

WEATHER ASSOCIATED WITH ANTICYCLONES

by Lindsay Frost

THERE ARE two types of weather system:

- cyclones (depressions) and
- anticyclones (Figure 1).

As their names suggest, they bring different weather conditions. This unit looks exclusively at all aspects of anticyclones.

Anticyclones consist of high air pressure (over 1000 millibars) and are much larger than depressions. High air pressure can be found on a large scale:

- 1 In the sub-tropics (30°–40° north or south of the Equator) where air is sinking from high altitude. As it sinks it warms up. The descending air absorbs moisture and stops condensation taking place, creating dry and hot weather conditions. The Azores and Bermuda (in the Atlantic Ocean) are examples of sub-tropical high-pressure areas.
- 2 Over continental areas in winter, notably North America and Siberia, where cold air sinks towards the ground. (The maximum air pressure ever recorded was 1079 mb in Siberia.)

These sub-tropical and continental sources of high pressure are the birthplace of the anticyclones that occasionally cover Britain. In particular Britain receives anticyclones from North Africa in summer (Tropical Continental air mass) and from central Asia in winter (Polar Continental air mass) – see Figure 2. These bring contrasting weather conditions. For example, the highest recorded shade temperature is 58°C at Al'Aziziyah, Libya (North Africa) in 1922, and the coldest permanently inhabited place is Oymyakon, Siberia, Russia with –68°C in 1933.

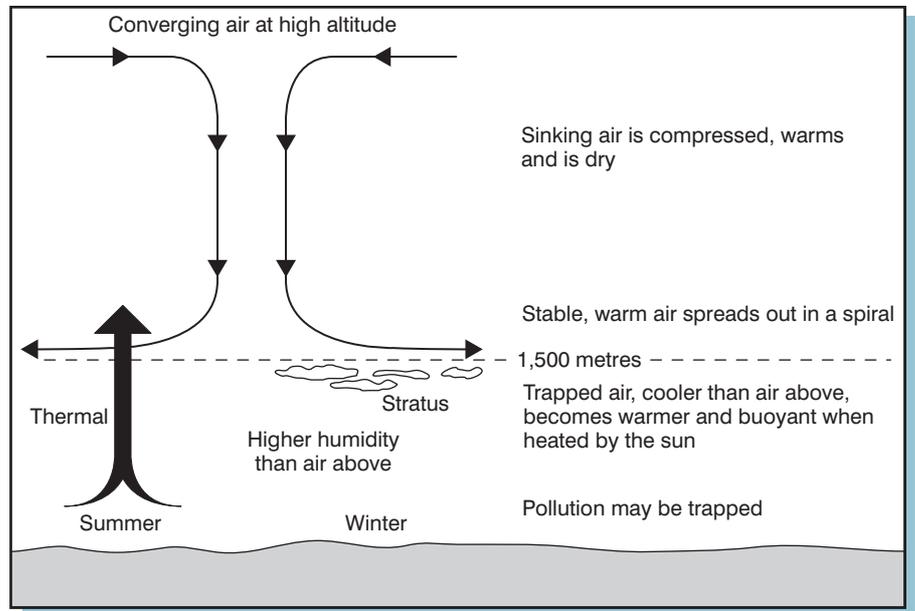


Figure 1: Structure of an anticyclone

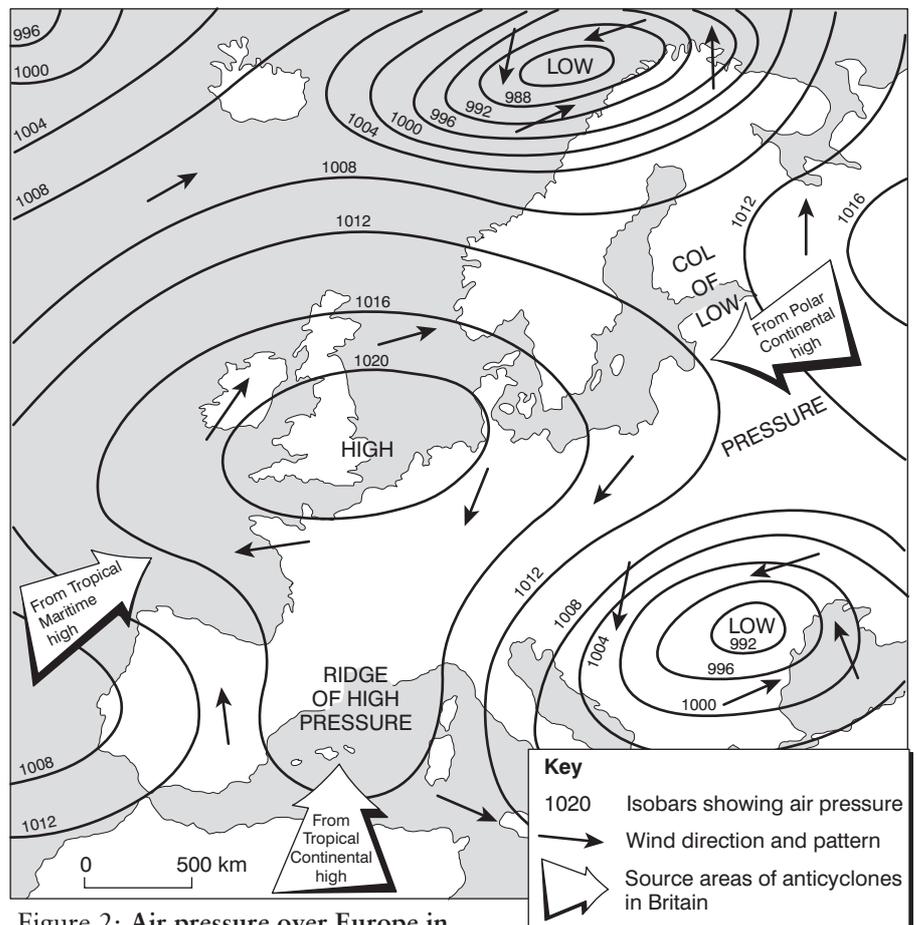


Figure 2: Air pressure over Europe in summer

Winds

The highest air pressure is in the centre of an anticyclone and it decreases very slowly outwards. This is shown on a weather map by the wide spacing of the isobars. The closer together the isobars are the stronger the winds will be (Figure 2). As anticyclones are stable (ie very little mixing of air vertically or laterally) they stay in one place for a relatively long period of time, perhaps a week or more. (This is a particularly good time for checking that barometers – the instruments that measure air pressure – are accurately set.) As the air pressure only changes gradually, winds are very gentle and conditions are often described as ‘calm’.

Winds are caused by the atmosphere trying to equalise air pressure, so the air moves from areas of high pressure to low pressure. The winds therefore blow clockwise and outwards from the centre of an anticyclone in the northern hemisphere (anticlockwise in the southern hemisphere). The wind direction in the centre of an anticyclone is very variable. Areas to the east of a high-pressure centre generally have cooler polar winds, while those areas to the west have warmer tropical breezes.

Precipitation and temperature

Anticyclones consist of only one air mass, so there is very little mixing of air (except at the edges) and little cloud cover. If there are no clouds there is no precipitation, so weather conditions are dry. Near the edge of an anticyclone there may be some instability, and stratus clouds or hazy conditions may form. Winds blowing from a cool sea may also form clouds over the warm land.

In a summer anticyclone there is a chance of thunderstorms forming, especially if the high pressure is associated with the Tropical Maritime air mass. Over Britain

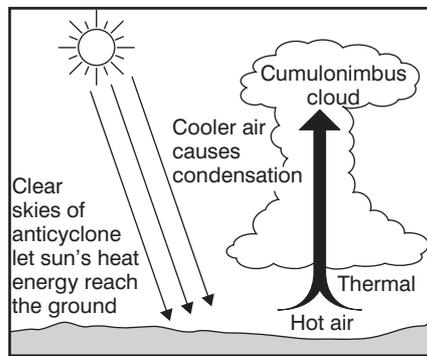


Figure 3: Thunderstorm formation (summer anticyclone)

this air mass contains a lot of water vapour evaporated from the Atlantic Ocean, and so relative humidity is high. These thunderstorms bring heavy rainfall in a short period of time, which can in turn cause ‘flash’ floods. Thunderstorms form from late afternoon into the evening, after the ground has been heated all day by the sun. This process is very effective in areas with little or no vegetation cover. Hot air begins to rise in some places (**thermals**) so causing some of the water vapour to condense in the cooler air above. Towering cumulonimbus clouds form, and lightning, thunder, hail and heavy rain occur. A line of thunderstorms may form when sea breezes keep them together and stop them moving.

Anticyclones have contrasting temperatures depending on the season.

Summer

In summer, days are usually dry, clear, very sunny, hot and with very little wind – apart from the occasional thunderstorm. It is very hot and sunny because of the clear skies, which allow all of the sun’s energy to reach the lower atmosphere and the ground uninterrupted (Figure 3). British people have to be very careful about sunburn and heatstroke in these conditions. The ground will cool at night and this may allow some early morning mist and dew to form. As an anticyclone can last for many days, the lack of rainfall can cause problems for some people (eg farmers). If there are several anticyclones during a winter and summer then a drought may be experienced, with water supply problems as reservoirs dry up and river levels drop.

One-third of the USA experienced a drought over the winter of 2001/02. Part of the reason for this was a persistent high-pressure area over the east of the country. In March 2002 New York declared a ‘drought emergency’. However, some people would regard these weather conditions as excellent holiday weather, sometimes called a **heatwave**.

Winter

In winter, conditions are still dry, clear and sunny, but there is a

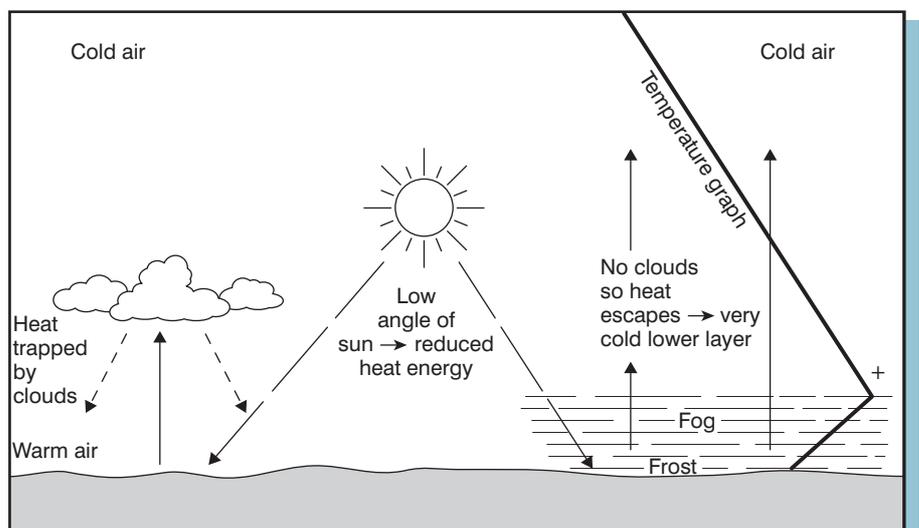


Figure 4: Winter anticyclone conditions

major difference in temperature. The amount of heat energy received from the sun is reduced in winter, and the absence of clouds at night means that the heat gained during the day is quickly lost. Clouds normally act like a blanket, trapping heat in the lower atmosphere, but if they are absent and there is no wind, then heat escapes (Figure 4).

With the loss of heat (by radiation) from the ground and lower atmosphere, the temperature is often lower than the temperature in the atmosphere above! This is called a **temperature inversion** (Figure 4). This means that any water vapour in the air condenses onto the cold ground in the form of dew or frost (if the temperature is below freezing), or in the cold air as fog.

Cold Siberian air travelling over the Baltic and North Seas may even bring some powdery snow to eastern Britain.

People have to make sure that they keep warm by heating their homes, or wearing warm clothes. In Britain retired people receive a 'cold weather payment' from the government to ensure that they can afford to keep themselves warm in long cold spells.

Anticyclonic weather hazards

The extreme cold of winter can be a hazard in several ways.

- Travelling can be hazardous because of icy roads, and thick fog that cuts down visibility. (Fog is classified as visibility less than 1,000 metres, and *thick fog* as less than 180 metres.)
- Frost in winter can benefit farmers as it helps break up the soil and kill pests. However, it can be a hazard to fruit farmers if there is a spring frost which may kill the tender shoots of fruit trees. (*Slight frost* occurs between -0.1 and -3.5°C , and *very severe frost* occurs below -11.5°C in calm conditions.)

The hazards in summer are associated with heat.

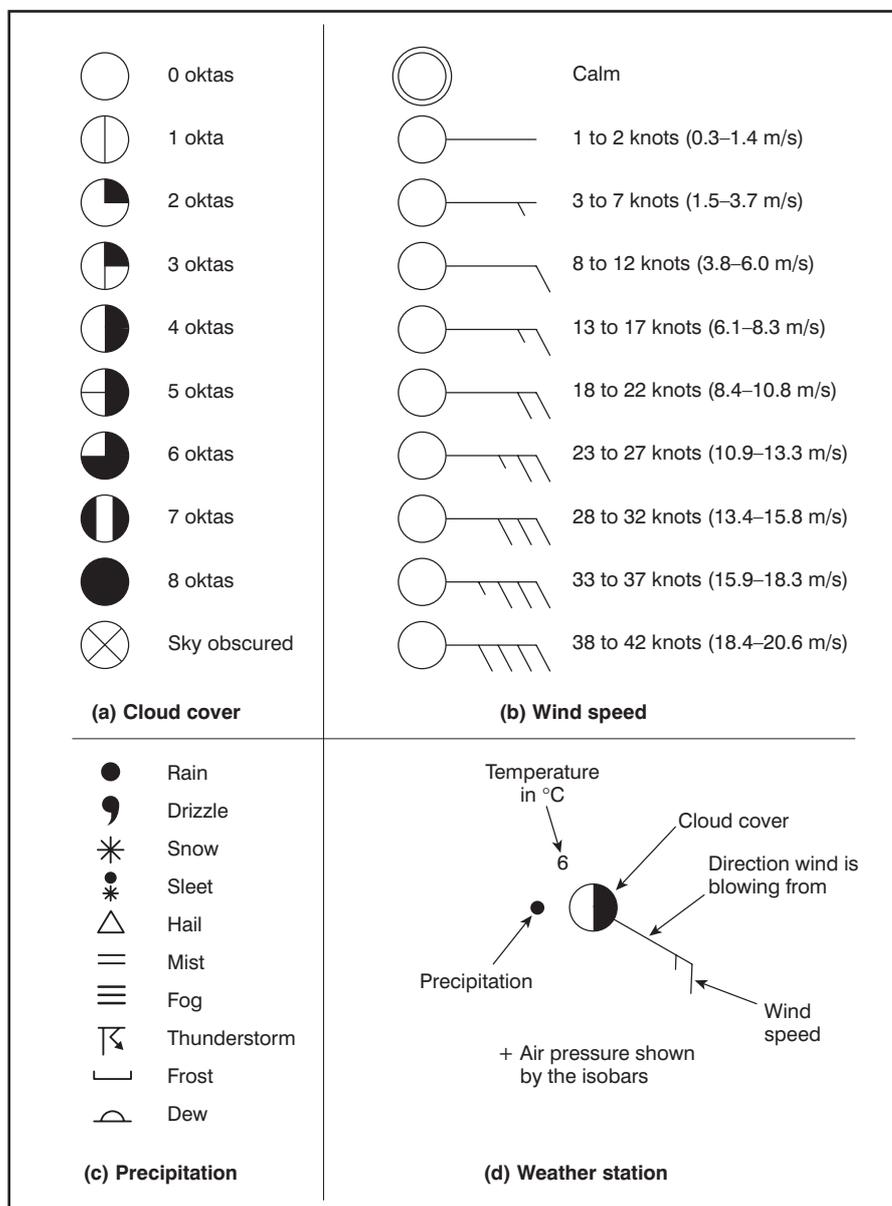


Figure 5: Selected weather symbols

- Droughts and heatwaves may be a hazard to people because of the lack of water, and the human body's inability to cope with very high temperature (sunstroke/heatstroke). The USA experienced a disastrous heatwave in 1980 that killed over 1,250 people.

Using weather maps

Land and sea-based weather stations record the aspects of weather. This information is then transferred onto weather maps (synoptic charts) using special symbols (Figure 5). These maps can then be used to analyse and predict weather patterns.

Conclusion

The larger the high-pressure area the slower it moves, and therefore the more likely it is to block depressions. Depressions are forced to travel around the high-pressure area. When this occurs the high-pressure area is called a **blocking anticyclone** or **blocking high**. This means that the same weather conditions can last for many days. In summer the calm, dry, sunny conditions lead to high temperatures, which increase over time. In winter the calm, dry, cloudless conditions lead to low temperatures which can get lower over time. The weather hazards become more noticeable the longer an anticyclone stays in one place.

Activities

1 Study Figure 2.

- (a) Which country is at the very centre of the anticyclone shown?
 (b) What is the approximate air pressure in this country?

2 Study Figure 2.

- (a) Which two countries are at or close to the centre of the depressions?
 (b) What is the approximate air pressure at the centre of the northernmost depression?

3 Describe and explain the weather conditions shown over Britain in Figure 6. (You will find Figure 5 useful, too.)

4 Study Figures 5 and 7, and climate information in an atlas.

- (a) Describe the weather conditions likely to be experienced by New Zealand on this day.
 (b) Draw a weather station summary using appropriate symbols for Wellington to represent the weather at 12 noon on this day.

5 Draw an appropriate graph to represent the information in Figure 8.

Weather	Fatalities	Economic losses
Cold	420	US\$20 million
Lightning	137	0
Heat	85	0
Fog	28	0
Thunderstorms	9	0
Low rainfall	3	US\$5,960.24 million
Hail	2	US\$20.15 million

Figure 8: Fatalities and economic losses from anticyclonic weather in 2000

6 What would the following people or organisations think about a summer anticyclone? Why?

- (a) Arable farmer
 (b) Water company
 (c) Ice-cream manufacturer
 (d) Gardener
 (e) Yachtsman
 (f) Family on a camping holiday

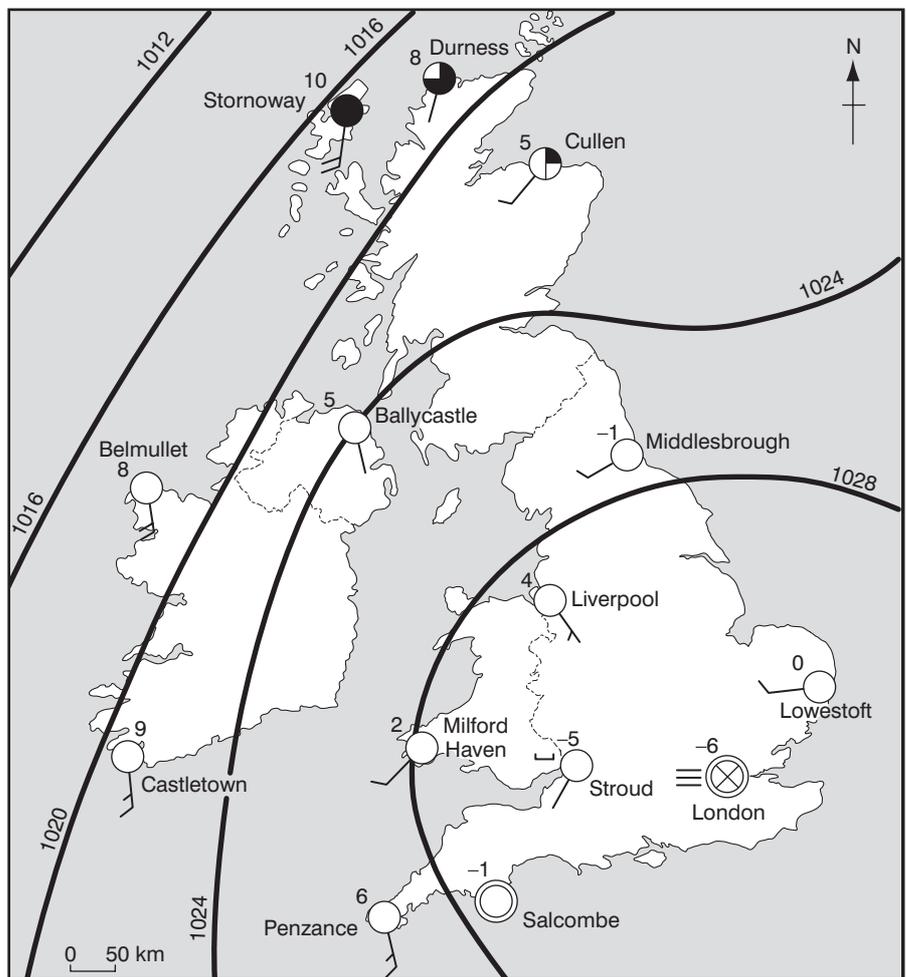


Figure 6: Anticyclone over the British Isles, 6 am in December

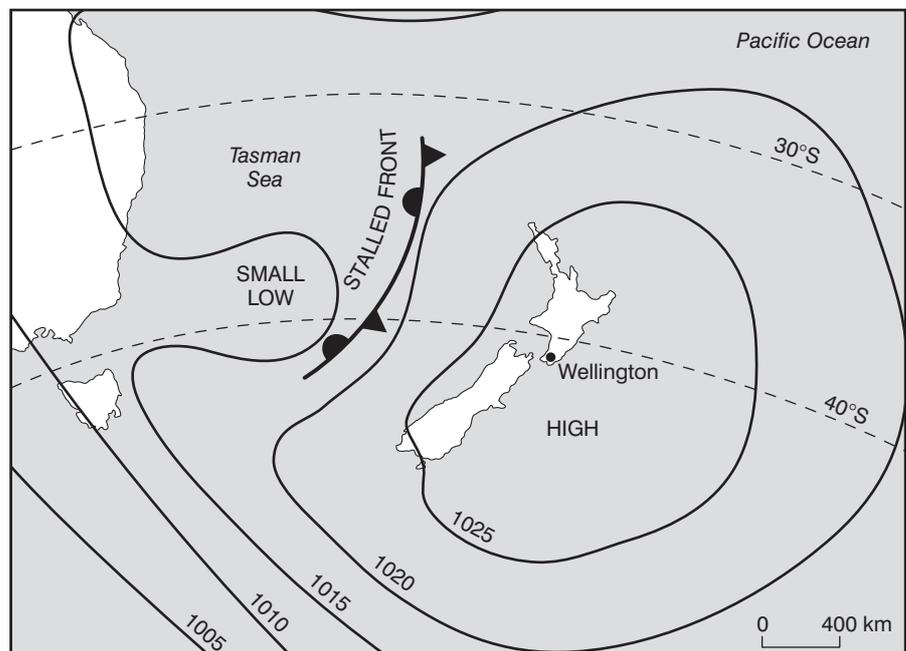


Figure 7: Anticyclone over New Zealand, 17 February 1990

7 What would the following people or organisations think about a winter anticyclone? Why?

- (a) Arable farmer
 (b) Fruit farmer
 (c) Water company
 (d) Airport manager

- (e) Elderly person living alone
 (f) A person commuting to work by car

8 What could people or organisations do to reduce the risks from anticyclonic weather hazards?