AVIATION WEATHER HAZARDS

Essendon Airport (YMEN)

Bureau of Meteorology › Aviation Meteorological Services

Latitude: S37 43.7

Longitude: E144 54.1

Height above MSL: 282ft

This Pamphlet describes hazardous weather conditions and climatological information for Essendon Airport. It is one of a series of pamphlets focussing on hazardous weather conditions at a number of the busier General Aviation Aerodromes in Victoria. It has been prepared by the staff of the Victoria Regional Forecasting Centre in Melbourne and is intended to provide an overview of potentially hazardous weather conditions at Essendon. Pilots should regard this publication as information provided in support of official forecasts.

Aerial view of Essendon Airport.

Introduction

Essendon airport is situated to the northwest of Melbourne City over land a few hundred feet above sea level. The Great Dividing Range is to the north with Mount Macedon, at 1001m (3284 ft), the closest point to the airport. The Pentland Hills are to the northwest and the Brisbane Ranges are to the southwest. Port Phillip Bay lies to the south with the ocean still further south.

Fog

Fogs at Essendon occur on about 25 days a year on average and can cause severe problems when they do occur.

Fogs in westerly flow are very rare, with cloud more likely if the air is moist enough. Often the air is reasonably dry in westerlies with little significant cloud. In southerly flow, low cloud is more likely to be the problem, although low cloud can lower to fog on occasions, particularly if there is prolonged precipitation.

Southeast to eastnortheast synoptic flow provides the greatest risk of fog development, with most fogs occurring in late autumn and winter. If the flow is moist but not light enough to allow the development of the katabatic wind, then fog is a real concern. A strong high pressure system in late autumn or early winter can lead to several nights of fog, with the fog persisting until late morning, then developing again soon after dark. Often in these situations haze is a problem through the day, with poor visibility reported. Fog can persist all day over Port Phillip Bay, then reform over land rapidly in the evening. The fog often reforms at Laverton and Point Cook earlier than in areas to the north and they are a good indicator for early fog formation at Essendon.

In late summer and the first half of autumn in northeasterly synoptic flow, low cloud rather than fog is the more likely issue, but on rare occasions the cloud can lower through the night with fog being the end result. This generally occurs with a lowering temperature inversion through the night.

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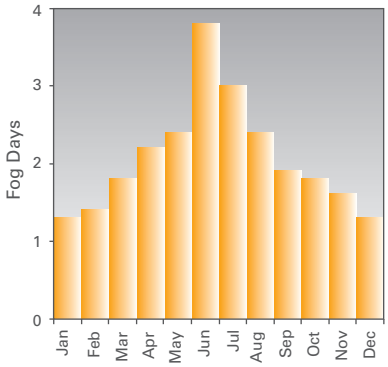


Mean number of days with fog for Essendon Airport from 1929–2009.

A northerly synoptic flow generally precludes fog. The presence of a northerly katabatic wind during the night also normally precludes fog formation until the katabatic dies after dawn. However, when the overall flow is light and the northerly katabatic dies down around dawn, fog or very low cloud can drift across the airport. This generally occurs when fog over the eastern suburbs of Melbourne drifts westward over Essendon. Occasionally fogs can form over the eastern suburbs and city early in the night but never reach Essendon until the katabatic wind dies down. However, if the synoptic flow is tending more northerly by dawn these aerodromes may see no fog. These situations are notoriously hard to predict.

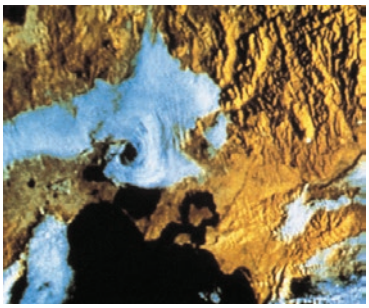
Fog can also occur during or following a rain event and in any synoptic airflow. Although rare, it is more likely in flow from the south through east to northeast.

Low Cloud

For general stream situations, moist southerly and southeasterly streams can produce low cloud, and, if the flow is cyclonic with widespread precipitation, can produce prolonged low cloud. However, if the flow shifts to eastsoutheast, conditions will often improve, as the flow comes across West Gippsland. Anticyclonic southerly or southeasterly synoptic flow is common in summer but generally only produces stratocumulus cloud. However, if conditions are moist enough, low cloud can form overnight, particularly if there is drizzle.

A southerly change often develops in summer in the afternoon bringing a shallow moist layer over the Essendon area. As the temperature falls at night, low cloud can form quite rapidly. The cloud can then lift through the night as the depth of cooler air increases.

Cloud over the city buildings in a southerly flow is often a good indication of very low cloud at Essendon and possibly fog. Cloud on the tops of city buildings 1000 ft above MSL may be an indication of cloud at 500 ft at Essendon airport.



Satellite image showing fog and/ or low cloud over Port Phillip Bay, associated with the 'Melbourne Eddy'.

Low cloud can also be a problem when a weak front moves through Bass Strait with the tail end of this front just reaching Melbourne. This can happen at any time of the year and can lead to low cloud lasting several hours, as the front can be orientated east/west and be slow to move through the area. The winds are often quite light in this situation, with a high-pressure ridge just to the west.

Southwesterly winds are quite common, particularly in late winter through spring to early summer. They can be associated with showery conditions but usually low cloud is only fleeting. In a particularly showery low cloud may occur intermittently, but cloud below 500 ft is rare. Southwesterlies do not often produce significant weather in summer, with cumulus and stratocumulus cloud more likely. Of course when a strong southwesterly change moves through any time of the year, there may be a period of low cloud with a rain band and even thunderstorms.

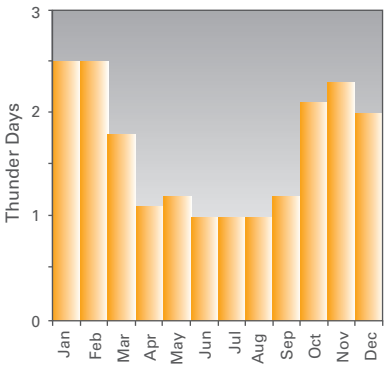
The most common surface wind at the airport is the northerly. Any synoptic flow from northwest through north to northnortheast produces a northerly surface wind. This wind dominates through the winter half of the year. Low cloud is extremely rare with northerly winds, as the air coming off the ranges to the north tends to dry as it descends from the Great Divide. Also at night in any light wind flow, a northerly katabatic wind develops rapidly after dark with the air drying and cooling as it descends down Mount Macedon. This often prevents the formation of low cloud.

However, the presence of a temperature inversion below 3000 ft negates the katabatic wind. Even with a light northerly synoptic flow, low cloud can form beneath such a low-level inversion if the air is moist enough, but this is rare. One scenario is when the northerly is so moist that clouds drift off the ranges to the north and affects the airport. This seldom results in cloud below 500 ft. Another scenario is one in which there has been a shallow change during the afternoon, most likely in summer, and the surface wind drifts back to the north overnight. If there is still a layer of very moist air near the surface, very low cloud can develop or even fog. This situation is rare but can

cause significant problems. Also be wary of synoptic flow tending from the north in a rain situation. The surface wind drops right away and can even become a light east to southeasterly. Visibility can be very poor and low cloud can be a problem in this type of rain situation.

Easterly synoptic flow situations can also cause problems at Essendon. Conditions tend to be stable in the daytime, although if rain is present, low cloud and poor visibility can occur if the stream is moist enough. In a northeast or easterly flow the Ranges block out the low-level wind and an eddy (known as the 'Melbourne Eddy') forms over the Essendon region at night. This eddy tends to form quite rapidly after dark during any time of the year, with a resultant westerly surface flow at the airport. If the flow is moist enough to the south, this moist air moves up over the west of Port Phillip over the outer western suburbs then over the airport. As the air is lifted over the land, low cloud can form quite rapidly then persist well into the morning. Autumn and early winter tend to be the times when low cloud is most likely to form with the eddy. Easterly flow is least common in late winter and spring. Although easterly flow is common during mid-summer, generally the stream is not sufficiently moist nor is there sufficient nocturnal cooling for low cloud formation.

Thunderstorms



Mean number of days with thunder for Essendon Airport from 1929–2009.

Thunderstorms at Essendon occur on about 20 days per year on average, with most occurring in the spring and summer months. They can occur with changes, or in any airstream, but most commonly in northeast or northwesterly synoptic flows. This is particularly so with a light wind regime which allows sea breeze development. If the sea breeze stalls in the region of the airport and the situation is unstable, low level convergence can enhance the chance of thunderstorms.

A common event in summer is for thunderstorms to form on the ranges to the northeast and northwest of the airports. If the steering winds aloft are towards the airport, the storms may move off the ranges and affect Essendon, particularly with northwesterly steering. Sometimes however, the storms weaken as they move away from the ranges. They may continually develop over the ranges to the north but with none reaching the airports.

Thunderstorms are more of a problem with the passage of fronts and troughs. Severe thunderstorms with heavy rain, large hail and extreme winds are possible in the warmer months.

Cold air thunderstorms occur mostly in winter and spring. They tend to be quick and not severe. In a very unstable southerly flow thunderstorm may develop along a convergent line over the airport. This is rare but can produce heavy rain, particularly if an upper cold pool moves across the area.

Wind

Northerly and southerly winds are the most common at Essendon. Northerly is the predominant wind direction in winter and can be quite strong any time of the year. In northerlies, the wind tends to funnel through the gap in the Dividing Range near Kilmore to the north, resulting in enhanced northerly flow and considerable gustiness at times. In a strengthening northerly flow, the weather reports from Kilmore Gap often provide early warning of increasing northerlies at Essendon.

A northerly wind is the most likely wind for an airport warning requirement. Development of a low level jet (i.e. a concentrated zone of maximum winds) can lead to the strongest and gustiest winds within a few hours of sunrise.

Southerlies can also be quite fresh as the stream comes directly off Bass Strait over Port Phillip Bay.

Northwesterly winds generally occur when the synoptic flow is westerly, while in any northwesterly synoptic flow the surface wind at the airports is invariably northerly.

Westerlies and southwesterlies can be quite strong and gusty at times, particularly with major air mass changes and in strong stream flow. Often southwest synoptic flow tends to be more westerly on the surface and overnight, with more frictional turning, a southwest synoptic flow may lead to a northwesterly surface wind.

In a strong southeasterly or east to southeasterly stream the wind tends to be south to southeasterly at the airports and again can be quite strong.

The ranges block any synoptic flow from east through northeast to northnortheast with light surface winds at the airports. This is often evident in summer with a high pressure system passing across Tasmania.

A strong southeasterly flow during the day results in south to southeasterly winds at the airport. As the high moves to the east the wind tends more easterly over the metropolitan area, particularly of an evening. The wind at the airport becomes light and tends to the west as the general flow tends east to northeasterly. This is the 'Melbourne Eddy' developing over Essendon. Fresh or strong northeasterly winds are exceedingly rare and tend only to occur with outflow from thunderstorms, or with gale force northeast flow when the wind aloft may mix to the surface.

The sea breeze direction is generally southsoutheast. In any southerly synoptic flow during the warmer months of the year, the southerly wind is enhanced during the afternoons and evenings due to the sea breeze and can be quite gusty.

Low Level Turbulence & Wind Shear

Significant turbulence occurs quite regularly at Essendon airport. Strong northerly flow often produces at least moderate low level turbulence and on a number of days each year the northerlies are strong enough to produce severe low level turbulence. Topography is a significant factor, with increased turbulence as the air descends off the ranges to the north.

Strong westerly flow can also lead to at least moderate turbulence, but southerlies off the sea do not tend to be as severe.

One unusual situation at Essendon is worthy of mention. On very rare occasions in a very strong northerly flow, a rotor effect can occur at the airport. The surface wind can be 30 to 40 knots at nearby Tullamarine, but Essendon will be experiencing a light southerly flow. This phenomenon is almost impossible to predict. The effect usually lasts only an hour or so.

Melbourne dust storm, 8 February 1983 (photo courtesy of Katsuhiro Abe)

Dust/Haze/Smoke

Dust is not common in the Melbourne area but has occurred with visibility reduced below 1000 metres. This occurs almost exclusively with strong north to northweserlies ahead of a strong southwesterly change. The worst dust conditions generally occur with the wind change.

Smoke is principally associated with bushfires. The worst conditions develop when fires occur over the eastern ranges and a northeasterly flow develops overnight. The smoke can be trapped below a low level temperature inversion and poor visibility can last overnight and through the morning until the solar heating eventually breaks down the inversion.

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