



Long-Range Forecasting in the Offshore Industry: Plan Ahead with Confidence

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Introduction: the benefits of long-range forecasting for offshore companies

In the offshore industry, timely, accurate, and actionable weather data is critical. No matter where you are working globally, metocean conditions affect all areas of operations. Therefore, reliable and precise forecasting is essential to increase operating thresholds and maximize vessel operability on a project. And the earlier you have insight into weather situations, the sooner you can mitigate risk and make informed decisions.

The challenge for offshore companies around the world is to do more with less. The priority for many is to optimize operations, without compromising on safety at sea. Many offshore companies are, therefore, exploring how long-range weather forecasts can help minimize expensive weather-related downtime.

For organizations looking to improve cost efficiencies, long-range forecasts potentially unlock new opportunities to reduce costs and optimize the decision-making processes. Long-range forecasts aid planning and decision making by illustrating the confidence of the forecast for a longer period. It also supports risk management and can be customized to meet your specifically requested parameters.

This article is an invitation to think about the usability of long-range forecasts for your organization.

It is now possible to obtain skillful forecasts beyond the traditional time horizon. We are at a point where increased knowledge and techniques, as well as vast amounts of data.

How is long-range forecasting different from traditional forecasts?

The range of traditional weather forecasting typically extends to between 10 and 14-days into the future. Looking beyond this time frame is considered long-range, or long-term, forecasting; it can cover forecasts for up to 6 months ahead.

It's not possible to predict the exact temperature three weeks ahead, let alone three months ahead. Therefore, long-term forecasting is probabilistic, with a confidence measure also included in the forecasts: low, moderate, or high. In other words, it's all about 'forecasts of opportunity'. When the forecast has a high probability of occurring and also high confidence, and you can take actions based on this forecast with reduced risk. If the forecast confidence is low, and the outcomes are less specific; it's tougher to use it as a basis for decision making. However, even low confidence, less precise forecast is, in itself, useful information for decision-makers.

Why is the time now right for long-range forecasts in the offshore industry?

The concept of a 7 to 14-day forecast has been widely available for many years. As the offshore industry is

comfortable with these forecasts, organizations seeking a competitive advantage are starting to look beyond that time horizon. They want to know, as much as possible, what the weather conditions could be beyond that 7 to 14-day range.

It is now possible to obtain skillful forecasts beyond the traditional time horizon. We are at a point where increased knowledge and techniques, as well as vast amounts of data, are becoming more available to enable long-range forecasts.

What changes have enabled more robust long-range forecasting?

The change is partly because of scientific advancement and because of increased computing power. The weather experts can now analyze a range of data points. They have access to worldwide teleconnections, meteorological, oceanographical, and other environmental phenomena, which they use to inform long-range forecasts. These interactions are becoming more understood, even in a larger time frame.

How does long-range forecasting work for offshore and marine applications?

The Ensemble Prediction System (EPS) Long Range Forecast usually contains three figures with wind and waves (precipitation, swells, and cloud are optional). The graph below shows the ensemble prediction from the ECMWF-model (the grey area) as well as the operational outcome from ECMWF (the red line), UKMO (the yellow line), NCEP (the blue line) and our model Meteo (black line). The Meteo forecast is a combination of several models, filtering for nearshore effects and contains the input of the meteorologist (black line in the graphs). The EPS Long Range Forecast shows a forecast for the coming 15 days.

Complex mathematical equations that describe the physical processes in the atmosphere, along with initial weather conditions, are used to compute how the weather is most likely to change in the atmosphere over the next weeks.

EPS forecasts are a handy tool for planning and decision making; they can be particularly useful when used alongside regular deterministic forecasts. Uncertainty in projections

increases with the duration of the forecast; that is why the EPS forecasts help you to determine the forecast confidence level over a given time. The EPS Long Range Forecast is an ensemble of 50 separate model runs from the ECMWF model compared with their operational forecast. These 50 model runs all start with slightly different initial weather conditions to analyze the effect of different starting values.

The red line in the graph shows the operational run of the ECMWF-model. The grey area indicates 80% of the 50 runs of the ECMWF-model. The highest five and lowest five runs (20%) are not included in the grey area. This grey area will normally plume wider with increasing forecast time. The wider the plume (vertical range) of the grey area, the lower the confidence level in the forecast.

The black line (Meteo) shows the best possible forecast for the location. This Meteo forecast is a combination of several models. In addition, nearshore effects are included, as well as the input of the experienced meteorologists in the weather room. The blue line is the operational run from the American National Centers for Environmental Prediction, and the yellow line is the operational run from the UK Met Office.

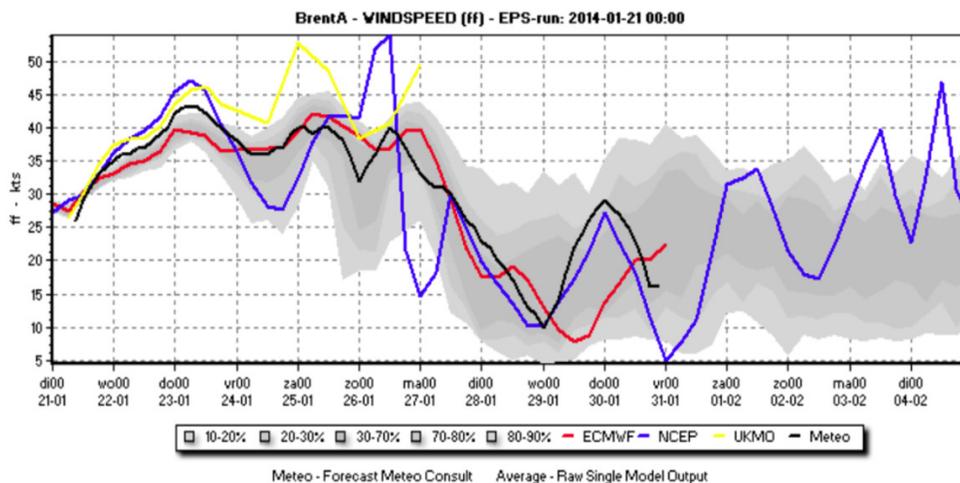


Figure 1 – Wind speeds in knots

How can offshore companies utilize EPS long-range forecasts?

EPS Long-Range Forecasts are particularly useful for planning purposes and risk management. This forecast provides additional value alongside a regular deterministic forecast. A deterministic forecast will state, for example, the wind speed and direction for a given time, e.g., 270 degrees and 23 knots at 12UTC on 22nd January. Still, when planning an operation, the tabular forecast does not give you a good sense of the confidence that the winds will remain below your limit of, for example, 25knots. That is where the EPS graph comes into play. By referring to the EPS graphs, you can then see what the probability is for the winds to stay below your limit of 25 knots and therefore aids decision making and planning.

How to choose a reliable long-range forecast provider?

It's crucial to join forces with a weather company that has specialist experience in the offshore industry, to access the benefits of long-range forecasting. Ask for information on how their forecasts are made. If no insight is available, alarm bells should ring.

Many free websites, for example, are offering all kinds of long-range prognoses. But they do not give any insight into how forecasts were created, or explain how these forecasts are verified.

Here are seven characteristics to look for in your forecast provider:

1. Clear insight into global correlations

Fundamentally, long-range forecasts require knowledge and skills in the drivers and teleconnections that influence the weather. These include relationships between atmospheric, oceanographic, and other physical phenomena.

For example, sea surface temperatures in the southern hemisphere can affect the large-scale air pressure patterns in the northern hemisphere. What happens in the higher layers of air around the North Pole might (after a few weeks) bring a severe cold spell to the USA, Europe, and northern Asia.

Discovering, identifying, and continuously learning about how different global weather patterns interact is of great importance for increased predictability and skillful forecasts, rather than just relying on the computer model output. When choosing a provider, consider the extent to which they have this knowledge and can exhibit it.

2. Database of historical weather observations and re-analysis.

Observations are crucial for dependable long-range forecasts. Suppose that ENSO (El Niño Southern Oscillation) is currently very active, which means warmer than average sea waters over a large portion of the central and eastern Tropical Pacific. Having a database of climate index values allows meteorologists to search for similar occurrences in the past. Having a visualization tool enables them to create a probability distribution map of how El Niño typically influences global weather patterns. A sophisticated

tool also allows them to analyze the combined result of El Niño, and other teleconnection patterns, such as the North Atlantic Sea Surface Temperatures.

If several teleconnection patterns suggest similar climate anomalies are likely in your area of interest, then forecast confidence can increase. Creating skillful statistical forecasts based on previous data is a robust methodology for enhancing long-range weather forecasts. A reliable and extensive re-analysis database is vital if a provider's ambition is to provide reliable long-range forecasts.

3. Calibration of model data

If a provider is serious about long-range forecasting, they need model information. Each reputable supplier will run or purchase a numerical weather model as a starting point for long-term predictions. Correct observations and continuous refinement are crucial to run a useful model. More sophisticated providers will create their own model mix, crafting an effective combination of multiple models. In other words, they create a statistically optimized combination, which generates the most reliable outcomes.

The best suppliers calibrate their purchased models, meaning they are analyzing the past performance of the model, and add corrections to make it more accurate for future predictions by removing biases, etc. They look back over previous data in and compare it to what really happened. This process is designed to ensure that they can be confident in forecasts that they make. It's a 'reliable' calibration, making sure the forecast probabilities are correct.

4. Working with probabilities

When setting a weather forecast for the next three days, you can talk about the expected highs and lows. If you look at 15-days from now, realistically, you'll only be able to talk about trends and opportunities. A long-range forecast is, therefore, embedded into opportunities; it offers an indication where the possible disruptions may be found.

The extent to which a chance can come true varies. An experienced provider, therefore, links a confidence measure to the long-range forecast, for example: low, medium, high. After all, there is something to be said about reliability. The probability of the forecast coming true depends, among other things:

- The number of model options that choose a particular direction
- The extent to which they do so
- The extent to which different teleconnections show the same trends
- The succession of weather events (worldwide) has occurred more often in history
- The season in which we find ourselves.

5. Provide meteorological support to your organization

Check the provider can support your decision making, with expert guidance provided by meteorologists. Establish whether they can communicate the complete weather story to you, including the most likely scenarios, the critical impacts expected, and the risks and confidence level.

6. Skill

Any self-respecting provider of long-term forecasts will be able to demonstrate the skill of the method used. This information will clarify to what extent the forecasts will be useful. If in doubt, ask for verifications.

7. Quantifiable experience in working with offshore organizations

In addition to the previous six characteristics, verify the weather organization's offshore and marine credentials. Establish whether:

- Does the supplier understand the intricacies and complexities of forecasting for different offshore locations around the globe?
- Are they able to tailor forecast information to your risk profile, location, and project priorities?
- Do they have a track record in developing weather models and products specifically for the offshore industry?

To find out more about long-range forecasting in the offshore industry, download our guide - How to use - EPS long-range forecasting.