DOCUMENT
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DOCUMENT TITLE

METEOROLOGY FOR AUSTRALIA

CHAPTER 28– CLIMATOLOGY ZONES

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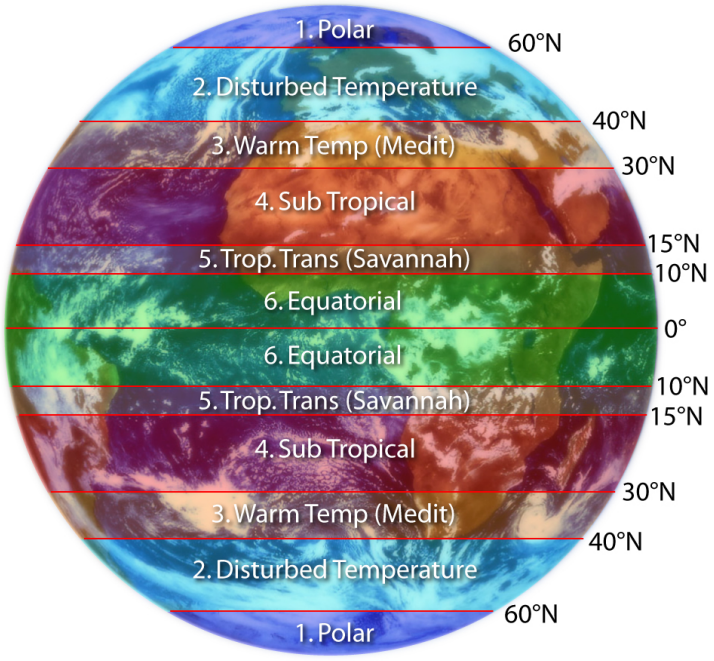
CLIMATOLOGY ZONES

OVERVIEW

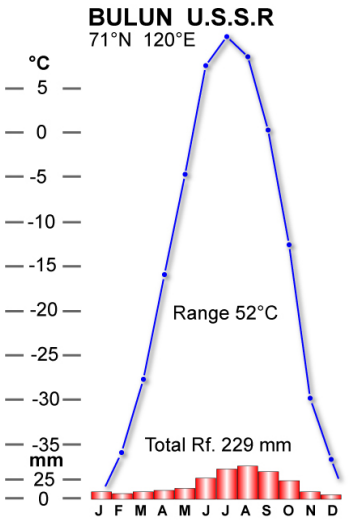
Due to the Earth's rotation, the tilt of its axis and the distribution of sea and land, the climate of the Earth separates into distinct climatic zones. Six major zones emerge but these may then be subdivided into smaller sub-zones. The major zones are:



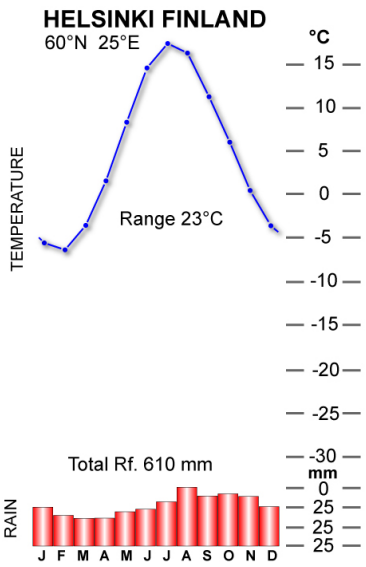
Idealised Climatic Zones

POLAR

The weather is usually settled because of the influence of anticyclones. There is little precipitation but it has a snow and ice surface. In the Northern Hemisphere, the area of lowest temperatures tends to be near Siberia (due to the large landmass) rather than over the North Pole itself. The polar areas are often influenced by travelling depressions bringing higher snow fall and blizzard conditions.

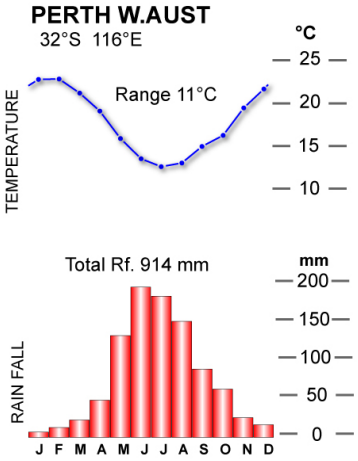


TEMPERATE



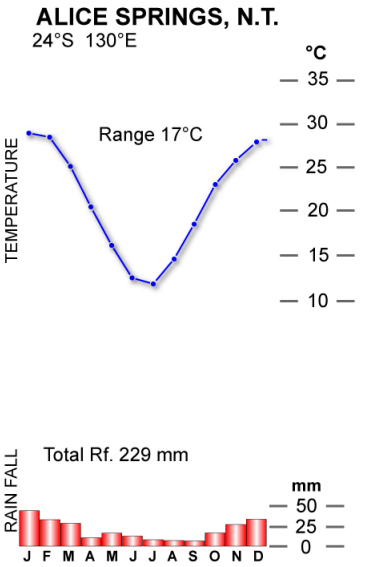
Temperate zones include UK, NW Europe, and South Island of New Zealand and Tasmania. They are often referred to as "disturbed" climates due to disruptions by travelling depressions and fronts. They have no distinct dry season.

MEDITERRANEAN



Mediterranean zones include the Mediterranean Sea, California, Southern South Africa, SW Western Australia and Southern South Australia. They are transitional zones, also called the warm temperate zones. In summer, under the influence of the sub-tropical high-pressure areas, the weather is fine, dry, and settled. In winter, under the influence of the temperature zone depressions, the weather is cool, unsettled and quite rainy.

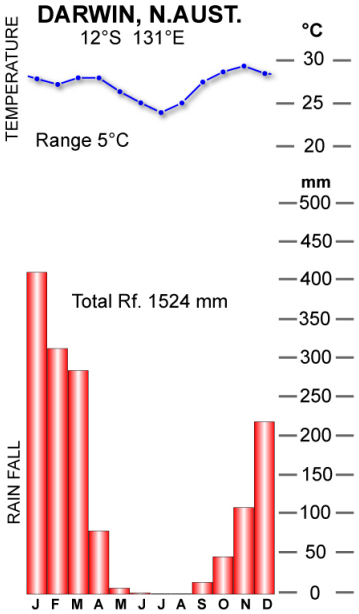
SUB-TROPICAL



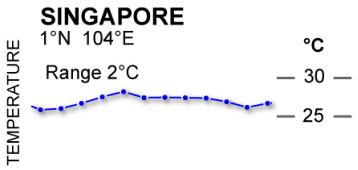
The Sub-Tropical zones are the desert and arid areas of the Earth. They are influenced in summer and winter by the sub-tropical H.P., resulting in stable, dry conditions throughout the year.

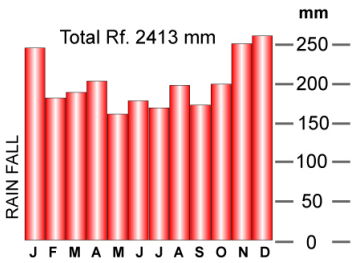
SAVANNAH

The Savannah is a true transitional climatic zones between the arid and equatorial climates. Included in the zone are the grasslands of Africa, Thailand, India and northern Australia. The Sub-Tropical high pressures influence it in winter, so are dry, but by the equatorial lows in summer, when they are wet. It has high temperatures throughout the year.

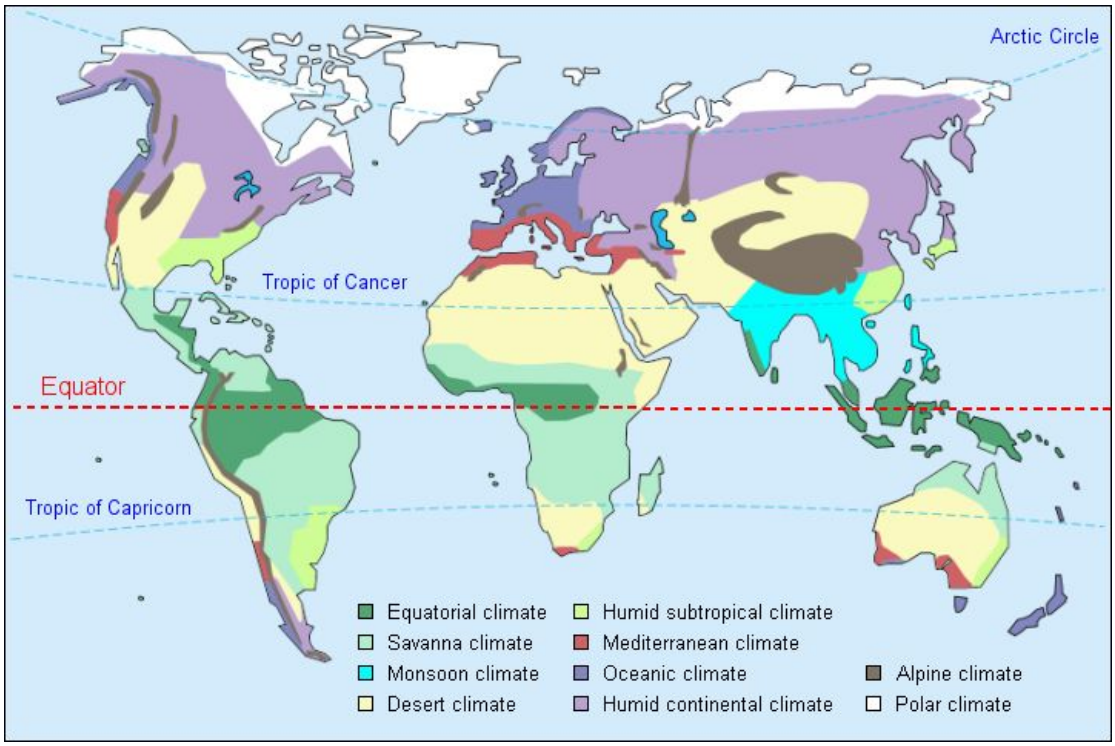


EQUATORIAL





Included in the Equatorial zone are Singapore, Congo Basin, Amazon Basin and Indonesia. The zone is hot and wet all year round although rainfall peaks may occur as the ITCZ migrates through.

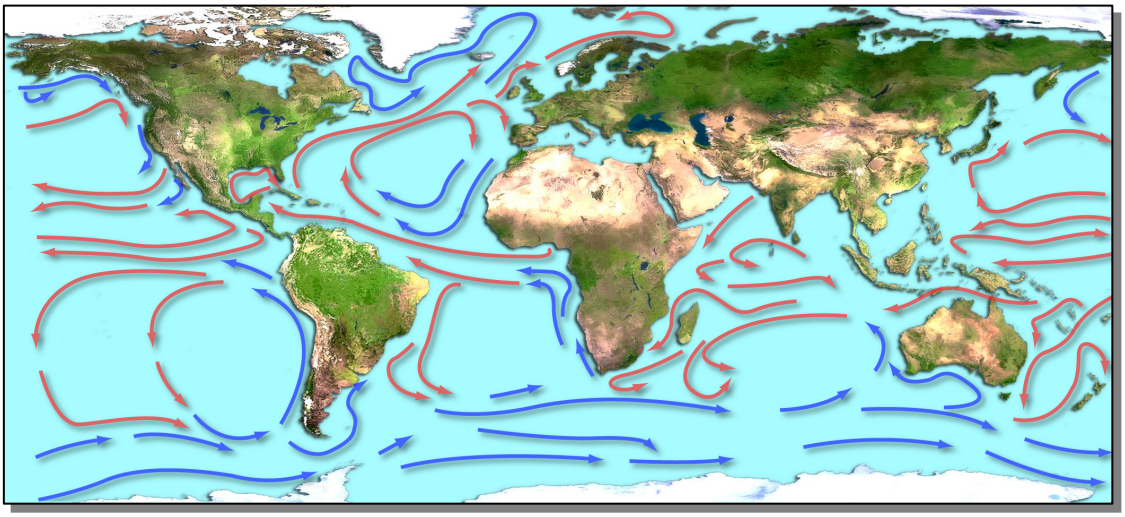


	NAME	CLIMATIC CHARACTERISTICS	PREDOMINATING AIR MASSES	VEGETATION TYPE
1	Equatorial	Hot and very wet all year round	**E** in all seasons	Equatorial rain forest
2	Tropical Savannah	Hot and wet in summer, warm and dry in winter	**E** in summer **Tc** in winter	Savannah grassland and woodland
3	Tropical Maritime (Tropical East Coasts)	Hot and very wet in summer, warm and wet in winter	**E** in summer **Tm** in winter	Tropical rain forest
4	Tropical Monsoonal	Hot and very wet in summer, warm and very dry in winter	**Tm** in summer **Tc** in winter	Monsoonal (semi-deciduous) forest
5	Hot Desert	Very hot and dry in summer, cool and dry in winter	**Tc** in all seasons	Desert
6	Warm Temperate or Sub-Tropical Eastern Maritime	Hot and wet in summer, mild or cool and wet in winter	**Tm** in all seasons (some **Pm** in winter)	Evergreen forest (some mixed forest)
7	Mediterranean (Warm Temperate Western Maritime)	Hot and dry in summer, cool and wet in winter	**Pm** and **Tm** in all seasons	Mixed deciduous and coniferous forest
8	Cool Temperate Western Maritime	Warm and wet in summer, cool and wet in winter	**Tc** in summer **Pm** and **Tm** in winter	Mixed deciduous and coniferous forest
9	Temperate Continental	Hot and dry or semi-arid in summer, very cold and dry in winter	**Tc** in summer **Pc** in winter	Temperate grassland and desert
10	Cool Temperate Eastern Continental (Humid Continental)	Hot and wet in summer, very cold and wet in winter	**Tm** and **Tc** in summer **Pm** and **Pc** in winter	Mixed deciduous and coniferous
11	Cold Temperate (Subarctic)	Warm summers, very cold winters, low annual precipitation	**Pc** mainly	Coniferous forest
12	Tundra	Cool summers, long and very cold winters, low annual precipitation	Pc and A	Tundra
13	Polar or Ice-cap	Cold to very cold, and dry all year	**A** and **AA** in all seasons	Nil

Approximate Latitude	Prevailing Pressure System	Temperature
90°N	High	Always cold
60°N	Usually low	**Continents** Develop highs in winter (e.g. Dec, Jan and Feb) because of intense cold
30°N	Usually high	Continental areas Develop lows in summer (e.g. Jun, Jul and Aug) as they become very hot.
0°	Low	Always hot
30°S	Usually high	Continental areas Develop lows in summer (e.g. Dec, Jan and Feb) because they become very hot.
60°S	Low	No land areas to interrupt pattern
90°S	High	Always cold

EFFECTS OF OCEAN CURRENTS

(Australia is an excellent example of this pattern)



Ocean Currents

COLD OCEAN CURRENT (eg WA)

Generally, these pass along the west coasts of continents (east side of ocean) at the latitude of the hot deserts. Air from above the cold water contains relatively small amounts of water vapour and when this blows onto the warmer land surface, its relative humidity drops still further. Advection fog is common.

WARM OCEAN CURRENTS (e.g QLD AND NSW)

Generally these tend to pass along the east coast of continents. (west side of ocean) Air from above warm water contains relatively large amounts of water vapour and once given a source of uplift, when blowing onto the land, bring high rainfall to these regions.

UPPER WINDS

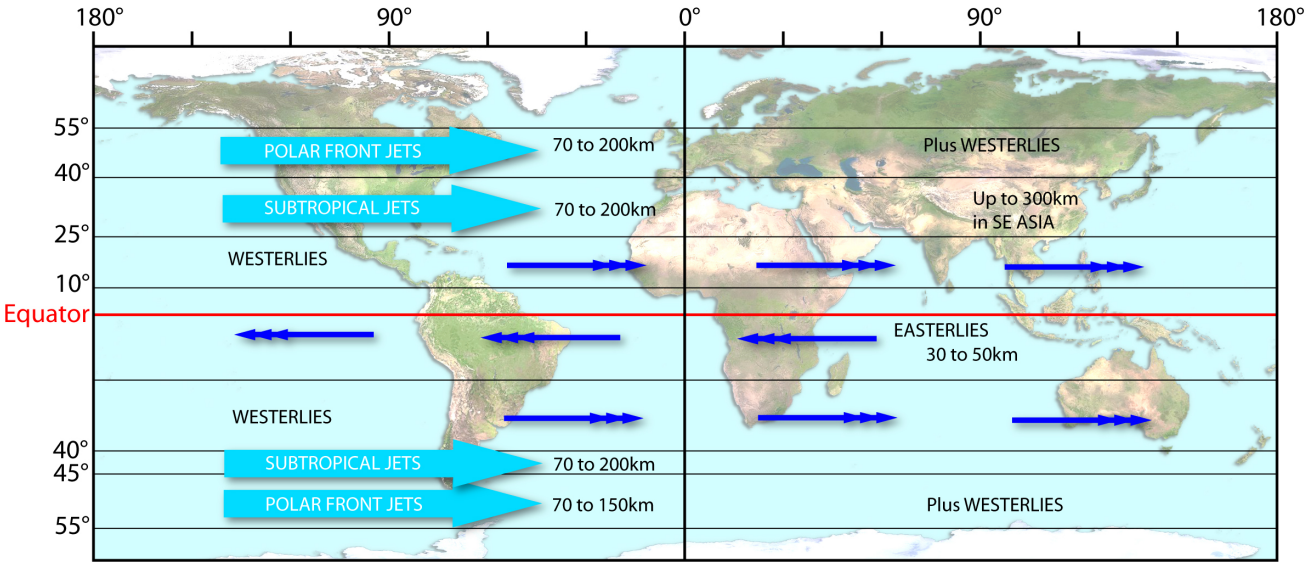
The upper wind tends to become more westerly at altitude due to the Earth's pole to equator temperature gradient.

However over the **equatorial** (ITCZ) area a reversed thermal gradient and the entrainment of the NE and SE trade winds tend to create upper **easterlies.** Normally these are light (10 to 20 kts) but may reach up to 50 to 60 kts between South East Asia and Africa in July.

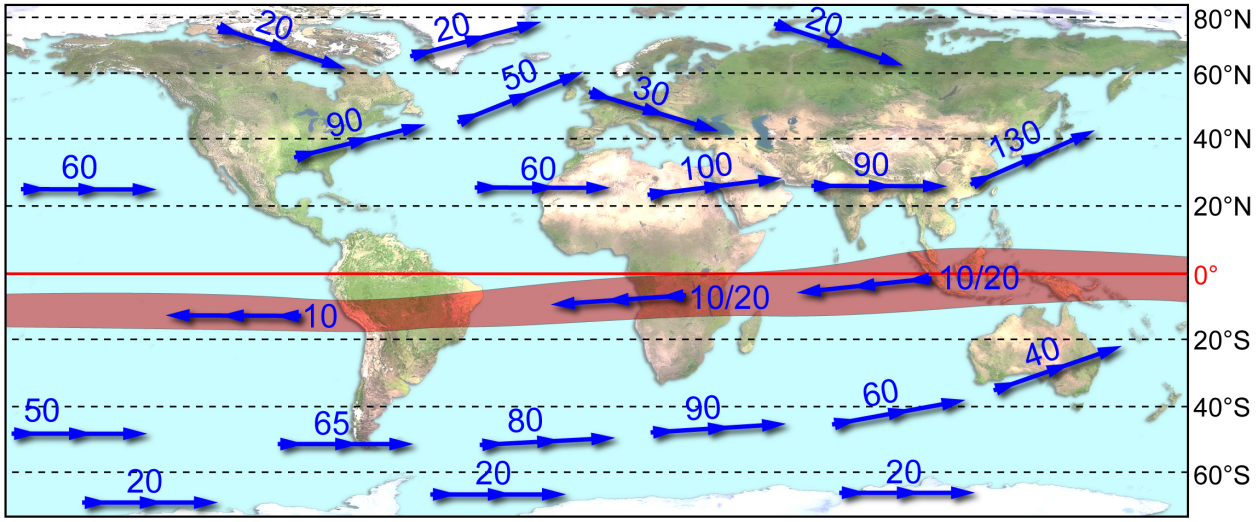
Away from the ITCZ the resultant upper winds are westerly in direction reaching maximum speeds at about 30° to 35° in winter (both hemispheres) and about 40° to 45° in summer (both hemispheres).

The cold continental air mass of Siberia meets the warmer Pacific area over Japan. The resultant upper winds may be up to 200 to 300 kts. Similarly the cold Canadian air meets warmer Atlantic air over New York. These jet streams may be up to 200 Kts. The uniformity of land and sea distribution in the Southern Hemisphere tends to create a more even distribution of winds than over the Northern Hemisphere.

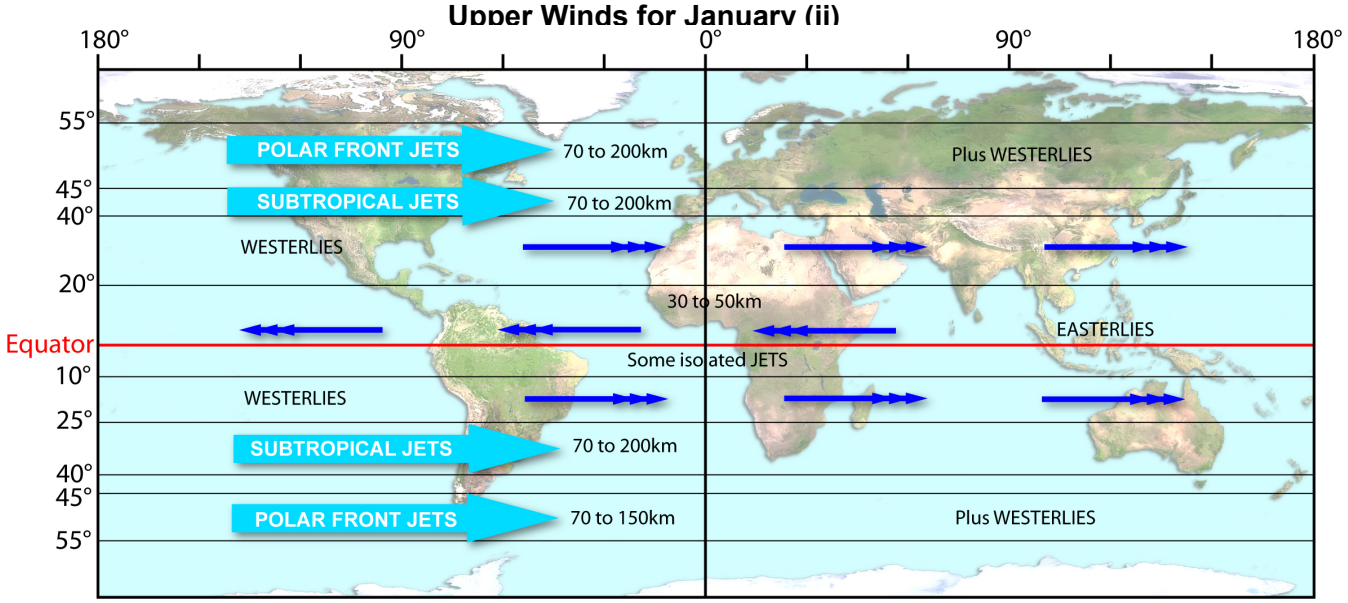
The following maps look at the upper winds in a simplified manner :



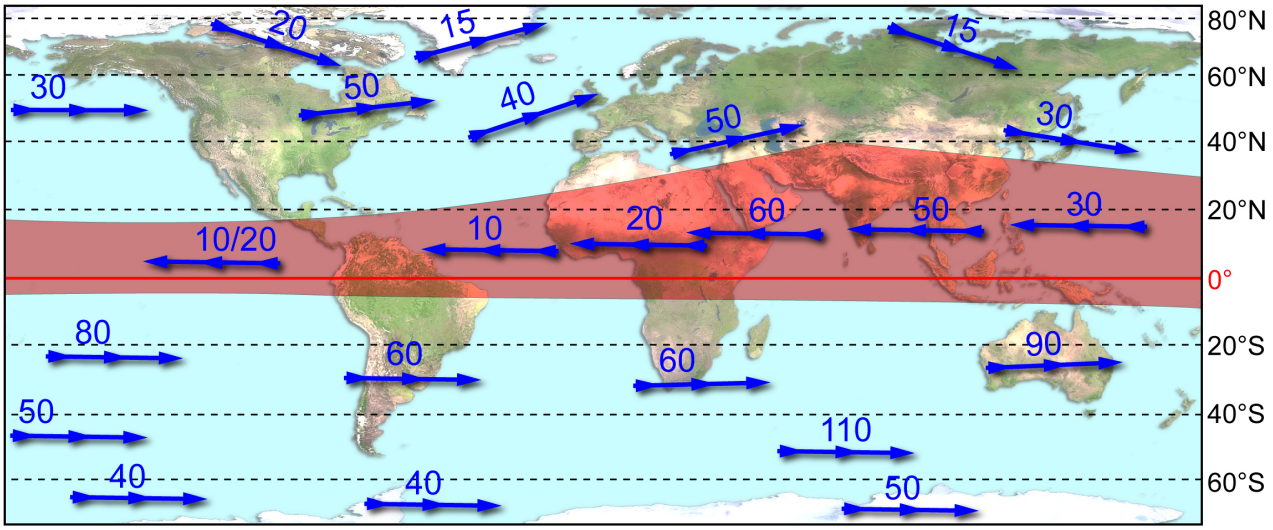
Upper Winds for January



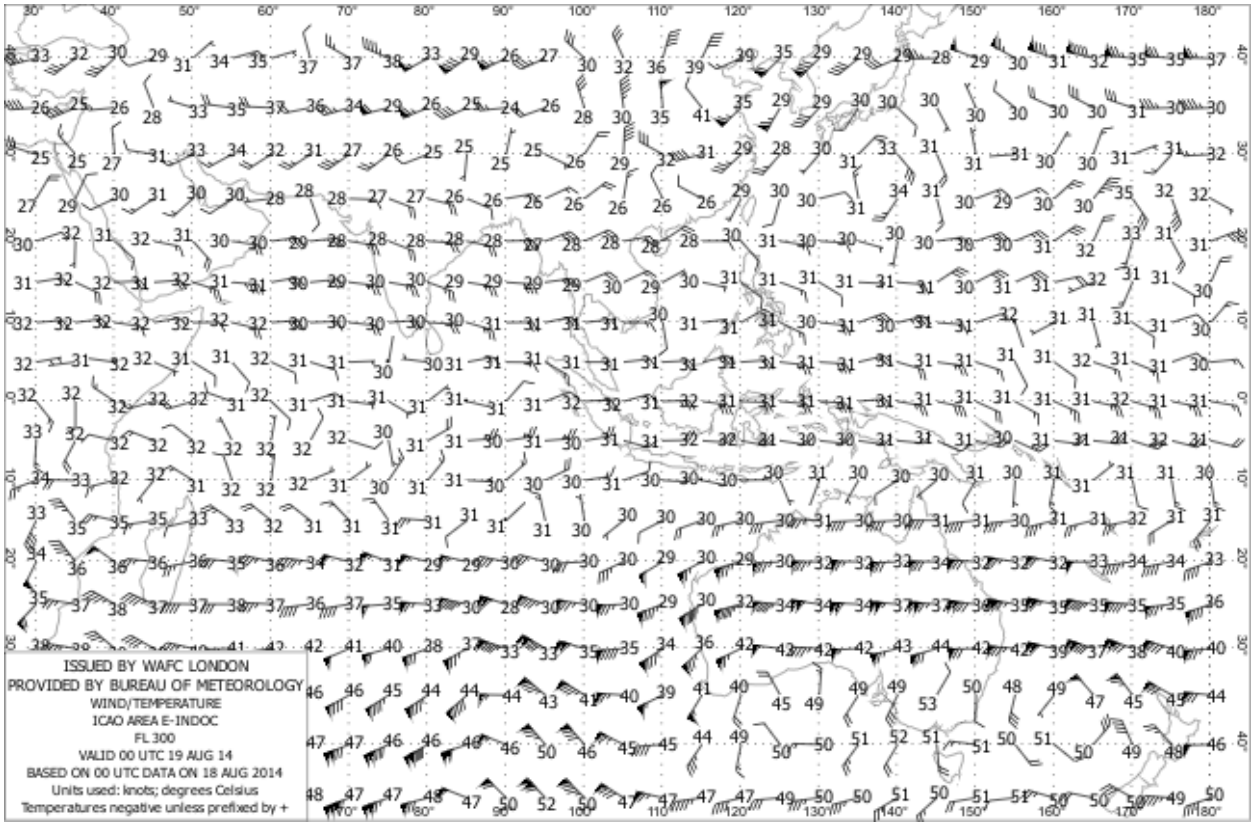
Upper Winds for January (ii)



Upper Winds for July



Upper Winds for July (ii)



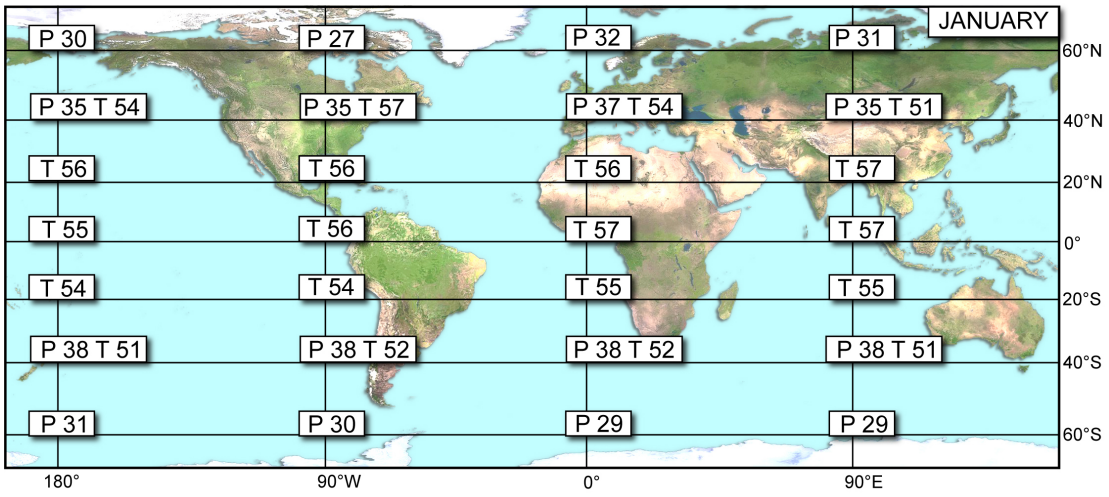
Wind and Temperature Chart for 250hPa / FL340

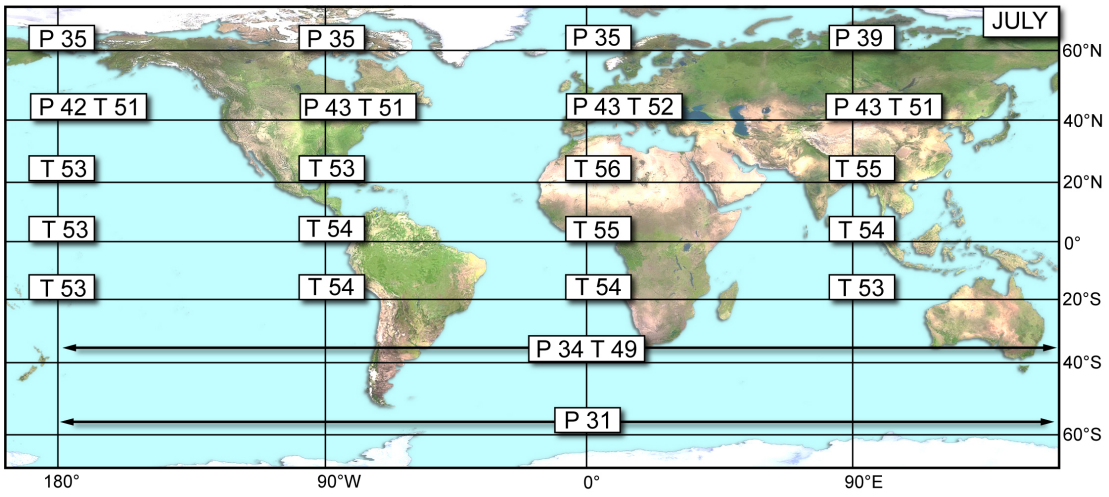
TROPOPAUSE HEIGHTS

The following charts show the tropopause mean heights in January and July. The tropopauses at 60°N and 60°S are in Polar air (P), whilst those between 40°N 40°S and at the Equator are in Tropical air (T). Between 40° and 60° in both hemispheres it is possible to have both the polar and tropical tropopauses overlapping.

Note:

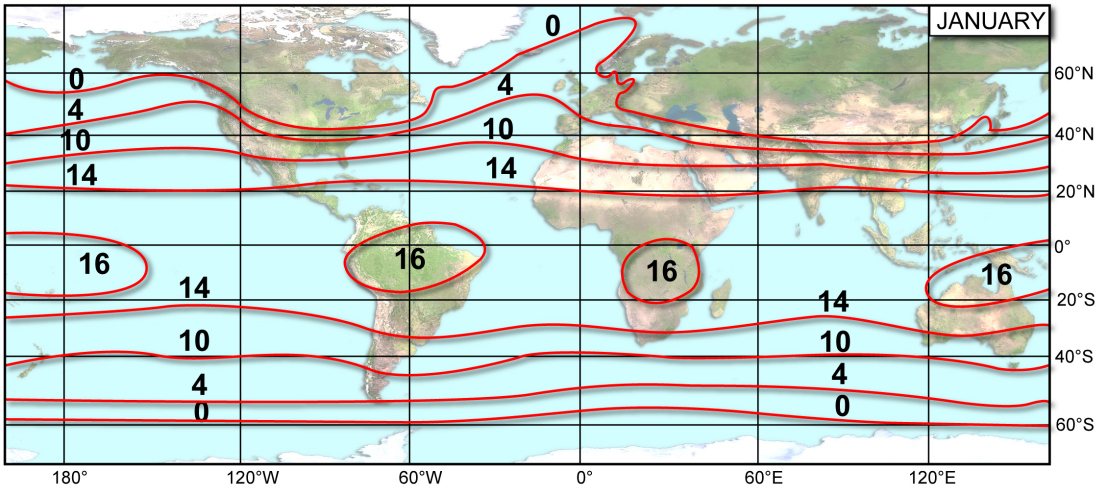
a) The consistent figures in the Southern Hemisphere compared with the Northern Hemisphere.
b) Tropopause heights between 20°N and S are between 53,000 ft and 57,000 ft throughout the year.

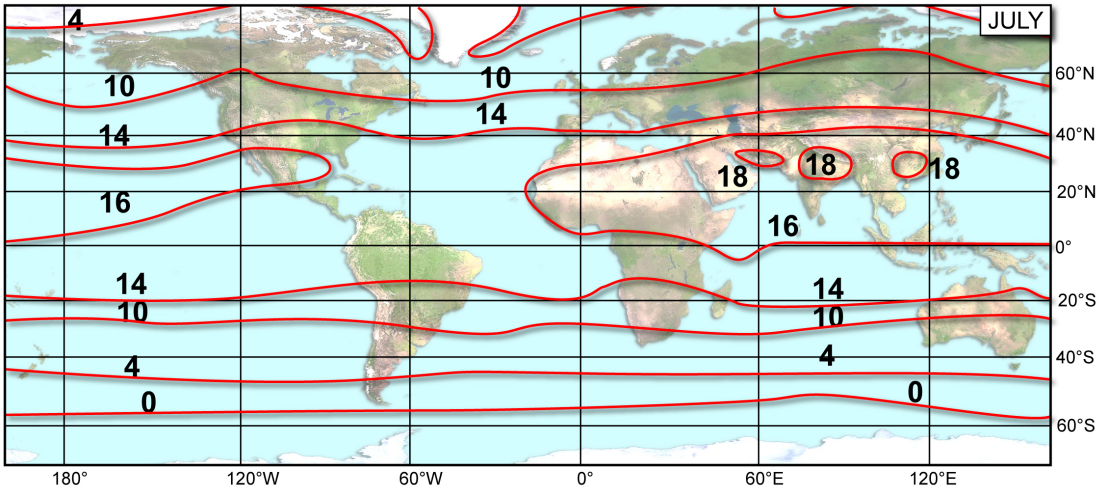




Tropopause Heights (x 1 000 ft)

FREEZING LEVELS





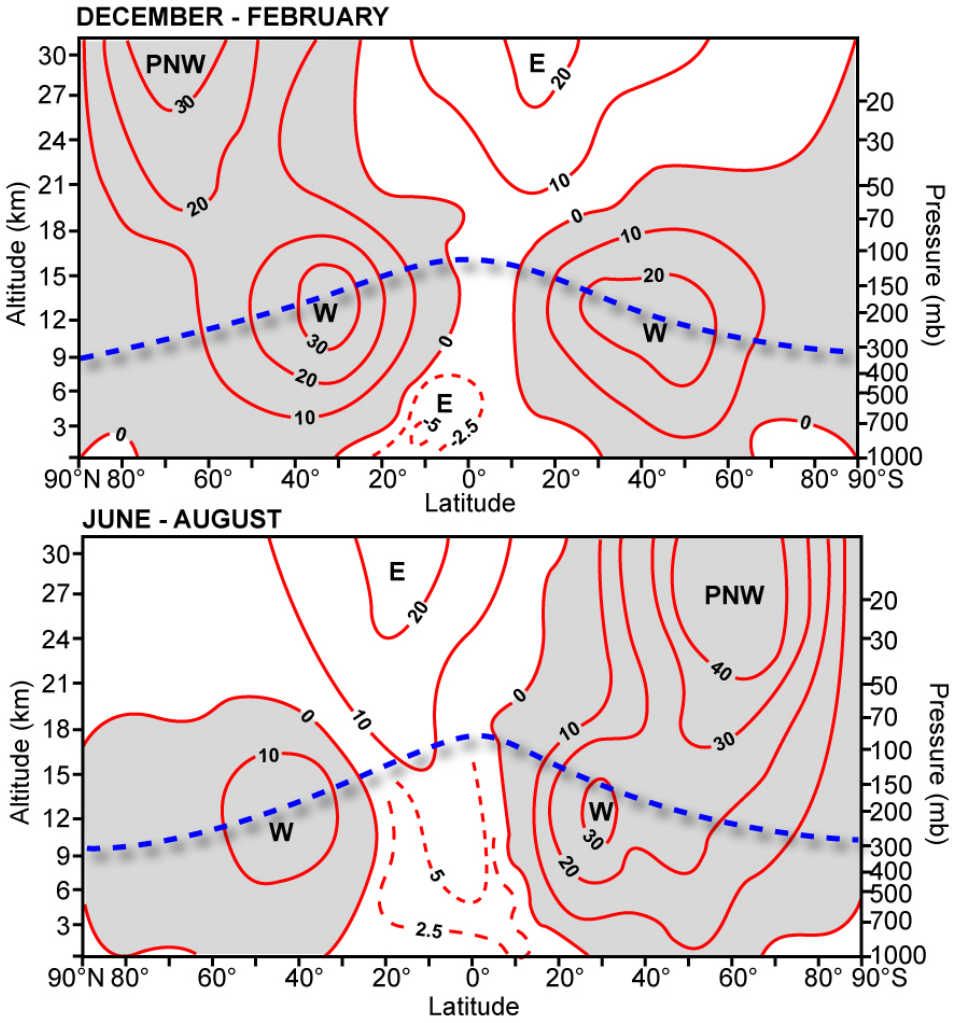
Freezing Levels in January and July (x 1000ft.)

Note:

a) The uniform lines in the Southern Hemisphere compared with those in the Northern (due to land and sea distribution).
b) Freezing levels between 10°N and 20°S throughout the year are mainly between 14,000 ft and 16,000 ft. The maximum height of 18,000 ft occurs in July over Southern Asia at around 30°N.
c) The freezing level reaches the surface in the Southern Hemisphere between about 55° and 60°S throughout the year.
d) In the Northern Hemisphere, however, land mass cooling causes the freezing level to be at the surface below 40°N in the winter over North America and Asia, while Gulf Stream heating causes it to be at sea level over the Arctic Ocean as high as 70°N. In summer, land mass heating means that the freezing level does not fall to the surface over most of the non-polar landmasses.

WIND IN THE STRATOSPHERE

Within the stratosphere, tropical easterlies are evident throughout the year. They reach a maximum at about the level of the Stratopause at a height of about 50km. and are centred over the southern tropical regions from December to February and over the northern tropics from June to August. Owing to the strong cooling of the polar stratosphere in winter, polar night westerlies develop at this time of the year in direct response to the thermal wind effect. These winds occur at about 30 km (100,000').



Mean zonal troposphere winds ($m.s^{-1}$) during December – February and June – August (after Newell *et al*., 1972). The heavy pecked blue line indicates the tropopause