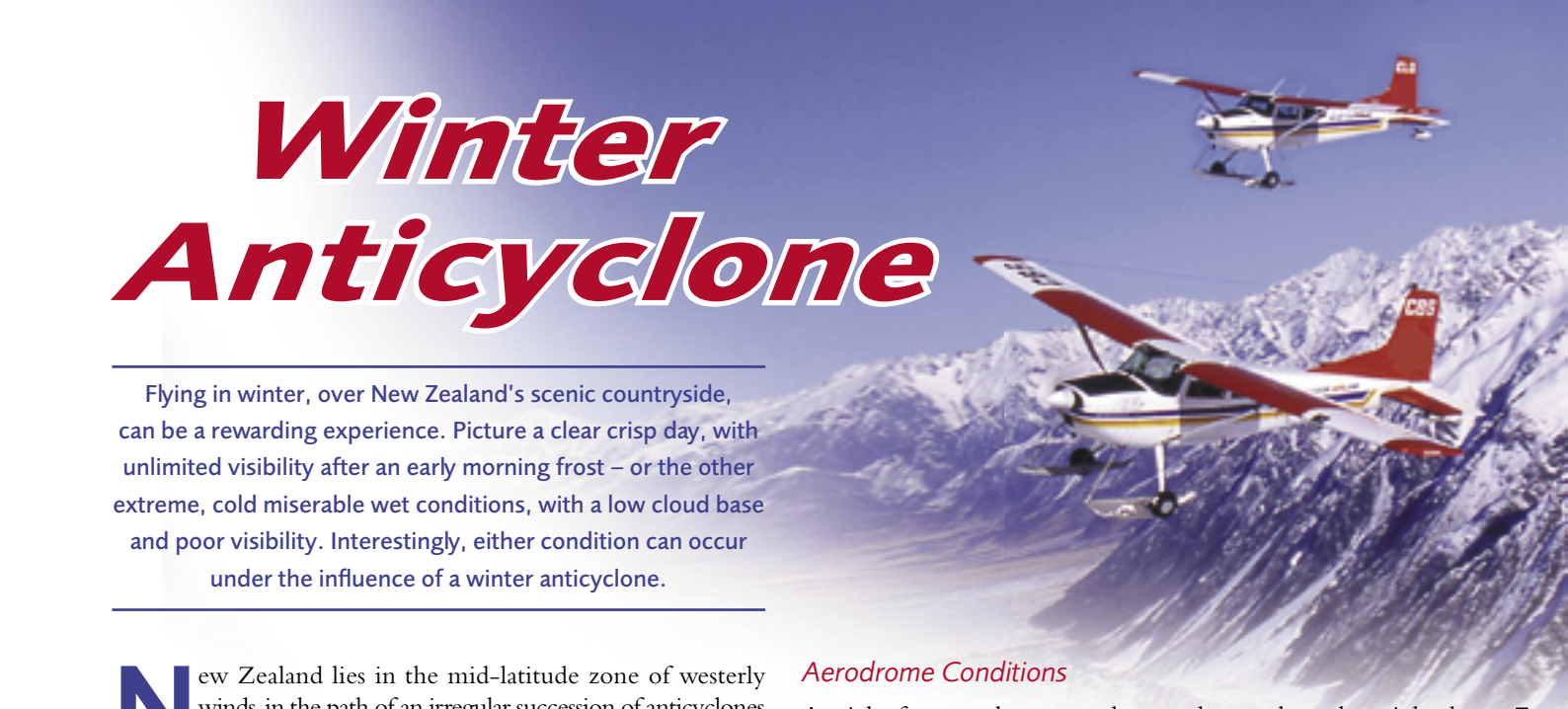
Winter Anticyclone

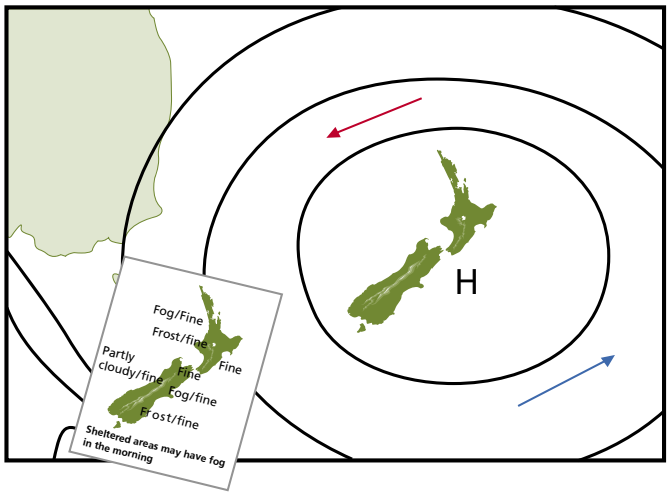


Flying in winter, over New Zealand's scenic countryside, can be a rewarding experience. Picture a clear crisp day, with unlimited visibility after an early morning frost – or the other extreme, cold miserable wet conditions, with a low cloud base and poor visibility. Interestingly, either condition can occur under the influence of a winter anticyclone.

New Zealand lies in the mid-latitude zone of westerly winds, in the path of an irregular succession of anticyclones which migrate eastwards. These are interrupted by troughs of low pressure, which extend northwards from low pressure depressions moving eastwards to the south of New Zealand. The centres of these anticyclones generally track across the North Island, with more northerly paths being followed in spring, and southerly paths during autumn and winter. Anticyclones generally bring settled weather, with light winds and clear skies, but they also bring frost, radiation fog, and cloud to some areas. Each anticyclone can produce different weather conditions, and will vary in strength, latitude and speed as they migrate eastwards.

Anticyclonic Conditions

High Pressure over New Zealand



When an anticyclone initially moves over the country, relatively clear skies will prevail. Some areas may, however, have stratocumulus cloud. This tends to be on the side of the country on which the large-scale wind flow is directed, with relatively clear skies on the lee side of the mountains. This flow is normally from the west, and usually results in stratocumulus cloud developing along the west coast, while eastern districts have clear skies. As the atmosphere stabilises, and the subsidence inversion (see definitions) lowers below mountain height, the wind flow tends to wrap around the terrain and cloud develops on the lee side. In Canterbury, this can happen after only one day.

Aerodrome Conditions

At night, frosts can be expected at aerodromes throughout inland and southern areas of the South Island, and in sheltered areas of the North Island, especially the central plateau. If the anticyclone remains situated over New Zealand for several days, air temperatures will become progressively colder, and frosts will become more severe in the South Island. Aircraft parked outside at night will receive a layer of frost on all exposed surfaces, which must be removed before flight. A layer of frost can form on aircraft that have been taken out of the hangar in the morning if the air temperature is still below zero degrees Celsius. This is common at inland aerodromes around Central Otago and Canterbury, where the air temperature can be as low as – 10° C in the early morning.

Frost can remain in shaded areas throughout the day. There may be sufficient solar energy to melt the frost, but water can remain on sealed runways when there is insufficient solar energy, or wind energy, to evaporate it. This may refreeze if there is another cold clear night, to form black ice. The thawing and refreezing process can make grass runways very soft and muddy.

Aircraft parked outside during a clear, cold night may receive a layer of frost on exposed surfaces.

Aerodromes situated near moisture sources, and located in confined topography on the lee side of the ranges, are more susceptible to radiation fog and stratus cloud. For example, Hamilton airport can be closed until late morning due to fog. Inland areas of Otago and Canterbury can have fog persisting for days at a time under

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Photo courtesy of Mt Cook Ski Planes.

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very intense anticyclones (over 1030 hectopascals). Auckland and Dunedin may have fog, but this usually disperses by 10 am. At Christchurch, approximately 50 percent of fog events clear by sunrise, but low lying stratus cloud may persist for the day. Wellington does not usually have radiation fog during winter.

Radiation fog normally occurs during a clear night, or in the early morning after sunrise. The depth of the fog layer varies depending on the availability of moisture, but typically is around 100-200 feet. Radiation fog can thicken after sunrise.

Photo courtesy of Mt Cook Ski Planes.

Radiation Fog clearing at Mount Cook aerodrome.

Dispersal of radiation fog can be a slow process. It can take until late morning for the wind to increase sufficiently to encourage mixing of the drier air above the inversion with the fog below. After the fog has dispersed, a layer of low-lying stratus may remain. The dispersal of the stratus layer is dependent upon wind speed and the amount of energy available from solar radiation.

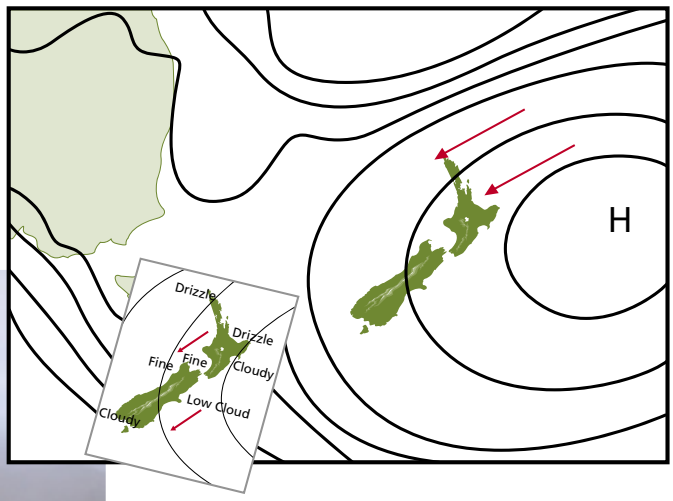
After sunset, runways can become slippery with the onset of frost. Strong inversion layers will begin to form which can, in some areas, result in smog and pollutants becoming trapped and reducing visibility. This is common at Christchurch airport.

In-Flight Conditions

Once fog clears, conditions from late morning until late afternoon will be ideal for flying. After a few days, broken stratocumulus cloud may form along coastal areas, with bases around 2000 feet amsl, with light to moderate turbulence. It may also thicken and spread inland, making VFR flight along coastal areas and the foothills more difficult. If the anticyclone is positioned only over the North Island, then clear skies may prevail north of a line from Nelson to Blenheim. Wanganui and Manawatu, however, may have extensive stratocumulus cloud and possible showers from a light westerly flow. To the south, a westerly flow will develop resulting in stratocumulus cloud forming along the west coast of the South Island. If this flow intensifies, then low cloud and precipitation may occur west of the Main Divide. On the east coast, clear skies will prevail from the fohn wind.

In both situations, sensible flight planning is required. Waiting for fog to clear or frost to melt may delay your flight until late morning. Stratocumulus and stratus cloud may mean a diversion to an alternative aerodrome. During winter, the days are short, and you may only have around four to five hours to achieve your planned flight.

High Pressure to the East of New Zealand



Aerodrome Conditions

When an anticyclone initially moves eastwards, it may cause strong northeasterly airflows over the country. Aerodromes in the far north, the Bay of Plenty and eastern regions of the South Island may have marginal VFR conditions, with low lying stratus and drizzle. Visibility can reduce to 2000 metres, and cloud heights can be 500 to 1000 feet amsl.

If the anticyclone becomes stationary to the east of the country, it may form a 'blocking high'. Lighter northeast flows may prevail, with low-lying stratus cloud, which may persist for days on the east of the South Island. The amount of cloud will, however, depend on the strength of the airflow. If the wind is light, cloud may be limited to coastal areas, with inland and western regions experiencing clear skies. Ironically, fog and low stratus will clear when a front approaches from the west, as this results in air blowing across the Southern Alps. This air descends on the eastern side and dries out. Any cloud it contains will evaporate.

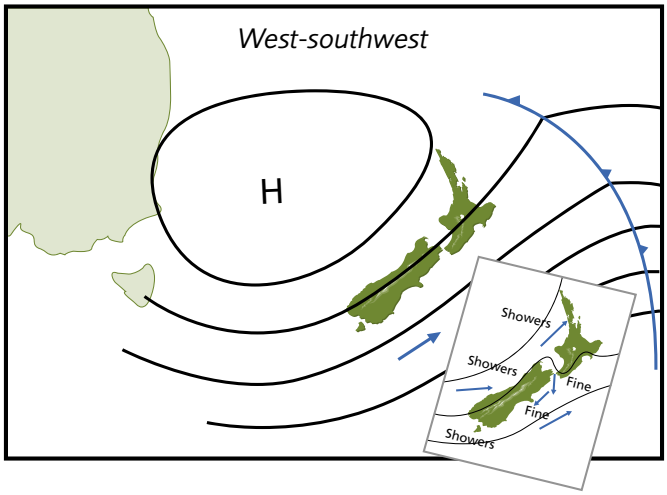
Aerodromes on the western sides of both islands, south of New Plymouth, may experience relatively clear skies. The central areas of Canterbury, Otago and Southland will also have clear skies, but fog may remain in the valleys. At night, frost will occur in sheltered areas.

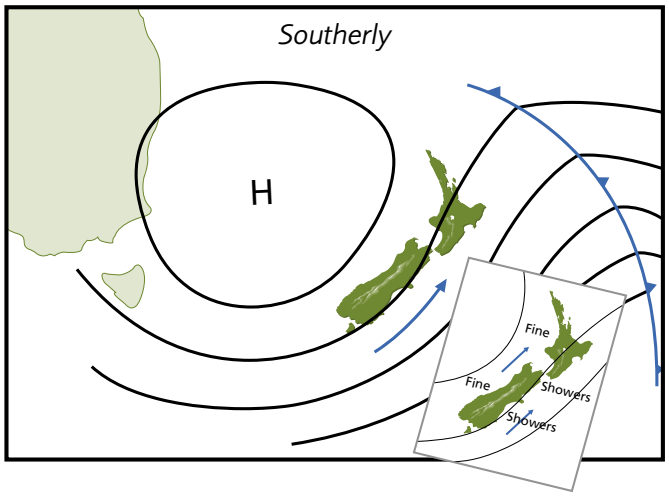
In-Flight Conditions

Aircraft flying VFR, north of a line from New Plymouth to Hastings, may encounter low-lying stratus and nimbostratus cloud. Along the eastern sides of both islands, VFR flight may not be possible with low stratus cloud or fog along the coast. South of New Plymouth to the Kapiti Coast, altostratus cloud may occur, which is not normally a problem for VFR flight. If the northeasterly flow is stronger than 20 knots, conditions may be turbulent in the lee of the mountain ranges.

High Pressure over the Tasman Sea

Cold fronts crossing New Zealand are generally followed by a southwesterly airstream. This is associated with a slow moving anticyclone over the Tasman Sea. The southwesterly airstream is unstable and small shifts in the wind direction can easily swap showers and fine weather between eastern and western districts of New Zealand.





Aerodrome Conditions

If the airflow is west-southwest, then aerodromes on the west, from Fiordland to Northland, will receive showery weather. This may be associated with snow showers down to sea-level. During heavy showers, the visibility may drop below 5 km. Aerodromes on the east, from Gisborne to Otago, will have mostly clear skies.

If the flow is southwest, showers may be confined to Southland, Manawatu, Taranaki and the far north, with fine weather elsewhere. This situation can easily change if the wind backs to a south-southwest flow, which will bring showers to the east from Southland to Gisborne. These areas may have cloud bases below 500 feet agl and visibility below 5 km. Aerodromes in western districts will have mostly clear skies.

As the high pressure system tracks eastward toward New Zealand, the southwest flow weakens in intensity. The air gradually becomes more stable, and therefore, more resistant to upward motion. This can force the southwest airflow to split into two streams that flow around the Southern Alps. This usually brings low stratus and drizzle to the eastern coasts of New Zealand as far north as Gisborne. The split airflow may also converge around the upper South Island and bring low stratus cloud through Cook Strait, and the lower North Island.

In-Flight Conditions

Flying VFR in a southwesterly airflow can be difficult. The weather is very changeable, and can vary greatly from one area to another. Turbulent conditions are typical when flying on the eastern sides of both islands. Along the western side of the South Island, VFR flight is possible away from showers. These conditions can quickly reverse if the flow backs to a southerly.

Depending on the rate of progress of the anticyclone, unstable conditions will remain for a few days until the centre of the anticyclone settles over the country. The showers and the cold southerly winds will then move to the east of New Zealand.

Summary

A winter anticyclone may bring ideal flying conditions to some areas but rarely to all of the country at the same time. Some regions will have frost and the formation of radiation fog at night. Other regions will have stratocumulus cloud. This tends to be on the side of the country to which the wind flow is directed.

For anticyclones positioned directly over New Zealand, the west coast of the South Island may be cloudy, while the eastern coasts remain clear.

If a 'blocking high' develops to the east of New Zealand, the northeasterly airflow may bring stratus and nimbostratus cloud to the far north of the North Island and eastern districts of the South Island. The amount of cloud will, however, depend on the strength of the airflow. If the wind is light, cloud may be limited to coastal areas, with inland and western regions experiencing clear skies.

If the anticyclone is to the west, a disturbed southwesterly airflow will bring changeable conditions over the country. Western districts will experience showers, and clearer skies will prevail on the east. This situation can, however, be reversed if the wind backs to the south. ■

Definitions

Inversion layer – air temperature increases with height, within a layer of air. This differs from the normal situation where the temperature decreases with height.

Subsidence inversion – an increase in temperature with height, within a layer of air, produced by the adiabatic warming of a layer of subsiding air under an anticyclone.

Fohn wind – refers to a warm, dry wind blowing on the leeward side of a mountain range. Commonly known as the nor'wester in New Zealand.

Radiation fog – a common type of fog, produced over a land area when radiation cooling reduces the air temperature to or below its dewpoint. Factors favouring the formation of radiation fog are a shallow surface layer of relatively moist air beneath a dry layer and clear skies, and light surface winds.

ELT Maintenance Correction

In our previous issue, *Vector* May/June 2004, page 13, we gave some erroneous advice regarding maintenance of ELTs. We referred to a "500-hour or six-monthly" inspection. This was wrong. Rule 91.615 *Emergency locator transmitter tests and inspections* requires only a check period of 12 months, the check to be carried out in accordance with Part 43 Appendix F. So long as it complies with rule 91.615, taking heed of the manufacturer's instructions is good advice.