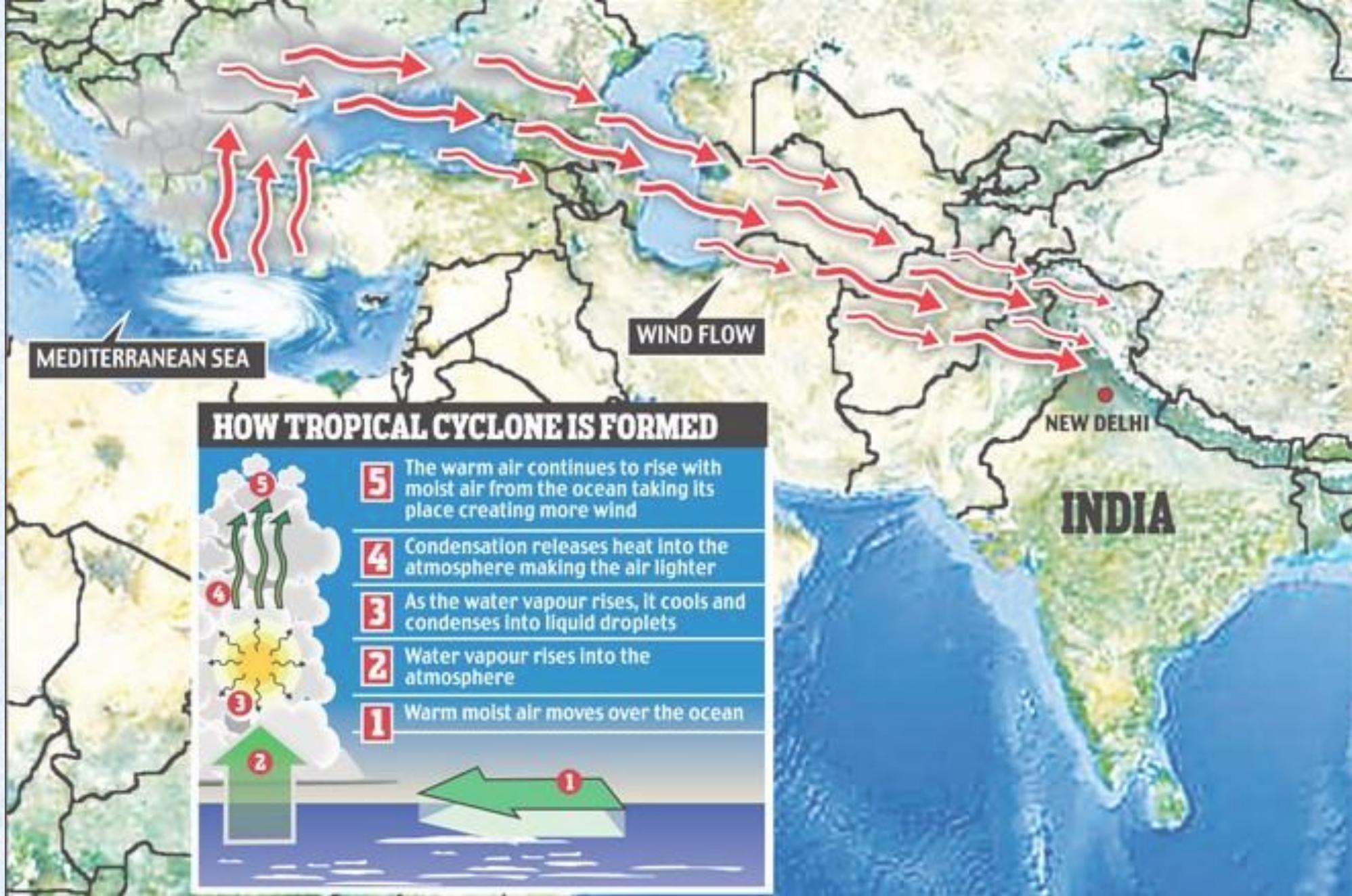
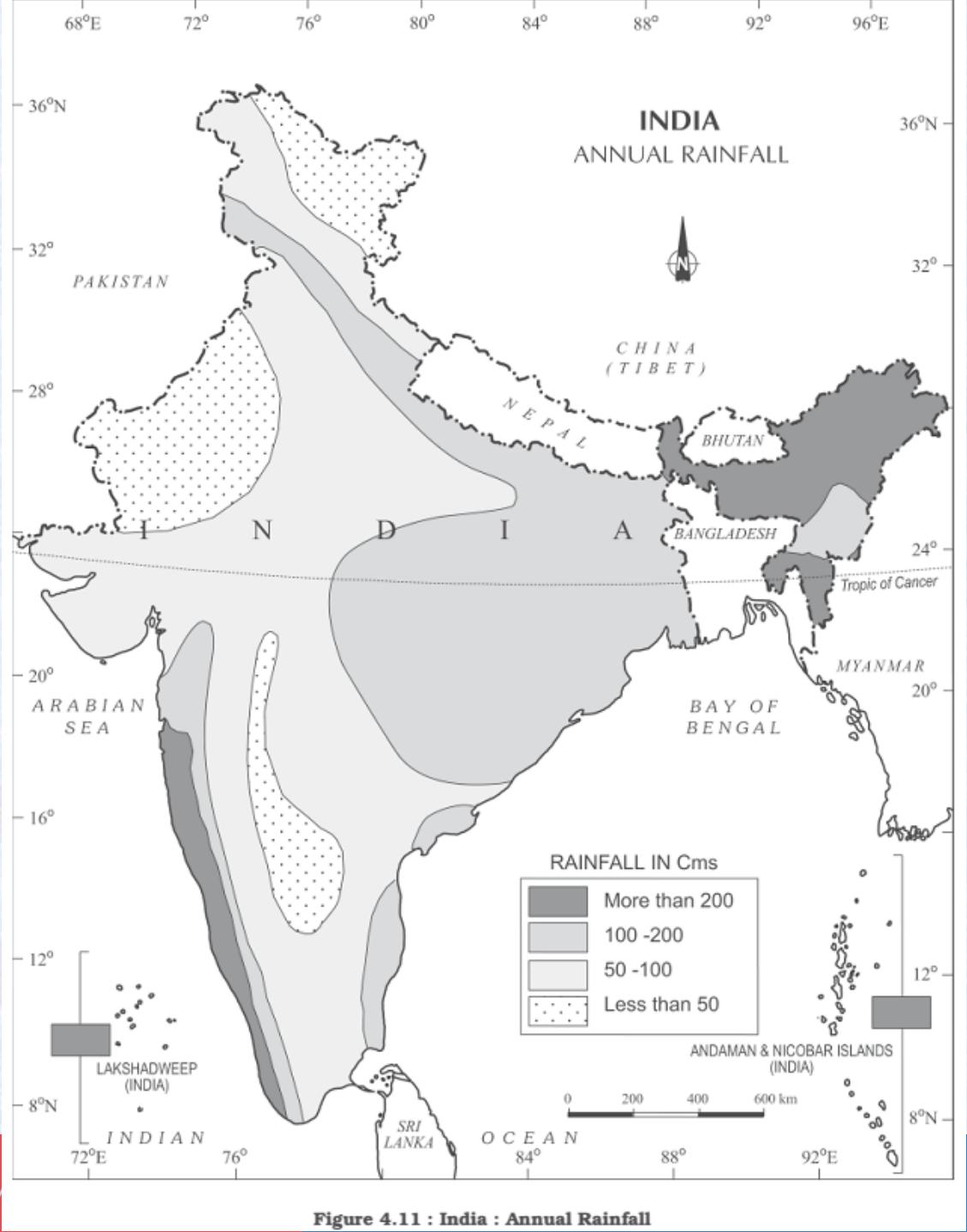


Figure 4.5 : India : Normal Dates of Onset of the Southwest Monsoon

Some Famous Local Storms of Hot Weather Season

- (i) *Mango Shower* : Towards the end of summer, there are pre-monsoon showers which are a common phenomena in Kerala and coastal areas of Karnataka. Locally, they are known as mango showers since they help in the early ripening of mangoes.
- (ii) *Blossom Shower* : With this shower, coffee flowers blossom in Kerala and nearby areas.
- (iii) *Nor Westers* : These are dreaded evening thunderstorms in Bengal and Assam. Their notorious nature can be understood from the local nomenclature of ‘*Kalbaisakhi*’, a calamity of the month of *Baisakh*. These showers are useful for tea, jute and rice cultivation. In Assam, these storms are known as “*Bardoli Chheerha*”.
- (iv) *Loo* : Hot, dry and oppressing winds blowing in the Northern plains from Punjab to Bihar with higher intensity between Delhi and Patna.





<i>Seasons</i>	<i>Months (According to the Indian Calendar)</i>	<i>Months (According to the Indian Calendar)</i>
Vasanta	Chaitra-Vaisakha	March-April
Grishma	Jyaistha-Asadha	May-June
Varsha	Sravana-Bhadra	July-August
Sharada	Asvina-Kartika	September-October
Hemanta	Margashirsa-Pausa	November-December
Shishira	Magha-Phalguna	January-February

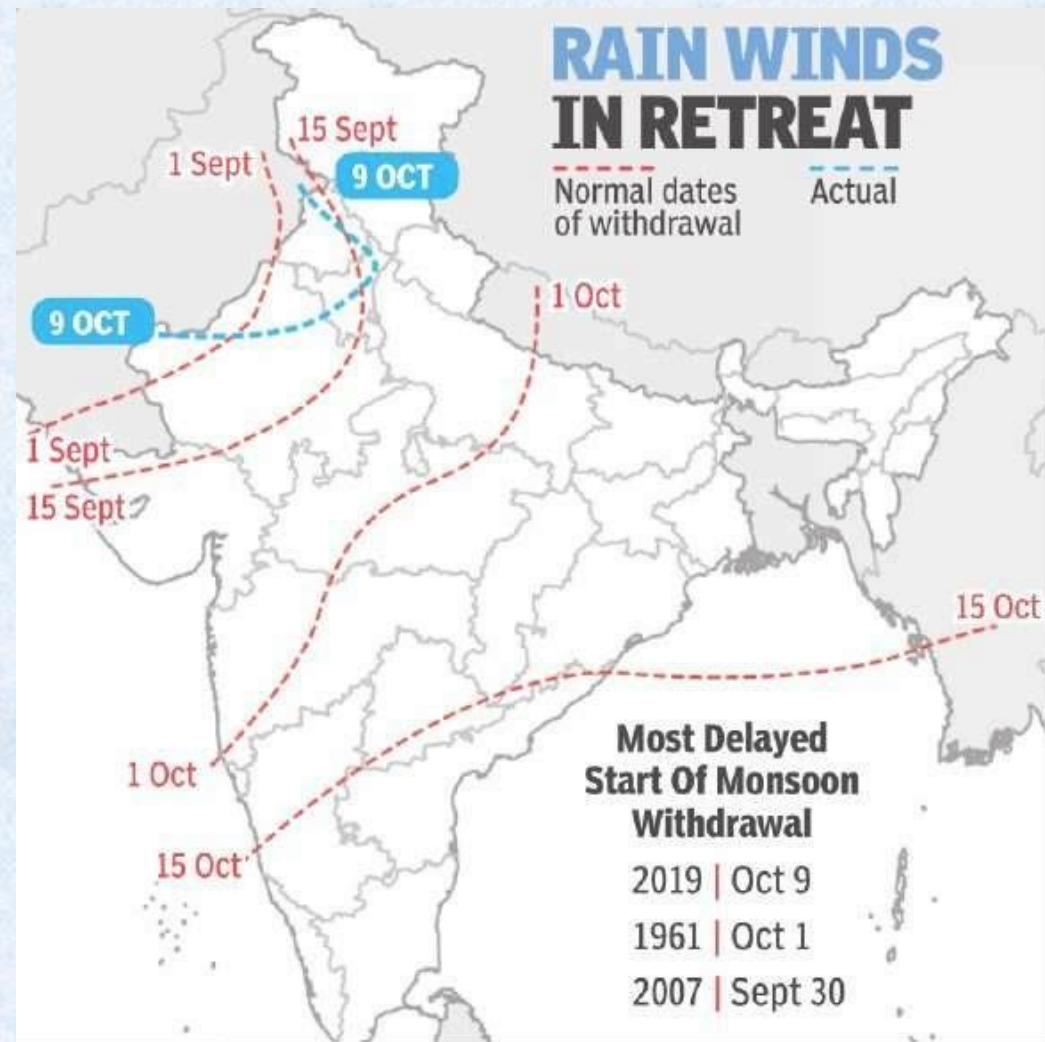


Table 12.1 : Climatic Groups According to Koeppen

<i>Group</i>	<i>Characteristics</i>
A - Tropical	Average temperature of the coldest month is 18° C or higher
B - Dry Climates	Potential evaporation exceeds precipitation
C - Warm Temperate	The average temperature of the coldest month of the (Mid-latitude) climates years is higher than minus 3°C but below 18°C
D - Cold Snow Forest Climates	The average temperature of the coldest month is minus 3° C or below
E - Cold Climates	Average temperature for all months is below 10° C
H - High Land	Cold due to elevation

Table 12.2 : Climatic Types According to Koeppen

<i>Group</i>	<i>Type</i>	<i>Letter Code</i>	<i>Characteristics</i>
A-Tropical Humid Climate	Tropical wet	Af	No dry season
	Tropical monsoon	Am	Monsoonal, short dry season
	Tropical wet and dry	Aw	Winter dry season
B-Dry Climate	Subtropical steppe	BSh	Low-latitude semi arid or dry
	Subtropical desert	BWh	Low-latitude arid or dry
	Mid-latitude steppe	BSk	Mid-latitude semi arid or dry
	Mid-latitude desert	BWk	Mid-latitude arid or dry
C-Warm temperate (Mid-latitude) Climates	Humid subtropical	Cfa	No dry season, warm summer
	Mediterranean	Cs	Dry hot summer
	Marine west coast	Cfb	No dry season, warm and cool summer
D-Cold Snow-forest Climates	Humid continental	Df	No dry season, severe winter
	Subarctic	Dw	Winter dry and very severe
E-Cold Climates	Tundra	ET	No true summer
	Polar ice cap	EF	Perennial ice
H-Highland	Highland	H	Highland with snow cover

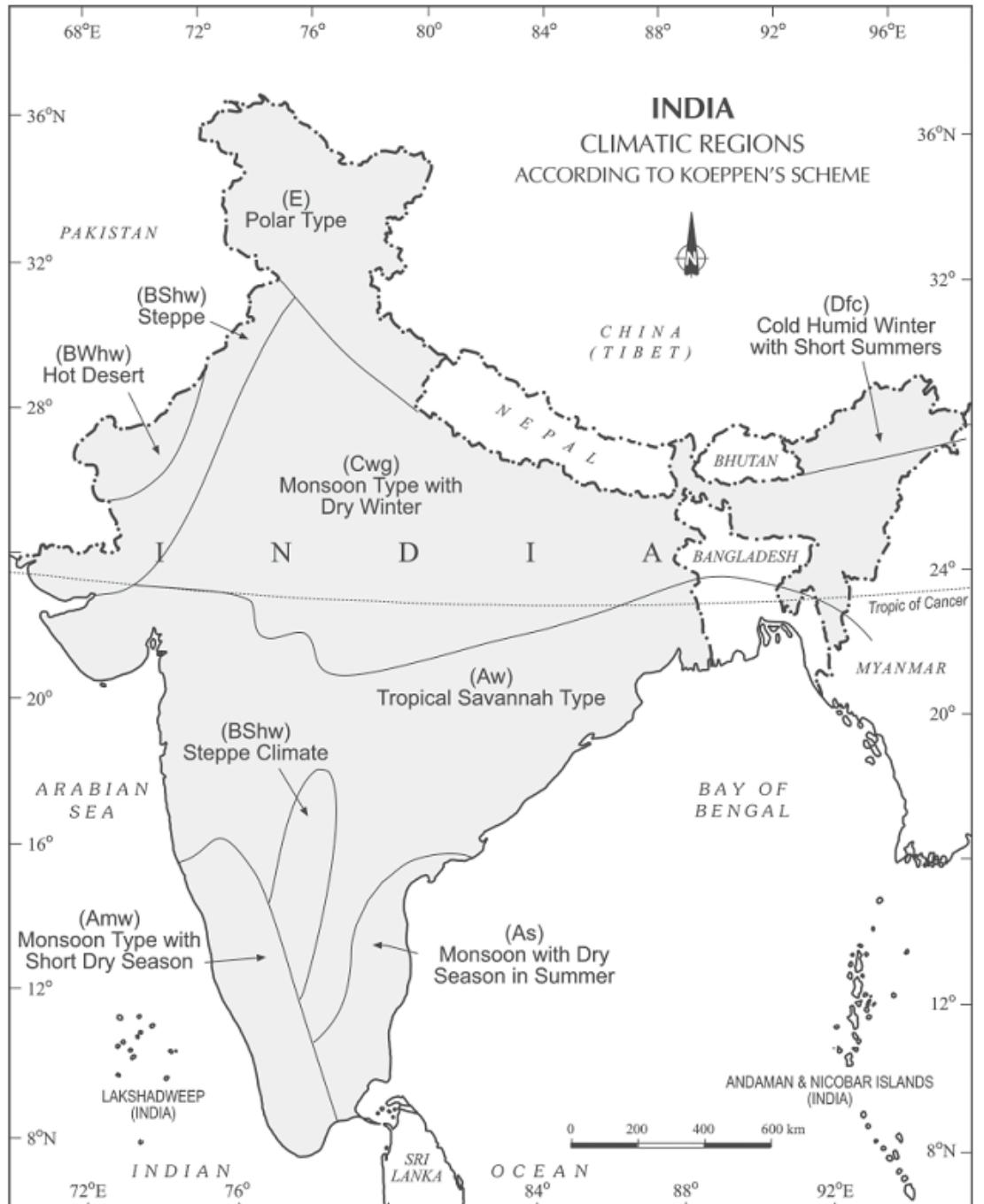


Table 4.1 : Climatic Regions of India According to Koeppen's Scheme

Type of Climate	Areas
Amw - Monsoon with short dry season	West coast of India south of Goa
As - Monsoon with dry summer	Coromandel coast of Tamil Nadu
Aw - Tropical savannah	Most of the Peninsular plateaus, south of the Tropic of Cancer
Bwhw - Semi-arid steppe climate	North-western Gujarat, some parts of western Rajasthan and Punjab
Bwhw - Hot desert	Extreme western Rajasthan
Cwg - Monsoon with dry winter	Ganga plain, eastern Rajasthan, northern Madhya Pradesh, most of North-east India
Dfc - Cold humid winter with short summer	Arunachal Pradesh
E - Polar type	Jammu and Kashmir, Himachal Pradesh and Uttarakhand

Figure 4.13 : India : Climatic Regions According to Koppen's Scheme

2009

Consider the following statements:

1. In the world, the tropical deserts occur along the western margins of continents within the trade wind belt.
2. In India, the East Himalayan region gets high rainfall from north-east winds.

Select the correct answer using the code given below.

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

2012

Consider the following statements:

1. The duration of the monsoon decreases from southern India to northern India.
2. The amount of annual rainfall in the northern plains of India decreases from east to west.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

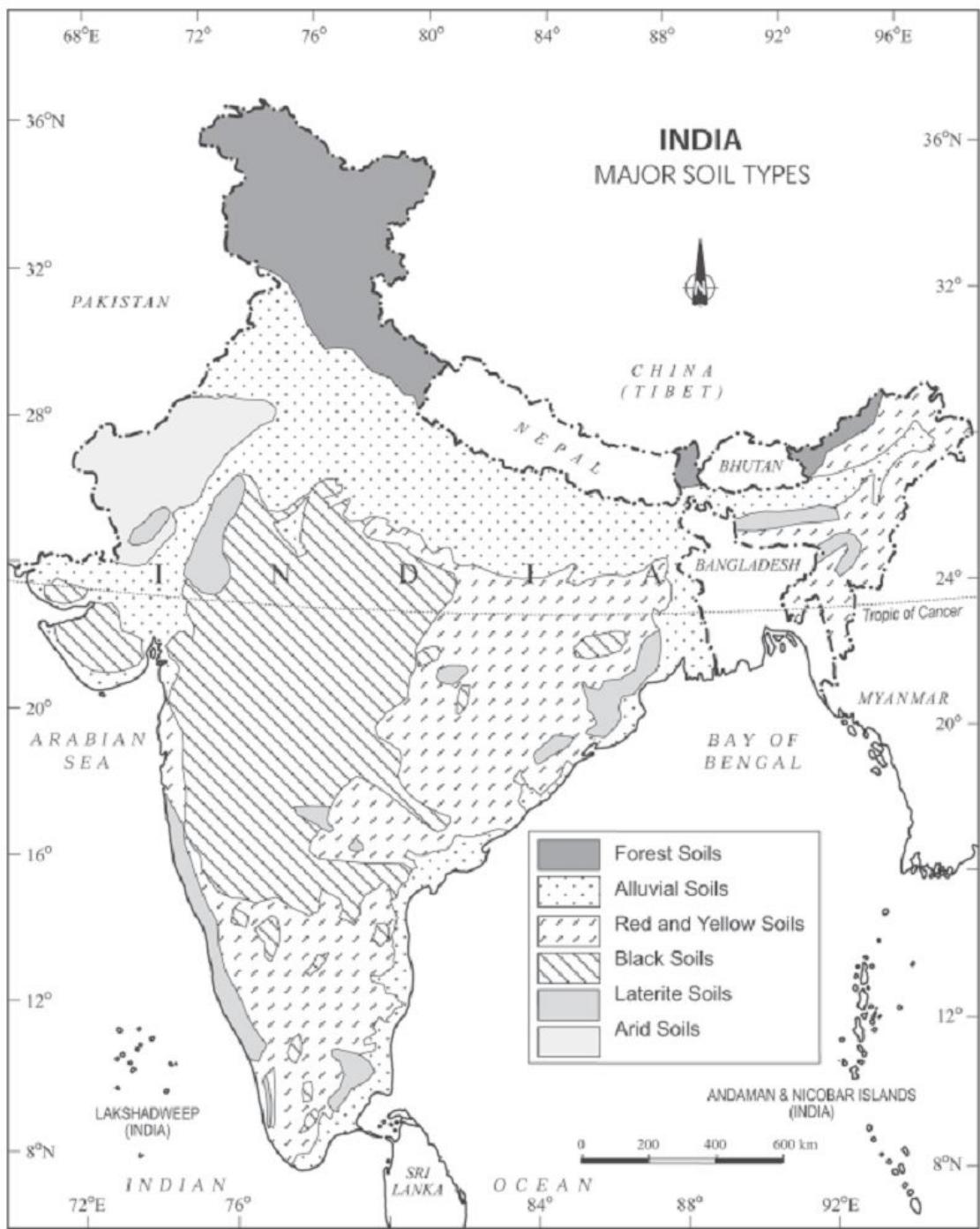
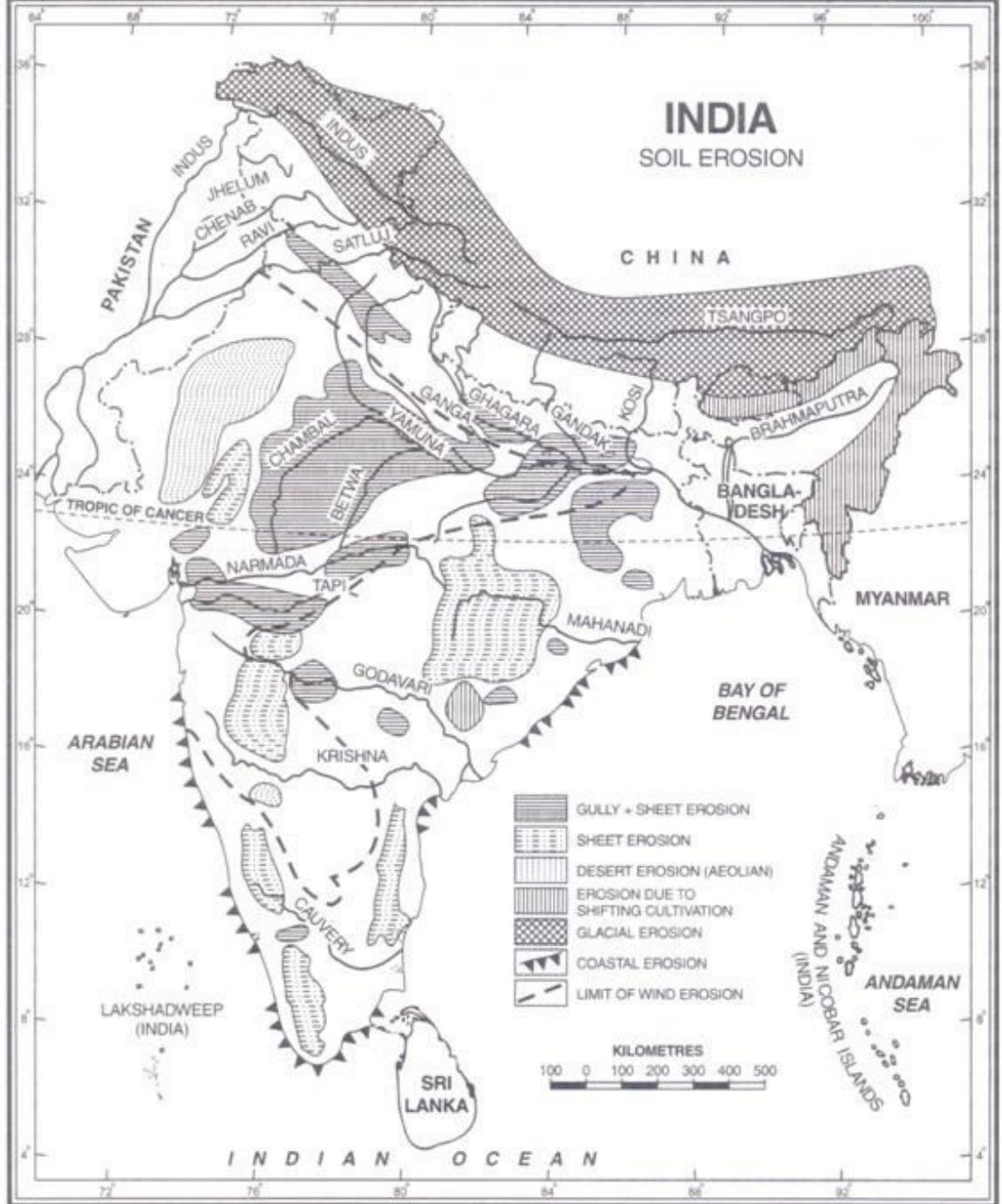


Figure 6.2 : Major Soil Types of India



2010	<p>When you travel in certain parts of India, you will notice red soil. What is the main reason for this colour?</p> <p>(a) Abundance of magnesium (b) Accumulated humus (c) Presence of ferric oxides (d) Abundance of phosphates</p>
------	--

2013	<p>Which of the following statements regarding laterite soils of India are correct?</p> <ol style="list-style-type: none">1. They are generally red in colour.2. They are rich in nitrogen and potash.3. They are well-developed in Rajasthan and UP.4. Tapioca and cashew nuts grow well on these soils. <p>Select the correct answer using the codes given below.</p> <p>(a) 1, 2 and 3 (b) 2, 3 and 4 (c) 1 and 4 (d) 2 and 3 only</p>
------	--

2014	<p>In India, the problem of soil erosion is associated with which of the following?</p> <ol style="list-style-type: none"> 1. Terrace cultivation 2. Deforestation 3. Tropical climate <p>Select the correct answer using the code given below.</p> <ol style="list-style-type: none"> (a) 1 and 2 only (b) 2 only (c) 1 and 3 only (d) 1, 2 and 3 only
2014	<p>What are the benefits of implementing the "Integrated Watershed Development Programme"?</p> <ol style="list-style-type: none"> 1. Prevention of soil runoff 2. Linking the country's perennial rivers with seasonal rivers 3. Rainwater harvesting and recharge of groundwater table 4. Regeneration of natural vegetation <p>Select the correct answer using the code given below.</p> <ol style="list-style-type: none"> (a) 1 and 2 only (b) 2, 3 and 4 only (c) 1, 3 and 4 only (d) 1, 2, 3 and 4 only



Questions??



- Online query (For faster reply)
- Read and revise what is taught
- Read the reference material
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)

FOOD CROPS OF INDIA				
Crops	Temperature	Rainfall	Soil	Leading Producers
1. Rice	Not above 35°C	150-300 cm	Clayey or loamy	West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu.
2. Wheat	10°-15°C (sowing) 21°-26°C (harvest)	80 cm	Well drained loams, and clay loams	Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh.
3. Millets				
(a) Jowar	Not below 16°C	<100 cm	Variety of soils including clayey, sandy	Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh and Telangana.
(b) Bajra	25°-30°C	40-50 cm	Sandy loams, black and red soils	Rajasthan, Uttar Pradesh, Gujarat, Maharashtra, Haryana.
(c) Ragi	20°-30°C	50-100 cm	Red, light black and sandy loams	Karnataka, Tamil Nadu, Uttarakhand, Maharashtra and Andhra Pradesh.
4. Pulses	20°-25°C	50-75 cm	Dry, light soil	Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan and Andhra Pradesh.

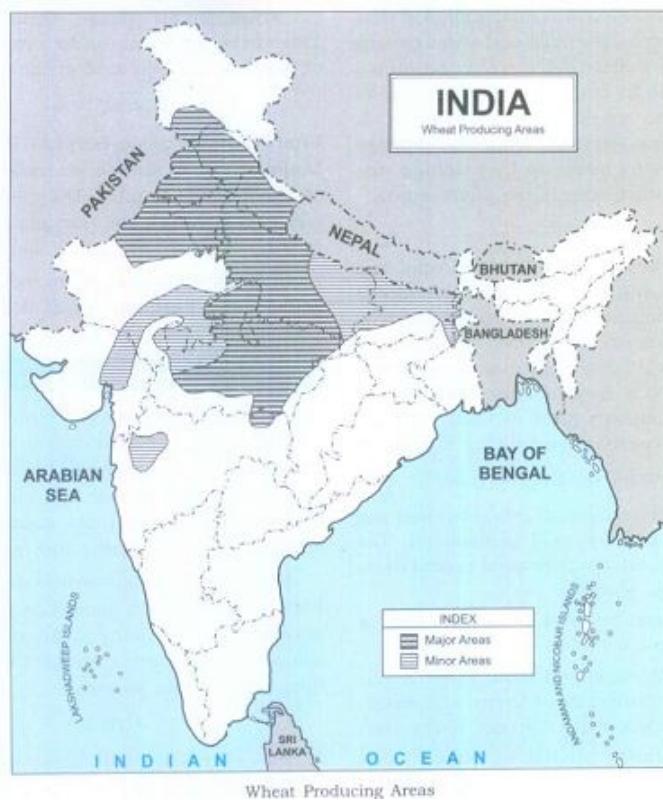
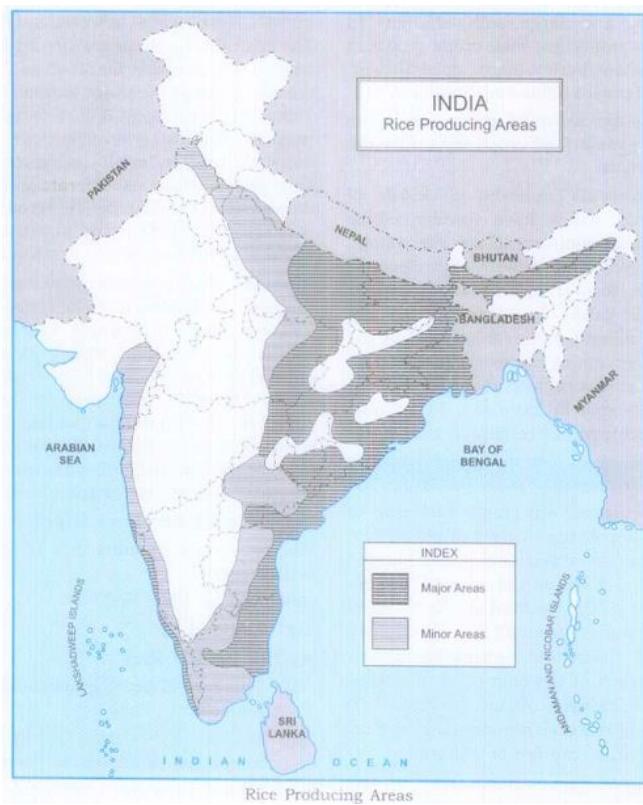
Crop	Temperature	Rainfall	Soil	Leading States
Sugarcane	20°C-26°C	100-150 cm or irrigation facilities with high humidity.	Well-drained rich alluvial, heavy loam or lava soil.	UP, Maharashtra, Tamil Nadu (highest yield hectare), Karnataka, Andhra Pradesh.
Cotton	21°C-30°C but not below 21°C. 200 frost free days	50-75 cm or irrigation facility.	Deep black soil (regur), alluvial soils and laterite soil.	Gujarat, Andhra Pradesh, Maharashtra and Punjab.
Jute	24°C-35°C	Heavy rainfall of 150 cm with 90 per cent of relative humidity.	Light sandy or clayey loams.	West Bengal (70 per cent of the production, over 60 per cent of the area), Bihar, Assam, Odisha.

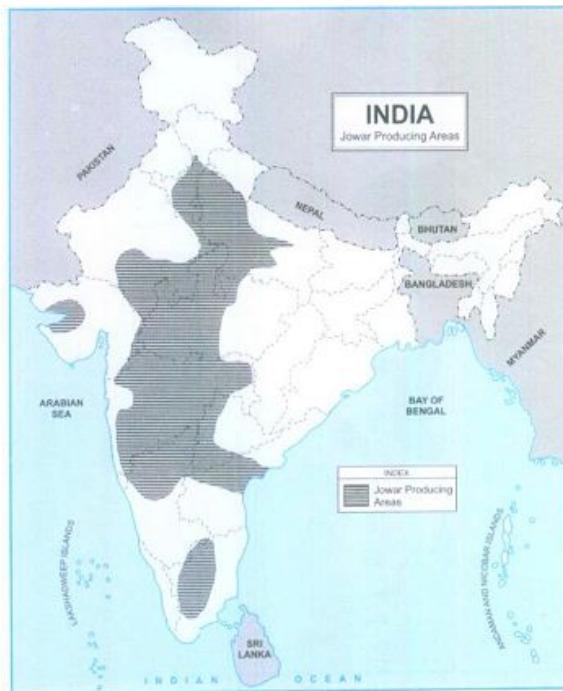
Crop	Temperature	Rainfall	Soil	Leading States
Groundnut	20°C to 25°C	50 to 100 cm	Sandy loams, loams and well-drained soils.	Gujarat, Telangana and Tamil Nadu.
Mustard and Rapeseed	10°C to 20°C	25 to 40 cm	Loams. Heavier loams (for mustard). Light loams (for rapeseed).	Uttar Pradesh, Rajasthan, Punjab, Madhya Pradesh and Haryana.
Soyabean	13°C to 24°C	40 to 60 cm	Friable loamy, acidic soils.	Madhya Pradesh, Rajasthan and Maharashtra.
Sunflower	26°C to 30°C	Less than 50 cm	Well-drained loamy soils.	Bihar, Maharashtra, Andhra Pradesh and Karnataka.
Sesamum	21°C	40 to 60 cm	Well-drained light loamy soil and black cotton soil.	Uttar Pradesh, Rajasthan, Maharashtra, Madhya Pradesh, Odisha, Gujarat, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu.
Cotton Seeds	21°C to 30°C	50 to 75 cm	Black soils.	Gujarat, Andhra Pradesh, Telangana, Maharashtra and Punjab.
Linseed	15°C to 20°C	45 to 75 cm	Alluvial soils, clayey loamy soils and deep black soils.	Madhya Pradesh and Uttar Pradesh.
Castor Seeds	20°C to 25°C	50 to 75 cm	Red sandy loams in Peninsular India and light alluvial soils in the Plains.	Gujarat, Andhra Pradesh, Telangana and Rajasthan.

Important Cash Crops of India

Crops	Temperature	Rainfall	Soil	Distribution
Tea	24°C-30°C	at least 150cm	forest soil; rich in humus and iron.	1. Assam: the Brahmaputra valley, Surma valley 2. West Bengal: the Duars, Darjeeling 3. Tamil Nadu: highest yield per hectare 4. Kerala
Coffee	15°C-28°C but does not tolerate frost or heat	150-200 cm	well drained, friable loamy soil, rich in vegetable mould.	1. Karnataka 70.4 % of total production; 2. Kerala 21.7 % of total production; and 3. Tamil Nadu 5.8 % of total production.
Rubber	25°C-35°C	152-200 cm	rich well drained alluvial or laterite soils.	1. Kerala: Kottayam, Ernakulum, Kozhikode and Kollam. 2. Tamil Nadu 3. Karnataka

Soil	Formation	Areas	Characteristics	Crops
Alluvial Soil	Deposition of sediments by rivers.	Inland alluvium in Punjab, Haryana, U.P., Bihar, West Bengal, parts of Gujarat and Rajasthan. Deltaic alluvium in the deltas of Ganga-Brahmaputra, Mahanadi, Godavari, Krishna and Kaveri. Coastal alluvium along the coastal strips of the Peninsula.	Loamy. Coarse and dry in upper reaches of the river and gets finer and moist as the river flows down. Rich in minerals especially Potash and Lime. Poor in Nitrogen and Humus.	Large variety of Rabi and Kharif crops; rice, wheat, sugarcane, cotton, gram and oilseeds; jute in Ganga-Brahmaputra delta.
Black Soil	Residual soils formed by weathering of lava rocks.	Deccan lava tract. Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka, Rajasthan, Uttar Pradesh and parts of Tamil Nadu.	Clayey. Black in colour. Rich in lime, Magnesium. Poor in Phosphorous, Nitrogen and Organic matter. Very fertile.	Cotton, cereals, oilseeds, citrus fruits and vegetables, tobacco, and sugarcane.
Red Soil	Prolonged weathering of crystalline rocks. Differs on the basis of parent rock material and climatic conditions.	Plateau region of Peninsular India extending northwards along Konkan coast. Tamil Nadu, Karnataka, Andhra Pradesh, South-East Maharashtra, Chhattisgarh, parts of Odisha, Jharkhand, Bundelkhand, Meghalaya, Mizoram, Manipur, Telangana and Nagaland.	Loamy or Sandy. Red in colour due to large amounts of iron-oxides Deep and fertile in lowland; thin and poor in highlands. Poor in Nitrogen, Phosphorus, Potassium and Organic matter.	Vegetables, rice, ragi, tobacco, groundnut and potatoes.
Laterite Soil	Due to leaching in areas of heavy rain.	Highland areas of Peninsular plateau. Patches in Madhya Pradesh, Odisha, Maharashtra, West Bengal, Andhra Pradesh, Telangana, Karnataka, Kerala, and Tamil Nadu.	Coarse and porous. Red due to Iron Oxide. Poor in Lime, Nitrogen and Magnesium. High acidity and low moisture retention.	Tapioca, cashewnuts. With manure ragi, rice, sugarcane, tea, rubber and coffee.





Jowar Producing Areas



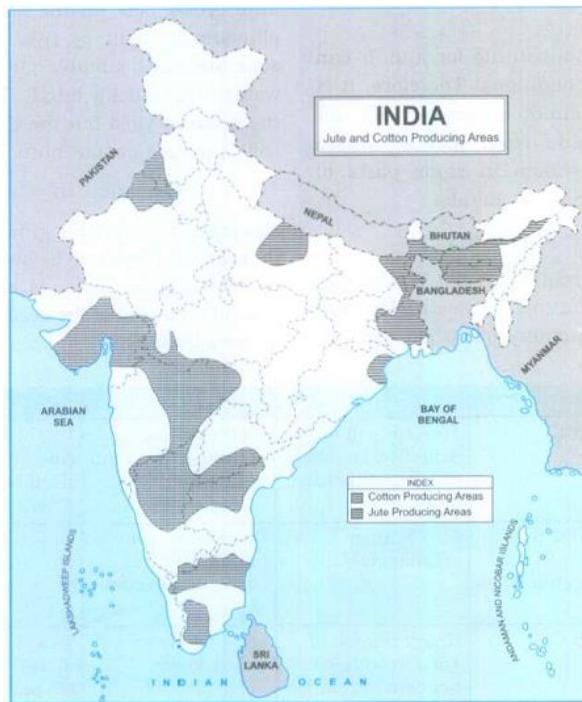
Bajra Producing Areas



Ragi Producing Areas



Sugarcane Producing Areas



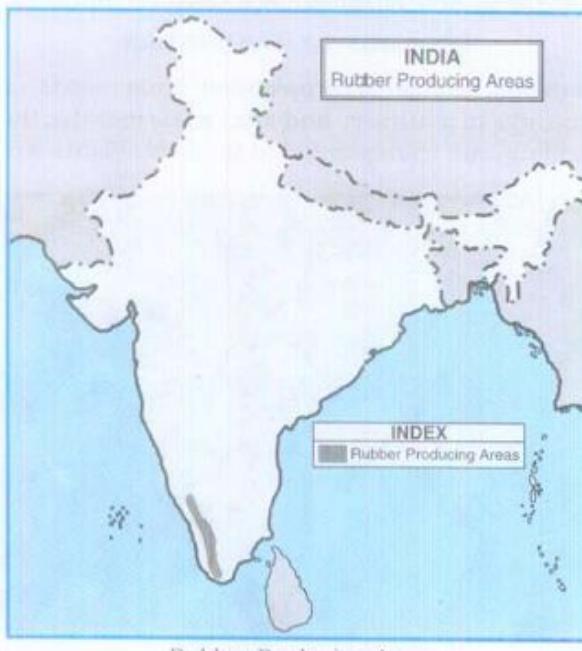
Cotton and Jute Producing Areas



Tea Producing Areas



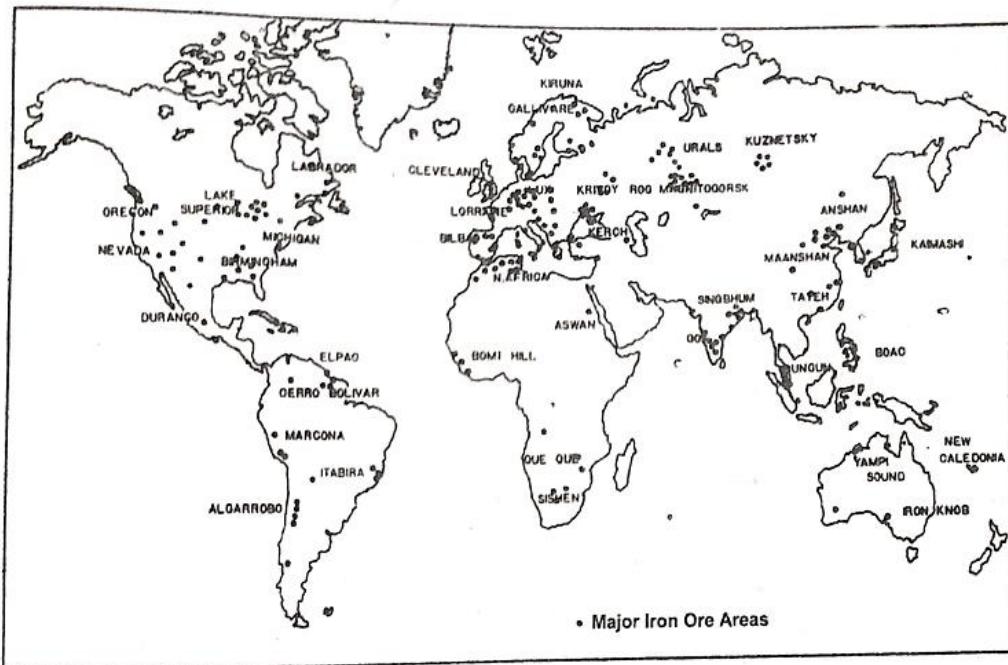
Coffee Producing areas



Rubber Producing Areas

World locations of minerals and energy resources

1. Iron Ore



- **North America:** Lake Superior region, NE USA, Labrador, Newfoundland
- **South America:** Itabira (Brazil), Cerro Bolivar (Venezuela)
- **Europe:** Kiruna & Gallivare (Sweden), Bilbao (Spain)
- **Africa:** Bomi hills (Liberia), Postmasberg & Transval (South Africa)
- **Asia:** Krivoy Rog, Kerch (Ukraine) , Kuzbas, Magnetogorsk (Siberia), machuria (China)
- **Australia:** Iron knob, Mt.Goldsworthy

2. Manganese



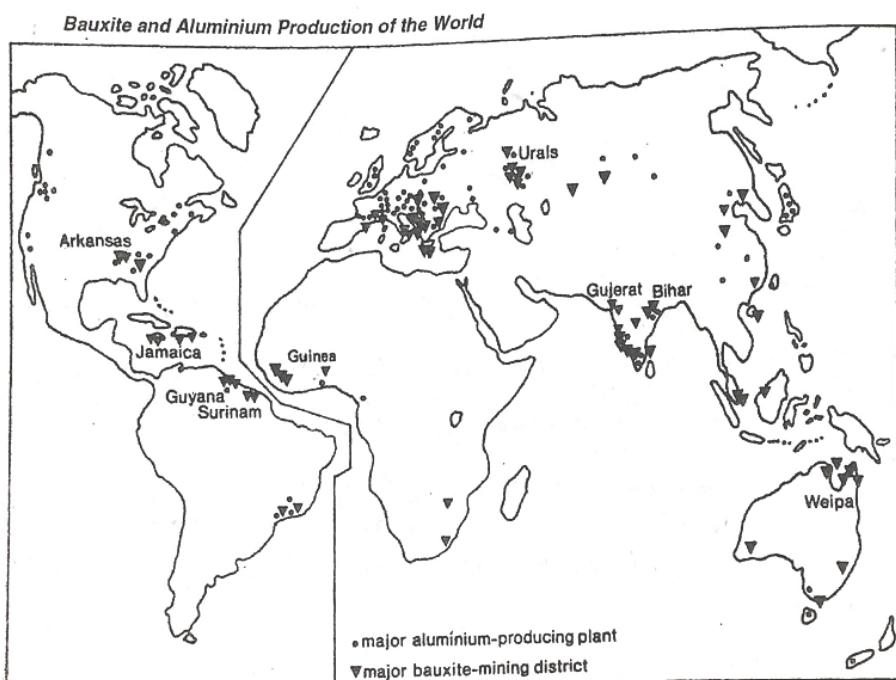
- **South America:** Macapa, Minas Gerais (Brazil), Western Mato Grosso
- **Africa:** Zaire, Postmasberg (South Africa)
- **Asia:** Nikopol and Tokmak (Ukraine), Chiatura (Georgia), Urals

3. Copper



- **North America:** Sudbury, Lynn Lake (Canada)
- **South America:** Casapalco (Peru), Chuquicamata & San Jose (Chile)
- **Africa:** Katanga
- **Asia:** Lake Balkash (Russia), Ulanbatore (Mongolia)

4. Bauxite (Aluminium)



- **North America:** Alabama, Arkansas (USA)
- **South America:** Jamaica, Guyana, Surinam
- **Europe:** France, Hungary
- **Africa:** Guinea
- **Asia:** Urals, Krasnaya (Russia)
- **Australia:** Weipa, Cape York, Darling range

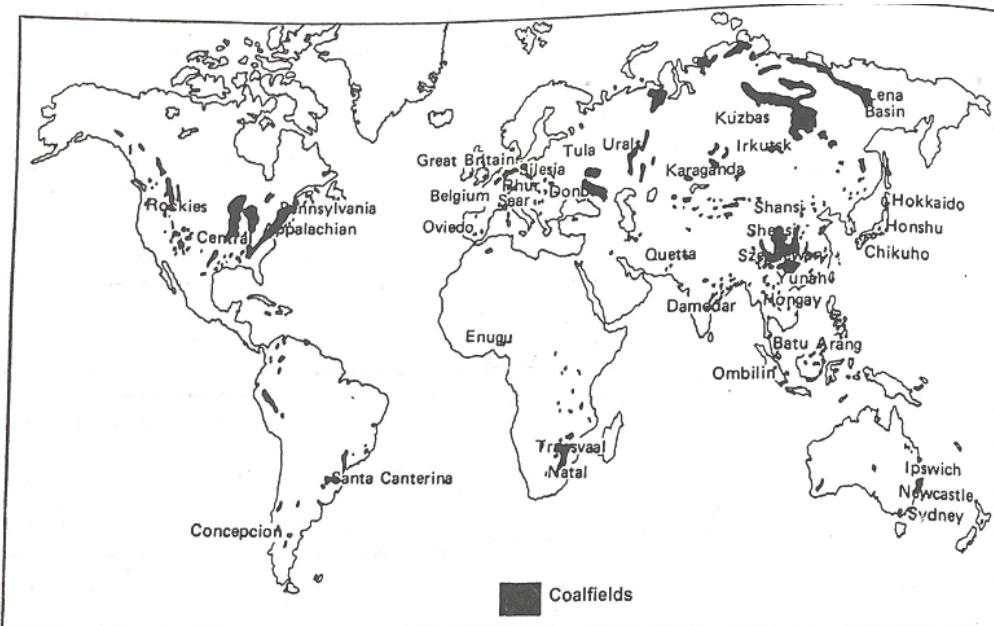
5. Gold and silver

- **North America:** Yellow knife (Canada), California, Alaska (US)
- **Africa:** Witwatersrand (South Africa)
- **Asia:** Kolyma river, Lake Baikal
- **Australia:** Kalgoorlie and Coolgardie

6. Tin

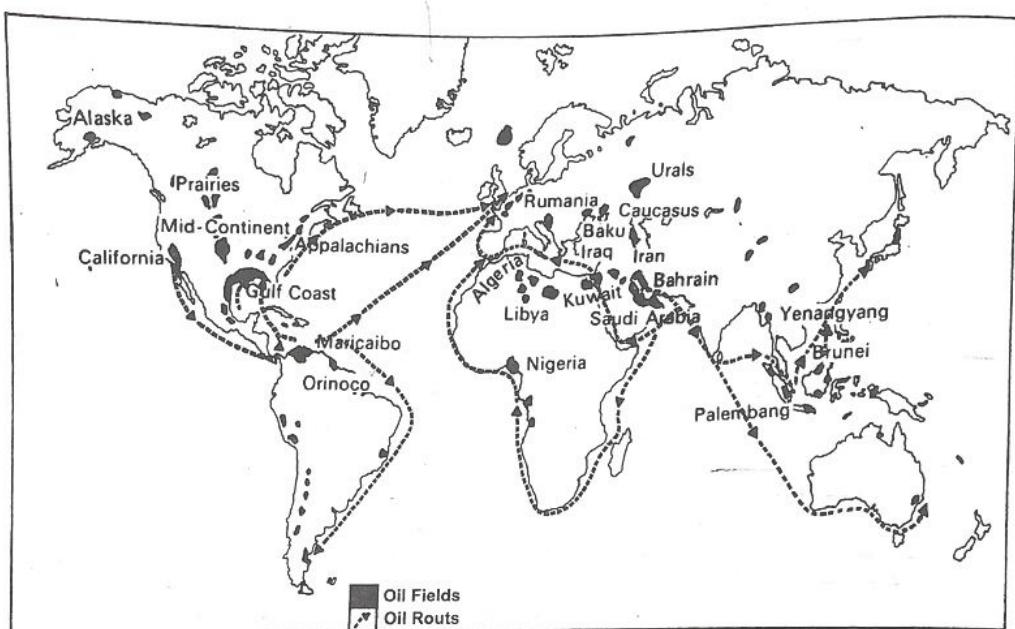
- **Africa:** Jos plateau (Nigeria)
- **Asia:** Kinta valley, Kelang valley (Malaysia), Kra peninsula, Phuket island (Thailand), Sumatra (Indonesia)

7. Coal



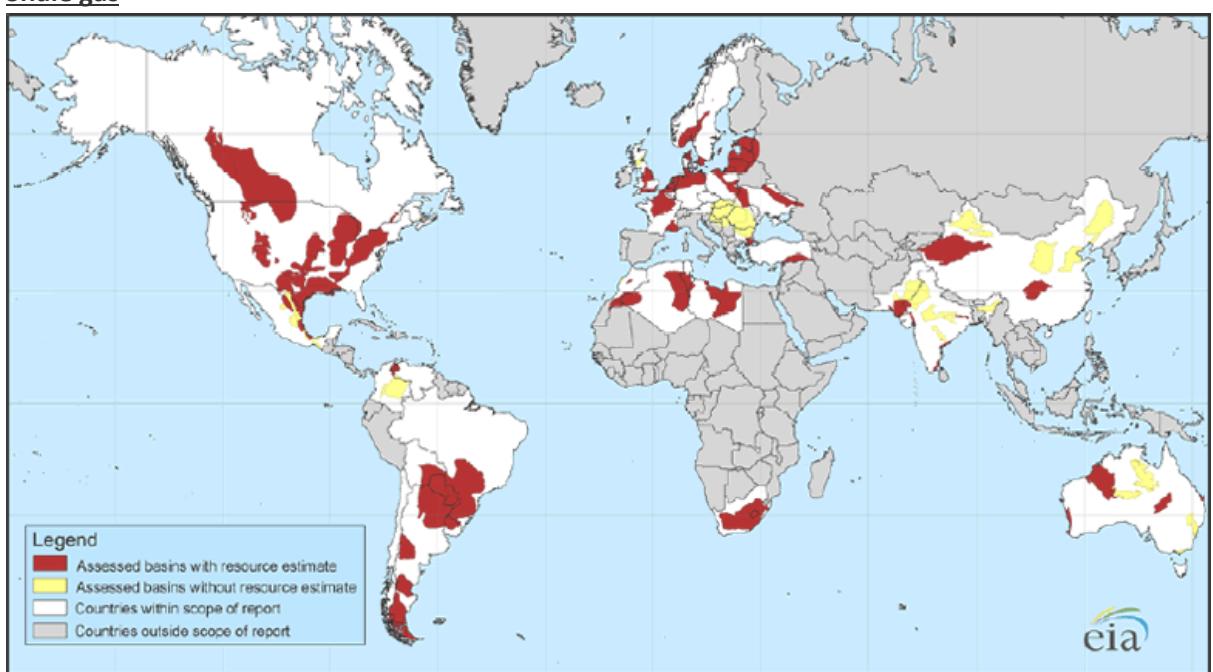
- **North America:** Pennsylvania, Appalachian, Rockies, Mexican gulf (USA), Vancouver, Nova scotia (Canada)
- **South America:** Santa Caterina (Brazil), Concepcion (Chile)
- **Europe:** Great Britain, Ruhr & Saar (Germany), Spain
- **Africa:** Zambia, Zimbabwe, Enugu (Nigeria), Transval & Natal (South Africa)
- **Asia:** Donetsk, Donbas, Moscow – tula, Kuzbas, Urals, Lena (Russia), Shanxi, Shantung, Yunnan (China)
- **Australia:** Ipswich, New castle

8. Petroleum



- **North America:** Gulf coast, Appalachian, California, Alaska (USA), Prairies, Edmonton, Calgary (Canada)
- **South America:** Maracaibo, Orinoco basin (Venezuela), Magdalena (Columbia), Punta Arenas (Chile), Falkland
- **Europe:** North Sea, Norway
- **Africa:** Algeria, Libya, Nigeria – Niger delta
- **Asia:** Dhaharan, Quatif (Saudi Arabia), Mosul, Kirkuk, Zubair (Iraq), Masjid Sulaiman (Iran), Kuwait, Bahrain, Qatar, Abudabhi (UAE); Baku (Azerbaijan), Urals, Caucasus, Caspian sea, NW Siberia, Sakhalin (Russia); Sumatra, Borneo (Indonesia); Brunei; Sarawak, Sabah (Malaysia), China

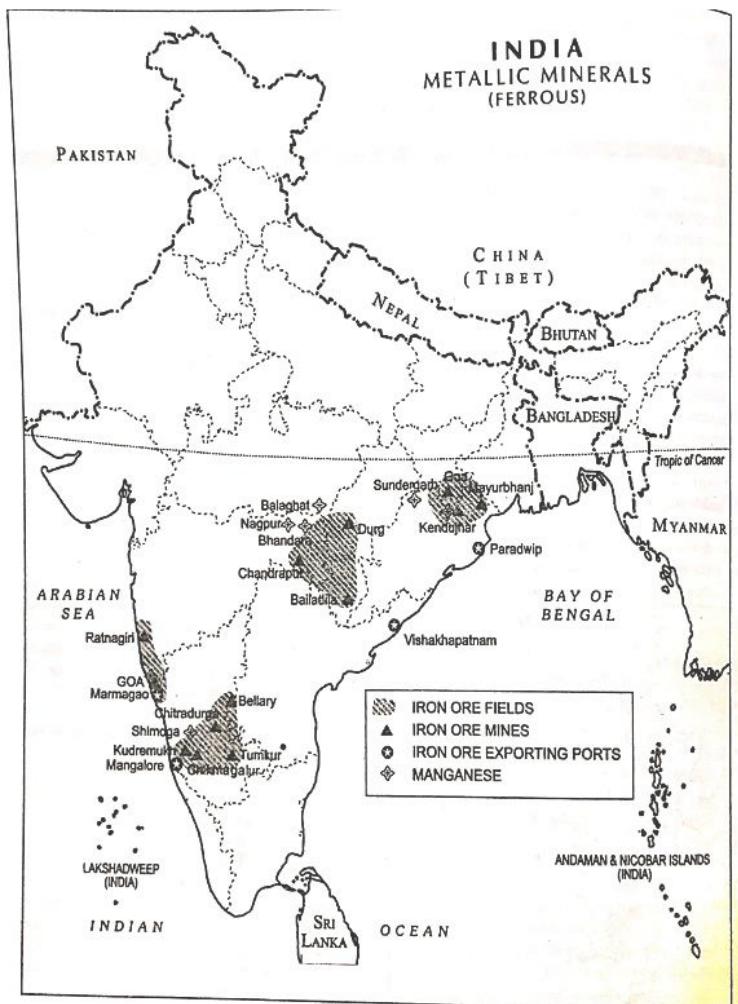
9. Shale gas



- China, Argentina, Algeria, USA, Canada, Mexico, Australia, South Africa, Russia, Brazil

India – Mineral and Energy resources

1. Iron

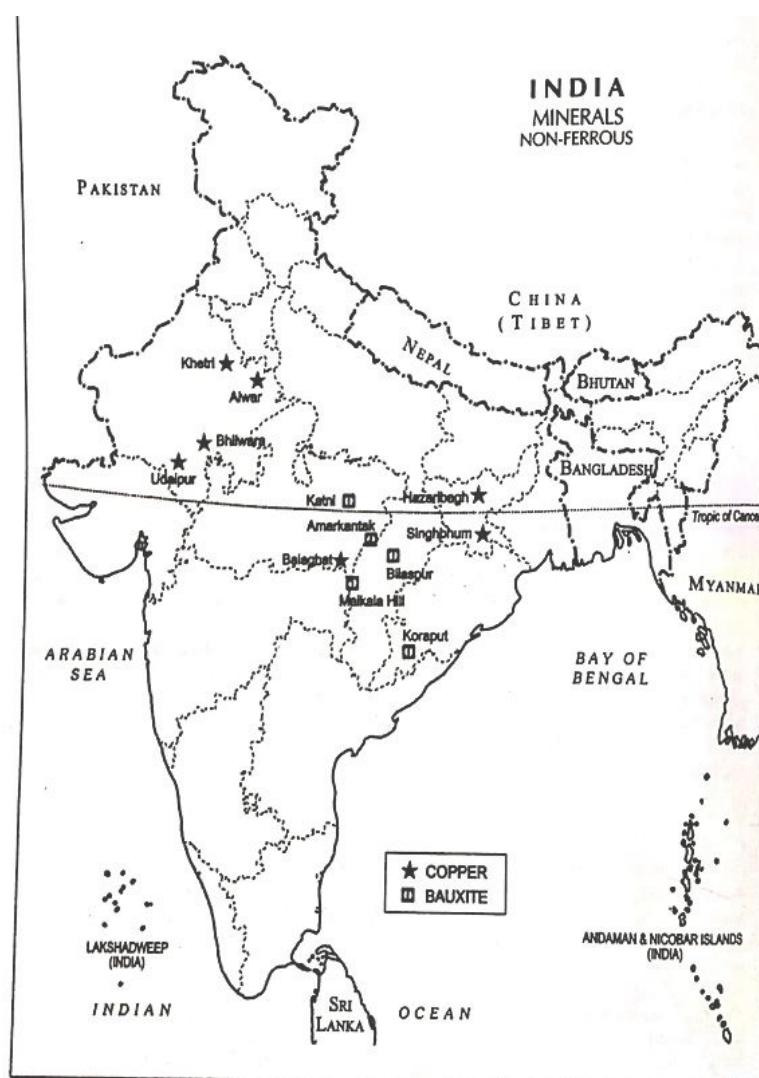


- ✓ Odisha: Gurumahisani, Sulepat and Badam Pahar in Mayurbhanj district; Baramjader group extended in Keonjhar and Sundargarh districts.
- ✓ Singhbhum district of Jharkhand
- ✓ Bailadilla of Bastar district in Chhattisgarh;
- ✓ Sandoor Hills at Bellary - Hospet region and Bababudan Hills at Chikmaglur district in Karnataka;

2. Manganese

- ✓ Keonjhar and Karaput region in Orissa
- ✓ Balaghat and Chindwara in Madhya Pradesh
- ✓ Nagpur and Bhandara in Maharashtra
- ✓ Panchmahal in Gujarat
- ✓ Vishakhapatnam and Srikakulam in Andhra Pradesh
- ✓ Singhbhum in Jharkhand
- ✓ Udaipur and Banswara in Rajasthan

3. Copper



- ✓ Singhbhum in Jharkhand;
- ✓ Jhunjhunu, Bhilwara, Alwar and Udaipur in Rajasthan; Khetri Mine in Rajasthan has been a major copper extracting region since the age of Indus valley civilization.
- ✓ Balaghat in Madhya Pradesh;
- ✓ Guntur and Nellore districts in Andhra Pradesh.

4. Bauxite

- ✓ Ranchi and Palamau in Jharkhand
- ✓ Sarguja, Shahdole, Durg and Balaghat in Madhya Pradesh;
- ✓ Kolaba, Thane and Ratnagiri in Maharashtra;
- ✓ Belgaon and Bababudan Hills in Karnataka;
- ✓ Palni, Javdi and Shevaroy hills regions in Tamil Nadu

5. Mica

- ✓ Muscovite and Biotite types of mica are extracted from Hazaribagh, Singhbhum and Palamu districts.
- ✓ Other major mica producing regions are Gaya and Munger in Bihar
- ✓ Nellore and Khammam in Andhra Pradesh
- ✓ Udaipur and Bhilwara districts in Rajasthan.

6. Coal



Coal Distribution in India

- ✓ The main regions of Gondwana rocks are found in West Bengal, Jharkhand and Orissa from where 76% of the total coal production is found.
- ✓ The first effort made to extract coal with modern technology in India was at Raniganj coal region in West Bengal. Raniganj area of West Bengal, located in upper valley of Damodar river, is the most important and the largest coal area of India.
- ✓ A good quality of Bituminous coal is found in Jharia, Bokaro, Giridih, Karanpura, Ramgarh, etc. of Jharkhand.
- ✓ Tatapani-Ramkola of Chhattisgarh
- ✓ Talchar- coal area of Orissa (Brahmani river valley)

- ✓ Singreni coal areas (Krishna Godavari river valley) of Andhra Pradesh are other major important area of coal.
- ✓ Tertiary coal is found in Neyveli (Tamil Nadu, famous for Lignite) and Palana (Rajasthan).

Table 11.1. Gondwana Coalfields

State	River Valley	Coalfields
1. Jharkhand	Damodar	Jharia, Karpura, Ramgarh, East and West Bokaro, Giridih, Auranga, Hutar and Daftonganj.
2. Odisha	Mahanadi	Sambalpur, Sundargarh and Talcher.
3. Madhya Pradesh	Mahanadi/Son	Singrauli, Narsingpur, Chhindwara, Betul.
4. Chhattisgarh	Mahanadi/Son	Sarguja, Sendurgarh, Rampur, Korba and Raigarh.
5. Maharashtra	Godavari	Kamptee, Wardha valley, Chandrapur and Yavatmal.
6. Andhra Pradesh	Godavari	East and West Godavari.
7. Telangana	Godavari	Adilabad, Khammam and Warangal.
8. West Bengal	Damodar	Raniganj, Bardhaman, Bankura, Purulia, Darjeeling and Jalpaiguri.

7. Petroleum and Natural Gas



- ✓ Assam region: Digboi, Naharkatiya, Hagriyan-Moran and Surma river valley. Natural gas is also found in Bagrijan-Moran area.
- ✓ Gujarat region: Khambat and Ankleshwar while oil regions are extended upto Navgaon, Kosamba, Olpad, Dholka, Mehsana, Kalal etc.
- ✓ Mumbai High region, 176 km away from the Mumbai coast
- ✓ Region off-shore in Krishna - Godavari river valley.

8. Shale gas

Prospective basins for phase 1 shale oil and gas exploration



India – Industrial regions





FIG. 27.17. India : Distribution of Sugar Industry



Metal Based Industries

Major Industries in India

Industry	States and Main Centres of Production
1. Iron and Steel	<ol style="list-style-type: none"> 1. Tata Iron and Steel Company (TISCO) — Jamshedpur, Jharkhand 2. Bokaro Steel Plant — Hazaribagh, Jharkhand. 3. Durgapur Steel Plant — Burdwan, West Bengal. 4. Bhilai Iron and Steel Plant — Durg, Chhattisgarh. 5. Rourkela Steel Plant — Sundargarh, Odisha. 6. Indian Iron and Steel Company (IISCO) — IISCO Plants are located at Burnpur, Hirapur and Kulti, near Asansol, West Bengal. 7. Vishvesvaraya Iron and Steel Limited — Shinoga, Karnataka. 8. Vijayanagar Steel Plant — Bellary, Karnataka. 9. Vishakhapatnam Steel Plant — Vishakhapatnam, Andhra Pradesh. 10. Salem Steel Plant — Salem, Tamil Nadu.
2. Heavy Engineering Industry	
(A) Shipbuilding	<ol style="list-style-type: none"> 1. Hindustan Shipyard Limited (HSL) — Vishakhapatnam, Andhra Pradesh. 2. The Cochin Shipyard — Cochin, Kerala. 3. The Garden Reach Workshop — Kolkata, West Bengal. 4. The Mazagaon Dock Limited (MDL) — Mumbai, Maharashtra.
(B) Automobile	<ol style="list-style-type: none"> 1. Bus and Trucks — Pune, Mumbai, Chennai, Kolkata, Jamshedpur, Lucknow, Uttaranchal. 2. Jeeps — Jabalpur (MP), Mumbai. 3. Cars — Gurgaon (Haryana), Kolkata, Chennai, Mumbai, Bengaluru, Sanand (Gujarat). 4. Two and Three Wheelers — Mumbai, Pune.
(C) Railway Locomotives	<ol style="list-style-type: none"> (i) The Chittaranjan Locomotive Works — West Bengal; (ii) The Diesel Locomotive Works — Varanasi (UP); (iii) The Integral Coach Factory — Perambur, Chennai; (iv) The Rail Coach Factory — Kapurthala, Punjab.
(D) Aircraft	<ol style="list-style-type: none"> (i) The Hindustan Aeronautics Ltd. (HAL) — Nasik, Koraput, Hyderabad, Kanpur, Lucknow, Bengaluru.
(E) Heavy Electrical	<ol style="list-style-type: none"> (i) The Heavy Electrical Ltd. — Bhopal, Madhya Pradesh; (ii) The Bharat Heavy Electrical Ltd. — Haridwar (UP), Ramchandrapuram (Telangana), Tiruchirapalli (Andhra Pradesh); (iii) The Hindustan Cables Factory — Jhansi (UP) and Rupnarainpur, West Bengal.
(F) Heavy Machines and Tools	<ol style="list-style-type: none"> (i) The Hindustan Machine Tools (HMT) — Bengaluru, Karnataka; (ii) The Heavy Machine Tools Plant — Ranchi, Jharkhand; (iii) The Machine Tool Corporation of India — Ajmer, Rajasthan; (iv) The Praga Tools Ltd., — Secunderabad, Andhra Pradesh; (v) The National Instruments Factory — Kolkata, West Bengal.
3. Electronics	<ol style="list-style-type: none"> (i) The Indian Telephone Industries (ITI) — Bengaluru, Karnataka; (ii) The Electronics Corporation of India Ltd. (ECIL) — Hyderabad, Andhra Pradesh; (iii) The Bharat Electronics Ltd. (BEL) — Bengaluru, Karnataka.

4. Space Technology	1. The Indian Space Research Organisation (ISRO) , — Bengaluru, Karnataka. 2. Satellite Launching Station — Sriharikota, Andhra Pradesh. 3. National Remote Sensing Agency — Hyderabad, Andhra Pradesh. 4. Chandrayaan-I — India's First Scientific Mission to Moon.
5. Software Industry	Bengaluru and Hyderabad.
6. Entertainment	Mumbai, Kolkata, Chennai and Pune
7. Petrochemical Industry	1. Herdillia Chemicals Ltd. — Chennai, Tamil Nadu. 2. National Organic Chemicals Industries Ltd. — Mumbai, Maharashtra. 3. Petrofils Cooperative Limited (PCL) — Three plants located at Vadodara and Naldhara in Gujarat. 4. Indian Petrochemical Corporation Ltd. — Vadodara, Gujarat. 5. The Bongaigaon Petrochemicals Ltd. — Bongaigaon, Assam. 6. The Reliance Industries : Hazira, Gujarat. 7. Haldia Petrochemicals Ltd. : Haldia, West Bengal. 8. The Indian Oil Corporation : Three plants in Gujarat and Panipat.



World locations – industries

➤ North America:

USA

- ✓ Pittsburgh – Iron and Steel capital of the world
- ✓ Los Angeles – Hollywood
- ✓ Chicago – Meat processing
- ✓ Detroit – Automobile
- ✓ San-Francisco – IT
- ✓ Seattle – Lumbering and aluminium industry

Canada

- ✓ Montreal – Ships and aircraft
- ✓ Quebec – Ships
- ✓ Ottawa – Paper
- ✓ Toronto – Engineering and Automobile

➤ South America:

Brazil

- ✓ Sao Paulo – Textile and coffee
- ✓ Rio de Janeiro – Coffee and textile

Argentina

- ✓ Buenos Aires – Ship building
- ✓ La Plata – Chemical and Iron and steel

Chile

- ✓ Valparaiso – Oil and petroleum

Venezuela

- ✓ Maracaibo – Oil refineries

➤ Europe:

Britain

- | | |
|--------------|---------------------------|
| ✓ Manchester | - Cotton Textile |
| ✓ Liverpool | - Ship Building |
| ✓ London | - Engineering & Transport |

France

- | | |
|--------------------------|------------------------|
| ✓ Paris | - Aircraft & Transport |
| ✓ Champagne and Bordeaux | - Wine & Liquor |
| ✓ Loraine-Saar region | - Iron & Steel |

Germany

- | | |
|-------------|---------------------------|
| ✓ Dortmund | - Iron & Steel |
| ✓ Frankfurt | - Engineering & Transport |

Netherlands

- | | |
|-------------|-------------------------------------|
| ✓ Rotterdam | - Marine Engineering, Ship building |
| ✓ Amsterdam | - Diamond polishing |

Italy

- | | |
|-------------------------------|----------------|
| ✓ Milan (Manchester of Italy) | - Silk Textile |
| ✓ Turin (Detroit of Italy) | - Automobiles |

➤ **Asia:**

Russia

- ✓ Moscow and Gorki - Iron Steel, Chemicals
- ✓ Magnitogorsk - Iron Steel, Oil refining
- ✓ Leningrad (St Petersburg) - Textile, Chemicals, Paper
- ✓ Moscow-Ivanovo - Cotton Textile

Ukraine

- ✓ Kirov Rog-Rostogo - Iron & Steel, Heavy Industries

Japan

- ✓ Nagoya (Detroit of Japan) - Aircraft, Automobile
- ✓ Osaka (Manchester of Japan) - Ships, Iron & Steel
- ✓ Kobe and Kyoto - Ships, Iron & Steel
- ✓ Nagasaki - Iron & Steel, Ship building, Machinery
- ✓ Tokyo - Engineering & Textiles

China

- ✓ Shanghai - Textiles & Machinery
- ✓ Wuhan - Textiles, Ships, Iron & Steel
- ✓ Beijing - Textiles, Machinery
- ✓ Anshan-Mukden (Pittsburgh of China) - Iron & Steel

Economic and Human Geography

Water Resources

Natural Vegetation

Agriculture

Mineral and energy resources

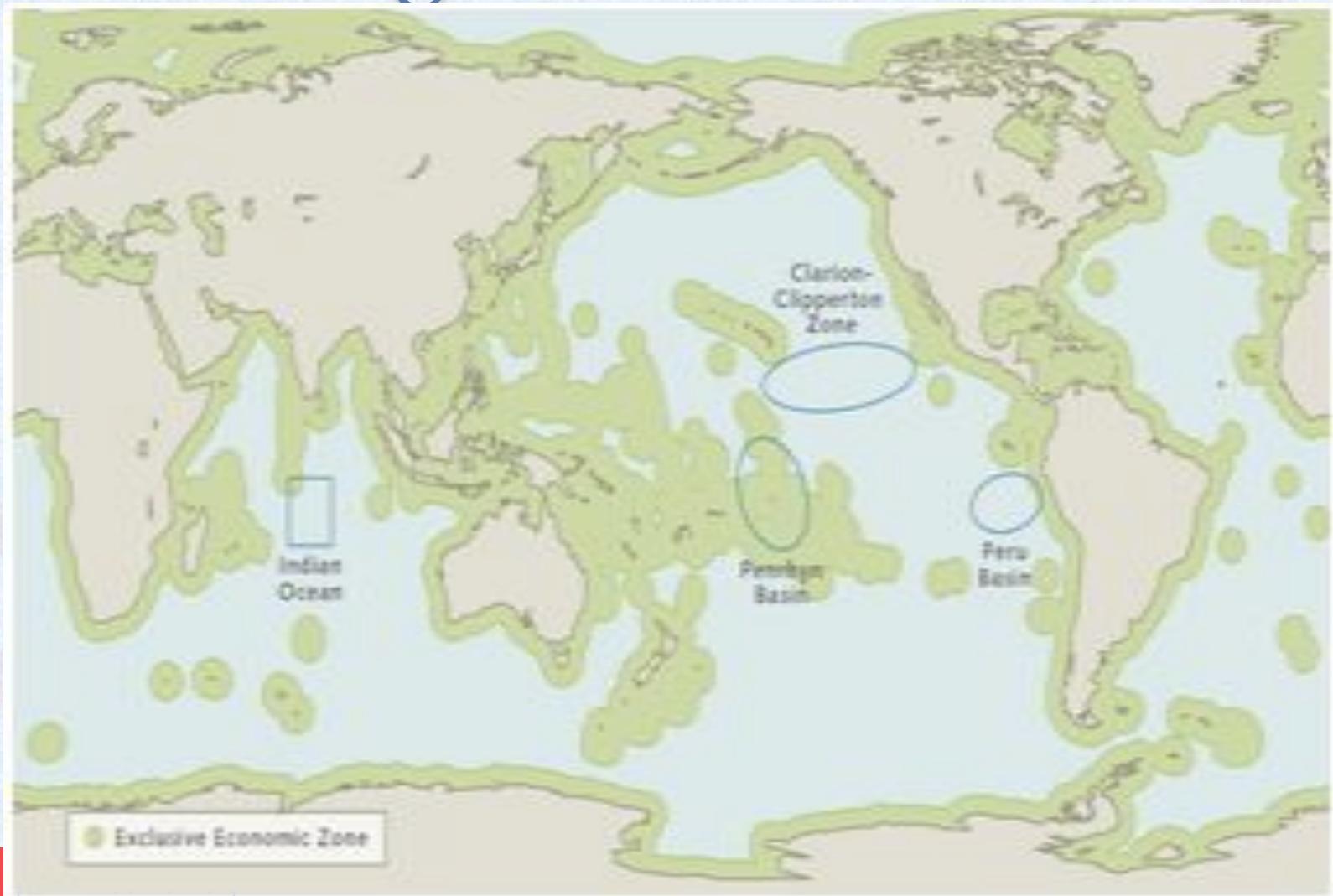
Industries & Transportation

Human Geography

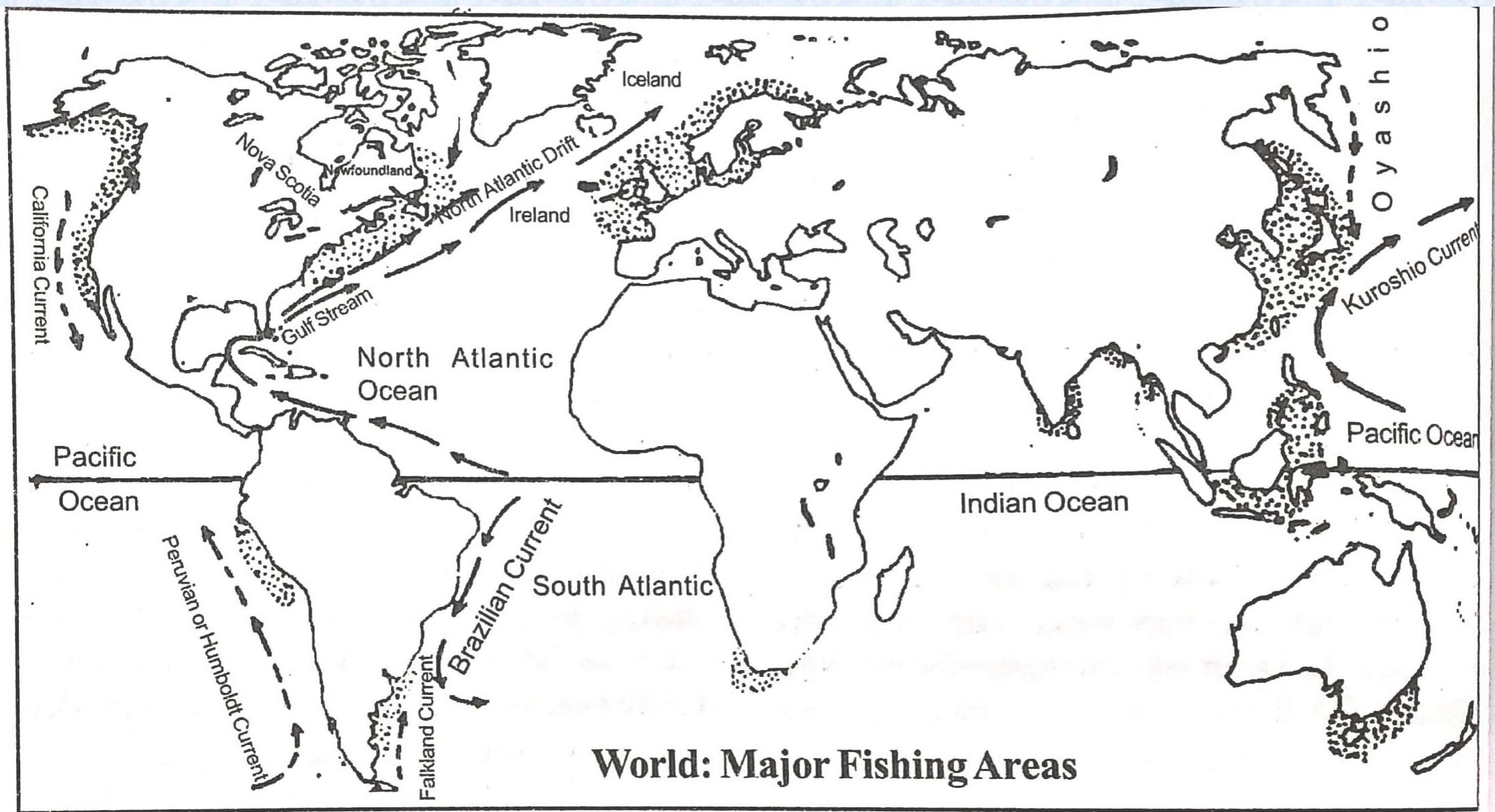
Syllabus

- ❖ Salient features of world's physical geography.
- ❖ Distribution of key natural resources across the world (including South Asia and the Indian sub-continent); factors responsible for the location of primary, secondary, and tertiary sector industries in various parts of the world (including India).
- ❖ Important Geophysical phenomena such as earthquakes, Tsunami, Volcanic activity, cyclone etc., geographical features and their location-changes in critical geographical features (including water-bodies and ice-caps) and in flora and fauna and the effects of such changes.

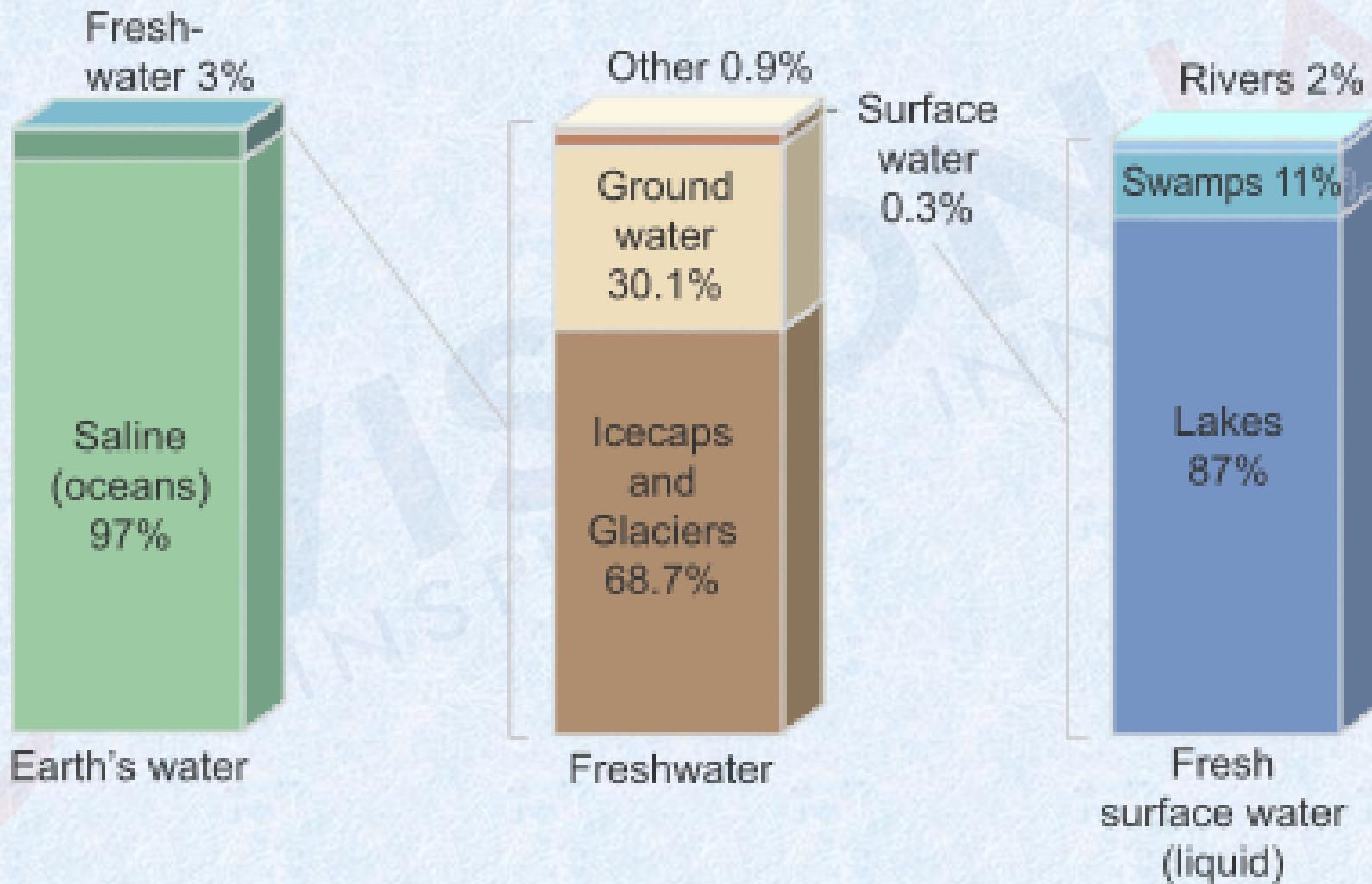
Manganese nodules



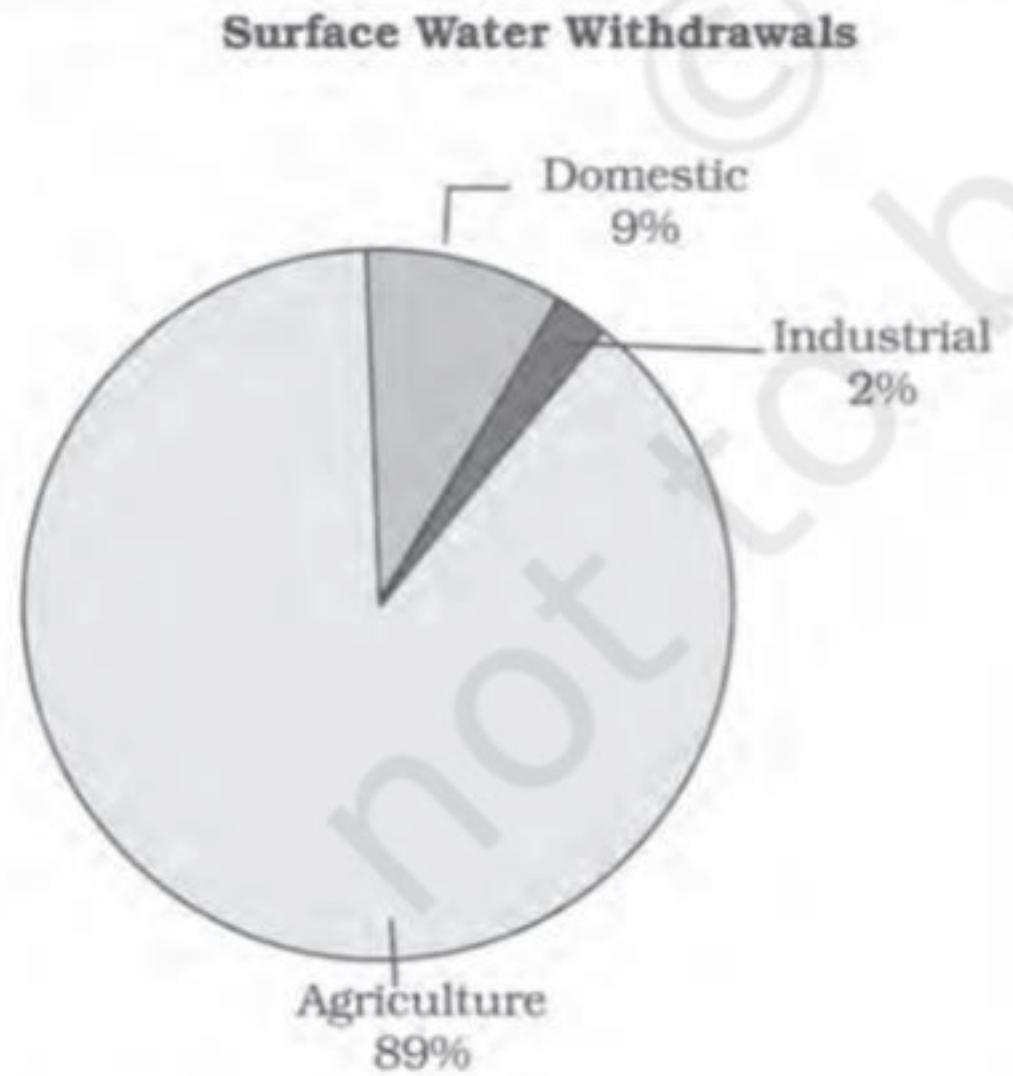




Distribution of Earth's Water







Source: Earth Trend 2001, World Resource Institute, as given in Govt. of India (2002) Report

Fig. 6.2 : Sectoral Usage of Surface Water

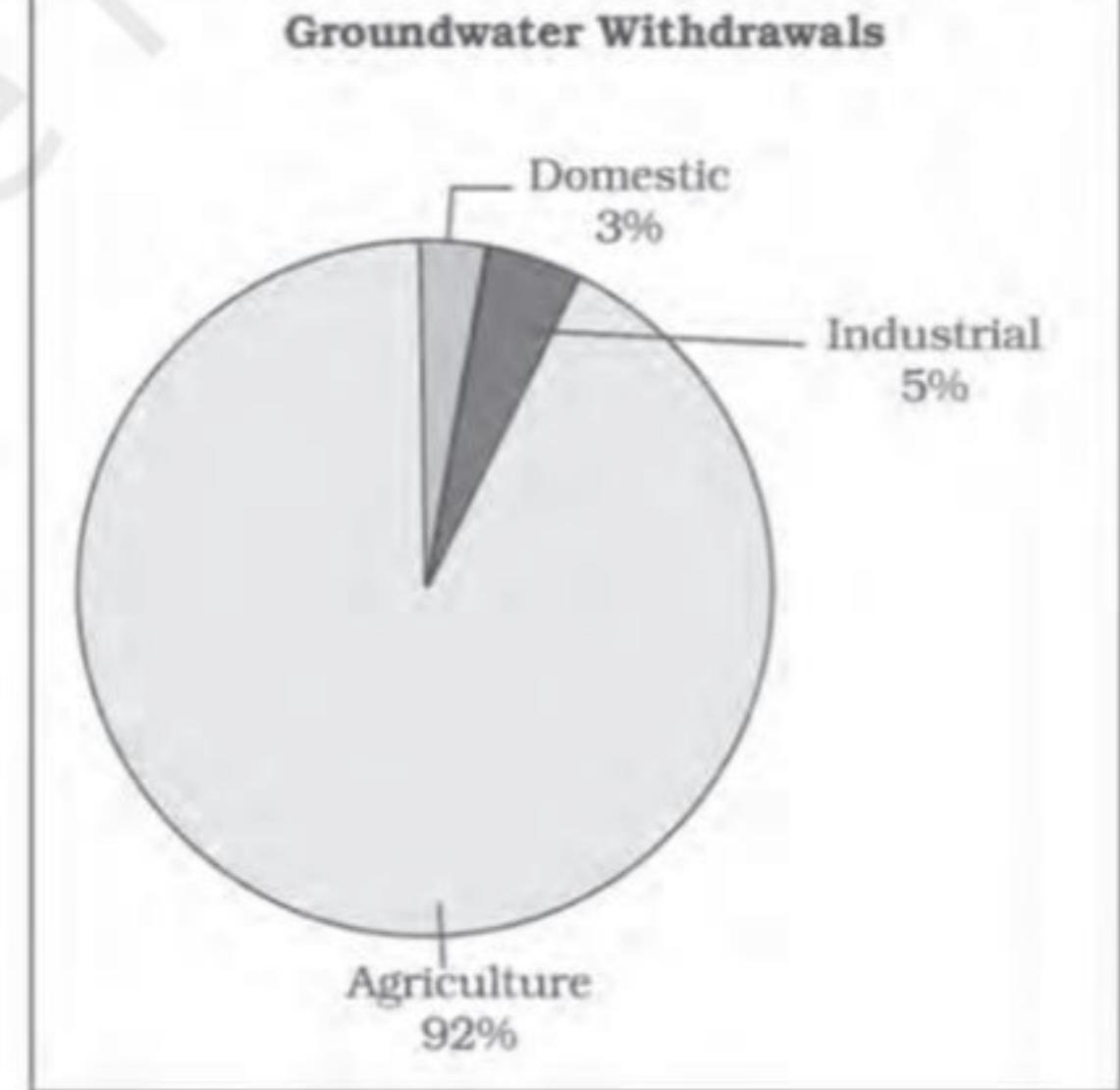
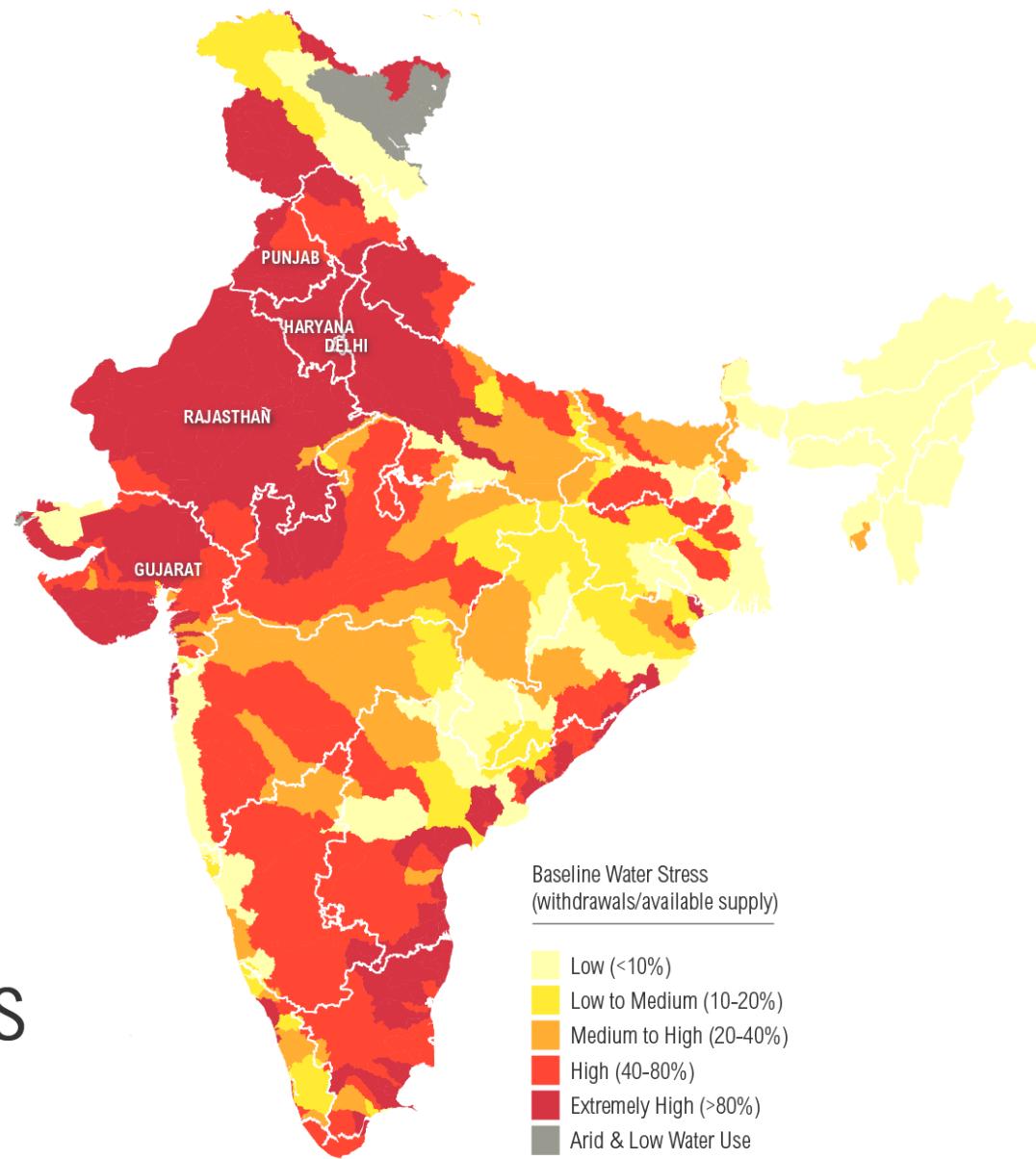


Fig. 6.3 : Sectoral Usage of Groundwater

54%
of India
Faces
High to
Extremely
High
Water Stress



WHAT IS A WATERSHED?

The Making of a River



IAS
AIO

Inter Basin Water Transfer Links

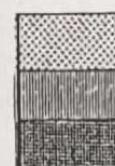
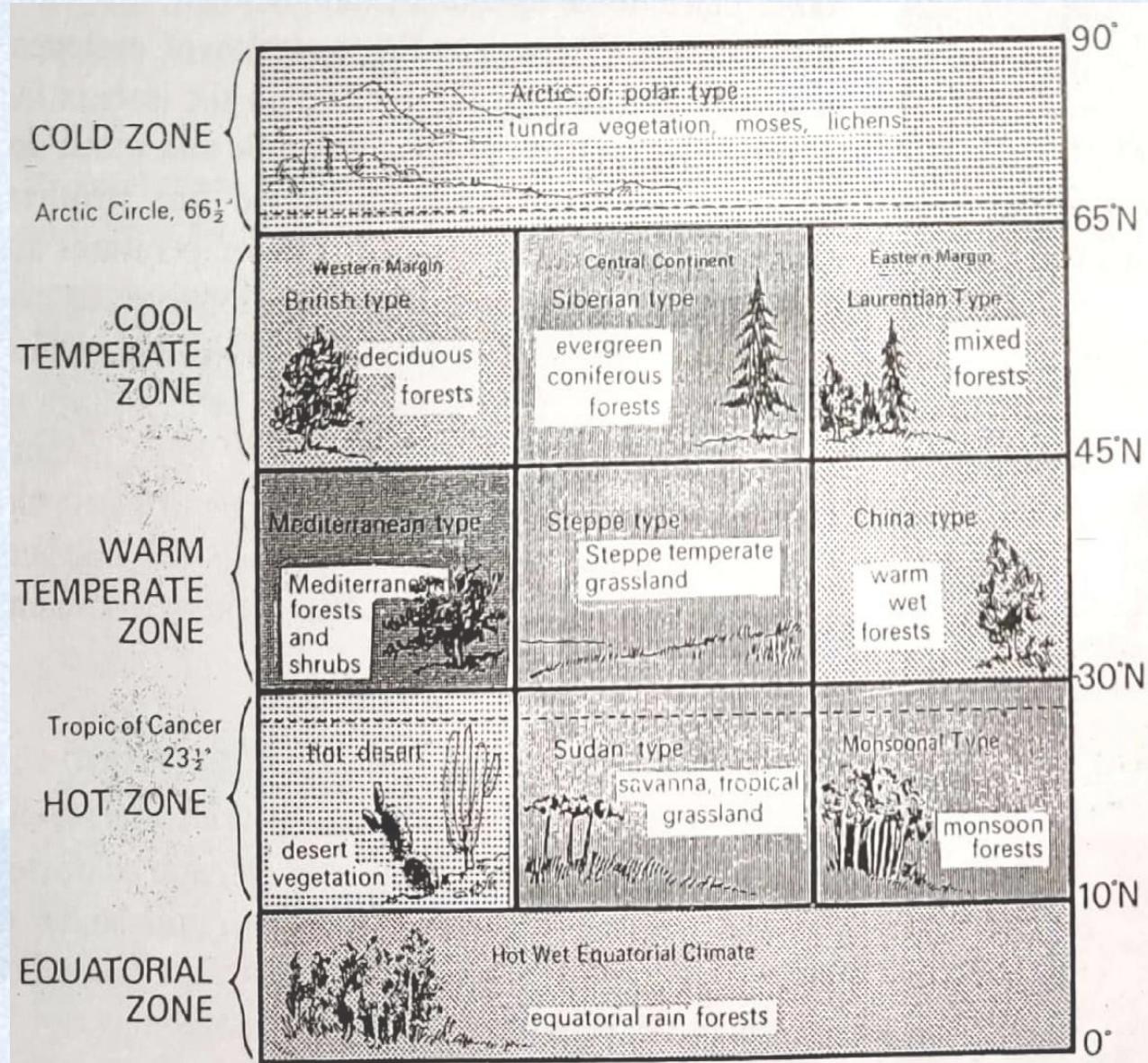


Himalayan component

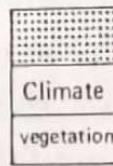
- ① Manas-Sankosh-Tista-Ganga
 - ② Kosi-Ghagra
 - ③ Gandak-Ganga
 - ④ Ghagra-Yamuna
 - ⑤ Sarda-Yamuna
 - ⑥ Yamuna-Rajasthan
 - ⑦ Rajasthan-Sabarmati
 - ⑧ Chunar-Sone Barrage
 - ⑨ Sone dam-southern tributaries of Ganga
 - ⑩ Ganga-Damodar-Subernarekha
 - ⑪ Subernarekha-Mahanadi
 - ⑫ Kosi-Mechi
 - ⑬ Farakka-Sunderbans
 - ⑭ Jogighopa-Tista-Farakka (alternative to ⑬)
- Water transfer link

Peninsular component

- | | |
|---|---|
| <ul style="list-style-type: none"> ⑯ Mahanadi (Manibhadra)-Godavari (Dowlaiswaram) ⑰ Godavari (Inchampalli)-Krishna (Pulichintala) ⑱ Godavari (Inchampalli)-Krishna (Nagarjunasagar) ⑲ Godavari (Polavaram)-Krishna (Vijayawada) ⑳ Krishna (Almatti)-Pennar ㉑ Krishna (Srisailam)-Pennar ㉒ Krishna (Nagarjunasagar)-Pennar (Somasila) ㉓ Pennar (Somasila)-Cauvery (Grand Anaicut) | <ul style="list-style-type: none"> ㉔ Cauvery (Kattalai)-Vaigai-Cundar ㉕ Ken-Betwa ㉖ Parbati-Kalisindh-Chambal ㉗ Par-Tapi-Narmada ㉘ Damanganga-Pinjal ㉙ Bedti-Varda ㉚ Netravati-Hemavati ㉛ Pamba-Achankovil-Yalippar |
|---|---|



Rain all year round
Summer Rain
Winter Rain

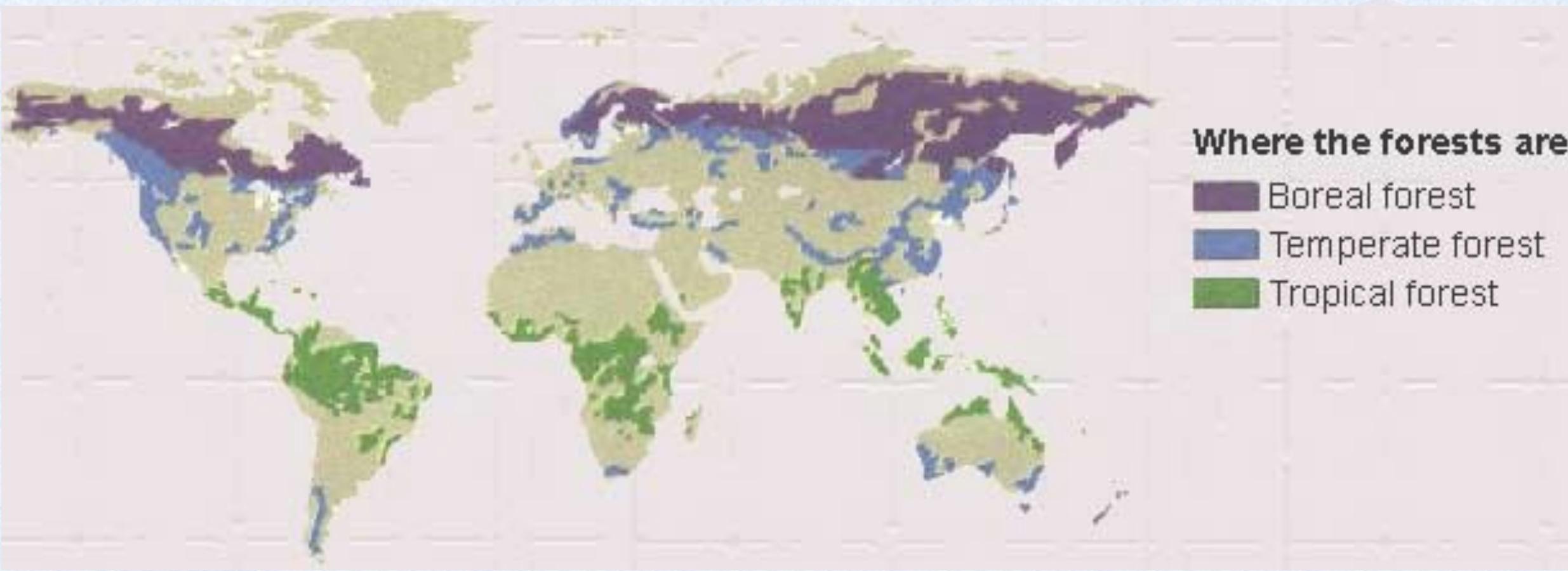


Little Rain at any time
Climate Types written in black
Natural Vegetation

Fig. 120 Scheme of the world's climatic types (with seasonal rainfall and natural vegetation also indicated)

WORLD CLIMATIC TYPES

Climatic Zone	Latitude (approximate)	Climatic Type	Rainfall Regime (with approx. total)	Natural Vegetation
Equatorial Zone	0° – 10°N. and S.	1. Hot, wet equatorial	Rainfall all year round: 80 inches	Equatorial rain forests
Hot Zone	10° – 30°N. and S.	2. (a) Tropical Monsoon (b) Tropical Marine 3. Sudan Type 4. Desert: (a) Saharan type (b) Mid-latitude type 5. Western Margin (Mediterranean type) 6. Central Continental (Steppe type) 7. Eastern Margin: (a) China type (b) Gulf type (c) Natal type	Heavy summer rain: 60 inches Much summer rain: 70 inches Rain mainly in summer: 30 inches Little rain : 5 inches Winter rain: 35 inches Light summer rain: 20 inches Heavier summer rain: 45 inches	Monsoon forests Savanna (tropical grassland) Desert vegetation and scrub Mediterranean forests and shrub Steppe or temperate grassland Warm, wet forests and bamboo
Warm Temperate Zone	30° – 45°N. and S.	8. Western Margin (British type) 9. Central Continental (Siberian type) 10. Eastern Margin (Laurentian type) 11. Arctic or Polar	More rain in autumn and winter: 30 inches Light summer rain: 25 inches Moderate summer rain: 40 inches Very light summer rain: 10 inches	Deciduous forests Evergreen coniferous forests Mixed forests (coniferous and deciduous) Tundra, mosses, lichens
Cool Temperate Zone	45° – 65°N. and S.	12. Mountain climate	Heavy rainfall (variable)	Alpine pastures, conifers, fern, snow.
Cold Zone	65° – 90°N. and S.			
Alpine Zone				



Natural Vegetation of India

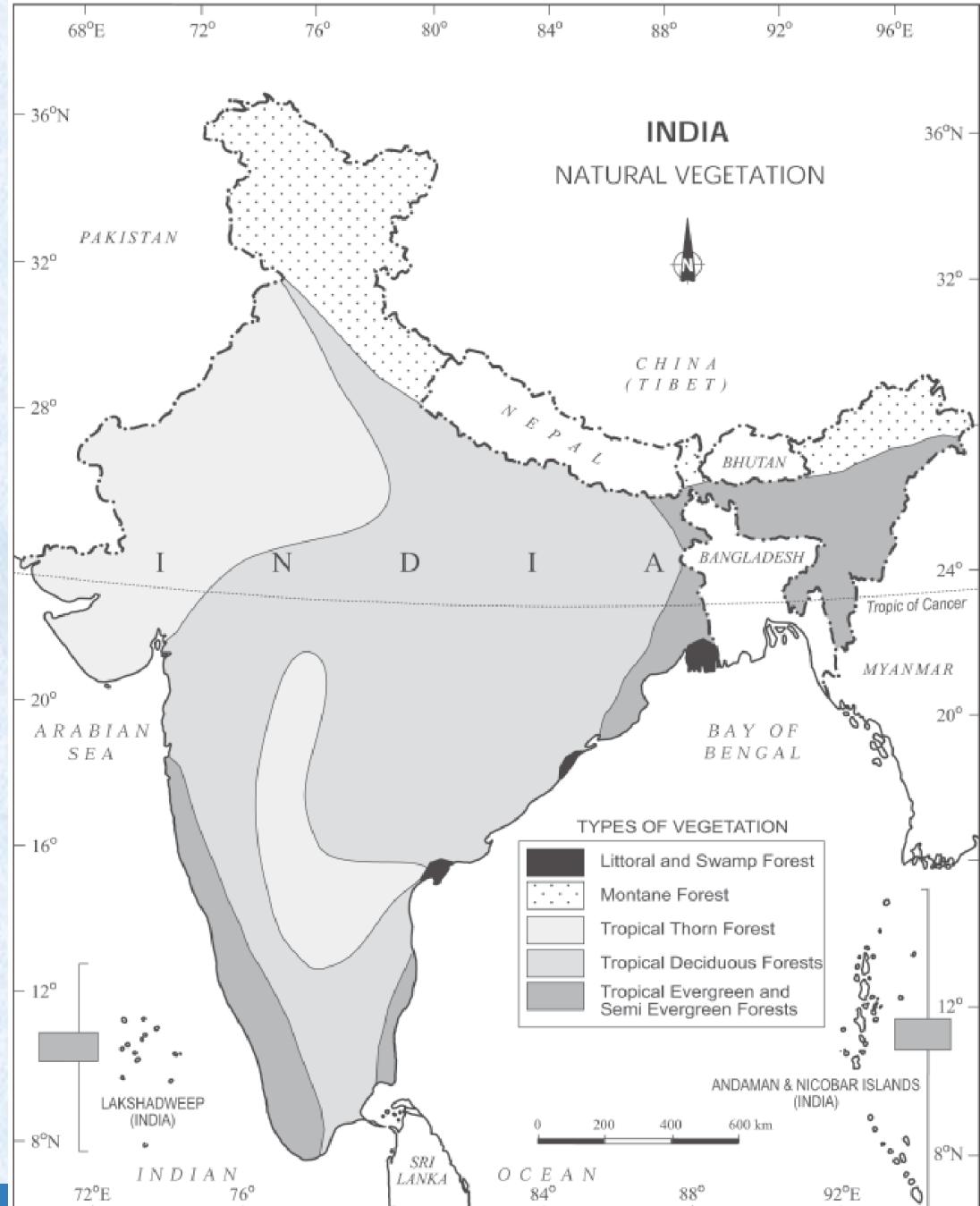
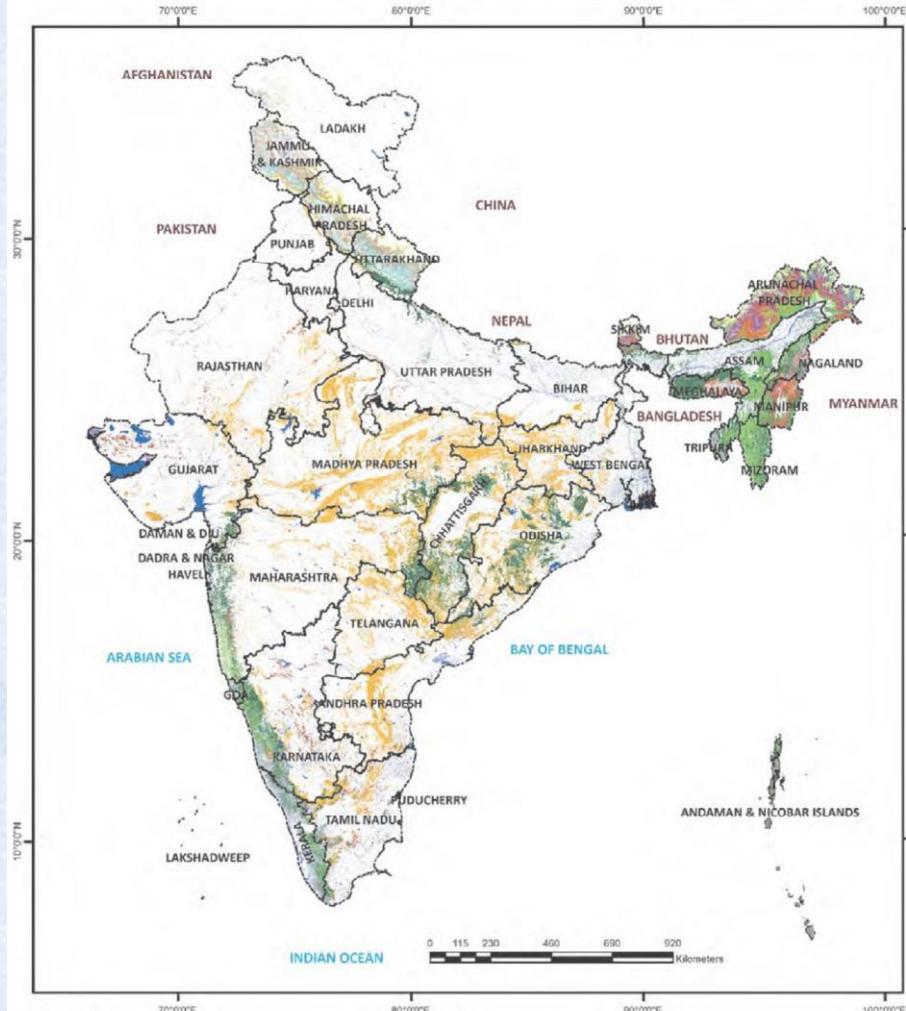


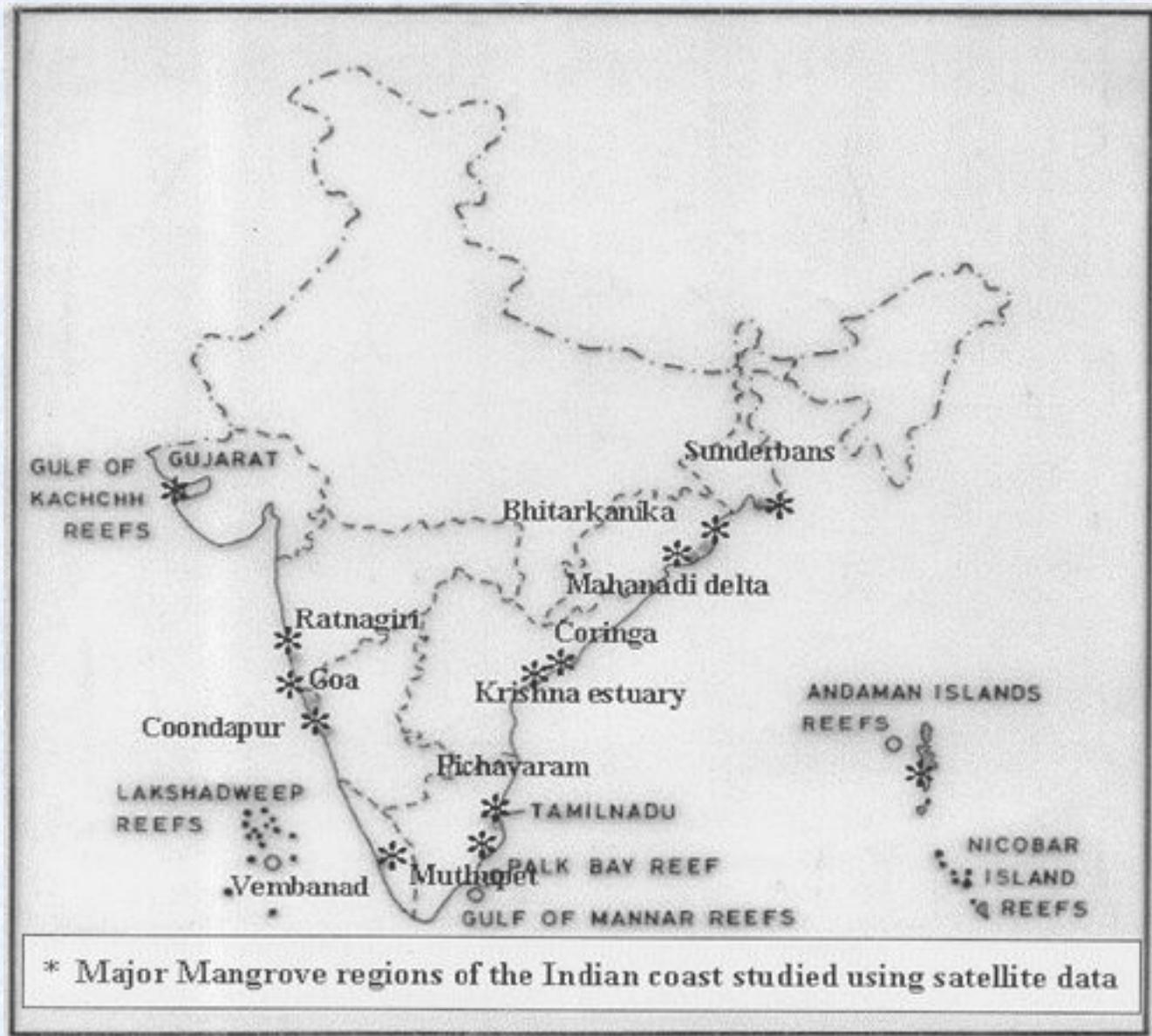
Figure 5.2 : Natural Vegetation

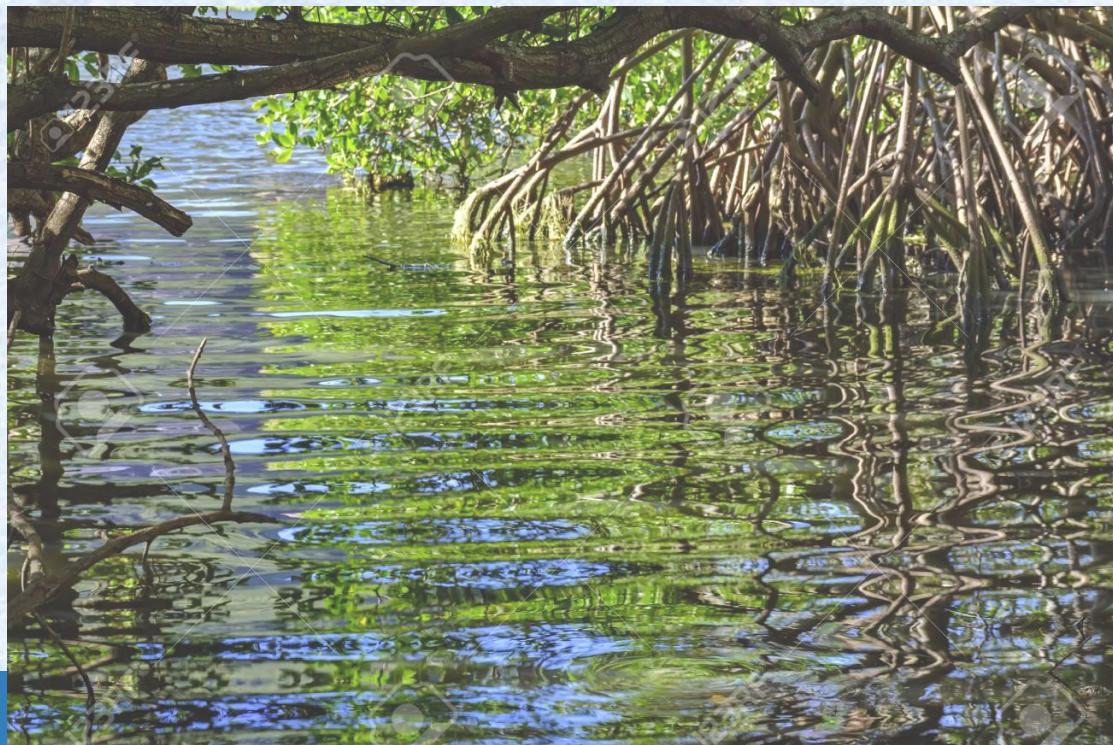


FOREST TYPE MAPPING - 2019
(Showing Type Groups as per Champion & Seth's Classification, 1968)

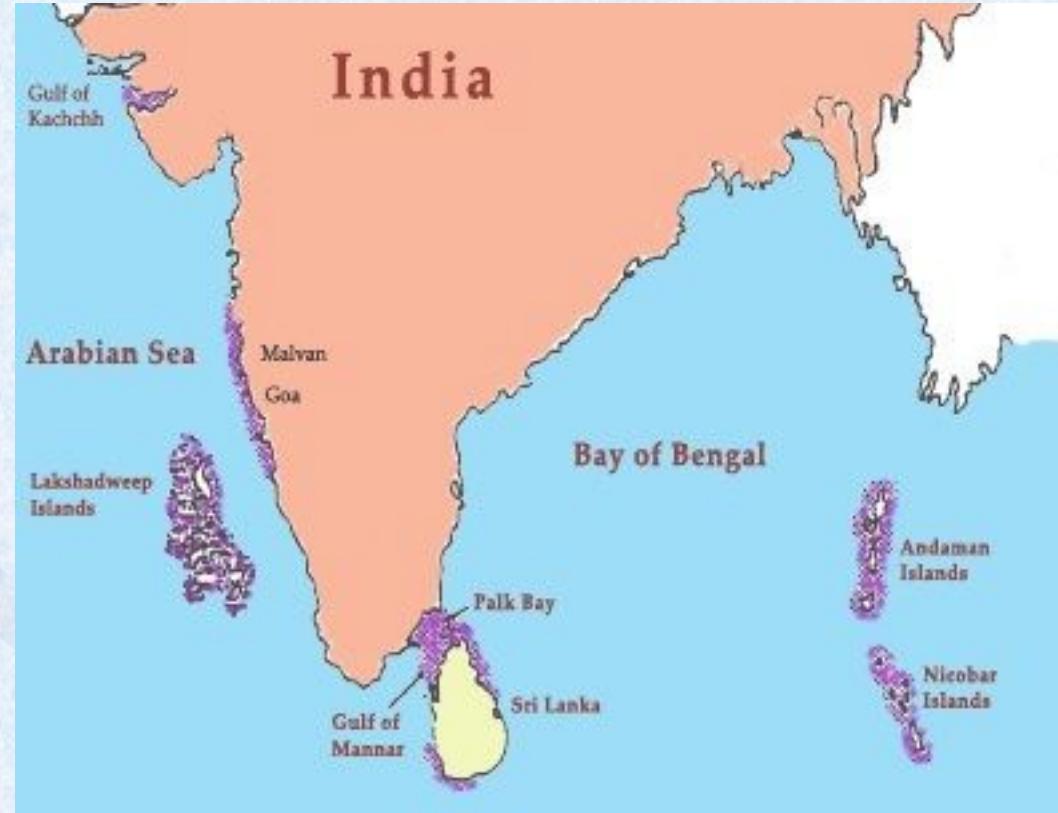












World Agriculture Regions

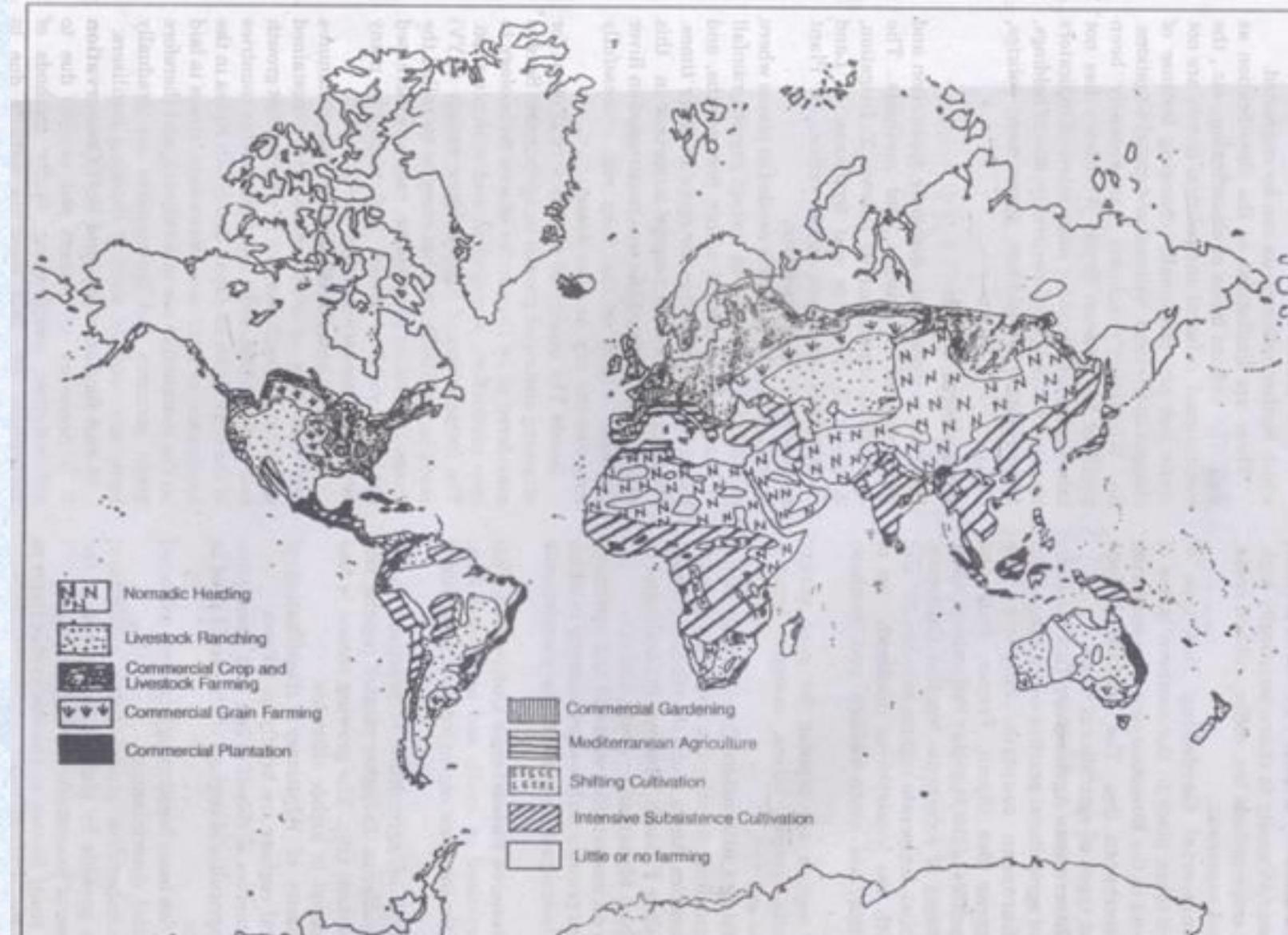
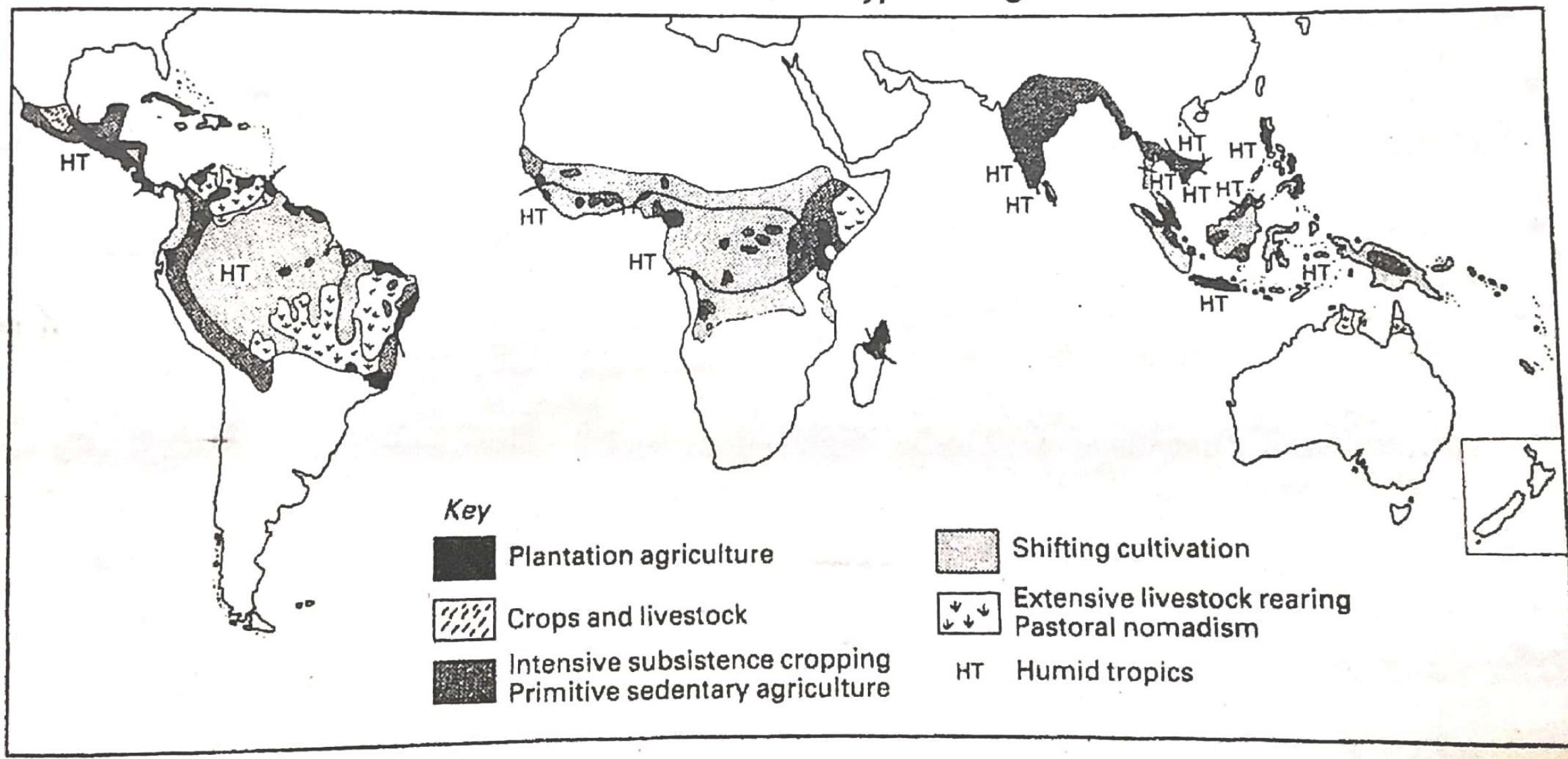
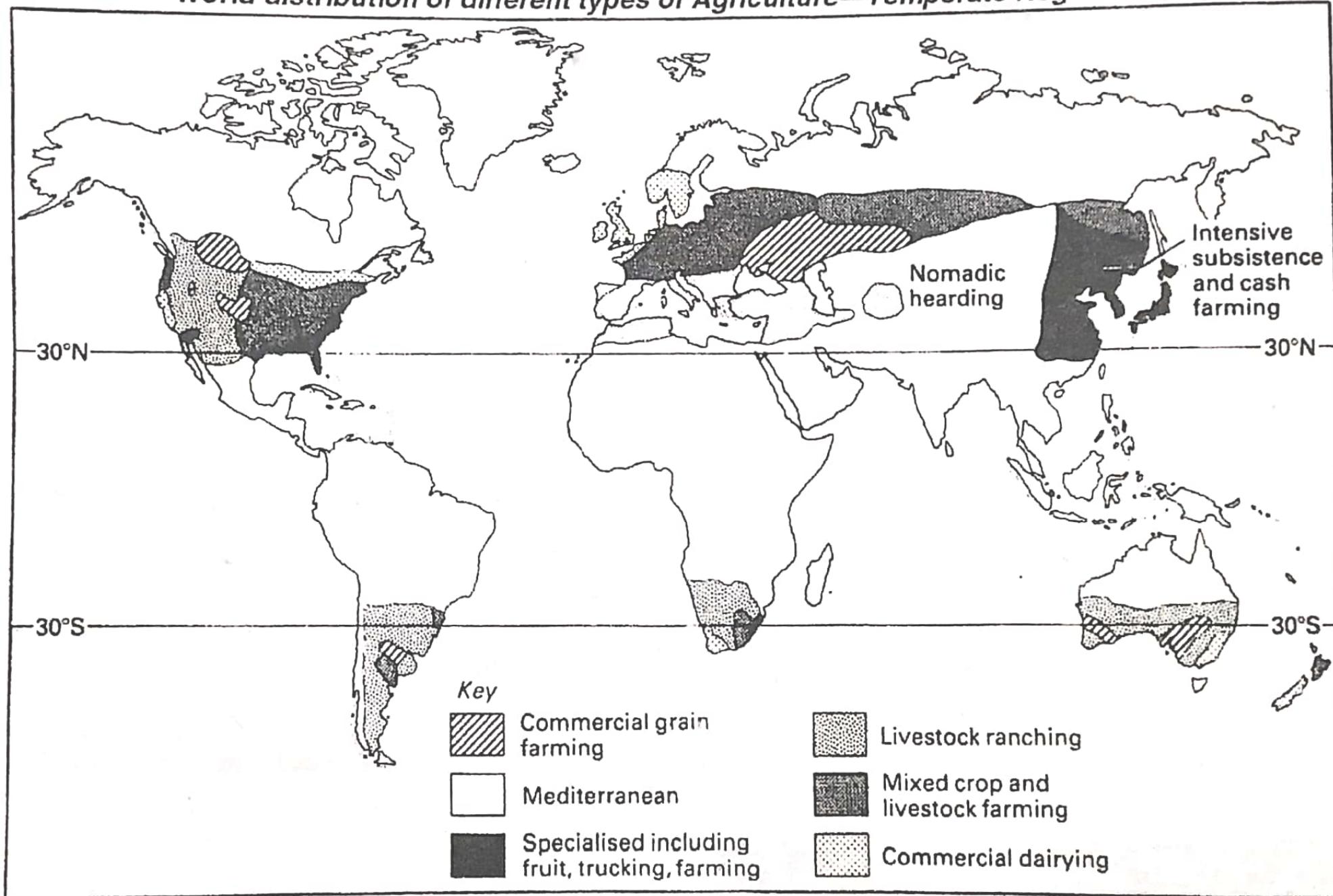


Fig. 10.19 Map Showing Whittlesey's agricultural regions.

World distribution of different types of Agriculture—Humid Tropics



World distribution of different types of Agriculture—Temperate Region



Changes in Shares of Land-use Categories in India : 1960-61 and 2008-09



From a
grain deficient nation
to **food security** for all



Green Revolution



AGRICULTURAL SEASONS			
	Kharif	Rabi	Zaid
1. Sowing Season	June-July	October-November	Aug.-Sept. (Zaid Kharif) Feb.-March (Zaid Rabi)
2. Harvesting Season	September-October	March-April	Dec.-Jan. (Zaid Kharif) April-May (Zaid Rabi)
3. Crops	Rice, maize, jowar, bajra, ragi, sugarcane pulses, cotton, jute.	Wheat, barley gram, linseed, mustard, potatoes.	Oilseeds (Zaid Kharif) Jowar, maize, summer vegetables and fruits. (Zaid Rabi)

MAIN CROPS IN INDIA			
Cereals wheat, rice, jowar, gram, bajra, ragi, pulses.	Plantations coffee, rubber, tea.	Cash Crops sugarcane, tobacco.	
Oilseeds linseed, groundnut, sesame, sunflower, rapeseed, mustardseed.		Spices pepper, ginger, turmeric, chillies, cloves, saffron.	Fibre Crops cotton, jute.

Crops	Temperature	Rainfall	Soil	Leading Producers
1. Rice	Not above 35°C	150-300 cm	Clayey or loamy	West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu.
2. Wheat	10°–15°C (sowing) 21°–26°C (harvest)	80 cm	Well drained loams, and clay loams	Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh.
3. Millets				
(a) Jowar	Not below 16°C	<100 cm	Variety of soils including clayey, sandy	Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh and Telangana.
(b) Bajra	25°–30°C	40–50 cm	Sandy loams, black and red soils	Rajasthan, Uttar Pradesh, Gujarat, Maharashtra, Haryana.
(c) Ragi	20°–30°C	50–100 cm	Red, light black and sandy loams	Karnataka, Tamil Nadu, Uttarakhand, Maharashtra and Andhra Pradesh.
4. Pulses	20°–25°C	50–75 cm	Dry, light soil	Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan and Andhra Pradesh.

Crop	Temperature	Rainfall	Soil	Leading States
Sugarcane	20°C-26°C	100–150 cm or irrigation facilities with high humidity.	Well-drained rich alluvial, heavy loam or lava soil.	UP, Maharashtra, Tamil Nadu (highest yield hectare), Karnataka, Andhra Pradesh.
Cotton	21°C-30°C but not below 21°C. 200 frost free days	50-75 cm or irrigation facility.	Deep black soil (regur), alluvial soils and laterite soil.	Gujarat, Andhra Pradesh, Maharashtra and Punjab.
Jute	24°C-35°C	Heavy rainfall of 150 cm with 90 per cent of relative humidity.	Light sandy or clayey loams.	West Bengal (70 per cent of the production, over 60 per cent of the area), Bihar, Assam, Odisha.

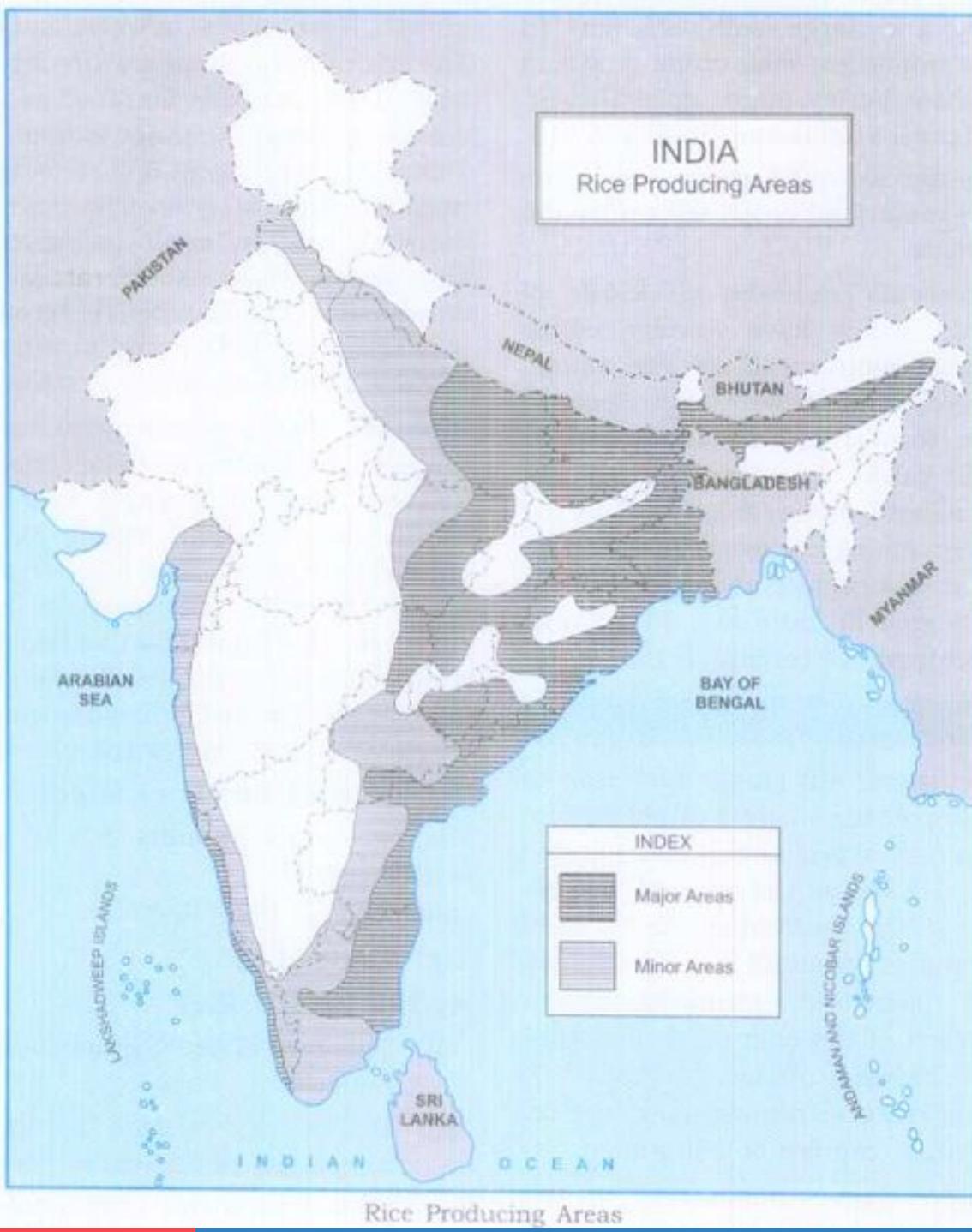
Crop	Temperature	Rainfall	Soil	Leading States
Groundnut	20°C to 25°C	50 to 100 cm	Sandy loams, loams and well-drained soils.	Gujarat, Telangana and Tamil Nadu.
Mustard and Rapeseed	10°C to 20°C	25 to 40 cm	Loams. Heavier loams (for mustard). Light loams (for rapeseed).	Uttar Pradesh, Rajasthan, Punjab, Madhya Pradesh and Haryana.
Soyabean	13°C to 24°C	40 to 60 cm	Friable loamy, acidic soils.	Madhya Pradesh, Rajasthan and Maharashtra.
Sunflower	26°C to 30°C	Less than 50 cm	Well-drained loamy soils.	Bihar, Maharashtra, Andhra Pradesh and Karnataka.
Sesamum	21°C	40 to 60 cm	Well-drained light loamy soil and black cotton soil.	Uttar Pradesh, Rajasthan, Maharashtra, Madhya Pradesh, Odisha, Gujarat, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu.
Cotton Seeds	21°C to 30°C	50 to 75 cm	Black soils.	Gujarat, Andhra Pradesh, Telangana, Maharashtra and Punjab.
Linseed	15°C to 20°C	45 to 75 cm	Alluvial soils, clayey loamy soils and deep black soils.	Madhya Pradesh and Uttar Pradesh.
Castor Seeds	20°C to 25°C	50 to 75 cm	Red sandy loams in Peninsular India and light alluvial soils in the Plains.	Gujarat, Andhra Pradesh, Telangana and Rajasthan.

Important Cash Crops of India

Crops	Temperature	Rainfall	Soil	Distribution
Tea	24°C-30°C	at least 150cm	forest soil; rich in humus and iron.	<ul style="list-style-type: none"> 1. Assam: the Brahmaputra valley, Surma valley 2. West Bengal: the Duars, Darjeeling 3. Tamil Nadu: highest yield per hectare 4. Kerala
Coffee	15°C-28°C but does not tolerate frost or heat	150-200 cm	well drained, friable loamy soil, rich in vegetable mould.	<ul style="list-style-type: none"> 1. Karnataka 70.4 % of total production; 2. Kerala 21.7 % of total production; and 3. Tamil Nadu 5.8 % of total production.
Rubber	25°C-35°C	152-200 cm	rich well drained alluvial or laterite soils.	<ul style="list-style-type: none"> 1. Kerala: Kottayam, Ernakulum, Kozhikode and Kollam. 2. Tamil Nadu 3. Karnataka

Soil	Formation	Areas	Characteristics	Crops
Alluvial Soil	Deposition of sediments by rivers.	Inland alluvium in Punjab, Haryana, U.P., Bihar, West Bengal, parts of Gujarat and Rajasthan. Deltaic alluvium in the deltas of Ganga-Brahmaputra, Mahanadi, Godavari, Krishna and Kaveri. Coastal alluvium along the coastal strips of the Peninsula.	Loamy. Coarse and dry in upper reaches of the river and gets finer and moist as the river flows down. Rich in minerals especially Potash and Lime. Poor in Nitrogen and Humus.	Large variety of Rabi and Kharif crops; rice, wheat, sugarcane, cotton, gram and oilseeds; jute in Ganga-Brahmaputra delta.
Black Soil	Residual soils formed by weathering of lava rocks.	Deccan lava tract. Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh, Karnataka, Rajasthan, Uttar Pradesh and parts of Tamil Nadu.	Clayey. Black in colour. Rich in lime, Magnesium. Poor in Phosphorous, Nitrogen and Organic matter. Very fertile.	Cotton, cereals, oilseeds, citrus fruits and vegetables, tobacco, and sugarcane.
Red Soil	Prolonged weathering of crystalline rocks. Differs on the basis of parent rock material and climatic conditions.	Plateau region of Peninsular India extending northwards along Konkan coast. Tamil Nadu, Karnataka, Andhra Pradesh, South-East Maharashtra, Chhattisgarh, parts of Odisha, Jharkhand, Bundelkhand, Meghalaya, Mizoram, Manipur, Telangana and Nagaland.	Loamy or Sandy. Red in colour due to large amounts of iron-oxides Deep and fertile in lowland; thin and poor in highlands. Poor in Nitrogen, Phosphorus, Potassium and Organic matter.	Vegetables, rice, ragi, tobacco, groundnut and potatoes.
Laterite Soil	Due to leaching in areas of heavy rain.	Highland areas of Peninsular plateau. Patches in Madhya Pradesh, Odisha, Maharashtra, West Bengal, Andhra Pradesh, Telangana, Karnataka, Kerala, and Tamil Nadu.	Coarse and porous. Red due to Iron Oxide. Poor in Lime, Nitrogen and Magnesium. High acidity and low moisture retention.	Tapioca, cashewnuts. With manure ragi, rice, sugarcane, tea, rubber and coffee.

Crops	Temperature	Rainfall	Soil	Leading Producers
1. Rice	Not above 35°C	150-300 cm	Clayey or loamy	West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu.
2. Wheat	10°–15°C (sowing) 21°–26°C (harvest)	80 cm	Well drained loams, and clay loams	Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh.
3. Millets				
(a) Jowar	Not below 16°C	<100 cm	Variety of soils including clayey, sandy	Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh and Telangana.
(b) Bajra	25°–30°C	40–50 cm	Sandy loams, black and red soils	Rajasthan, Uttar Pradesh, Gujarat, Maharashtra, Haryana.
(c) Ragi	20°–30°C	50–100 cm	Red, light black and sandy loams	Karnataka, Tamil Nadu, Uttarakhand, Maharashtra and Andhra Pradesh.
4. Pulses	20°–25°C	50–75 cm	Dry, light soil	Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan and Andhra Pradesh.











Crop	Temperature	Rainfall	Soil	Leading States
Sugarcane	20°C-26°C	100–150 cm or irrigation facilities with high humidity.	Well-drained rich alluvial, heavy loam or lava soil.	UP, Maharashtra, Tamil Nadu (highest yield hectare), Karnataka, Andhra Pradesh.
Cotton	21°C-30°C but not below 21°C. 200 frost free days	50-75 cm or irrigation facility.	Deep black soil (regur), alluvial soils and laterite soil.	Gujarat, Andhra Pradesh, Maharashtra and Punjab.
Jute	24°C-35°C	Heavy rainfall of 150 cm with 90 per cent of relative humidity.	Light sandy or clayey loams.	West Bengal (70 per cent of the production, over 60 per cent of the area), Bihar, Assam, Odisha.



Sugarcane Producing Areas



Cotton and Jute Producing Areas

Under MSP

- Groundnut
- Soyabean
- Sunflower
- Safflower

- Mustard/Rapeseed
- Toria (very similar to mustard)
- Sesamum/ Sesum (till)
- Nigerseed (Ramtil)

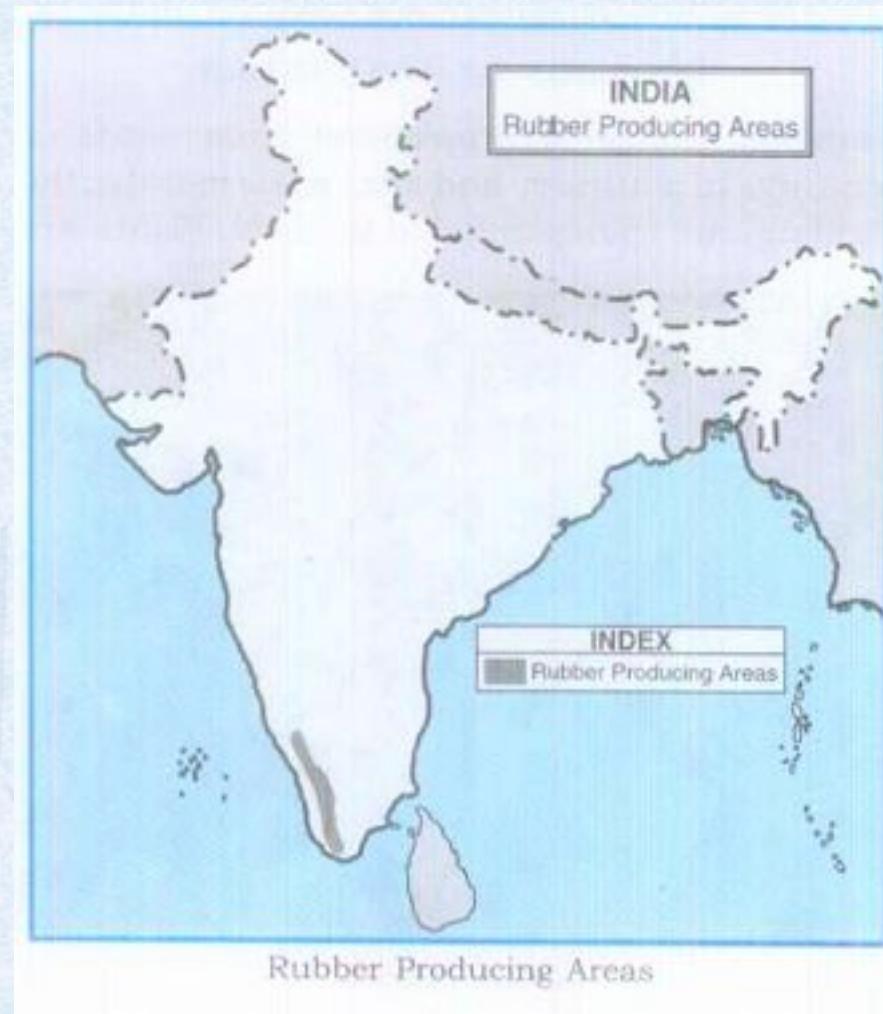
Crop	Temperature	Rainfall	Soil	Leading States
Groundnut	20°C to 25°C	50 to 100 cm	Sandy loams, loams and well-drained soils.	Gujarat, Telangana and Tamil Nadu.
Mustard and Rapeseed	10°C to 20°C	25 to 40 cm	Loams. Heavier loams (for mustard). Light loams (for rapeseed).	Uttar Pradesh, Rajasthan, Punjab, Madhya Pradesh and Haryana.
Soyabean	13°C to 24°C	40 to 60 cm	Friable loamy, acidic soils.	Madhya Pradesh, Rajasthan and Maharashtra.
Sunflower	26°C to 30°C	Less than 50 cm	Well-drained loamy soils.	Bihar, Maharashtra, Andhra Pradesh and Karnataka.
Sesamum	21°C	40 to 60 cm	Well-drained light loamy soil and black cotton soil.	Uttar Pradesh, Rajasthan, Maharashtra, Madhya Pradesh, Odisha, Gujarat, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu.
Cotton Seeds	21°C to 30°C	50 to 75 cm	Black soils.	Gujarat, Andhra Pradesh, Telangana, Maharashtra and Punjab.
Linseed	15°C to 20°C	45 to 75 cm	Alluvial soils, clayey loamy soils and deep black soils.	Madhya Pradesh and Uttar Pradesh.
Castor Seeds	20°C to 25°C	50 to 75 cm	Red sandy loams in Peninsular India and light alluvial soils in the Plains.	Gujarat, Andhra Pradesh, Telangana and Rajasthan.

Important Cash Crops of India

Crops	Temperature	Rainfall	Soil	Distribution
Tea	24°C-30°C	at least 150cm	forest soil; rich in humus and iron.	<ul style="list-style-type: none"> 1. Assam: the Brahmaputra valley, Surma valley 2. West Bengal: the Duars, Darjeeling 3. Tamil Nadu: highest yield per hectare 4. Kerala
Coffee	15°C-28°C but does not tolerate frost or heat	150-200 cm	well drained, friable loamy soil, rich in vegetable mould.	<ul style="list-style-type: none"> 1. Karnataka 70.4 % of total production; 2. Kerala 21.7 % of total production; and 3. Tamil Nadu 5.8 % of total production.
Rubber	25°C-35°C	152-200 cm	rich well drained alluvial or laterite soils.	<ul style="list-style-type: none"> 1. Kerala: Kottayam, Ernakulum, Kozhikode and Kollam. 2. Tamil Nadu 3. Karnataka







**Chickpeas/Garbanzo beans
Safed chana**



**Brown Chickpeas
Kala chana**



**Split Chickpeas (brown)
Chana Dal**



**Gram/
Bengal gram**



**Split Pigeon Peas
Toor Dal**



Black Gram Lentils
Sabut (whole) Urad



Split and dehusked black gram lentils
Urad Dal



Under MSP:
Gram, Arhar, Urad, Moong, Lentil

Indian Brown Lentils
Sabut Masoor



Red/Orange/Pink Lentils
Split and dehusked Brown Lentils
Masoor Dal



Mung Beans/Green Gram
Hare Mung



Petite Yellow Lentils
Split and dehusked Mung Beans
Mung Dal



Also as just
“Lentil”

Kidney Beans
Rajma



Black Eyed Peas
Raungi/Lobhia



Cowpea

Horsegram



MILLETS OF INDIA



Amaranth	राजगीरा
Barnyard	सनवा
Buckwheat	कुदू
Finger millet	रागी
Foxtail millet	कांगनी
Kodu	कोड़ों
Little millet	सामा
Pearl millet	बाजरा
Proso millet	चेना
Sorghum	जवार

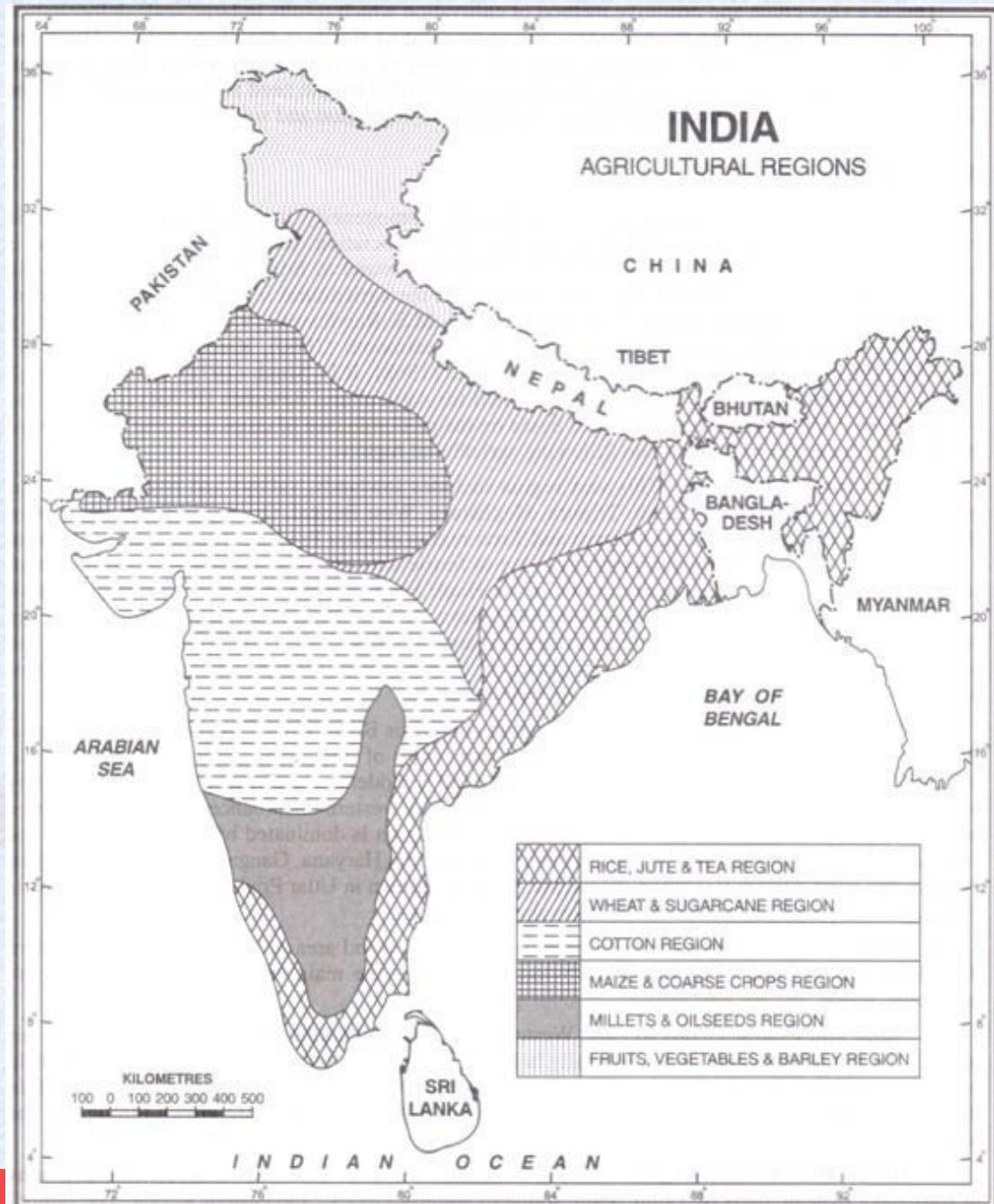


FIG. 22.1. India : Agricultural Regions

67.	Agriculture	2012	<p>Consider the following crops of India:</p> <ol style="list-style-type: none"> 1. Cowpea 2. Green gram 3. Pigeon pea <p>Which of the above is/are used as pulse, fodder and green manure?</p> <p>(a) 1 and 2 only (b) 2 only (c) 1 and 3 only (d) 1, 2 and 3</p>
68.	Agriculture	2013	<p>Consider the following crops:</p> <ol style="list-style-type: none"> 1. Cotton 2. Groundnut 3. Rice 4. Wheat <p>Which of these are Kharif crops?</p> <p>(a) 1 and 4 (b) 2 and 3 only (c) 1, 2 and 3 (d) 2, 3 and 4</p>

66.	Agriculture	2012	<p>Consider the following crops of India:</p> <ol style="list-style-type: none">1. Groundnut2. Sesamum3. Pearl millet <p>Which of the above is/are predominantly rainfed crop/ crops?</p> <p>(a) 1 and 2 only (b) 2 and 3 only (c) 3 only (d) 1, 2 and 3</p>
-----	-------------	------	--

63.	Agriculture	2011	<p>A state in India has the following characteristics:</p> <ol style="list-style-type: none"> 1. Its northern part is arid and semi-arid. 2. Its central part produces cotton. 3. Cultivation of cash crops is predominant over food crops. <p>Which one of the following states has all of the above characteristics?</p> <ul style="list-style-type: none"> (a) Andhra Pradesh (b) Gujarat (c) Karnataka (d) Tamil Nadu
64.	Agriculture	2011	<p>Among the following States, which one has the most suitable climatic conditions for the cultivation of a large variety of orchids with minimum cost of production, and can develop an export oriented industry in this field?</p> <ul style="list-style-type: none"> (a) Andhra Pradesh (b) Arunachal Pradesh (c) Madhya Pradesh (d) Uttar Pradesh

61.	Agriculture	2010	<p>The approximate representation of land use classification in India is?</p> <ul style="list-style-type: none"> (a) Net area sown 25%; forest 33%; other areas 42% (b) Net area sown 58%; forest 17%; other areas 25% (c) Net area sown 43%; forest 29%; other areas 28% (d) Net area sown 47%; forest 23%; other areas 30%
62.	Agriculture	2011	<p>The lower Gangetic plain is characterised by humid climate with high temperature throughout the year. Which one among the following pairs of crops is most suitable for this region?</p> <ul style="list-style-type: none"> (a) Paddy and cotton (b) Wheat and Jute (c) Paddy and Jute (d) Wheat and cotton

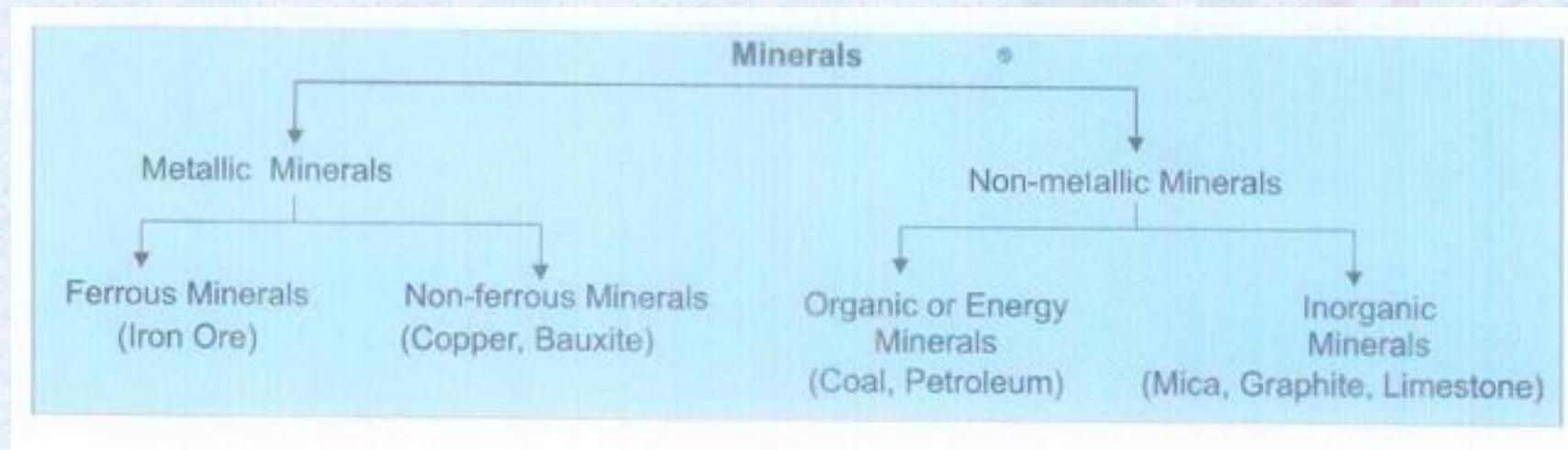
60.	Agriculture	2010	<p>Following are the characteristics of an area in India:</p> <ol style="list-style-type: none">1. Hot and humid climate2. Annual rainfall 200 cm3. Hill slopes up to an altitude of 1100 metres4. Annual range of temperature 15°C to 30°C <p>Which one among the following crops are you most likely to find in the area described above?</p> <p>(a) Mustard (b) Cotton (c) Pepper (d) Virginia tobacco</p>
-----	-------------	------	--

67. "The crop is subtropical in nature. A hard frost is injurious to it. It requires at least 210 frost-free days and 50 to 100 centimeters of rainfall for its growth. A light well-drained soil capable of retaining moisture is ideally suited for the cultivation of the crop." Which one of the following is that crop?

- (a) Cotton
- (b) Jute
- (c) Sugarcane
- (d) Tea

- 66.** With reference to pulse production in India, consider the following statements:
1. Black gram can be cultivated as both kharif and rabi crop.
 2. Green-gram alone accounts for nearly half of pulse production.
 3. In the last three decades, while the production of kharif pulses has increased the production of rabi pulses has decreased.
- Which of the statements given above is/are correct?
- (a) 1 only
 - (b) 2 and 3 only
 - (c) 2 only
 - (d) 1, 2 and 3

61.	Agriculture	2019	<p>With reference to the cultivation of Kharif crops in which in the last five years consider the following statements:</p> <ol style="list-style-type: none">1. Area under rice cultivation is the highest.2. Area under the cultivation of jowar is more than that of oilseeds.3. Area of cotton cultivation is more than that of sugarcane.4. Area under sugarcane cultivation has steadily decreased. <p>Which of the statements given above is/are correct? (a) 1 and 3 only (b) 2, 3 and 4 only (c) 2 and 4 only (d) 1, 2, 3 and 4</p>
-----	-------------	------	---





- **North America:** Lake Superior region, NE USA, Labrador, Newfoundland
- **South America:** Itabira (Brazil), Cerro Bolivar (Venezuela)
- **Europe:** Kiruna & Gallivare (Sweden), Bilbao (Spain)
- **Africa:** Bomi hills (Liberia), Postmasberg & Transval (South Africa)
- **Asia:** Krivoy Rog, Kerch (Ukraine) , Kuzbas, Magnetogorsk (Siberia), machuria (China)
- **Australia:** Iron knob, Mt.Goldsworthy

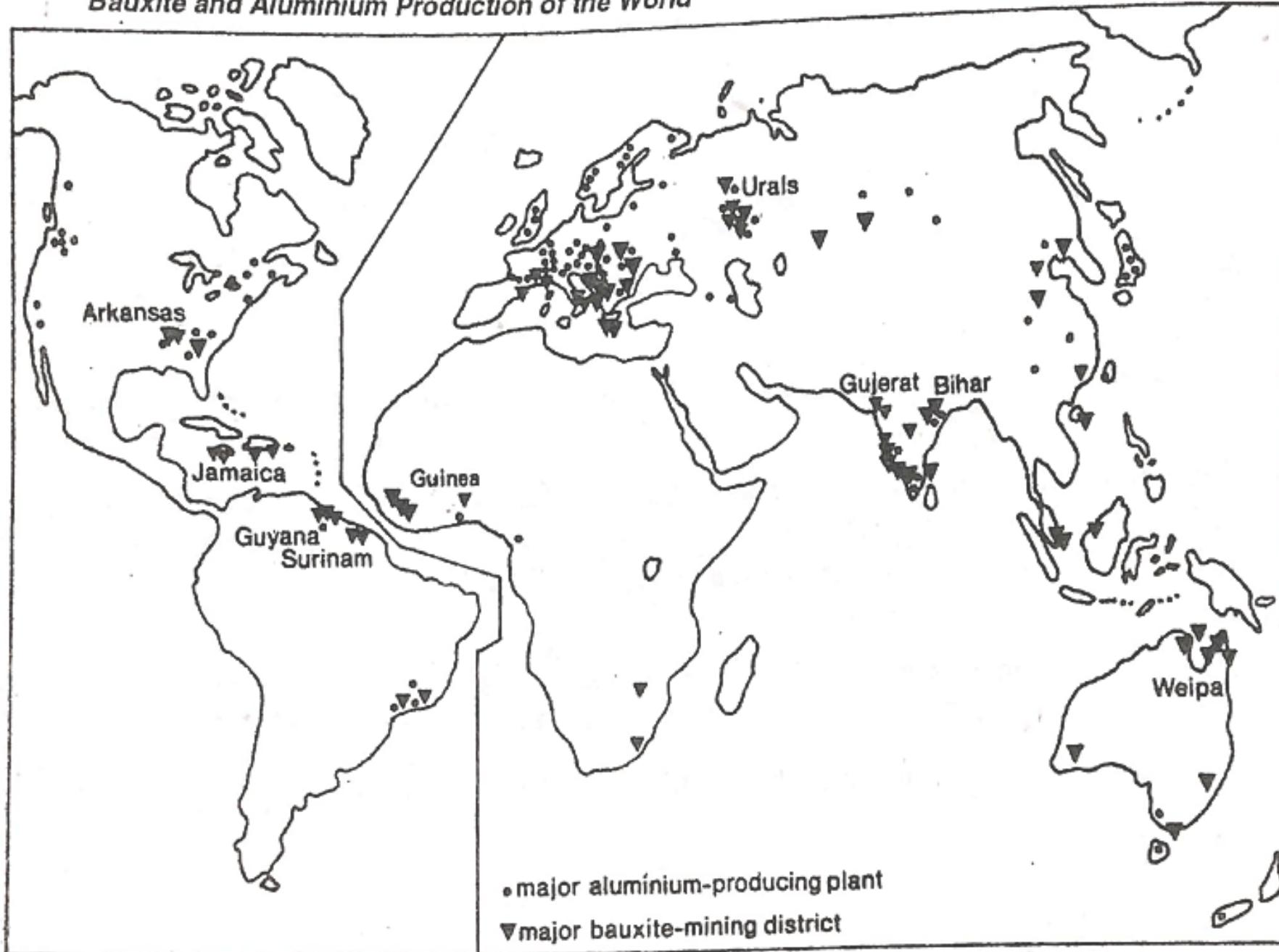


- **South America:** Macapa, Minas Gerais (Brazil), Western Mato grasso
- **Africa:** Zaire, Postmasberg (South Africa)
- **Asia:** Nikopol and Tokmak (Ukraine), Chiatura (Georgia), Urals

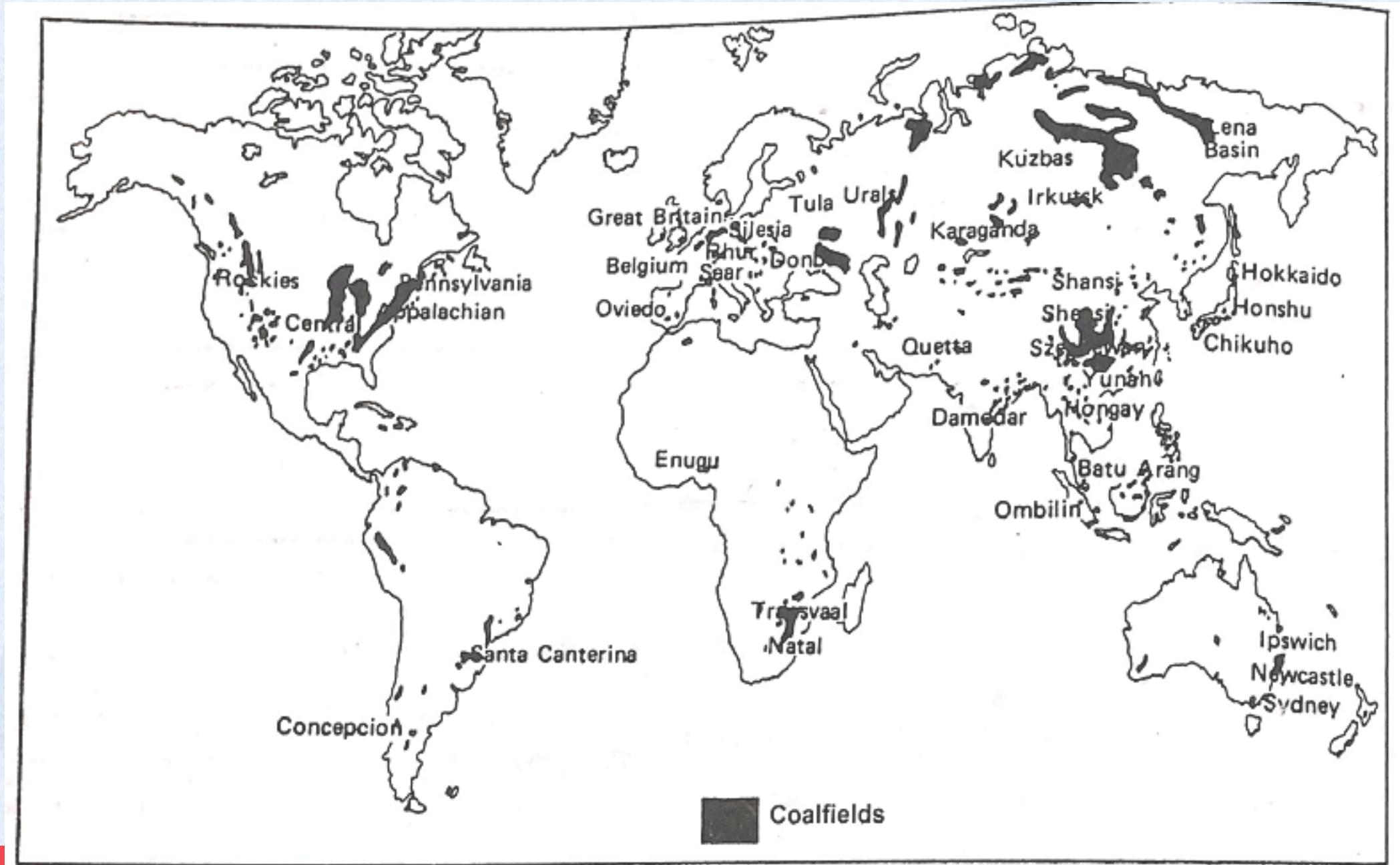


- **North America:** Sudbury, Lynn lake (Canada)
- **South America:** Casapalco (Peru), Chuquicamata & San Jose (Chile)
- **Africa:** Katanga
- **Asia:** Lake Balkash (Russia), Ulanbatore (Mongolia)

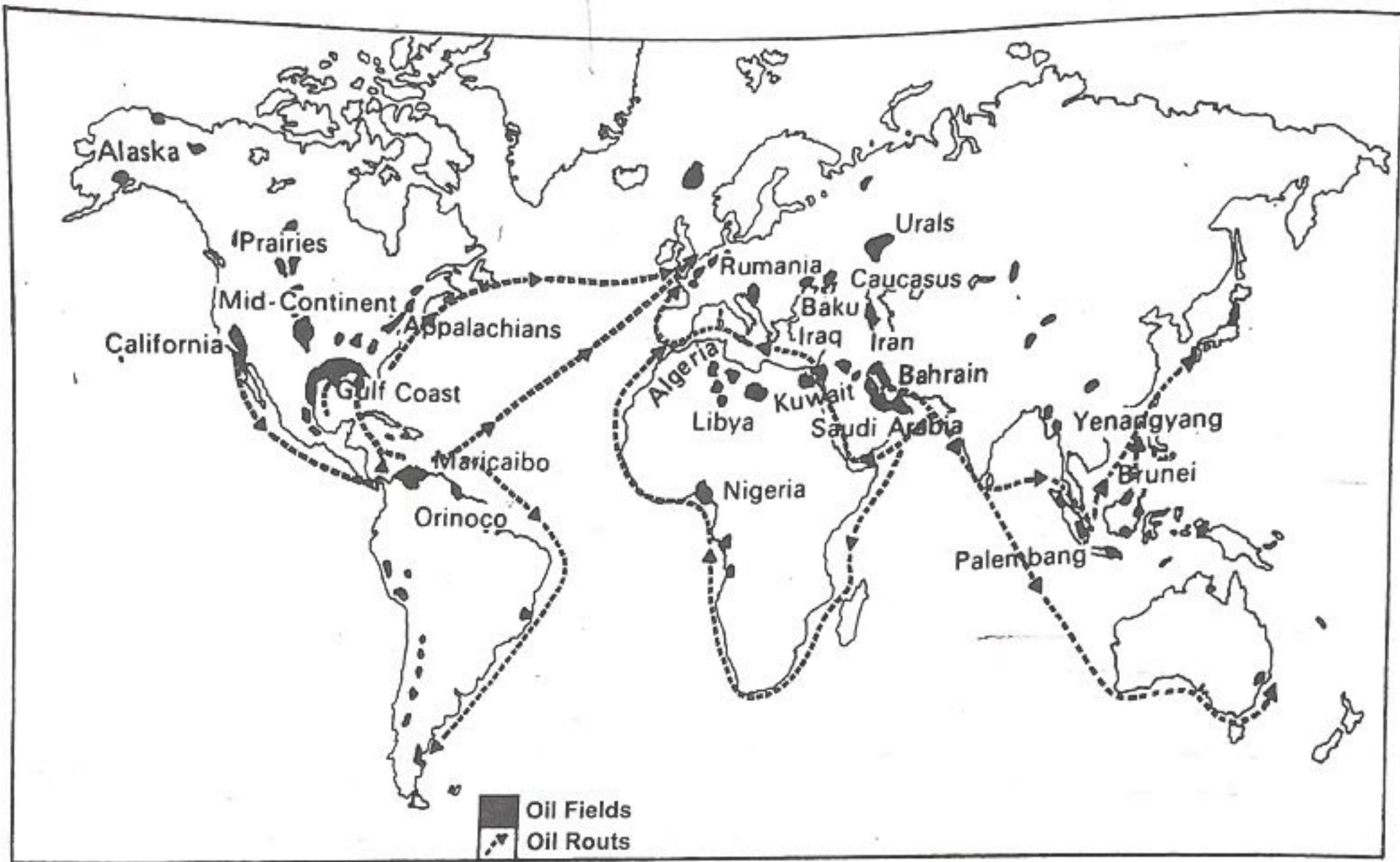
Bauxite and Aluminium Production of the World



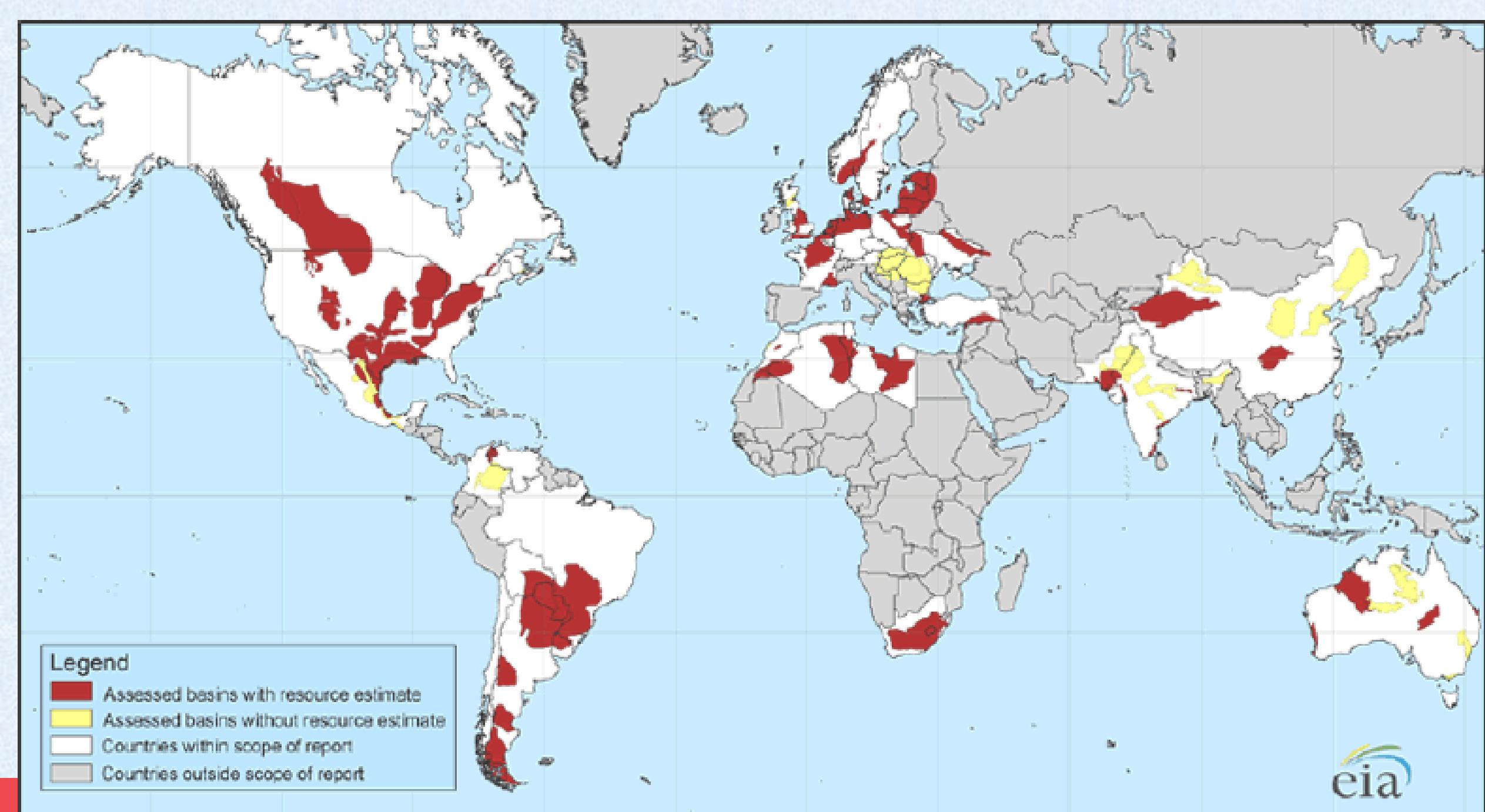
- **North America:** Alabama, Arkansas (USA)
- **South America:** Jamaica, Guyana, Surinam
- **Europe:** France, Hungary
- **Africa:** Guinea
- **Asia:** Urals, Krasnaya (Russia)
- **Australia:** Weipa, Cape york, Darling range



- **North America:** Pennsylvania, Appalachian, Rockies, Mexican gulf (USA), Vancouver, Nova scotia (Canada)
- **South America:** Santa Canterina (Brazil), Concepcion (Chile)
- **Europe:** Great Britain, Ruhr & Saar (Germany), Spain
- **Africa:** Zambia, Zimbabwe, Enugu (Nigeria), Transval & Natal (South Africa)
- **Asia:** Donetsk, Donbas, Moscow – tula, Kuzbas, Urals, Lena (Russia), Shanzi, Shantung, Yunnan (China)
- **Australia:** Ipswich, New castle



- **North America:** Gulf coast, Appalachian, California, Alaska (USA), Prairies, Edmonton, Calgary (Canada)
- **South America:** Maracaibo, Orinoco basin (Venezuela), Magdalena (Columbia), Punta Arenas (Chile), Falkland
- **Europe:** North Sea, Norway
- **Africa:** Algeria, Libya, Nigeria – Niger delta
- **Asia:** Dhaharan, Quatif (Saudi Arabia), Mosul, Kirkuk, Zubair (Iraq), Masjid Sulaiman (Iran), Kuwait, Bahrain, Qatar, Abudabhi (UAE); Baku (Azerbaijan), Urals, Caucasus, Caspian sea, NW Siberia, Sakhalin (Russia); Sumatra, Borneo (Indonesia); Brunei; Sarawak, Sabah (Malaysia), China

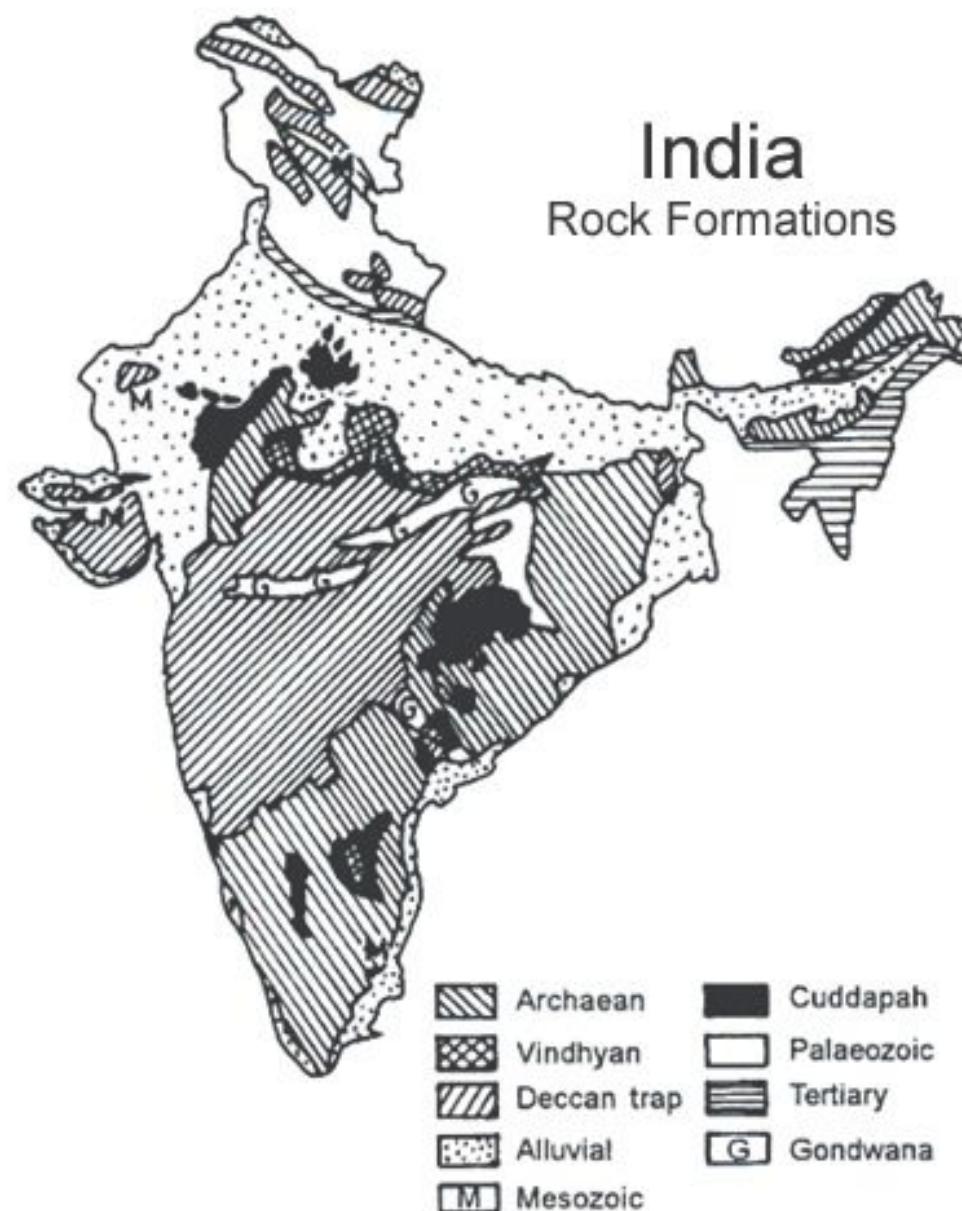


Legend

- Assessed basins with resource estimate
- Assessed basins without resource estimate
- Countries within scope of report
- Countries outside scope of report

Table 1: Leading Countries with Technically Recoverable Shale Gas Resources

Rank	Country	Technically recoverable Shale gas (trillion cubic feet)
1	China	1,115
2	Argentina	802
3	Algeria	707
4	U.S.A	623
5	Canada	573
6	Mexico	545
7	Australia	429
8	South Africa	390
9	Russia	285
10	Brazil	245
11	India	96
	World Total	7576





IAS
AO

Iron

- Odisha: Gurumahisani, Sulepat and Badam Pahar in Mayurbhanj district; Baramjader group extended in Keonjhar and Sundargarh districts.
- Singhbhum district of Jharkhand
- Bailadilla of Bastar district in Chhattisgarh;
- Sandoor Hills at Bellary - Hospet region and Bababudan Hills at Chikmaglur district in Karnataka;



Manganese Distribution in India

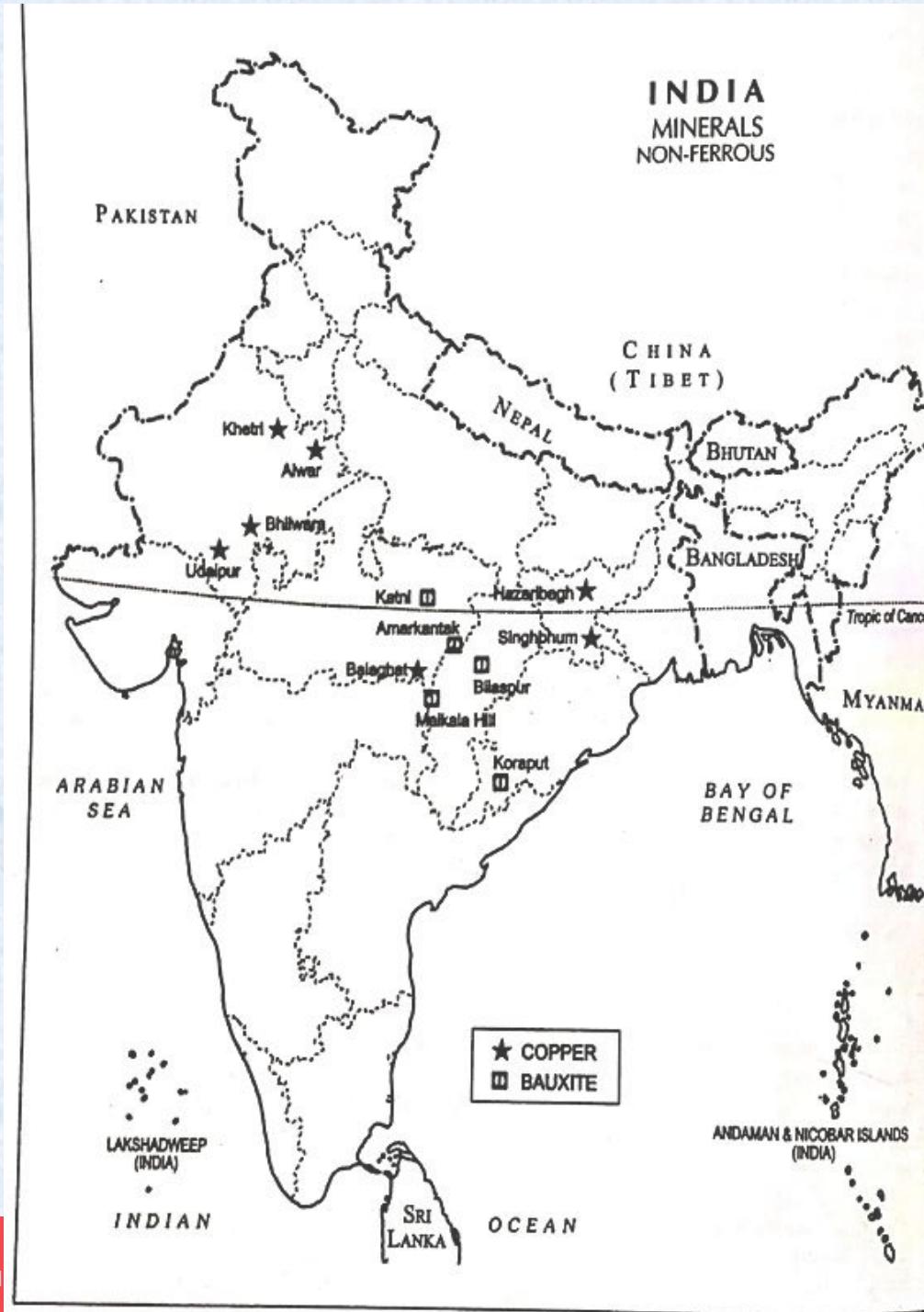
Manganese

- ✓ Keonjhar and Karaput region in Orissa
- ✓ Balaghat and Chindwara in Madhya Pradesh
- ✓ Nagpur and Bhandara in Maharashtra
- ✓ Panchmahal in Gujarat
- ✓ Vishakhapatnam and Srikakulam in Andhra Pradesh
- ✓ Singhbhum in Jharkhand
- ✓ Udaipur and Banswara in Rajasthan



Bauxite

- Ranchi and Palamu in Jharkhand
- Sarguja, Shah dole, Durg and Balaghat in Madhya Pradesh;
- Kolaba, Thane and Ratnagiri in Maharashtra;
- Belgaon and Bababudan Hills in Karnataka;
- Palni, Javdi and Shevaroy hills regions in Tamil Nadu



Copper

- ✓ Singhbhum in Jharkhand;
- ✓ Jhunjhunu, Bhilwara, Alwar and Udaipur in Rajasthan; Khetri Mine in Rajasthan has been a major copper extracting region since the age of Indus valley civilization.
- ✓ Balaghat in Madhya Pradesh;
- ✓ Guntur and Nellore districts in Andhra Pradesh.

Mica

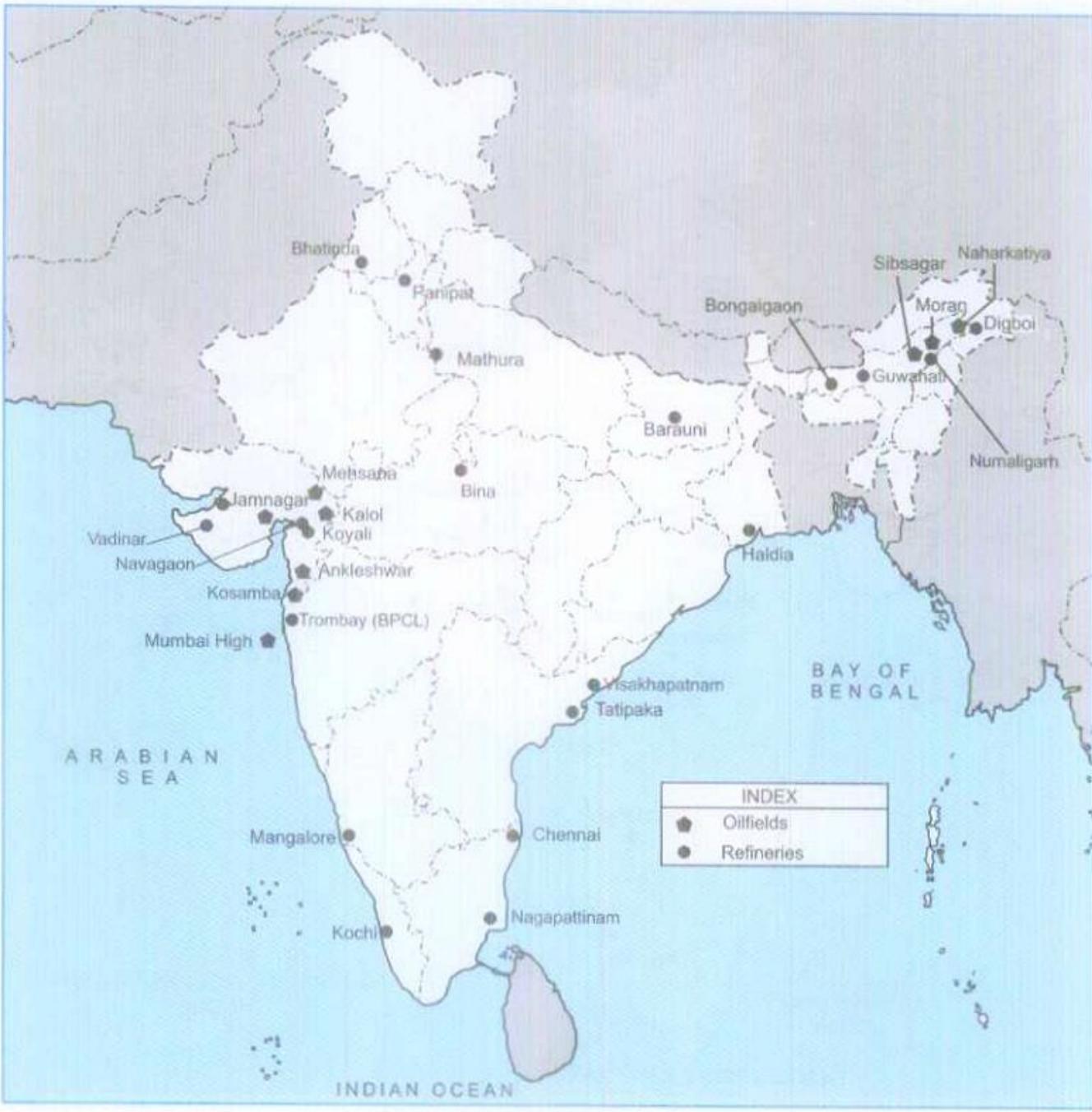
- Muscovite and Biotite types of mica are extracted from Hazaribagh, Singhbhum and Palamu districts.
- Other major mica producing regions are Gaya and Munger in Bihar
- Nellore and Khammam in Andhra Pradesh
- Udaipur and Bhilwara districts in Rajasthan.



Coal Distribution in India

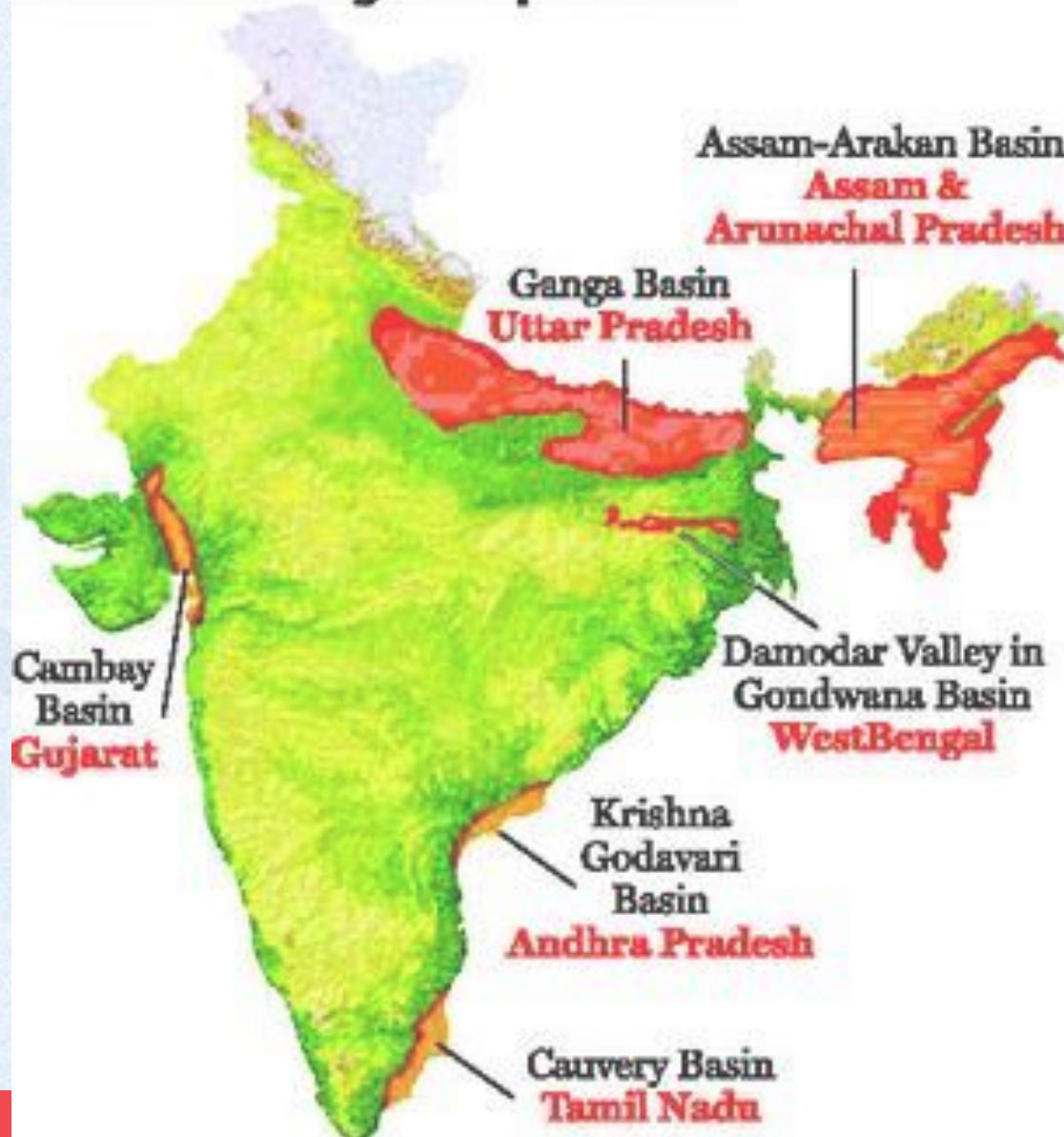
Table 11.1. Gondwana Coalfields

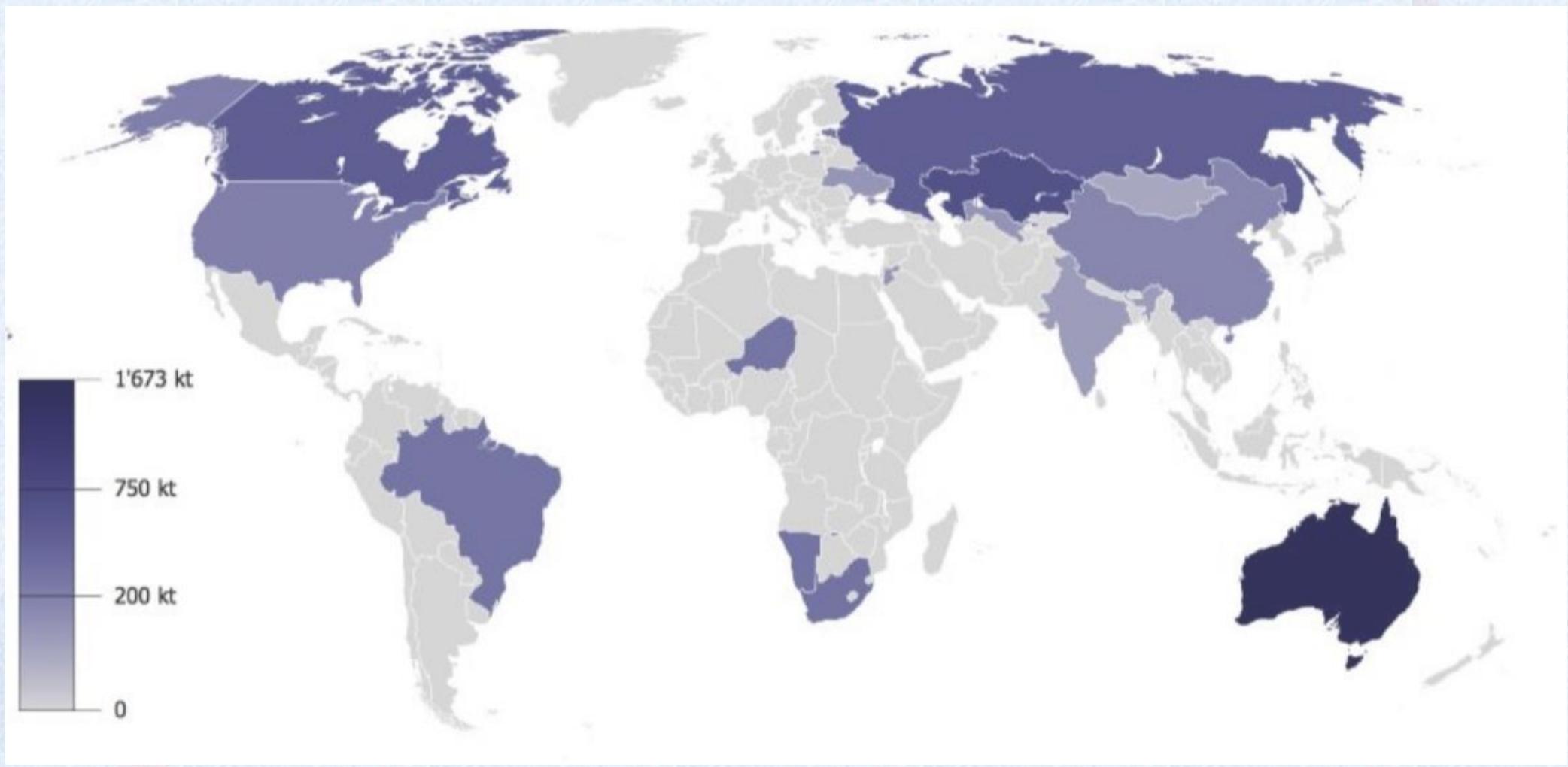
State	River Valley	Coalfields
1. Jharkhand	Damodar	Jharia, Karnpura, Ramgarh, East and West Bokaro, Giridih, Auronga, Hutar and Daltonganj.
2. Odisha	Mahanadi	Sambalpur, Sundargarh and Talcher.
3. Madhya Pradesh	Mahanadi/Son	Singrauli, Narsingpur, Chhindwara, Betul.
4. Chhattisgarh	Mahanadi/Son	Sarguja, Sendurgarh, Rampur, Korba and Raigarh.
5. Maharashtra	Godavari	Kamptee, Wardha valley, Chandrapur and Yavatmal.
6. Andhra Pradesh	Godavari	East and West Godavari.
7. Telangana	Godavari	Adilabad, Khammam and Warangal.
8. West Bengal	Damodar	Raniganj, Bardhaman, Bankura, Purulia, Darjeeling and Jalpaiguri.

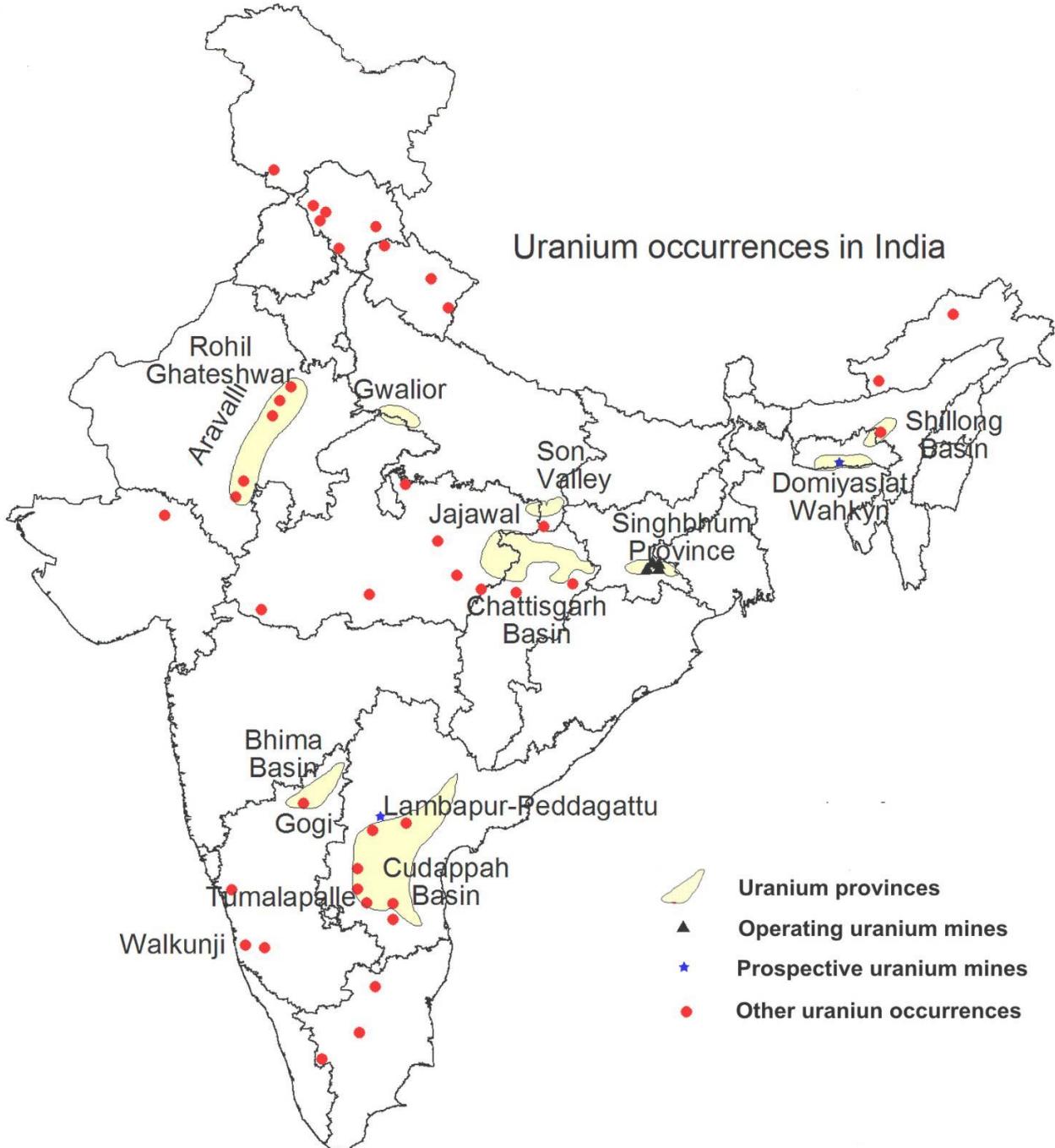


- **Assam region:** Digboi, Naharkatiya, Hagriyan-Moran and Surma river valley. Natural gas is also found in Bagrijan-Moran area.
- **Gujarat region:** Khambakt and Ankleshwar while oil regions are extended upto Navgaon, Kosamba, Olpad, Dholka, Mehsana, Kalal etc.
- **Mumbai High region**, 176 km away from the Mumbai coast
- Region off-shore in **Krishna - Godavari** river valley.

Prospective basins for phase 1 shale oil and gas exploration

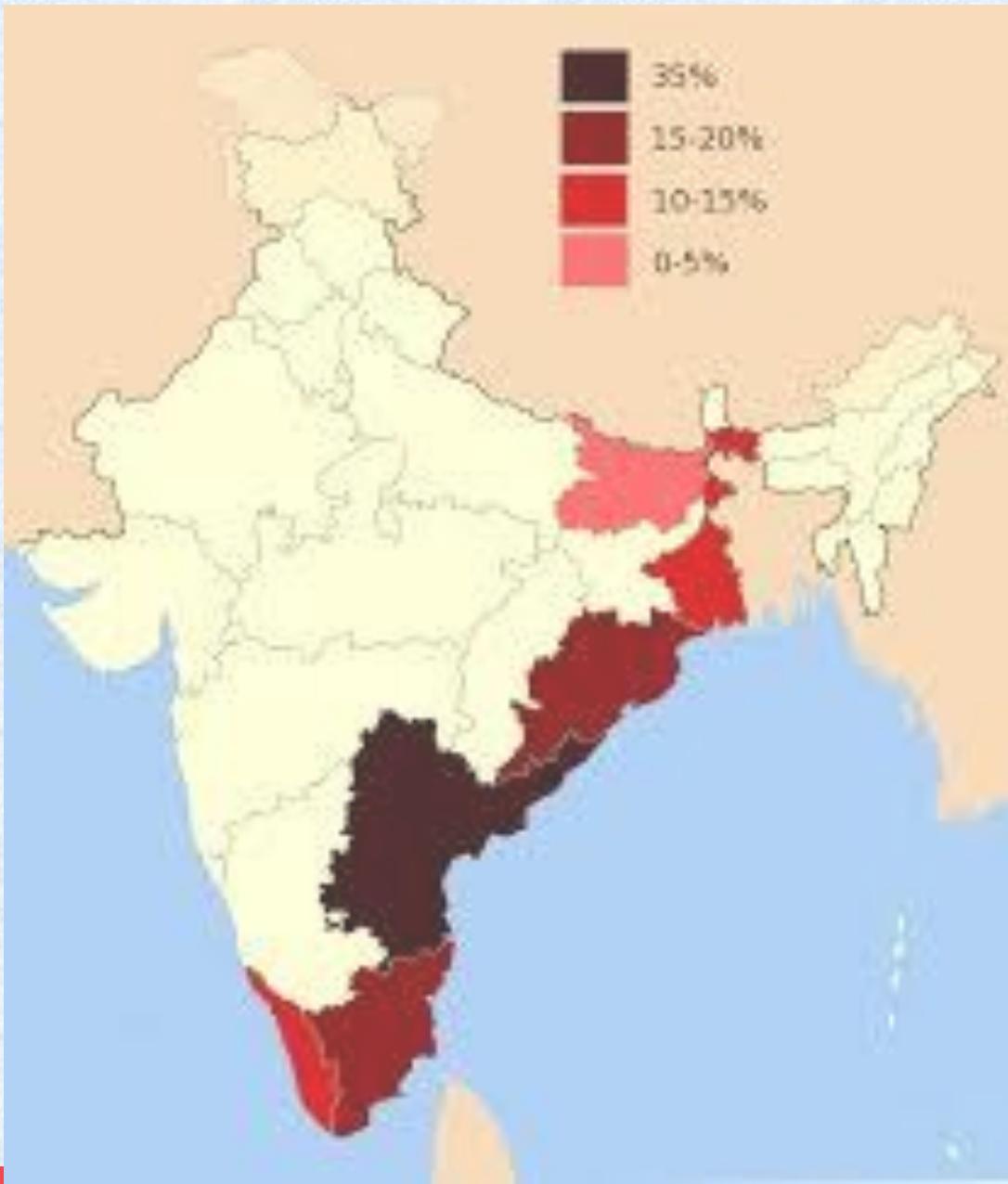






Uranium resources (as of July 2017)

State	Districts	Main deposits	Tonnes U
Andhra Pradesh	Kadapa	Tummalapalle	120,229
	Guntur	Koppunuru	2,341
Telangana	Nalgonda	Lambapur, Pedagattu, Chitrial	15,731
Jharkhand	E.Singhbhum	Jaduguda, Bhatin, Narwapahar, Turamidh, Banduhurang, Mohuldih, Bagjata,	53,237
	Saraikela-Kharswan	Bangurdih	1,367
Meghalaya	West Khasi Hills	KPM (Domiasat), Wahkyn, Wahkut	19,538
Rajasthan	Sikar, Udaipur	Rohil, Umra	7,989
Karnataka	Yadgir, S.Kanara	Gogi	3,970
Chhattisgarh	Rajanandgaon, Surguja	Bodal, Jajawal	3,380
	Sonbhadra	Naktu	666
Uttarakhand	Rudraprayag	Pokhri-Tunji	85
Himachal Pradesh	Una, Shimla, Mandi	Rajpura	665
Maharashtra	Gondia	Mogarra	301
Total			229,499



USGS Estimates in tonnes (2011)

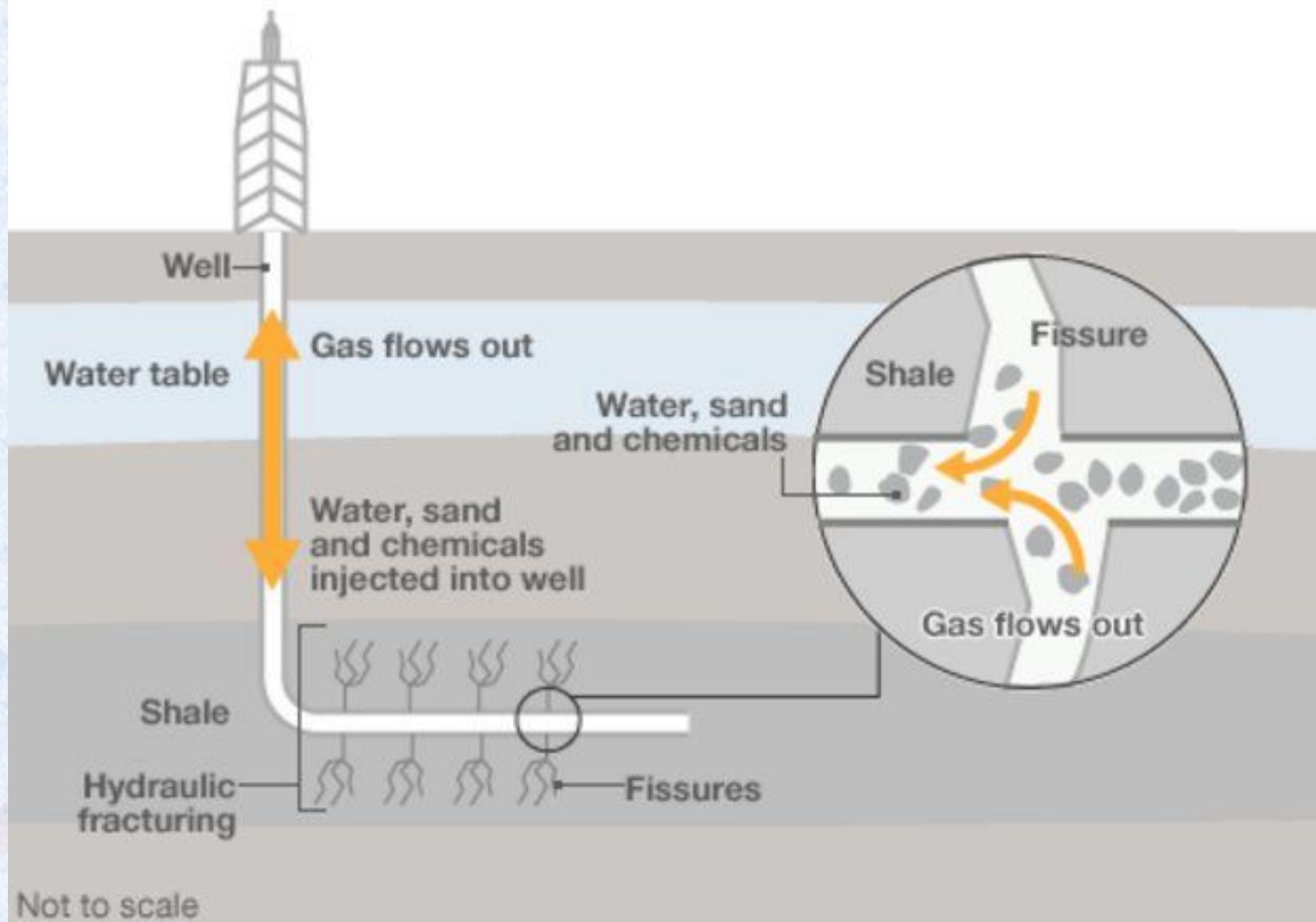
Country	Reserves
India	963,000
United States	440,000
Australia	300,000
Canada	100,000
South Africa	35,000

State	Monazite (Million tonnes)
Odisha	2.41
Andhra Pradesh	3.72
Tamil Nadu	2.46
Kerala	1.90
West Bengal	1.22
Jharkhand	0.22
Total	11.93



S
O

Shale gas extraction



I. Major Minerals

Fuel Minerals

Coal

Lignite

Natural Gas

Petroleum (Crude)

Other Major Minerals

Metallic Minerals

Bauxite

Chromite

Copper Ore

Gold

Iron Ore

Lead Concentrates

Zinc Concentrates

Manganese Ore

Silver

Tin Concentrates

Tungsten Concentrates

Non-Metallic Minerals

Agate

Andalusite

Apatite

Asbestos

Ball Clay

Barytes

Calcite

Chalk

Clay (Others)

Corundum

Calcarious sand

Diamond

Diaspore

Dolomite

Dunite

Felspar

Fire Clay

Felsite

Flourite(Graded)

Flourite (Concentrates)

Gypsum

Garnet (Abrasives)

Garnet (Gem)

Graphite run-on-mines (r.o.m.)

Jasper

Kaolin

Kyanite

Laterite

Limestone

Limestone Kankar

Lime Shell

Magnesite

Mica(Crude)

Ochre

Pyrites

Pyrophyllite

Phosphorite

Quartz

impure quartz,

Quartzite

Fuchsite Quartzite

Silica Sand

Sand Others

Salt (Rock)

Salt (Evaporated)

Shale

Slate

Steatite

Sillimanite

Vermiculite

Wollastonite

II. MINOR MINERALS

Bentonite

Boulder

Brick Earth

Building Stones

Chalcedony or Corundum

Fuller's Earth

Gravel

Lime Stone

Granite

Mica

Marble

Murram

Ordinary Clay

Ordinary Sand

Ordinary Earth

Pebbles or Kankar

Quartzite and Sand stone

Road Metal

Salt Petre

Shale

Shingle

Slate



INDIA Cotton Textile Industries



Cotton Textiles

INDIA
Textile Industries
Jute and Silk Textiles



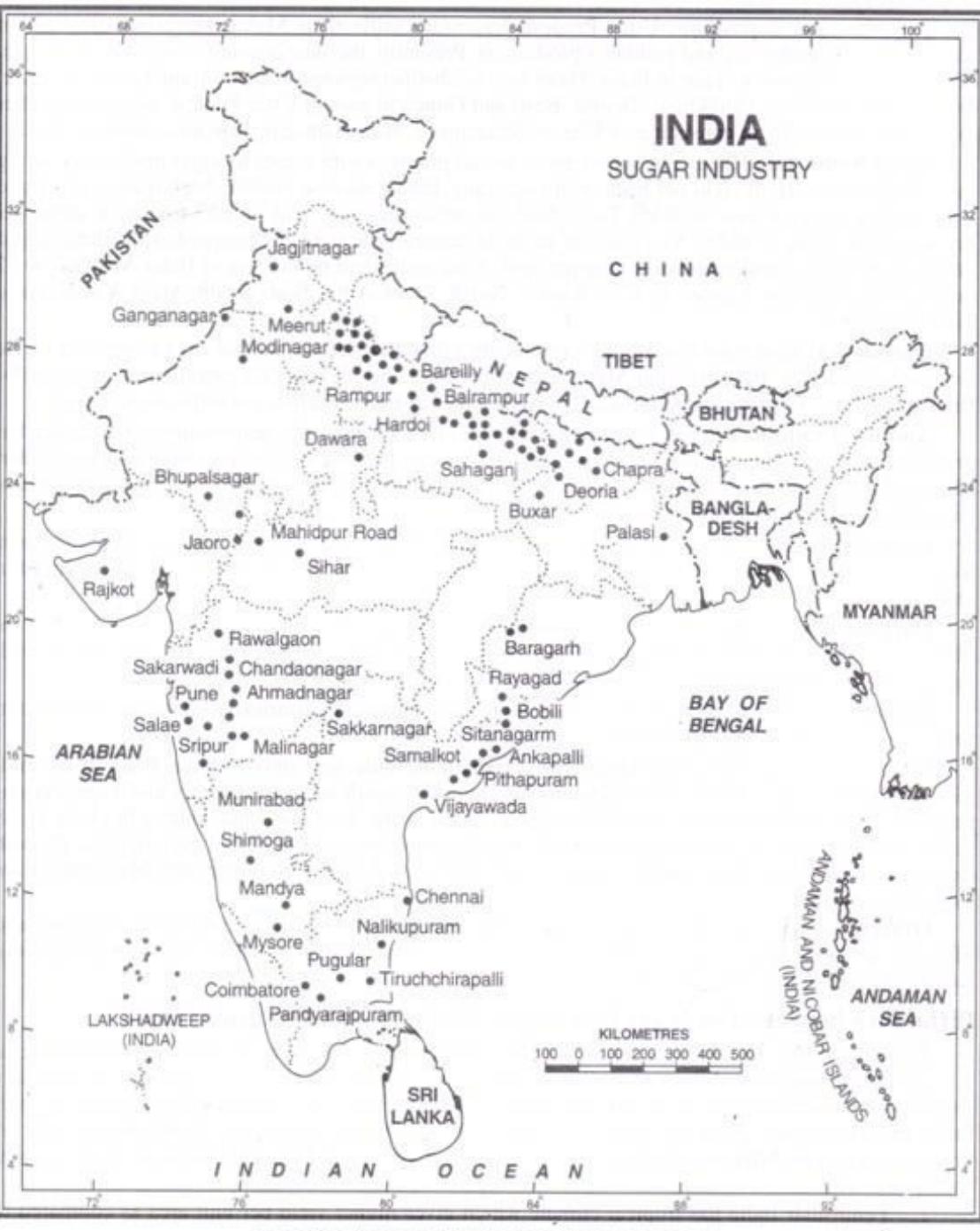


FIG. 27.17. India : Distribution of Sugar Industry

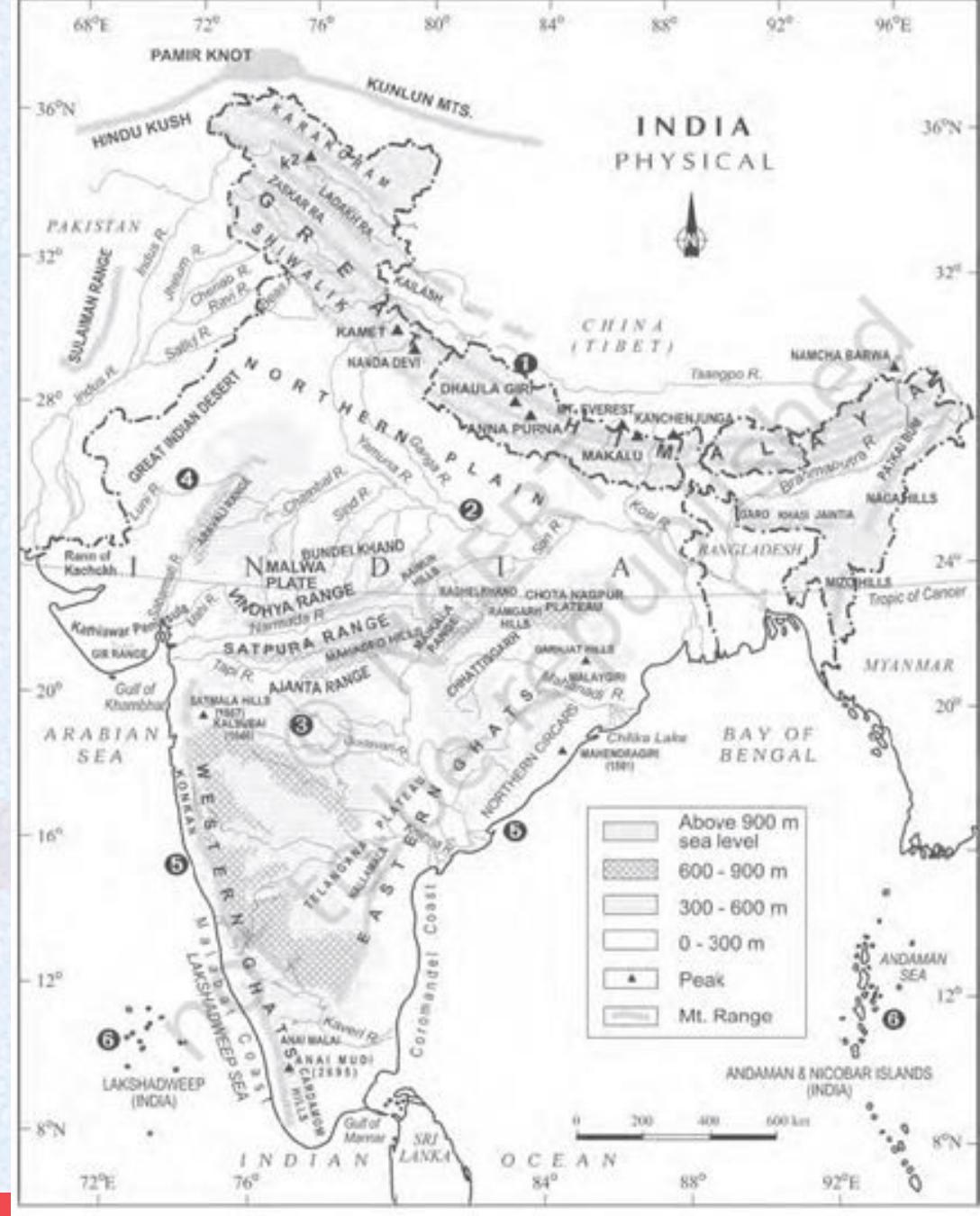


DISTRIBUTION -

I&S Plant	Iron Ore	Coal	mine & Mag	Water	Labour	Power
Jamshedpur TISCO Jharkhand	Jharkhand Odisha	Jharkhand Odisha	Odisha	Subarnrekha Odisha	Bihar Odisha	Jharkhand
Burnpur WB	Jharkhand	Raniganj	Odisha	Damodar	Bihar	Damodar Valley Corp.
Durgapur WB Help of UK	Jharkhand	Raniganj	Odisha	Damodar	Bihar	DVC
Bokaro (Jharkh.) USSR	Jharkhand	Bokaro	Odisha	Local Reservoir	Bihar	DVC
Rourkela (Odisha) Germany	Odisha	Bokaro	Odisha	Local Rivers	Odisha	Hirakud Project
Bhilai (Chhattisgarh) USSR	Chhattisgarh	Godavari Valley + Chhattisgarh	Mona + MP	Local Stream	Chattisgarh	Thermal Power Plant

72

I&S Plant	Iron Ore	Coal	mine & Mag	Water	Labour	Power
Bhadraatti (Karnataka) VISL	Karnataka	Godavari Valley AP, Ch.	Karnataka	Bhadra River + Tunga River	local	Shrawasti Power Project
Vizag (AP)	Chhattisgarh	Godavari	Karnataka + Local			
Vijaynagar Steel Plant (Kar.)	Karnataka	AP	Karnataka	Tungabhadra area	local	Tungabhadra PP
Salem (T.Nadu)	Karnataka	Neyveli Coal	Karnataka	Cauvery	local	Mettur PP



Major Industries in India

Industry	States and Main Centres of Production
1. Iron and Steel	<ol style="list-style-type: none"> 1. Tata Iron and Steel Company (TISCO) — Jamshedpur, Jharkhand 2. Bokaro Steel Plant — Hazaribagh, Jharkhand. 3. Durgapur Steel Plant — Burdwan, West Bengal. 4. Bhilai Iron and Steel Plant — Durg, Chhattisgarh. 5. Rourkela Steel Plant — Sundargarh, Odisha. 6. Indian Iron and Steel Company (IISCO) — IISCO Plants are located at Burnpur, Hirapur and Kulti, near Asansol, West Bengal. 7. Vishvesvaraya Iron and Steel Limited — Shinoga, Karnataka. 8. Vijayanagar Steel Plant — Bellary, Karnataka. 9. Vishakhapatnam Steel Plant — Vishakhapatnam, Andhra Pradesh. 10. Salem Steel Plant — Salem, Tamil Nadu.
2. Heavy Engineering Industry	
(A) Shipbuilding	<ol style="list-style-type: none"> 1. Hindustan Shipyard Limited (HSL) — Vishakhapatnam, Andhra Pradesh. 2. The Cochin Shipyard — Cochin, Kerala. 3. The Garden Reach Workshop — Kolkata, West Bengal. 4. The Mazagaon Dock Limited (MDL) — Mumbai, Maharashtra.
(B) Automobile	<ol style="list-style-type: none"> 1. Bus and Trucks — Pune, Mumbai, Chennai, Kolkata, Jamshedpur, Lucknow, Uttarakhand. 2. Jeeps — Jabalpur (MP), Mumbai. 3. Cars — Gurgaon (Haryana), Kolkata, Chennai, Mumbai, Bengaluru, Sanand (Gujarat). 4. Two and Three Wheelers — Mumbai, Pune.

(C) Railway Locomotives	<ul style="list-style-type: none"> (i) The Chittaranjan Locomotive Works — West Bengal; (ii) The Diesel Locomotive Works — Varanasi (UP); (iii) The Integral Coach Factory — Perambur, Chennai; (iv) The Rail Coach Factory — Kapurthala, Punjab.
(D) Aircraft	<ul style="list-style-type: none"> (i) The Hindustan Aeronautics Ltd. (HAL) — Nasik, Koraput, Hyderabad, Kanpur, Lucknow, Bengaluru.
(E) Heavy Electrical	<ul style="list-style-type: none"> (i) The Heavy Electrical Ltd. — Bhopal, Madhya Pradesh; (ii) The Bharat Heavy Electrical Ltd. — Haridwar (UP), Ramchandrapuram (Telangana), Tiruchirapalli (Andhra Pradesh); (iii) The Hindustan Cables Factory — Jhansi (UP) and Rupnarainpur, West Bengal.
(F) Heavy Machines and Tools	<ul style="list-style-type: none"> (i) The Hindustan Machine Tools (HMT) — Bengaluru, Karnataka; (ii) The Heavy Machine Tools Plant — Ranchi, Jharkhand; (iii) The Machine Tool Corporation of India — Ajmer, Rajasthan; (iv) The Praga Tools Ltd., — Secunderabad, Andhra Pradesh; (v) The National Instruments Factory — Kolkata, West Bengal.
3. Electronics	<ul style="list-style-type: none"> (i) The Indian Telephone Industries (ITI) — Bengaluru, Karnataka; (ii) The Electronics Corporation of India Ltd. (ECIL) — Hyderabad, Andhra Pradesh; (iii) The Bharat Electronics Ltd. (BEL) — Bengaluru, Karnataka.

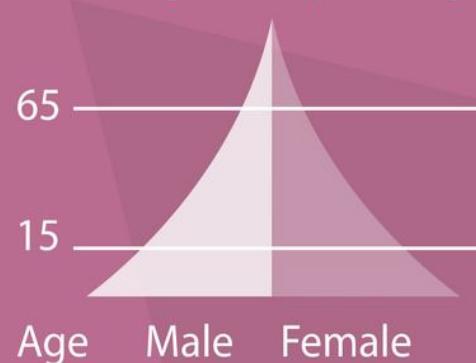
4. Space Technology	<ol style="list-style-type: none"> 1. The Indian Space Research Organisation (ISRO), — Bengaluru, Karnataka. 2. Satellite Launching Station — Sriharikota, Andhra Pradesh. 3. National Remote Sensing Agency — Hyderabad, Andhra Pradesh. 4. Chandrayaan-I — India's First Scientific Mission to Moon.
5. Software Industry	Bengaluru and Hyderabad.
6. Entertainment	Mumbai, Kolkata, Chennai and Pune
7. Petrochemical Industry	<ol style="list-style-type: none"> 1. Herdillia Chemicals Ltd. — Chennai, Tamil Nadu. 2. National Organic Chemicals Industries Ltd. — Mumbai, Maharashtra. 3. Petrofils Cooperative Limited (PCL) — Three plants located at Vadodara and Naldhari in Gujarat. 4. Indian Petrochemical Corporation Ltd. — Vadodara, Gujarat. 5. The Bongaigaon Petrochemicals Ltd. — Bongaigaon, Assam. 6. The Reliance Industries: Hazira, Gujarat. 7. Haldia Petrochemicals Ltd.: Haldia, West Bengal. 8. The Indian Oil Corporation: Three plants in Gujarat and Panipat.



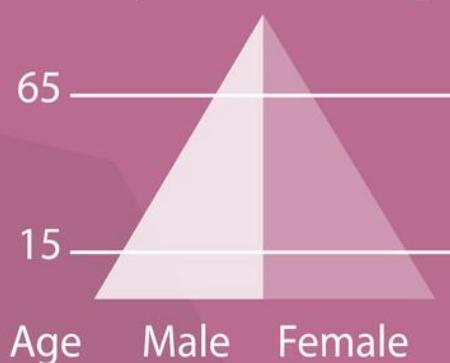
Industrial Regions

POPULATION PYRAMID SHAPES

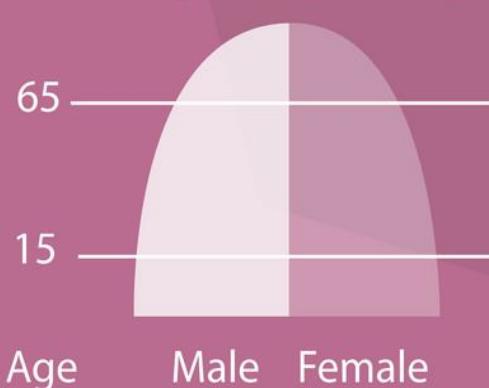
Stage 1 - expanding



Stage 2 - expanding



Stage 3 - stationary

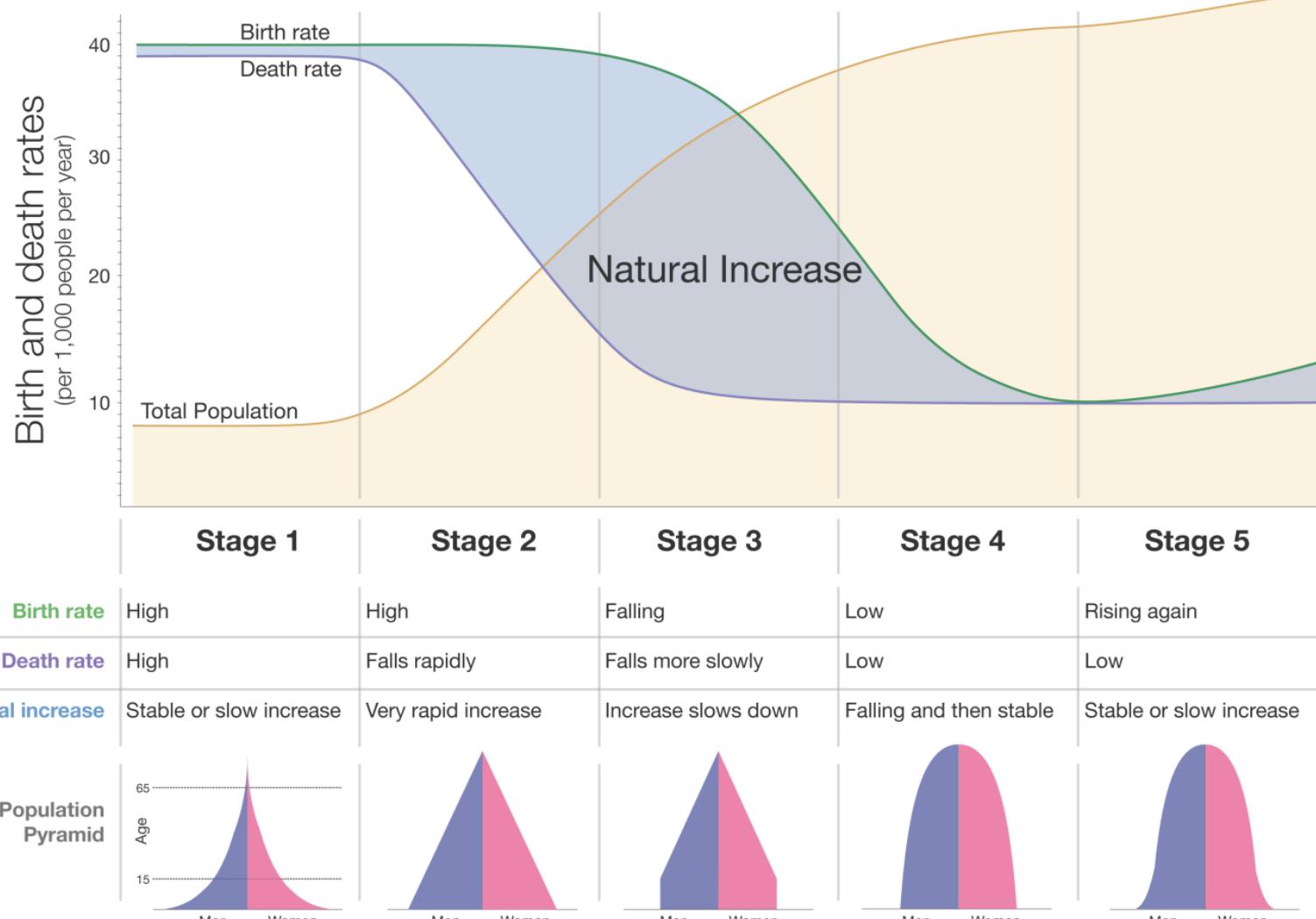


Stage 4 - contracting



The demographic transition in 5 stages

Our World
in Data



The author Max Roser licensed this visualisation under a CC BY-SA license. You find more information at the source: <http://www.OurWorldInData.org/world-population-growth>



Questions??



- Read and revise what is taught
- Read the reference material
- Online query (For faster reply)
- Mentoring sessions

If Dil Maange beyond MORE...

Mail: rajesh@visionias.in
Twitter: [@naturiousoul](https://twitter.com/naturiousoul)