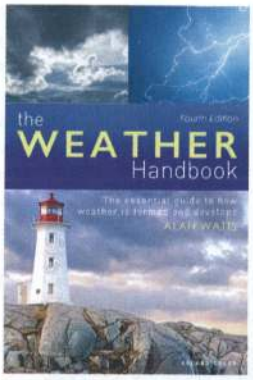
Understanding 'low' weather

An explanation of surface-level (low) weather patterns: an extract from the 4th edition of *The Weather Handbook* by Alan Watts



***The Weather Handbook* by Alan Watts, published by Adlard Coles, £16.99**

The temperate latitude and sub-tropical jet streams tend to circle the globe and they are inextricably interwoven with the depressions (Fig 1, right). The rules are that new lows form some hundreds of miles on the equatorial side of the jets and their centres then move north-eastwards until they are under the jet. That is when they begin to occlude.

This means that young depressions must have the jet stream to their north which is why we can see jet cirrus ahead of a newly developing low but not ahead of an old occluded low. There will be cirrus ahead of the occlusion but it will not have the jet form.

The jet cirrus forms on the southern side of the jet not far from its axis but the only places it can be truly seen is well ahead of the warm front and behind the cold front. However, these are the places where we need to be able to see it so that we can make forecasts for the coming hours or even days. After that, other clues will help to make it evident that the foretold weather is actually coming.

In Fig 2 we have a cross-section through a typical jet stream and Fig 3 shows where the jet will lie in relation to a developing surface low. The vertical sections show the frontal surfaces and how the jet lies just in the warm air below the tropopause. We also see the surface wind directions ahead of and behind the low and how they tie in with the direction of the winds at cirrus height.

We can best show where the jet lies over surface depressions with a diagram like Fig 4. Here are depicted three lows formed along the polar front. On the left is a new embryonic wave low developing to the south of the jet and travelling fast as waves often do.

In the centre is a low in its prime but just about to start occluding as the centre almost lies under the jet. Its speed is lower than that of the wave and it has a classic vee-shaped warm sector.

On the right is a low past its prime and well into the occluding stage of its life cycle. The point of occlusion moves so as to remain under the jet and the low centre is now well to the north. However it sometimes happens that a new low forms on the point of occlusion.

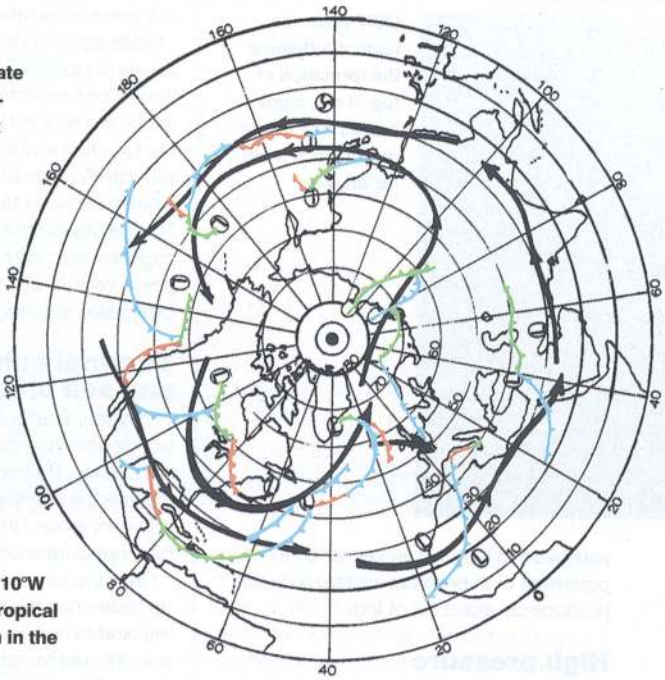


Fig 1

Sometimes the temperate latitude jet and the sub-tropical jet form almost continuous girdles around the whole hemisphere. Note that the low at about 50°W is a developing wave depression and is south of the jet. Most of the other lows are occluded and so their centres are north of the jet. The point of occlusion on the 20°W meridian lies under the jet just as it should. There are another two examples at 80°W and 110°W while close to the sub-tropical jet at 140°E is a typhoon in the China Sea

The diagram also indicates the extent of the cloud shields over the low centres and we see that the only shield which looks like a spiral belongs to the middle aged occluding low. We have also indicated typical places where the different cloud types can be seen.

Figure 4 also shows a cross-section of the frontal surfaces and cloud wedges along the dashed line X-X together with some of the heap clouds which can form in the ridges etc between the low centres.

The tropopause puts a lid on upward cloud development but note that the 'trop' domes up over the warm air. Conversely it dips down over the cold air between the lows.

The dashed lines that envelope the different air masses form corridors along the warm and cold frontal surfaces. This is not just a convention. It is a fact – and many will see it as an amazing fact – that

ABOUT THE AUTHOR

One-time professional meteorologist Alan Watts, who died earlier this year, wrote his first weather book in 1968 having spent considerable time studying wind changes and short-term alterations in the weather. This, combined with his enthusiasm for sailing, has led to the bestselling *The Weather Handbook*, *Instant Weather Forecasting* and *Instant Wind Forecasting*, all published by Adlard Coles.

the two air masses do not mix along the frontal surfaces. As we have only thin air on both sides surely they must run into one-another. That they do not is because they are at different temperatures and so different densities. It is also because there is a third kind of air, dry and originally from the stratosphere, sandwiched between them. This is what is being indicated by the 'corridors' that represent the frontal surfaces.

The clouds of the wave low do not necessarily extend very high but they are building all the time and as soon as they produce rain they must have grown to heights cold enough for the rain-making process to occur.

'The two air masses do not mix along the frontal surfaces'

The maturing low has the greatest cloud masses above its frontal surfaces and so will produce the most rain (or snow) while the occluded front should not produce the same amount. In practice occlusions can rain very heavily for a considerable time because they sometimes get a new lease of life from having a blast of cold air injected into them.

The distances shown are typical ones and with 1,200 miles between the wave low and its mature colleague the wave has room to develop into a full-blown depression. Otherwise, if too close to a low ahead, waves will be stifled in their development and will remain ripples in the polar front, eventually dying out.

Fig 2 Cross-section through a typical jet stream

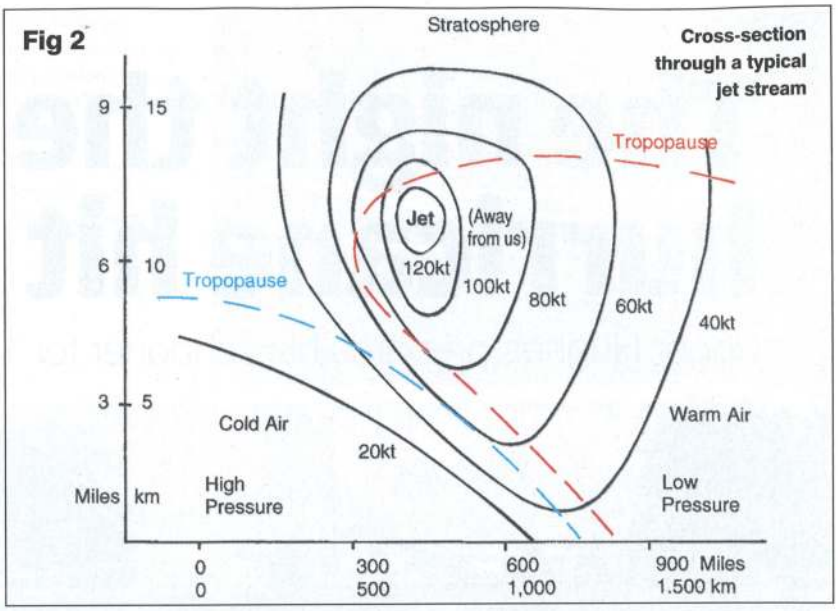
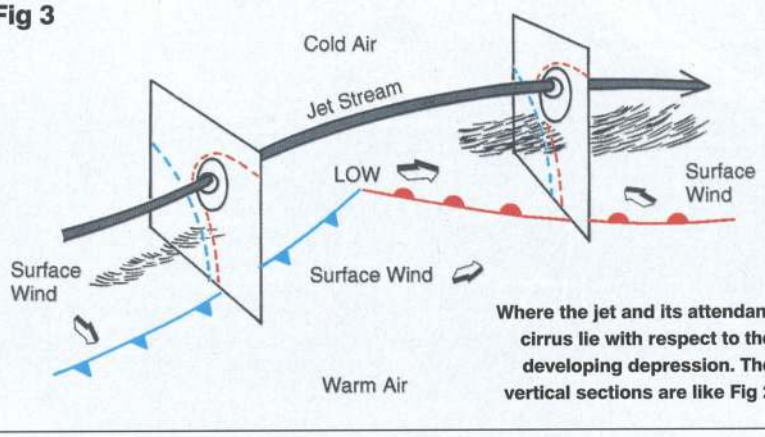
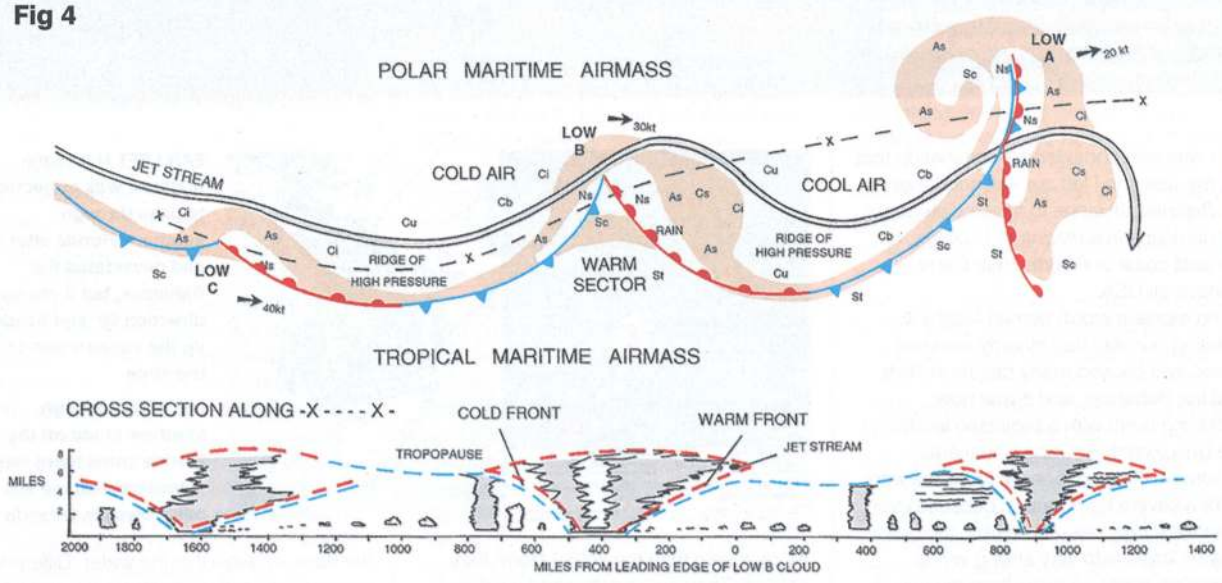


Fig 3



Where the jet and its attendant cirrus lie with respect to the developing depression. The vertical sections are like Fig 2

Fig 4



Three lows along the polar front. On the left a new but developing wave depression travels along the polar front at 40 knots while the mature depression in the centre has slowed down to 30 knots. As the apex of its warm sector is almost under the jet it will soon begin to occlude and start the filling-up process. That is what has happened to the depression on the right. Note how the cloud shield of the mature depression has become a whirl over the occluded one. Typical cross-sections along the line X-X-X are shown on the lower diagram with typical distances which may be widely different from these.