WEATHER ADVICE FOR YOUR SAFETY

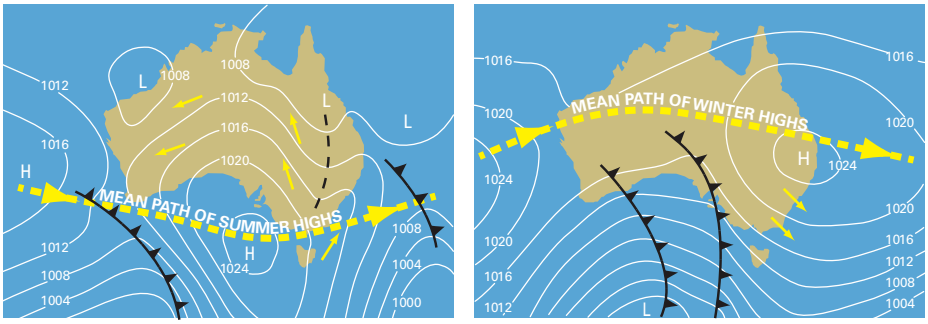
Flying the Southwest

This pamphlet provides an overview of the weather over southwest Australia (defined as south of latitude 23.5˚S and west of longitude 135˚E), particularly as it affects aviation.

Weatherwise pilots keep in touch with the current and expected weather patterns by:

- **obtaining the latest aviation observations, forecasts, warnings and charts from the briefing system listed at the end of this pamphlet,**
- **telephoning the Bureau of Meteorology for elaborative briefing, when appropriate, and**
- **paying attention to media weather presentations and reports.**

Pilots also benefit from understanding the characteristics of particular weather situations and systems which affect the area in which they operate. This pamphlet discusses some of the hazardous weather elements and situations that may be experienced in southeastern Australia from an aviation perspective.



Average MSLP in summer (left) and winter (right).

General Climate

The climate of southwest Australia is largely of Mediterranean type with mostly cool wet winters and warm to hot dry summers; although inland towards central Australia, the climate becomes semi-arid to arid. It is useful to consider flying conditions from a 'winter' (May to September) and a 'summer' (November to March) perspective. There is a transitional period between the two seasons, with October and April being the transition months.

Summer

Summer, with its long periods of clear skies, presents the best flying conditions, however hazards may be present in the form of:

- thunderstorms
- tropical cyclones (occasionally)
- mechanical turbulence
- dust storms
- low cloud (occasionally), particularly coastal.

Winter

Adverse flying conditions in winter are usually associated with one of the following systems:

- orographic lifting of low-level moist air by the terrain leading to extensive low cloud
- cold fronts
- fog, particularly on the days following the passage of a cold front
- cut-off lows
- cloud bands
- localised convergence of moist air near the coast, giving rise to low cloud and drizzle.

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Significant Weather Systems

Orographic Lifting

Any moist low-level airflow over gradually rising ground usually causes extensive low cloud to develop. A relatively frequent example of this occurs over the Goldfields area in the early mornings when a high-pressure ridge moves into the Great Australian Bight. The low-level moist southeasterly rising over the terrain can result in low cloud which often persists well into the day.

Cold Fronts

Cold fronts usually bring adverse flying conditions in the form of:

- reduced visibility in rain and lowered cloud base
- thunderstorms, possibly with hail, either along the front or in the cold unstable southerly air that follows the frontal passage
- tornadoes may occur (infrequently) with thunderstorms associated with particularly vigorous fronts
- strong winds, both pre and post-frontal
- radiation fog often occurs in the clearing skies and moderating winds after frontal rain.

Each frontal system is somewhat unique with respect to the cloud and weather pattern. Consequently the forecasts and warnings must be scrutinised carefully to determine the pattern of a particular front. Satellite pictures provide, with limitations, a pictorial representation of the cloud distribution – take care though, as high clouds sensed by the satellite may mask low cloud.

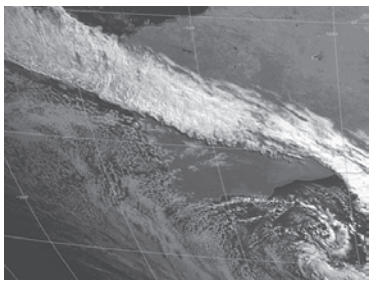
Cut-off Lows

Occasionally during the cooler months, large, deep, slow moving low-pressure systems may become cut-off from the westerly flow further southwards. Cut-off lows are usually associated with strong winds, extensive rain and thunderstorms. Such systems may dominate weather conditions in the area for several days.

Northwest Cloud Band

Cloud bands can develop great vertical and horizontal extent, resulting in non-VMC conditions with rain, low cloud, fog and even embedded thunderstorms.

One particularly significant weather system that affects safe flight mainly over the northern and eastern parts of southwest Australia is the northwest cloud band which usually first appears to the northwest of Australia and extends for several thousands of kilometres towards the southeast. The cloud forms when warm, moist tropical air moves poleward in the middle levels of the atmosphere, and rises gradually. Usually light rain falls initially, and as the intensity increases, the cloud base lowers and the visibility deteriorates.

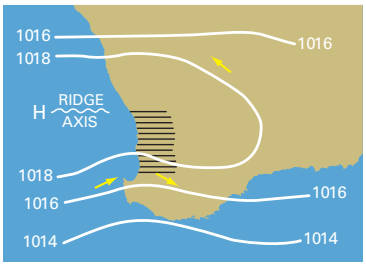


Northwest cloud band.

A fully developed northwest cloud band presents very bad flying conditions because:

- cloud cover may extend for thousands of kilometres in the east-west direction, though generally less in the north-south direction
- cloud is often unbroken from low levels to about 20 000 feet. Once a VFR pilot is inadvertently caught in cloud, there may be little opportunity to escape
- below minima conditions may persist for many hours or even days
- fog frequently forms following the passage of the cloud band, in areas where there has been extensive rainfall.

Fully active northwest cloud bands usually occur at least twice a year, but their frequency may be greater in some years. Cloud bands which are relatively weaker and of more limited extent occur much more frequently. They may occur in any month but are most likely to develop in the cooler months of the year. They are readily discernible on satellite images.



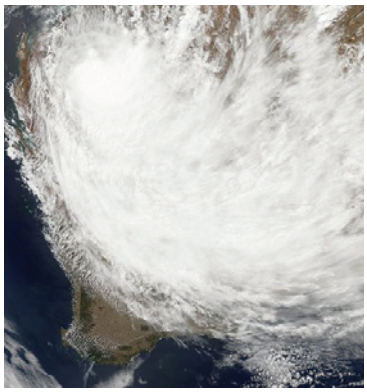
A localised MSL analysis showing the area likely to be affected by low cloud produced by coastal convergence.

Coastal Convergence

This term is used to describe the mechanism by which a narrow zone of low cloud and poor visibility in association with rain or drizzle persists for several hours near the coast.

The cloud zone, which roughly parallels the coast, forms due to convergence between an onshore flow (associated with the pressure pattern) and an off-shore flow that develops overnight, due primarily to local land-sea temperature contrasts. The cloud zone generally forms after sunrise and clears later in the morning as temperatures rise. It forms only in weak onshore airstreams, usually over land and south of the high pressure ridge axis. The cloud base is typically below 1000 feet and cloud top typically about 7000 feet. The lower west coast from Lancelin to Bunbury is particularly prone to this weather situation.

Tropical Cyclones



Tropical Cyclone Emma, February 2006, courtesy of NASA.

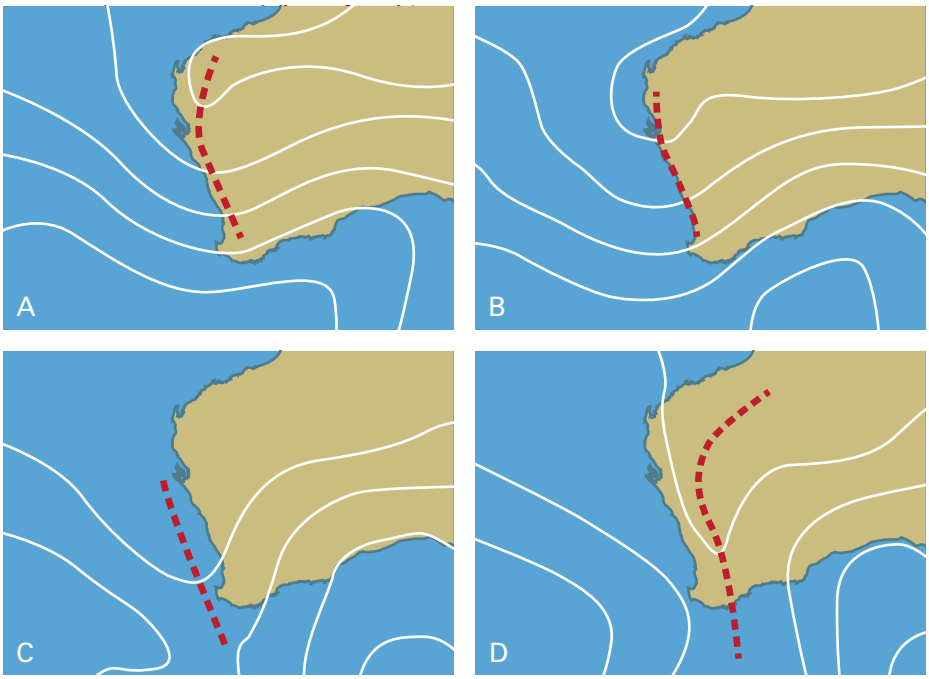
About once in every five years, a tropical cyclone moves very rapidly towards southwest Australia. Although many of the typical cloud features of the cyclone have dissipated by the time the cyclone reaches the area, gale-force winds prevail in association with a very deep low. The gale-force winds frequently cause blinding duststorms, particularly to the north of the cyclone track. Very heavy rain may occur to the south of the cyclone.

Tropical cyclones which move rapidly towards southwest Australia (and retain their gale-force winds) are most likely to be experienced in late summer or early autumn. This type of situation is very hazardous to aviation and should be avoided at all costs.

Hazardous Phenomena

Low Cloud

Low cloud can occur at any time of the year in the southwest. However it is particularly problematic on the west coast in the summer months when the west coast trough moves from inland to just offshore before moving inland again. In this type of weather situation, hot and dry continental air moves offshore and absorbs moisture from the ocean. When the trough moves inland again, the low level moist air is cooled as it rises over the terrain. As this air is likely to be trapped under hot air aloft, the cooling may lead to saturation of the lower air and subsequent formation of hazardous low cloud.



MSL analysis chart sequence showing the west coast trough moving offshore and then moving onshore again, bringing moisture from the ocean to the land.

Fog

The occurrence of fog follows a seasonal trend, being much less likely in summer than in winter and the transition months. Radiation fogs are common inland in winter when the sub-tropical ridge lies over the south of the state resulting in clear skies and light winds. These fogs are usually isolated and they dissipate by mid-morning. More widespread fogs tend to form in the wake of cold fronts when rapid ridging behind the front forms a temperature inversion which traps the moisture from the earlier rainfall. The west coast trough can also produce fog about the coastal plain as it moves inland, advecting moist maritime air. There have been isolated instances of this occurring as a sea fog during the day.

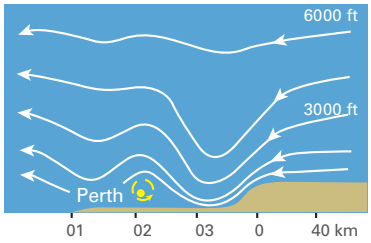
Thunderstorms

Thunderstorms occur mainly in the warmer months, except in the far southwest where winter thunderstorms associated with cold fronts are most frequent.

Thunderstorms often form along the west coast trough which develops in the summer months.

Summer thunderstorms are often high-based but nevertheless can cause severe effects near the ground in the form of downdraughts, gust fronts, locally raised dust and hail. Microbursts may also be present.

Low-level Turbulence



A schematic diagram showing disturbed flow and rotor formation between the Darling Scarp and the coast.

Turbulence may develop with strong low-level winds especially when the terrain is elevated or there are sharp topographical features (e.g. escarpments). A particularly dangerous area for turbulence is the Darling Scarp and the adjacent coastal plain; this is especially the case when strong low-level easterly flows prevail overnight and in the morning. Rotors may form in these conditions, with wind speed and direction changing greatly over short distances, particularly in the east-west direction. Airports that may be affected include Perth, Pearce and Jandakot.

When the surface pressure pattern indicates a moderate to strong easterly flow, airfields west of the Scarp are prone to strong wind gusts. Wherever possible in these circumstances, parked aircraft should be securely moored or moved to hangers. Such situations are most common in summertime but can occur at any time of year when the appropriate conditions prevail.

Dust storm in the town of Sandstone, Western Australia. Photo by Janene Denny.

Duststorms

Duststorms seriously reduce atmospheric visibility, and the large quantities of dust raised into suspension are potentially damaging to aircraft engines. Most duststorms occur in summer months although they have been observed at all times of year. They occur throughout much of the southwest, with the highest incidence along the Nullarbor Plain and the Great Victoria Desert. There is a tendency towards multiple occurrences of duststorms when there has been a prolonged dry spell. Pilots should be conscious that duststorms are much more likely in drought years, and should report any incipient or developed duststorms in a special AIREP, particularly in remote areas (where observations are sparse).

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Airservices Australia is the official distributor of aviation forecasts, warnings and observations issued by the Bureau of Meteorology. Airservices' flight briefing services are available at www.airservicesaustralia.com. Telephone contact details for elaborative briefings are contained in Airservices' Aeronautical Information Publication Australia (AIP), which is available online through their website.

Other brochures produced by the Bureau of Meteorology's aviation weather services program can be found at www.bom.gov.au/aviation/knowledge-centre.