

CLIMATOLOGY

At the present time, a number of companies maintain databanks of sea and meteo-oceanic conditions worldwide.

The sea state data are based on altimeter measurements from Geosat, Topex-Poseidon and ERS and on wave spectra extracted from SAR wave mode data.

They are often supported by additional data from wave buoys, meteorological records and ship based observations.



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Applications of such products include:

- ☞ preliminary surveys for construction projects
- ☞ wave energy resource studies
- ☞ coastal defence planning

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Marine warranty and Insurance companies:

50 years extremal values of sea state are required for vessels working in specific areas.

statistics on the 100 years extreme values are required for structures liable to be operating for longer periods.

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Off shore drilling:

A major use of sea state climatology data is in the development of a mooring strategy for connection of oil tankers to "riser" pipes.

The knowledge of sea state climatology permits to develop an optimal production and distribution strategy.

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Climatological systems have been developed in Europe, using Geosat, Topex-Poseidon and ERS data.

Wavsat: developed by Satellite Observing System

Cliosat: wave climatology service provided by MeteoMer and developed in conjunction with IFREMER.

Data assimilation in wave models

ERS data assimilation in real time represents a major tool for wave modelling and forecasting.

There are a number of investigations currently underway on the assimilation of SAR wave mode data into wave forecasting models.

ERS data are used to provide continual corrections to the model input as

- initial conditions
- boundary conditions

Re-running of the model will implement such corrections.

Data assimilation in wave models

The principal mechanisms affecting the wave evolution are:

- ☞ non-linear wave-wave interactions
- ☞ energy transfer from atmosphere
- ☞ energy dissipation

Modelling such phenomena is computationally intensive and requires considerable resources.

(Using machines such as the Cray YMP or the CYBER-205, processing time is of the order of 2-3 hours).

Data assimilation in wave models

The majority of wave prediction providers are using some forms of the WAM model developed in preparation for the launch of ERS-1.

This is a third generation wave model, based on the physical theories of wave evolution, which solves an action balance equation to determine how the wave energy evolves as a function of frequency, wavenumber, position and time.

Data assimilation in wave models

Sea state forecasts during lifting operations

In order to ensure personnel safety and to minimise the likelihood of damage, offshore heavy lifting operations can be carried out if:

- wave height remains at a reasonable amplitude
- period of local swell is different from the natural periods of the vessels involved

Decisions must be based on accurate short and medium term sea state forecasts.

Data assimilation in wave models

A demonstration project was carried out by Delft Hydraulics to provide sea state forecasts to an offshore engineering company

PHIDIAS : WAM based on wave modelling and sea state forecasting system that is currently undergoing a migration towards full operational use.

data source : UKMO for wind fields

ERS FD ALT products and

ERS FD SWM products for wave input

Data assimilation in wave models

There are other modelling processes as well as WAM, second generation wave models, but they do not utilise ERS data in an operational manner.

The main alternative to the WAM modelling philosophy is to provide time series data for a particular point of the ocean. This is implemented on the Integrated Swell Forecasting System developed by MeteoMer and IFREMER.

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Sea state hindcasting:

- provision of sea state and weather conditions at particular location and specific time (\Rightarrow *insurance investigations*)
- production of climatological parameters for construction, surveying and research.

Previously, hindcasts and forecasts information were unavailable outside the main shipping routes, only places where detailed measurements have been carried out and gathered in atlases.

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Large scale engineering works are carried out in the world oceans throughout the year.

Accurate meteo-oceanic forecasts are a key factor of these projects as such operations must be carried out successfully and safely .

⇒ real time ERS measurements provide the possibility of refinement of meteo-oceanic forecasts for offshore operations.

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