2.3 READING A WEATHER MAP

Fact Sheet Objectives

- Highlight the main features of weather maps
- Outline some tips on how to use weather maps to predict the weather in your area

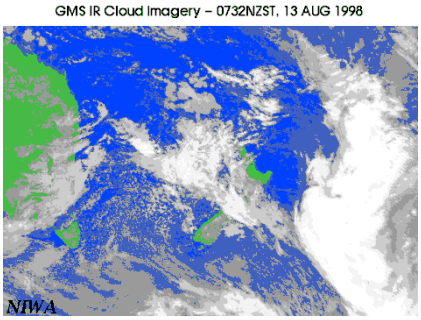

Figure 1. Satellite infrared image of the Southwest Pacific.

Interpreting Satellite Images

The 'whiteness' of the cloud indicates cloud height and temperature:

- Very white cloud layers have temperatures of -30°C to -40°C, with the top of the cloud reaching to 7-10 km above the earth.
- Grey colour indicates lower lying stratiform cloud, often associated with higher pressures and low levels of rainfall.
- Shower clouds can be seen as cellular cloud forms, for example, to the west of the South Island.

(Source: NIWA)

Reading a weather map

Two common forms of weather maps are:

- Satellite images showing clear skies and bands of cloud (Figure 1)
- Weather charts showing atmospheric pressure at Mean Sea Level (MSL), also known as surface charts (Figure 2).

The MSL Chart contains information about the kind of weather that is in progress in the region. Two charts are often shown together – the *Analysis Chart*, which represents the present weather and the *Outlook Chart*, which represents the forecaster's view of what the weather pattern might be like after a given interval, say 12 or 24 hours.

The main features of a typical weather map are **isobars**, **troughs**, **ridges**, and **fronts**.

Isobars

The most prominent feature of MSL charts are the plain lines that curve across the map, known as isobars. These are lines of the same barometric pressure (*iso = equal, bar = pressure*). They are drawn using as much information as possible from land observations, as well as from ship and aircraft reports.

Isobars often form closed circles around areas of high pressure (highs or anticyclones) and areas of low pressure (lows, depressions or cyclones). Numbers shown on the isobars indicate the atmospheric pressure in hectoPascals (hPa), and normally range between 985 and 1030 hPa. The central pressure of an intense anticyclone is above 1030 hPa, and at the other extreme the centre of a deep or intense depression will be below 980 hPa.

In the southern hemisphere, winds in anticyclones flow in an anticlockwise 'out spiral'. When you look at a weather map, you assume that the air flows are at an angle across the isobars away from the centre of the high pressure area (Figure 3). Cyclonic winds flow in a clockwise 'in spiral' at an angle across the isobars towards the centre of the low pressure system. When isobars are close together it is an indication that the wind speeds are relatively high. Conversely, when the isobars are more widely spaced, wind speeds are relatively low.

Isobars can also extend for thousands of kilometres in lines that don't curve very much, indicating a long, relatively straight air stream.

What the isobars don't show quite so well is how wind speed and direction are affected by New Zealand's rugged topography. Air passing across mountainous terrain flows in eddies around hills, and strongly through gorges or gaps in the mountains, producing local changes to wind speed and direction that cannot always be shown by the broad isobar pattern. The isobars on surface pressure maps also don't tell us what's happening in the upper atmosphere where temperature and wind structures have a large effect on weather at the earth's surface.

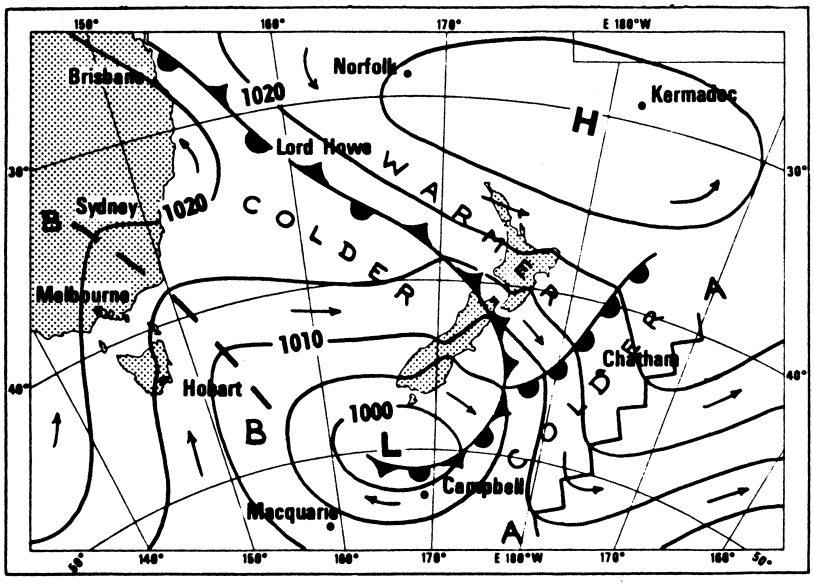

Figure 2. Weather map showing a number of weather systems (for an explanation see 'Reading a weather map' in adjacent column).

Troughs and ridges

Anticyclones and depressions are clearly marked on the weather map with the letters H and L respectively (Figure 2). Ridges and troughs can also be identified by the more abrupt curving of the isobars. The progression of these centres of high and low pressure across New Zealand cause the winds to change in direction and intensity at any given location.

Fronts

Fronts mark the boundary between masses of relatively warm and cold air, and are shown on the map with triangular or semi-circular symbols (Figure 3). As a front passes, the air is likely to become cooler or warmer than before, depending on whether a cold front or a warm front is advancing. Note also on the map that some fronts are almost stationary, shown by alternate triangular and semicircular symbols. A final type of front is called an *occluded front*, when air on either side of the line of the front is of similar temperature.

Reading a weather map

A *cold front* is shown as a line of triangular symbols with the colder air following behind this line, as seen over Nelson and Marlborough in Figure 2. The symbols protrude into the warmer air and point in the direction the front is moving, in this case towards the North Island.

A *warm front* is shown as a line of semi-circular symbols with warm air following behind this line, as seen between the North Island and Chatham Islands. The symbols protrude into the colder air and point in the direction the front is moving, in this case towards Chatham Islands.

A *stationary front* is shown as a line of alternate triangular and semicircular symbols on opposite sides of the isobar and moves only slowly, as seen over Lord Howe Island. As with the previous fronts, the triangular symbols protrude into the warmer air, and the semi-circular symbols protrude into the colder air.

An *occluded front* is shown as alternate triangular and semi-circular symbols on the same side of the isobar, as shown near Campbell Island. The symbols point in the direction the front is moving, in this case towards Campbell Island, but the air temperature is much the same on both sides of the front.
The zigzag line A-A marks a *ridge of high pressure*. The dashed line B-B marks a *trough of low pressure*. These lines are not normally marked on a weather map (Figure 2).

When is rain likely?

Rain most commonly occurs within bands of cloud associated with depressions. These situations often appear on satellite images as curved cloud bands, stretching out from the centre of the depression. Usually these cloud bands occur along fronts or troughs, and often they are broadest on the eastern and southern sides of the low pressure area. Most rainfall occurs within these bands, but there are often showers to the west and north of the low pressure area as well (see the schematic example given in Figure 4).

Contrary to common expectation, rain can also occur in an anticyclone, particularly if there is a trough or low pressure system in the upper atmosphere (which unfortunately is not shown on an MSL chart). Thunderstorms can occur in this situation in summer.

Rain may also occur when there are long, straight or slightly curved isobars stretching from some distance offshore onto New Zealand. If there is a range of mountains in the path of the air mass as it comes ashore, there is likely to be cloud upwind of the mountains, and possibly some rain. There is typically little cloud and no rain on the lee side of the range in this situation.

Analysis for 21 June 1976

A deep depression lay just east of the North Island and a slow moving anticyclone over the southwest Tasman Sea extended a ridge of high pressure to the south of the country. The strong cold southerlies between the high and low pressure zones brought widespread snow to low levels over the east of the North Island (Figure 3).

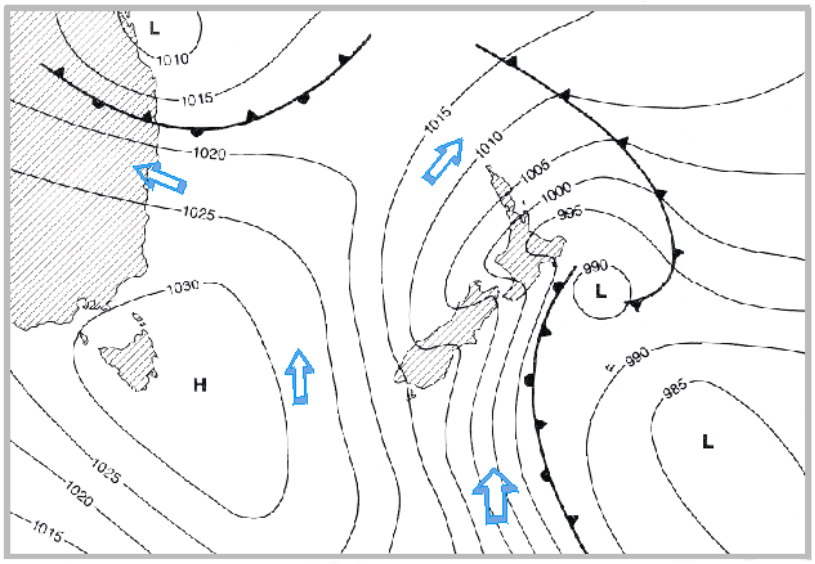

Figure 3. Weather Map, 21 June 1976 (for an explanation see Analysis in adjacent column).

Typical Cloud Sheet in a Depression

The speckled area shows where the cloud is thickest. This area typically forms a band that curves around on the eastern and southern side of the low pressure area, where it often becomes broadest. The dashed line encloses an area that is often occupied by shower clouds (Figure 4).

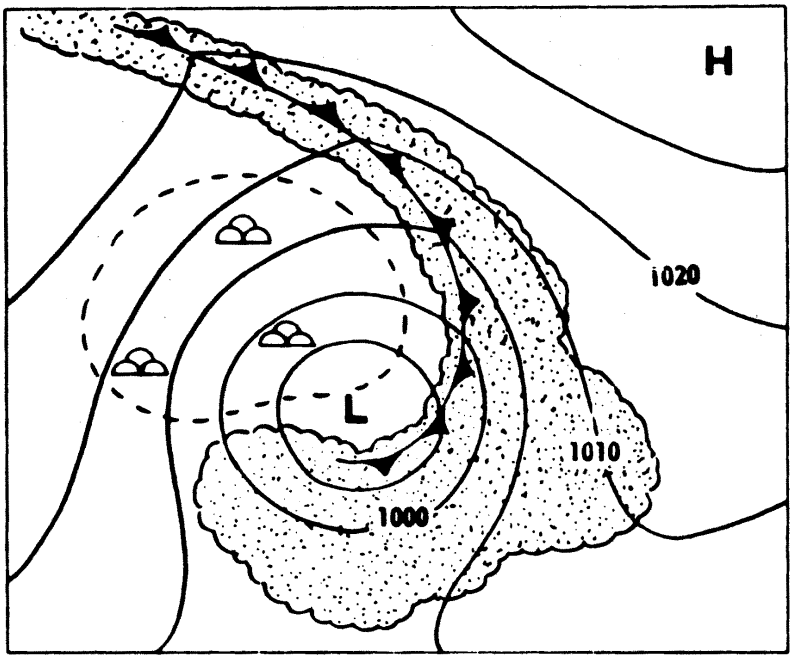

Figure 4. Typical Cloud Sheet in a Depression (for an explanation see adjacent column).

Summary

- Weather maps we see most are Satellite Images and Mean Sea Level Charts (also known as surface charts)
- The lines and symbols show the main features of the current (Analysis Chart) or forecast (Outlook Chart) weather
- A sequence of weather maps, combined with your own local observations, can be a valuable tool in determining typical patterns and developments in your local weather

Further Information

www.metservice.co.nz see Learning Centre

www.stuff.co.nz see weather home