

Australia

Physical features

Lies between 10°s and 40°s with Tropic of Capricorn more or less dividing the land mass.

Surrounded by Ocean all around

Maritime influence felt along the coast

Most of the land is of low elevation. Only in south east coast & at places in NE coast hill range (Great dividing range) is seen with elevation of 1 to 2 km height.

Ocean Currents : a) warm east Australia current
b) West wind drift (to south)
c) cold west Australia current

Influence is not much due to these being diffuse.

Temperature :

January receives maximum insolation

NW Australia Temperature exceeds 33 deg C

Southern Coasts cooler due to southerly latitude & due to coastal weather influence.

Winter Temperature sharply decreases towards south
Isotherms run more or less parallel to latitude as the land mass is not extensive.

Rainfall :

Summer

a) Heat low is sometimes situated in northern Australia & the ITCZ dips running across northern coastal districts of Australia.

b) feeble monsoon effect due to NE trade winds of N.H. deflecting to NWly wind bringing Rainfall.

c) Northern Coastal districts get rainfall due to Convective showers resulting in unstable tropical maritime air.

d) Further, east hill ranges cause orographic rainfall along east coast.

e) Tropical cyclones (willy willies) form in seas to NW & NE of Australia

f) Lilly Wellies form in warm seas NW of Australia taking SW, S & SE course bringing rainfall to NW coast of Australia. Sometimes they enter Australia & take eastward course as extratropical system causing rainfall in southern coast.

g) Tropical storm approaching Queensland coast from NE, turn south & SE along east coast of Australia. Southeast Coast is not affected by TC of Indian Ocean due to their movement at southerly latitude. However extreme SE coast gets rainfall due to these systems.

winter

a) Australia is a region of high Pressure with winds flowing from land to sea & as such most part of Australia do not get rainfall in winter season.

b) Southern coasts get some rainfall due to movement of extratropical systems at lower latitude.

c) East coast gets rainfall due to warm east Australian current.

Australian Deserts

a) SE region does not have a dry season in summer due to monsoon NWlies & TCs. SE coast gets rainfall due to orographic lift of SEly winds from ocean & due to TCs. In winter, SE coast gets rainfall due to extra tropical systems.

b) Central & western part of the continent receive very little rain. Due to anticyclone in winter its subsiding air inhibits rainfall. In Summer, the Indian Ocean subtropical anticyclone off west coast of Australia brings subsiding air over west coast of continent. The cold western Australian current is also one of causes of aridity.

c) Great Victoria Desert, Simpson Desert & Gibson Desert. These regions get very rarely rainfall when some extratropical systems move at lower latitude unusual rainfall occurs in association with westerly trough.

d) Extreme SW part of Australia receives rainfall in winter with dry summer & it experiences mediterranean climate.

South America

Physical features

South America extends from 10°N to 55°S

Tropic of Capricorn passing through middle of Continent

Equator is passing across northern part.

Around 7°S latitude it has max. longitudinal extent of about 45° .

Continent tapers northward & southward from 7°S .

Southern edge Land is very narrow.

a) Large area of tropical rainy climate

b) smaller area of arid climate & warm temperate rainy climate.

Due to maritime influence & small width in lower latitude no cold climate is present inspite of extension of continent to southerly latitude.

Coastline of south America resembles that of Africa with no prominent penetration of sea into land.

It is free of inland lakes.

Andes: continuous chain of lofty mountain range extending from Venezuela to Cape Horn.

widest near 20°S where land is over 1000 m above sea level from west to east for a distance of about 500 Km.

South of 40°S below 3000 m except for isolated high peaks.

Very narrow & runs close to West Coast.

Bolivian plateau elevation more than 4000 m

It has significant influence on the climate of entire continent because it prevents passage of Pacific air mass across vast low lands of Brazil in tropical latitudes

Pacific air mass appear over Argentina south of 35°S as the mountain barrier becomes less formidable at these latitudes.

Southeast Brazil: High land region. Few mountains are over 1500 m. Easterlies from Atlantic get orographic lift along Atlantic coast resulting in orographic precipitation

Extreme north: Small areas of high lands in northern Brazil, Guyana & in southern Venezuela. No barrier to ^{maritime} air mass from northeast incursion of north Atlantic maritime air takes place in the interior of Brazil (Amazon basin)

Low Lands: Betⁿ Andes & elevated land areas lies low lands of Argentina, Uruguay, Paraguay & Brazil.

Amazon basin: mighty river consisting of large network of tributaries source region for moist air mass \rightarrow invading central portion of the continent.

Climate 3 Types

1) Tropical rainy climate

a) south of Equator

January

ITCZ takes a dip at a V shaped front over the area with bottom of V touching nearly 20° S

Tropical maritime air is drawn into land area from Atlantic Ocean to east & north \Rightarrow moisture & high convective activity during afternoon & evening.

eastern slopes of Andes covering Amazon basin \rightarrow orography adds to lifting of moist air causing heavy RF season of max. RF is associated with location of ITCZ

Trough shifts northwards with march of sun, RF activity decreases except eastern slopes of Andes where orography continues to contribute RF.

July

6) North of Equator: narrow coastal belt along west coast \rightarrow abundant RF occurs. ITCZ north of Equator during most part of year, feeble southwest monsoon wind from Pacific gets obstructed by steep slopes of Andes. The forced ascent of moist air mass results in heavy precipitation

North Venezuela Less RF
Part of coast gets annual RF < 50 cm

few restricted areas low as 20 to 25 cm
 \rightarrow Downward acceleration (Divergence) of resultant wind with subsidence of air from aloft.

Elevated land area of extreme northern part of the continent also makes this area a rain shadow region.

2) Arid Region - Two Atacama & Patagonia deserts
Atacama deserts narrow coastal region along west coast south of Equator & adjoining mountain areas (Andes) upto 35° S. Reason - cold Peru current off west coast of Chile & Peru. Subtropical Anticyclone of South Pacific gives rise to subsiding air & outflow from this Anticyclone blows parallel to west coast from south to north. Upwelling of ocean water cold water rises to surface level. High elevation of Andes in adjoining region makes mountain region also arid. Patagonia desert - eastern slope of Andes south of 35° S. Rain shadow region in extratropical belt. Windward side of Andes south of 35° S RF due to extratropical systems. Lee ward side is arid - southern most part of Argentina.

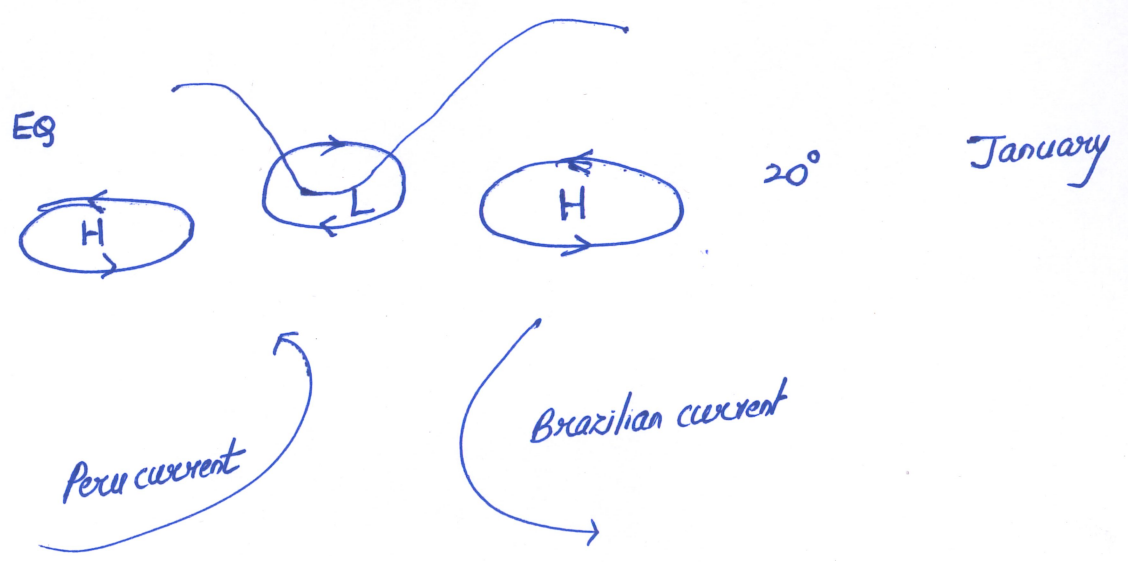
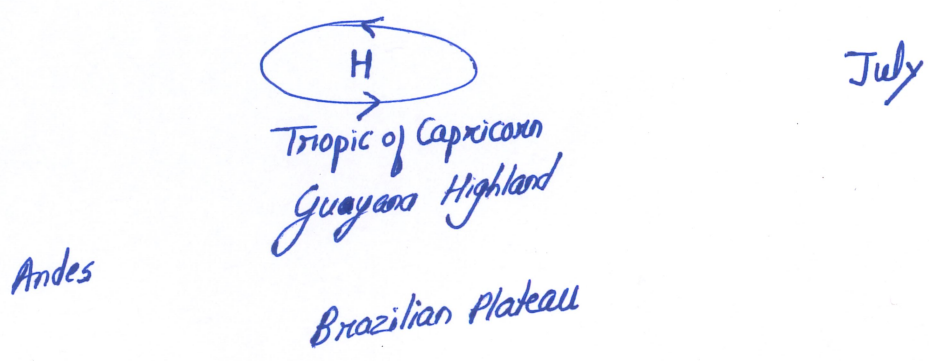
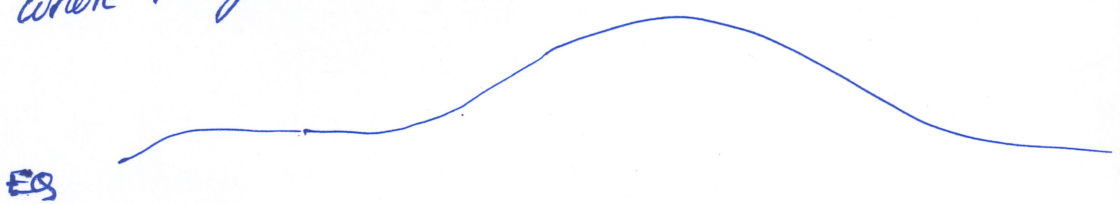
3) Warm Temperate climate

seen along west coast of 35°S
 east of Andes between tropical rainy areas & Patagonia desert.
 West coast south of 35°S is not cold though extending
 upto 55°S due to adjoining ocean & maritime influence.

Extra tropical systems move from west to east → bring RF on
 windward side of land mass. Hence this region is having
 warm temperate rainy climate.

Areas east of Andes between tropical rainy areas and
 Patagonia desert have temperate climate due to low
 latitude — comes under influence of maritime air mass
 from adjacent Atlantic Ocean.

The warm Brazil ocean current is also responsible
 for the warm temperate rainy climate.
 Orographical features also enhance rainfall activity
 However rainfall activity decreases towards south
 where Patagonia desert is located.



Africa

Physical features

This continent lies between 35 deg N and 35 deg S.

Equator runs in the middle of Continent.

South of Equator, the size of the continent gradually decreases southward & surrounded by oceans on three sides.

North Africa extends almost twice the longitudinal width of south Africa.

North Continent is separated from Europe by Mediterranean sea.

Northeast Continent is separated from Asia by Red Sea.

There are no extensive mountain ranges in Africa.

Atlas mountain near northeast coast (Average elevation is 2 Kms)

Presence of Elevated Land & Plateau

a) Ethiopian high land in north east

b) Central African high land (Kenya, Uganda & Tanzania)

surrounding lake Victoria located on the equator.

c) Area south of equator (vast plateau) more than 1 Km

except in Northwest portion between equator & 10 deg S (part of Congo and north Angola)

Climate is classified into 4 types

1) Tropical Rainy climate

Between 10° N and 10° S except eastern most

region — Tropical rainy climate

Rainfall > 150 cm.

Migration of ITCZ in this area brings copious RF

Convective RF occurs when moist air from Atlantic becomes unstable (Reason: due to insolation & wind convergence)

RF also occurs when warm dry air from north is undercut by cold moist air from sea in south.

July - ITCZ is north of Equator

January - ITCZ is south of Equator

Max. RF April - September (North of Equator)

October - March (South of Equator)

Thunderstorm is maximum twice a year (when trough ITCZ passes over the region)

In Northern Summer RF extends north of $10-15^{\circ}$ N

In Northern Winter dryness increases more from 5° N towards north.

South of 10° S the rainfall extends to southerly latitude (even up to 20° s) in October to March Months.

Guinea coast of Africa - The ITCZ is mostly north of Equator. Further when ITCZ moves northward with sun (from April to September) the south west monsoon winds over Guinea coast starts.

Guinea current keeps coast warm \rightarrow Transport of warm moist air from sea to land bringing monsoon Rain. At places with high land orographic lifting causes

lot of precipitation.

Oct - March Warm Continental dry wind extend over most part of this area.

2) Arid Regions (North Africa)

a) North Africa (Sahara desert)

b) South Africa (Kalahari desert)

North Africa - North of 15°N exception plains in the north of Atlas mountains (Morocco and North Algeria), Somalia in east coast (though it lies bet' Eq & 10°N - Arid region Reason: In Northern Summer April - Sept. Somalia is a rain shadow area to southwesterly wind from Atlantic due to Ethiopian & Central African high lands)

In Northern Winter (Oct - March) the wind flow from anticyclone in Arabia is northeasterly over Somalia which does not bring much rainfall.

Central Area of Sahara no rain as moist wind do not penetrate into these areas, especially in northern Summer

Long distance from ocean/sea is another factor for aridity of this region.

Cold Canaries current along west coast of north Africa also contributes to the aridity of the region.

Winds are continental northeasterlies (outflow from anticyclone)

No moisture incursion

Along Mediterranean coast — some precipitation occurs due to extratropical disturbances.

Hottest Region in northern summer with max. temp. over large area exceeding 38 to 40°C. Temperatures of the order of 45 to 47°C is also common. Radiational cooling at night — diurnal variation is

Maximum

Annual range of temp. is high

South Africa Covering Namibia & Botswana Kalahari desert — subsiding air of south Atlantic subtropical anticyclone.

Cold Benguela current along southwest coast of Africa also contributes to aridity.

3) Warm Temperate Climate

January on ITCZ takes a sharp dip at almost 20°S. As a result southern summer precipitation extends to southerly latitudes in south Africa compared to north Africa during northern summer.

Precipitation — Mostly Convective showers.

Extension of tropical climate towards south cool night temp. & warm day temp. — due to high elevation of continent.

Warm temperate rainy climate extends upto 20° s.

Source of moisture — Maritime air from Atlantic to the west & Indian Ocean to the east Southeastern part of Africa (Tanzania & Mozambique) gets more rainfall compared to southwestern part — dry Kalahari desert. — due to warm Mozambique current & Agulhas current flowing off east coast.

At times Tropical cyclones from Indian Ocean strike this coast bringing rainfall especially over Madagascar Island. (100 cm RF)

Less RF along west coast due to high lands at centre of this island running parallel to the coast.

⇒ Mediterranean Type Climate

Extreme northern part & extreme southern part of continent with dry summer & wet winter.

North Africa — northern coastal areas along Mediterranean sea & northwest coastal areas along Atlantic ocean

Extratropical systems moving eastward in northern winter — RF

Windward side of Atlas Mountains get good rainfall on such occasion due to orography.

Southern most part during southern winter gets precipitation due to extratropical systems. Due to lower latitude &

higher elevation temperature is mild with rainfall in winter & dry summer.

Eastern coast of southern tip of continent has no dry season due to warm ocean current.

Agulhas current flowing off east coast. At times tropical cyclones from Indian Ocean strike this coast bringing rainfall especially near Madagascar Island. (see ex 4.7)

Less RF along west coast due to high latitude of centre of this island situated parallel to the coast.

→ Mediterranean type climate

Extreme northern part & extreme southern part

of continent with dry summer & wet winter

North Africa - coastal areas

Mediterranean sea & northwest

coastal areas along Atlantic ocean

Extratropical systems moving eastward in northern

winter - RF

Windward side of Africa (Mediterranean) get good rainfall

as such occur due to geography

South coast part during winter get precipitation

due to extratropical systems. Due to lower latitude &

African Continent

Entire continent is within the tropical zone

Equator bisects the continent

Areas N & S of Equator climates are similar

Broad Northern area in East-West direction → maritime effects inland are minimal

Summer Southern part Low Pressure

Winter Southern part High Pressure

Western shores cold ocean current → influx of cool winds & associated weather

No mountain ranges present.

Precipitation greatest near equator
a) decreases sharply to north
b) gradually decreases to south

PPT Belt, ITCZ moves with season

West ← → East

Northern

Sahara desert

CT dry
hot day } due to
cool night } radiational cooling

North Central

semiarid region

Subequatorial region (Eq to semiarid region)

Wet (Nov-Mar) Dry rest of year
Little seasonal variation of temp.

Winter western portion cool w. from north

Equatorial region (5°N - 5°S) west coast to Lake Victoria

Two distinct rainy seasons (Nward & Sward movement of ITCZ)

RF 120 inches annually

Temp moderate all year round -
No mountains

Southwestern

Kalahari desert
Semiarid no extreme temp.

PPT in winter
maritime air from Mediterranean in the south

Southeast coastal region

humid subtropical climate

RF all year 45 inches on average

moderate Temp. 72°F

avg max. in winter (July)

89°F in Summer (Jan)

Southeastern interior region

Wet & dry type of maritime climate

considered as temperate

Low temp. common to higher elevation

South America

Continent tapers sharply from north to south → CP air does not exist.

Larger northern area close to equator → NO influx of cold mP air from south.

Tropical climates prevail much of continent.

Western coast high Andes mountains → some areas extremely dry & others are extremely wet.

Northeastern Climate

high T, humidity RF all year

Sept (warm) T = 82°F

Jan (cold) T = 79°F

Night Temp rarely fall below 65°F

RF avg. 87 inches

June 12 inches

Oct 2 inches

Higher elevations. greater range of humidity & PPT. (not extreme)

West coast

northern Peru to middle of Chile → desert

N & S of this desert midsection → humid climate

NW coast Tropical climate wet & dry season

Below Chile → climate is generally rainy & cool
No summer season
Winter temp. avg below freezing.

Southern Climate

Jan (warm) 74°F

July (coolest) 49°F

PPT all year around avg 38 inches.

No distinct rainy season

Below 40°S dry & cooler climate →

extreme southern tip year round cold & damp climate

→ strong maritime influence.

$$^{\circ}\text{C} = \frac{9}{5} (^{\circ}\text{F} - 32)$$

Antarctica

I) Solar radiation

- 1) southern Hemisphere summer - earth sun distance is minimum.
- 2) Elevation of continent 2500m
- 3) pure atmosphere

Latitudes of 80° south register lowest temp. on the earth, receive maximum monthly mean solar radiation.

75% of what is received is reflected by snow covered surface. In the longwave, the surface acts as a black body permanent pack ice belt is found around the continent September - peak area equals that of continent.

II) Temperature

Avg. monthly temp. well below 0°C due to latitude effect, presence of permanent ice cover, high elevation of continent.

III) Surface Inversion

Common feature of the Antarctica Atmosphere. Temp. of surface may be as much as 30°C colder than air just to a few hundred metres above. This is due to the intense cooling of the surface air. meridional temp. gradient breeds many intense cyclones

IV) Pressure

shallow anticyclone of thermal origin prevails close to surface. Its Centre coincides with the south pole. Aloft there is cyclonic circulation with westerly winds.

V) Winds

polar easterlies emanating from the anticyclonic centres creep downwards from the sloping terrain & are converted into sudden down rush of air, jumping to 30-40 knots from lull. These winds are katabatic winds reach gale force, kicking up snow & bringing visibility to zero known as blizzards. This effect is seen upto 3 km from the coast & velocity convergence where their speed abates leads to appearance of vertical wall of cloud & blowing snow.

VI) Precipitation

is small due to anticyclone & low temperature.