MAJOR AIR MASSES OVER AUSTRALIA

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Air Mass

- An air mass is an extremely large body of air whose properties of temperature and moisture are similar in any horizontal direction at any given altitude.
- Usually occupying the whole troposphere in a region.
- Within an air mass, the surface pressure may be low or high has little significance in this connection.
- The processes which create or modify air masses at the source and in their travels are fairly numerous, especially in middle latitudes far removed from the polar region and tropical sources.
- The modifications have a marked effect on the type of weather that will occur within the air mass.
AIR MASSES WHICH AFFECT AUSTRALIA
Regions of the atmosphere
Air masses which affect Australia

- Air Mass characteristics.
- The area of origin.
- The nature of the track from it’s area. origin to Australia.
The term “stream” is applied to a more or less steady flow of air from a constant direction over an area for a period (up to 4 to 5 days).

We may also consider a stream as an air mass in motion from a constant direction e.g “southerly stream”.
Process affecting the weather in streams

- Different air masses are recognisable by having distinctly different values of temperature and humidity.”
- The area of origin.
- The nature of the track that the air mass follows from it’s area of origin to Australia.
The factors which modify air mass properties

- Latitudinal effects.
- Topography.
- Subsidence near the centre of an (anticyclone).
- Turbulence (Stratiform clouds 2000ft).
- Upper wind shifts (Mid-level clouds).
Polar maritime air mass

- Very cold, moist and unstable air mass.
- Source in the southern ocean on the margin of the Antarctic (55 - 68 S).
- Affect southern NSW in winter months during strong southerly flow after the passage of vigorous cold-front.
- Often accompanied by snow and sleet to low levels.
AIR MASSES AS THEY AFFECT S. E. AUSTRALIA

1. POLAR MARITIME

Source - Polar Anticyclone.
Track - Long sea track over progressively warmer sea.
Characteristics - Cold and moist.
Polar Maritime Air mass Weather Pattern

Typical temp/height graph for Polar Maritime air.

1. Cold air aloft
   - Makes the air very unstable

2. Lower layers warmed by progressively warmer sea
   - The air is moist
   - Dew Point
   - Temp
   - Height
   - 1200m

- 0°C
- 5 → 10°C
- → Temp

- Showers over the coast
- Showers over the sea
- T.CU
- SC
- CB
- E

- Showers of snow over the ranges
- Good visibility outside showers
- Thunderstorms over the sea in early winter when the sea temp. is high
Southern Maritime air mass

- Cool air mass, moist and unstable at low levels but stable above.
- Source in the southern ocean (35 - 55 S).
- It brings cool, moist, cloudy weather and drizzle to southern Australia at any time of the year.
- Little rain unless orographical uplifted.
2. TEMPERATE MARITIME

Source
- Anticyclone over Bight or Southern Tasman.
Track
- Short sea track over progressively warmer sea.
Characteristics
- Cool and moist.

Typical temp/height graph for Temperate Maritime air.

![Temp/Height Graph]

1. Cool air aloft
2. Warmer air near surface

a. As a South Westerly Air Stream
Temperate Maritime Weather Pattern

- The air is usually unstable to sea surface temp. off the East Coast. It picks up moisture again over the sea, giving cloud and showers well seawards.
- Good visibility
- Strong Westerly winds at Nowra caused by funneling down the Shoalhaven Valley
- Showers on Western side of the ranges
- Turbulence and Mountain Waves on Eastern Side of the ranges
- Air dries out as it comes over the ranges

Fine on East Coast of NSW
South Easterly Air Stream
South Easterly Air Stream

- Light showers
- Layered SC with embedded CU (~3000m)
- Hill fog
- Drizzle / Showers over the coastal area, and East side of the ranges
- Partly cloudy over the sea
- To partly cloudy West of ranges

CU

E
North Easterly Air Stream
North Easterly Air Stream Weather Pattern

The sea breeze effect is usually very significant in this situation.

Fine West of the ranges

Partly cloudy East of the ranges and over the sea
As a South Easterly with a Depression off the Coast
(Usually associated with cold air aloft which increases the instability of the air mass)
East Coast Low Pressure
Weather Pattern

Partly cloudy to cloudy on the West side of the ranges

Showers over the ranges

Hill fog

Heavy rain, extensive low cloud and poor visibility over the coastal area of N.S.W. and Eastern side of the ranges

Embedded large

Showers over the sea
Tropical Maritime “Tasman”

- Warm air mass, unstable and moist to high levels.
- Brings warm, cloudy and drizzle weather to coastal regions of eastern Australia, with heavier rain if some means of lifting available.
- This air mass is influential along central coast region most of the year.
Tropical maritime “Pacific”

- This air mass is warm, humid.
- Source further north in coral sea and tropical pacific ocean.
- Effects the northern QLD coast most of the year and can bring heavy rainfall if associated with a tropical cyclone.
Tropical Maritime Air Mass

Source - Tropical area of Western Pacific.
Track - Sea track over progressively colder sea.
Characteristics - Warm and moist - humid.
Tropical Maritime Weather Pattern

Typical Temp/Height Graph for Tropical Maritime air.

- **Temp**
- **Height**
- **Dew Point**
- **Warm, moist air aloft**
- **Surface layer cooled by the progressively colder sea giving a stable layer near the surface over the sea**

**Good visibility in unstable air over the ranges**

- **CU**
- **CB**

**Orographic lifting, and high daytime temps cancel out the effect of the surface inversion in the air mass over the ranges, making the air unstable, and causing afternoon thunderstorms over the ranges**

- **Haze, giving poor visibility, trapped beneath the surface inversion over the sea**
- **Sea fog patches when sea temp is lower than the Dew Point**
Tropical Maritime with Cold Pool Aloft

b. Tropical Maritime with Cold Air Aloft

The combination of warm moist air at low level and cold air aloft gives a mass very unstable, giving prolonged heavy rain over N.S.W.
Tropical Maritime with Cold Air Aloft

Medium and High Cloud extending Eastwards with the upper winds

Heavy rain, Poor visibility
Low cloud, Hill fog

Light rain
Tropical continental air mass

- Source over central Australia.
- Very hot, dry unstable in summer.
- Cooler in winter.
- Cloud and rainfall are severely inhibited by a lack of moisture.
- This air mass may bring heat-wave conditions to southern Australia in summer under strong northerly flow.
Equatorial Maritime

- Very warm moist and unstable air mass.
- Associated with the monsoon season.
- Affects north and north-western Australia in summer.
- This air mass can affect areas as far south as lat. 30°S (during active monsoon.)
Tropical Continental Air Mass

Source - Centre of the Australian Continent.
Track - Overland.
Characteristics - Hot and dry.
Tropical Continental

Good visibility by day, reduced by Haze trapped below the Surface Inversion at night

Commonly occurs ahead of a Cold Front, ahead of a Southerly Buster in Summer
Tropical Maritime “Indian”

- Very similar characteristics to Pacific tropical maritime. Source in the eastern Indian ocean.
- Affects the north-western coastal areas of Australia.
MAJOR AIR MASSES DURING THE SUMMER MONTHS

- TROPICAL MARITIME
- DRY TROPICAL CONTINENTAL
- SOUTHERN MARITIME
Mid Spring – Late Autumn

AIR MASSES

Tropical Maritime

Tropical Continental

Southern Maritime

Southern Maritime modified by Tasman Sea

MID SPRING - LATE AUTUMN
SUMMER
MID SPRING - LATE AUTUMN

TROPICAL MARITIME:

- Warm, very moist.
- Day temperatures greater than 25/30 deg and dew points greater than 20 deg.
SUMMER
MID SPRING - LATE AUTUMN

SOUTHERN MARITIME

- Usually cool & fairly moist.
- Day temperatures 10/20 degrees.
- Dew Points 10/15 degrees.
- Slightly modified by warmer Tasman Sea.
SUMMER
MID SPRING - LATE AUTUMN

DRY CONTINENTAL AIR MASS

- Warm to Hot, low dew points
- Day time air temperatures >30 degrees
- Dew points < 5 degrees
MAJOR AIR MASSES DURING THE WINTER MONTHS

- TROPICAL MARITIME.
- SOUTHERN MARITIME.
- POLAR MARITIME.
Late Autumn – Mid Spring

LATE AUTUMN - MID SPRING
WINTER
LATE AUTUMN - MID SPRING

TROPICAL MARITIME

- Only influences the far north of Australia.
- It is not a major Winter air mass.
- Warm & very moist.

Source - Tropical area of Western Pacific.
Track - Sea track over progressively colder sea.
Characteristics - Warm and moist - humid.
WINTER
LATE AUTUMN - MID SPRING

SOUTHERN MARITIME

- Most dominant for areas south of 20 degrees south.
- Usually cool & fairly moist.
WINTER
LATE AUTUMN - MID SPRING

POLAR MARITIME

- Cold bursts of ex-Antarctic air
- Day temperatures 5/12 degrees & Dew Points 0/5 degrees.
- The true "outbreak" has an intense secondary low & high pressure with a strong ridge southwards.
THE END