AVIATION WEATHER HAZARDS

Lord Howe Island Airport (YLHI)

Bureau of Meteorology › Aviation Weather Services

Latitude: S31 32.3

Longitude: E159 04.6

Height above mean sea level: 17 ft (5 m)

Runway orientation: RWY 28/10, 886 m long

This pamphlet describes hazardous weather conditions for Lord Howe Island Airport. It is one of a series of pamphlets focusing on hazardous weather conditions at a number of the busier general aviation aerodromes. Pilots should regard this publication as information provided in support of official forecasts.

Lord Howe Island Airport viewed from the north. The prominent mountains to the south of the aerodrome are clearly visible. Image source, www.mcp.com.au

Introduction

Lord Howe Island is a small crescent-shaped island in the sub-tropical Tasman Sea, approximately 600 km east of Port Macquarie (New South Wales). The island is approximately 10 km long, and up to 2 km wide. The aerodrome is in the centre of the island at one of the narrowest points. Tourism is a primary industry and, given its remoteness, air travel is the major mode of transport to and from the island. While the island generally experiences a mild maritime climate with good conditions for aviation, there are some conditions, most notably certain wind regimes, which can present aviation hazards.

Hilly, forested terrain occupies the far northern and southern ends of the island with the highest point, Mt Gower (875 m/2791 ft), located about 2 km south of the aerodrome, and the hills to the north (1200 ft) around 5 km away. This terrain makes turbulent winds one of the primary aviation concerns. Any strong winds from the northern or southern quadrants are not only concerns for crosswind but also regularly create severe turbulence for approaching aircraft.

Wind

As the sub-tropical ridge shifts north and south with the seasons, Lord Howe Island becomes influenced by warm and humid east and northeast winds during summer, shifting to cool and dry west and southwest winds during winter. In general, winds vary daily depending on the surrounding synoptic systems. Winds from the northeast have a high moisture content and are capable of producing more significant and prolonged weather, while winds from the southeast tend to be dry, creating good flying conditions. When the wind is from the northwest it can often be an indicator of an approaching cold front, especially with freshening northwesterlies. Behind mid-latitude frontal systems, winds will turn southwesterly and generally remain quite fresh, often accompanied by showers.

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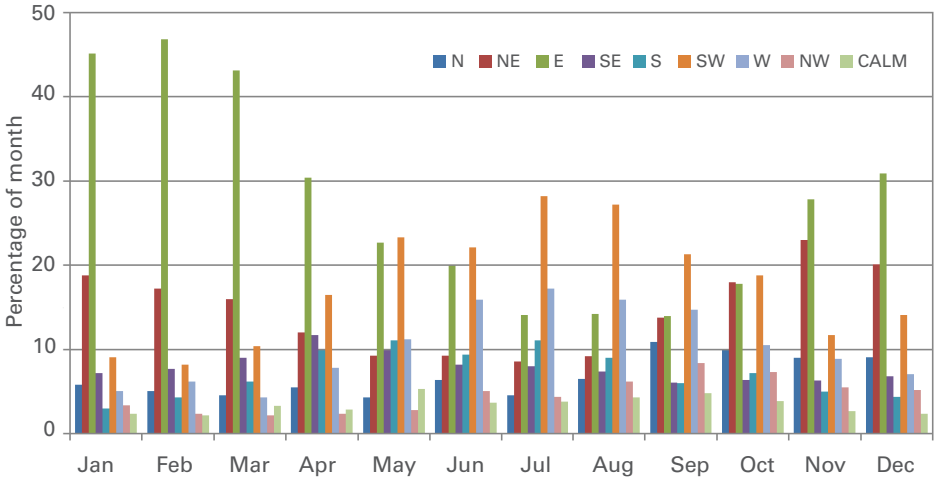
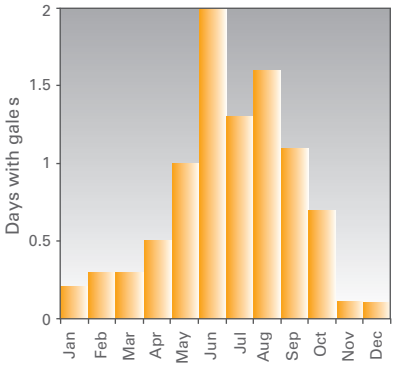


Wind direction expressed as a percentage per month at Lord Howe Island Airport, 1994–2013



Monthly mean number of days with gales (mean wind speeds ≥34 knots) at Lord Howe Island Airport, 1988–2013

Lord Howe Island normally experiences its strongest winds during the winter months, when strong southwest winds tend to dominate following the passage of mid-latitude fronts or strong low pressure systems. Strong west or northwest winds will also often precede the frontal passage. On average, gale force winds (mean wind speeds ≥34 knots) are most likely to occur during winter, associated with west and southwesterlies in mid-latitude systems. During summer, tropical lows or dips from north of the island are capable of producing strong or gale force north to northeast winds at the aerodrome.

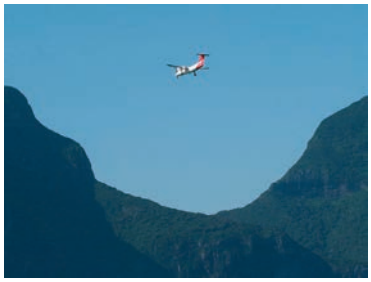
Pilots should note that the Lord Howe Island Aerodrome (YLHI) automatic weather station (AWS), can sometimes misrepresent winds in a southwest or northerly airstream, as winds are generally blocked by the surrounding hills. In these situations, the gradient flow (winds at approximately 3000 ft) can be used as an approximation of surface wind conditions. Alternatively, the Lord Howe Windy Point (LHWP) AWS can be a better representation of true wind conditions, particularly for southwesterly airstreams. In addition, the wind sock on Blackbird Island in the lagoon is often a good indicator of true wind directions when winds are from the southwestern quadrant.

Wind directions at Lord Howe Island can be particularly significant. Apart from being a reasonable indicator of the likely weather at the island, winds are also regularly a concern for crosswind, tailwind and turbulence at the aerodrome.

Meteorological observations, including wind information from both AWSs (YLHI and LHWP) are broadcast via YLHI Automatic Weather Information Service (AWIS). More information is provided in the En Route Supplement Australia (ERSA) entry for Lord Howe Island.

Turbulence

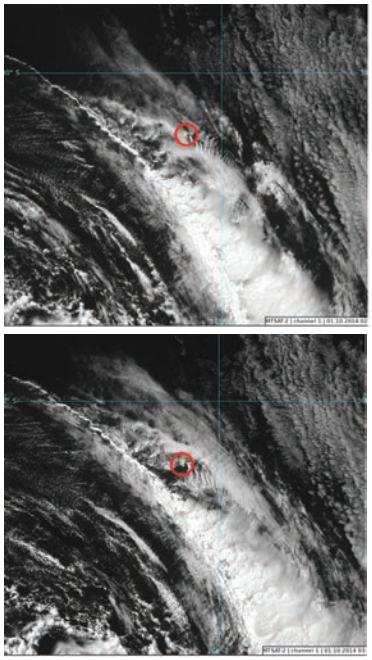
Low-level turbulence and wind shear



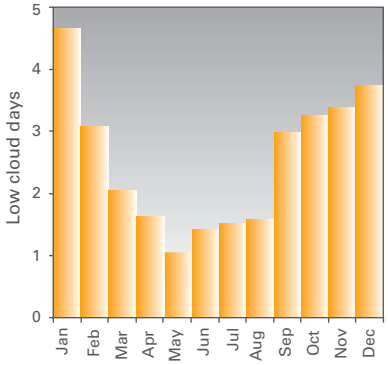
Qantas flight arriving on Lord Howe Island. Image courtesy, Toby Hudson

Winds from the northern and southern quadrants can create problems for aviation. Winds from these directions are of concern for crosswind and could also cause topographically induced mechanical turbulence and/or locally induced wind shear (both horizontal and vertical) because of the surrounding topography. Some synoptic systems near the island, such as intense low pressure systems, can cause wind shear at the aerodrome as wind speed and direction change rapidly with height.

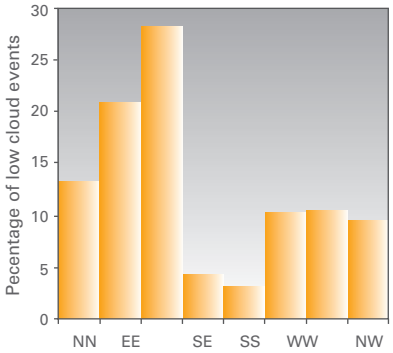
Any low-level winds greater than 20 knots from the northern and southern quadrants are a consideration for moderate and/or severe turbulence and will regularly prompt the issuing of a SIGMET for the surrounding area. In addition, the impact of winds from these quadrants can affect approach paths, such that some commercial flights will not fly to the island once wind strength and direction pass certain thresholds.



Visible satellite imagery (MTSAT) at 02:32 UTC (top) and 03:32 UTC (bottom) on Wednesday 1 October 2014, showing a cold front approaching Lord Howe Island and mountain waves extending downstream of the island. Lord Howe Island is circled in red



Mean number of days per month with low cloud observed at Lord Howe Island Airport, 1997–2013



Percentage of any low-cloud event at YLHI associated with each wind direction, 1997–2013

Mountain wave turbulence

Mountain waves are possible at Lord Howe Island during certain wind regimes and atmospheric conditions. Mountain waves can be particularly hazardous for aircraft due to the accompanying severe downdrafts as well as the potential for rotor formation and significant wind shear at the base of the waves.

The satellite images on the left show trapped mountain wave turbulence over and southeast of Lord Howe Island as a result of a strong low-level northwesterly airstream ahead of an approaching cold front. The mountain waves can be seen radiating downstream of the island as parallel bands of lenticular clouds. In this particular case, low-level northwesterly winds ahead of the cold front increased from around 20–25 knots at the surface, to 35–40 knots at approximately 3000 ft, and were supported by a sharp stable layer also at approximately 3000 ft; just above the height of Mt Gower. This is a favourable set-up for the formation of mountain waves.

On this day, Lord Howe Island AWS recorded a mean wind speed of 35 knots with gusts to 49 knots accompanied by thunderstorms in the wake of the cold front.

Low cloud

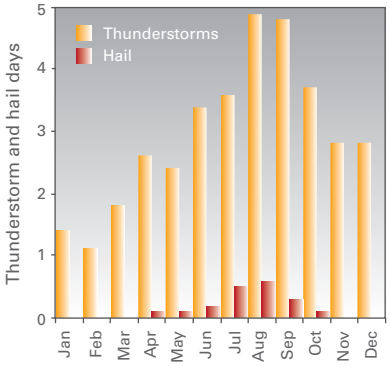
Low cloud below 2163 ft (highest alternate minima (HAM) conditions for Lord Howe Island), is relatively rare, observed around 12 days per year on average. It is more frequently observed during the warmer months of the year, October through to March, and in the majority of cases (roughly 65 per cent of the time) it occurs in association with precipitation at or near the island. Winds are predominantly from the east and/or northeastern sectors during the warmer months, directions from which the air is naturally moist and unstable, leading to a higher chance of significant and prolonged precipitation, such as that associated with tropical lows or troughs. Generally low cloud in these events can be extensive and has a relatively low base due to the continuous feed of moisture. Low cloud is also possible with thunderstorms, showers or drizzle, however when the precipitation is not continuous, such as with intermittent showers, low cloud events are generally short-lived.

On occasion, prevalent east or northeasterly airstreams can produce low cloud without any associated precipitation due to the relatively high maritime moisture. Roughly 35 per cent of all low-cloud events at the aerodrome occur in these situations and can be difficult to accurately forecast.

When winds are from the west and southwest during the cooler months (April to September), low cloud is highly unlikely unless it is associated with precipitation. With the passage of mid-latitude frontal systems, low cloud can form with precipitation, however, it is unlikely to persist for lengthy periods due to the drier nature of the south to southwesterly post-frontal airstreams. South and southeasterly airstreams in particular are highly unfavourable for low-cloud formation at the island, generally due to the drier air masses. In addition, significant weather from these directions is highly unlikely, reducing the risk of low cloud associated with precipitation. Southeasterly winds, particularly those on the northern edge of a high pressure system, will consequently often coincide with good flying conditions.

Thunderstorms

Thunderstorms occur in all months of the year, but are generally more common during the winter and spring months. During these months the sub-tropical ridge moves to lower latitudes, allowing mid-latitude systems such as cold fronts and low pressure troughs to penetrate sufficiently north to impact the island. Within these systems, provided the environment is reasonably unstable, thunderstorms tend to form along the wind convergence line as a system approaches the island across the Tasman Sea. Thunderstorms are therefore most likely to affect the aerodrome either on or slightly ahead of the wind change with these systems. A reasonably high level of confidence can be placed in forecasting thunderstorms at or near the aerodrome in these situations.



Mean number of days per month with thunderstorms and hail at Lord Howe Island, 1988–2013

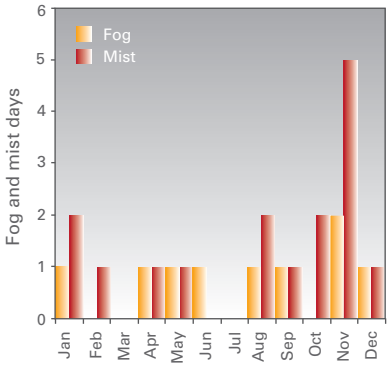
Thunderstorms are also occasionally possible behind a frontal change. This usually occurs when particularly cool air in the upper atmosphere is associated with the cold front. In these situations the generation of thunderstorms tends to be more unpredictable, with the majority of the precipitation in the post-frontal convective field tending to be showers rather than thunderstorms. In these scenarios, there is a very low chance across a very broad area that a shower will develop into a thunderstorm.

Thunderstorms not associated with broad scale synoptic systems are uncommon as the surrounding maritime environment is generally too stable, acting as a suppressant for locally induced deep convection over the island. Occasionally synoptic systems from the tropics such as deep tropical lows or troughs will drift sufficiently south to impact the island. Heavy, continuous rainfall and large masses of mid to upper-level cloud will generally accompany these systems. Embedded and obscured thunderstorms are possible within these cloud masses and these can be quite difficult to predict given the low chance of occurrence in a broad area.

Hail can also be observed at the aerodrome, associated with thunderstorms when extremely cold air in the upper atmosphere accompanies cold fronts. However, this is a relatively rare event and on average hail is observed less than twice per year. Hail is confined almost exclusively to the winter and spring months. Some thunderstorms also have the potential to produce very strong low-level wind gusts, particularly when associated with a cold front.

An important distinction for pilots to be aware of is that even though thunderstorms may not be observed at the aerodrome, they can often affect conditions in the surrounding area, including maritime. An aerodrome forecast is only concerned with thunderstorms within a 5 nautical mile radius of the aerodrome, and manual aerodrome observations will report thunderstorms within the surrounding 10 nautical miles. Thunderstorms occurring beyond this distance over the maritime area can still impact the aerodrome operations. Often, manual observations will include a plain language remark such as 'Distant TS to SE' (distant thunderstorm to the southeast), if thunderstorms are observed outside of the 5 or 10 nautical mile radius.

Fog



Maximum number of fog and mist days per month at Lord Howe Island Aerodrome, 1988–2013

Fog and mist are very rare, on average occurring less than once per year. Formation requires a favourable set of atmospheric conditions for the surface air to drop to saturation. Primarily the winds must be calm or very light to allow the formation of a surface temperature inversion which assists the surface air in cooling to saturation. However, these conditions can be difficult to achieve on an exposed island as winds conditions are rarely sufficiently light due to the influence of the surrounding sea.

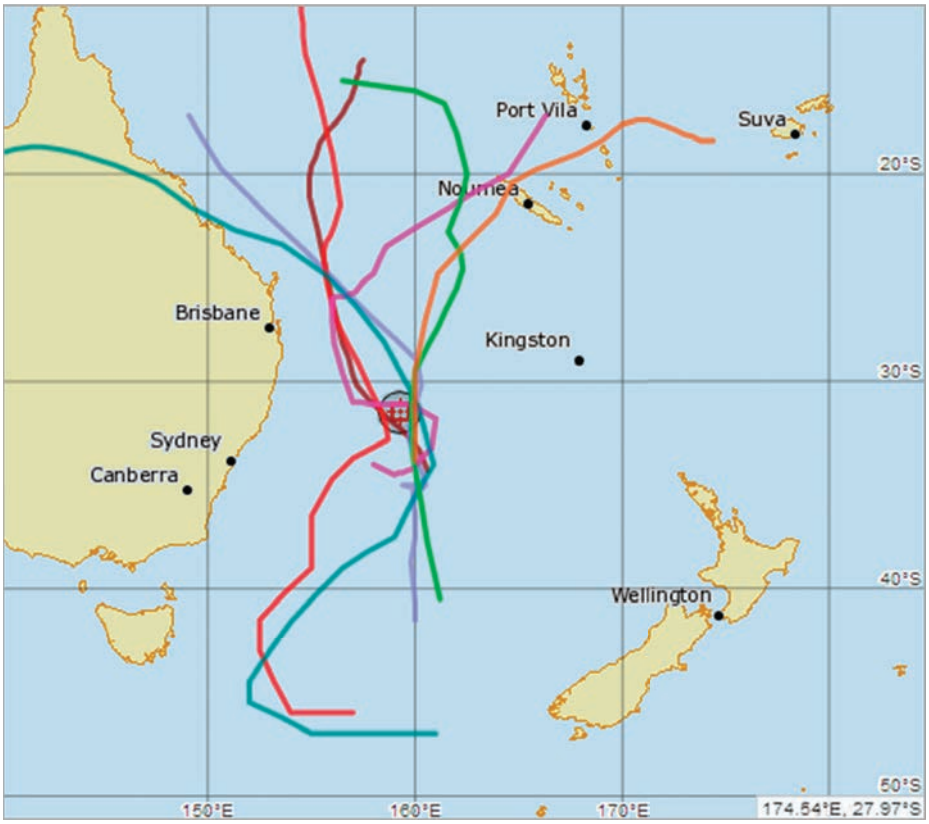
Mist requires a similar set of atmospheric conditions for formation as it can form with surface air close to saturation. The occurrence of mist days is marginally higher than that of fog days, however it is still highly unlikely. On occasions when fog or mist does develop, the event is short-lived and highly unlikely to persist much past sunrise when both the surface temperature and surface wind speeds are likely to increase quickly.

Although rare, the highest likelihood of fog or mist formation comes under the influence of a high pressure system; preferably close to the system centre where skies are generally clear and winds are synoptically very light. The likelihood of fog or mist increases with increased available surface moisture, and so winds from the eastern or northeastern sectors pose the greatest risk as they carry higher moisture content. These wind directions are more common during the warmer months of the year when a high pressure system sits in the southeastern Tasman Sea, making the aerodrome slightly more susceptible to fog during this period. During the cooler months as the sub-tropical ridge shifts north, winds are predominantly from a west or southwest direction. These wind quadrants are generally less favourable for fog formation as the air masses tend to be too dry. However, recent precipitation from frontal or low pressure systems can also increase the surface moisture near the aerodrome thus making a cooler month post-frontal or post-rain fog possible under the right conditions.

Tropical cyclones

Tropical cyclones (TCs) can pose a real threat during the summer and autumn months, with a TC or ex-tropical cyclone (ex-TC) passing within 500 km of the island on average every two years. However, the likelihood of a TC or ex-TC passing directly over the island is very low as out of the 27 cyclones that have passed within 500 km of the island between 1969 and 2010, only seven have passed within 100 km and only one within 50 km (TC *Hope*, 1975/76). Fortunately for the majority of cases, TCs weaken as they move south, away from the tropics, and encounter cooler sea surface temperatures, usually transitioning to ex-TCs before they reach the latitudes of Lord Howe Island. Despite this, even the outer peripheries of ex-TCs are capable of generating damaging wind gusts and heavy rainfall with the potential for serious damage.

The highest wind gust ever recorded on Lord Howe Island was 96 knots, which occurred in January 1948 when a severe tropical cyclone passed to the east of Brisbane before moving out into the Tasman Sea (not shown on the map below). In March 1995, TC Violet produced a 68 knot wind gust at Lord Howe Island.



Tropical cyclones or ex-tropical cyclones that have passed within 100 km of Lord Howe Island, 1969–2010 (seven TCs/ex-TCs)

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