18. Synoptic Charts and Forecasting

18.1 Sources of information

For the purpose of this Unit surface pressure charts will be used which are available from the Met Office for the synoptic hours daily. These cover the North Atlantic Ocean.

An analysis chart is issued for each of the synoptic hours along with forecast charts for five days ahead. These are updated every 12 hours around 0730 and 1930, with the exception of charts for days four and five which are only issued once per day at 0730.

For the coverage area of the surface pressure charts the following additional resources should be used in practice to increase the accuracy of any weather predictions:

18.1.1 Shipping forecast

In the UK, the Maritime and Coastguard Agency (MCA) is responsible for the provision of Maritime Safety Information (MSI) to ships at sea, which includes the broadcast of warnings and forecasts. This includes Navigation Warnings.

The Met Office initiates warnings and prepares routine forecasts for dissemination on behalf of the MCA.

BBC Radio 4 broadcasts weather bulletins daily on FM and long wave (LW).

Weather bulletins for shipping are broadcast daily on BBC Radio 4 at the following times:

- 0048 and 0520 (long wave and FM)
- 1201 and 1754 (normally long wave only)

The bulletins consist of:

- a gale warning summary
- general synopsis
- sea-area forecasts
- coastal station reports

In addition, gale warnings are broadcast at the first available programme break after receipt. If this does not coincide with a news bulletin, the warning will be repeated after the next news bulletin.

The waters around the British Isles are divided into 31 sea areas shown on the map. The shipping forecast can be found at:

https://www.metoffice.gov.uk/public/weather/marine/shipping-forecast

The site is interactive to display information for specific sea areas by clicking on the sea area required.

Fig. 18.1 – Shipping forecast sea areas.
https://www.metoffice.gov.uk/guide/weather/marine/shipping-forecast

18.1.2 Marine forecast glossary

Marine forecasts contain a number of terms which are used to convey specific meanings.

Gale warnings

Gale
Winds of at least Beaufort force 8 (34-40 knots) or gusts reaching 43-51 knots

Severe gale
Winds of force 9 (41-47 knots) or gusts reaching 52-60 knots

Storm
Winds of force 10 (48-55 knots) or gusts reaching 61-68 knots

Violent storm
Winds of force 11 (56-63 knots) or gusts of 69 knots or more

Hurricane force
Winds of force 12 (64 knots or more)

Note
The term used is 'hurricane force'; the term 'hurricane' on its own means a true tropical cyclone, not experienced in British waters.

Imminent
Expected within six hours of time of issue

Soon
Expected within six to 12 hours of time of issue

Later
Expected more than 12 hours from time of issue

Visibility

Very poor
Visibility less than 1,000 metres

Poor
Visibility between 1,000 metres and 2 nautical miles

Moderate
Visibility between 2 and 5 nautical miles

Good
Visibility more than 5 nautical miles

Movement of pressure systems

Slowly
Moving at less than 15 knots

Steadily
Moving at 15 to 25 knots

Rather quickly
Moving at 25 to 35 knots

Rapidly
Moving at 35 to 45 knots

Very rapidly
Moving at more than 45 knots

Pressure tendency in station reports

Rising (or falling) more slowly
Pressure rising (or falling) at a progressively slower rate through the preceding three hours

Rising (or falling) slowly
Pressure change of 0.1 to 1.5 hPa in the preceding three hours

Rising (or falling)
Pressure change of 1.6 to 3.5 hPa in the preceding three hours

Rising (or falling) quickly
Pressure change of 3.6 to 6.0 hPa in the preceding three hours

Rising (or falling) v. rapidly
Pressure change of more than 6.0 hPa in the preceding three hours

Now rising (or falling)
Pressure has been falling (rising) or steady in the preceding three hours, but at the time of observation was definitely rising (falling)

Note
For those more familiar with the millibar, 1 hPa = 1 mb

Wind

Wind direction
Indicates the direction from which the wind is blowing

Becoming cyclonic
Indicates that there will be considerable change in wind direction across the path of a depression within the forecast area

Veering
The changing of the wind direction clockwise, e.g. SW to W

Backing
The changing of the wind in the opposite direction to veering (anticlockwise), e.g. SE to NE

Sea state

Smooth
Wave height less than 0.5 m

Slight
Wave height of 0.5 to 1.25 m

Moderate
Wave height of 1.25 to 2.5 m

Rough
Wave height of 2.5 to 4.0 m

Very rough
Wave height of 4.0 to 6.0 m

High
Wave height of 6.0 to 9.0 m

Very high
Wave height of 9.0 to 14.0 m

Phenomenal
Wave height more than 14.0 m

https://www.metoffice.gov.uk/guide/weather/marine/glossary

18.1.3 High seas forecast

Forecasts for the high seas are issued twice a day at 0930 and 2130 GMT and covers the next 24 hours and outlooks for the following 24 hours.

The part of the North Atlantic known as Metarea I is divided into 12 sea areas shown on the map. Six of the areas are also in the Shipping forecast.

The forecast contains:

- a general synopsis
- sea-area forecasts containing forecast wind direction and force, weather and visibility for the next 24 hours with an
- outlook for the following 24 hours

Fig. 18.2 - High seas forecast areas.
https://www.metoffice.gov.uk/guide/weather/marine/high-seas

There are additional resources available on the Met Office web site including cloud cover charts and satellite IR images.

Seek out other websites giving great information including visible and IR satellite images.

18.2 Forecasting from synoptic charts

18.2.1 Surface pressure

The isobars on a weather chart indicate the *relative pressure* in hectopascals (hPa), formerly millibars (mb) were used.

Relative pressure is the pressure that is reduced to sea level whereas *absolute pressure* is that taken at some height above sea level that has not been corrected for height.

- Isobars are plotted at 4 hPa intervals from a base level of 1000 hPa.
- Intermediate values may be obtained by interpolation between the isobars with reasonable accuracy.
- The centres of High and Low pressure systems are indicated by an 'X' on the chart with the highest or lowest pressure value indicated beside it.

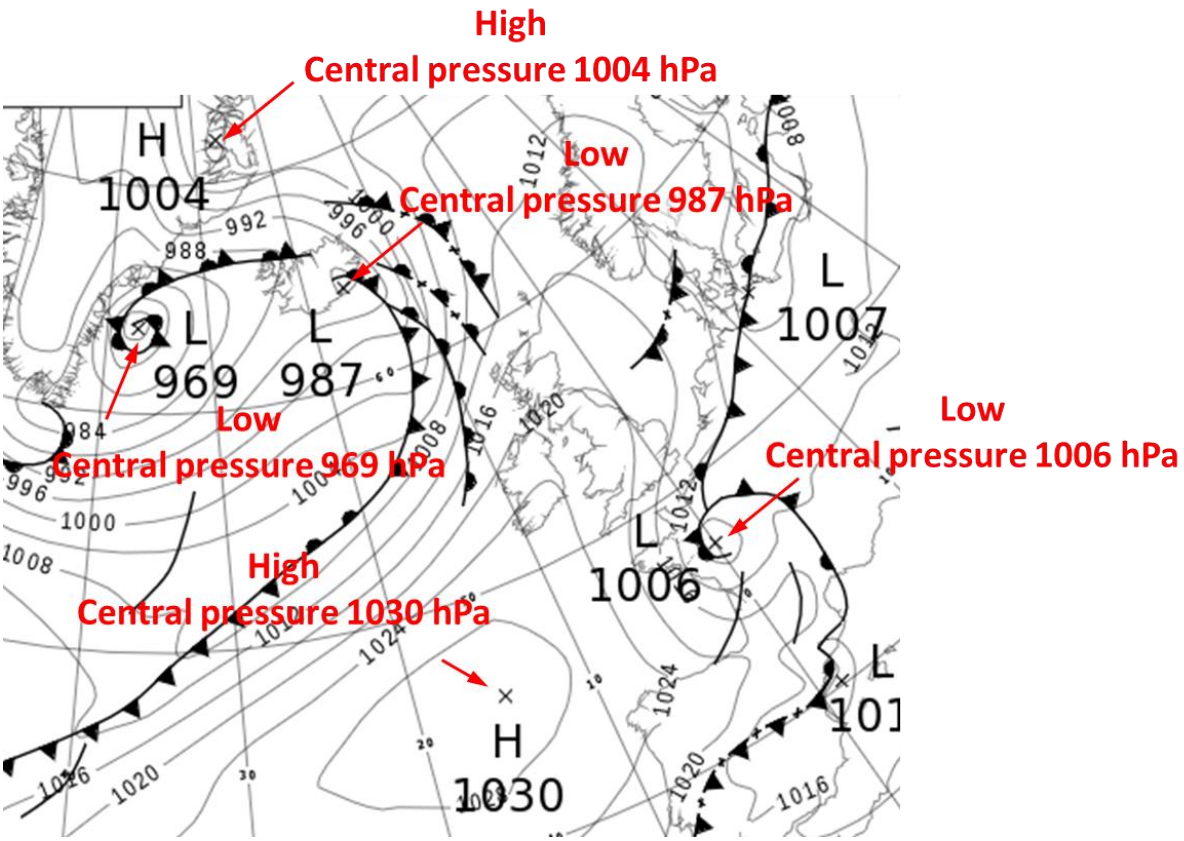

Fig. 18.3 – Representation of pressure at 4 hPa intervals.

18.2.2 Wind speed

Wind speed is proportional to the spacing of the isobars at the location in question, the closer together the isobars; the greater the wind speed.

The geostrophic wind is the theoretical wind that would result from an exact balance between the Coriolis force and the pressure gradient force. This condition is called *geostrophic balance* and the wind is directed parallel to the isobars.

The procedure to determine the geostrophic wind is as follows:

- The distance between two adjacent isobars is measured at the position in question.
- This distance is laid off from the left-hand edge of the scale at the appropriate latitude
- The geostrophic wind speed is read off from the curved lines, interpolating where necessary.

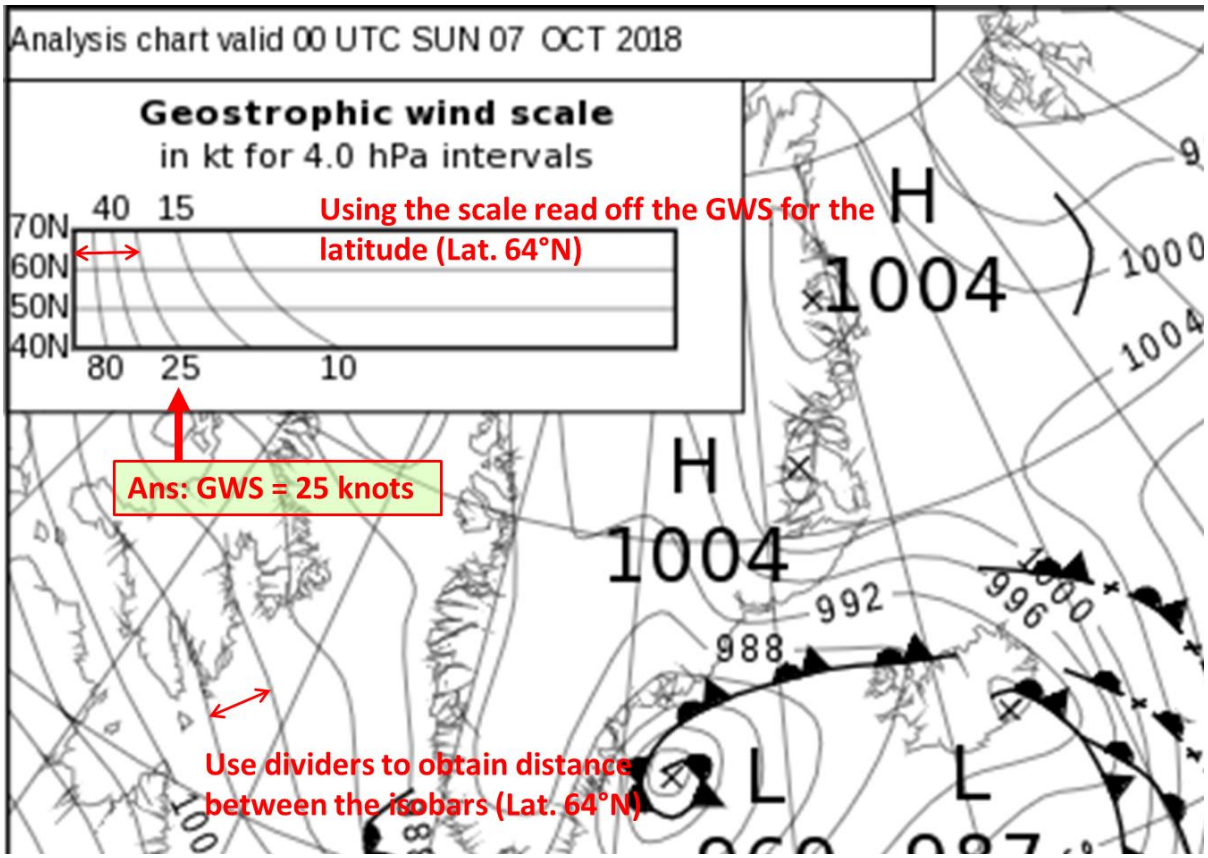

Fig. 18.4 - Obtaining the geostrophic wind speed.

The true wind speed will be different at the surface due to forces such as friction.

- **Over land surfaces wind is approximately half of the geostrophic wind speed**
- **Over the sea wind equals approximately two thirds of the geostrophic wind speed.**

For the above example the surface wind speed over the sea would be:

$$25 \times 2/3 = 16.7 \approx \textbf{17 knots}$$

18.2.3 Wind direction

The geostrophic wind direction will be that dictated by the direction of the isobars in accordance with the locations of the surrounding pressure systems.

To obtain the true wind direction at the surface will blow at an angle across the isobars **towards the low pressure** as follows:

- **Over land the angle of the surface wind is approximately 30 degrees to the direction of the isobars.**
- **Over the sea the angle of the surface wind is approximately 15 degrees to the direction of the isobars.**

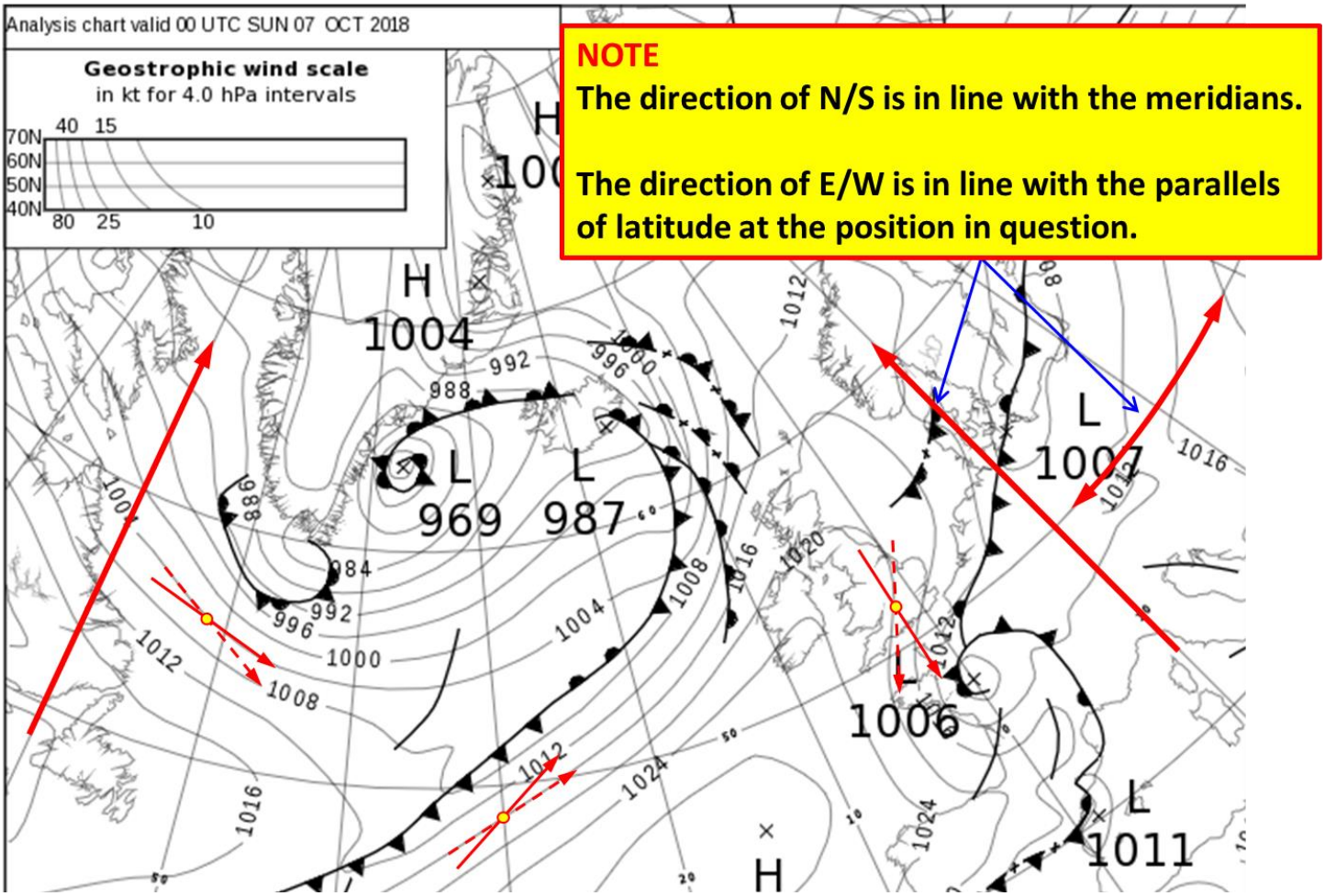

Fig. 18.5 – Estimating surface wind direction.
(NOTE THAT THE ARROWS SHOW WHERE THE WIND IS BLOWING; FOR WIND DIRECTION REVERSE THE DIRECTION)

18.2.4 Path and movement of depressions

The directions and speeds of motion of different depressions may vary widely, depending on surrounding pressure, temperature, air circulation and upper-air conditions.

Depressions have an average rate of motion varying from 20 to 30 miles per hour. The lower speeds prevail during late spring, summer, and early autumn, when atmospheric circulation in general is rather sluggish. This speed then increases with the higher rates prevailing during the winter period. Depression activity as a whole is far more active during the cold part of the year in either hemisphere, when the vigorous polar front encroaches toward tropical latitudes, causing the production of numerous and active depression waves.

Depressions, on average, follow certain well defined paths or tracks.

However, depressions tend to move parallel to the isobars in their warm sectors.

Weather patterns move generally eastwards in the middle latitudes. However, a particular weather system may move either north or south of a due-east line. Also, conditions within a system may change as it moves.

As a general procedure, forecasting involves an estimation of:

(1) the movement and changes in highs, lows, and other pressure configurations,

(2) the movement and changes of fronts and associated frontal weather conditions, and;

(3) the changes in air mass characteristics shown on previous maps.

18.2.4.1 Forecasting rules related to depressions

1. An occluded low will move very slowly or remain almost stationary until it dissipates.

2. In general, lows tend to follow the record of previous days, that is, their historical sequence; they will also tend to move toward regions of greatest rainfall during the last 24 hours.

3. Secondary depressions tend to move in the direction of the wind circulation around the primary low, moving faster in winter than in simmer.

4. Lows moving south-eastward (north-eastward in the Southern Hemisphere) usually increase in intensity on re-curving to the northward (southward in SH), but their movements will be slow.

5. Lows with isobars closely crowded on the west and north-west (west and south-west in the Southern hemisphere) generally move slowly to the east or southeast (east or north-east in the Southern Hemisphere).

6 Rainfall and strong winds will continue for a longer period than usual in western and northern sections of the low (western and southern sections in the Southern Hemisphere)

7. A young low usually moves in the direction of the isobars in the warm sector.

8. Until a low occludes, its rate of movement increases and after it has occluded its speed decreases until the maximum deepening of its centre occurs.

18.2.4.2 Forecasting rules relating to pressure centres

1. When the warm sector narrows, the disturbance deepens until occlusion takes place.

2. When fresh cold, air intrudes in a filling depression, it will start to deepen again.

3. In winter a low will usually deepen when passing over the ocean from the land, in summer, deepening usually takes place as the low passes from ocean to land.

4. A fully occluded depression rarely deepens, but it may fill up slowly or persist for several days.

5. Old depressions may fill up rapidly when new deepening lows move into their circulation.

6. Large depressions, when completely occluded, move very slowly and sometimes on an irregular course.

7. Depressions tend to move around large, warm, well-established highs in the direction of the airflow around the boundaries of the highs.

18.2.5 Movement of fronts

These are as follows:

- **The speed of a warm front may be taken as about two-thirds of the geostrophic wind speed.**
- **The speed of a cold front is usually the same as, or slightly greater than, the geostrophic wind speed.**
- **The speed of an occlusion is best assumed to be equal to the geostrophic wind speed.**
- **The direction of movement of warm and cold fronts can be assumed to be in a direction normal to the direction of the front.**