

BMT ARGOSS

Metocean Capabilities

Martin Williams FIMarEST, CMarSci
Senior Metocean Specialist



BMT Group Ltd

- Parent company to BMT ARGOSS
- International network of subsidiaries providing engineering, design and risk management consultancy
- Formed in 1985 through government privatisation of British Ship Research Association (BSRA) and National Maritime Institute (NMI)
- Heritage of research and technology and ongoing investment in R&D £150 million turnover
- Employee Benefit Trust set-up in 1998, profits distributed to staff
- 24 subsidiary companies in Europe, North America and Asia with over 60 offices worldwide = 1,300 staff

BMT provides consultancy services in the below sectors:

- Defence
- Marine Risk & Insurance
- Maritime Transport
- Ports and Logistics
- Energy and Environment

and does so globally



BMT ARGOSS (www.bmtargoss.com)

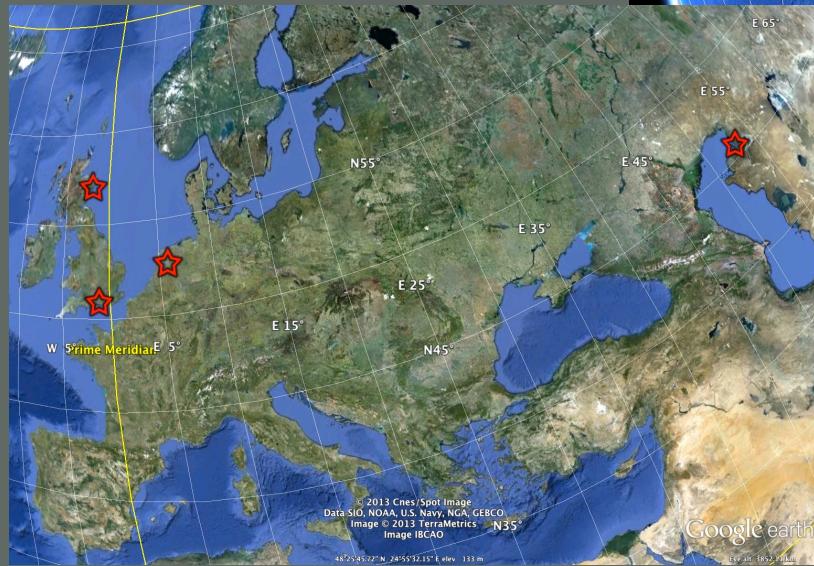
Specialist provider of Metocean, Environmental and Maritime Information Systems, services and consultancy GLOBALLY

- Metocean services and consultancy
- Weather forecasting
- Vessel maneuvering and performance Systems
- Port and waterway design and feasibility consultancy services
- LRQA 9001 certificated

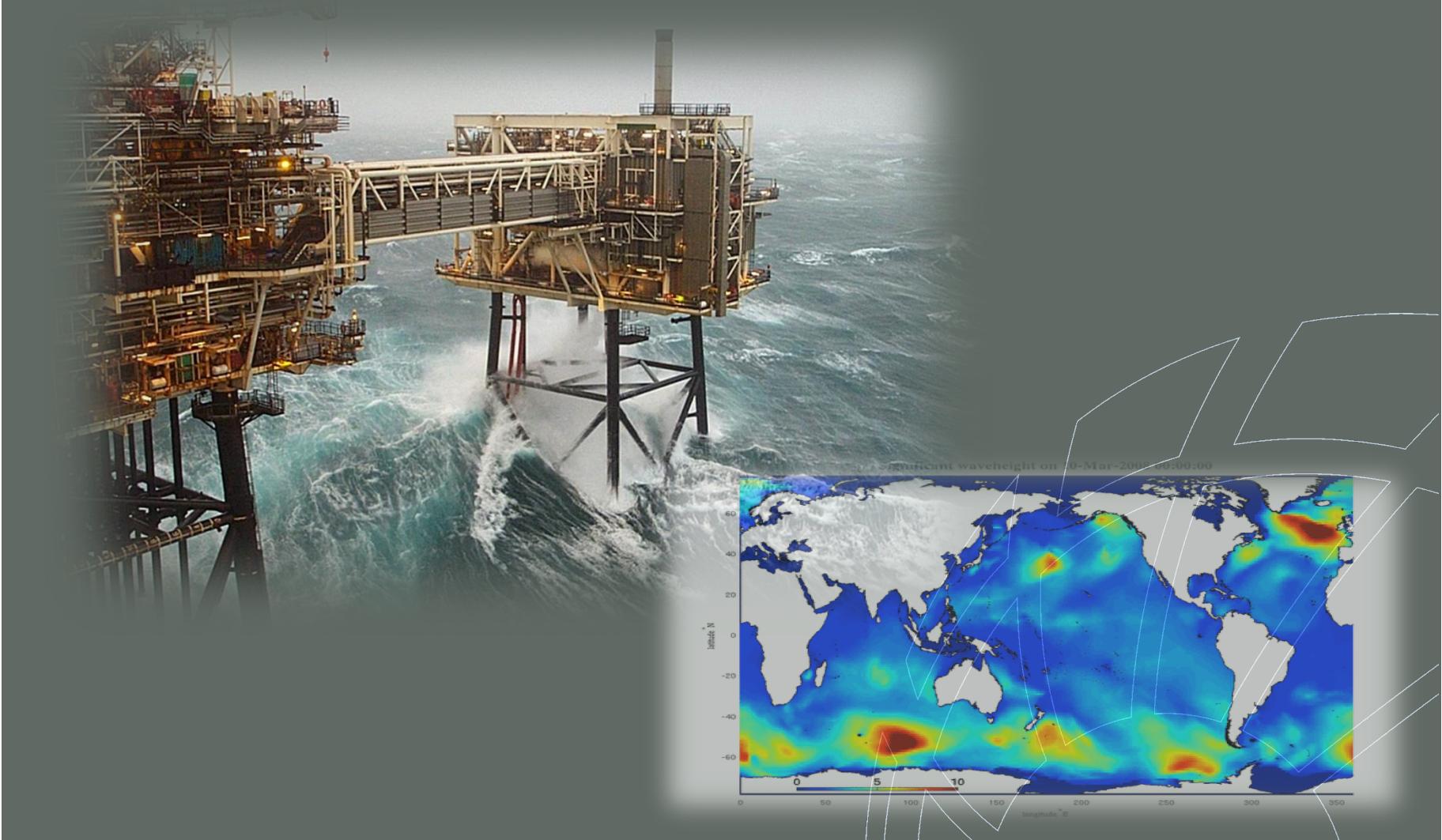


BMT ARGOSS – Office Locations

- Marknesse, The Netherlands
- Fareham, UK
- Aberdeen, UK
- Kuala Lumpur, Malaysia
- Perth, WA
- Jakarta, Indonesia
- Atyrau, Kazakhstan



Metocean Services



Providing metocean support to...

Engineering design



- Feasibility/concept
- FEED
- Detailed design
- MATLAB toolboxes
- ISO 19901-1 compliant
- Floater, fixed structures, pipes, turbines, coastal etc

Operations planning



- Weather sensitive ops
- Downtime/delay assessment
- Multi-parameter thresholds
- 20 years of continuous data

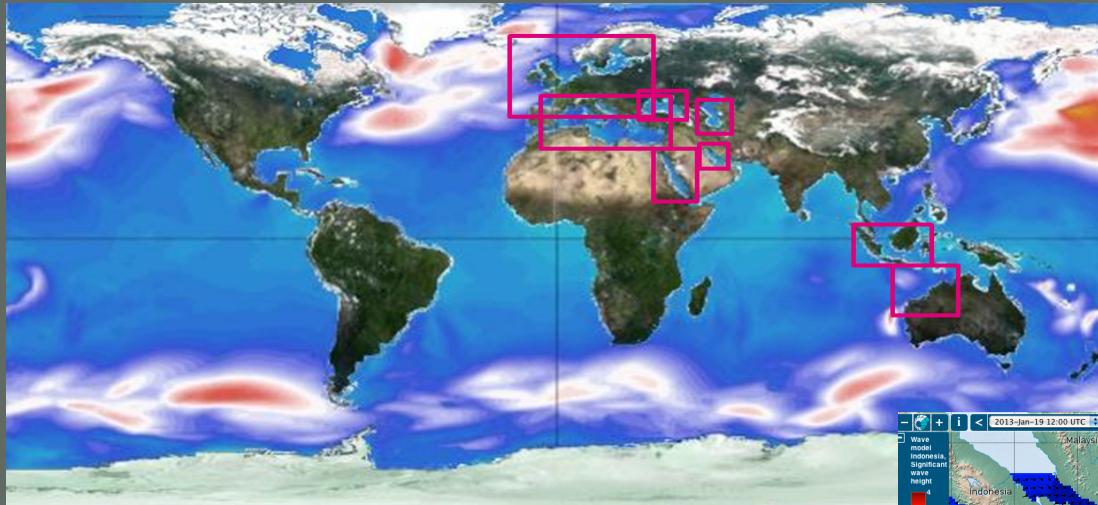
Marine transportation



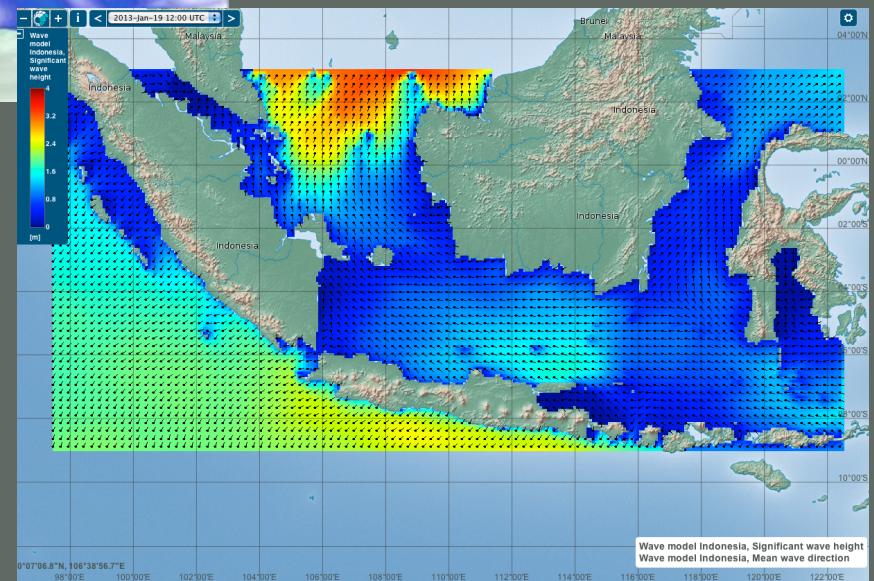
- Route planning
- Seafastening criteria
 - ✓ Fatigue
 - ✓ Adjusted extremes
- Safe havens
- Piracy!

PLUS: Data provision, R&D

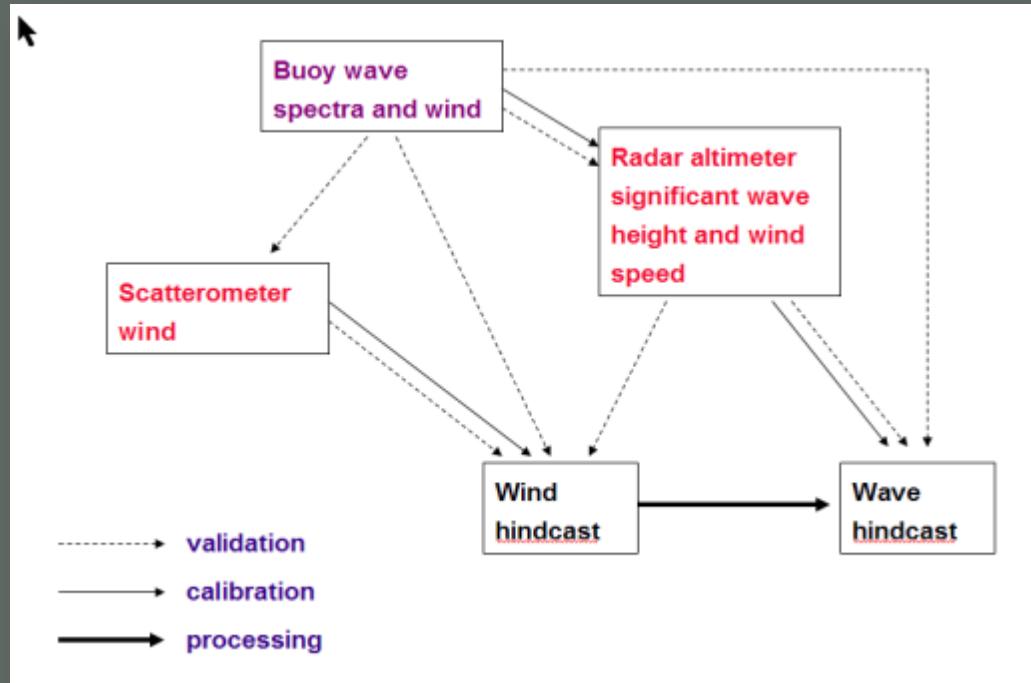
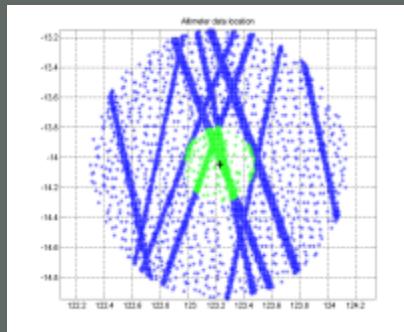
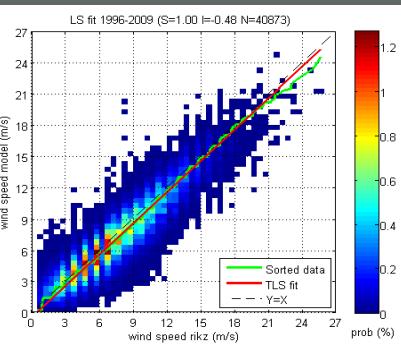
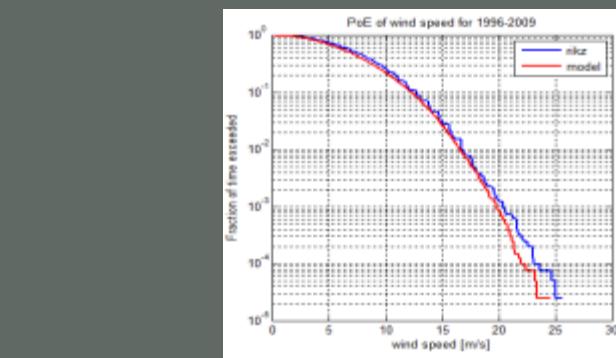
Wind/wave modelling – hindcast and forecast



- Global ($1.00^\circ \times 1.25^\circ$) and regional wave models down to approx 5' (SE Asia)
 - WWIII code
 - NCEP and ECMWF
 - Quality validated with remote sensing data
 - 3 Hourly data available (1992 onwards)
 - 2-D spectra
- Dedicated set up when required
- 3rd party data when appropriate



Wind/wave modelling - quality control



- Model data compared to coincident and co-located altimeter (winds and waves) and scatterometer observations (winds)
- Satellite observations validated against buoys – US, Pacific and UK shelf
- Additional validation in accordance with ISO 19901-1
- **MEASUREMENTS**

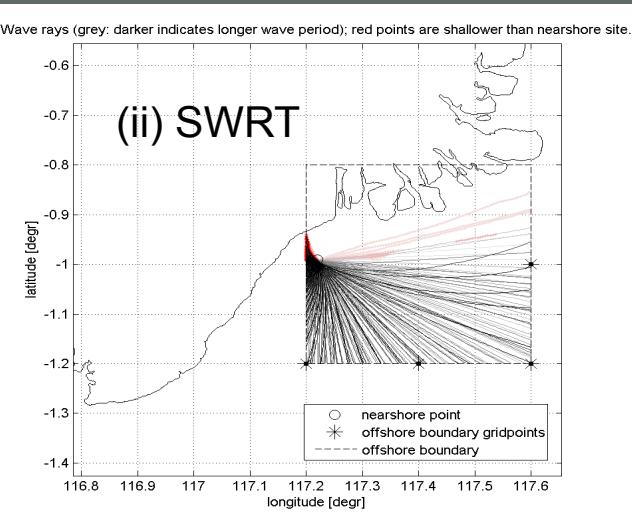
Nearshore wave modelling

Complexity = precision = time = cost

(i) Simple e.g.
SMB, ACES
etc

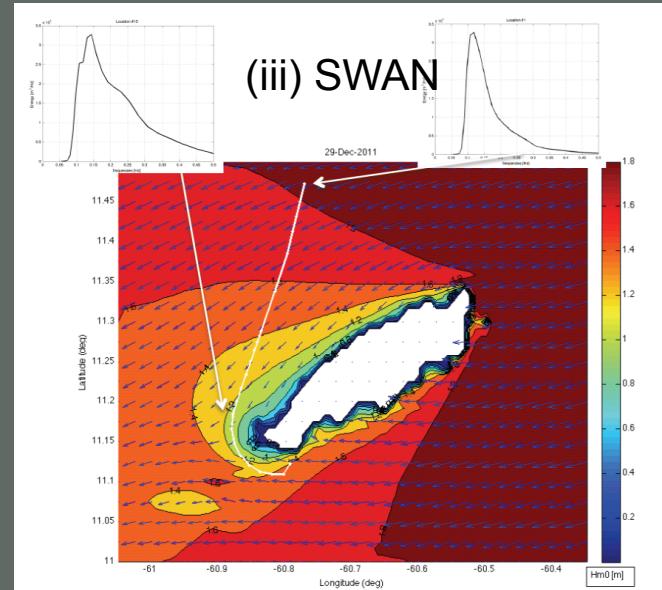


Wind wave growth
only based on fetch
and duration



- Wave ray tracing applied to discrete spectral frequencies and propagation directions
- Refraction, shoaling, breaking and sheltering
- Quick to run

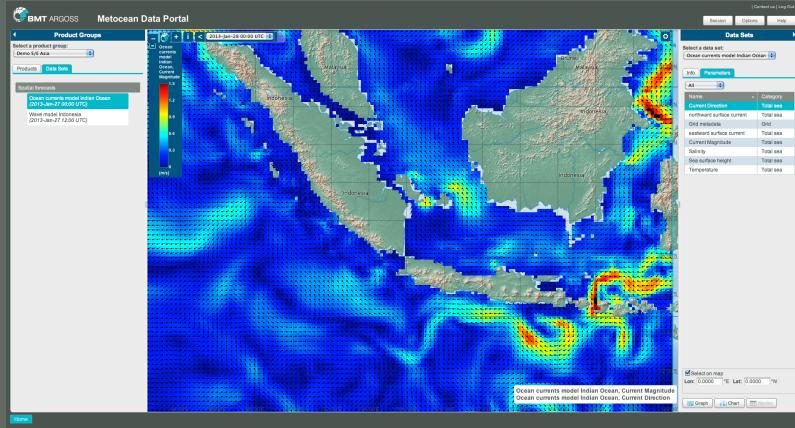
PLUS MEASUREMENTS



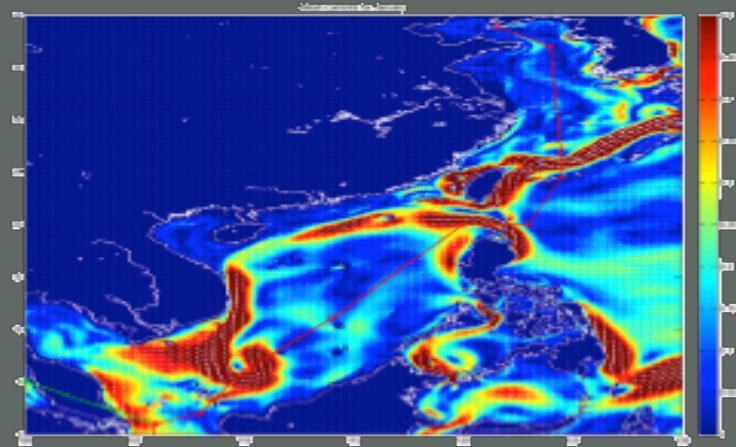
- Wave action balance
- Refraction, shoaling, breaking, white capping, blocking, bottom friction, wave-wave, wave-current
- Flexible grid; stationary transformation function or instationary time series

Ocean (non-tidal) currents - high resolution information

FORECAST



HISTORIC



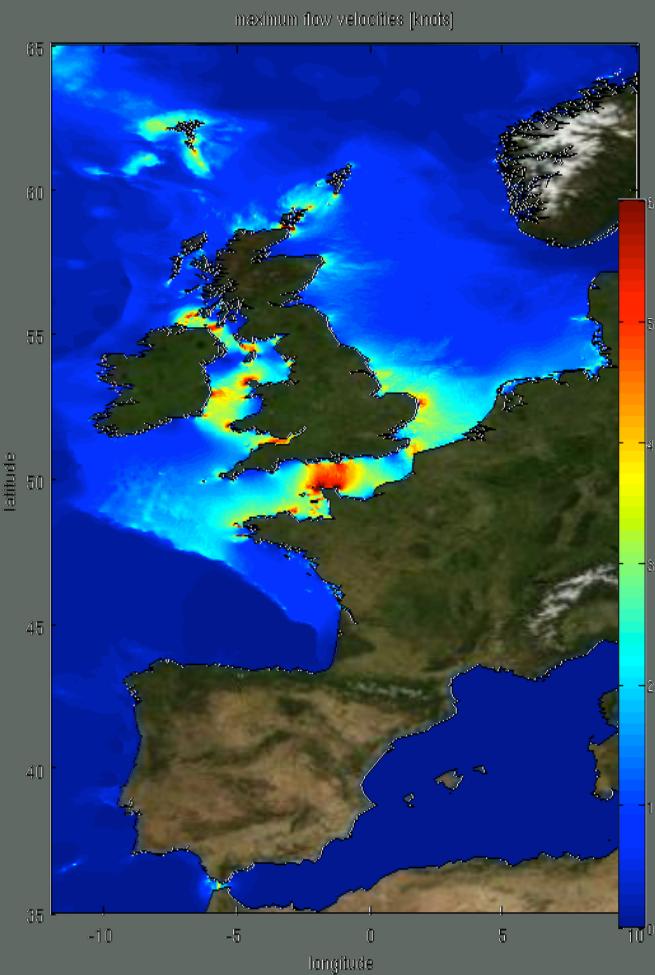
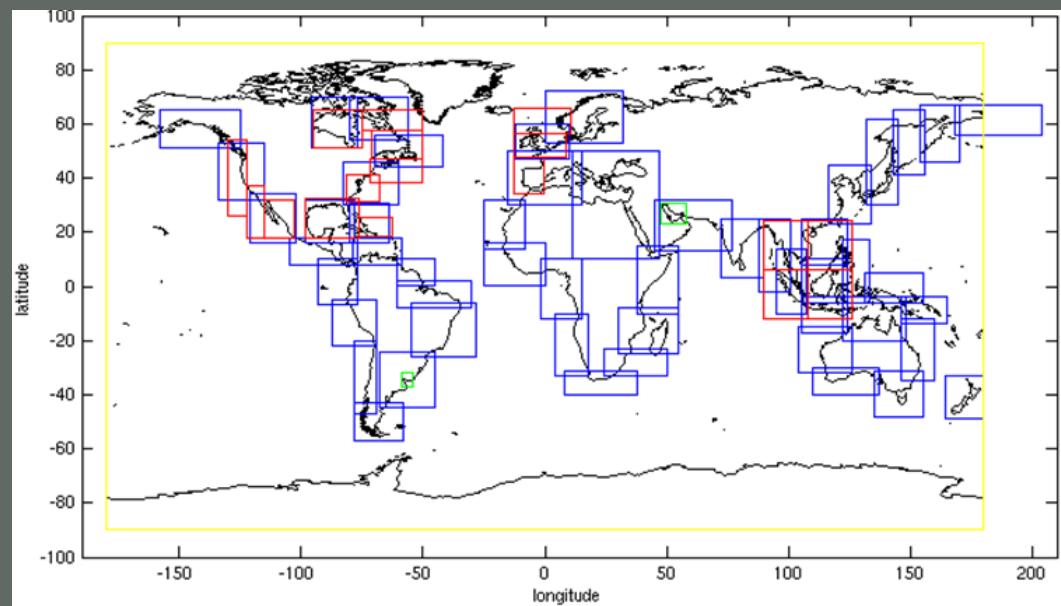
- MyOcean (www.myocean.eu)
- EU project (29 countries)
- Global forecast currents
 - 7 days, update daily
 - $1/4^\circ$ ($1/6^\circ$??) spatial resolution
 - 43 levels (0-5,500 m)
- HYCOM (www.hycom.org)
- US-led project (GODAE/NOPP), 29 partners
- Archived data:
 - Daily means
 - $1/12^\circ$ spatial resolution
 - 45 levels
 - 2003 to date

PLUS MEASUREMENTS

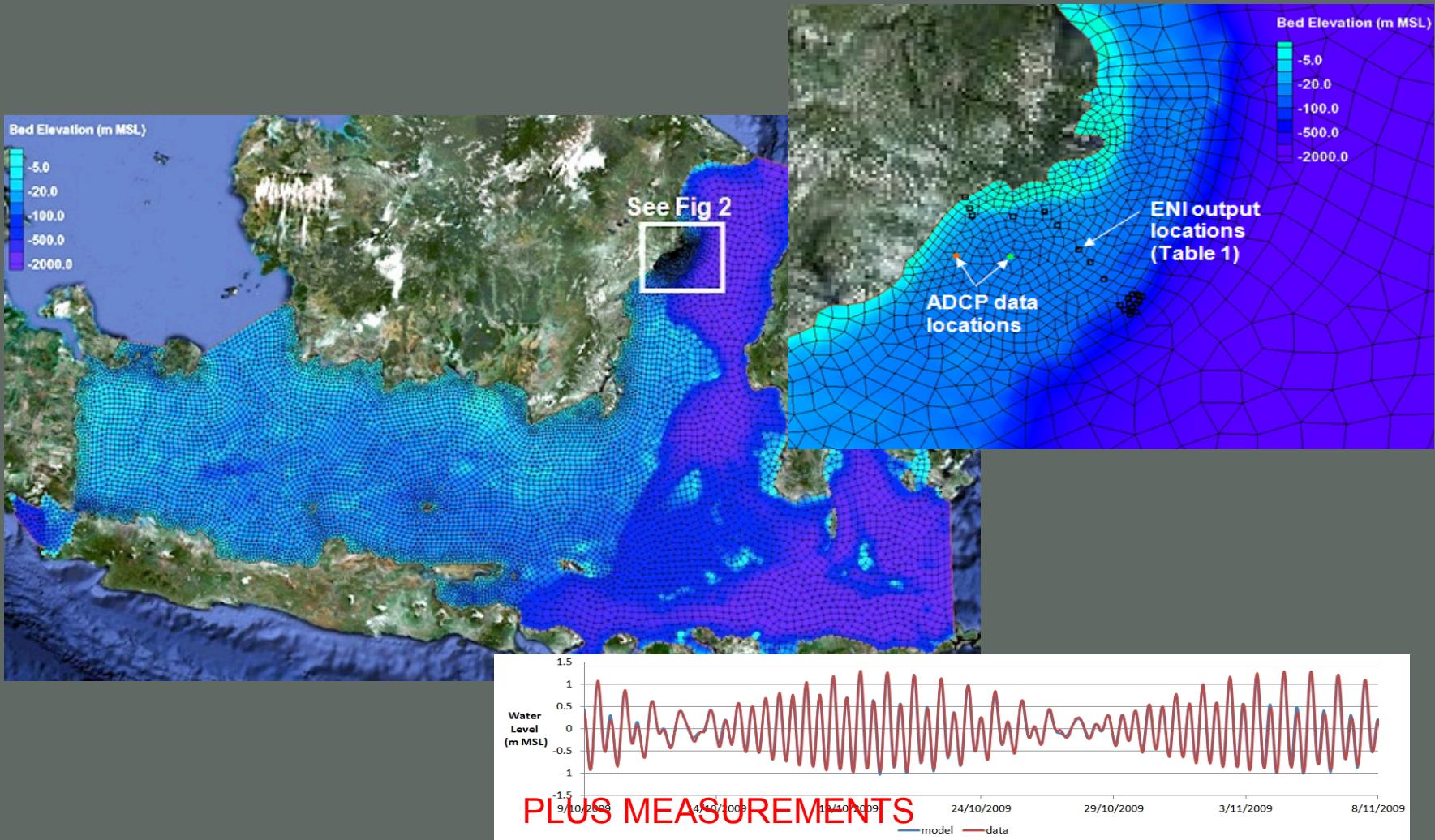
Tidal current and elevation modelling

Global high resolution tide database

- Depth averaged tidal model and integration of 5000+ tidal stations and over 20 years of satellite measurements
- Spatial resolution globally 4', regionally up to 1' (EU, US, Indonesia and P. Gulf)

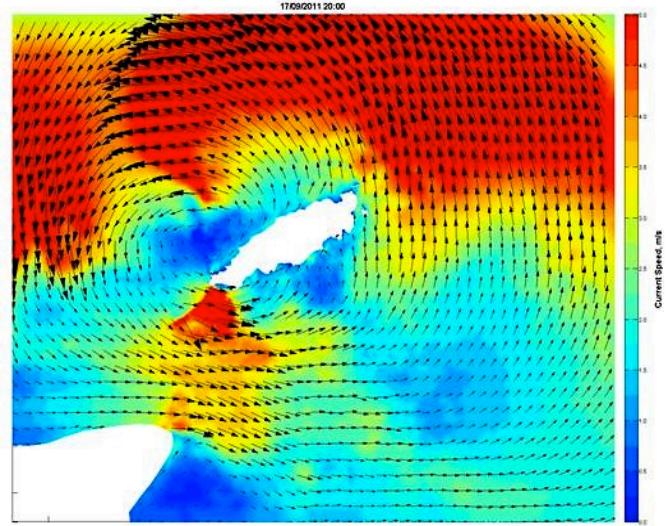
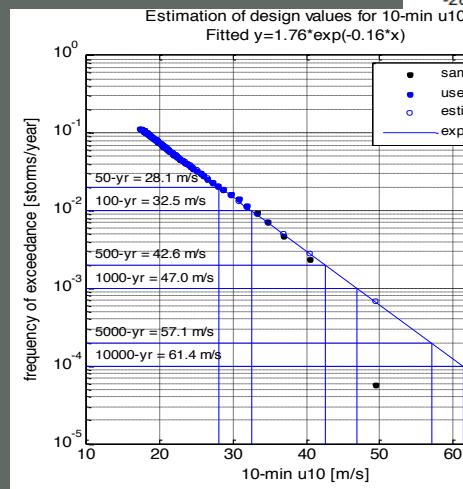
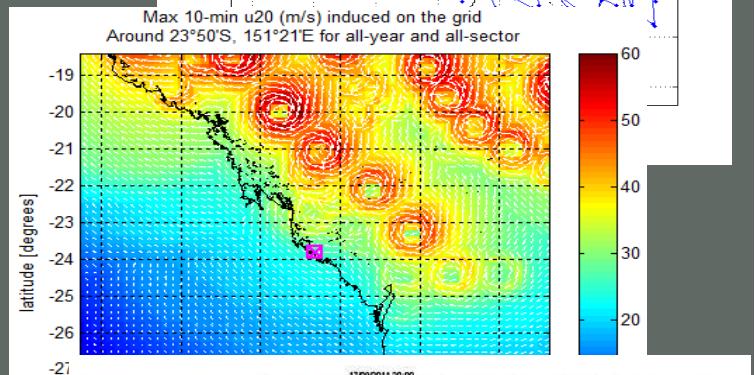
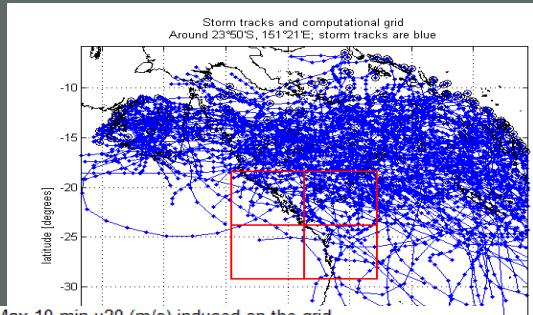


Coastal hydrodynamic modelling – TUFLOW



Tropical revolving storms

- GTECCA best track data (1972-2011)
- Parametric model to find max wind per storm on predefined grid
 - Increase sample population
 - Classify severity per month
 - Spatial pattern
 - Coverage over time
- Fit to highest ensemble samples
- $H_s = u_{10} * 0.25$
- SWAN for nearshore waves
- TUFLOW for currents
- WRF for winds?



Web-based data services

- Winds and waves
- Satellite or hindcast data
- Time series, stats and persistence
- Voucher system
- Rapid, preliminary appraisal

Waveclimate.com

Offshore Location: 19° 09' S, 104° 47' E. Size of offshore area for satellite data: 200x200 km. Results will come from the demo site.

Grid points wave model

Location: 15 deg 0 min South 194 deg 47 min East 208 km. Zoom in: 1. View chart: Grid points wave model. Data are taken from: Wavemodel computations. Update map. OK. Reset.

Waveclimate.com

Offshore Location: 63° 00' N, 20° 00' W. Size of area for satellite data: 200x200 km. Results will come from the demo site!

Offshore model point: 63° 00' N, 20° 00' W.

Output Type: Variable Input: Select the variable to show. Type of Display: For each month you will see. Data Source: Select the offshore data source.

Monthly Statistics: Wave height Wind speed Relative distribution (table) Wavemode computations Satellite observations

Season Selection: If this is unchecked, all year will be chosen. Hold CRTL on your keyboard to select multiple months. Output Options: Rose instead of 2D scatter table 1x Write all monthly 2D scatter tables at once to one output page (including in year).

Output Type: Variable Input: Select the variable to show. Spectrum: Select part of the spectrum to use for wave parameters. Data Source: Select the offshore data source.

Histogram: Wave height Mean wave period Peak wave period Peak wave direction Wind speed Wavemode computations Satellite observations

Scatter Table 2D: Wave height vs. direction Wave height vs. mean period Wave height vs. zero-crossing period Wave height vs. peak period Wave height vs. wind speed Wind speed vs. direction Total Wind Sea Swell

Scatter Table 3D: Wave height, mean period, wave direction Wave height, zero-crossing period, wave direction Wave height, peak period, wave direction Wave height, wind direction Wave height, mean period, wind speed Wave height, zero-crossing period, wind speed Wave height, peak period, wind speed Total Wind Sea Swell

Output Options: Select the offshore data source. Wavemode computations only available data source. OK. Reset.

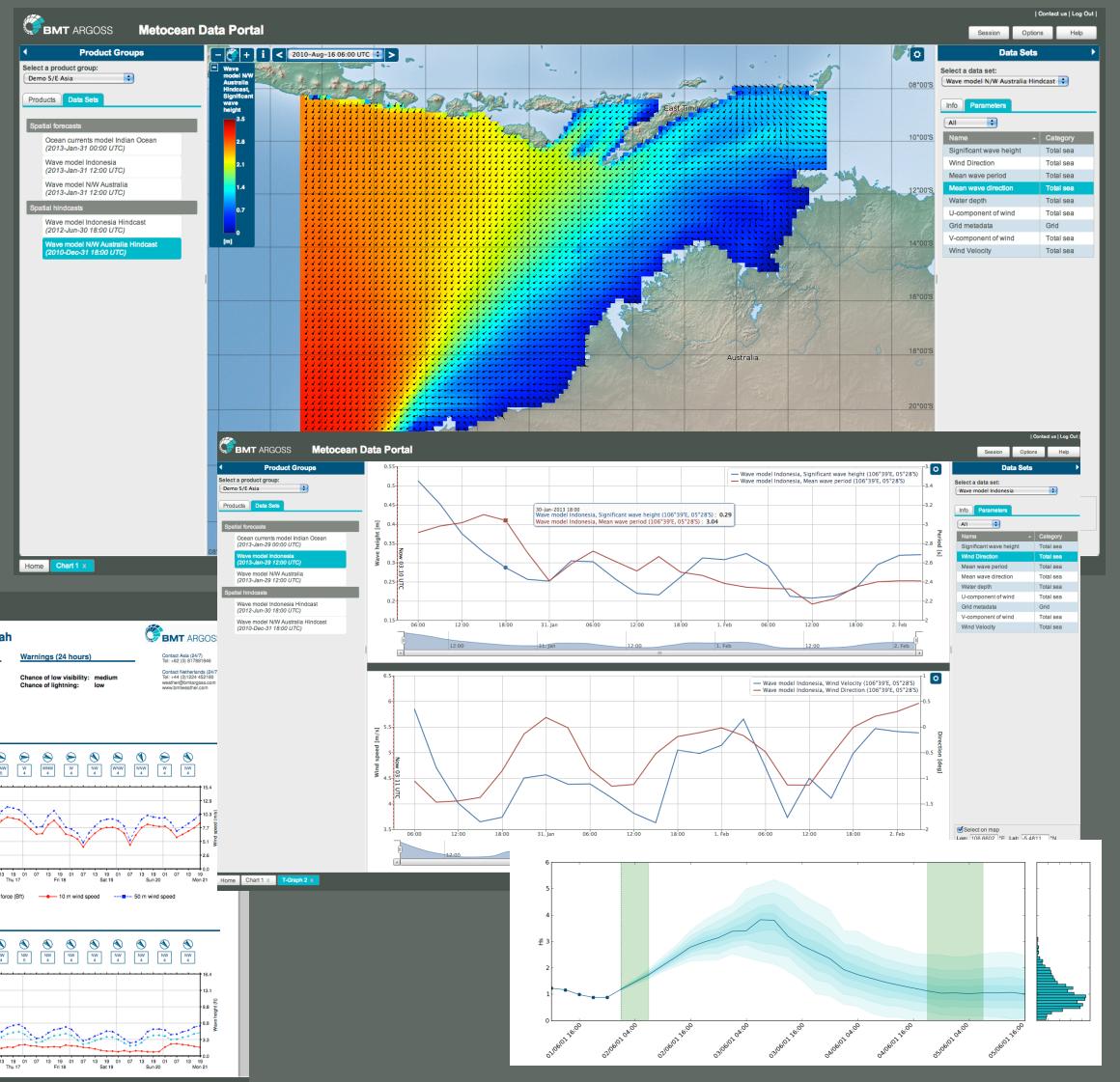
Offshore Location: Climate Normandie. Scatter table 3D. Iter table 3D. Download the 1D scatter table. Percentage of occurrence of wave height (m) in rows versus mean wave period (s) in columns.

	lower	0.0	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2	7.6	8.0	8.4	8.8	9.2	9.6	10.0	10.4	10.8	11.2	11.6	12.0	12.4	12.8	13.2	13.6	14.0	14.4	14.8	15.2	15.6	16.0	16.4	16.8	17.2	17.6	18.0	18.4	18.8	19.2	19.6	19.8	20.0	20.4	20.8	21.2	21.6	22.0	22.4	22.8	23.2	23.6	24.0	24.4	24.8	25.2	25.6	26.0	26.4	26.8	27.2	27.6	28.0	28.4	28.8	29.2	29.6	29.8	30.0	30.4	30.8	31.2	31.6	32.0	32.4	32.8	33.2	33.6	34.0	34.4	34.8	35.2	35.6	36.0	36.4	36.8	37.2	37.6	38.0	38.4	38.8	39.2	39.6	40.0	40.4	40.8	41.2	41.6	42.0	42.4	42.8	43.2	43.6	44.0	44.4	44.8	45.2	45.6	46.0	46.4	46.8	47.2	47.6	48.0	48.4	48.8	49.2	49.6	50.0	50.4	50.8	51.2	51.6	52.0	52.4	52.8	53.2	53.6	54.0	54.4	54.8	55.2	55.6	56.0	56.4	56.8	57.2	57.6	58.0	58.4	58.8	59.2	59.6	60.0	60.4	60.8	61.2	61.6	62.0	62.4	62.8	63.2	63.6	64.0	64.4	64.8	65.2	65.6	66.0	66.4	66.8	67.2	67.6	68.0	68.4	68.8	69.2	69.6	70.0	70.4	70.8	71.2	71.6	72.0	72.4	72.8	73.2	73.6	74.0	74.4	74.8	75.2	75.6	76.0	76.4	76.8	77.2	77.6	78.0	78.4	78.8	79.2	79.6	80.0	80.4	80.8	81.2	81.6	82.0	82.4	82.8	83.2	83.6	84.0	84.4	84.8	85.2	85.6	86.0	86.4	86.8	87.2	87.6	88.0	88.4	88.8	89.2	89.6	90.0	90.4	90.8	91.2	91.6	92.0	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.8	97.2	97.6	98.0	98.4	98.8	99.2	99.6	100.0
lower	0.0	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2	7.6	8.0	8.4	8.8	9.2	9.6	10.0	10.4	10.8	11.2	11.6	12.0	12.4	12.8	13.2	13.6	14.0	14.4	14.8	15.2	15.6	16.0	16.4	16.8	17.2	17.6	18.0	18.4	18.8	19.2	19.6	19.8	20.0	20.4	20.8	21.2	21.6	22.0	22.4	22.8	23.2	23.6	24.0	24.4	24.8	25.2	25.6	26.0	26.4	26.8	27.2	27.6	28.0	28.4	28.8	29.2	29.6	30.0	30.4	30.8	31.2	31.6	32.0	32.4	32.8	33.2	33.6	34.0	34.4	34.8	35.2	35.6	36.0	36.4	36.8	37.2	37.6	38.0	38.4	38.8	39.2	39.6	40.0	40.4	40.8	41.2	41.6	42.0	42.4	42.8	43.2	43.6	44.0	44.4	44.8	45.2	45.6	46.0	46.4	46.8	47.2	47.6	48.0	48.4	48.8	49.2	49.6	50.0	50.4	50.8	51.2	51.6	52.0	52.4	52.8	53.2	53.6	54.0	54.4	54.8	55.2	55.6	56.0	56.4	56.8	57.2	57.6	58.0	58.4	58.8	59.2	59.6	60.0	60.4	60.8	61.2	61.6	62.0	62.4	62.8	63.2	63.6	64.0	64.4	64.8	65.2	65.6	66.0	66.4	66.8	67.2	67.6	68.0	68.4	68.8	69.2	69.6	70.0	70.4	70.8	71.2	71.6	72.0	72.4	72.8	73.2	73.6	74.0	74.4	74.8	75.2	75.6	76.0	76.4	76.8	77.2	77.6	78.0	78.4	78.8	79.2	79.6	80.0	80.4	80.8	81.2	81.6	82.0	82.4	82.8	83.2	83.6	84.0	84.4	84.8	85.2	85.6	86.0	86.4	86.8	87.2	87.6	88.0	88.4	88.8	89.2	89.6	90.0	90.4	90.8	91.2	91.6	92.0	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.8	97.2	97.6	98.0	98.4	98.8	99.2	99.6	100.0		

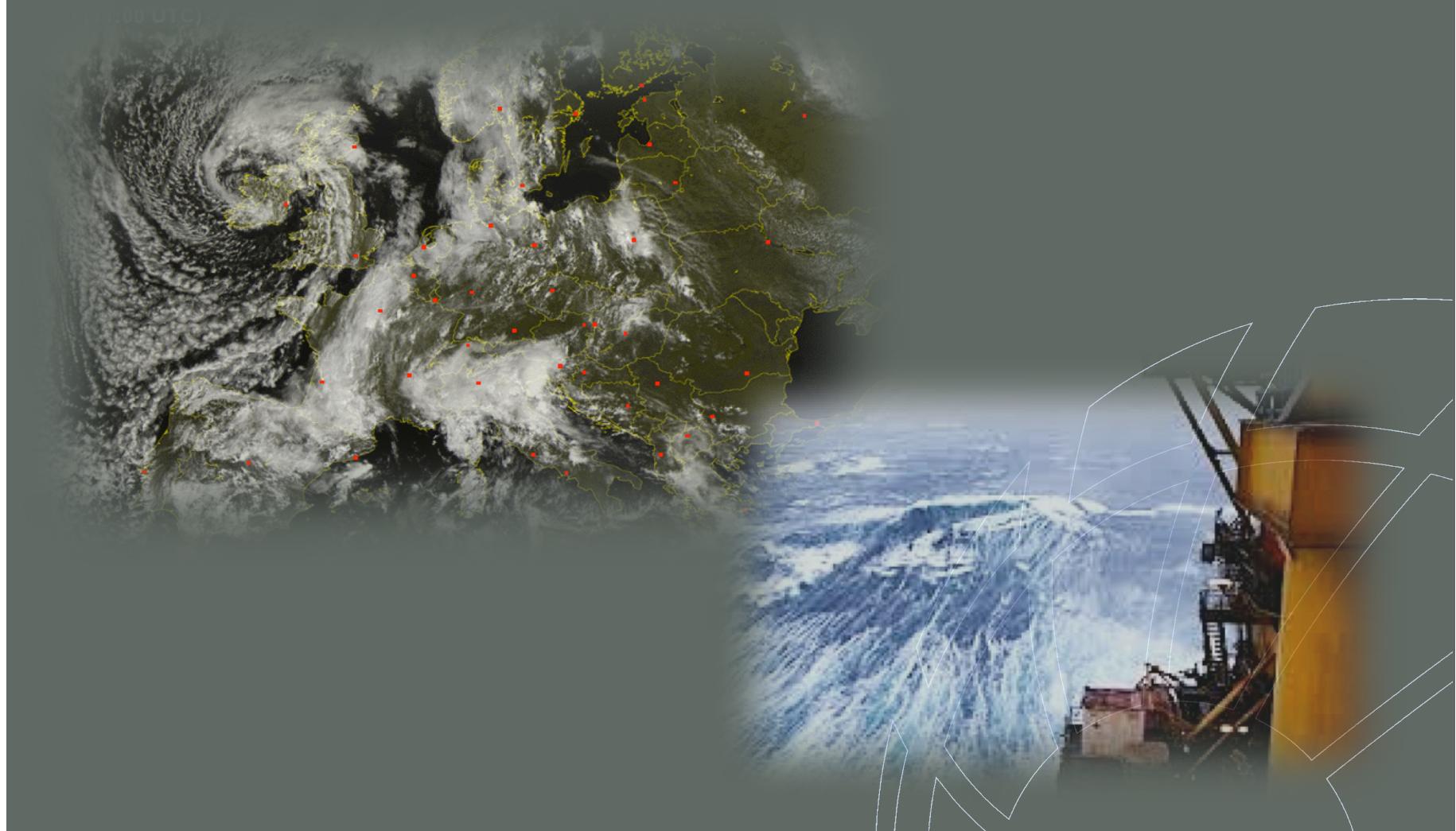
Your choices :
 Directional sector is CRNW
 Model output point is 63° 00' N, 20° 00' W
 Session is all year
 Variables are wave height, mean period, zero-crossing period, peak period, mean wave direction, mean wind speed, wind direction
 Data source is wavemode computations
 Results are based on 62000 model records
 Direction conversion is "leaving port"
 Copy this result page into a wordprocessor or spreadsheet
 Download the 1D scatter table

Metocean support – the next generation

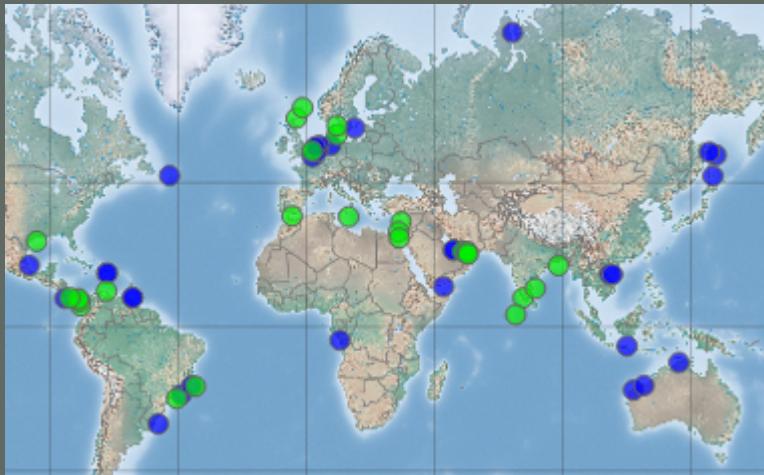
- Online access to forecast, hindcast and real-time data and reports
- Increase confidence, efficiency and safety
- Client-specific web portal
- Your data, one place, fast



Metocean Forecasting & Emergency Response



BMT ARGOSS forecasting



- 24/7 operation
- Last count up to 112 forecasts per day.
- 6 forecasts per hour (10 minutes for one forecast)

Projects in SE Asia and Australia

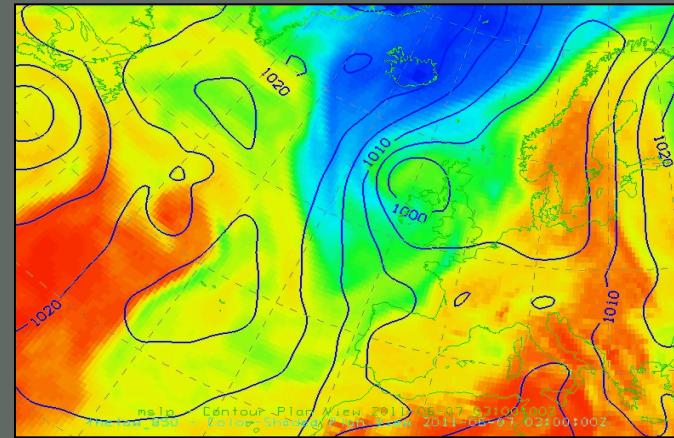
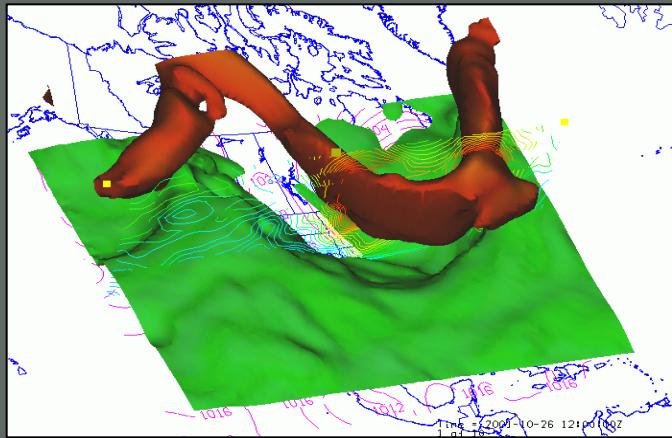
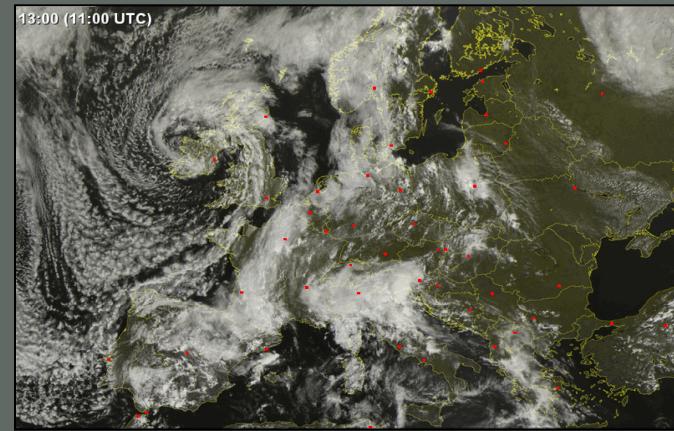
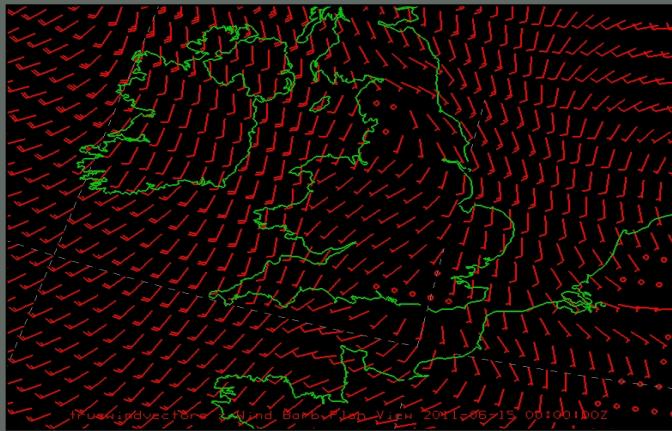
Oil & Gas (Hess):

- Weather routing, rigmove and support vessel.
- Day to day support and monitoring (squall) rig (Java Sea).

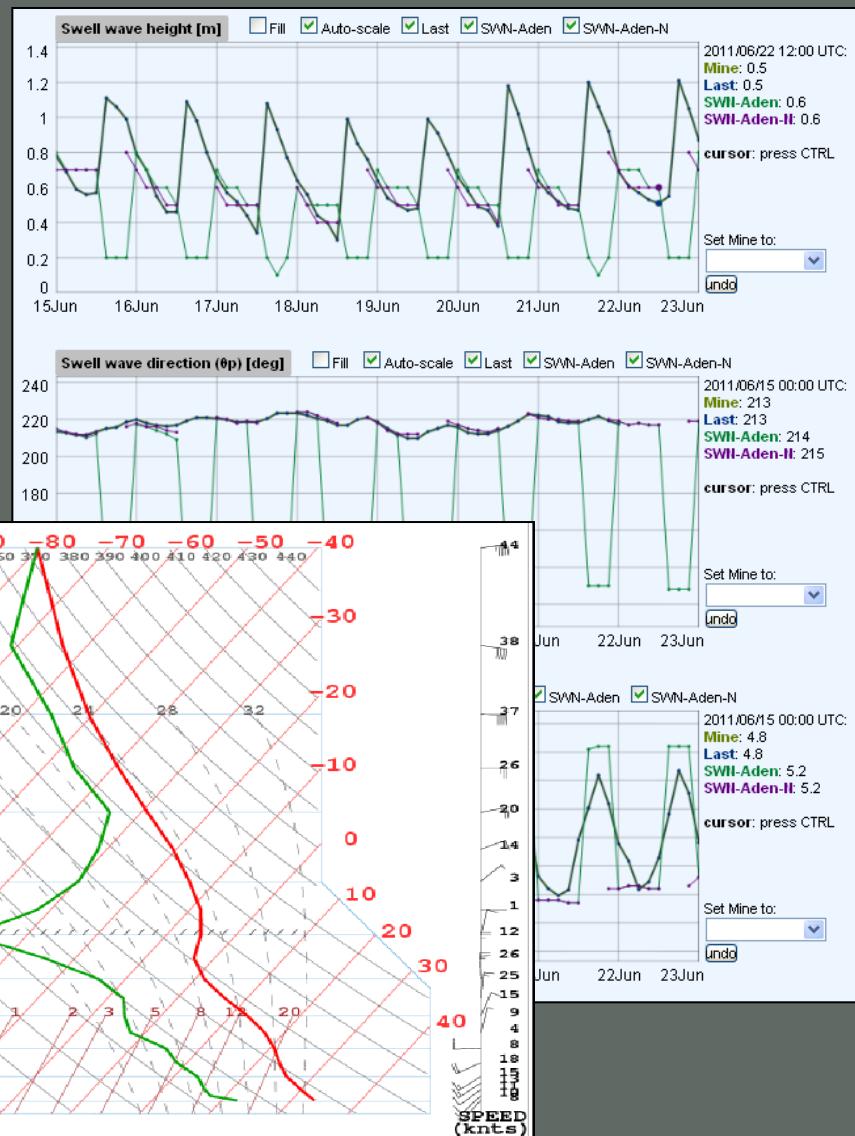
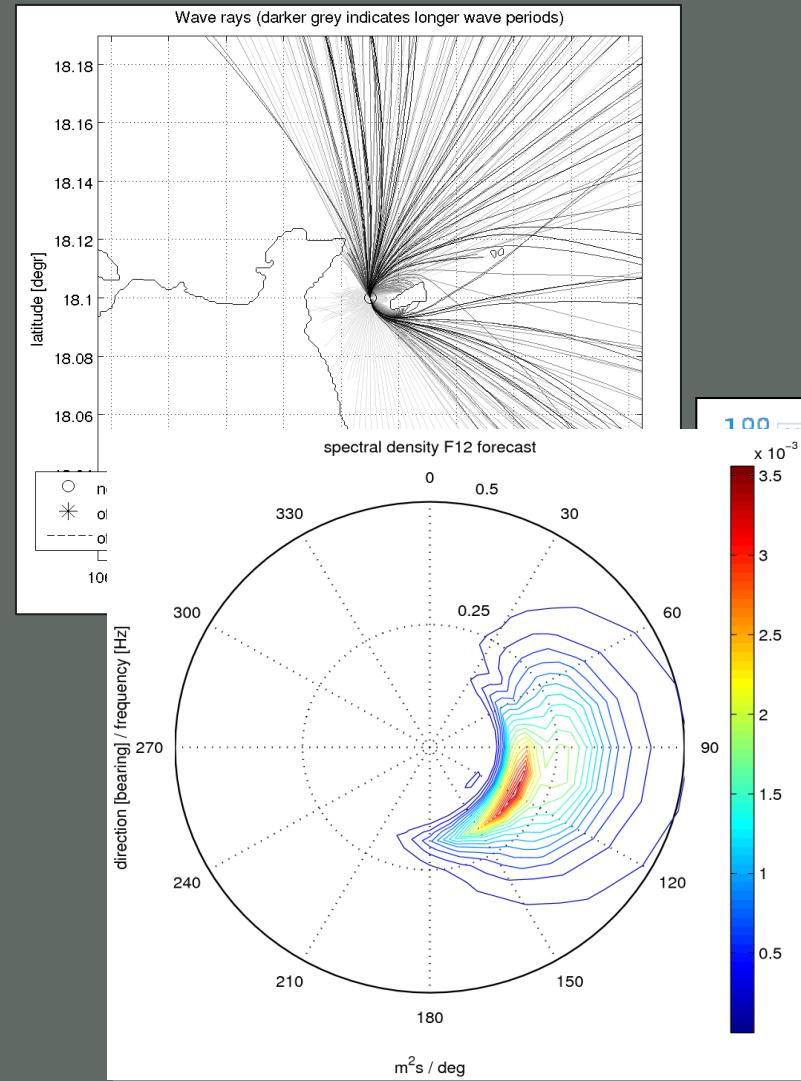
Dredging (Jan de Nul, Boskalis, van Oord, DEME):

- Macedon
- Wheatstone

Detailed information gathering

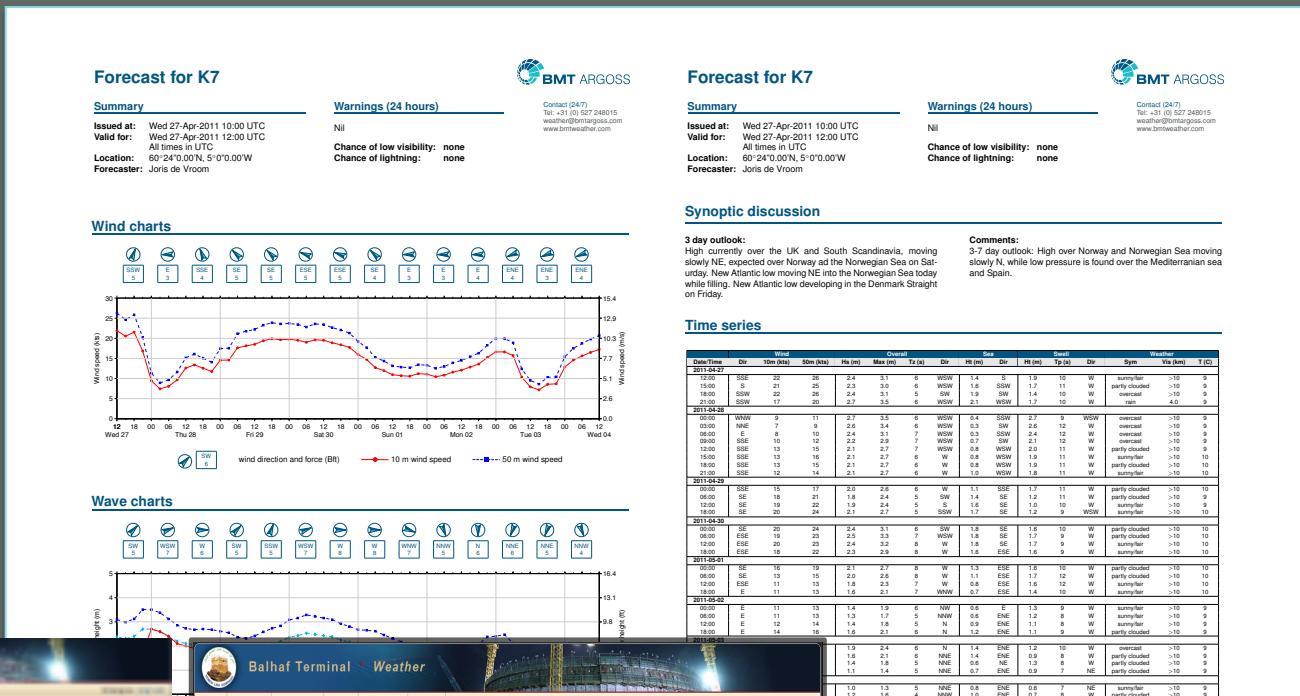
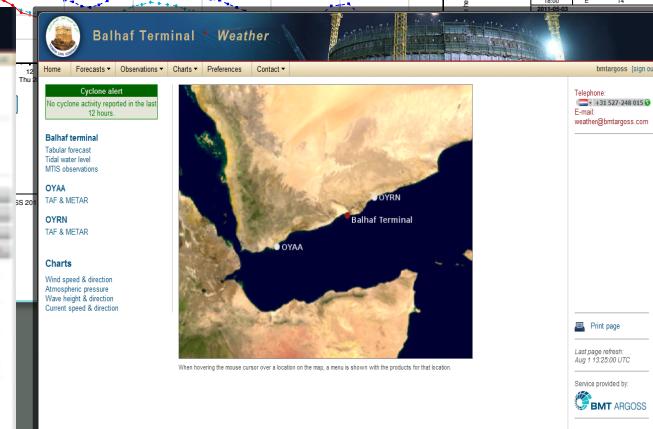
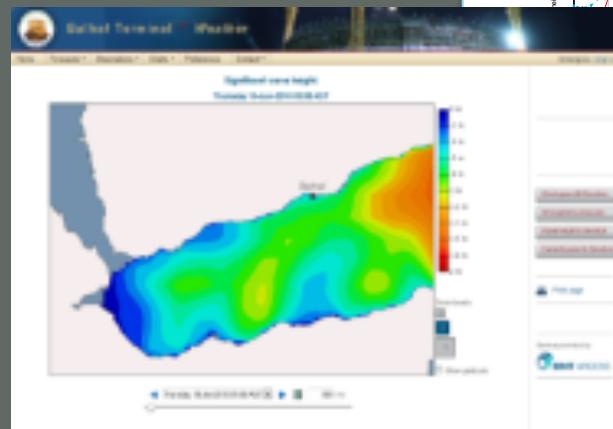


Creating a forecast



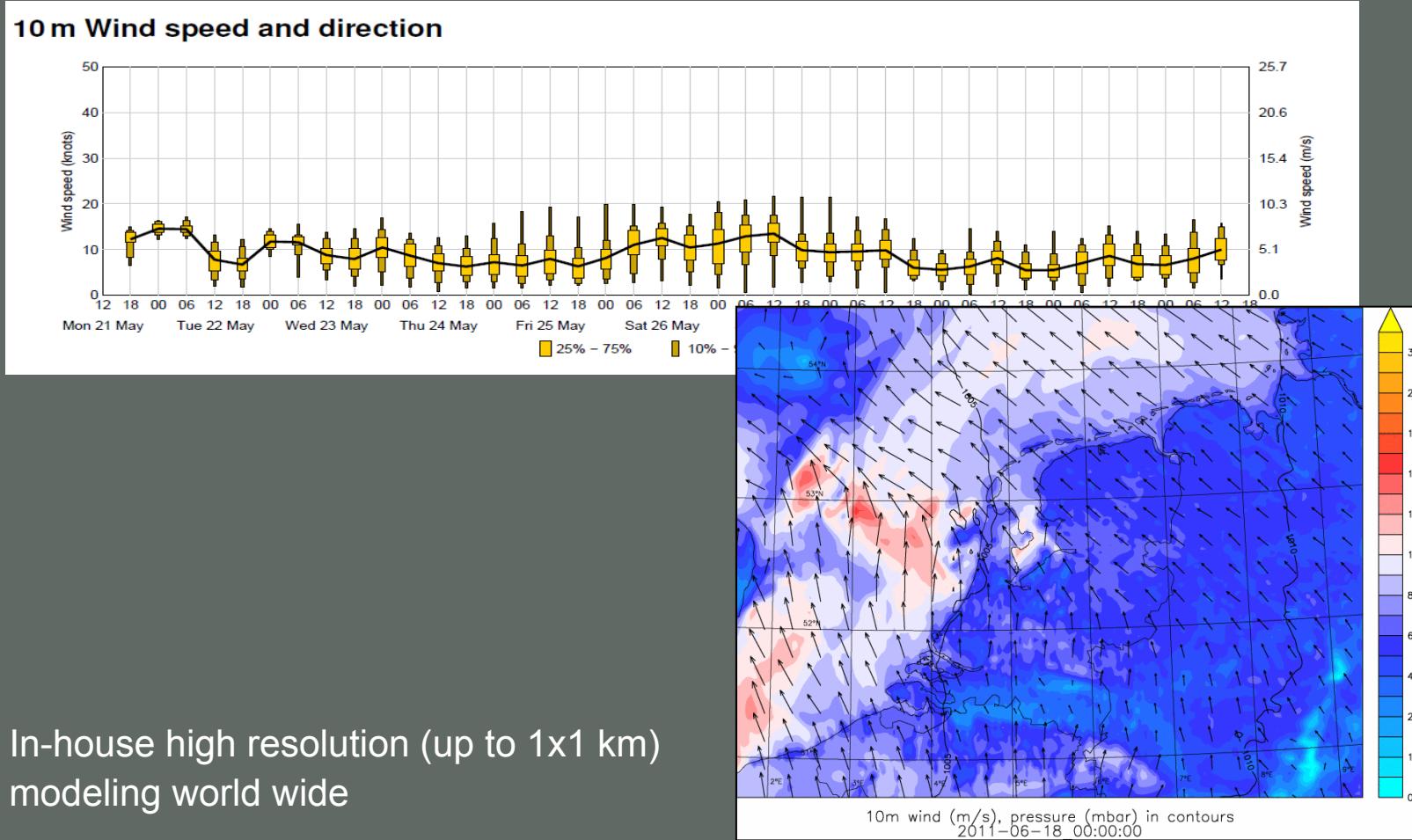
Forecast delivery

- Metocean Portal
 - Email (.pdf)
 - Fax
 - SMS
 - Phone
 - Other secure web site



New - ensemble and high resolution forecasting

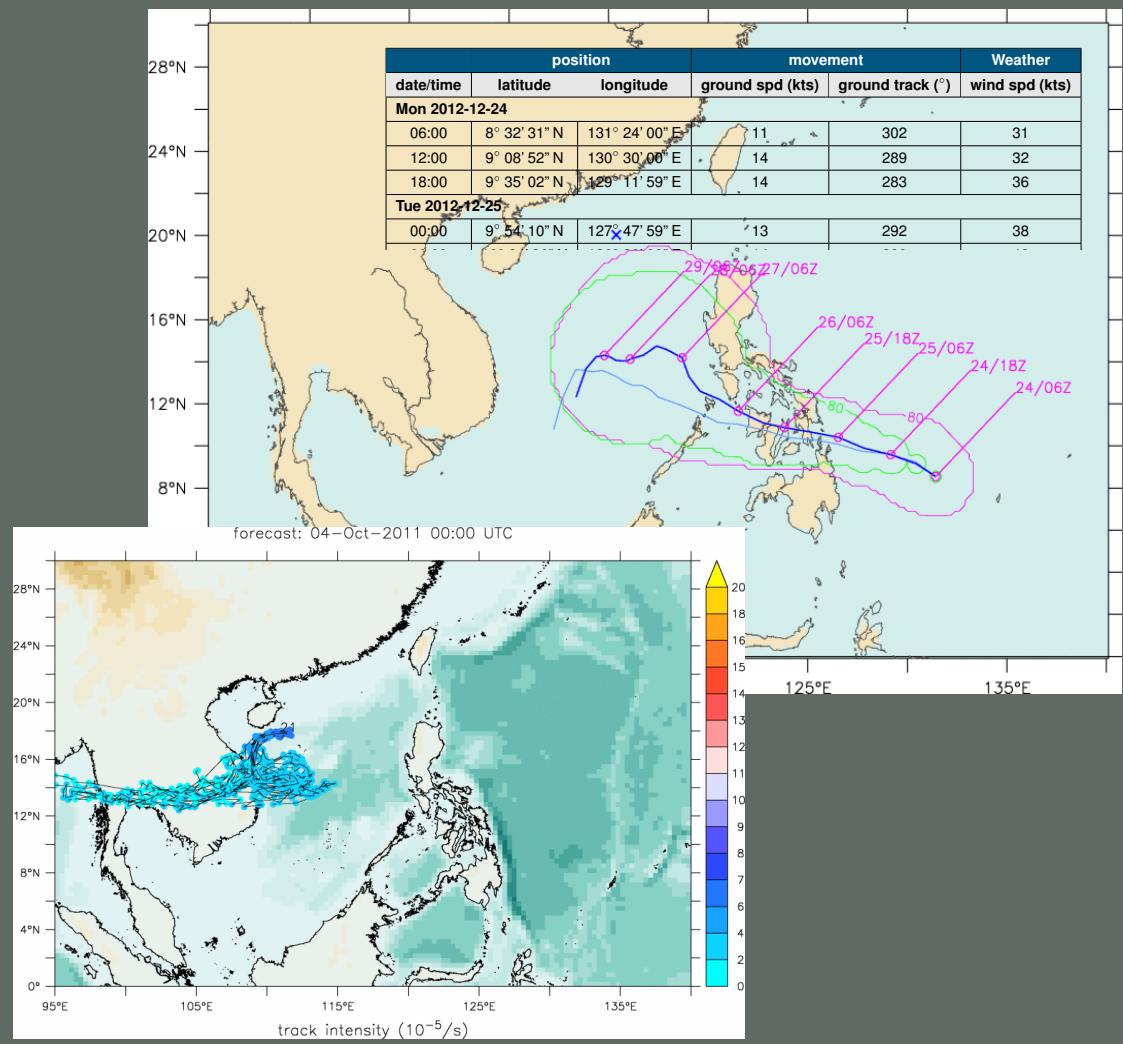
10 day ensemble forecasting



In-house high resolution (up to 1x1 km)
modeling world wide

Tropical storm forecasting and tracking

- Vorticity-based analysis
- University of Reading
- NCEP GFS ensemble data
- “Uncertainty plume”
- Forecast cyclone bulletin



Services - worldwide site and route forecasts

- On-site/offshore maritime forecasters
- 24/7 weather briefings



- Oil Spill Identification System (OSIS)
- Search and Rescue Information System (SARIS)
- Adverse weather warning (Cyclone/Hurricane/Squall/Lightning/Fog)



BMT ARGOSS Metocean Capabilities - Summary

- In-depth experience and track record based on innovative, client-focused approach
- Support for offshore and coastal infrastructure design and operability
- Oil and gas, renewables, ports/harbours, marine transportation
- Strong heritage in data generation and provision (including web based delivery – new Portal approach)
- Close links with other BMT companies and Metocean Services International (for measurements)
- State of the art tools for metocean analysis and forecasting



Thank you