Make your own local weather forecasts

Rupert Holmes explains how to use basic knowledge of meteorology and local topography to better understand likely weather conditions

Local winds and coastal effects are very difficult for weather apps to forecast. This is because the science of numerical weather prediction (NWP) relies on enormous quantities of data across huge areas of land and sea, which in modern times provides amazingly accurate large-scale forecasts. However, small-scale geographical features can become 'lost' in larger-scale models, resulting in some coastal effects, including winds around headlands and narrow channels, not being accurately modelled.

Models with a very small grid size, such as the short term UKV and Arome models from the UK MetOffice and MeteoFrance respectively, are much better in this respect. Even then, they will struggle to produce good data for features of much less than 3-4km in size.

That's where the human input that goes into forecasts such as the Shipping and Inshore Waters forecasts can be enormously beneficial. But even these tend to cover such wide areas that this extra information may be of limited value.

Fortunately, with a bit of knowledge, it can be relatively straightforward to refine a forecast to improve our understanding of likely conditions for the precise waters in which we will be sailing.

Julian Eales/Alamy

Sailing downwind in an easterly direction off Lyme Regis, you'd expect divergence and reduced wind strength in relation to the forecast strength

Step by step forecasting

The starting point is to get the most accurate and up to date forecasts, ideally looking at more than one model. For example: the Windy app or windy.com set to view Arome data, in combination with MetOffice spot forecasts for nearby specific locations and the Inshore Waters and Shipping forecasts. These three together would give a good overview from different sources.

Further info can be gleaned from predictions for the CAPE index – this shows the potential energy in the atmosphere that's available to create thundery squalls and can help to highlight days when there's a possibility of powerful cells forming, even if the risk is low.

Rupert Holmes

If the wind is blowing off the land you can expect to be lifted on port tack when heading towards the shore

It's also worth analysing the likely sea state – often the conditions our boats can manage are determined more by waves than solely by the strength of the wind.

The next stage is to assess whether local geography is likely to increase or decrease the wind strength or modify its direction. Are stronger gusts possible? Instinctively we know that on the lee side of land (ie in its shelter) average wind speeds tend to be reduced, however, it can also be gusty, with bigger changes in wind direction.

It's also well known that hills and mountain ranges will force air upwards and in doing so it cools, forming clouds and often rain.

But even the lowest and flattest land creates more friction for airflow than water. As well as reducing the wind speed this also creates a wind shift – the wind over land is backed (shifted anticlockwise) by around 20° compared to that over open water.

It's important to realise that this is not a step change at the shoreline – it's a gradual change that takes place over a few miles. Therefore, when the wind is blowing offshore, a boat approaching the

Ian Rutherford/Alamy

Ailsa Craig in Scotland's Firth of Clyde is a steep-sided obstacle driving the wind upwards, cooling it and forming cloud

coast on port tack will be progressively lifted. Conversely a vessel on starboard tack will be headed as it closes the shore.

Convergence and divergence zones are also important to understand. If the wind is blowing along a coast, with the land on your right with your back to the wind, the change of direction of the breeze over the land will augment the strength of the wind experienced at sea.

On the other hand, if the wind is reversed and the land is still on your right, wind direction over the land will diverge from that over the sea and a belt of reduced wind strength will be experienced within two or three miles of the shore.

The change of direction on wind over land also has an important effect on the airflow around islands. The wind is

'The starting point is to get the most accurate and up to date forecasts'

strengthened on one side of the island, and reduced on the other, with these effects potentially experienced a considerable distance downwind of the landmass.

There are other places in which acceleration of the wind strength can be expected. Just as it will funnel down mountain valleys, it will also be funnelled by estuaries, even if the terrain each side is flat – the mere presence of land has enough frictional effect to make a difference.

This can often be clearly seen after the passage of a cold front in the Solent – the north-westerly wind will funnel down Southampton Water and the Eastern Solent, reaching a much higher strength than the breeze in the west Solent. Similarly, headlands will focus the wind over the sea into a narrower band of stronger flow, with the direction fanning out around the headland.

Tidal flow also modifies the wind that's experienced at sea. For instance with a westerly breeze in the English Channel, an eastgoing tide will decrease the windspeed and vice versa. With tidal streams flowing at up to four knots on spring tides this can result in a gradual rise and fall equivalent to a full Beaufort force on every tidal cycle, even if the gradient windspeed remains constant.

In practice the difference in this example may even feel greater than this, as the strongest breeze will be with wind against tide, resulting in an agitated sea state, whereas the lighter winds on any given day will be experienced with wind and tide aligned and a relatively benign sea state.

On the south coast a brisk sea breeze can create challenging conditions, even if the weather appears benign earlier in the day. This is particularly true with spring tides, as the out-going (west bound) stream will reach its maximum speed at the same time as the sea breeze tends to swing to the south-west and reach its peak strength.

Thus a day that starts cloudless and with almost calm offshore winds (ideal conditions for the propagation of a sea breeze) may turn into one with an unpleasant chop in the Solent, steep seas in the Needles Channel and near major headlands, plus dangerous breaking waves on the Chichester bar and those of other harbours and estuaries.

These are places in which it's always easy to be caught out. Yet such conditions can nearly always be predicted in advance. PBO

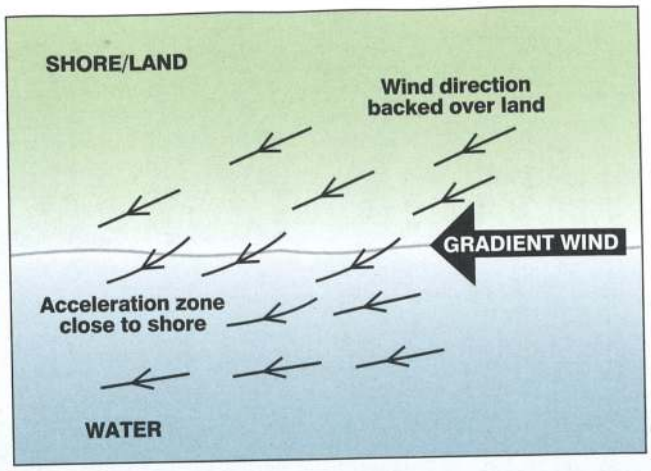

FIGURE 1 convergence zone

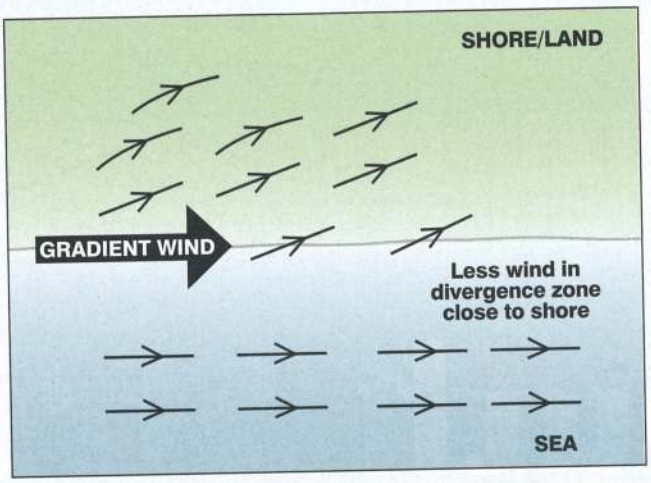

FIGURE 2 Divergence zone

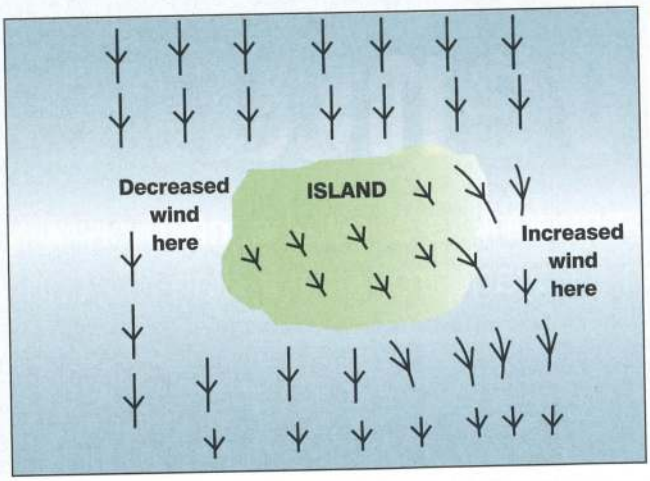

FIGURE 3 Winds in the lee of an island