



# **GEOGRAPHY**

# *Climatology*

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Weather and climate

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Composition of atmosphere

---

Structure of atmosphere

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Insolation, Heat Budget & Albedo

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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

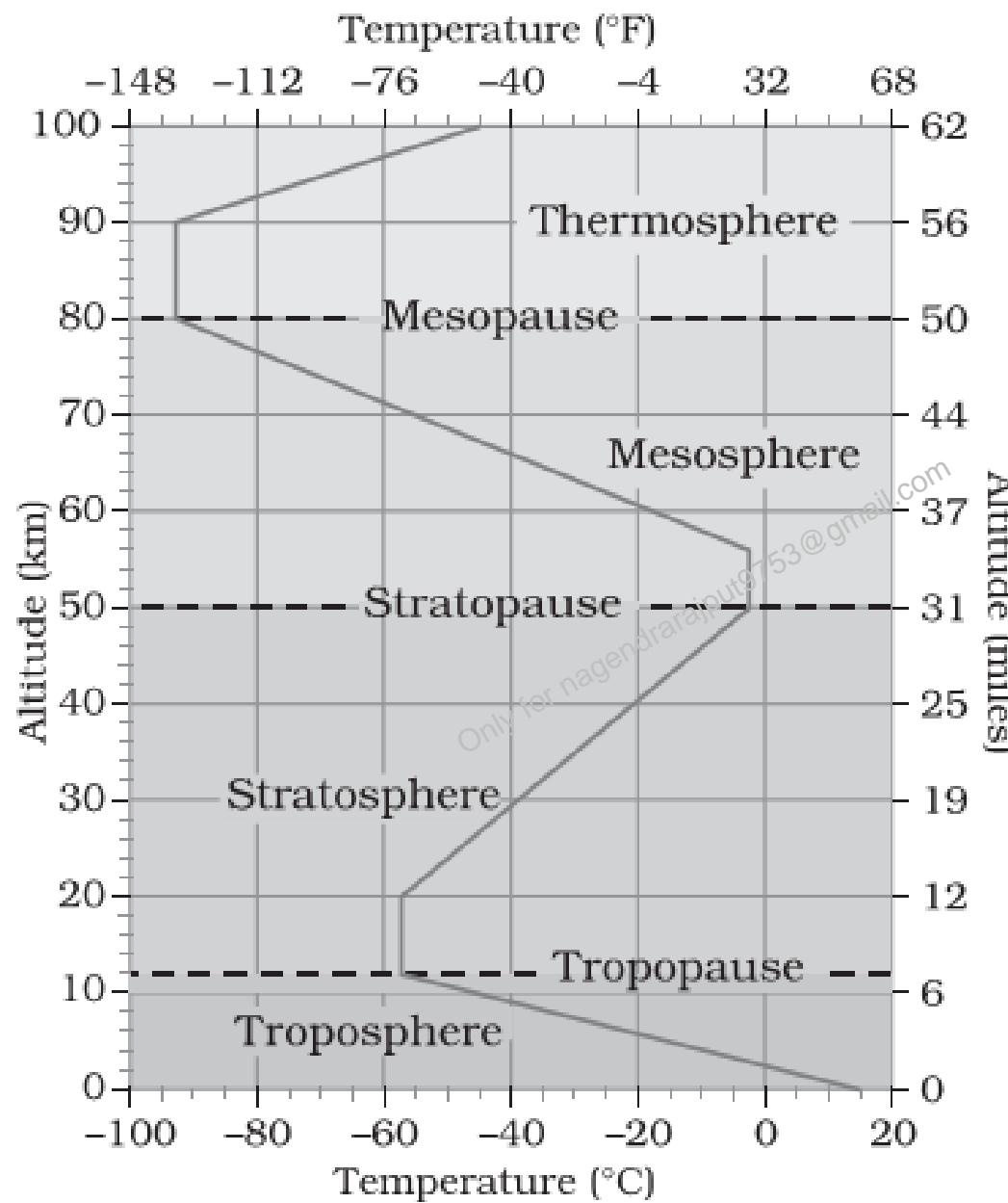
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Climatic regions

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**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**

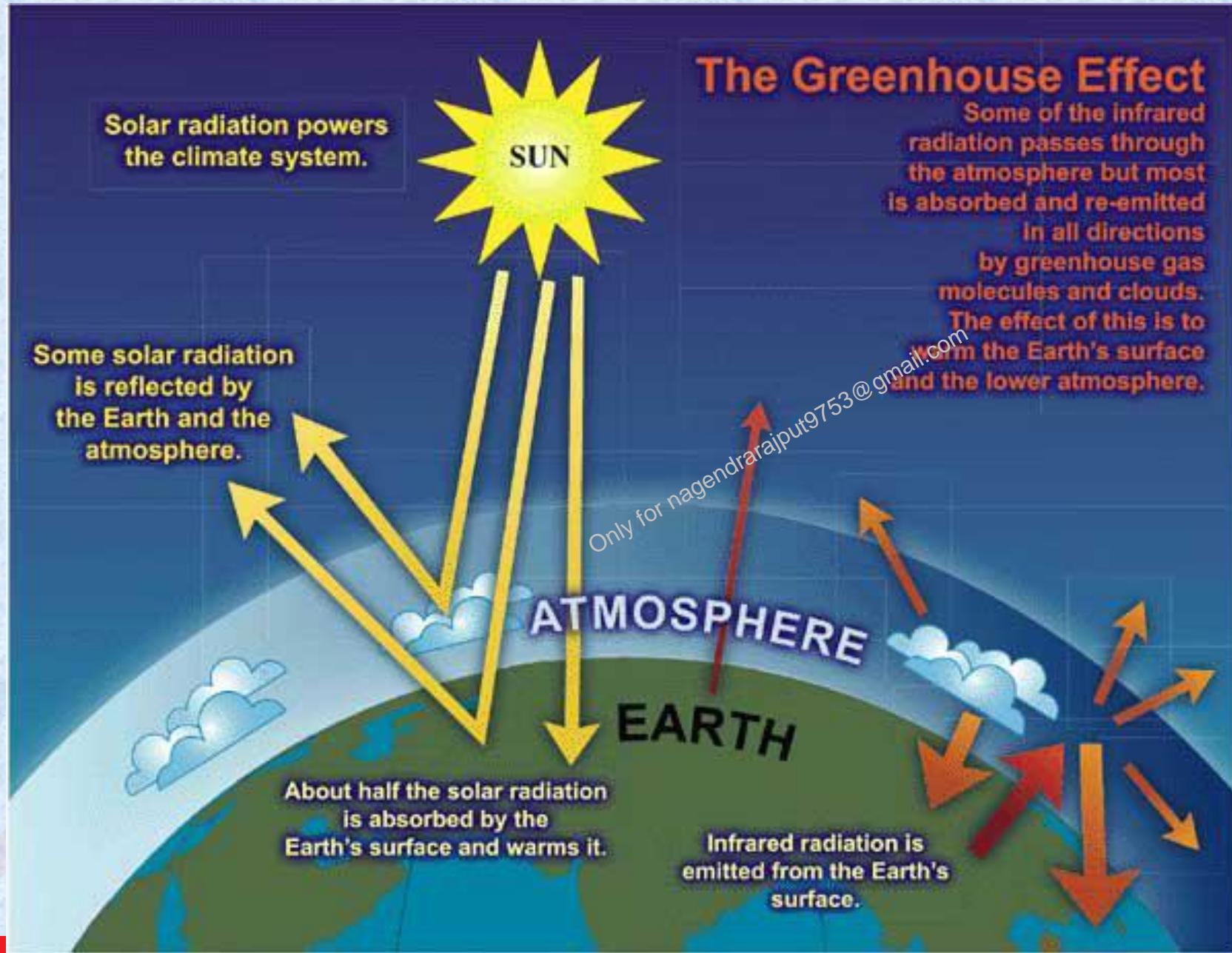
A layer in the Earth's atmosphere called Ionosphere facilitates radio communication.

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**

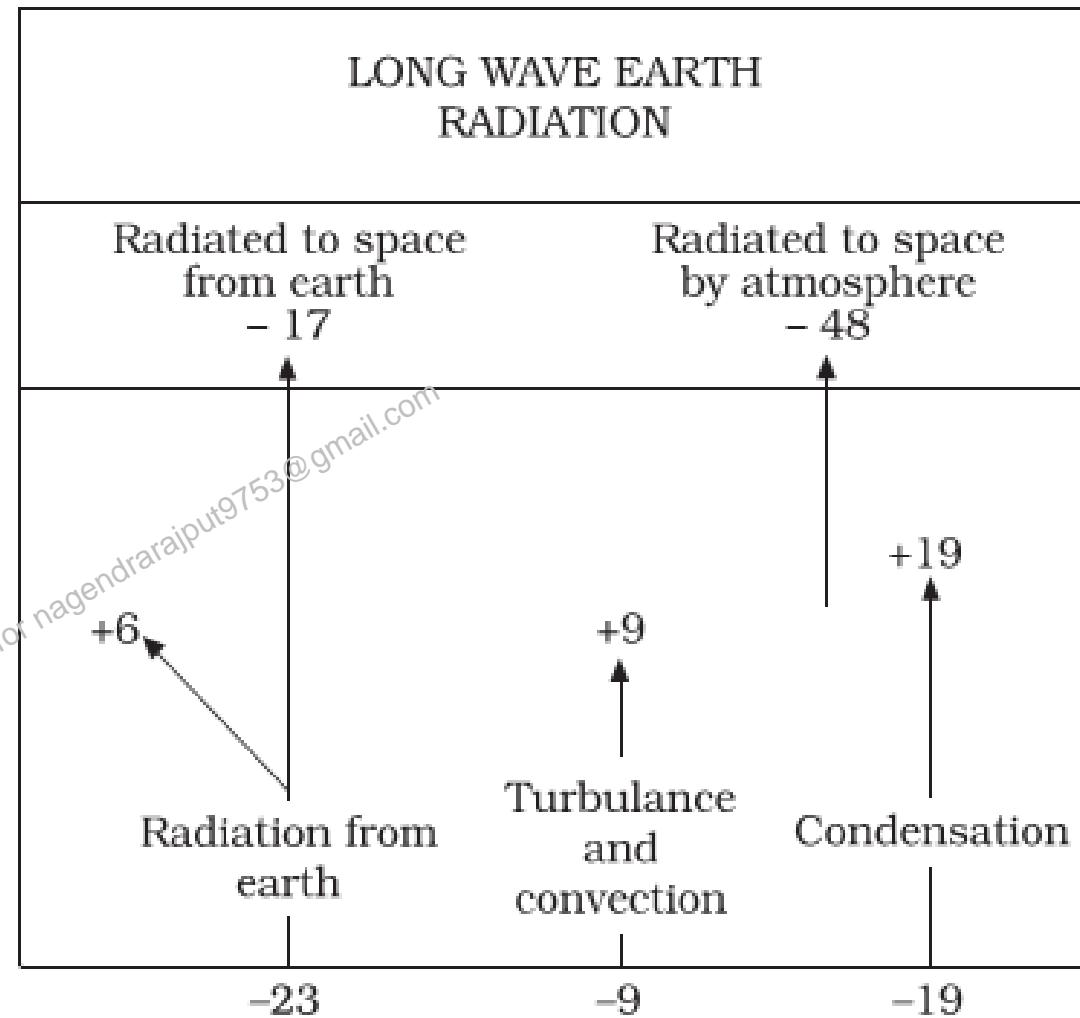
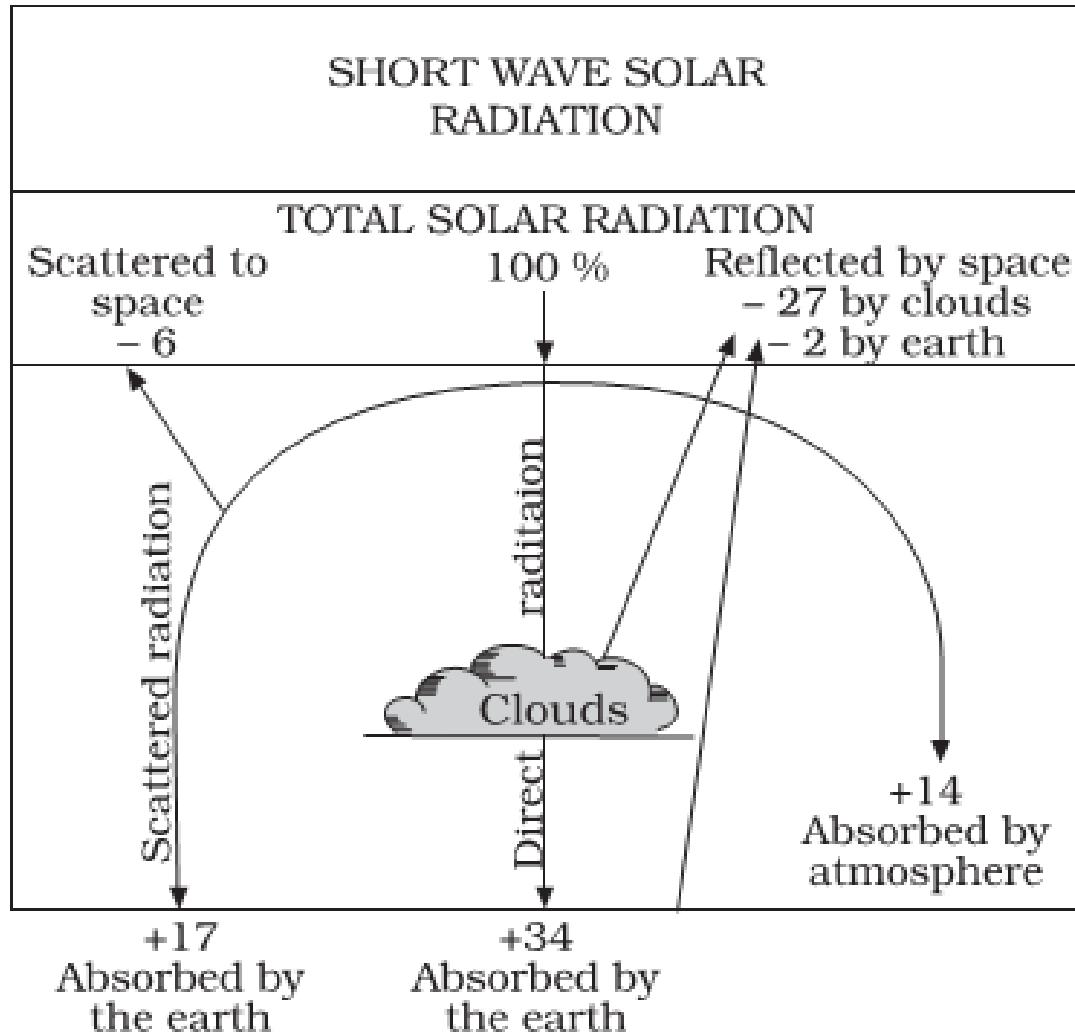
**Consider the following which can be found in the ambient atmospheres:**

- 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**

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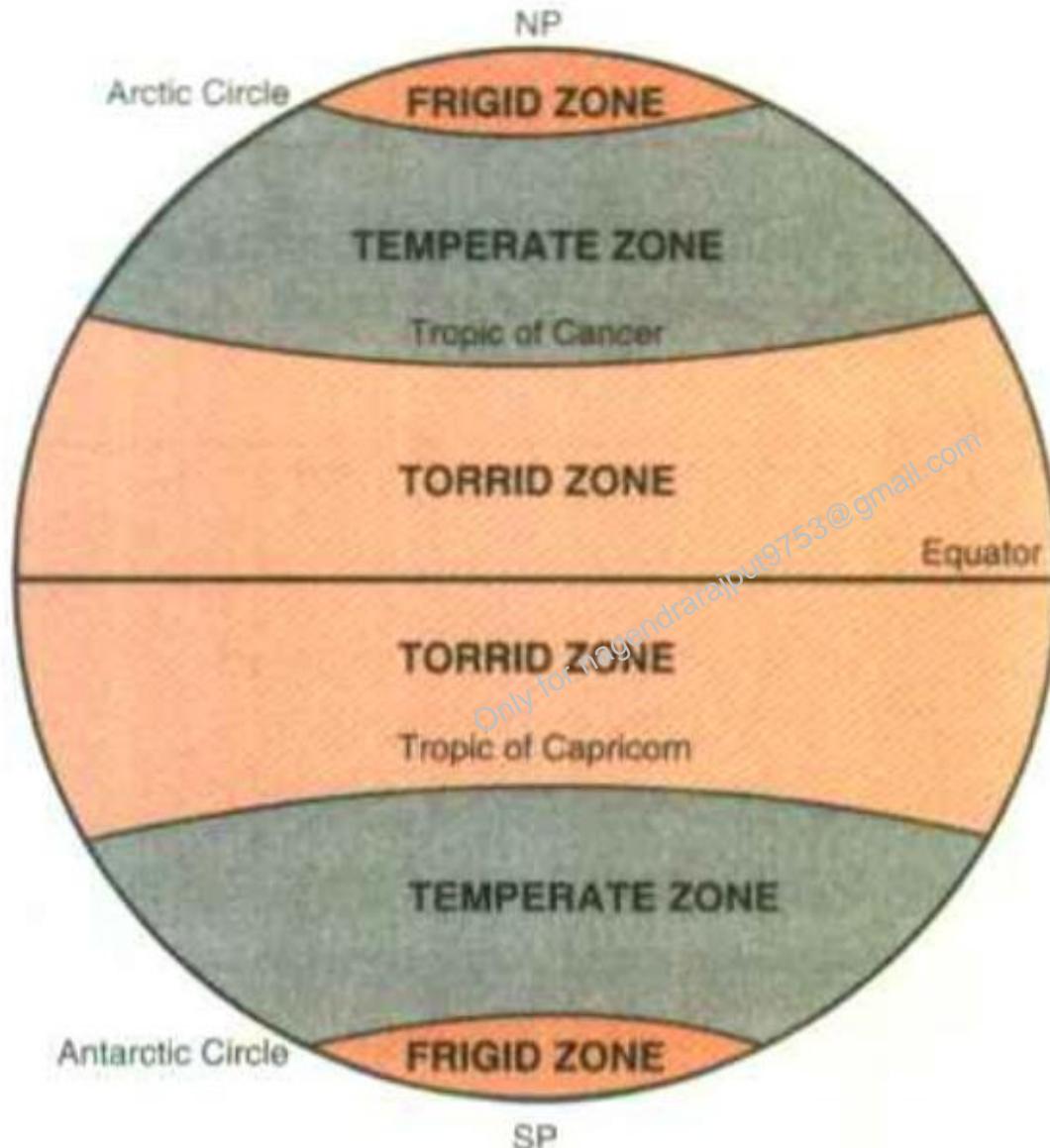
**Figure 9.2 : Heat budget of the earth**

## Sample Albedos of Earth

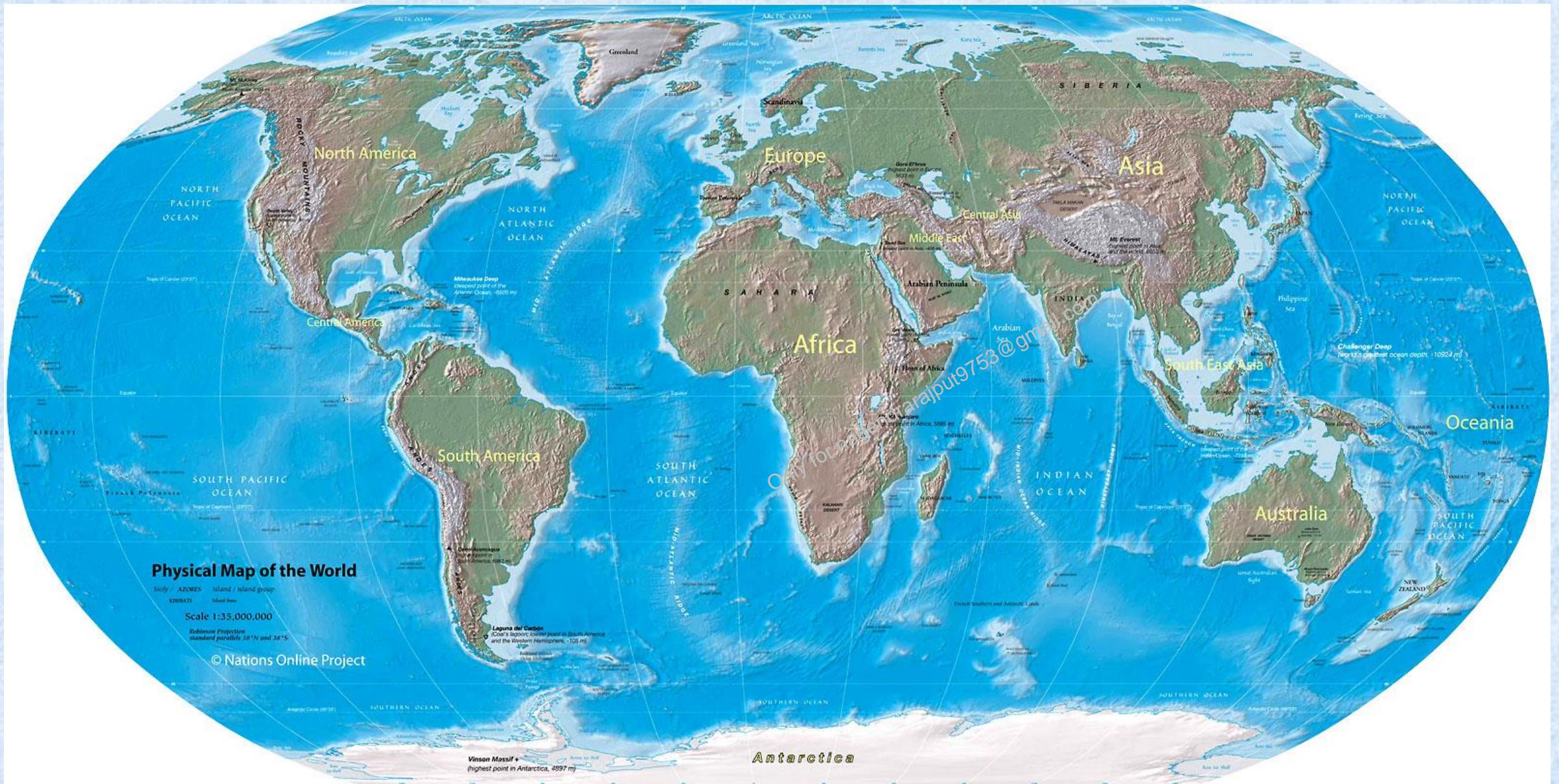
<u>Surface</u>	<u>Typical albedo</u>
Fresh asphalt	0.04
Open ocean	0.06
Worn asphalt	0.12
Conifer forest (Summer)	0.08, 0.09 to 0.15
Deciduous trees	0.15 to 0.18
Bare soil	0.17
Green grass	0.25
Desert sand	0.4
New concrete	0.55
Ocean ice	0.5–0.7
Fresh snow	0.80–0.90

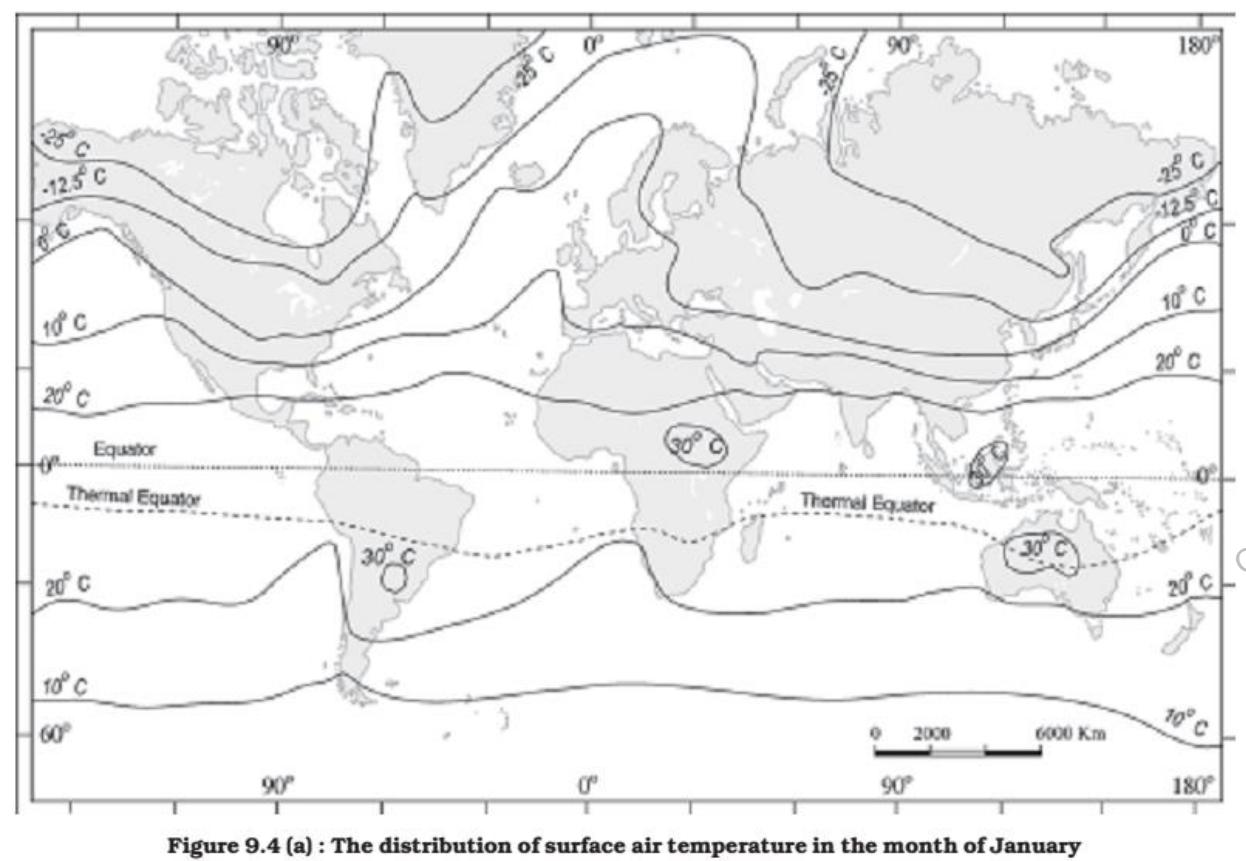
2010	<p>Which one of the following reflects back more sunlight as compared to other three?</p> <p>(a) Sand desert (b) Paddy crop land (c) Land covered with fresh snow (d) Prairie land</p>
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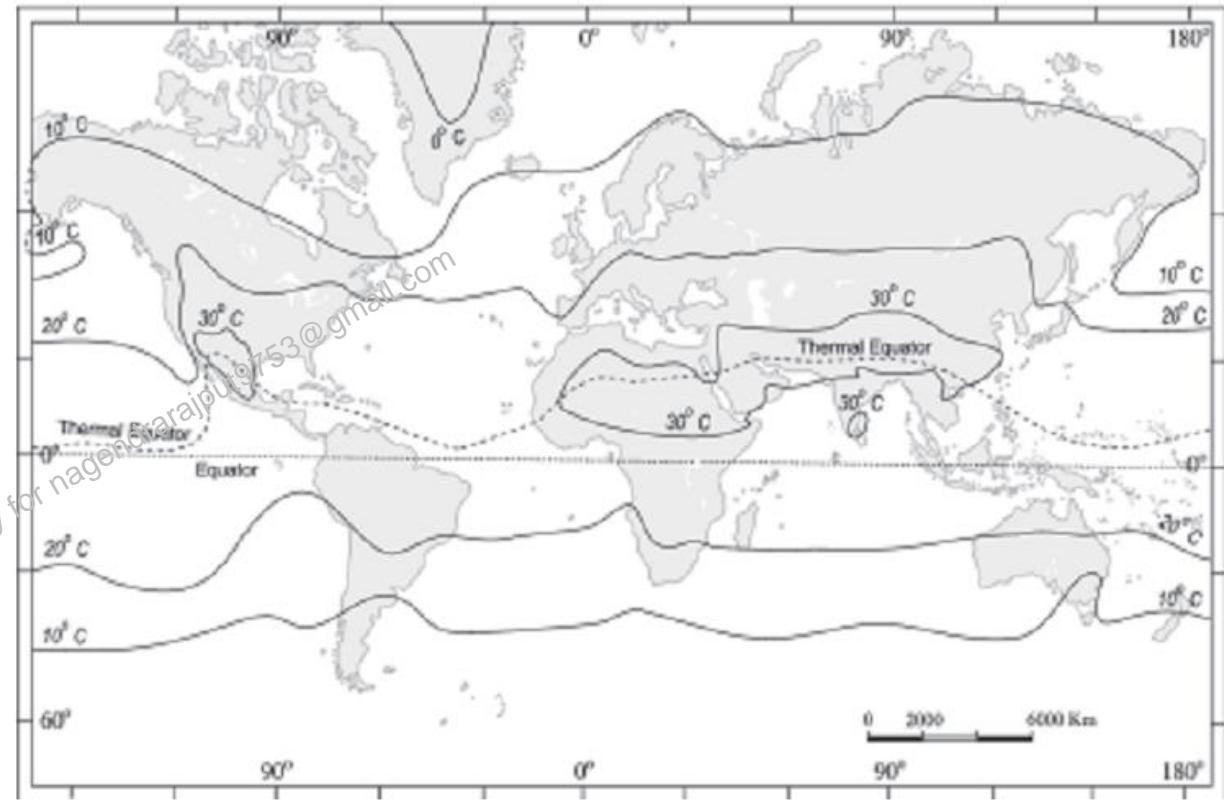


**Fig. 15.3. Heat Zones**





**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) **DECEMBER 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

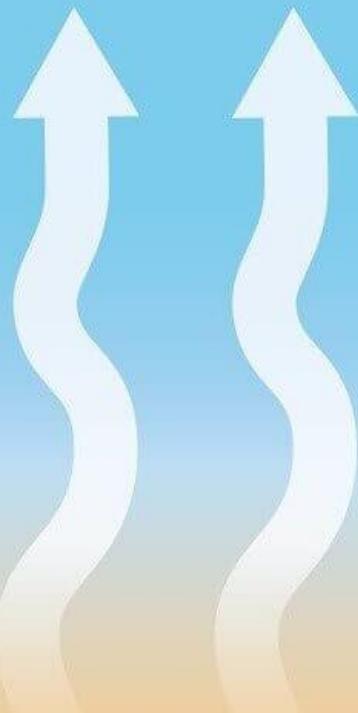
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## Normal Conditions

Cold Air

Cooler Air

Warm Air



## Temperature Inversion

Cold Air

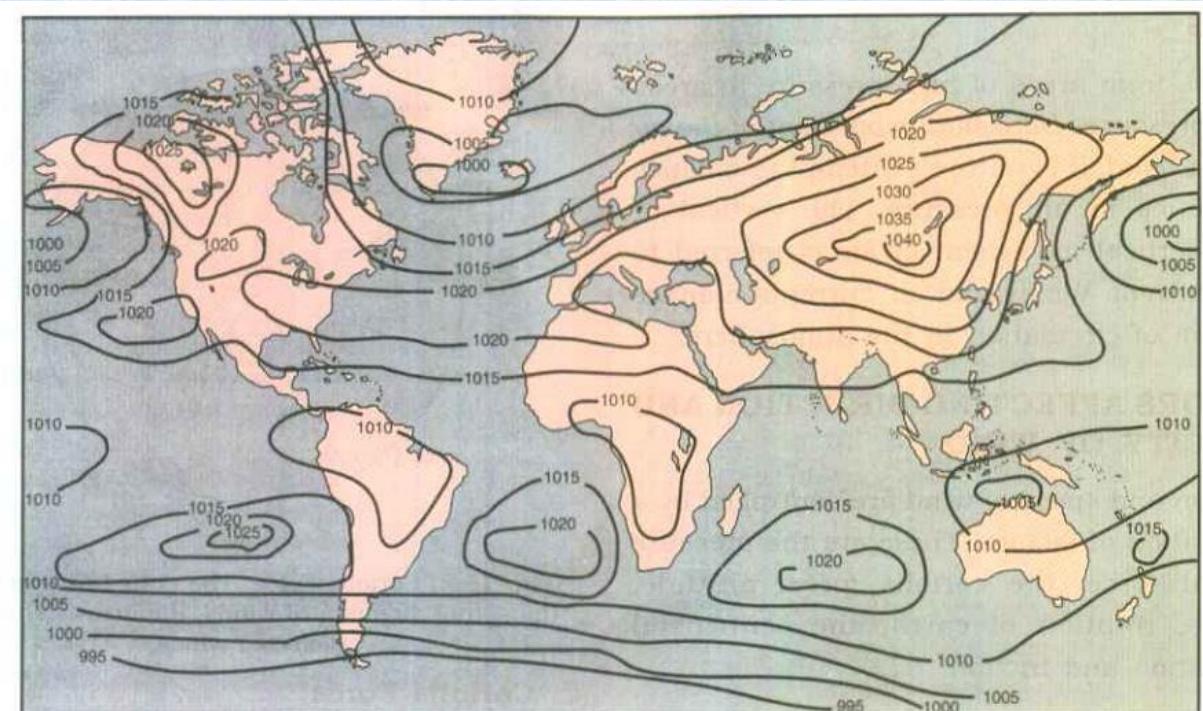
Warm Air – Inversion Layer

Cooler Air

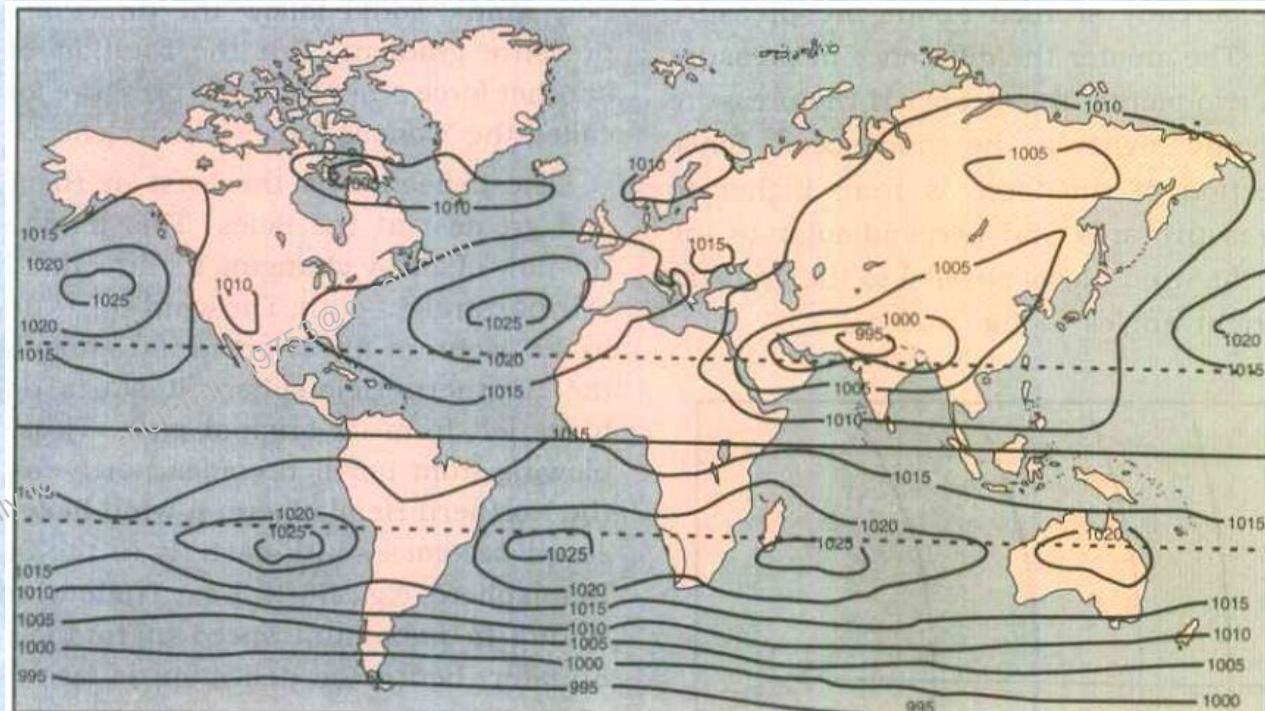
Smog

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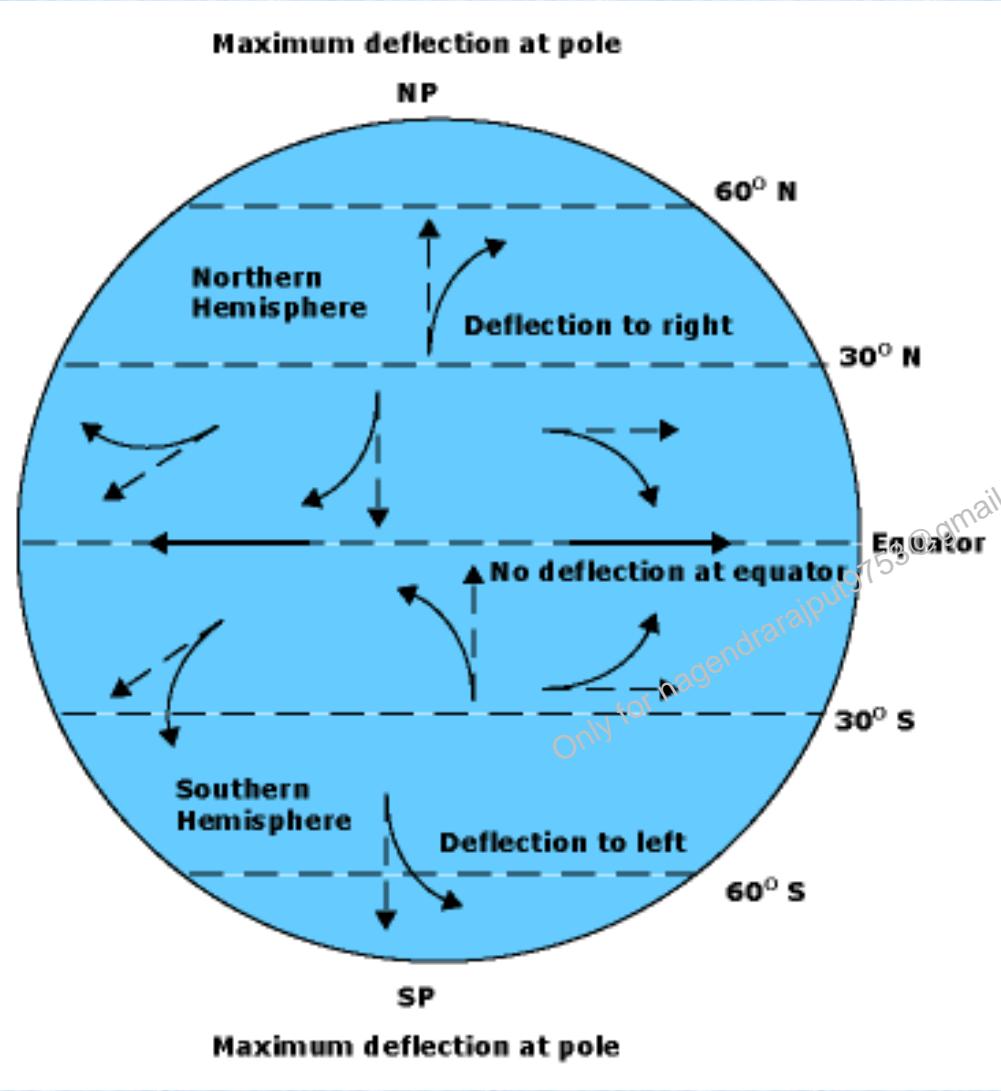




**Fig. 16.5.** World distribution of pressure in January (Figures are in millibars)



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



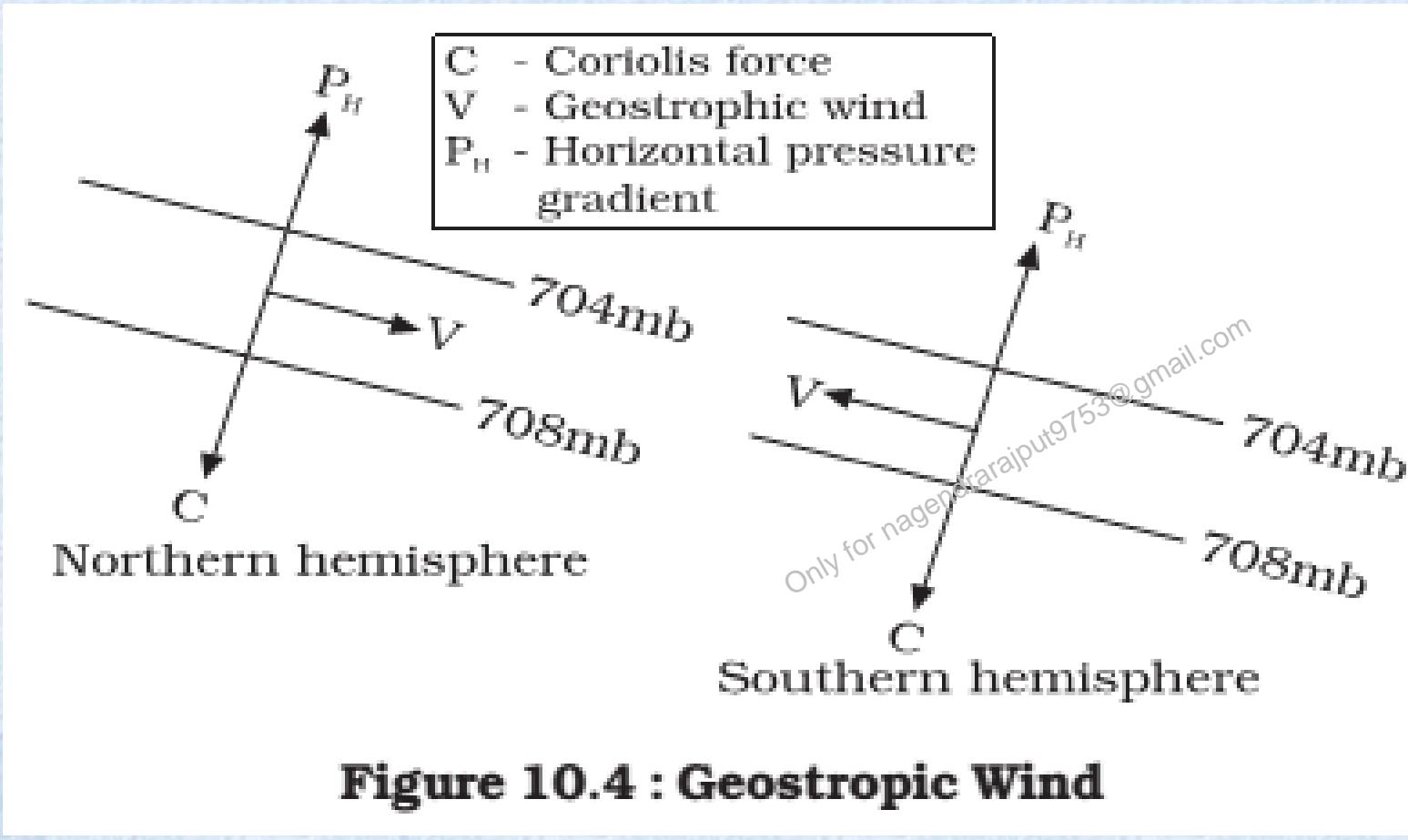
<https://www.youtube.com/watch?v=mPsLanVS1Q8>

**2010**

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

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

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**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

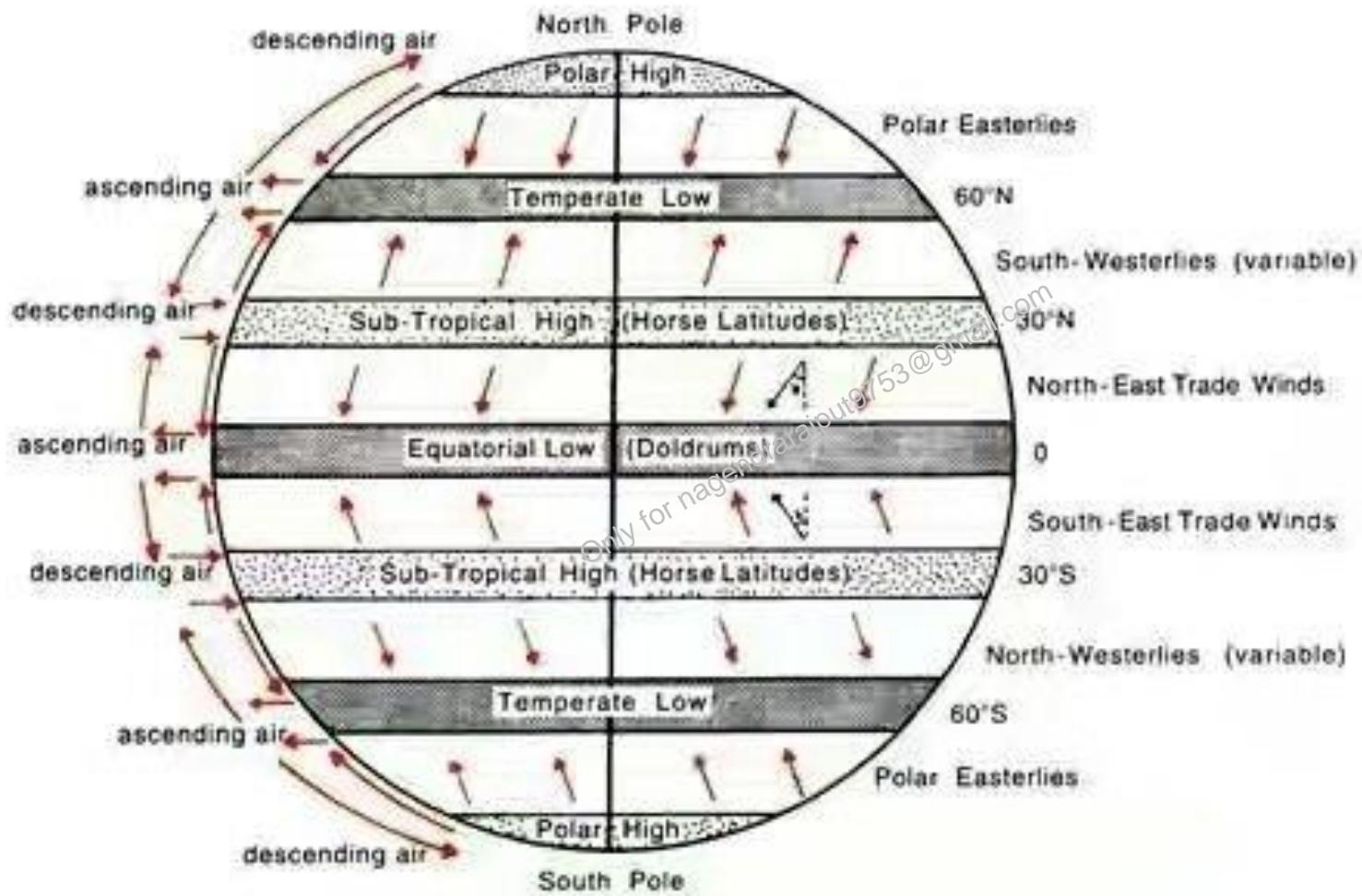
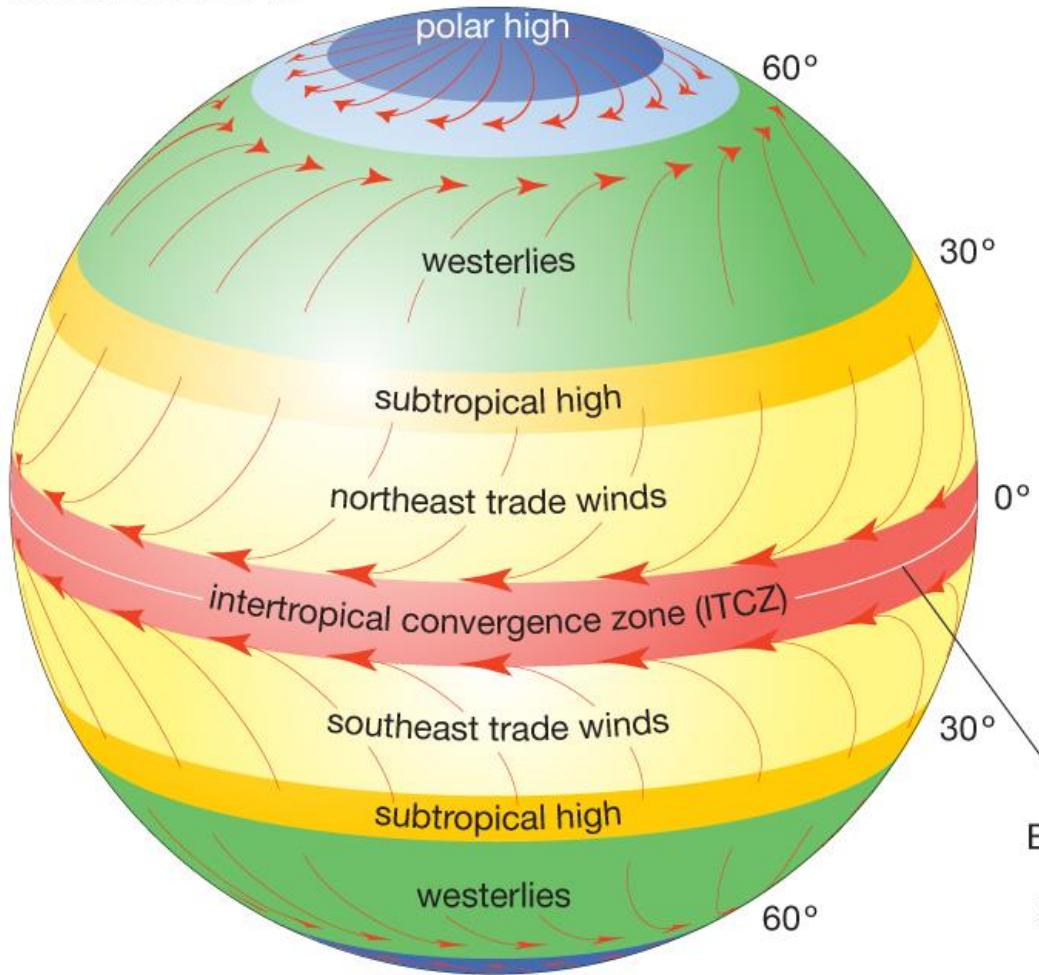


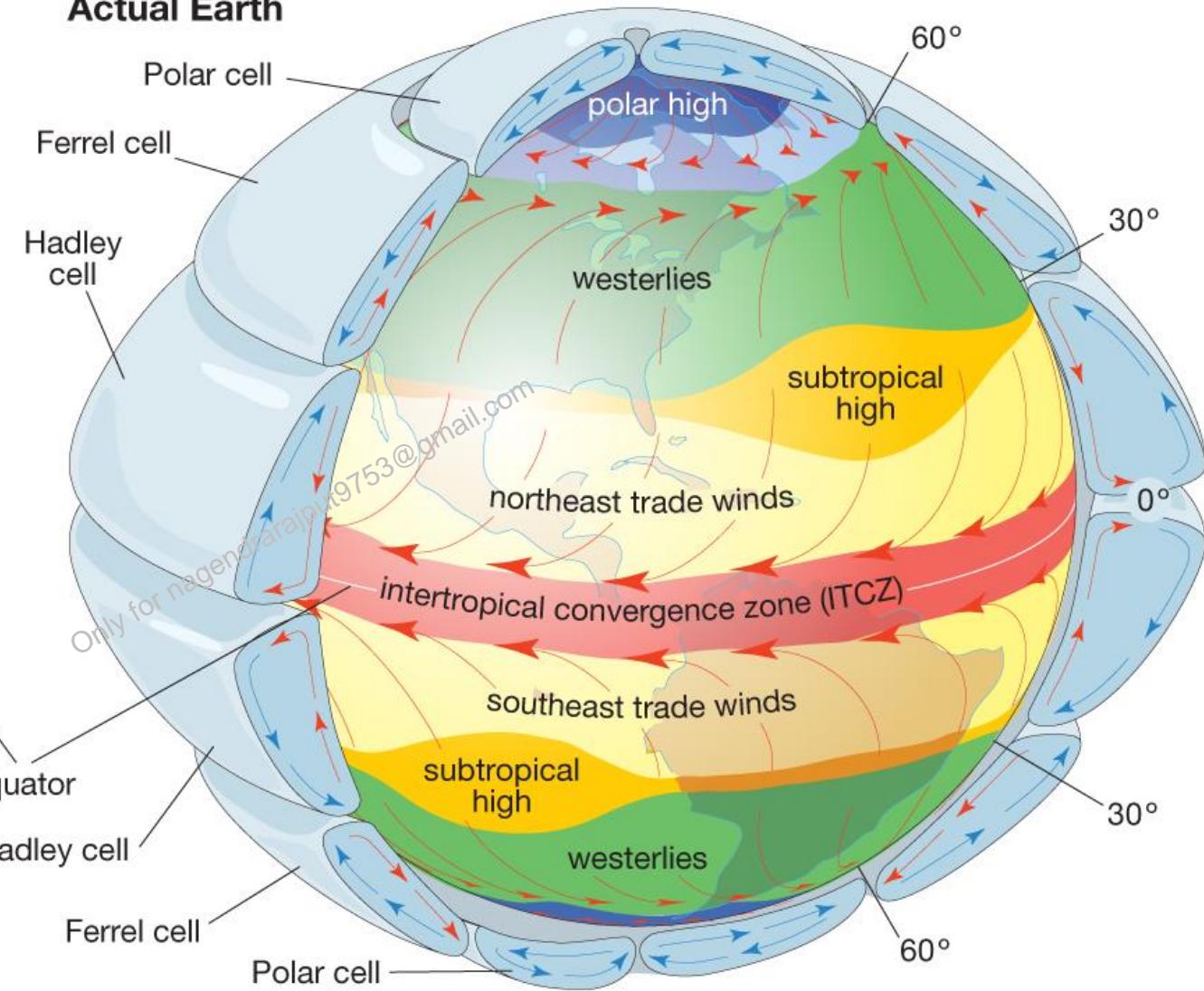
Fig. 115 The distribution of world pressure belts and planetary winds

**Idealized Earth**



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**Actual Earth**



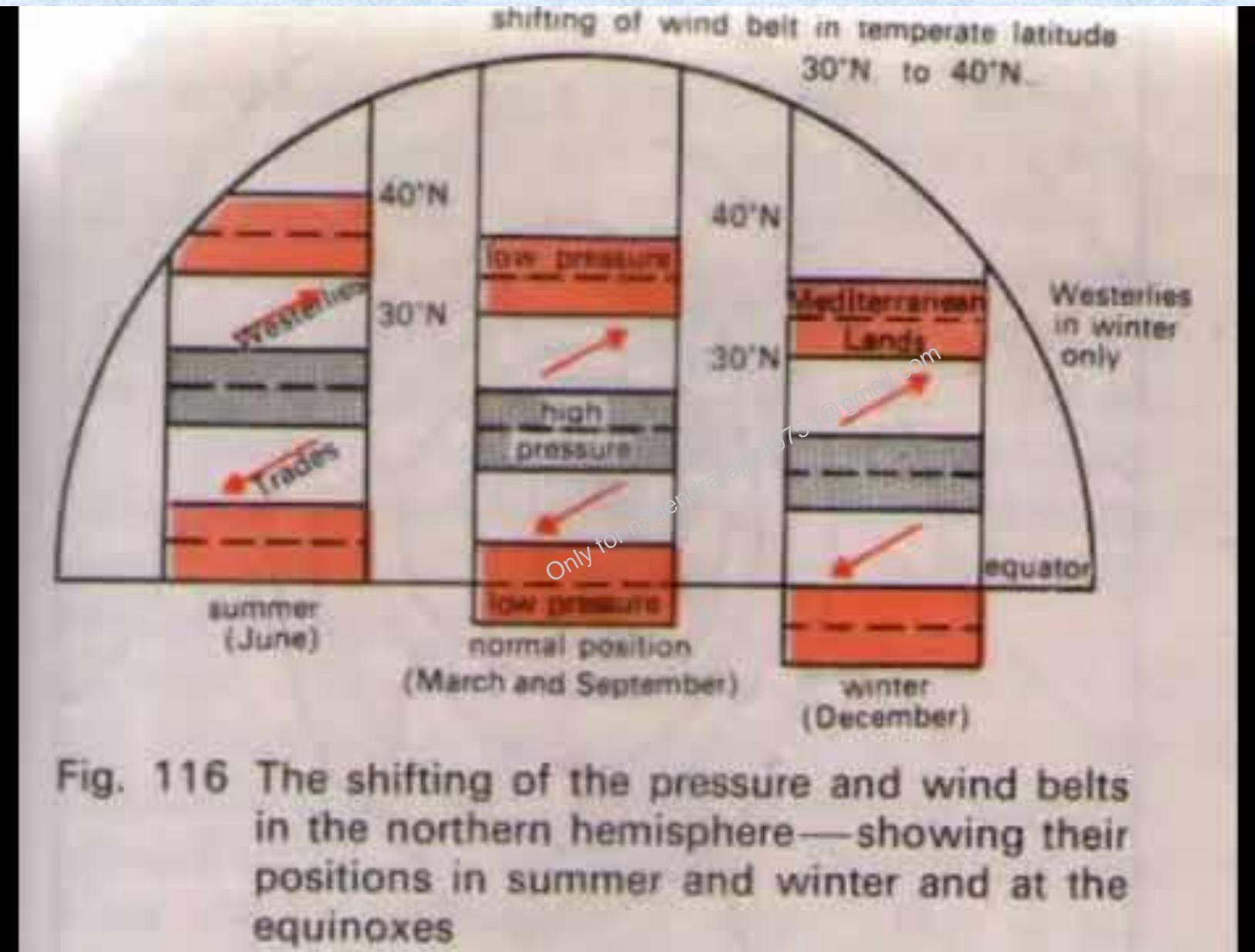


Fig. 116 The shifting of the pressure and wind belts in the northern hemisphere—showing their positions in summer and winter and at the equinoxes

<https://earth.nullschool.net>

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IAS

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>
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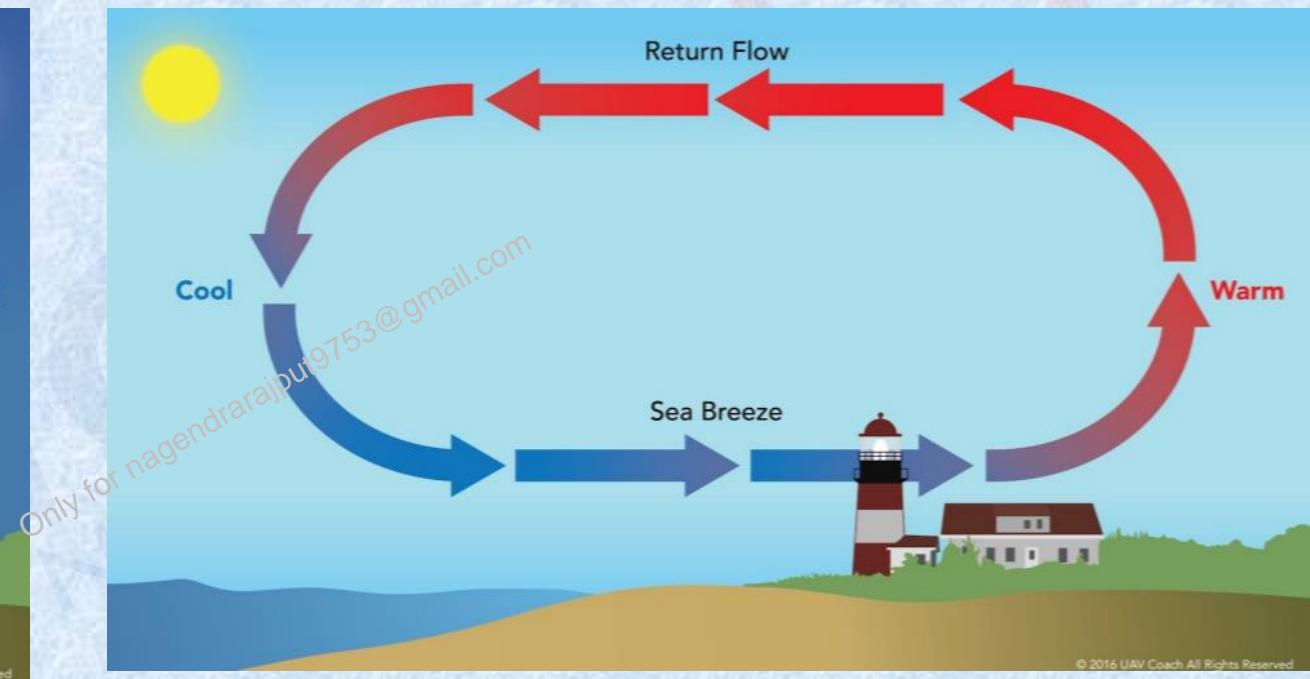
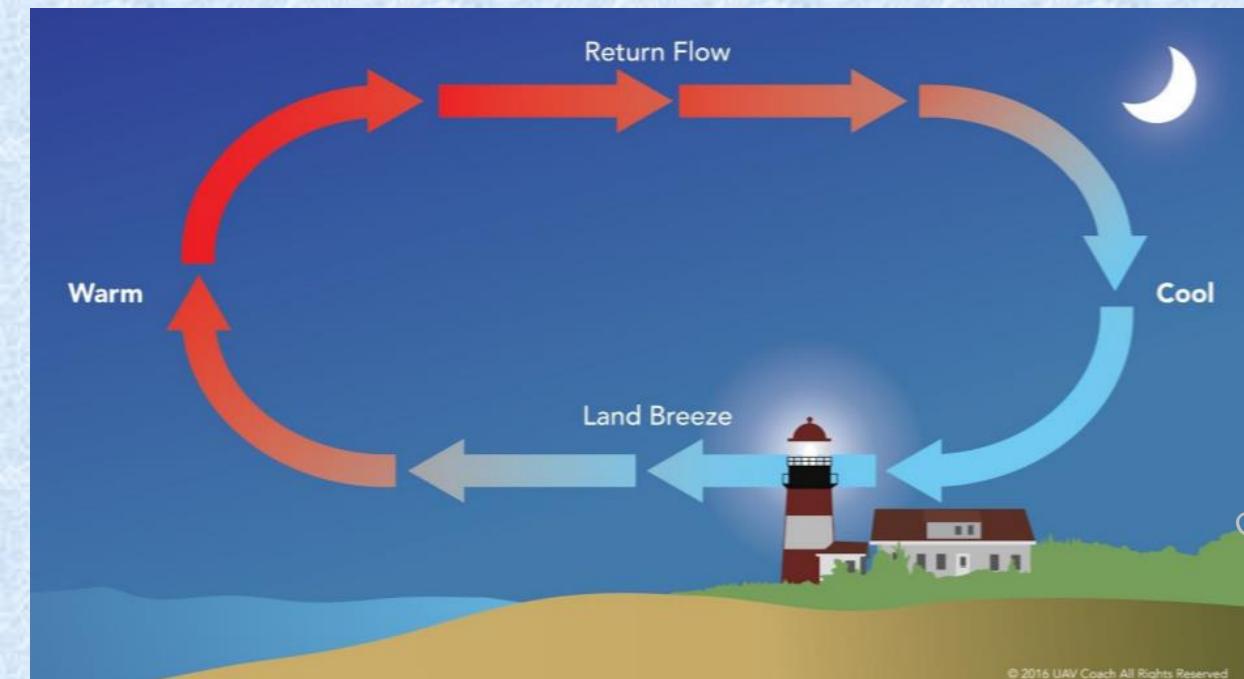
**2015**

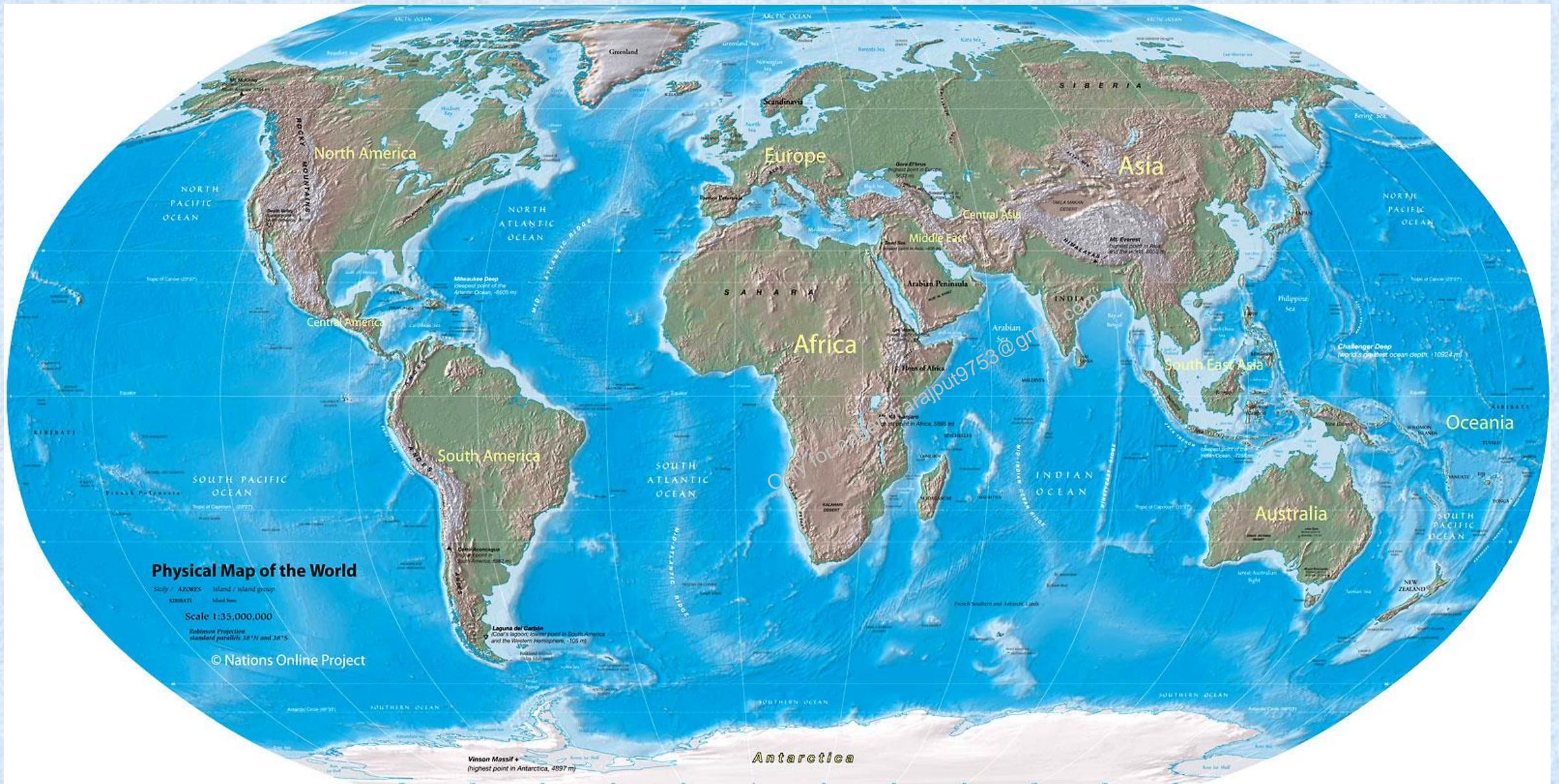
**Consider the following statements:**

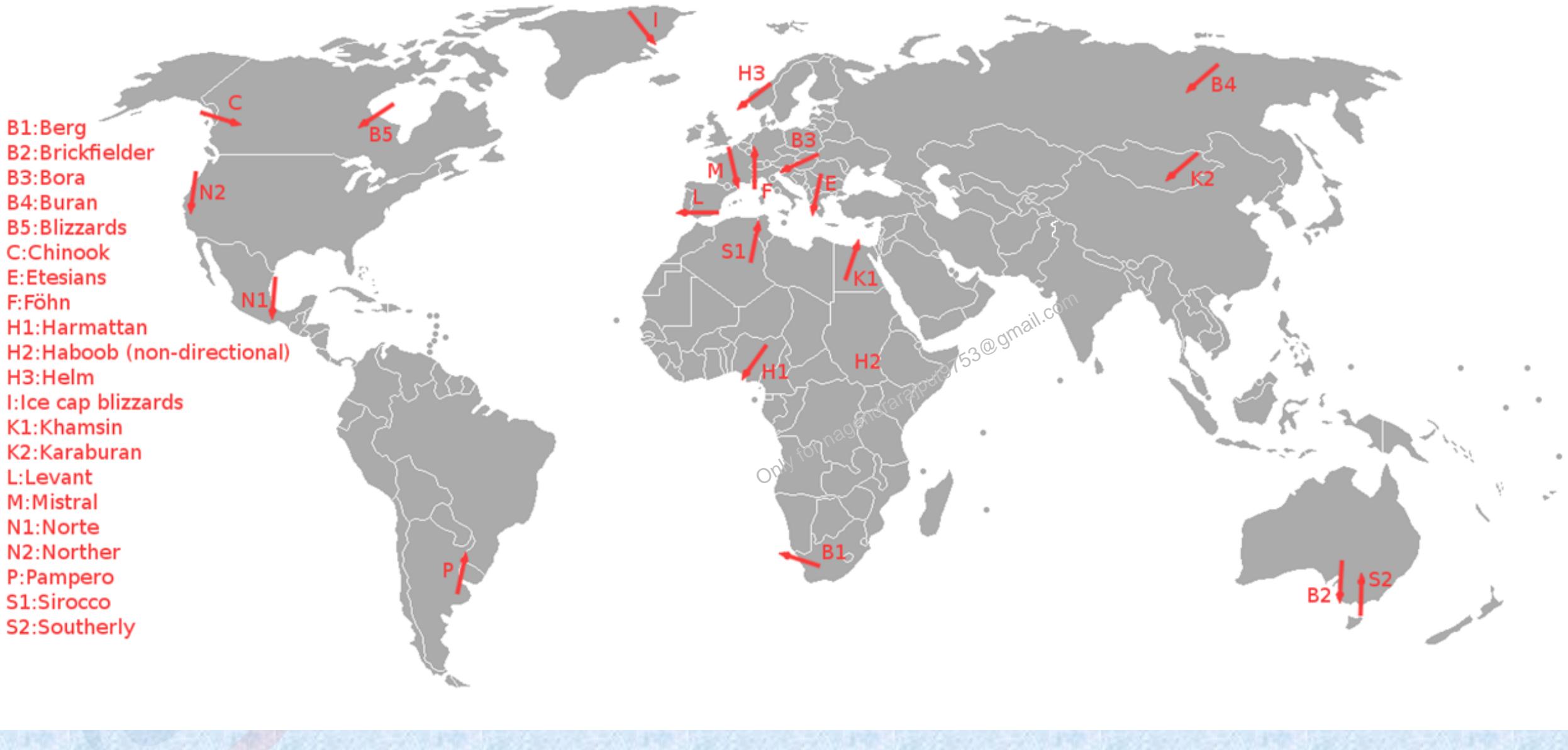
1. The winds which blow between  $30^{\circ}$  N and  $60^{\circ}$  S latitudes throughout the year are known as westerlies.
2. The moist air masses that cause winter rains in North-Western region of India are part of westerlies.

**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









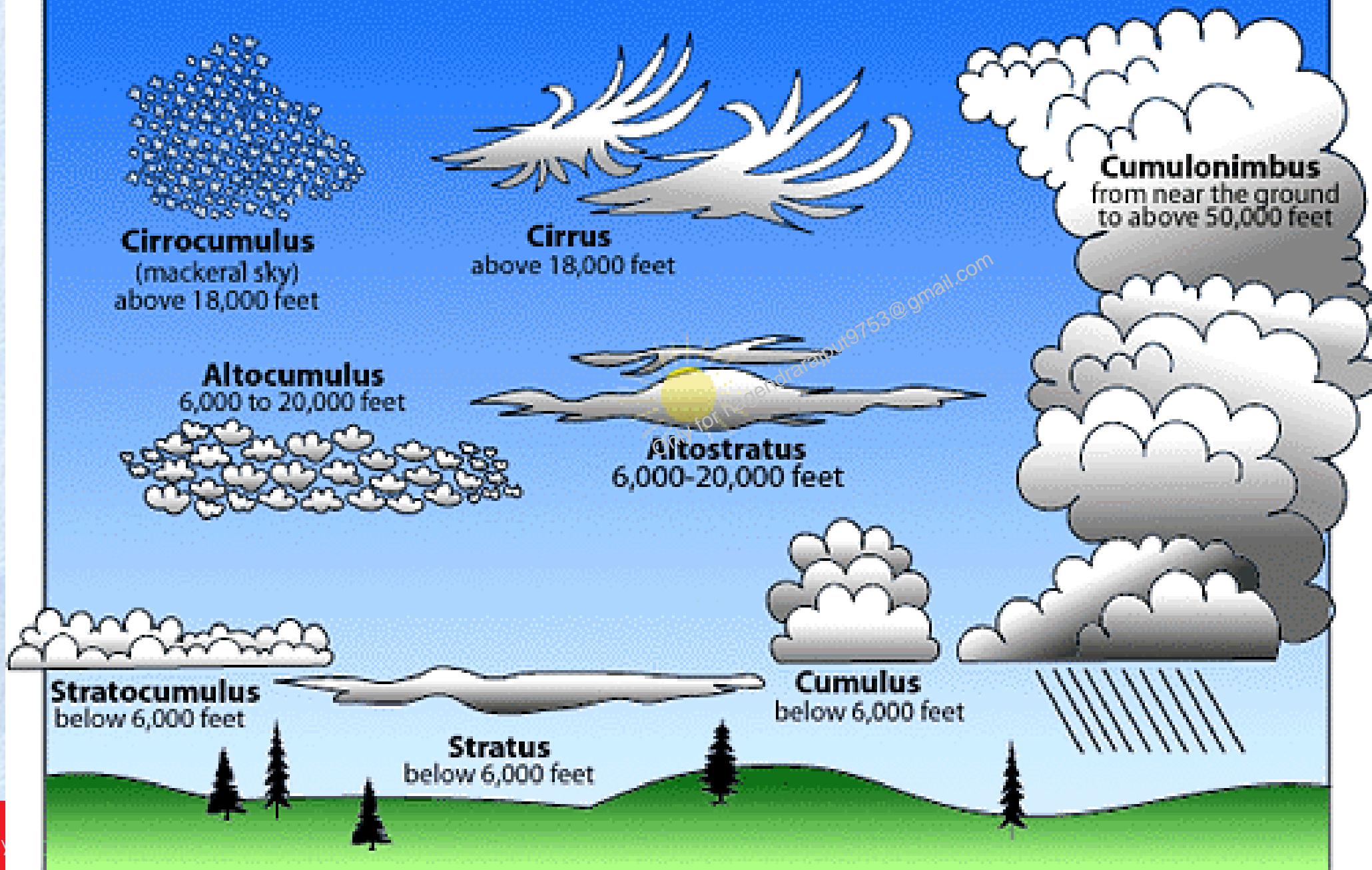
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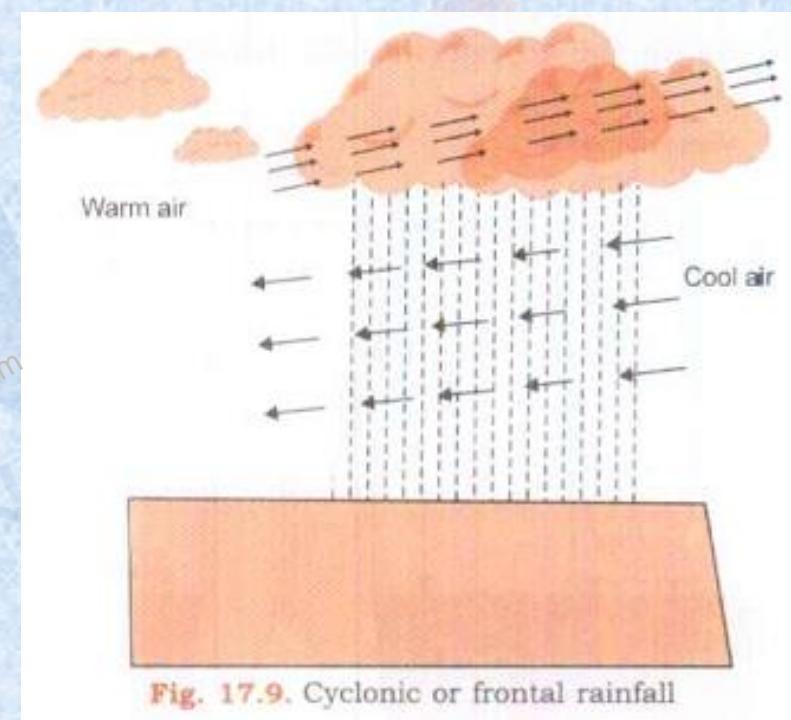
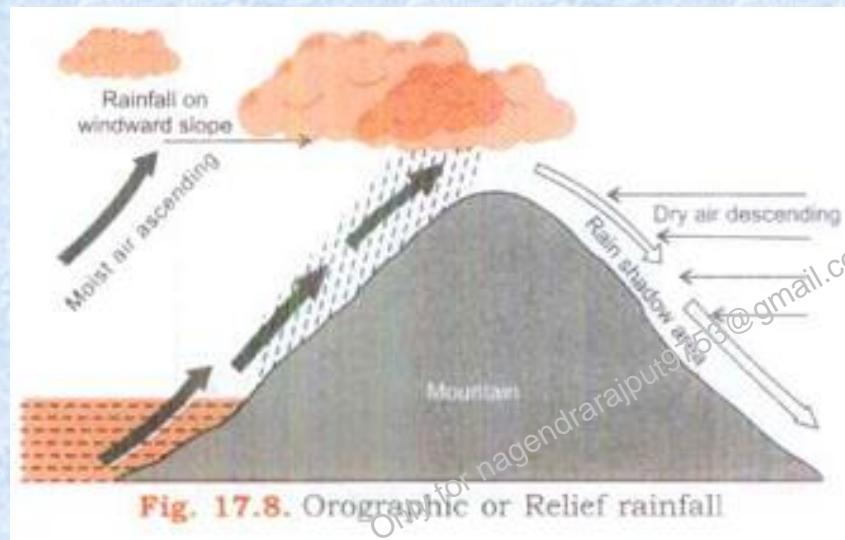
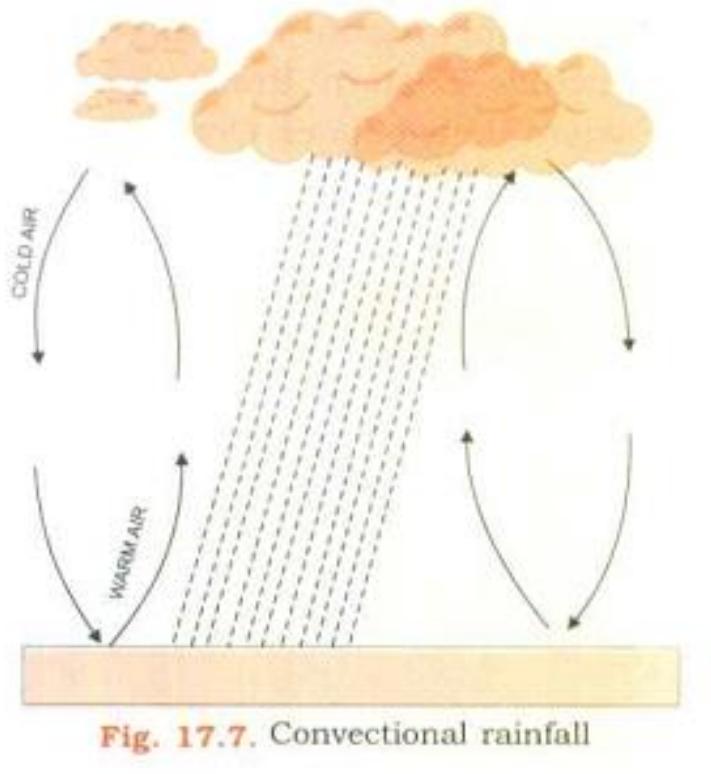


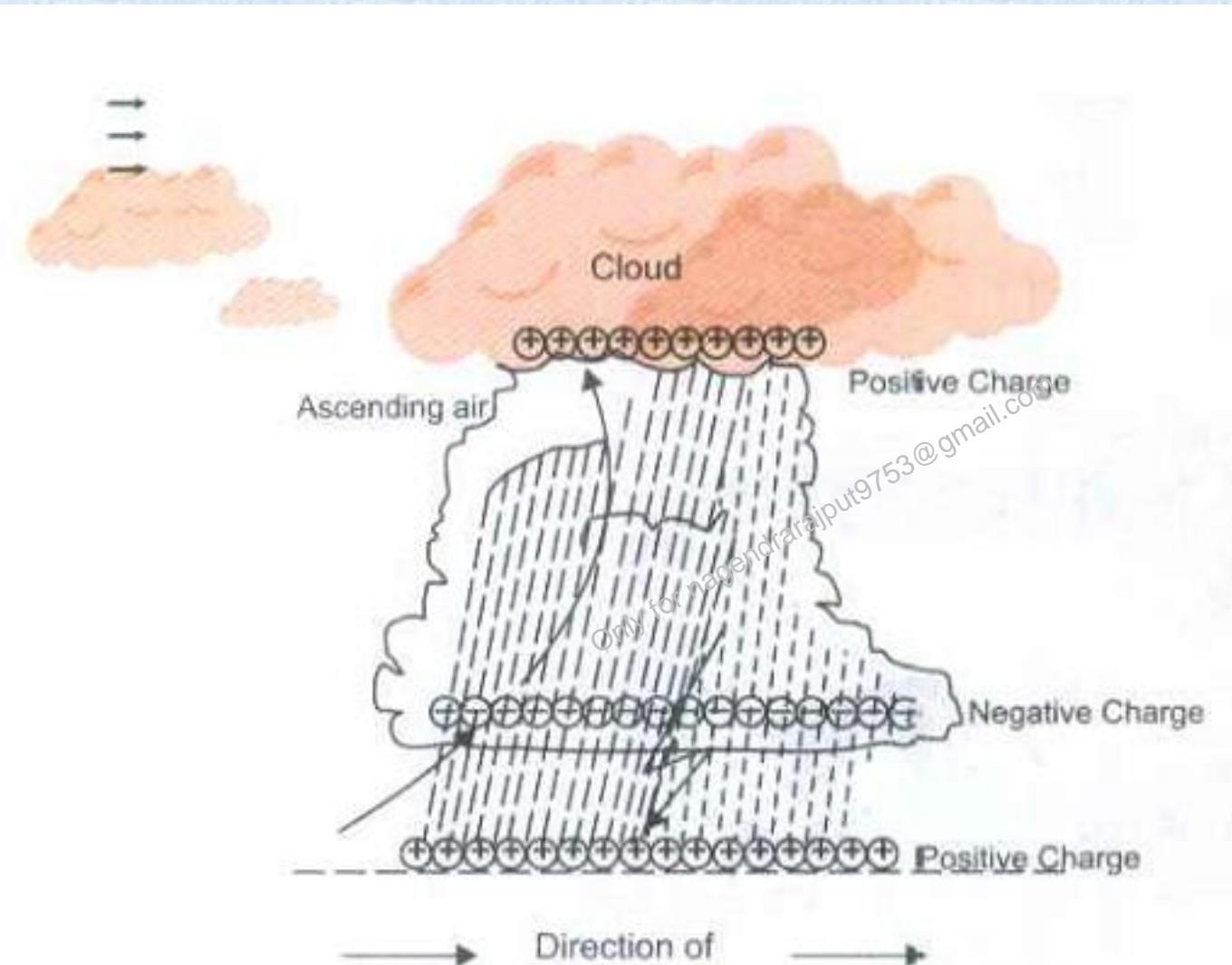


44	Climatology	2019	Why are dewdrops not formed on a cloudy night?  (a) Clouds absorb the radiation released from the Earth's surface. (b) Clouds reflect back the Earth's radiation. (c) The Earth's surface would have low temperature on cloudy nights. (d) Clouds deflect the blowing wind to ground level.
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## Common types of clouds in the troposphere







**Fig. 17.10. Thunderstorm**



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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.

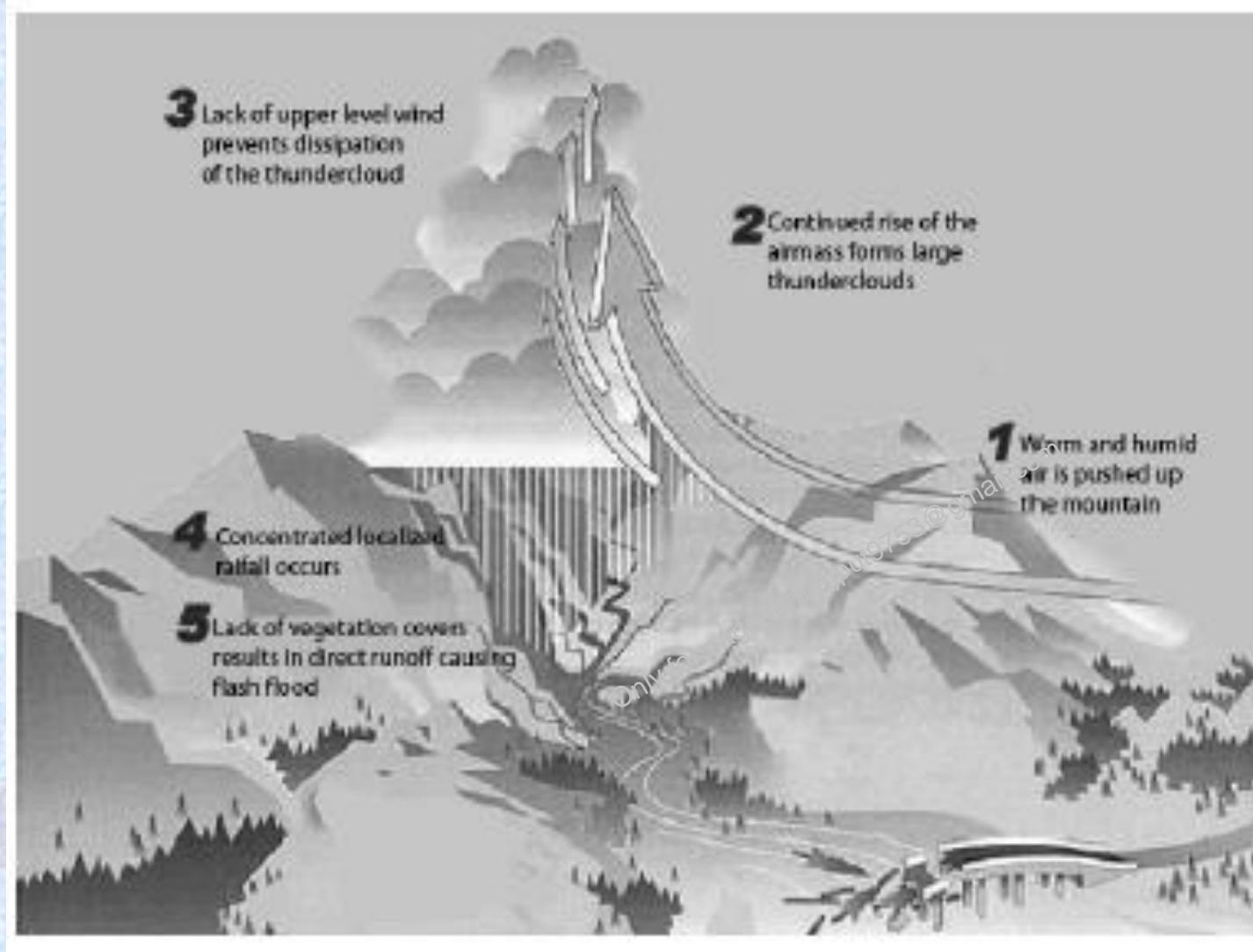
Select the correct answer using the codes given below.

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

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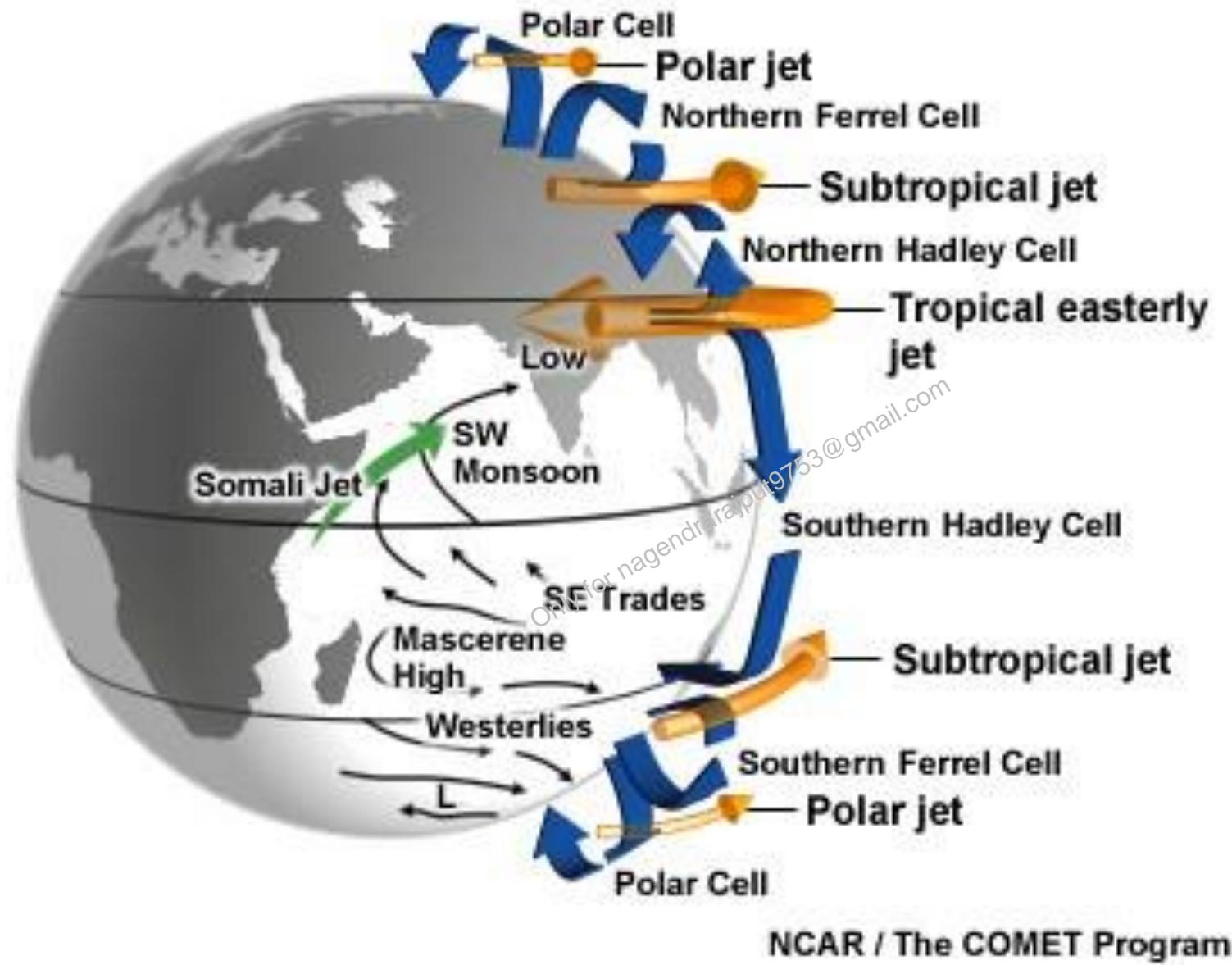


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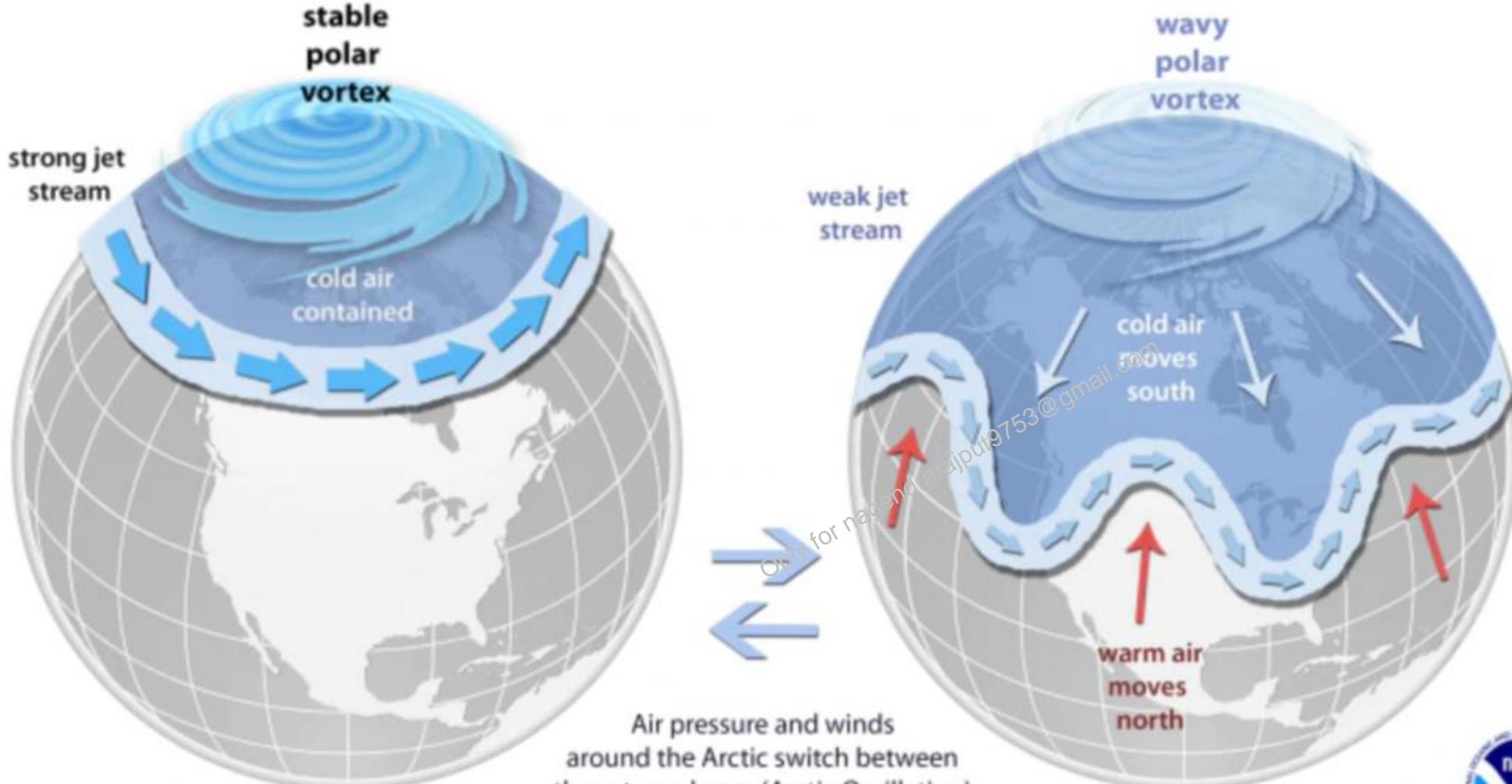


<https://www.youtube.com/watch?v=xiaXZwdroW4>



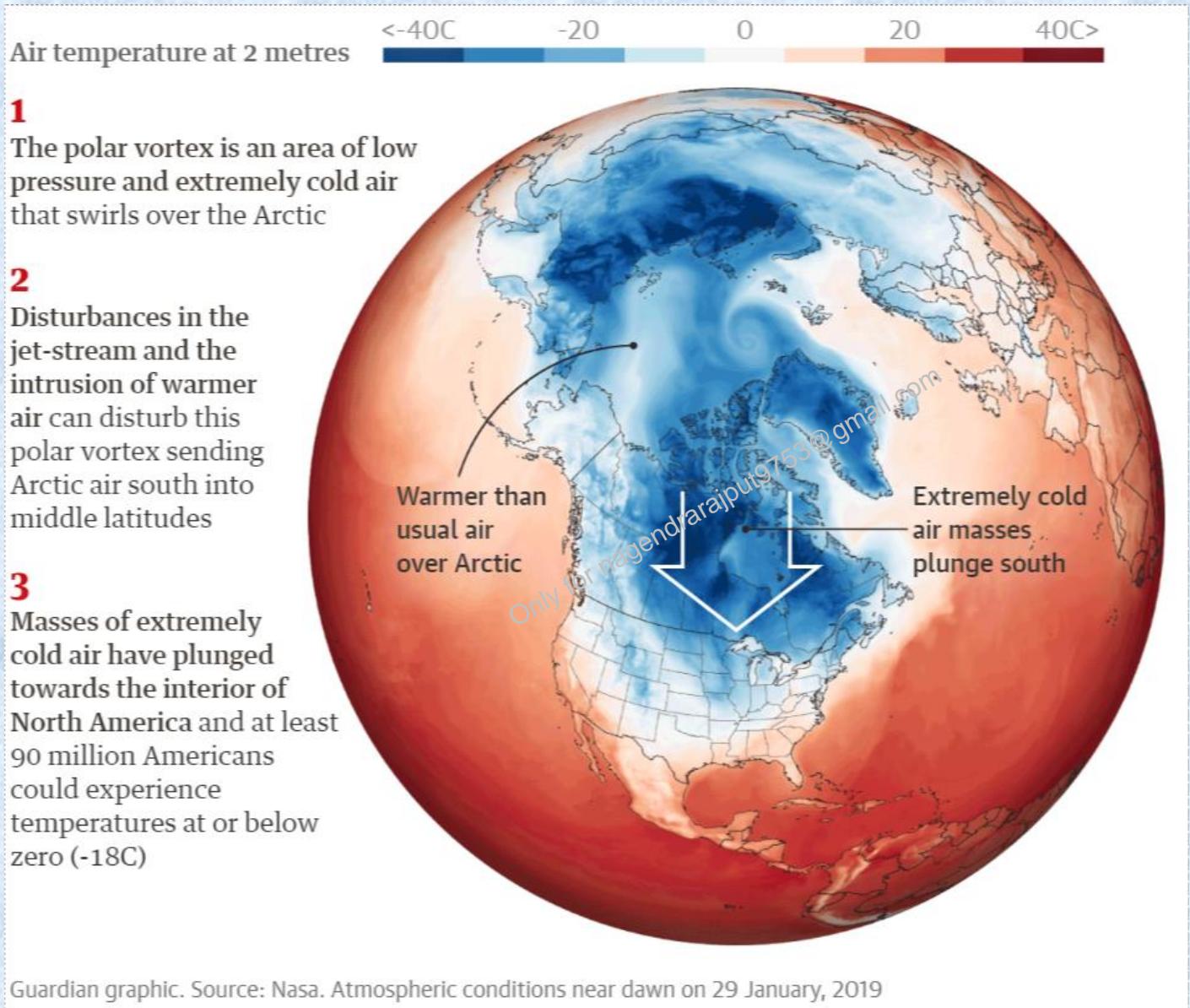


<https://www.youtube.com/watch?v=kefYlzHslVI>



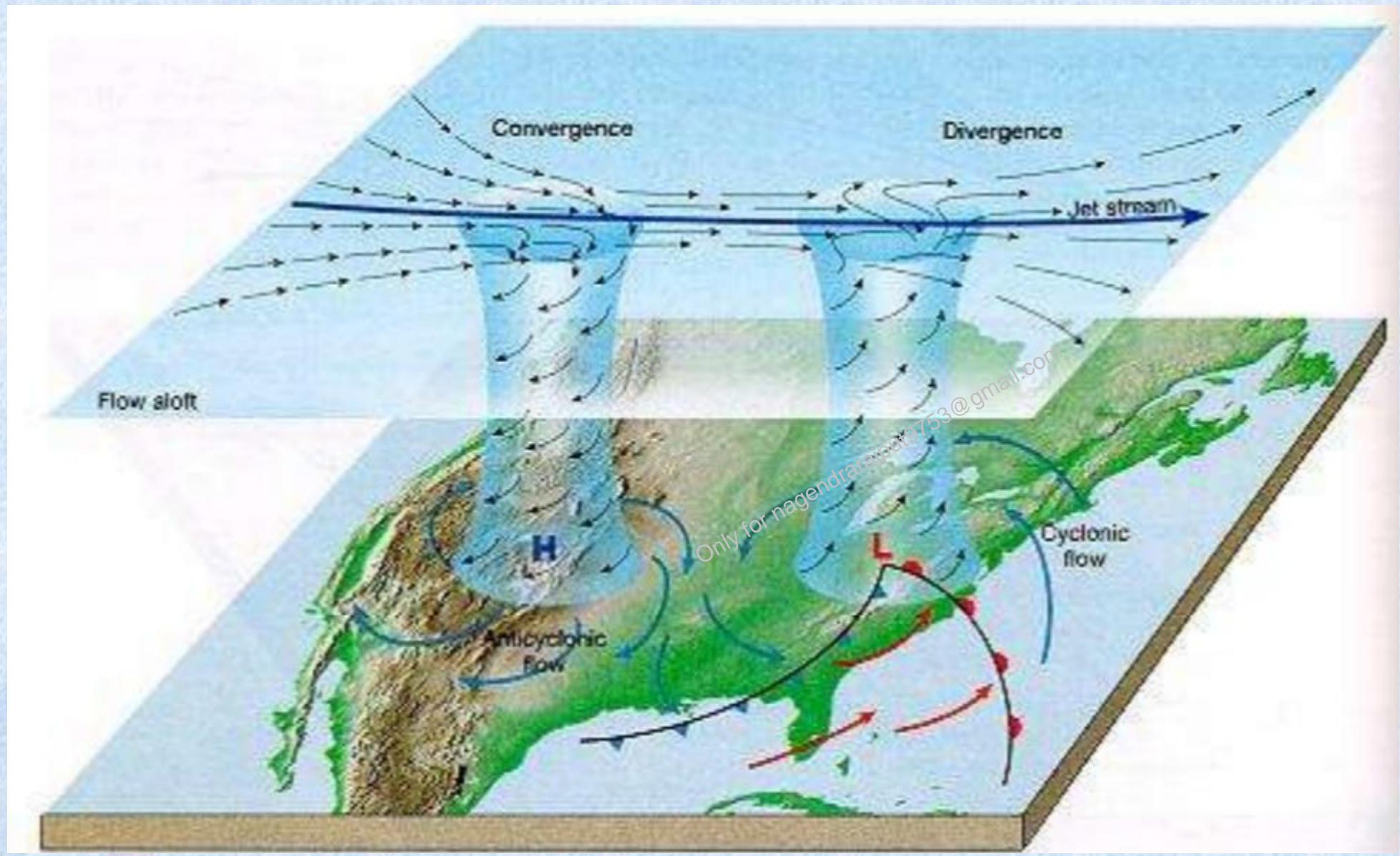
The science behind the polar vortex.(Image: NOAA)



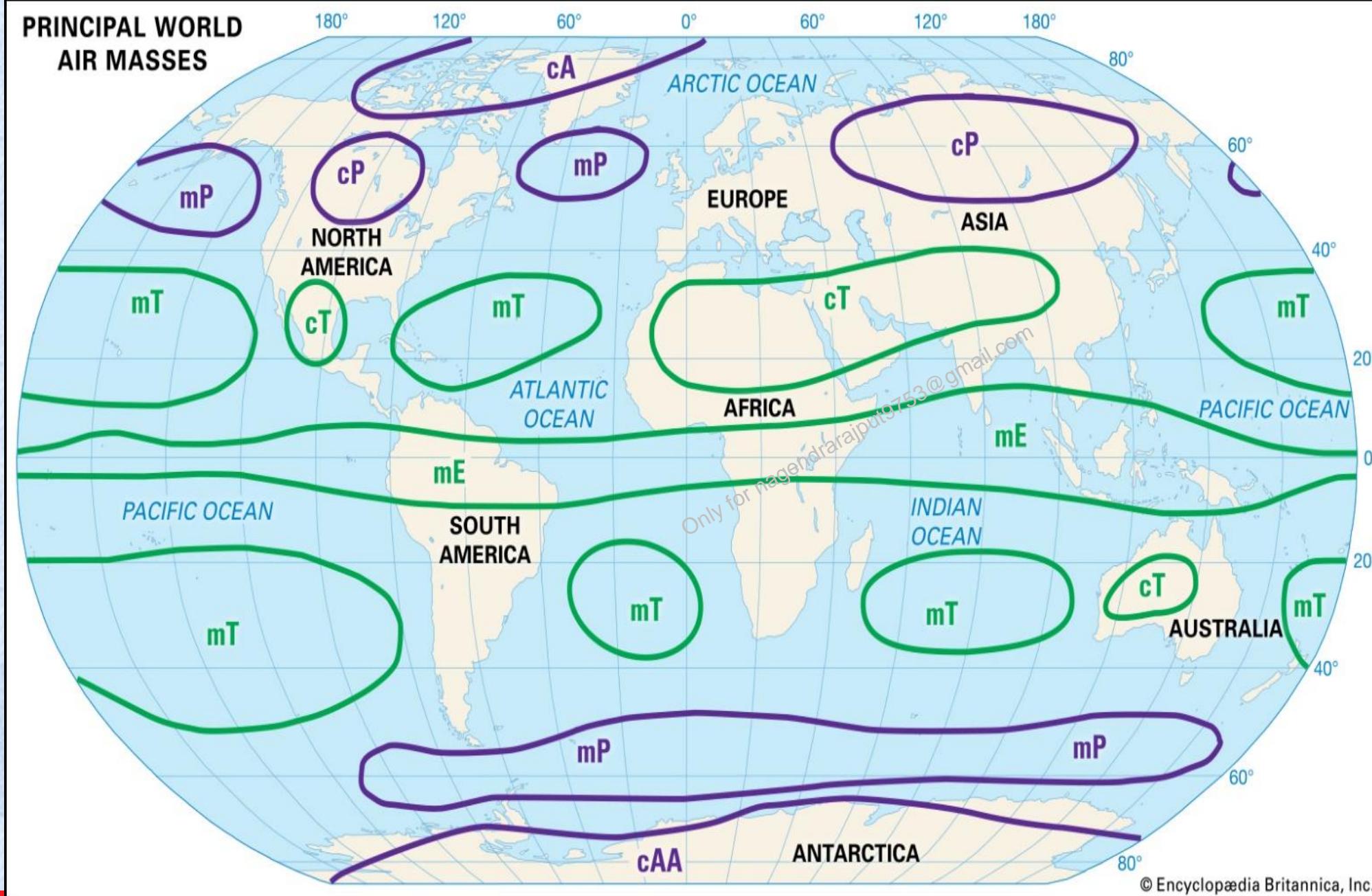




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## PRINCIPAL WORLD AIR MASSES



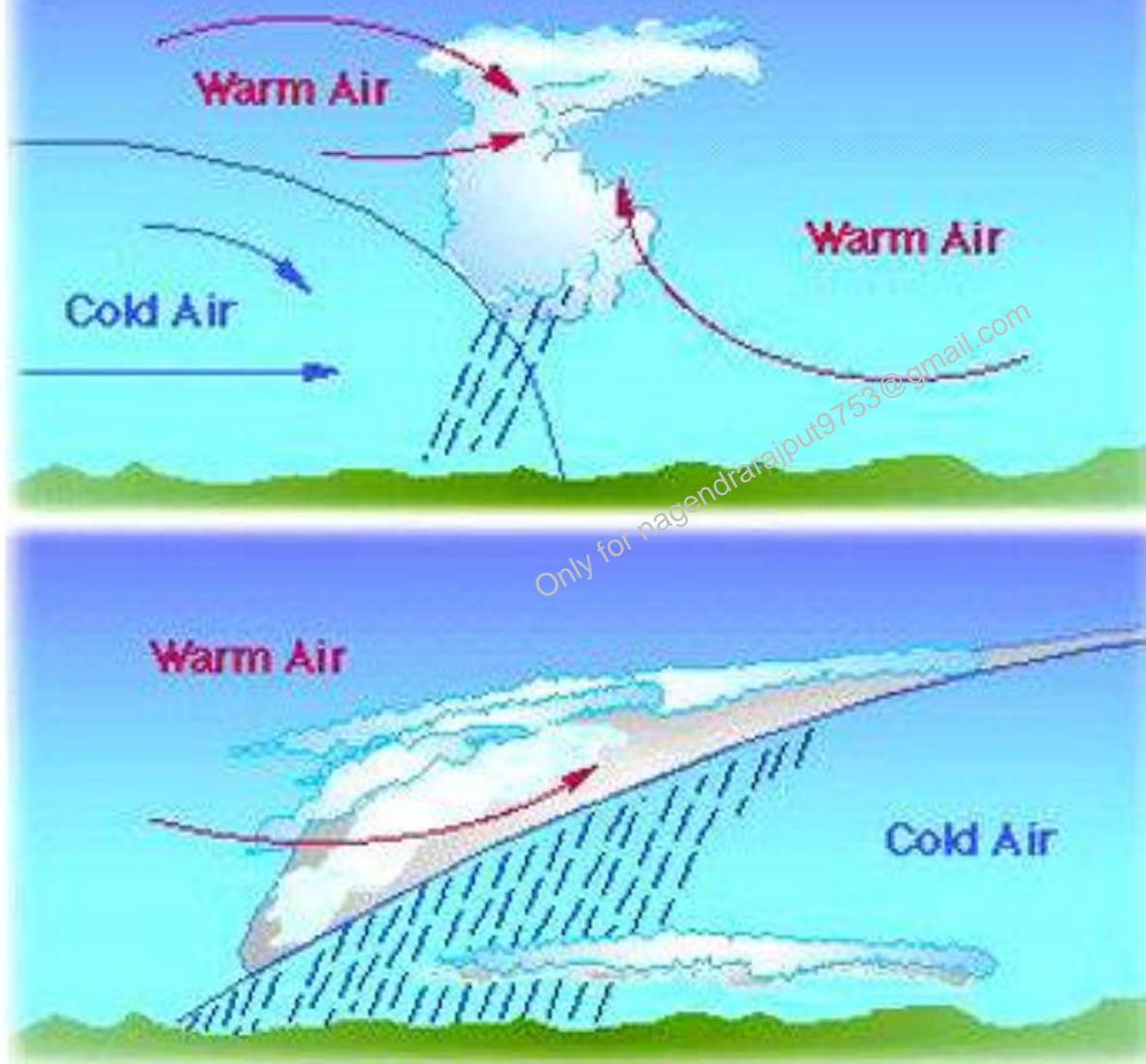
2016

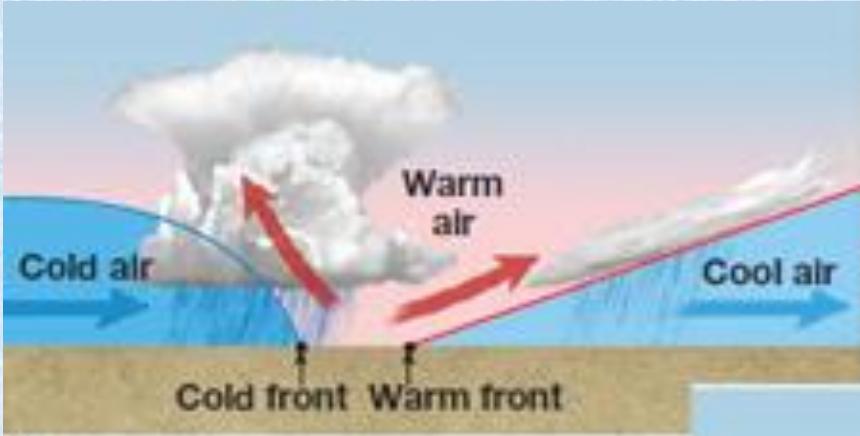
Discuss the concept of air mass and explain its role in macro-climatic changes.

12.5

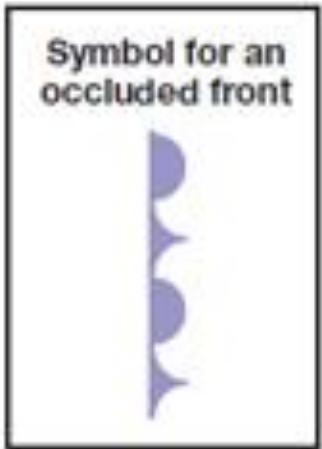
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## Warm and Cold Fronts

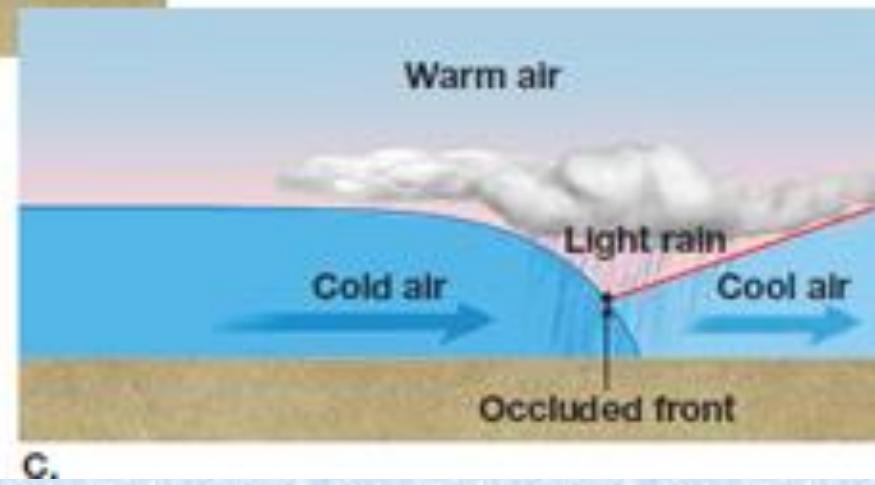




A.



B.

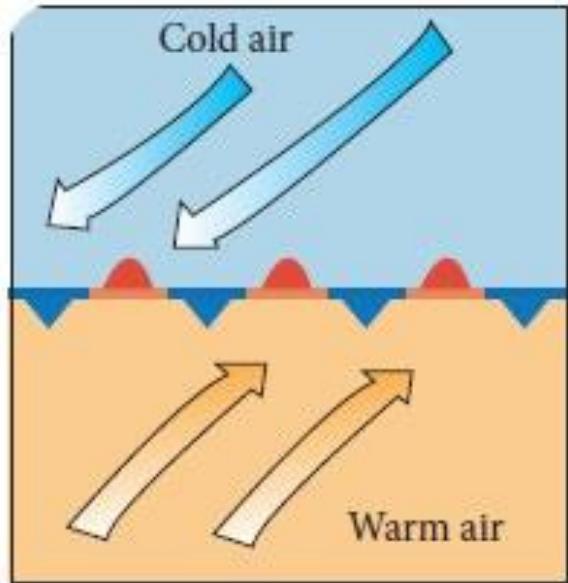


C.

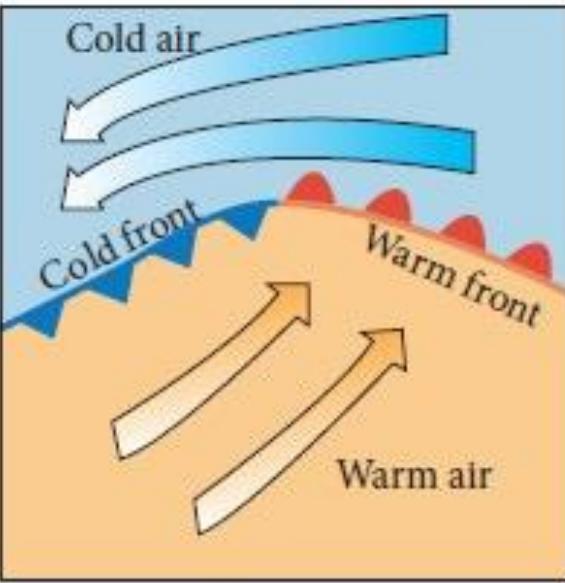
<https://www.youtube.com/watch?v=jch-sxx71ko>

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

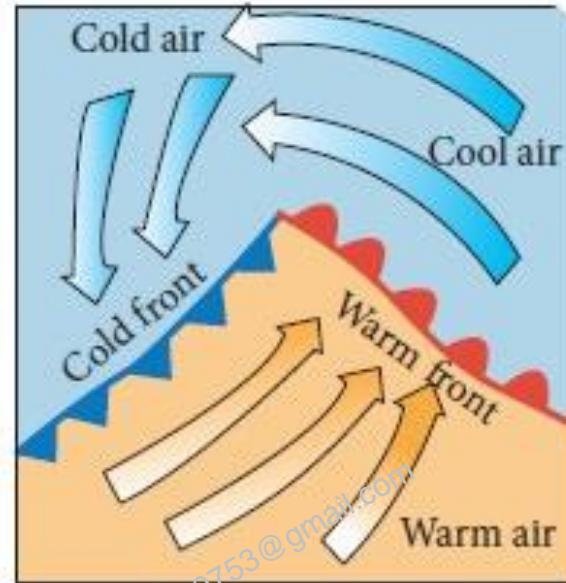
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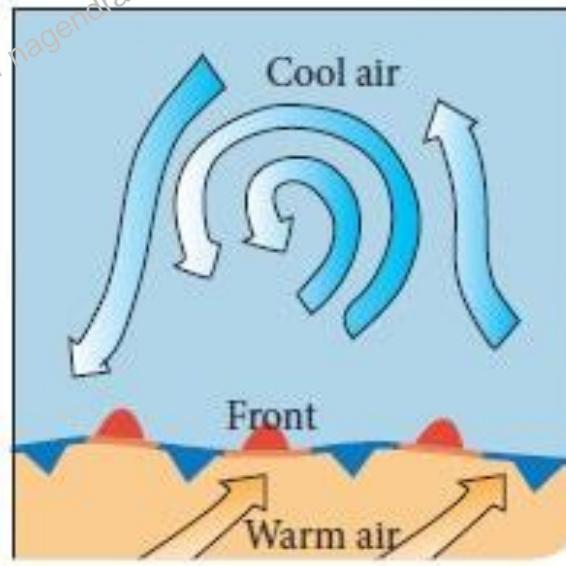
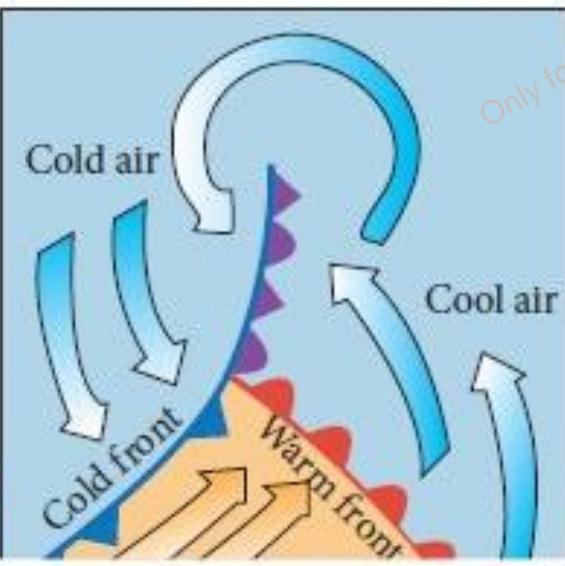
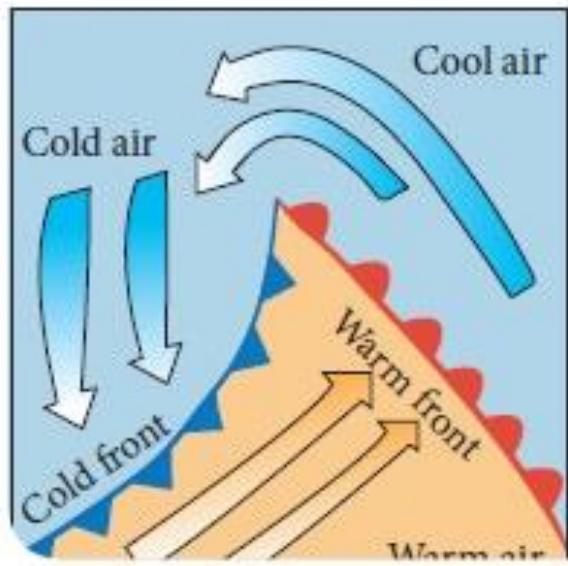
a)



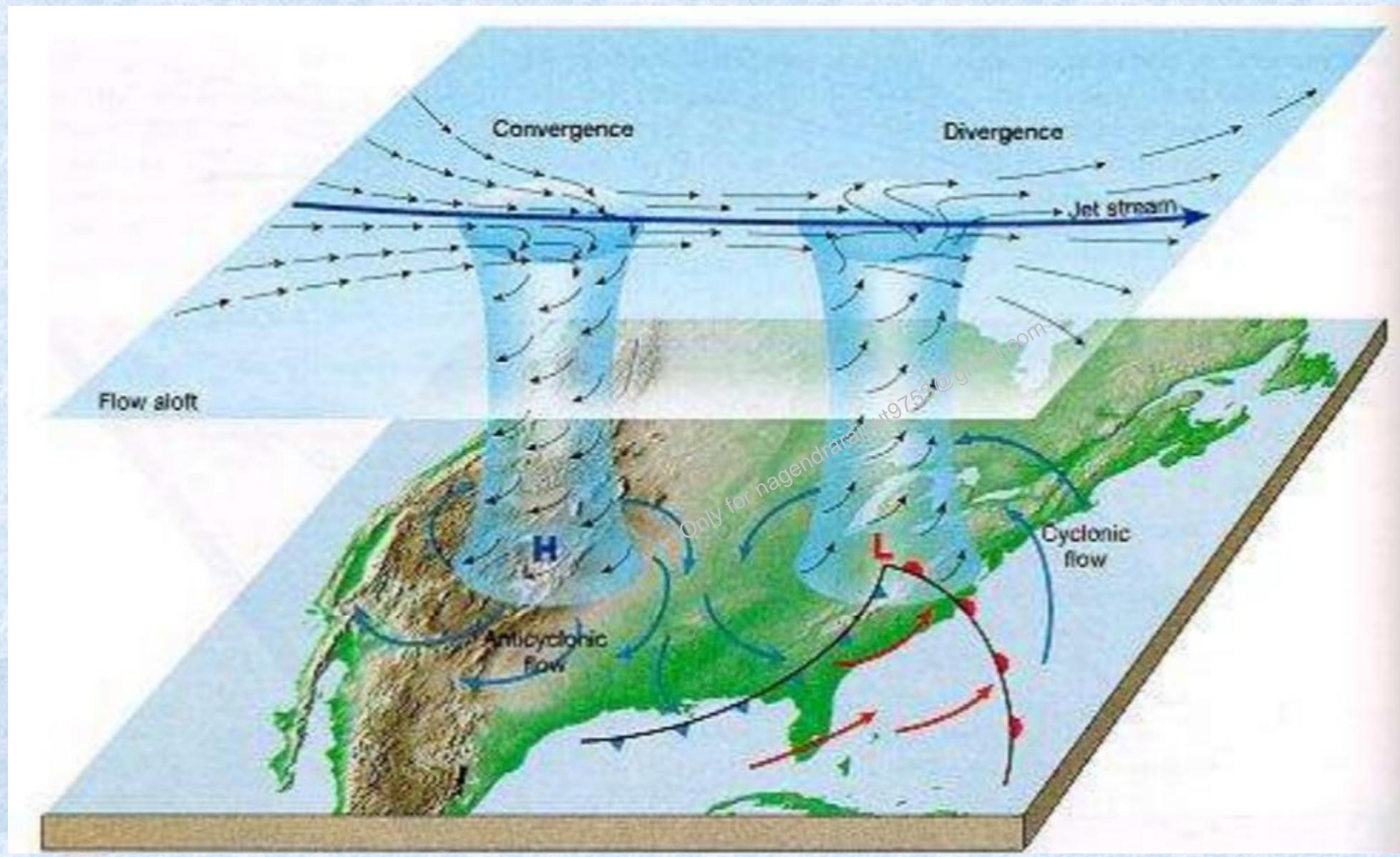
b)



c)

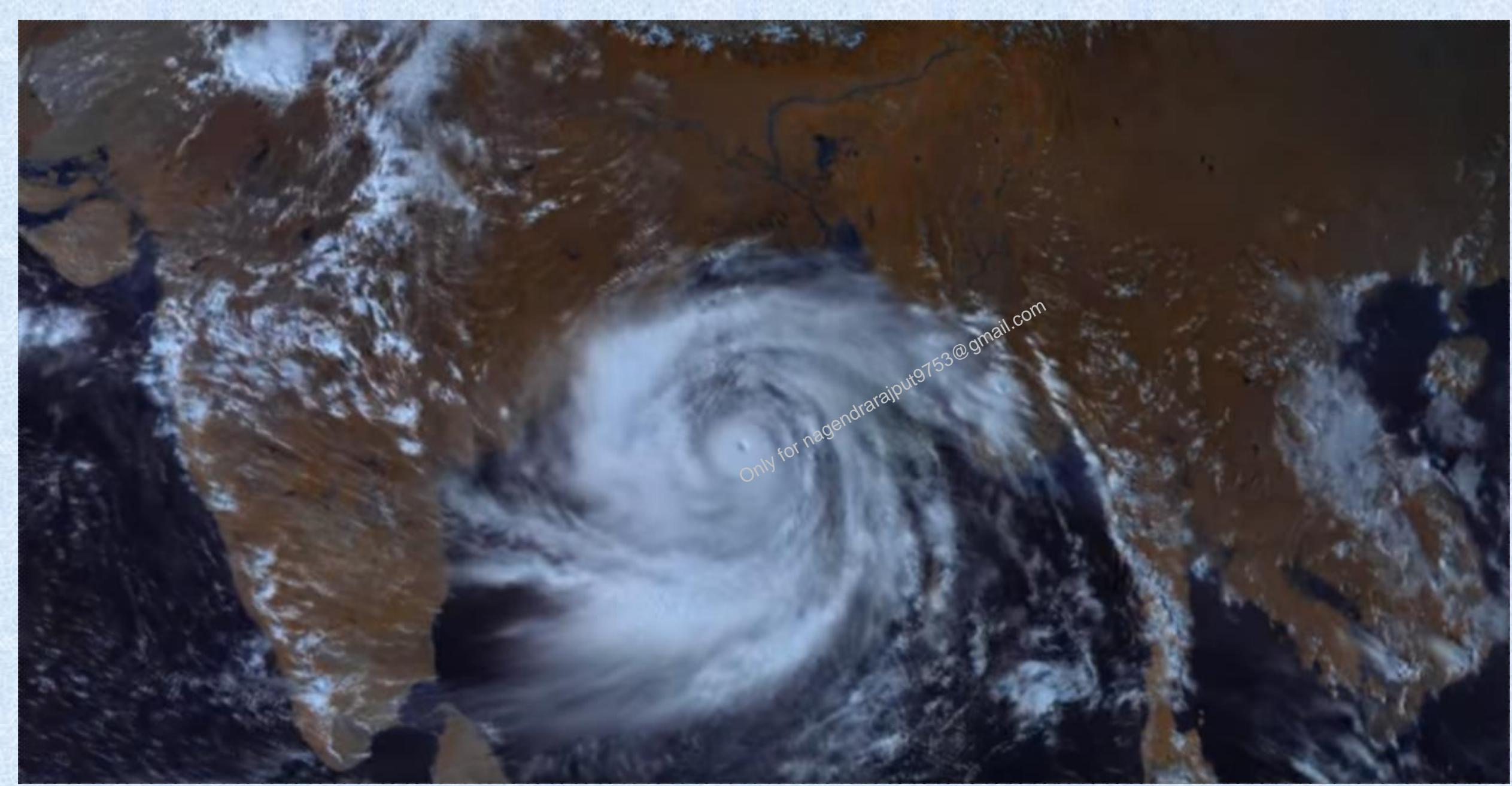


**Figure 6.40** Development of Temperate cyclone



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

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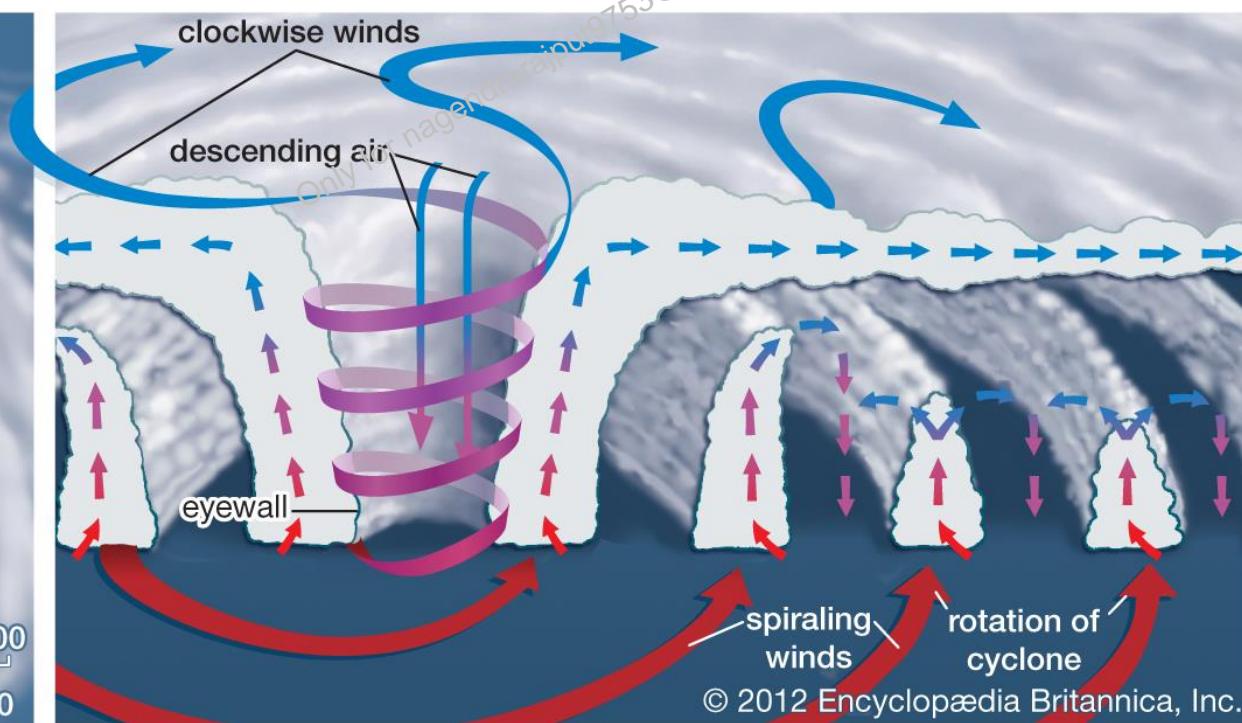
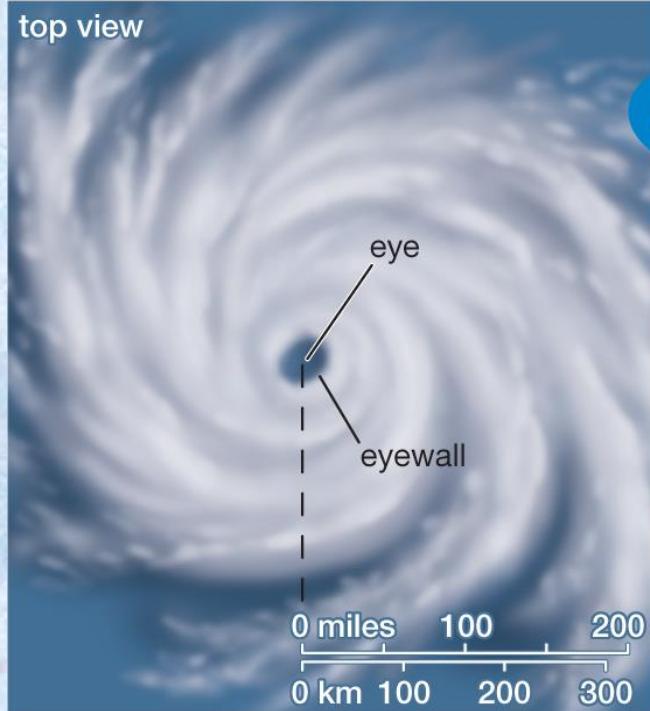
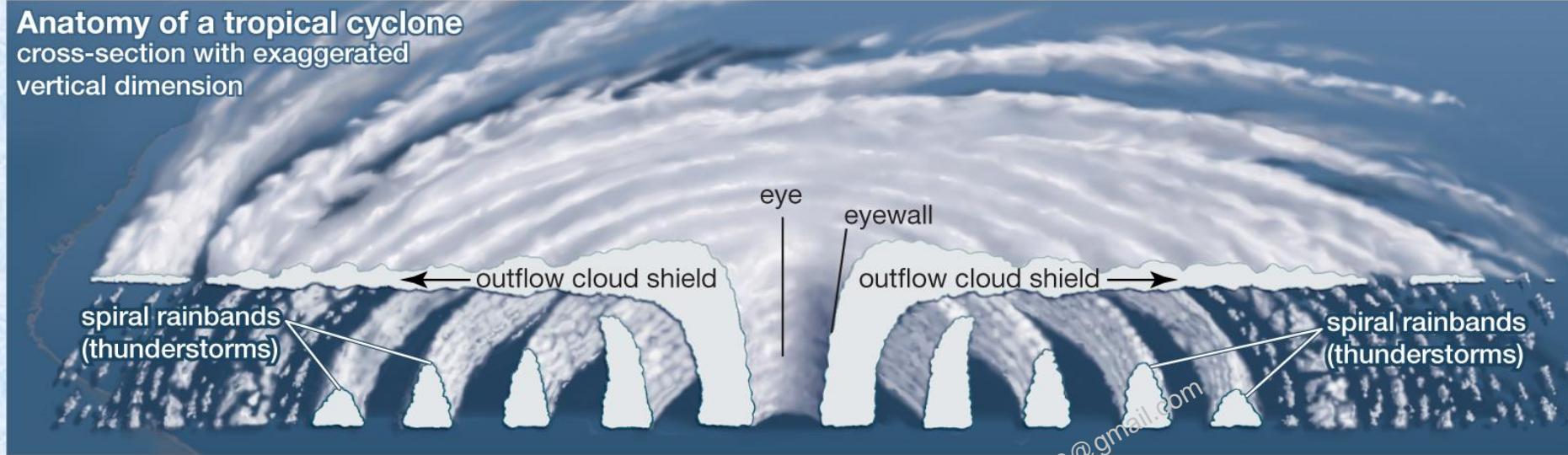
**Table 2-2: Classification used in India for tropical cyclones**

	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

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



<https://www.youtube.com/watch?v=UkL9NIxLIIE>

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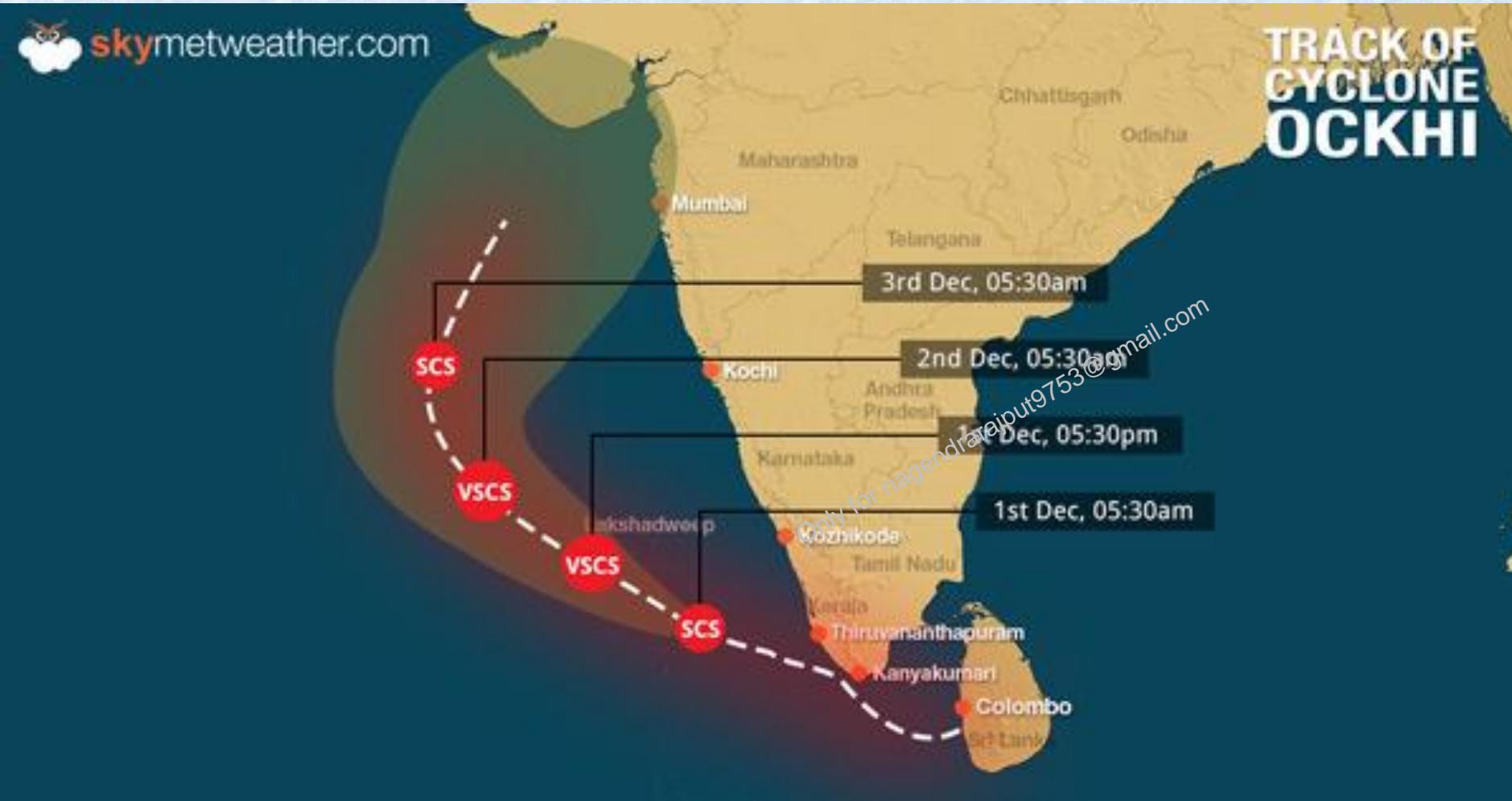
## List of Northern Indian Ocean tropical cyclone names

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

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**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	



Likelihood	High				
	Medium				
	Low				
	Very Low				
	Very Low	Low	Medium	High	Impact

<b>Green</b>	No severe weather expected
<b>Yellow</b>	<b>Be Aware:</b> There is a moderate risk of severe or a low risk of extreme weather occurring. <i>Remain alert and ensure you access the latest weather forecast.</i>
<b>Amber</b>	<b>Be Prepared:</b> There is a high risk of severe or a moderate risk of extreme weather occurring. <b>Amber</b> <i>Remain vigilant and make sure you access the latest weather forecast. Take precaution where possible</i>
<b>Red</b>	<b>Take Action:</b> There is a high risk of an extreme weather event occurring. <i>Remain extra vigilant and ensure you access the latest weather forecast. Follow orders and any advice given by the authorities under all circumstances and be prepared for extra ordinary measures</i>

Sub-Divisions	28 April 2019 *	29 April 2019 *	30 April 2019 *	01 May 2019*
Coastal Tamilnadu & Puducherry	Light to moderate rainfall at many places	Rainfall at most places with heavy falls at Isolated Places	Rainfall at most places with heavy to very heavy falls at a few places with extremely heavy at isolated places	Rainfall at most places with heavy to very heavy falls at a few places with extremely heavy at isolated places
Kerala	Light to moderate rainfall at many places	Rainfall at most places with heavy falls at Isolated Places	Rainfall at most places with heavy falls at Isolated Places	Rainfall at a few places
South Coastal Andhra Pradesh	Rainfall at isolated places	Rainfall at many places with heavy falls at Isolated Places	Rainfall at many places with heavy falls at Isolated Places	Rainfall at a few places

Note: \* Rainfall till 0830 IST of next day.

Legends: Orange- Be prepared; Red- Take action, Green: No warning

Heavy rain: 64.5-115.5 mm/day; Very heavy rain: 115.6-204.4 mm/day; Extremely heavy rain: more than 204.4 mm/day

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## Difference between Tropical Cyclones and Temperate Cyclones

<b>Tropical Cyclones</b>	<b>Temperate Cyclones</b>
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.

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

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2014

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

10

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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

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**59.** Consider the following statements:

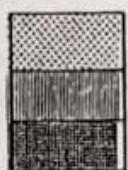
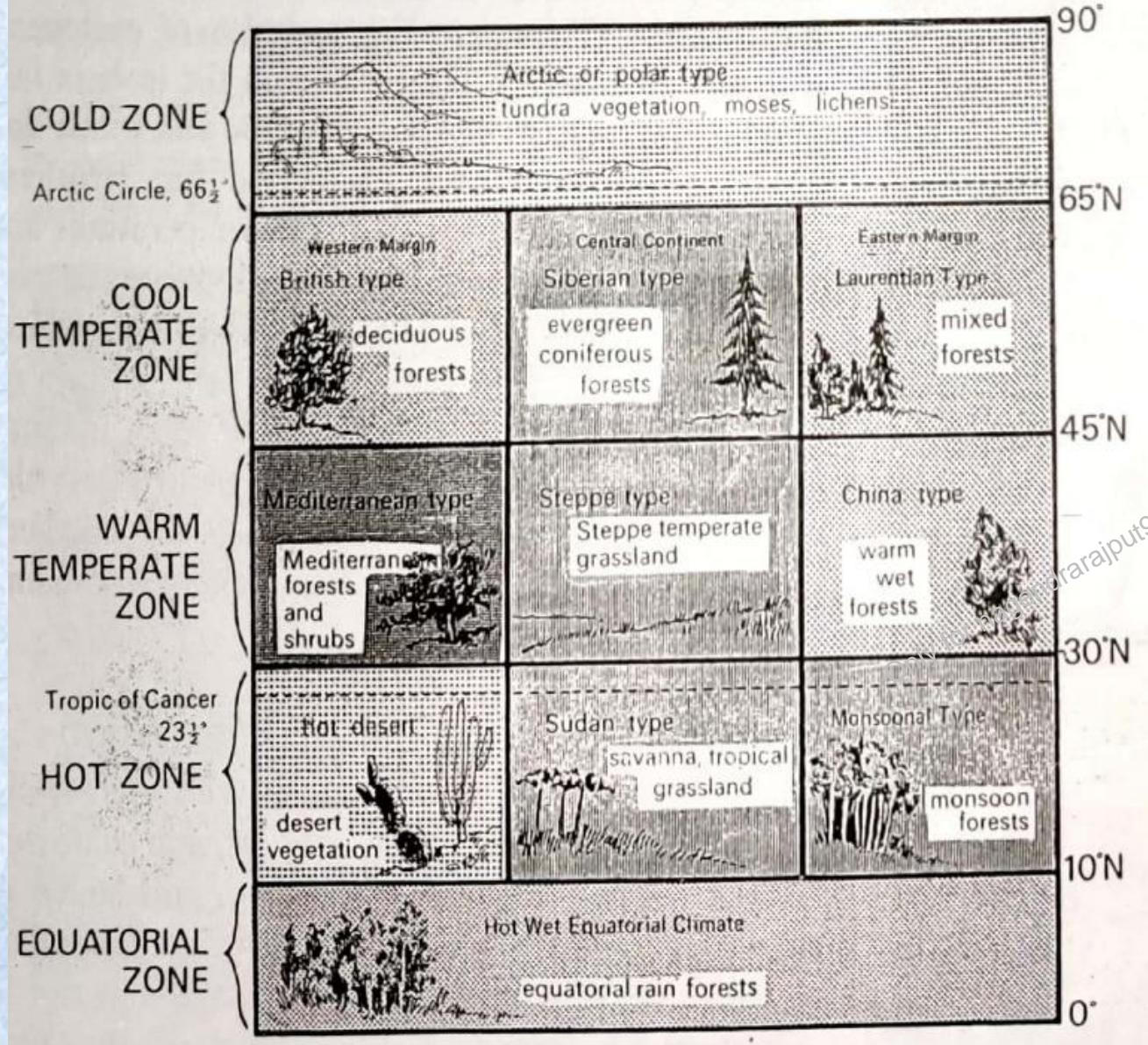
1. Jet streams occur in the Northern Hemisphere only.
2. Only some cyclones develop an eye.
3. The temperature inside the eye of a cyclone is nearly  $10^{\circ}\text{C}$  lesser than that of the surroundings.

Which of the statements given above is/are correct?

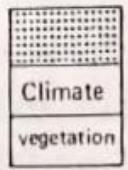
- (a) 1 only
- (b) 2 and 3 only
- (c) 2 only
- (d) 1 and 3 only

2020





Rain all year round  
Summer Rain  
Winter Rain



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

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

## WORLD CLIMATIC TYPES

<b>Climatic Zone</b>	<b>Latitude (approximate)</b>	<b>Climatic Type</b>	<b>Rainfall Regime (with approx. total)</b>	<b>Natural Vegetation</b>
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 8. Western Margin (British type) 9. Central Continental (Siberian type) 10. Eastern Margin (Laurentian type) 11. Arctic or Polar 12. Mountain climate	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 More rain in autumn and winter: 30 inches Light summer rain: 25 inches Moderate summer rain: 40 inches Very light summer rain: 10 inches Heavy rainfall (variable)	Monsoon forests  Savanna (tropical grassland) Desert vegetation and scrub  Mediterranean forests and shrub  Steppe or temperate grassland Warm, wet forests and bamboo  Deciduous forests Evergreen coniferous forests Mixed forests (coniferous and deciduous) Tundra, mosses, lichens Alpine pastures, conifers, fern, snow.
Warm Temperate Zone	30° – 45°N. and S.			
Cool Temperate Zone	45° – 65°N. and S.			
Cold Zone	65° – 90°N. and S.			
Alpine Zone				

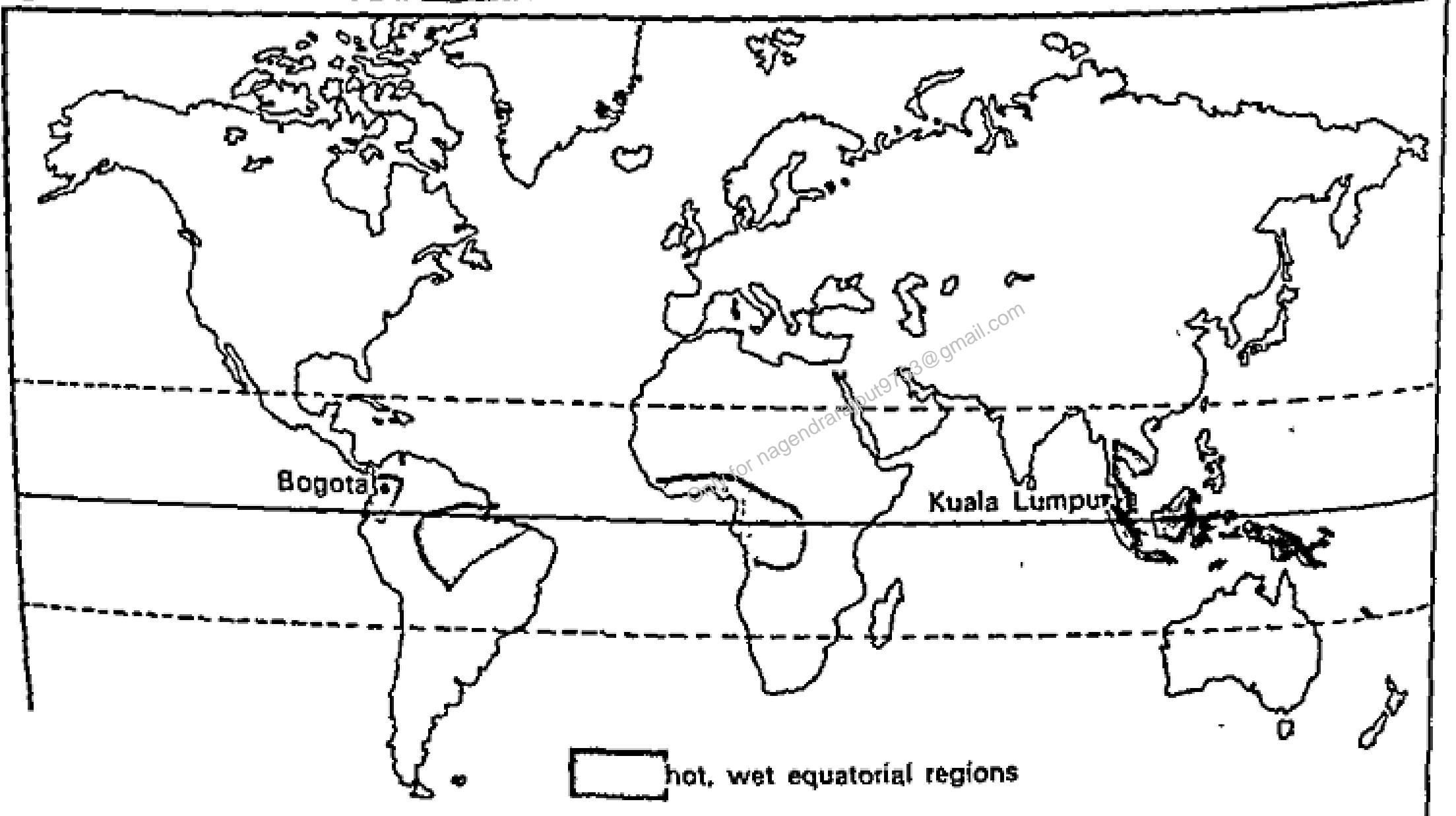
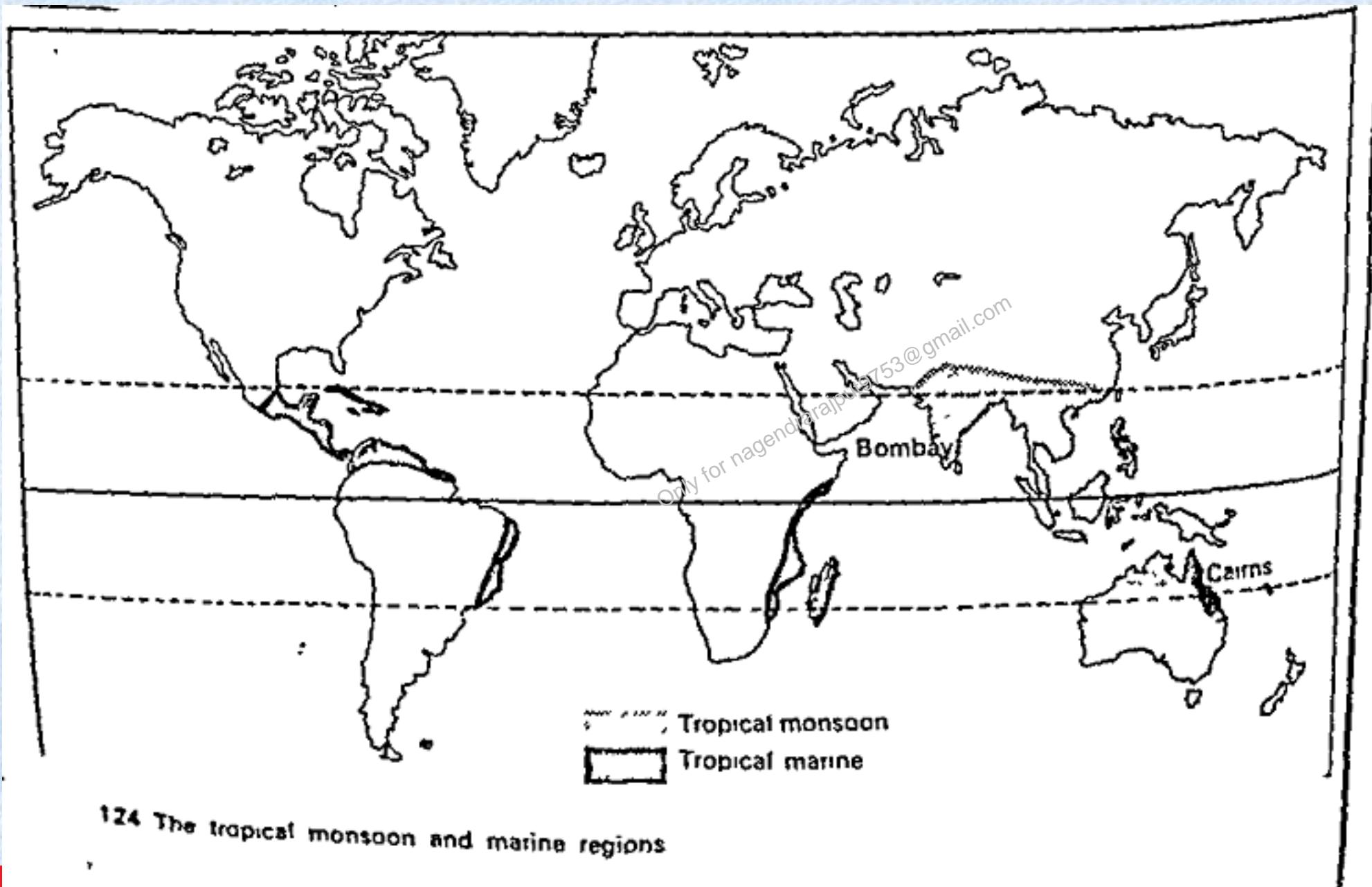
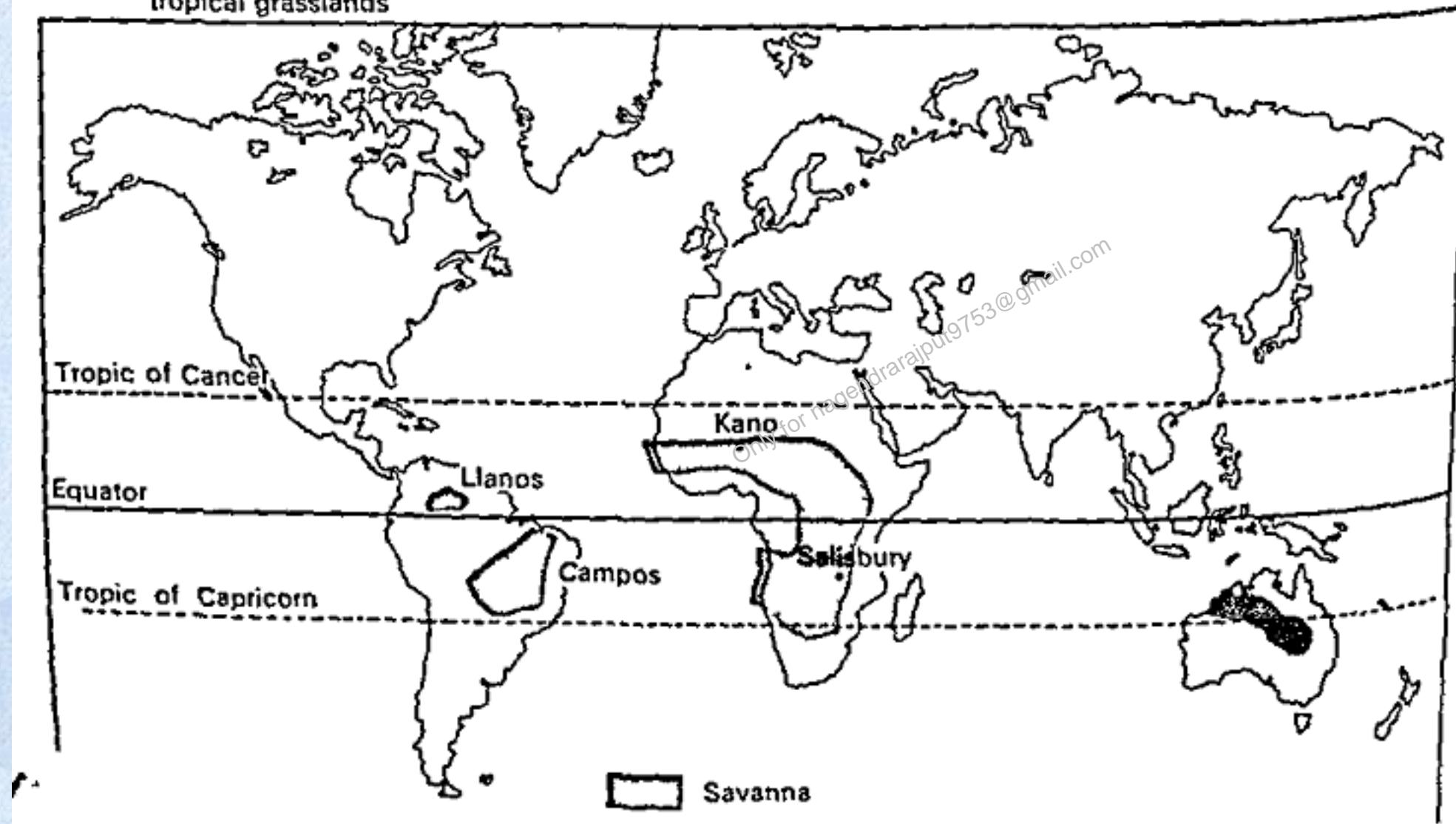


Fig 121 The hot, wet equatorial regions



124 The tropical monsoon and marine regions

Fig 128 Regions of Sudan Climate with savanna or tropical grasslands



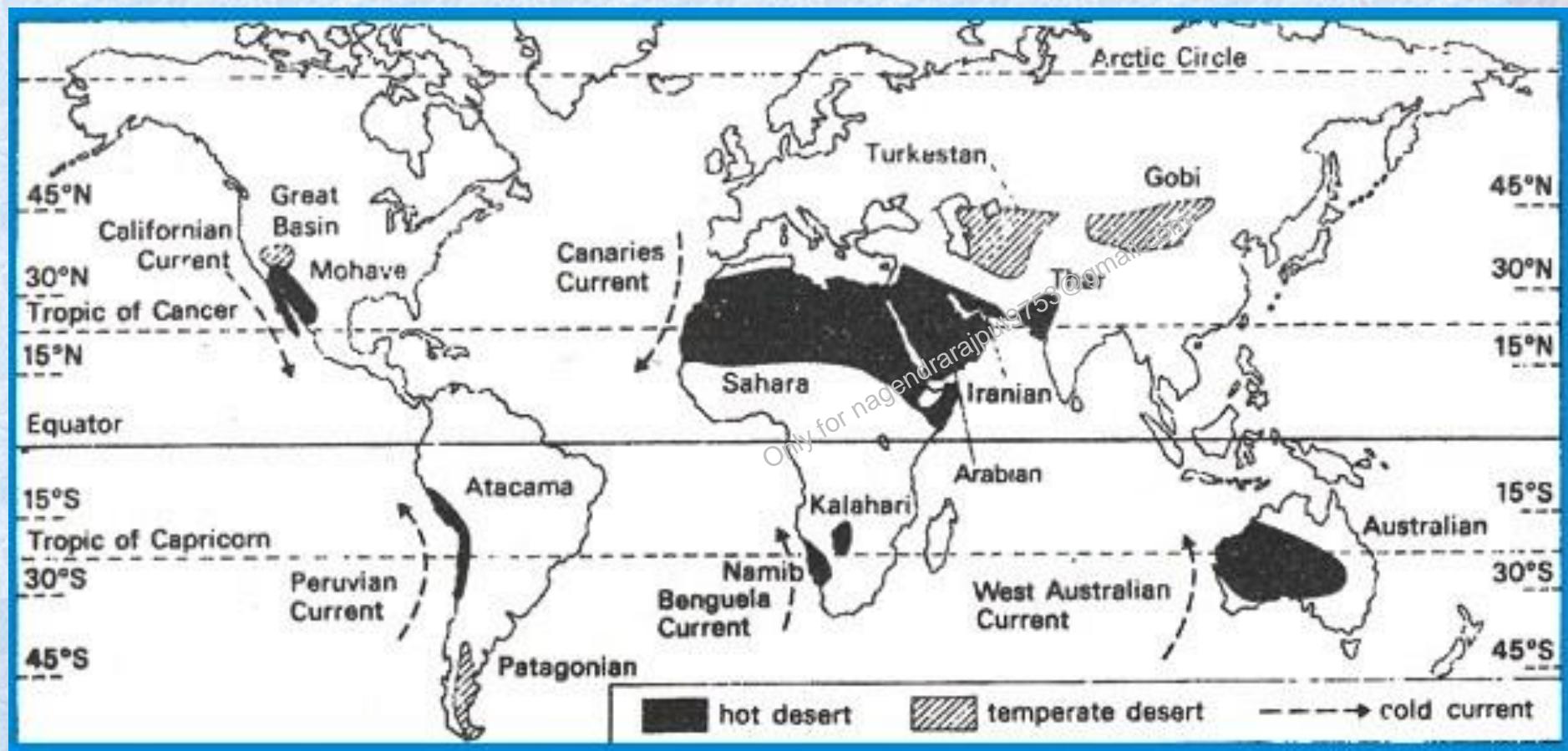
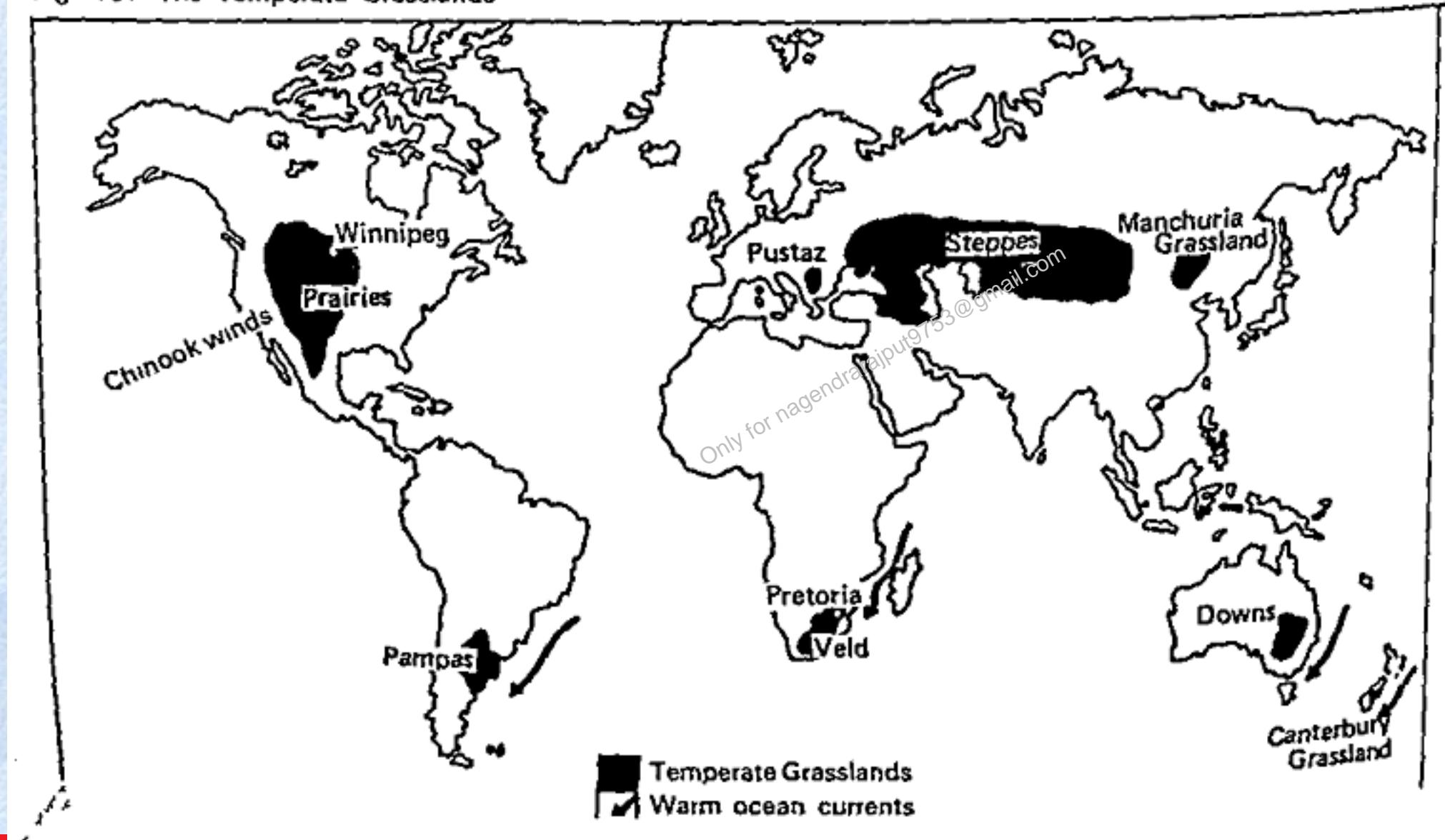
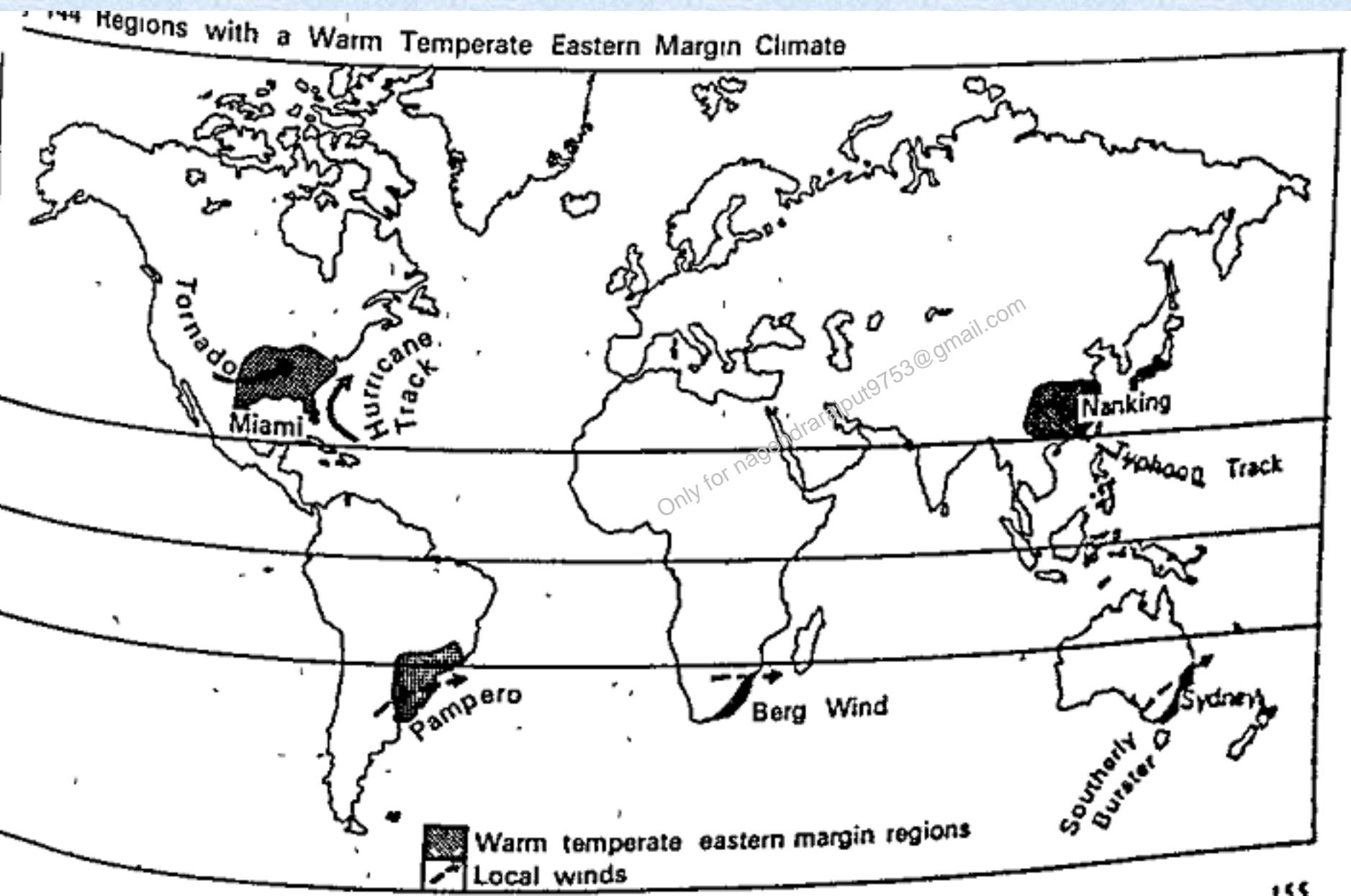




Fig 137 The Temperate Grasslands





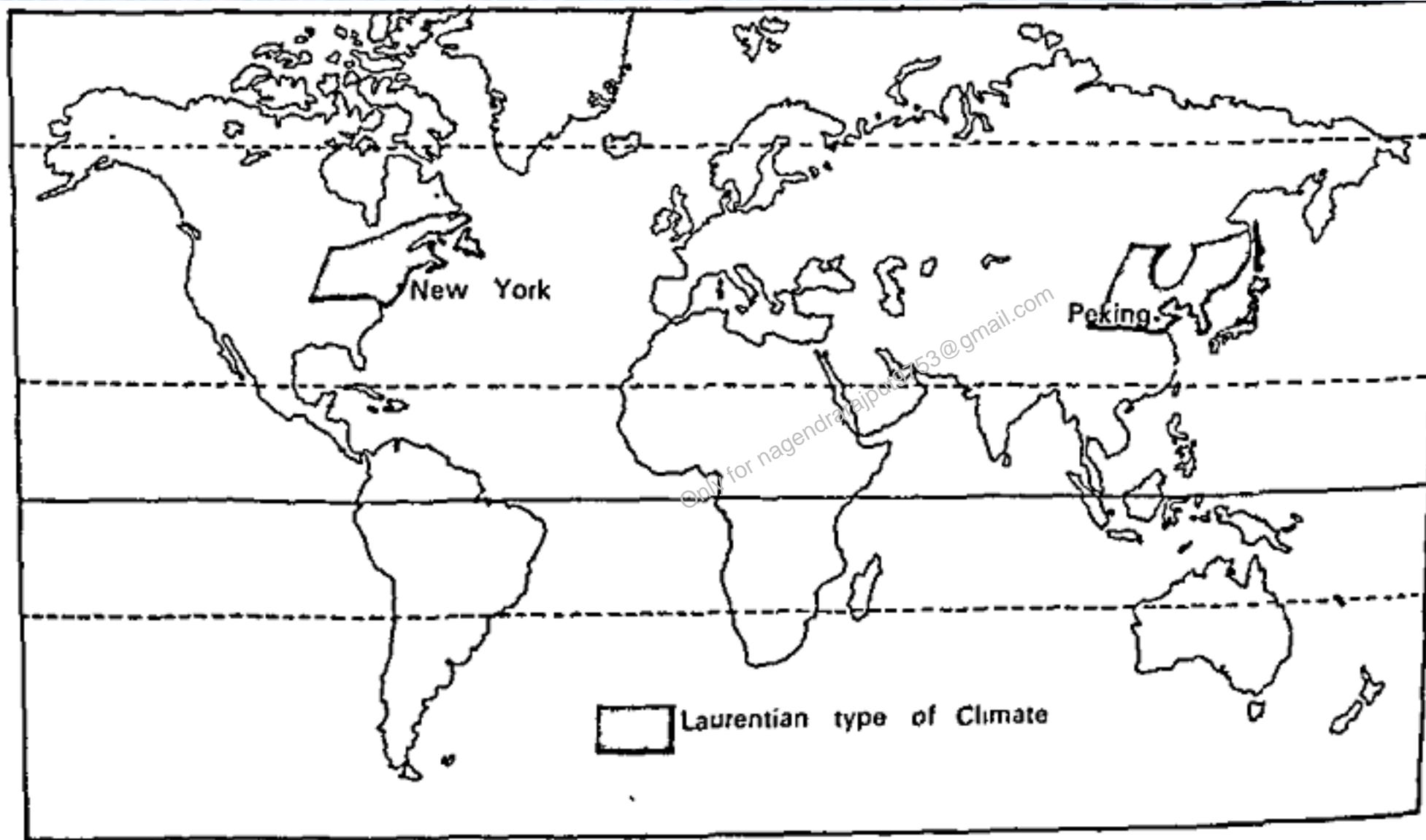


Fig. 153 Regions with a Cool Temperate Eastern Margin Climate (Laurentian type)

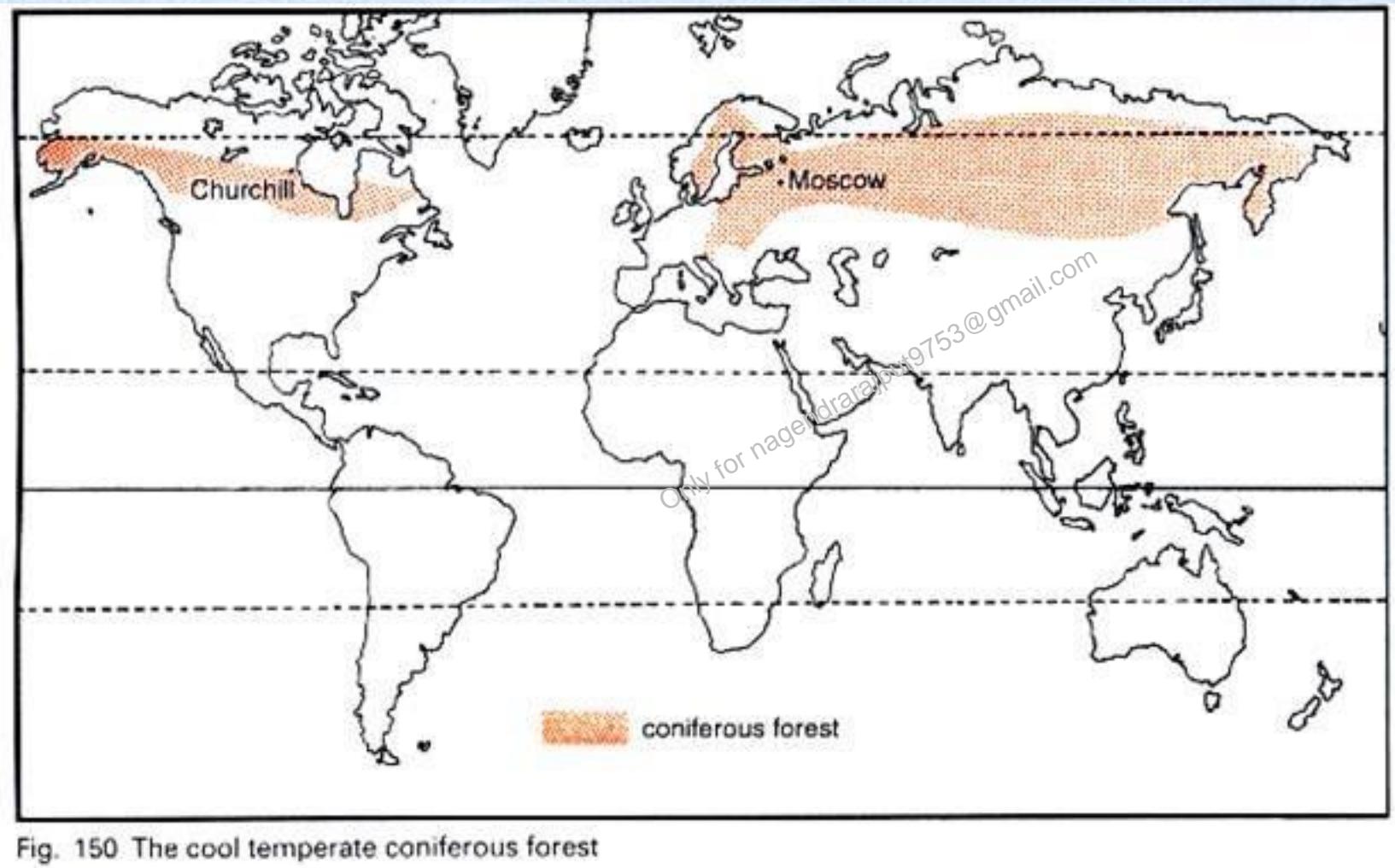
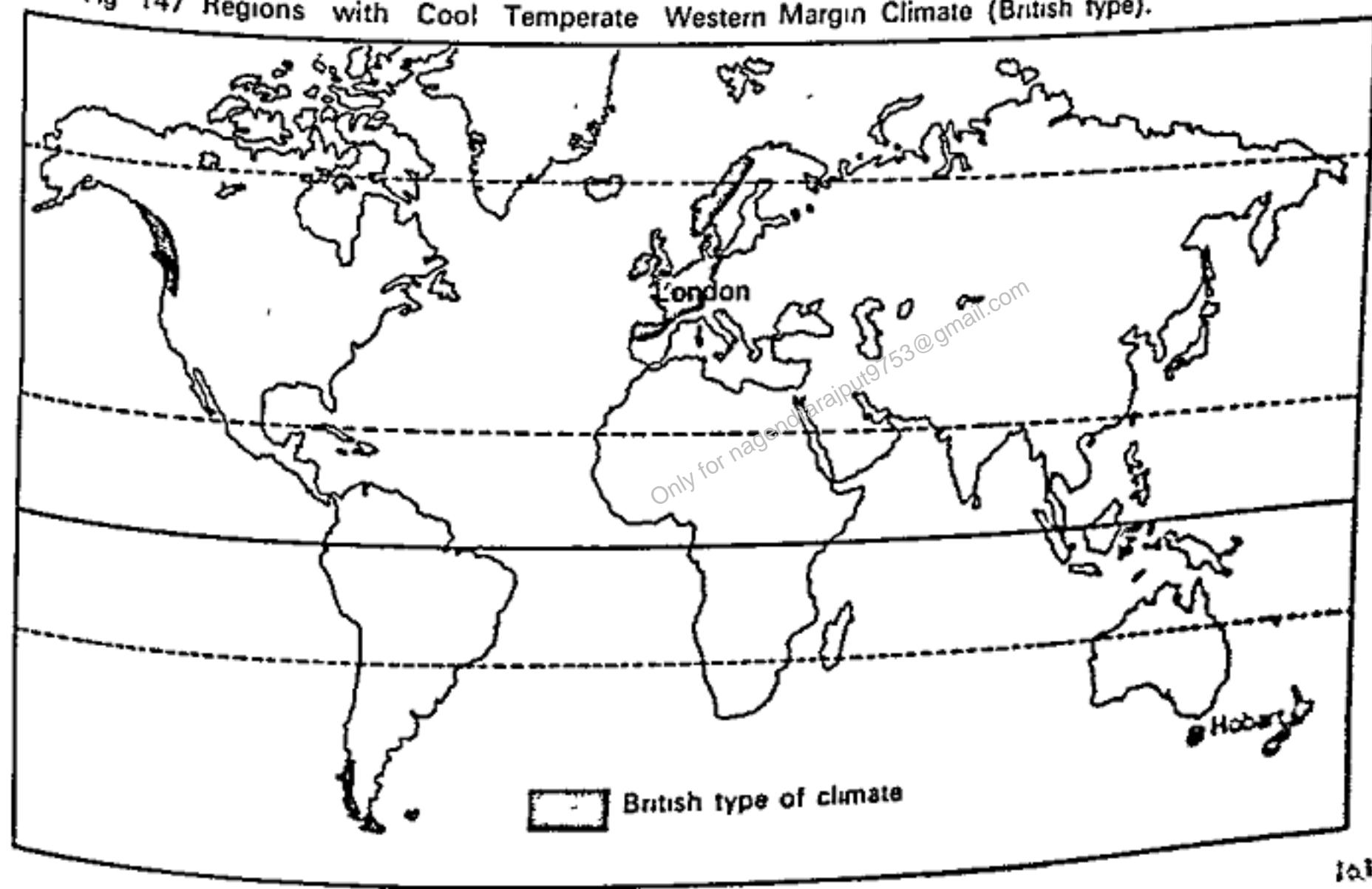


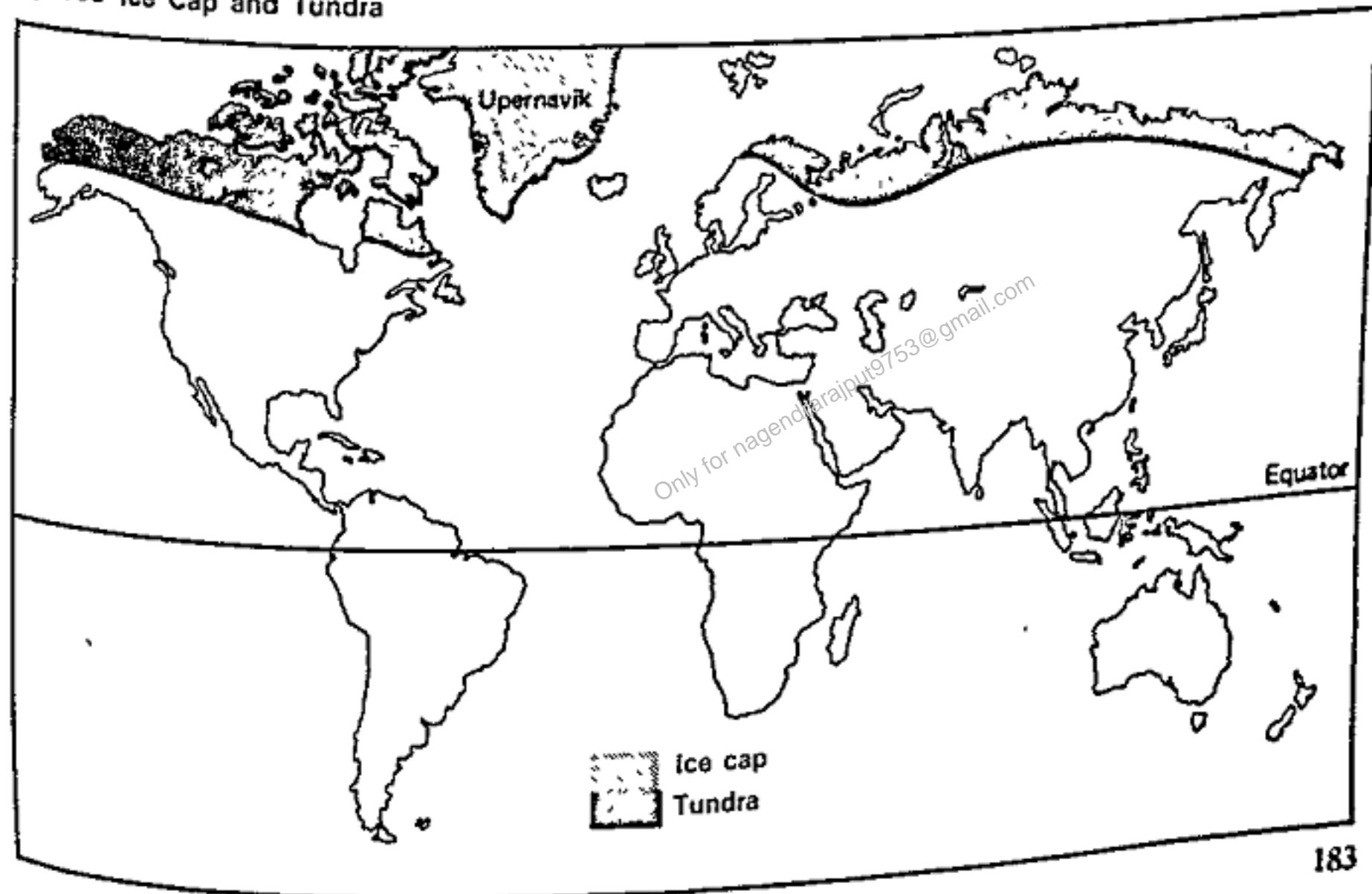
Fig. 150 The cool temperate coniferous forest

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



101

Fig 156 Ice Cap and Tundra



183

2017

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

10

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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

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2013

"Climate is extreme, rainfall is scanty and the people used to be nomadic herders."  
The above statement best describes which of the following regions?

(a) African Savannah  
(b) Central Asian Steppe  
(c) North American Prairie  
(d) Siberian Tundra

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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

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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.

<p><b>2011</b></p> <p>What could be the main reason/reasons of the formation of African and Eurasian desert belt?</p> <p>1. It is located in the sub-tropical high pressure cells.</p> <p>2. It is under the influence of warm ocean currents.</p> <p>Which of the statements given above is/are correct in this context?</p> <p>(a) 1 only      (b) 2 only</p> <p>(c) Both 1 and 2    (d) Neither 1 nor 2</p>
--

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**

Group	Type	Letter Code	Characteristics
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...

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