Marine Weather Decision Making

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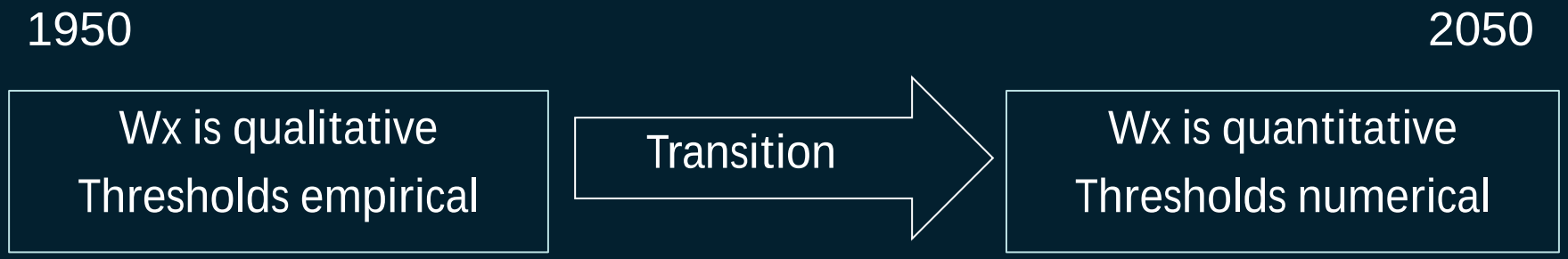
Marine Weather Decision Making

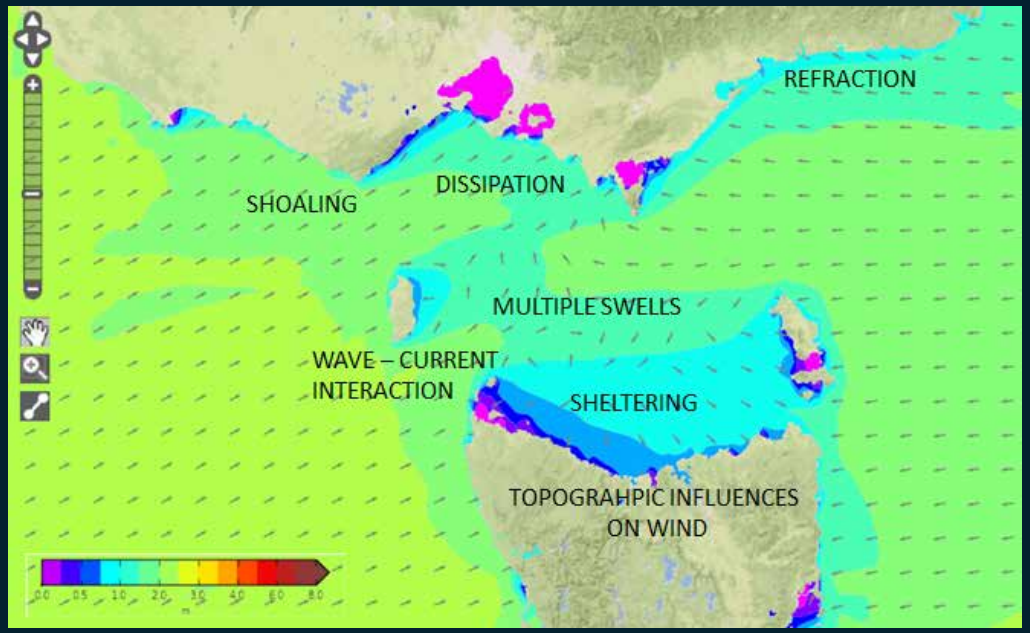


In 2015 we are somewhere along this spectrum.

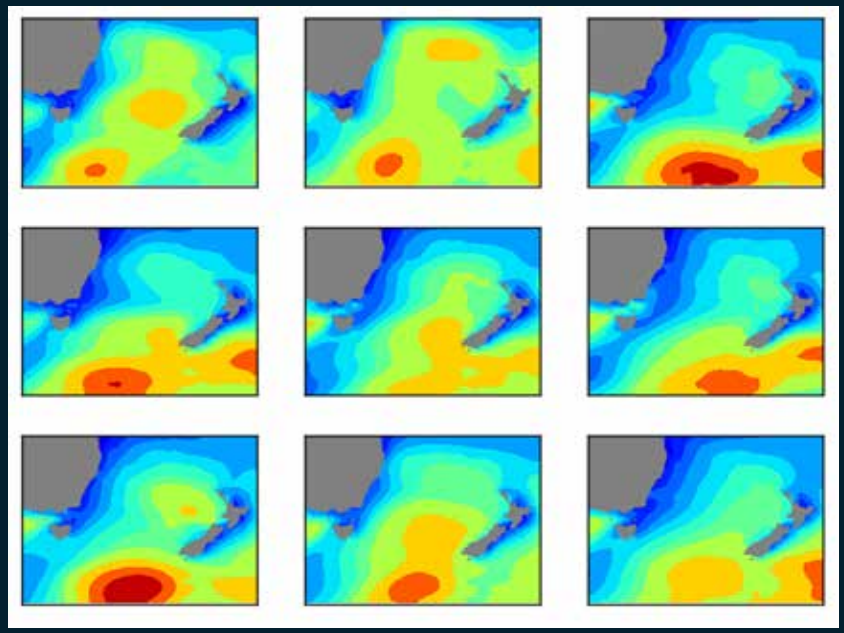
A key parameter in the decision-making process is the perception of safety:

- **GREEN** we feel safe and comfortable - everything is fine
- **YELLOW** it's ok but we are a bit worried about.....
- **RED** this is dangerous - we should not be out here doing this!
- **INGNORANCE** we are unaware of the risk profile

The technical challenge



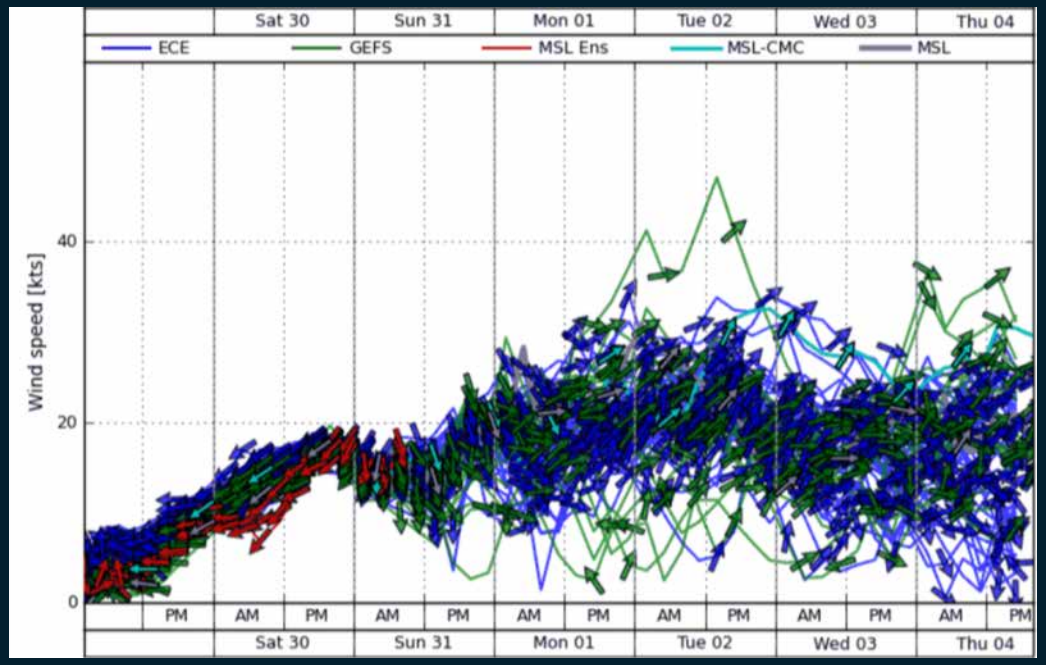
Complex



Chaotic

The consequence of living on a wet, rotating planet is complex , chaotic weather.

Finding the balance for practical marine guidance



Assimilation

Deterministic

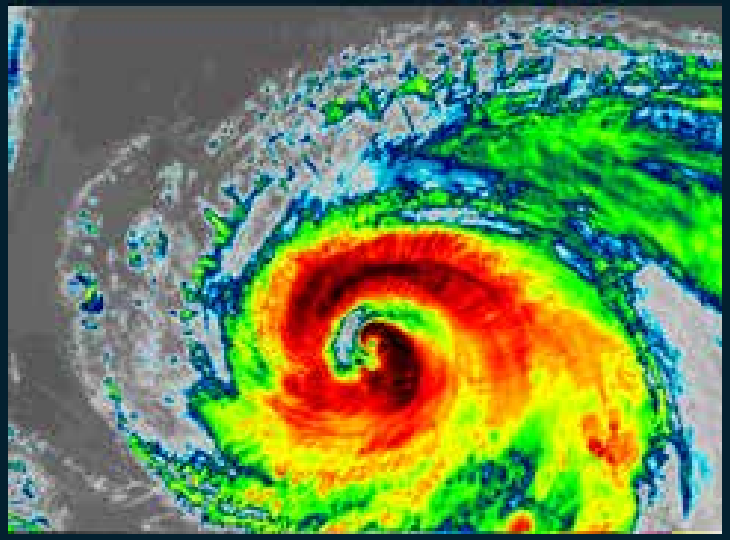
Probabilistic

t

1d

3d

Future data assimilation opportunities



Hyper-spectral soundings

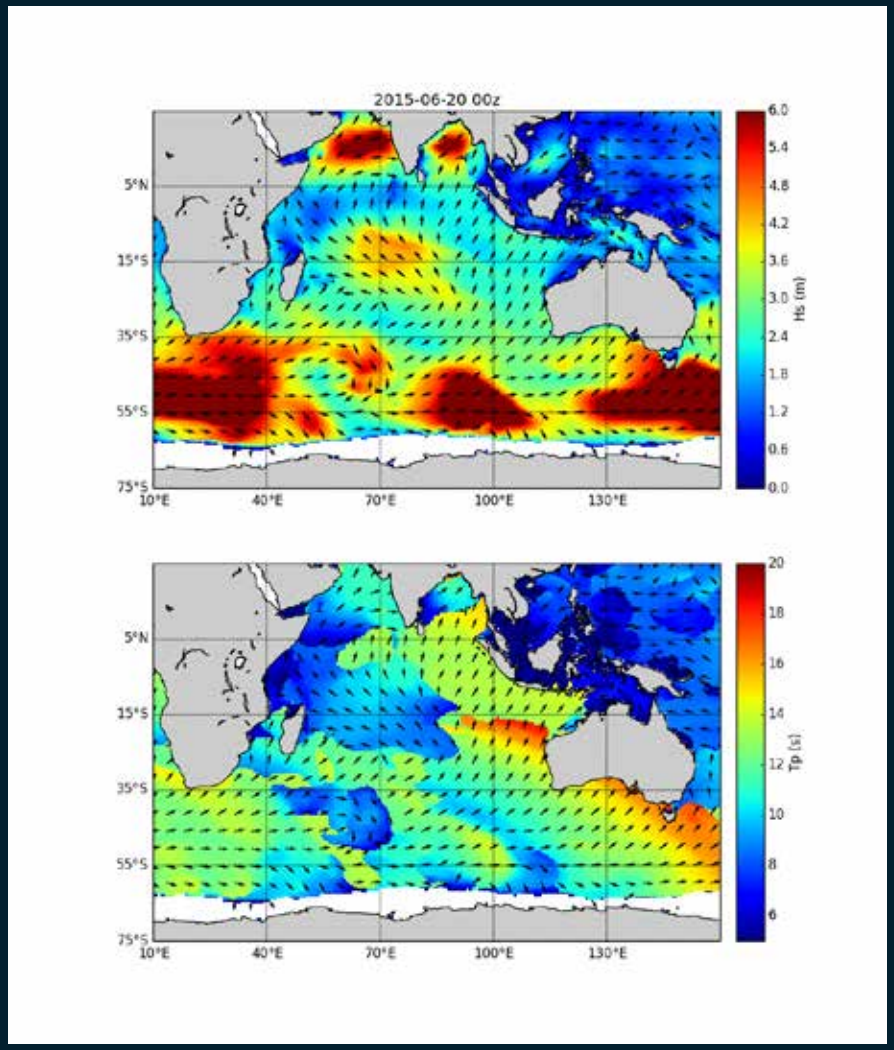
Wx telematics

Cheap sensors

Private data networks

What will the weather business look like in 2020?

Local or regional scale data assimilation – waves



Improve model physics

Improve timing

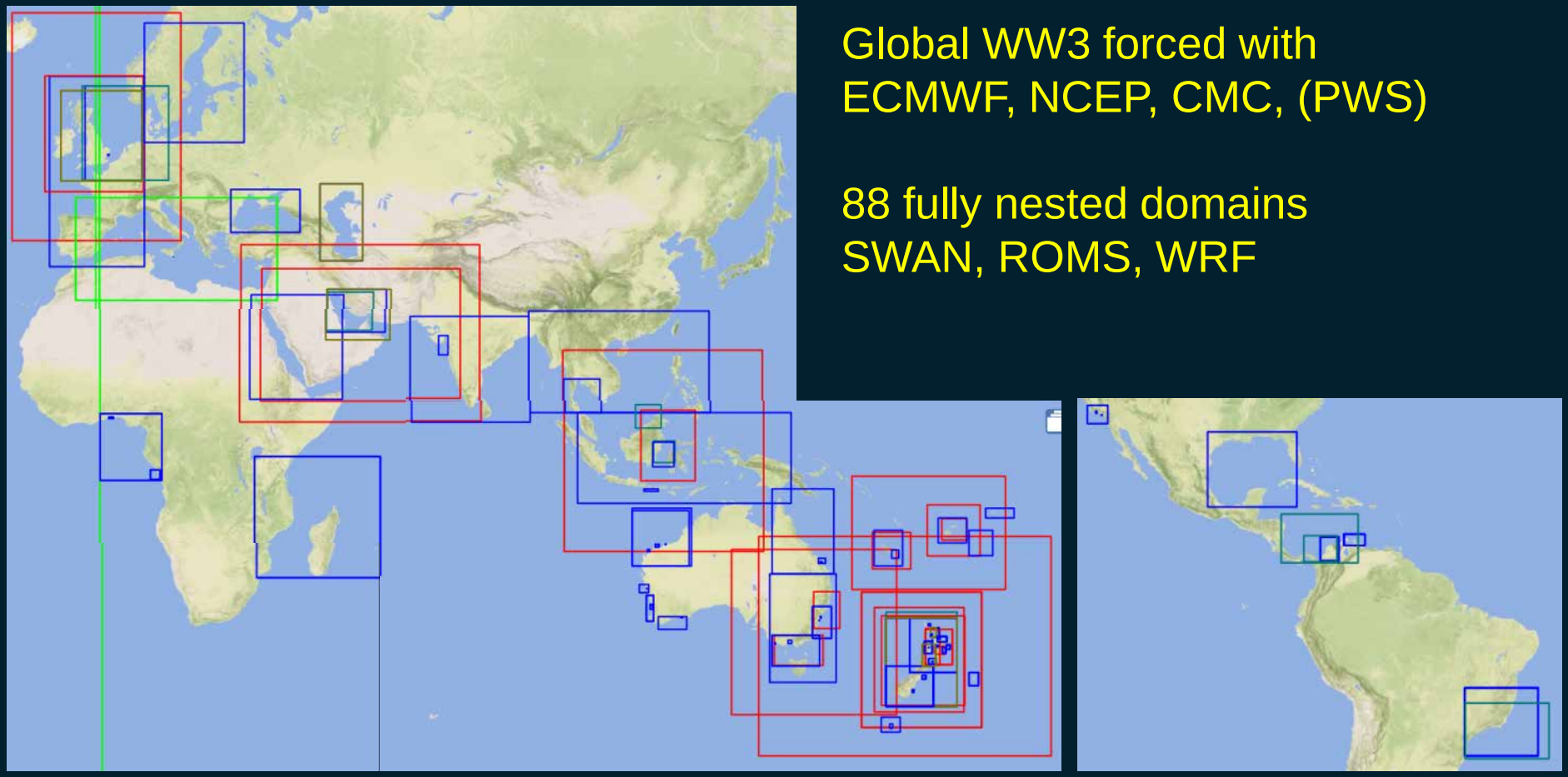
Spectral shapes

Sea state changes

Groupiness, Hs/Hx

Allow better human interpretation

Dynamical solutions – nested models

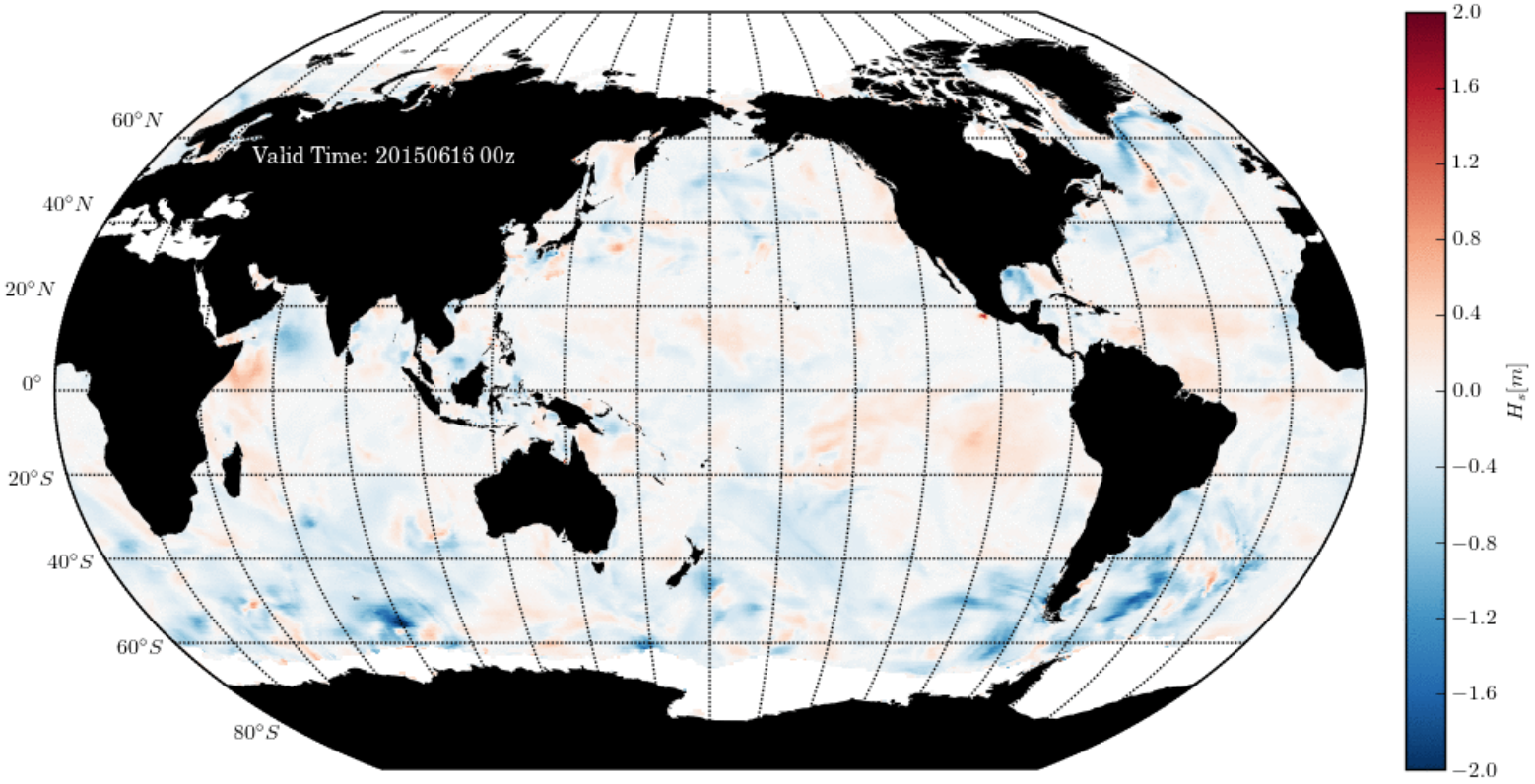


Global WW3 forced with
ECMWF, NCEP, CMC, (PWS)

88 fully nested domains
SWAN, ROMS, WRF

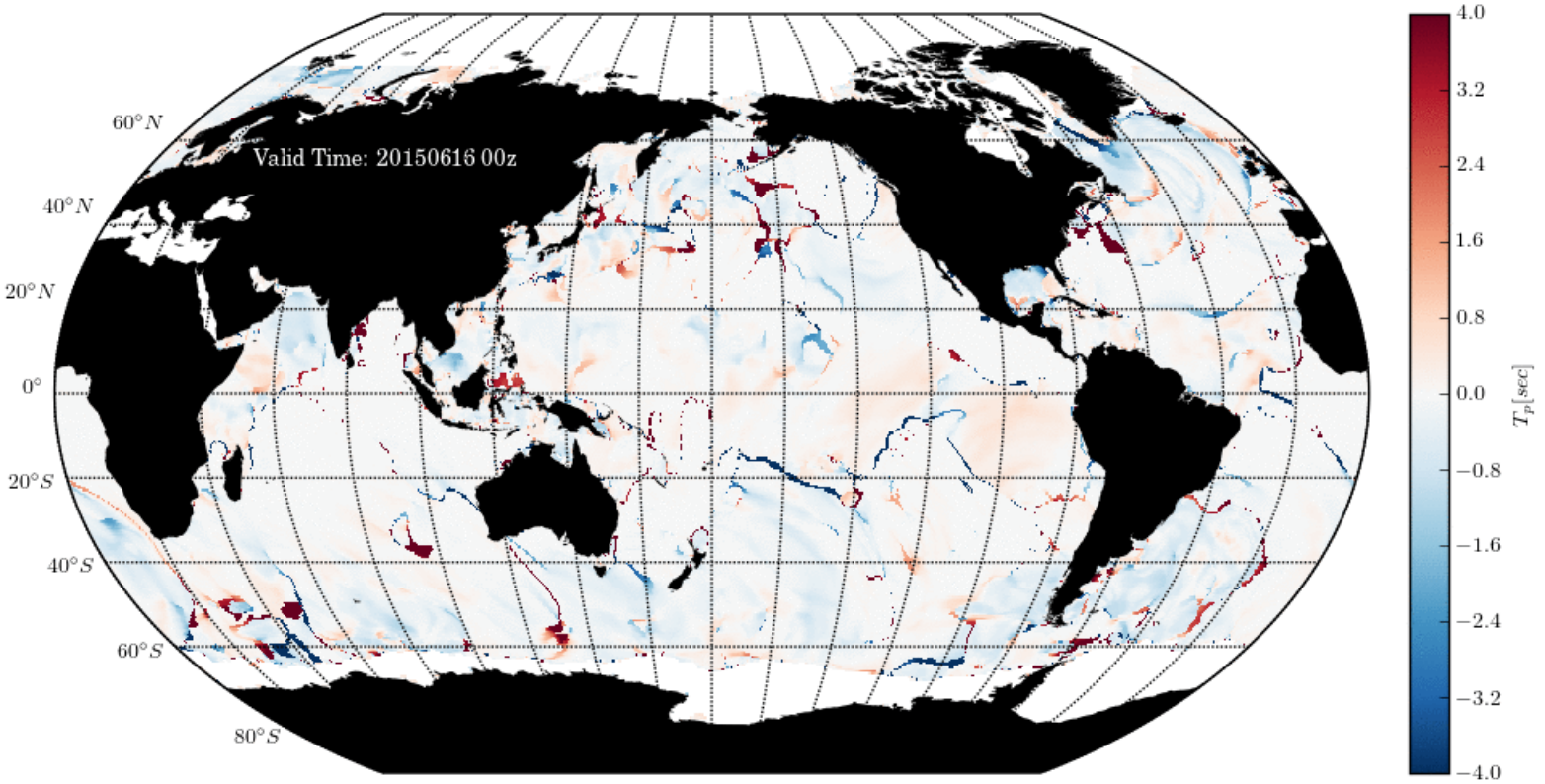
WW3 (ECMWF – GFS)
Hs difference

Dynamical solutions - global scale wave



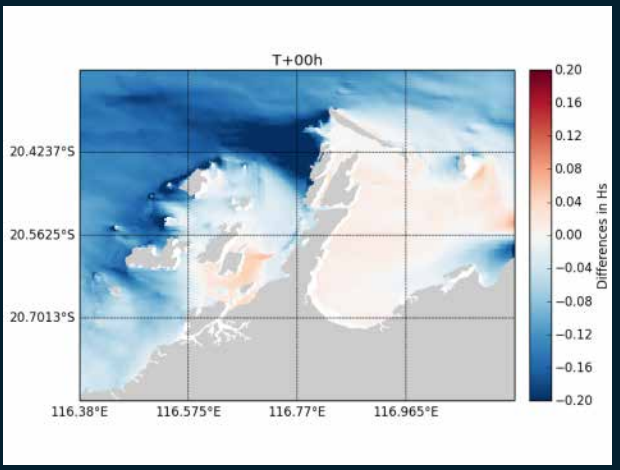
WW3 (ECMWF – GFS)
Tp difference

Dynamical solutions - global scale wave

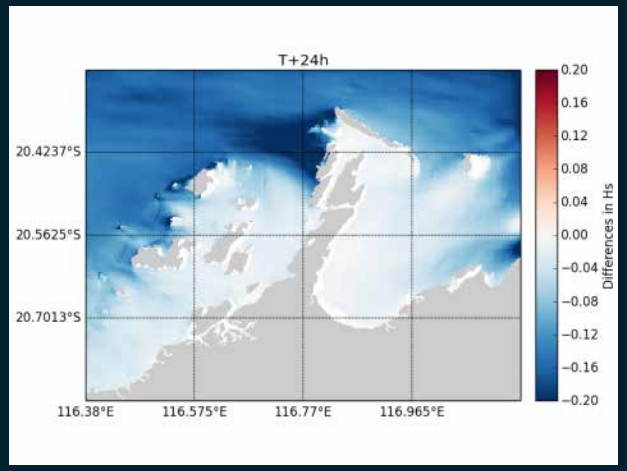


Dynamical solutions – local scale wave

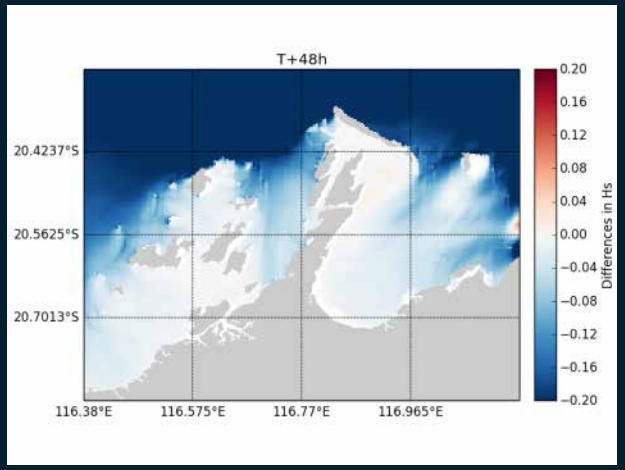
T+0h

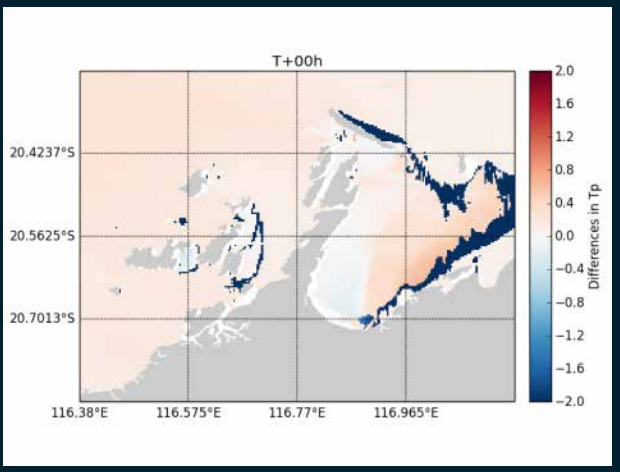


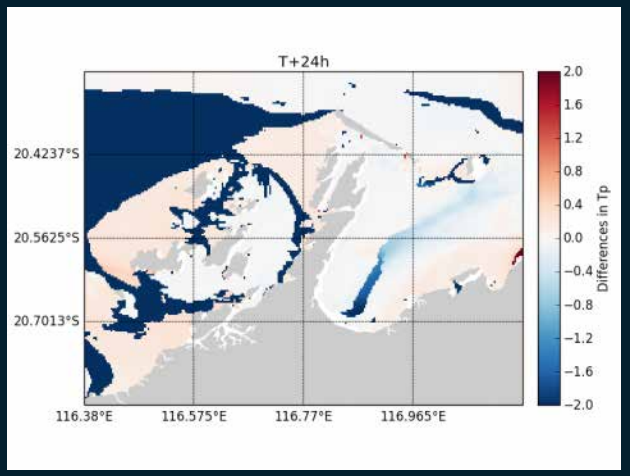
T+24h

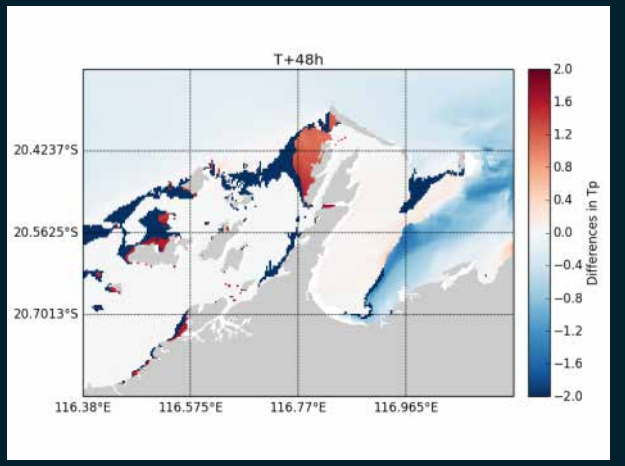


T+48h

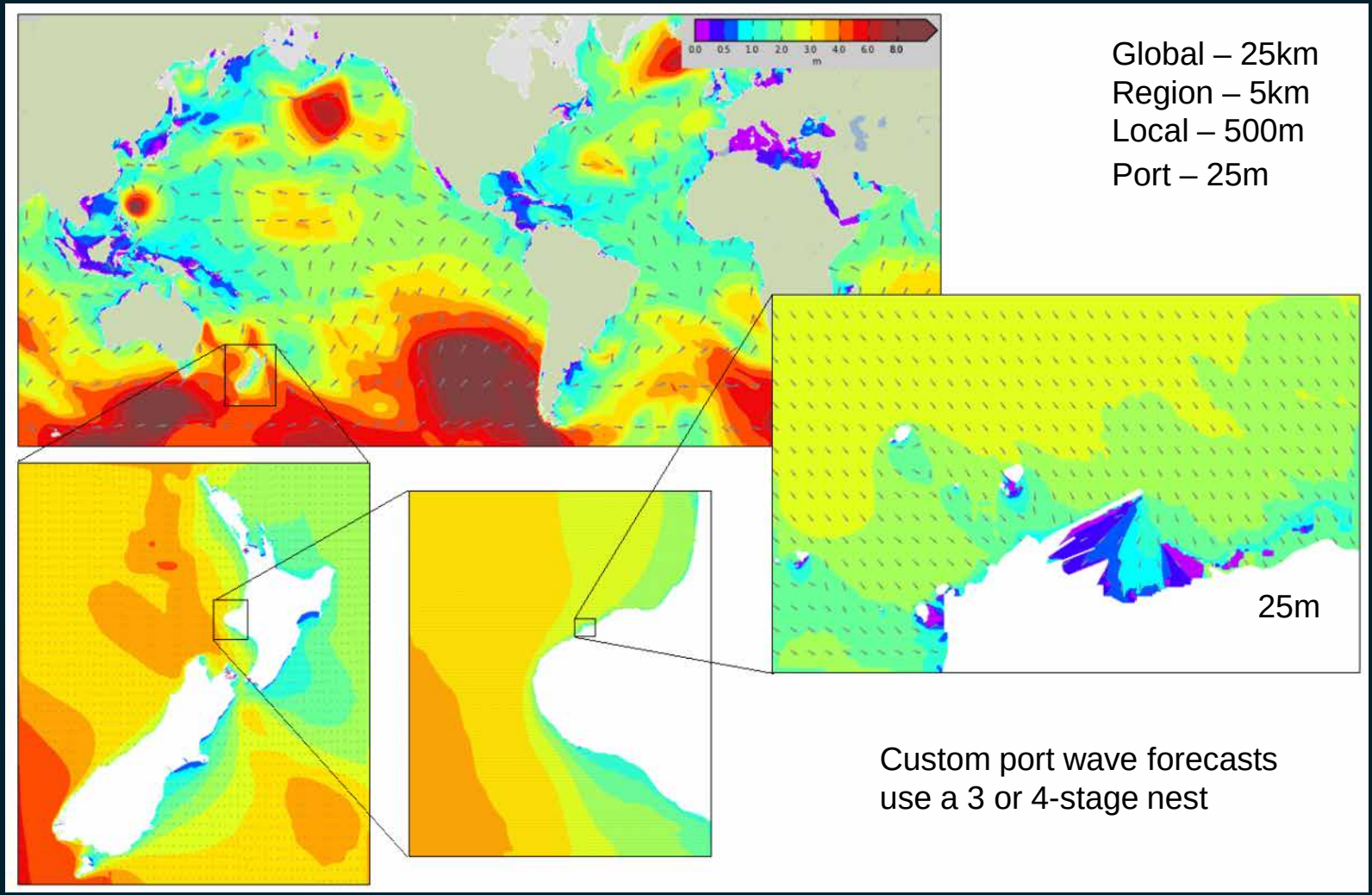








Dynamical solutions - wave

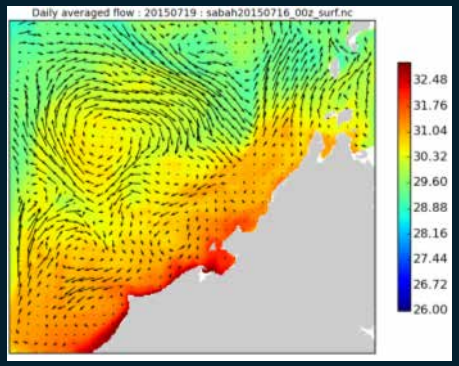


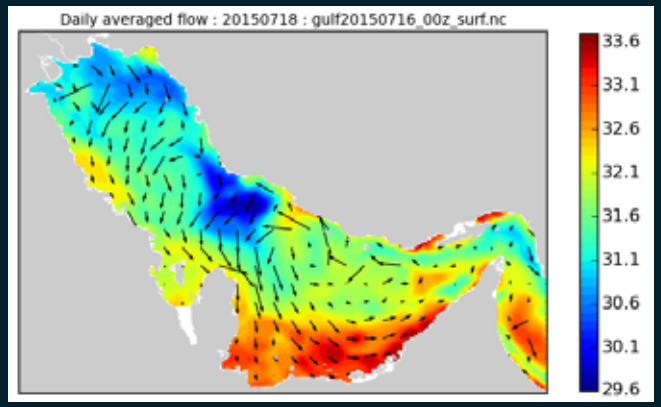
ECMWF and NCEP
RTOFS and ORCA12

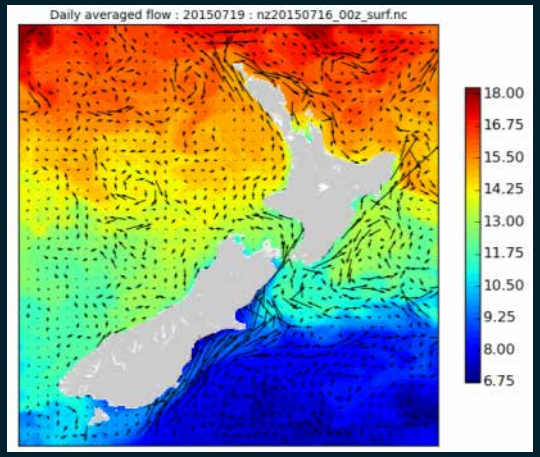
Dynamical solutions - ROMS

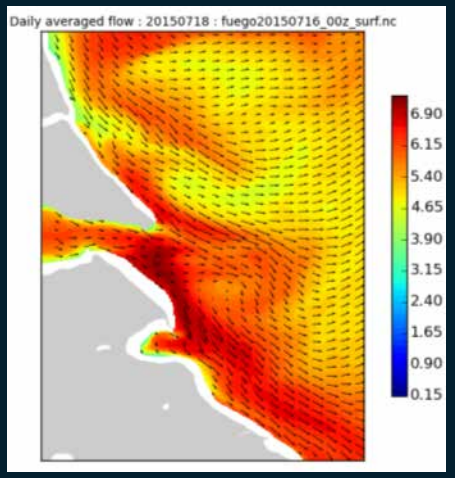
Bass Strait, Makassar Strait, Campos Basin, Patagonia, North Sea, Persian Gulf, Sabah Malaysia, New Zealand, Vietnam, Columbia, Dubai

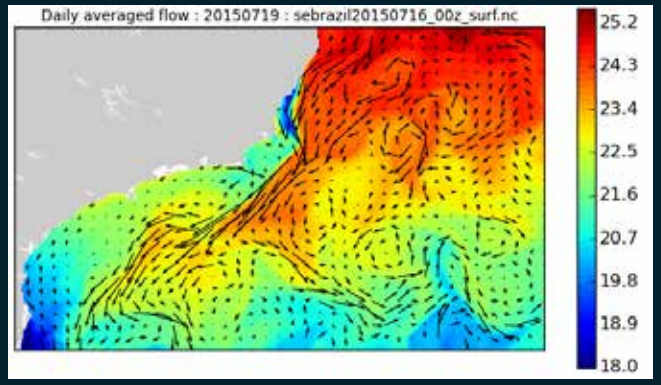
Coming soon – South Australia, Gulf of Thailand, NW shelf Australia

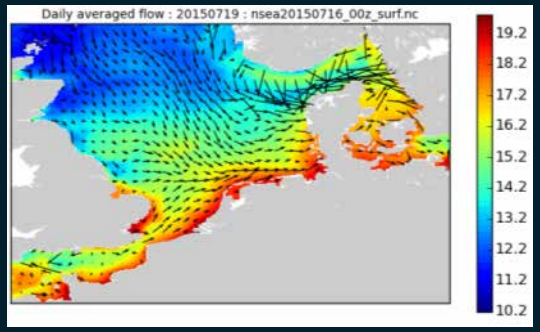


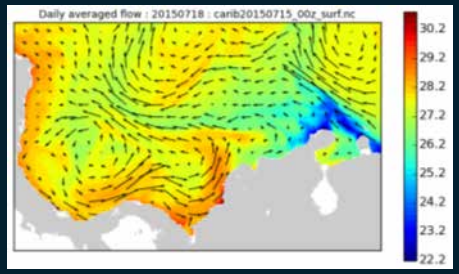




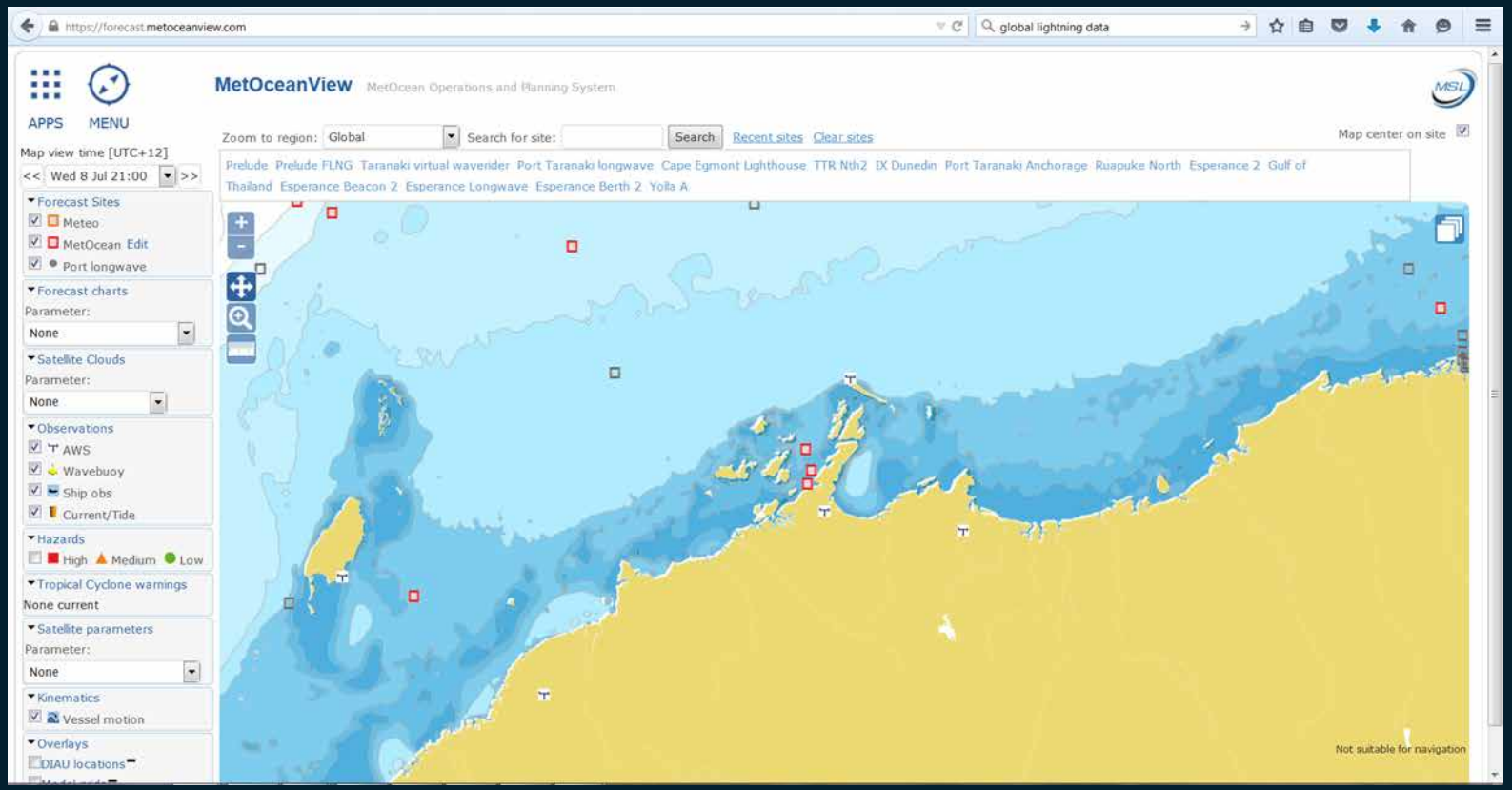






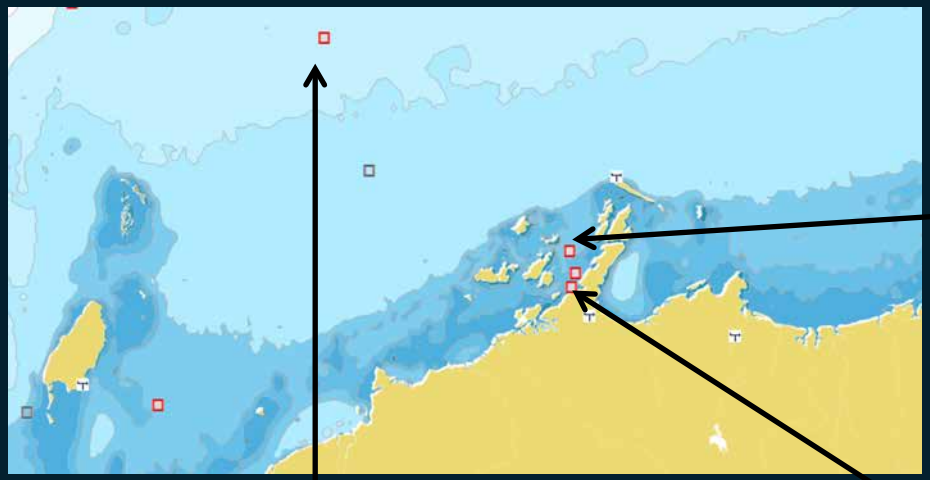


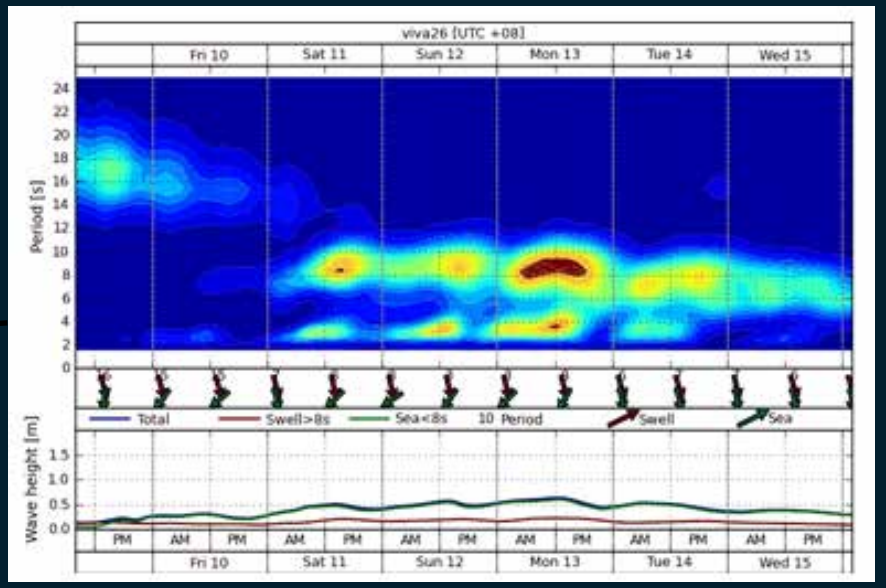
Dynamical solutions - visualisation

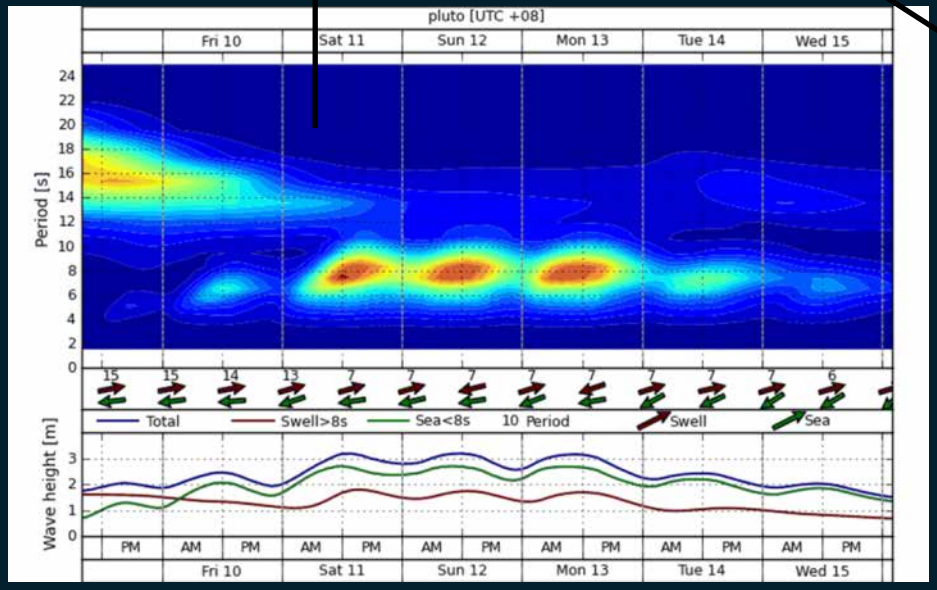


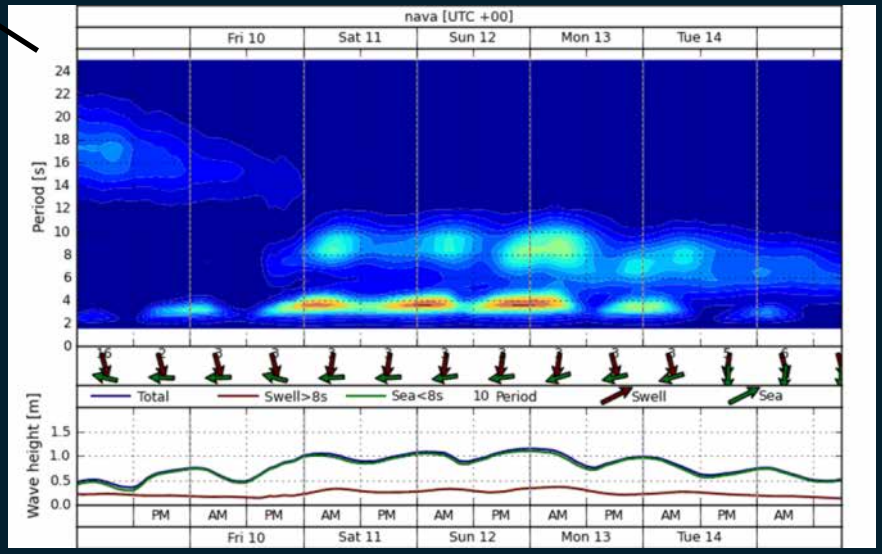
Fully nested wave, wind and current models

Dynamical solutions



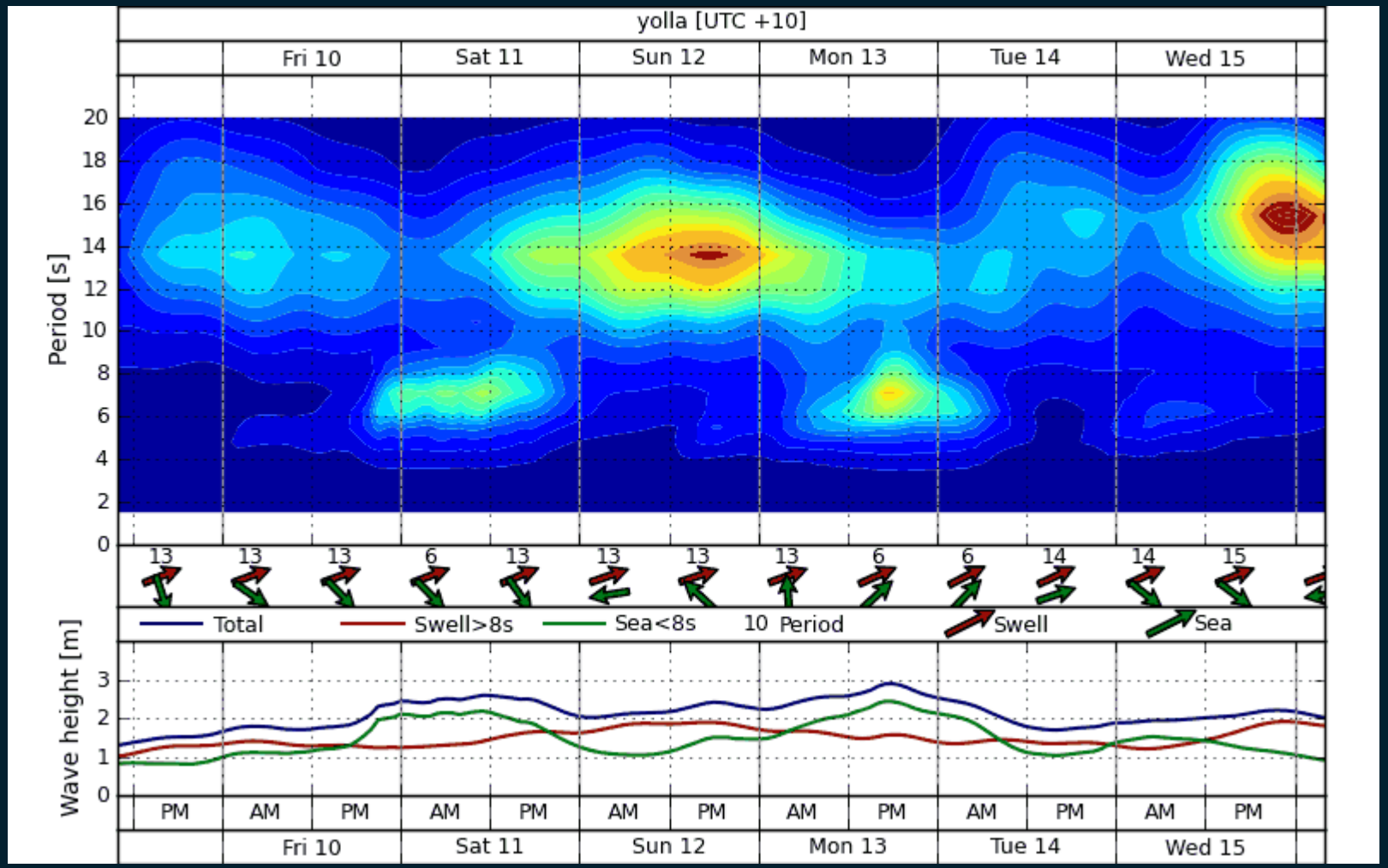




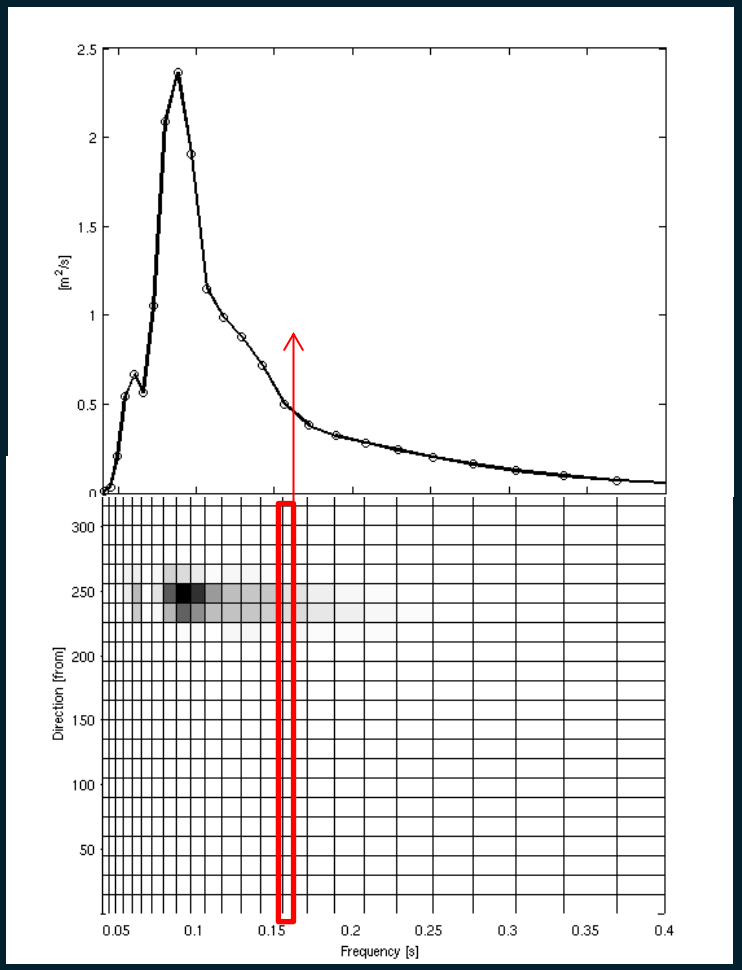


Wave – current in Bass Strait

Dynamical solutions



Probabilistic solutions – D**ownscaled Super Ensemble**

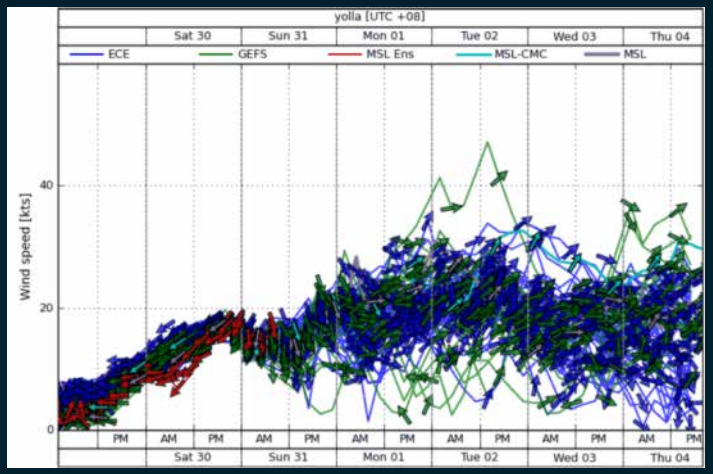


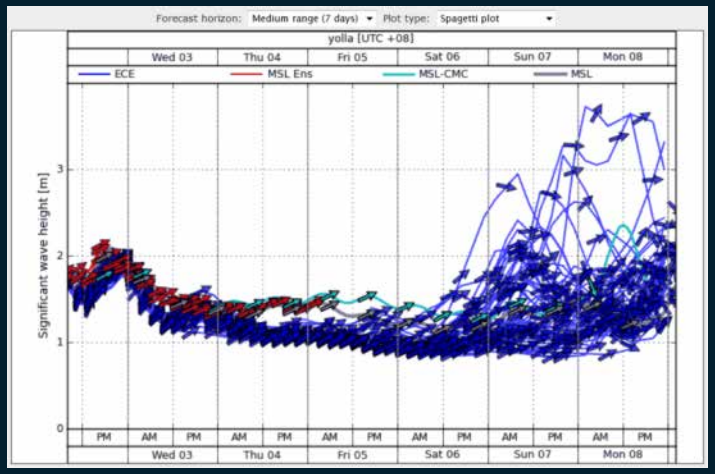
1. Select one or more points from global model
2. Aggregate co-temporal spectra
3. Reduce inshore spectra
4. Postulate linear relationship:

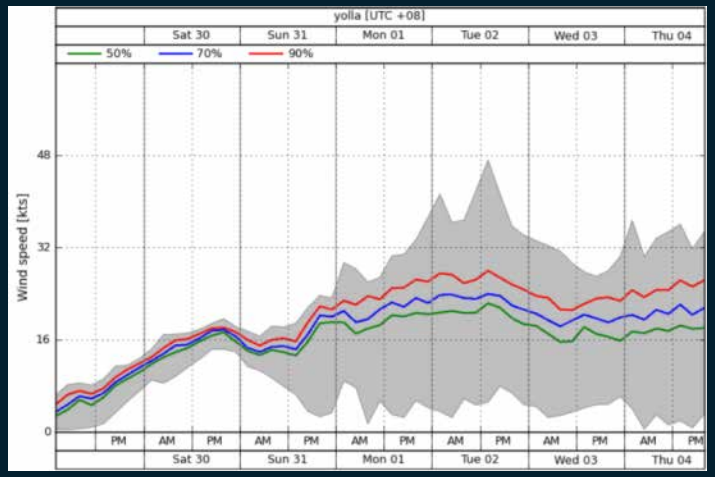
$$S(f) = A_{ij} D\left(f, \theta_j\right)_i + B_i$$

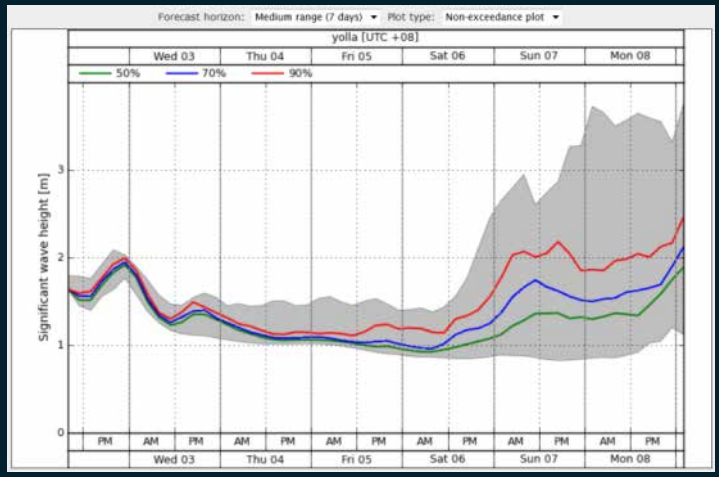
4. Fit model coefficients for each frequency
5. Apply statistical model to new offshore spectra
6. Calculate spectral parameters

Forecasting the uncertainty









Wind

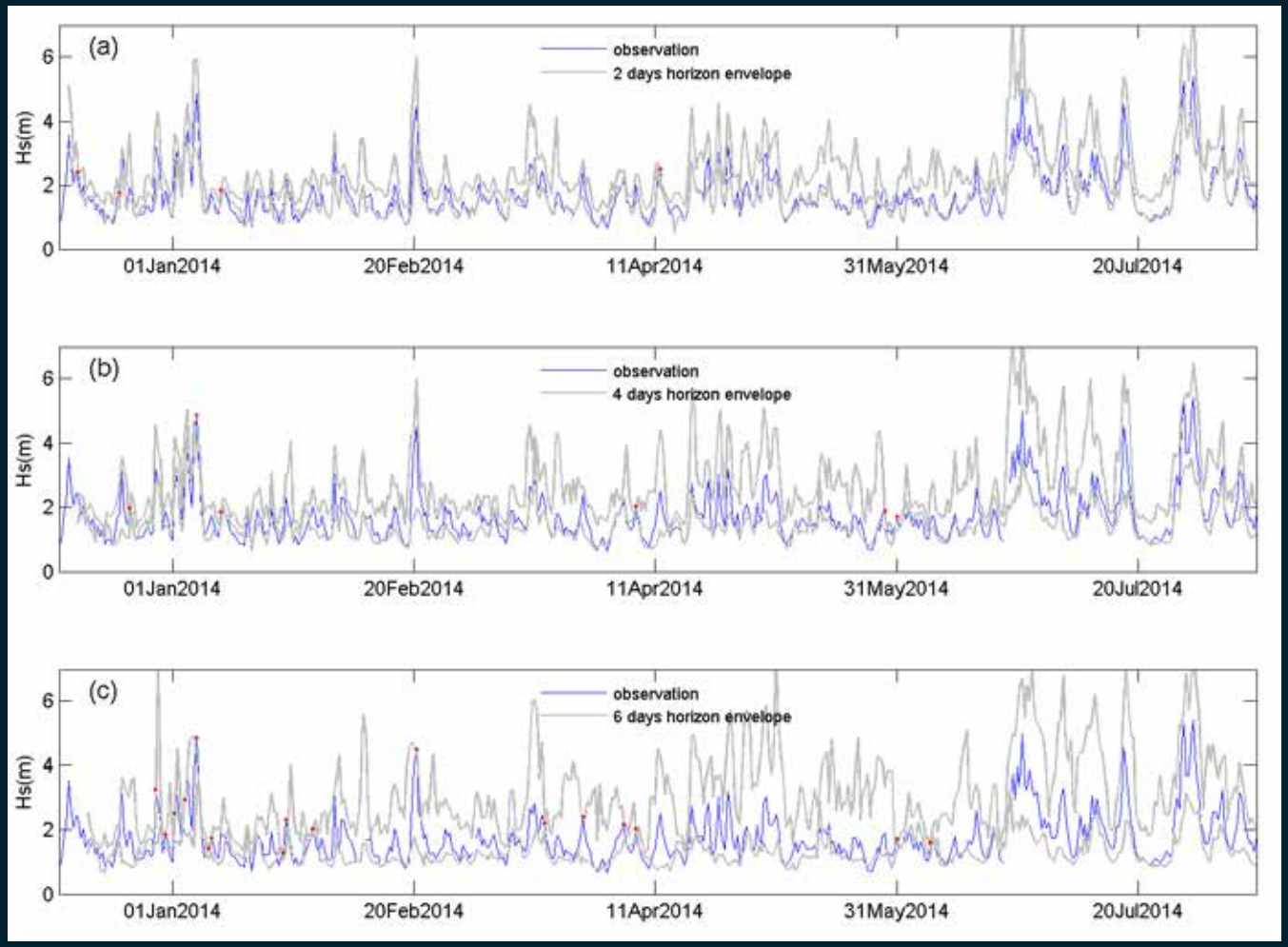
Wave

Forecasting the uncertainty - validation

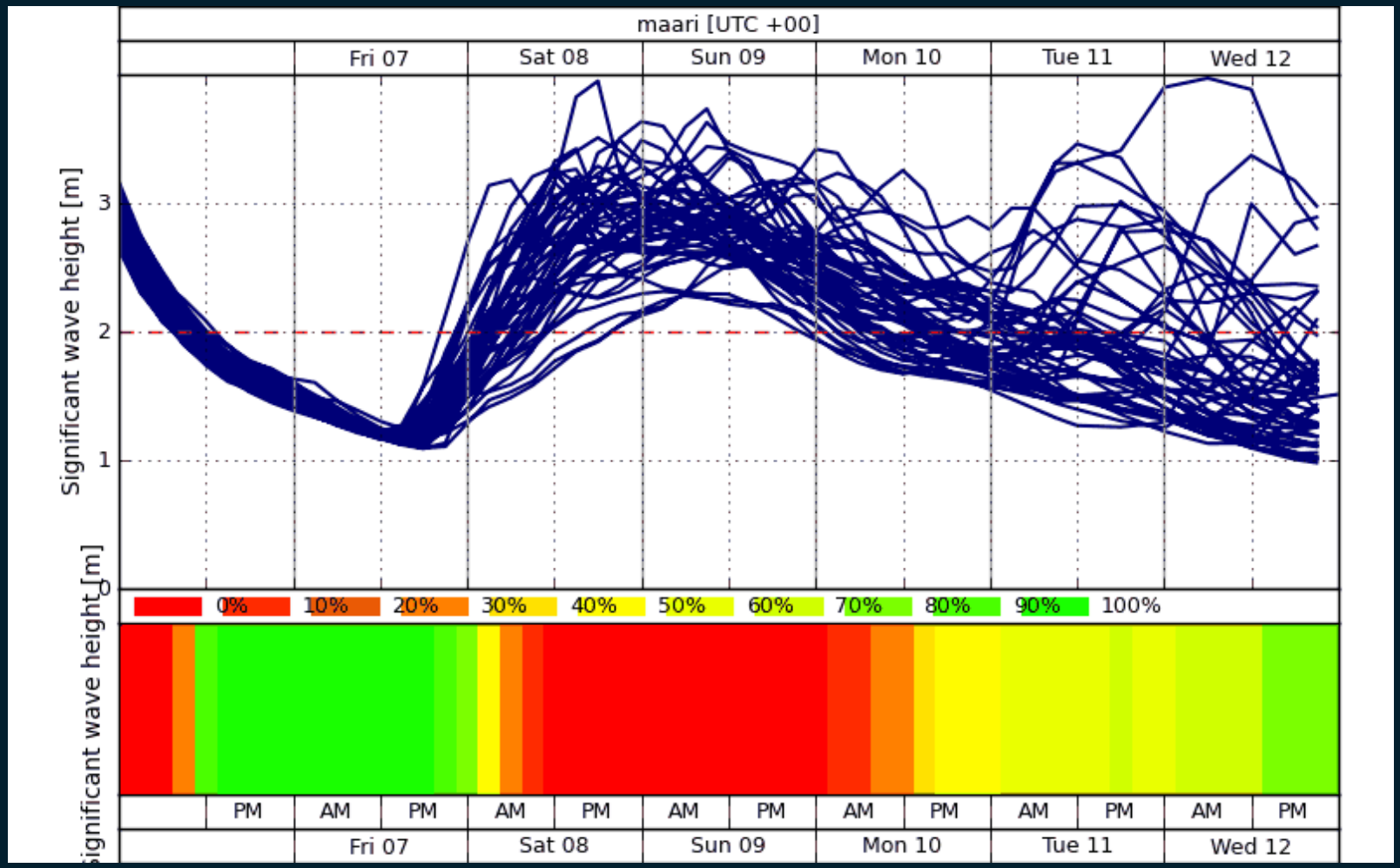
2 day horizon

4 day horizon

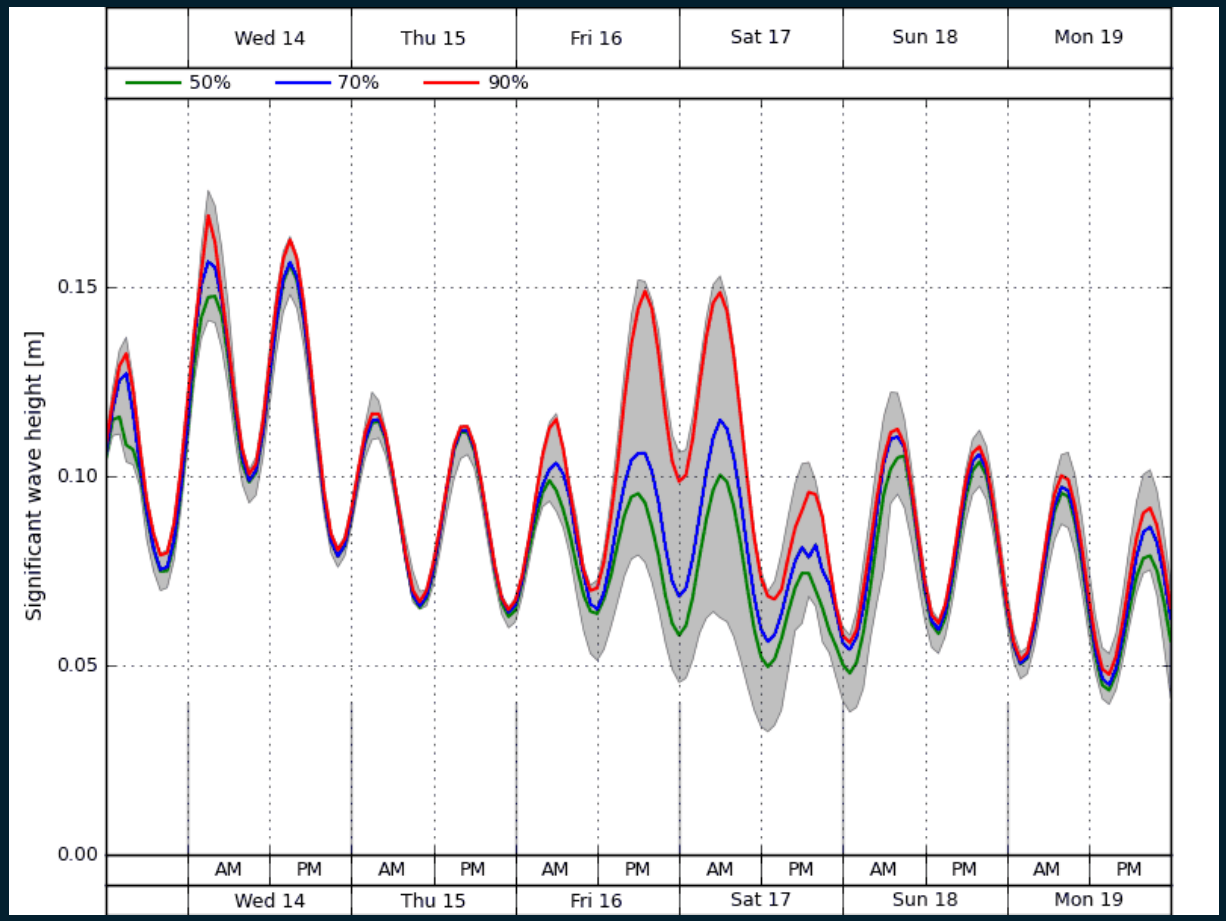
6 day horizon



Forecasting the uncertainty - visualisation



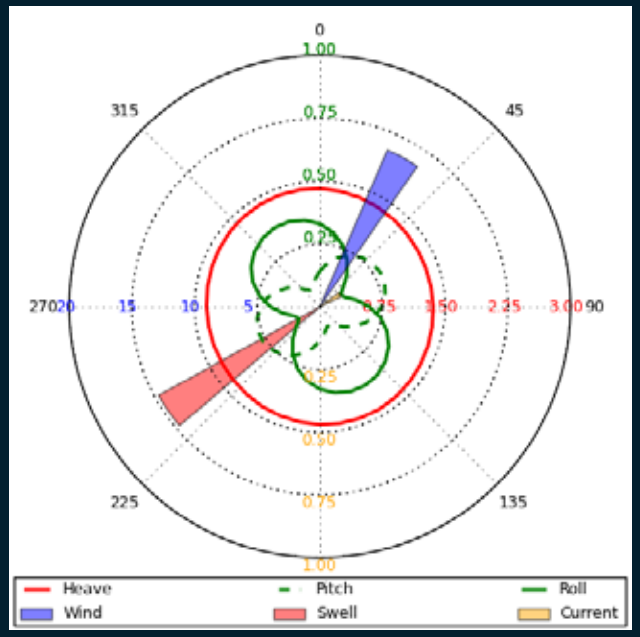
Forecasting uncertainty in something very complex



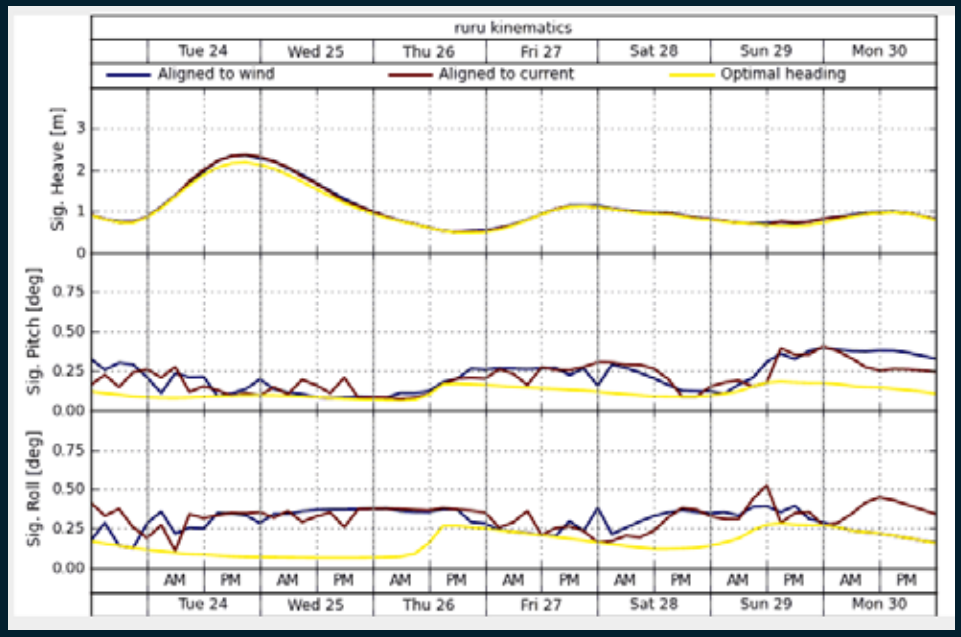
Forecast of the long period waves inducing surge at a berth inside a harbour

Forecasting complex things – vessel motion

Forecast 2D wave spectra convolved with RAO = motion forecast solutions



Heave/roll/pitch amplitude as a function of heading

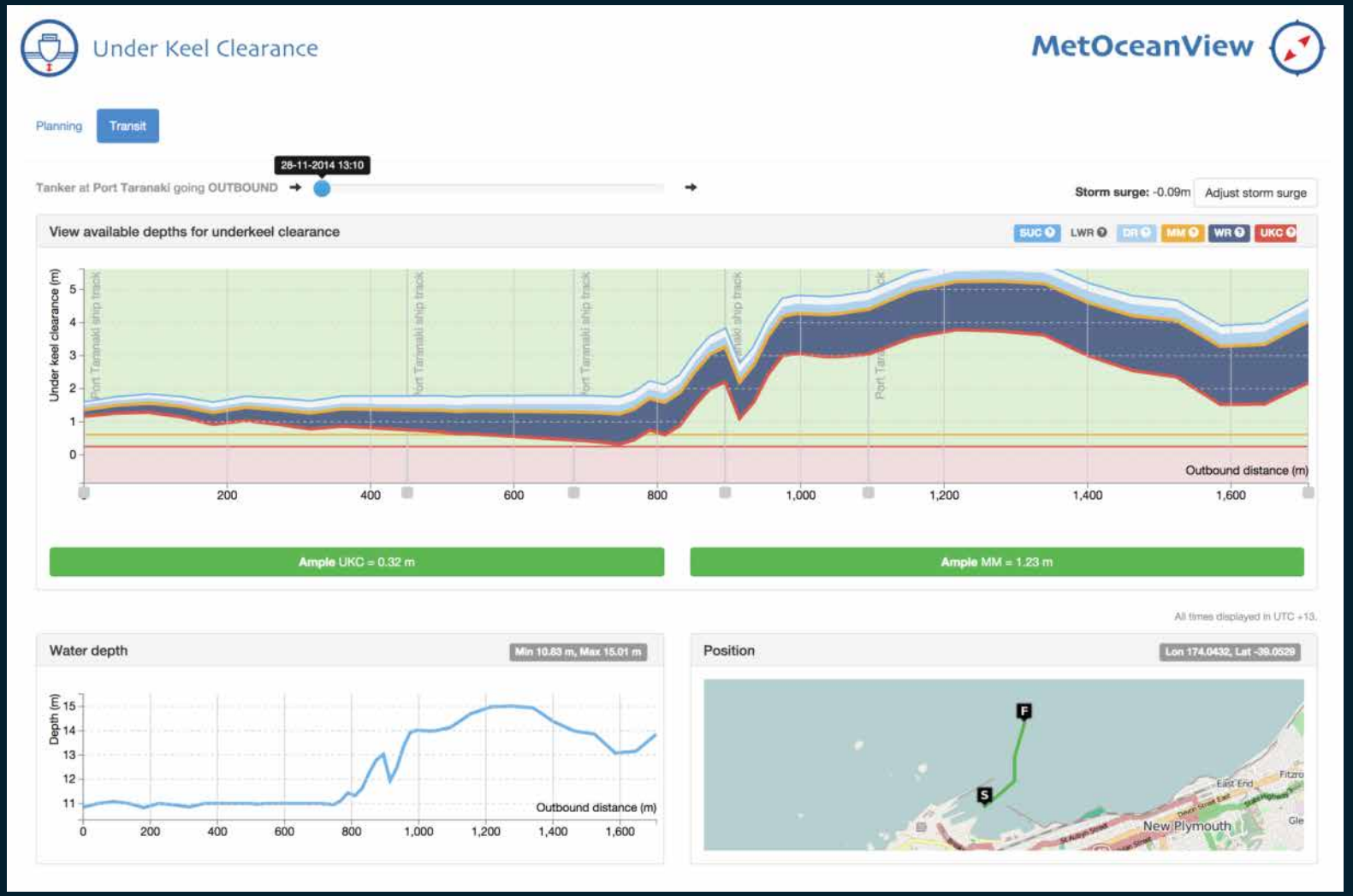


Time series forecast of vessel motion

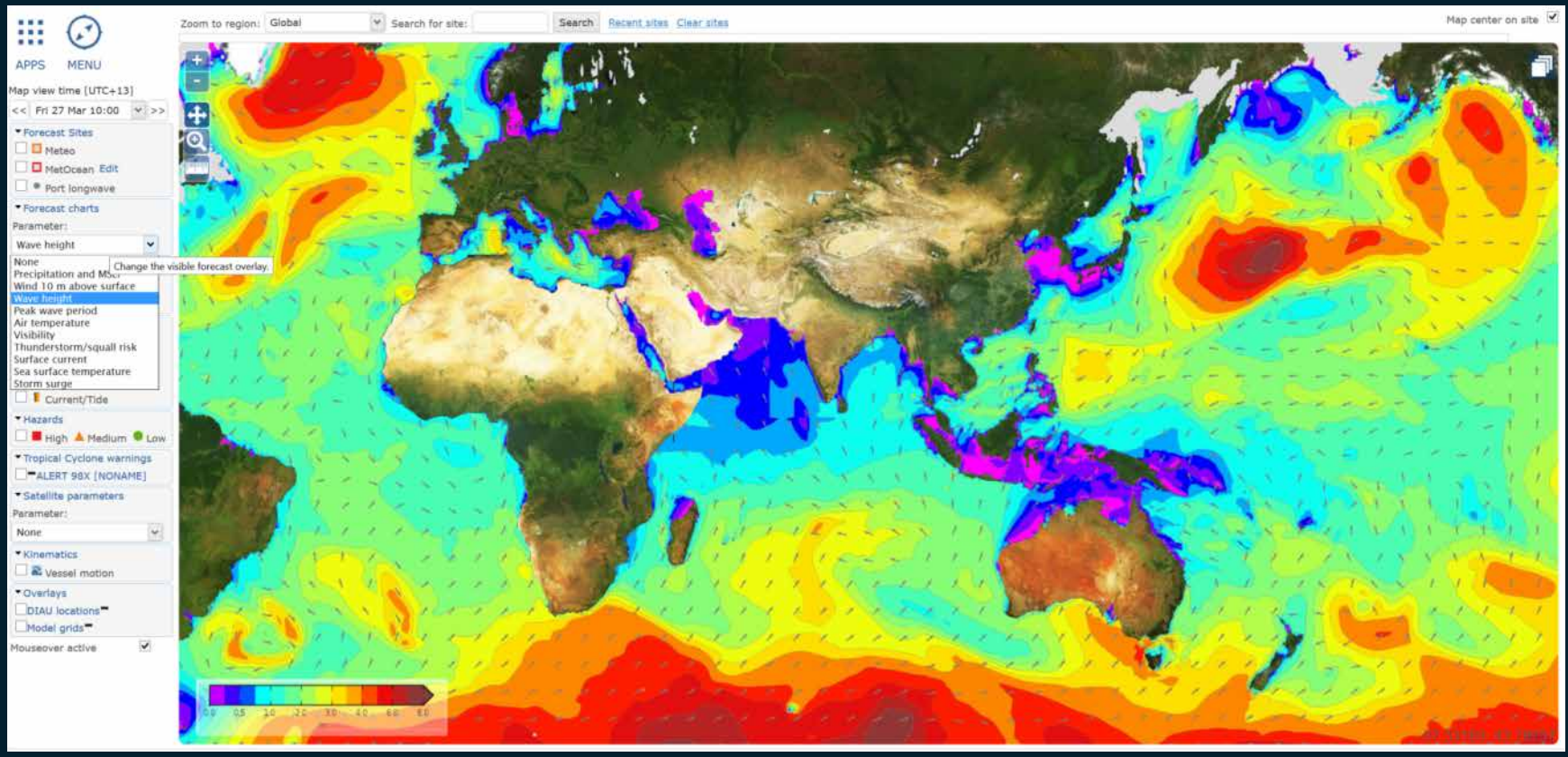
Forecasting something complex and making it simple

Safe under keel clearance windows for harbour transits

Forecasting something complex and making it simple



Thank you



Make easy-to-use tools for users and industry to improve their knowledge and make an intelligent transition. Don’t limit the available data for decision makers.