



Medium range weather forecasting and the effect on the bottom line

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Introduction

One of the most difficult jobs facing project managers tasked with the mobilisation of critical resources in the renewables industry is planning ahead for what are often referred to as medium range weather impacted events. Forecasting weather over longer periods (typically up to 15 days in advance, often termed medium range forecasts) are extremely difficult to predict with any degree of accuracy due to the volatile and chaotic nature of the atmosphere. Very small variations in the initial conditions of a computer forecast model can lead to huge variations in the forecast – a phenomenon known as the ‘Butterfly Effect’. This is why forecasters can typically only forecast conditions up to roughly three days ahead with any degree of precision. Beyond this time scale, conditions become significantly more influenced by these tiny initial variations.

Understanding Uncertainty

The key to understanding medium range weather forecasting lies in an understanding of how to deal with uncertainty. Weather is a risk related activity because forecasters are dealing with uncertainty. One of the best ways of dealing with this, whether it be related to weather prediction or any other risk assessment activity, is to use probability as the mechanism of measurement.

Probability & Weather

Probability deals with the likelihood of an event occurring. Probability weather forecasting therefore specifies how *likely* a defined weather event is to occur on a particular occasion and represents that probability as a percentage. A probability of 10% means that the forecast event will occur 10 times out of 100 or the odds against the event occurring are 1 in 10. Even a low probability of an event occurring can provide a useful warning of a serious event likely to cause significant disruption. Even though there is a 90% probability that the event will *not* occur, knowledge of the 10% risk enables users to prepare for the worst, eliminating the element of surprise. The remaining time the forecast event does not occur is referred to as false alarms. Subscribers to online weather forecasts or a weather alert service have likely used probability forecasting.

Planning for ‘that’ Weather Related Event

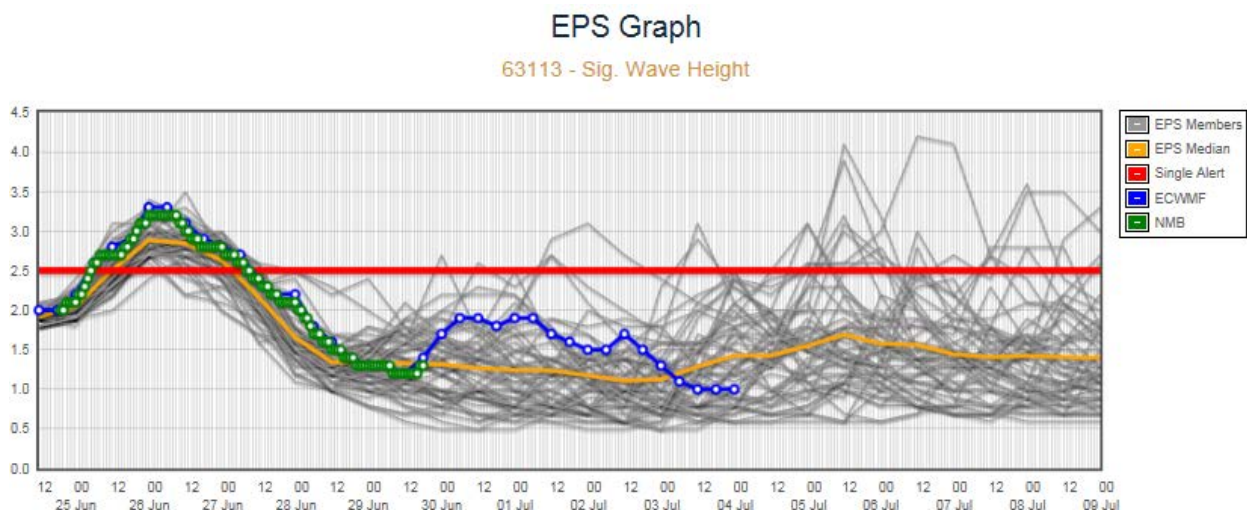
For a project manager tasked with an expensive turbine installation or crane operation, 15 days’ ahead and the headache of mobilising expensive resources and manpower, the degree of probability upon which he/she decides to set as a threshold will be determined by their individual attitude to risk, the cost variables involved in mobilising a date that far in advance (against the profits involved in early mobilisation), and the losses involved in missing that deadline and having to wait a further 15 days until favourable conditions re-occur.

Improving probability also relates to the occurrence of particular weather related events occurring at a specific location e.g. the likelihood of a given temperature, wind speed, or wave height occurring at a precise location, such as an offshore wind farm at a specified latitude and longitude. This is called setting threshold levels. Working with a meteorologist to define the thresholds required for a given operation helps to define the probabilities of the event occurring and helps to minimise the degree of uncertainty around the weather impact on the operation. Regardless of the probability however, there still exists a degree of uncertainty reflected in the percentage given. To further reduce this degree of uncertainty, meteorologists use a system called ensemble forecasting.

Improving Probability – Ensemble Prediction System (EPS)

In 1992, The European Centre for Medium Range Weather Forecasting (ECMWF) pioneered an ensemble prediction system for use by national meteorological organisations and private weather providers.

The ECMWF is an international organisation supported by 21 European Member States and 13 cooperating States, including the UK. Specialising in numerical weather prediction for medium range weather forecasting, the ECMWF operates one of the most powerful supercomputer complexes in Europe, however does not issue weather forecasts itself, but distribute its products to weather providers across its member states.



Weather Window Report

Figure 1: EPS Graph illustrating various national weather service medium range forecast models demonstrating the likelihood of significant wave height occurring at a predefined threshold level.

Ensemble Prediction System Forecasting

Opposed to running a forecast model once (deterministic forecast), ensemble forecasts run the model 50 times from slightly different initial conditions. Each forecast in an ensemble is called a ‘member’ and the relationship between each member, over a number of days ahead, define the accuracy of the forecast. If all ensemble members are similar then forecasters will have a high degree of confidence that the forecast will be reliable.

Probabilistic Ensemble Forecasting based on a precise location and pre-set thresholds can prove an invaluable tool for project managers operating on any renewable energy project by helping to understand the effect of weather impacted events on operational planning. Evidence suggests that when medium range weather forecasting (probabilistic) is used intelligently with deterministic forecasts the results equate to an improved bottom line. The reason for this is simple, whilst probabilistic forecasts still equate to a degree of missed opportunities (the degree which reflects the individual’s attitude to risk against the required percentage of the event not occurring) they also allow for operations to be more prepared and ready to take advantage of a greater number of weather windows occurring.

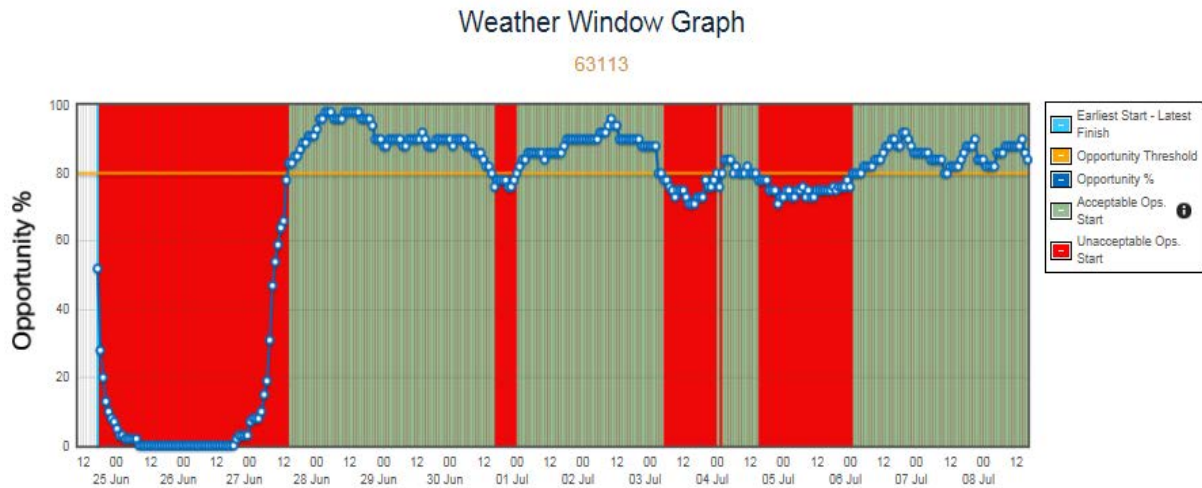


Figure 2: The same information as displayed on the EPS Graph in figure 1 reflected as weather windows. The red column illustrates shut down conditions and the green columns illustrate weather windows for the given thresholds. The probability of the events occurring is set at 80% along the left side of the graph. Illustration from WeatherWindowPlanner – a high resolution medium range meteocean planning tool from MeteoGroup.

The Degree of Uncertainty

For those still relying on deterministic forecasts, it must be remembered that every time a forecaster issues a deterministic forecast the underlying uncertainty still exists, and the accuracy of the forecast depends on the skill and experience of the forecaster in the same way as probabilistic forecasts do.

MeteoGroup is Europe's largest independent weather forecasting company. MeteoGroup provides innovative weather solutions for the life-cycle of renewable energy installations, from site assessment and construction and installation, to operations and maintenance.

Do you have any questions about medium range weather forecasting? Or would you like more information? Please contact us:

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