

# Providing a window on the weather



The edge of an approaching 40-knot squall in Mauritania

*The increasing accuracy of weather forecasting, and the addition of specialised services, has led to it playing an ever more important role in the offshore oil and gas industry. Even more so, thanks to greater awareness that advanced knowledge of wind and wave conditions leads to safer, more efficient offshore operations, and, potentially, enormous cost savings. Trevor Pitt and Rob Cowle, Forecasting Managers at Fugro GEOS,\* explain.*

**T**he demand for tropical cyclone charts, swell forecasts, squall forecasts and forecasts covering weather sensitive tasks such as heavy lifts, installation of an FPSO (floating

production, storage and offloading vessel) or crew transfers is continually increasing as their worth is realised by the industry.

Weather forecast usage in the

industry ranges from project planning, when initial consultation can indicate weather expectations, to real-time forecast information. A typical service can also include the supply of on-site forecasters for exploration drilling rigs, FPSOs, seismic and survey vessels, pipeline and construction barges, and cable installation and repair vessels.

Time lost offshore for unexpected weather events can be frustrating and expensive. Weather forecasts have been part of a standard requirement for all offshore operations and Fugro GEOS has been supplying standard marine weather forecasts to the offshore oil and gas industry for many years, the quality of which continues to improve. However, in addition to these standard forecasts, there are other environmental factors that have to be considered and new services covering each of these factors are proving crucial to clients.

Safety is very much in the mind of companies working in the offshore oil industry. Weather forecasts have traditionally consisted of a table of weather parameters for specific points in time and, perhaps, a graphical representation of selected variables. The users of these forecasts scan and compare the forecast values to their own operating criteria to decide if the forecast weather conditions will impact on their planned operations.

This approach works if a particular operation depends on just one weather element. However, if an operation is dependent on multiple weather elements, the process of comparing the forecast to the operating criteria can be quite tedious and prone to errors. As a result, access to expert knowledge is now viewed as essential.

With this in mind, Fugro GEOS devel-



Weather forecasters identified the weather window during the towage and installation of a topside in the Caspian Sea

oped the Operational Safety Forecast (OSF), which has been designed specifically for operations that are dependent on multiple weather elements. It provides the user with an easy to understand representation on how the weather forecast will affect one or many varied planned operations.

## Vital for heavy lift operations

Take the case of a heavy lift operation where the barge's response to the wave conditions is varied. It may be able to continue operations with a significant wave height below 2 metres if the period is less than 8 seconds, but only below 1.5 metres if the wave period is above 8 seconds. In addition, these criteria may only be applicable with the waves coming from a certain direction.

Looking through the forecast to identify non-operational conditions based on the above criteria can be prone to error, taking both time and effort. The OSF will take all these criteria into consideration and provide the user with a colour-coded timeline showing when the lifting operation can proceed, when it would be marginal, and when the weather conditions will exceed the criteria during the whole forecast period.

The OSF is used for multiple operations based on the same forecast – the user merely names the operations that are planned, along with their safe weather limits, and the OSF does the rest. The results for all operations are displayed in a single graphic so that dependant operations can also be compared. For example, crew transfers by basket may be able to proceed, but become a pointless exercise if a vessel cannot come alongside because the weather conditions are forecast to exceed the safe criteria.

Vessel motion response is well understood by marine engineers and designers, but the weak link has always been in the use and understanding of complex spectral swell forecast data generated directly from global wave models. Fugro GEOS forecasters routinely provide both raw and modified spectral wave data for their clients in the offshore construction industry around the world. Essentially, the latest global or nested wave models generate the spectral wave data used for the forecast. The data depicts the energy of all the swell waves present in the ocean at any particular point or time. These data can then be sub-analysed into specific wave trains from all compass directions and input into the vessel motion response, with a prediction of the motion being generated.

By altering the vessel's orientation



The offshore safety forecast showed 'green' conditions throughout the deployment of the concrete gravity structure in Sakhalin

and its internal ballast state, based on the supplied swell data, the motion of the vessel can be minimised over the forecast period. This ensures maximum utilisation of the asset.

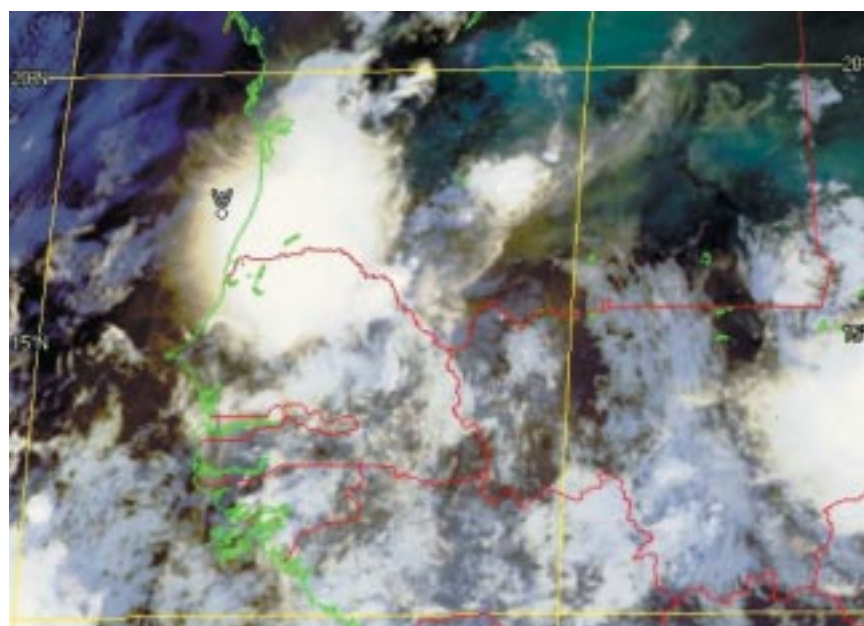
The weather models usually update the data twice daily and this allows fine-tuning of the vessel's motion state to be made. The forecasting technique is applicable to all sea areas, but has proved most successful in locations where long period swells are the prevalent swell energy, such as offshore Angola, Congo and Nigeria. For the best interpretation of the data, and for constant updates and comparison of wave buoy data, a forecaster should be present on-site – although remote fore-

casting is undertaken for less weather sensitive operations.

## Squall warnings save downtime

Unexpected or un-forecasted winds from squalls in the tropics are extremely hazardous. Accurate forecasting of these squalls requires a higher level of forecaster involvement compared to other forecasting services. For this reason, Fugro GEOS has recently put a high-level squall warning service in operation to help assets in these squall prone areas. The system was used during drilling

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Satellite image of a squall over Mauritania

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operations off the coast of Mauritania, predicting and monitoring five squalls during the initial two weeks of the service. This was vital as drilling was in extremely shallow water of about 300 metres – if strong winds had shifted the vessel by more than 5 metres, expensive damage would have been caused to the riser and the subsea assets.

The aim of the squall warning service is to establish a system that provides a minimum of three hours between updates and a six-hour warning of the threat of a serious squall. It is essential that a 24/7 watch is maintained on the satellite images. From interpretation of these images, Fugro GEOS set up a three-tiered warning system:

- Green for 'keep working'.
- Amber for 'risk that we will have to stop working'. These reports are updated at two-hour intervals.
- Red squall warning for 'make suitable preparations for the squall'. In this latter instance, the warnings are updated hourly.

All warnings provide details of the storm, its direction and most likely intensity. The system has proved to work well in practice off the coast of Mauritania. It is considered ideal for projects of a highly weather sensitive nature, especially drilling rigs and FPSOs off the coast of West Africa that are affected by seasonal squalls.

## Tropical cyclone charts

The biggest impact on production operations comes from tropical cyclones. Shutdowns impact operating companies severely, incurring costs associated with deferral of production, transportation of crews to safety and back, downtime for damage assessment, and the costs of facility repairs prior to resuming safe operations. Improved storm forecasts can potentially save several days of production shutdown for companies operating offshore. Fugro GEOS' clients now benefit from customised tropical cyclone charts that are supplied with their weather forecasts, specific to their location.

These charts provide track warnings of any type of tropical cyclone in relation to the client's location. All details of the tropical storm are supplied and warning radii are in line with the client's Emergency Response Plan (ERP).

As the offshore industry continues on its quest for safety during operations and ever-greater cost efficiency, specialist weather forecasting has a proven and ever-increasing role to play. ●

*\*Fugro GEOS has forecasting centres in Kuala Lumpur, Singapore, Abu Dhabi and at its head office at Wallingford, UK.*

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