Met Office Probability Forecasts

Summary of changes Feb 2020 vs. previous version

- Resolution of data increased from 1.5 degrees to 0.25 degrees
- Direction box plots replaced with radial plots
- Presentation quality improved

Introduction

The primary method of ascertaining the probability of a weather event occurring is to use ensemble forecasts as a basis for measuring the probability of critical thresholds being exceeded. These ensemble forecasts are based on atmospheric and ocean wave models. Given a realistic starting point (i.e. the current condition of the global atmosphere estimated using observations), the model can project the likely changes in the atmosphere and ocean for some days ahead.

The models are run a number of times from slightly different starting conditions. The complete set of these forecasts is referred to as the ensemble, and individual forecasts within it as ensemble members. Ensemble forecast systems are designed so that each member should be equally likely. The initial differences between the ensemble members are small, and consistent with uncertainties in the observations. But when we look several days ahead the forecasts can be quite different.

The forecasts are created using global ocean wave models, therefore forecast output can be created for any marine location worldwide.

How Can I Use This Information?

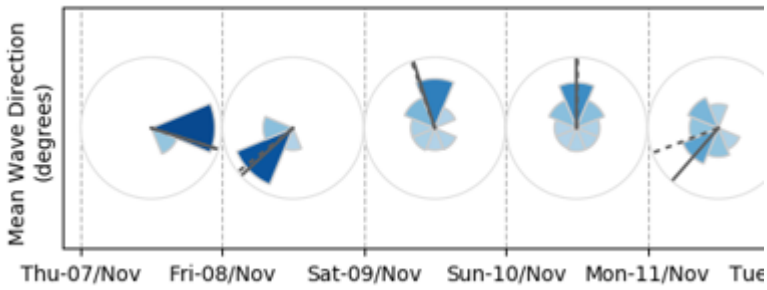
These probabilistic products can be used as a very powerful decision aid in terms of risk assessment and planning.

One significant way to get benefit is to compare them with the issued or 'deterministic' forecasts from the Met Office. The traditional forecast implies a high level of accuracy e.g. the 10M wind at 1200 on day 4 is 320 Deg 18 KT. What is not evident from this type of forecast is the level of certainty about the wind staying below a critical threshold, say 20KT.

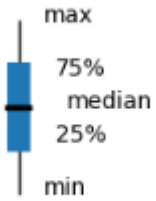
There may be times when the Met Office is confident that, whatever happens, the wind should stay below 20KT. At other times, not only is confidence low, there may be, for example, a reasonable chance of 30 KT or more being observed. The probability forecast effectively supplies the 'missing' information and therefore helps determine and reinforce critical business decisions.

Product Details

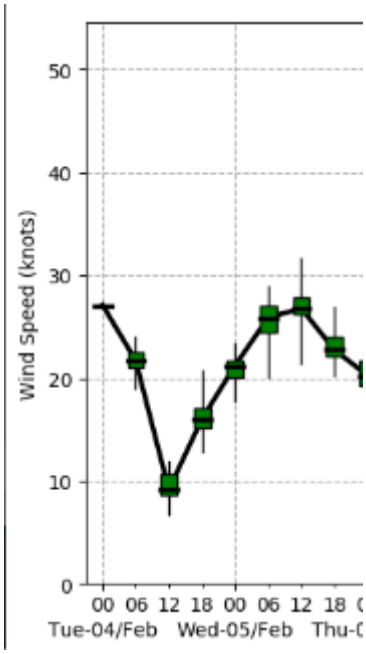
The product shows:-

- Wind Speed box and whisker plot (panel 1)
- Wind direction radial plots (panel 2)
- Significant wave height box and whisker plot (panel 3)
- Mean wave direction radial plots (panel 4)
- Mean wave period box and whisker plot (panel 5)
- Wind plots are shown in Green, Wave plots are shown in Blue
- Wind speed, in panel 1, is calibrated in Knots.
- The vertical scale in the box and whisker plot is modulated in line with the highest expected speeds (e.g. 0 to 50 KT wind speed in the example shown).
- Wind Direction in panel 2, is shown on a 360° radial plot, which is showing the forecast for 1200 for each day.
- Wind Direction is calibrated in Degrees.
- Significant wave height, in panel 3, is calibrated in Meters, the vertical scale modulated in line with the highest expected significant wave height (0 to 16m in the example shown).
- The Mean Wave Direction, in panel 4, is shown on a 360° radial plot, which is showing the forecast for 1200 for each day.
- Wave Direction is calibrated in Degrees.
- Mean Wave Period (in panel 5) is calibrated in Seconds, and like Significant Wave Height, the vertical scale modulates in line with the highest expected periods (zero to 16 seconds in the example shown).
- In both direction panels (wind and wave), the radial plots show the direction where the wind/waves are coming from, i.e. this example waves are coming from the East. 
- In both direction panels, the size and shade of the segment represents the volume of ensemble members, with darker and larger segments showing a greater number of agreeing members and therefore higher confidence (as in the first radial plot below). In the example below, as time goes on the radial plots become paler, smaller and more spread out, showing there is less agreement across the ensembles and therefore less confidence in any one wave direction.
- The black solid line represents the ensemble mean and the black dashed line represents the ensemble median.
- 

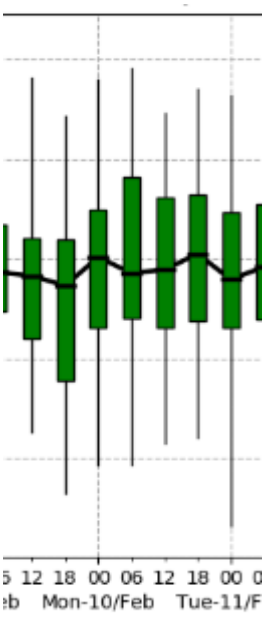
- In the box and whisker plots, the black lines within the boxes are the median values.
  - The 25% to 75% probability quartiles determine the 'Box' top and bottom.
  - The ‘whiskers’ – the vertical lines emanating from the boxes, depict the upper and lower quartiles. The upper quartile shows values where the probability of being equal to or greater than that value is greater than 0.75 and the lower quartile shows values where the probability of being equal to or less than that value is less than 0.25.



  - If the Box, Median and Whiskers are close together and the values are close to the issued (deterministic) forecast, then we have higher confidence in the outcome.



High Confidence



Lower Confidence

If the top of a box (75%) quartile, lies below an operational limit then we can be reasonably confident of not exceeding the limit (providing the issued deterministic forecast is consistent with this). The confidence can be even greater if the upper quartile whiskers also lie inside operational thresholds.

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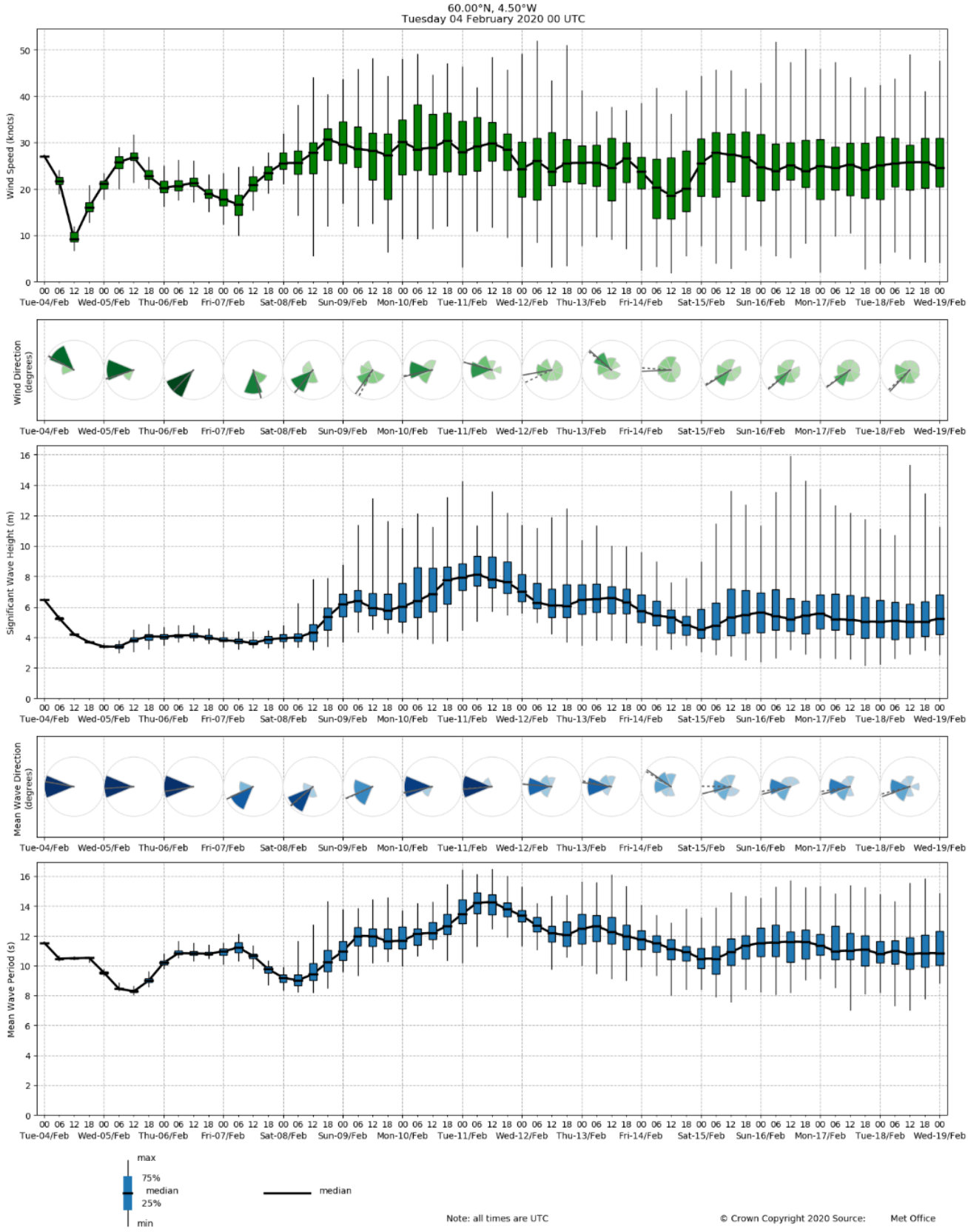
Example wind/wave Meteogram



Summary

- Probability forecasts, objectively derived from model ensembles, are powerful decision making aids. When used in conjunction with the 5 day Tabular and Graphical (deterministic) forecast they can add considerable value to the risk assessment process, in particular when making critical operational decisions.
- Like any model product, it is a simulation of the real atmosphere. One weakness in traditional deterministic forecasts is that they do not necessarily capture the range of possible scenarios or the level of certainty about a parameter staying below a critical threshold. Probability forecasts on the other hand objectively measure and show the range of uncertainty and have been shown to add considerable value to 'traditional' forecasts.

The data utilised in this product is available twice per day, based on the 0000 and 1200 UTC model runs.

Please note:
This forecast is based on different underlying data to some other Met Office forecasts you may receive. Therefore, you may occasionally see some variance between them.