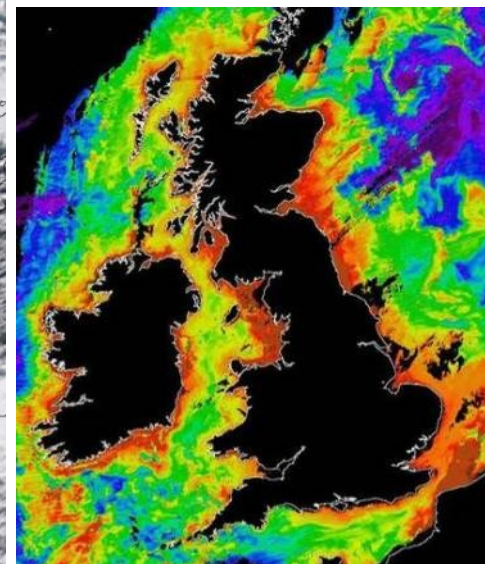
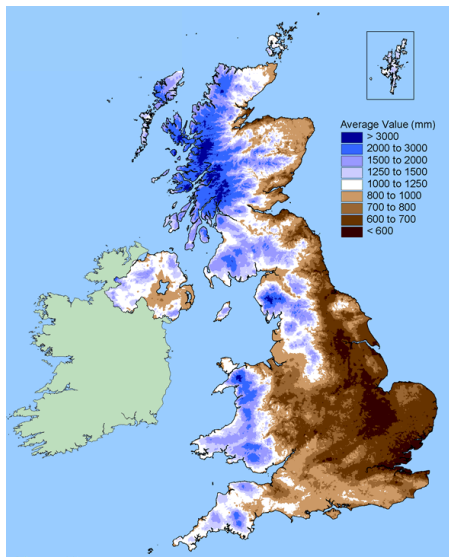
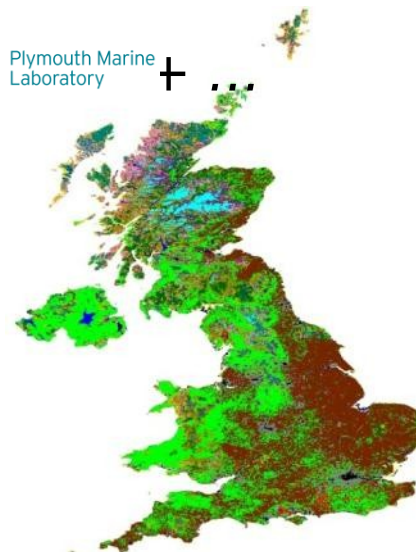
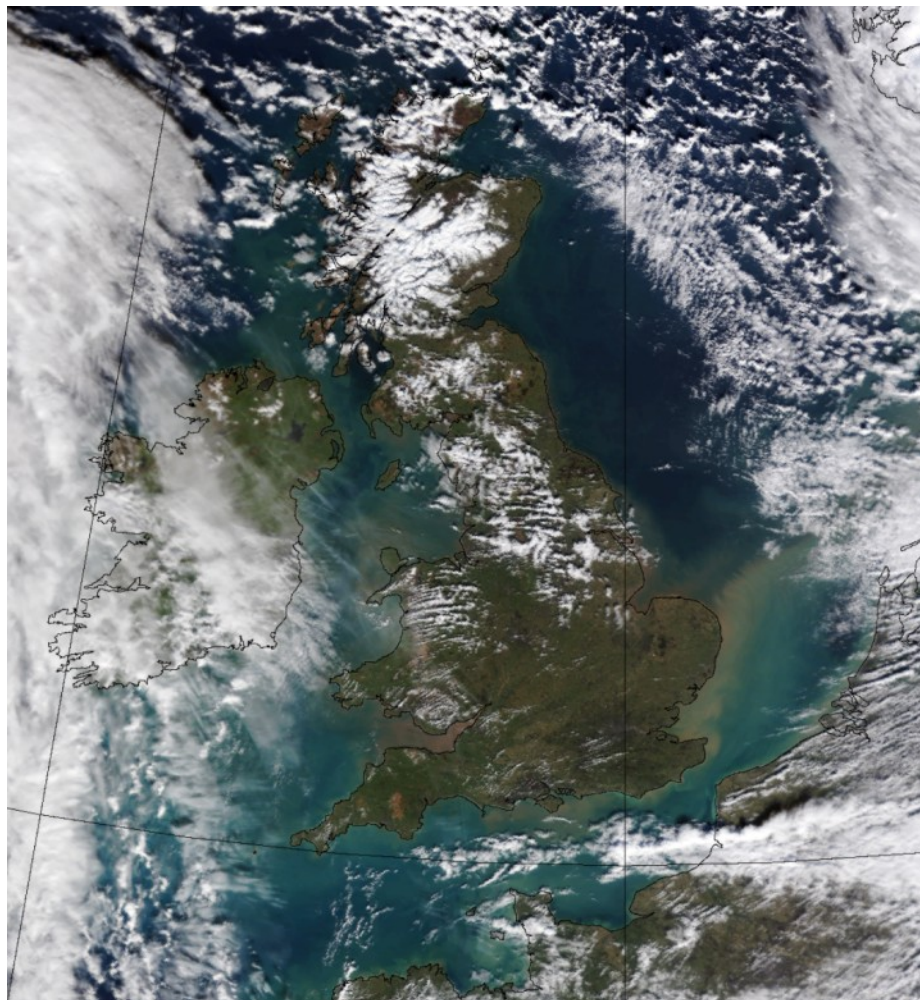
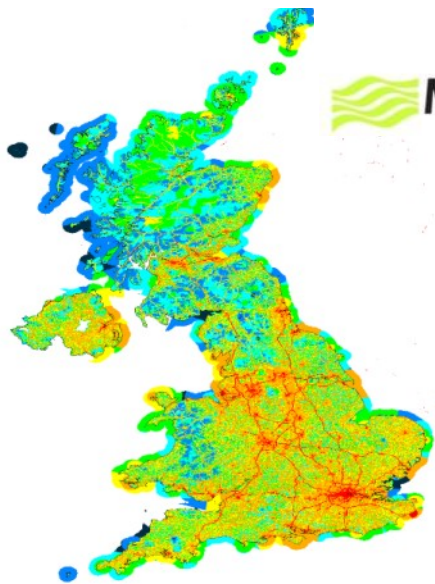


UK Environmental Prediction

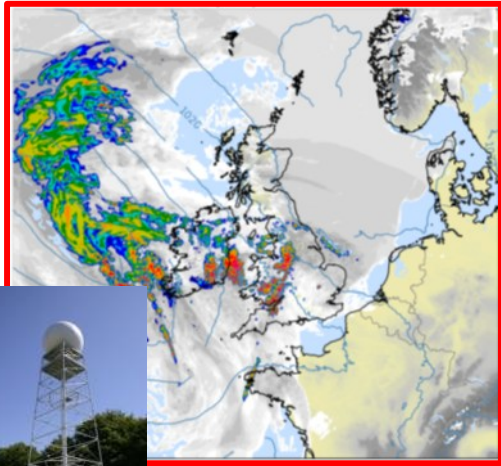


Huw Lewis, *Met Office*

Challenger Wave Meeting, Wallingford, Oct 2016

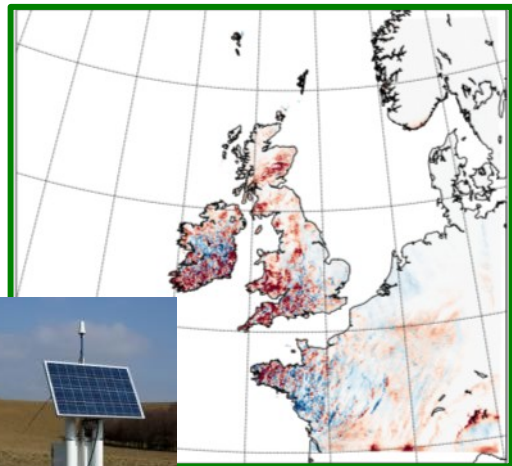
Towards coupled prediction?

ATMOSPHERE



Surface
fluxes

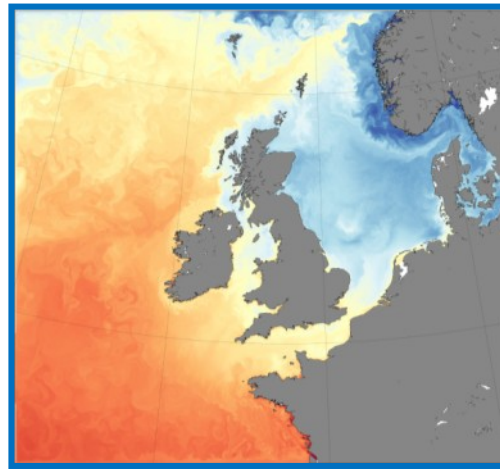
Radiation, Temp,
Precip, Evap



LAND SURFACE

Freshwater

Freshwater, Nutrients, Temperature



OCEAN

Wind, Pressure, Temperature,
Radiation, Surface fluxes

SST, Currents

Wind

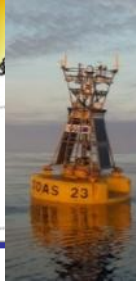
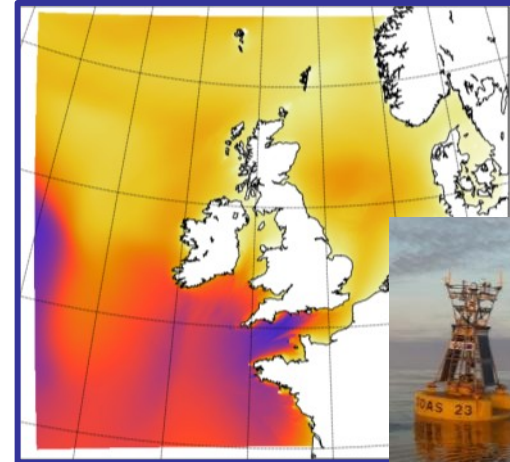
Surface stress

Wave height, Sfc stress,
Btm stress, Dissipation

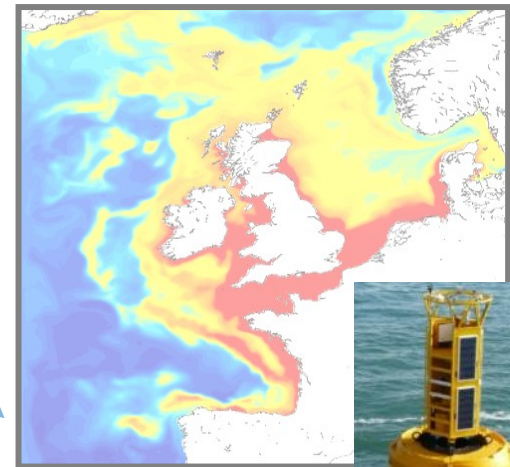
Currents, Depth

Bottom stress
Currents

WAVES



Bottom
stress



SEDIMENTS/BIOGEOCHEM

Delivering the Prototype...

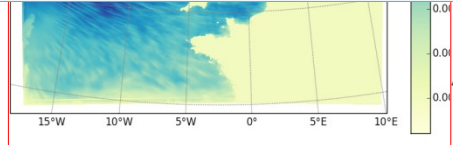
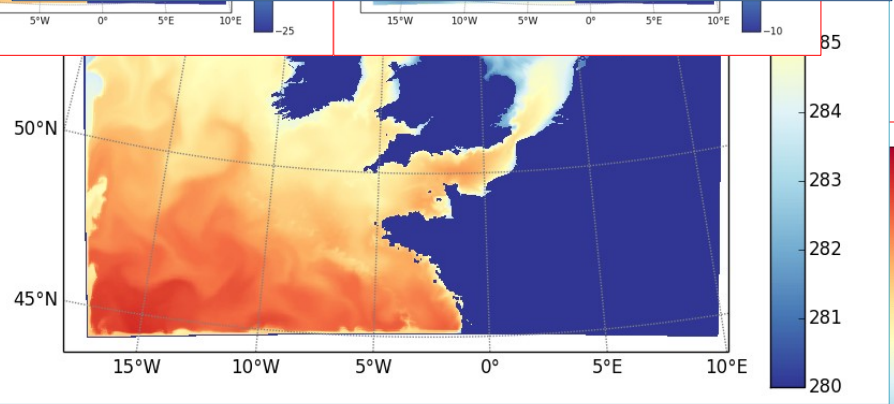
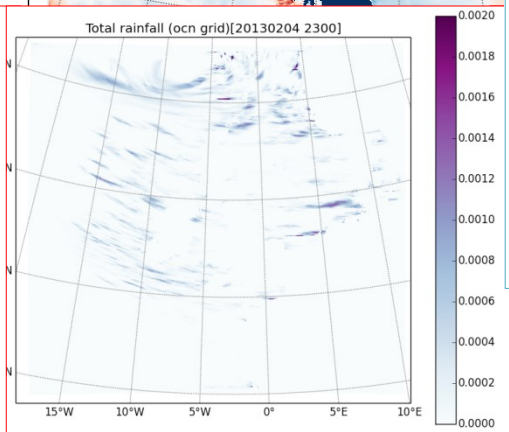
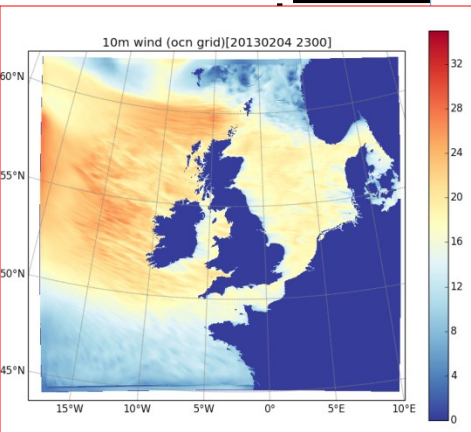
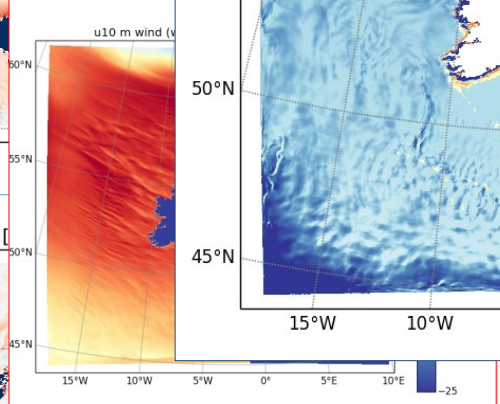
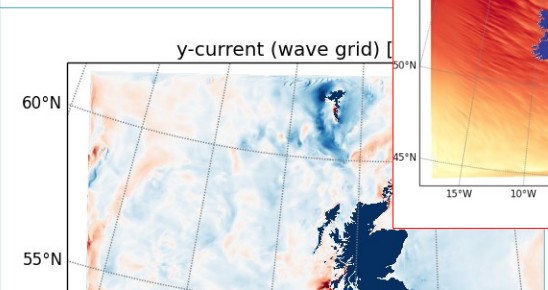
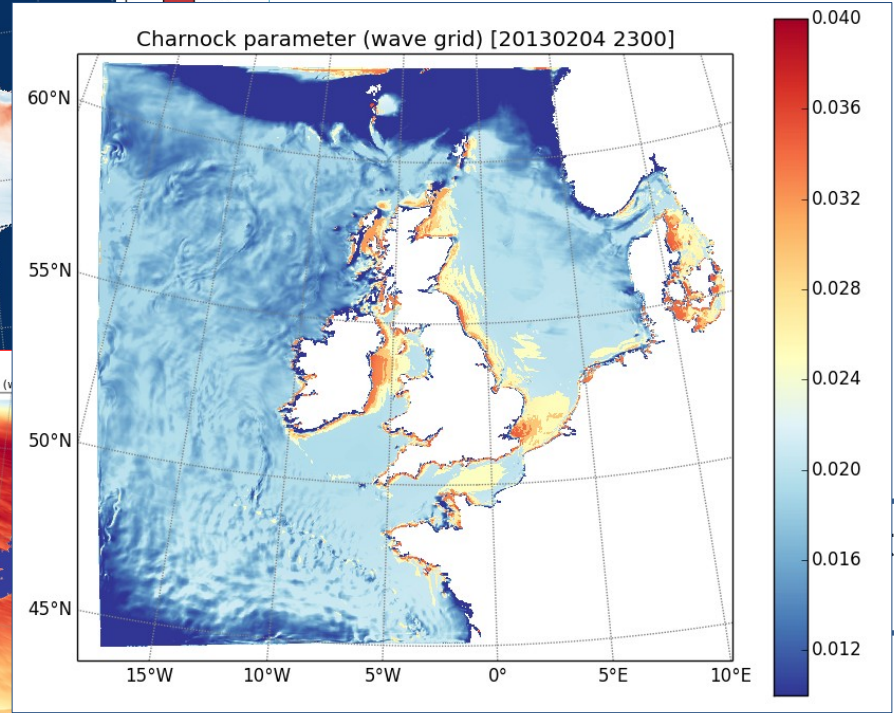
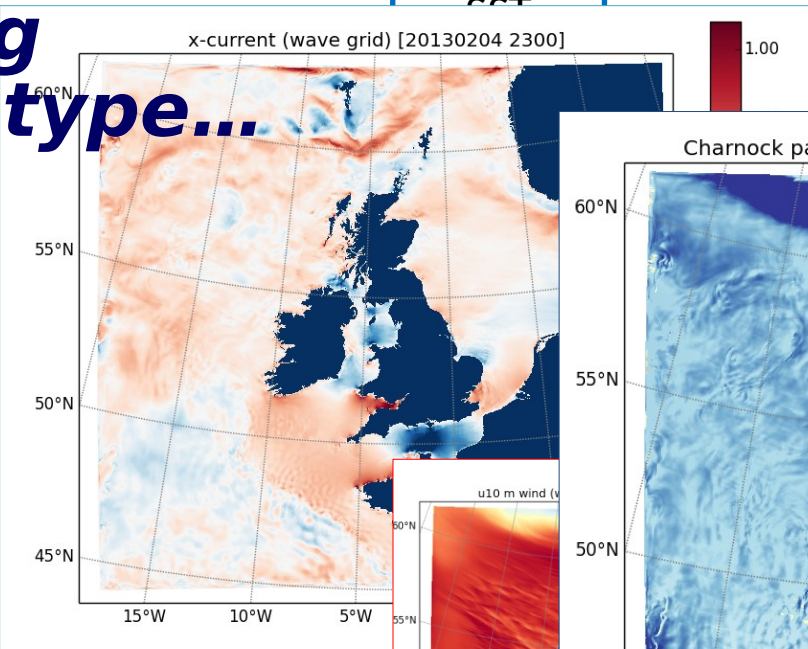
the UKC2 system

Global BCs
Coupled SST

Atm
(Un

La

R



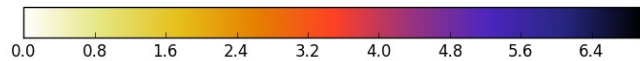
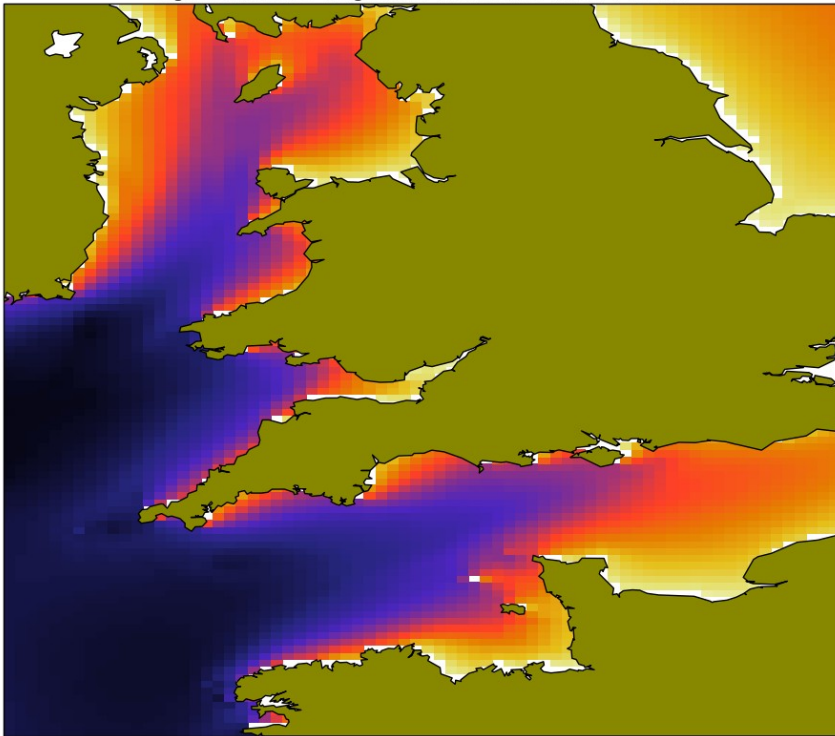
[Juan Castillo et al.]



A new km-scale coastal wave model

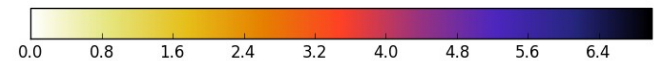
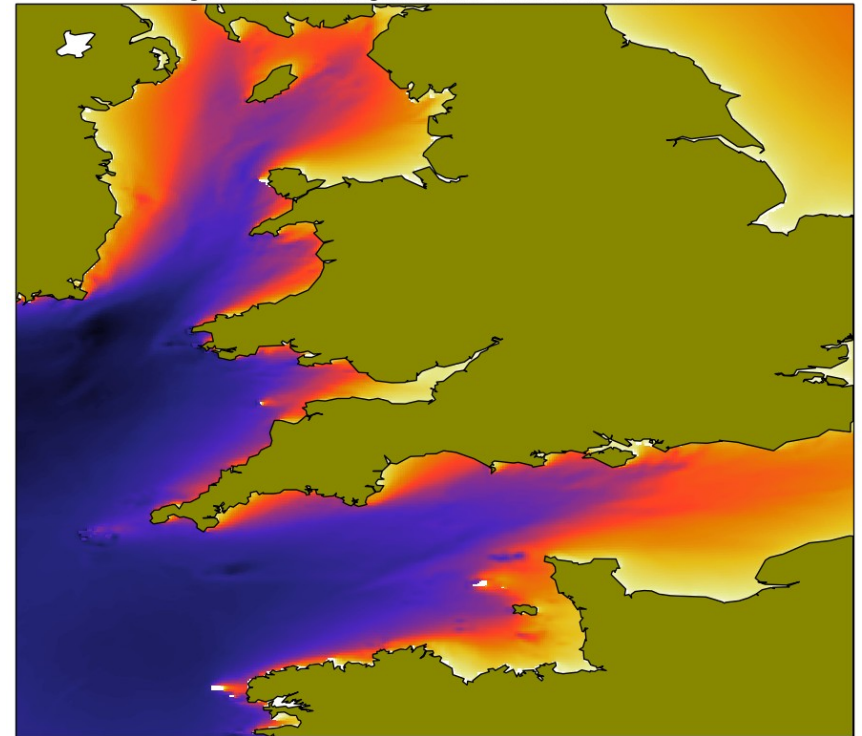
LOW-RESOLUTION (AMM7)

Significant Wave Height (m), 2014/01/06 2100Z - AMM7

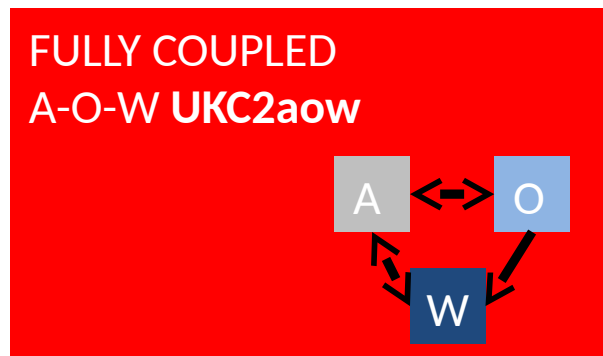
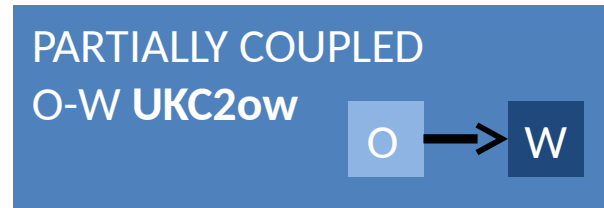
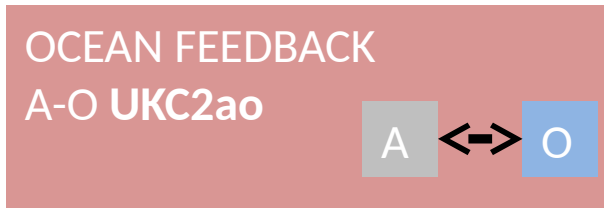
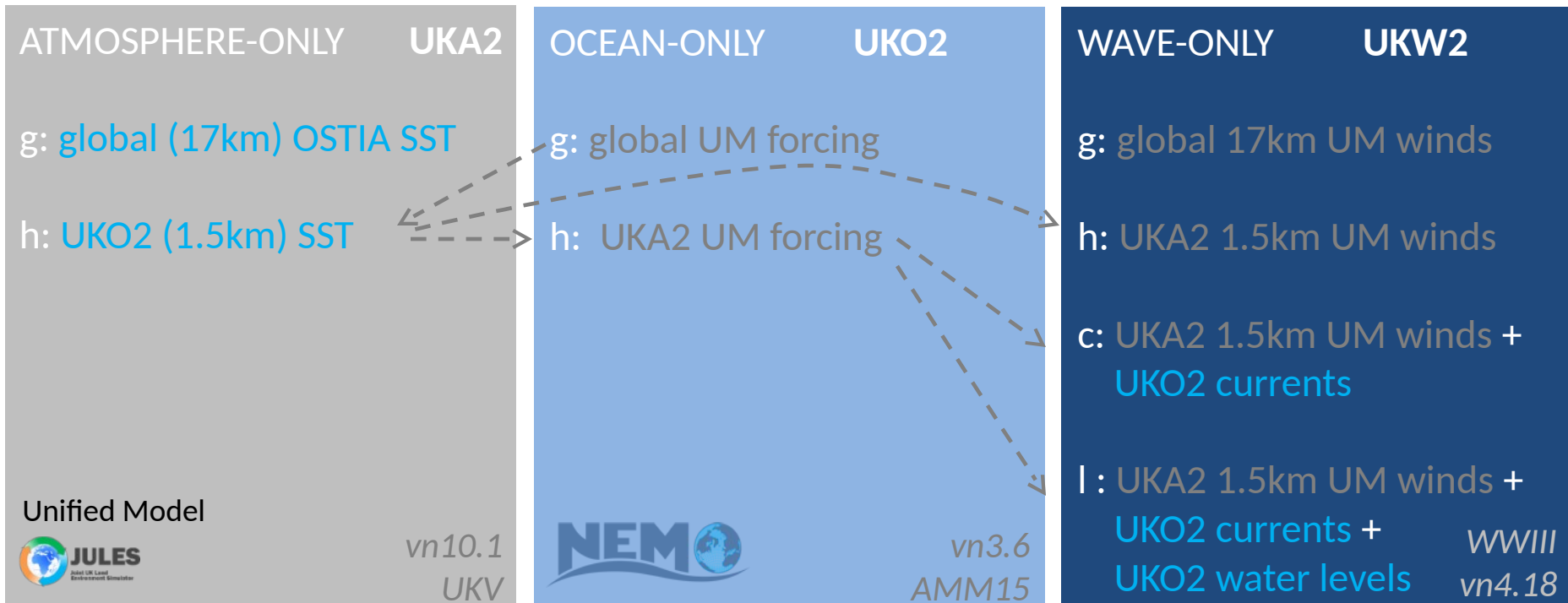



HIGH-RESOLUTION (1nm)

Significant Wave Height (m), 2014/01/06 2100Z - UK01



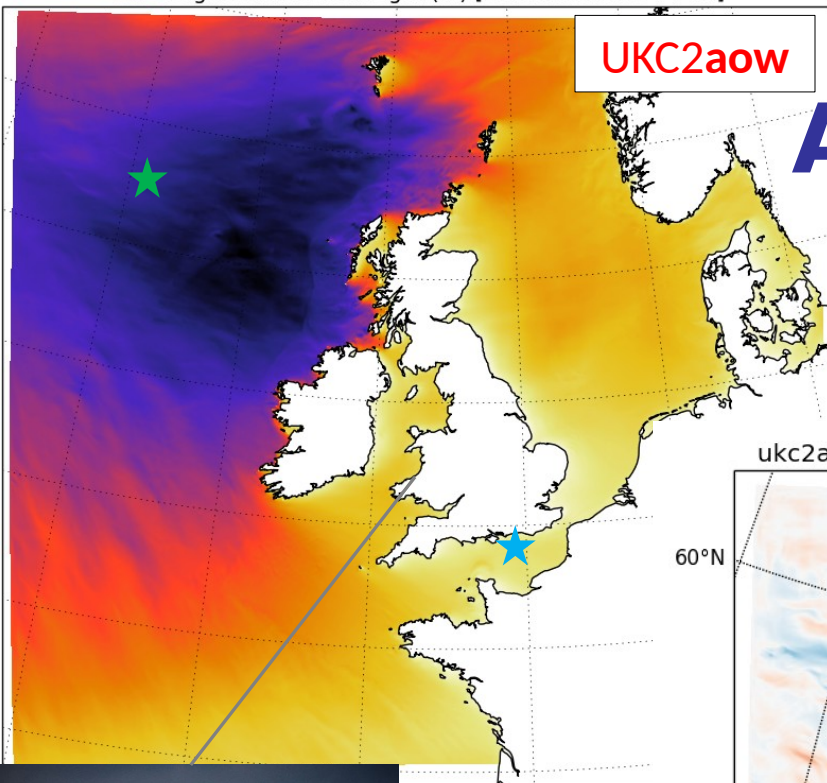
UK ENVIRONMENTAL PREDICTION - UKC2 Toolkit



 Hourly coupling via OASIS3-MCT

N.B. For future development: Wave feedbacks in ocean

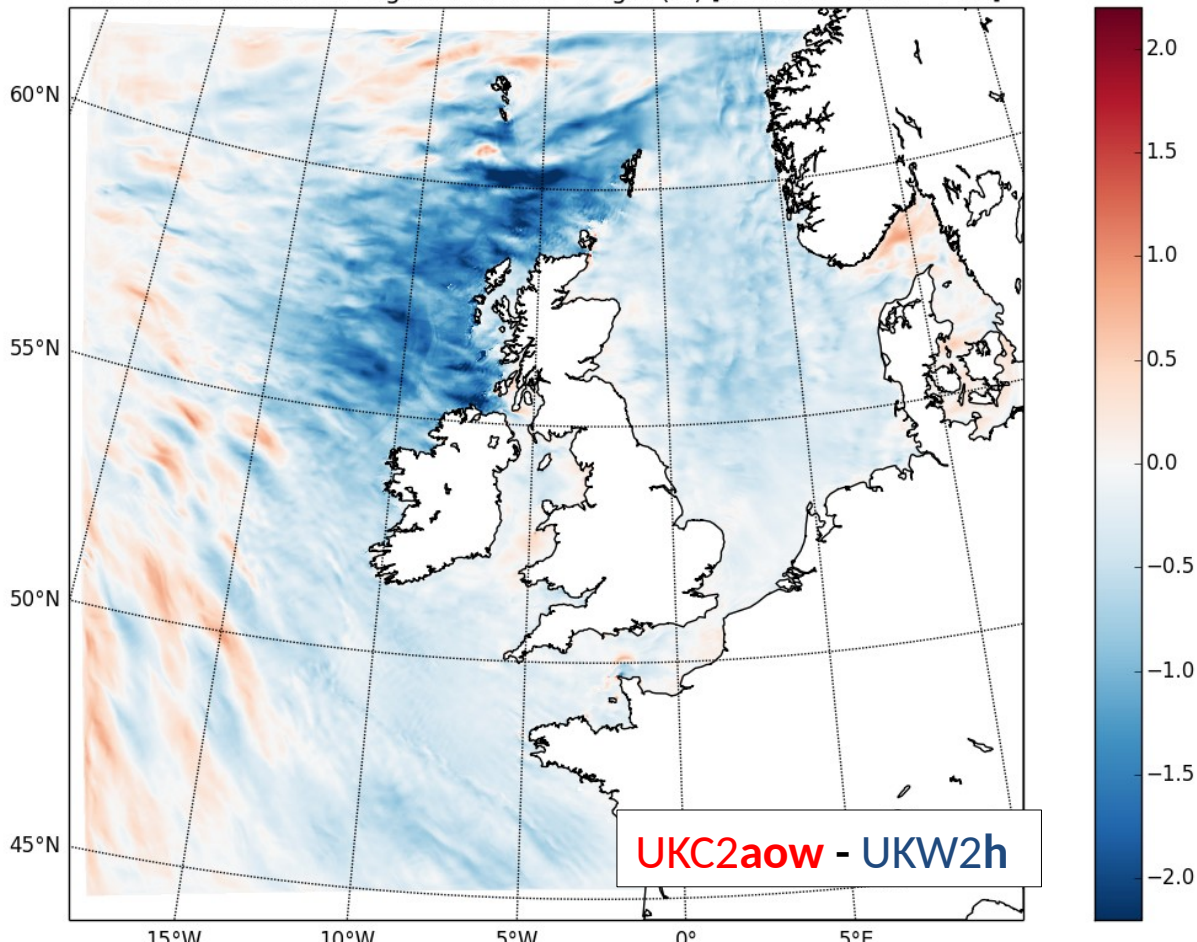
UKC2 Significant wave height (m) [201412101200 T+ 12]



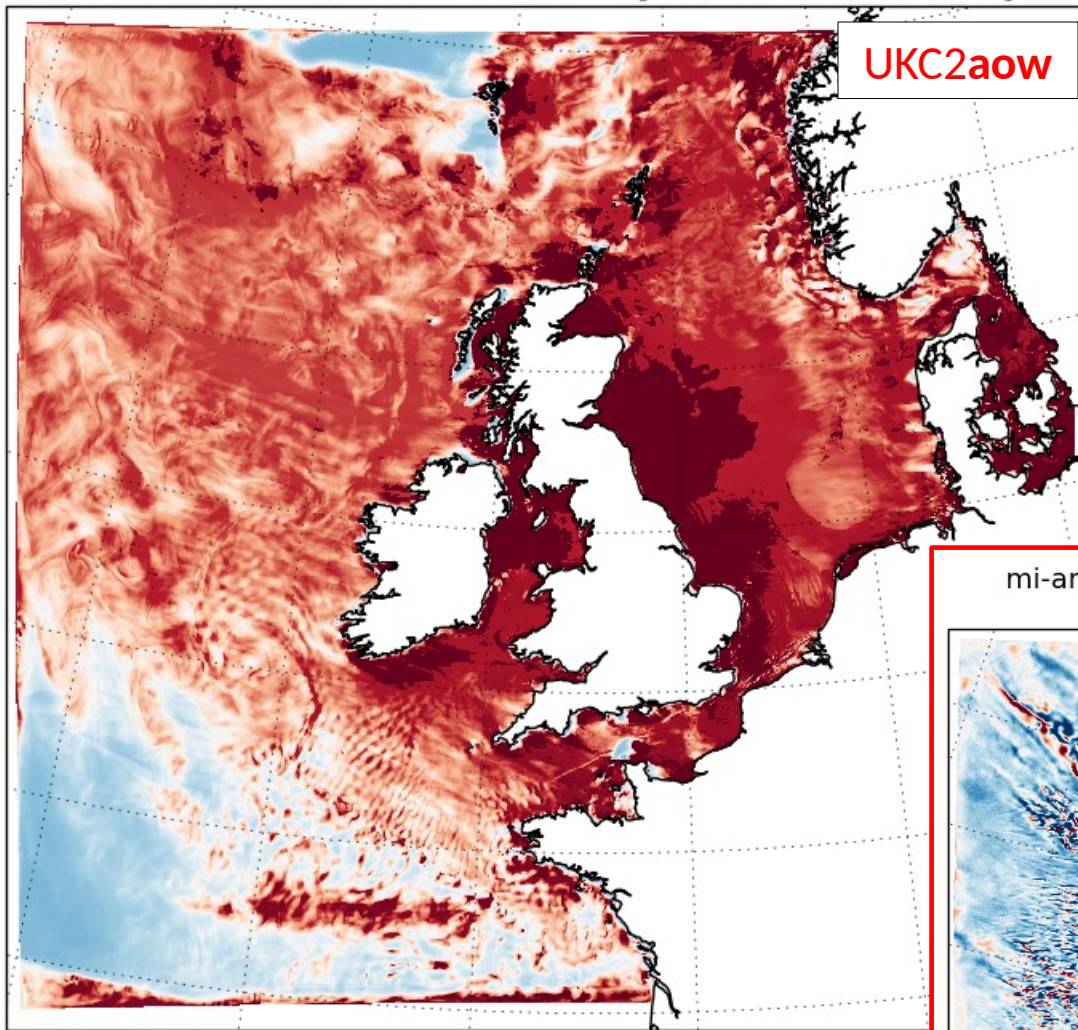
Impact on waves?

A “weather bomb”: Dec 2014

ukc2aow-ukw2h DIFF Significant wave height (m) [201412101200 T+ 12]

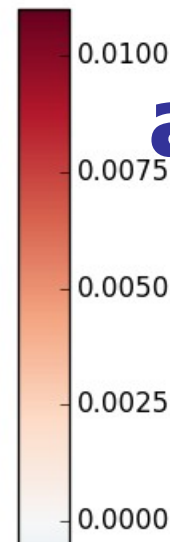


UKC2 Charnock coefficient - 0.011 [201412101200 T+ 12]

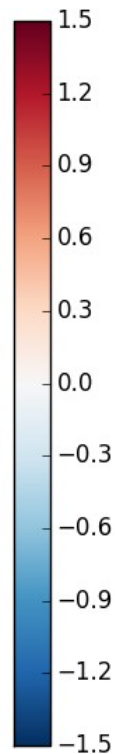
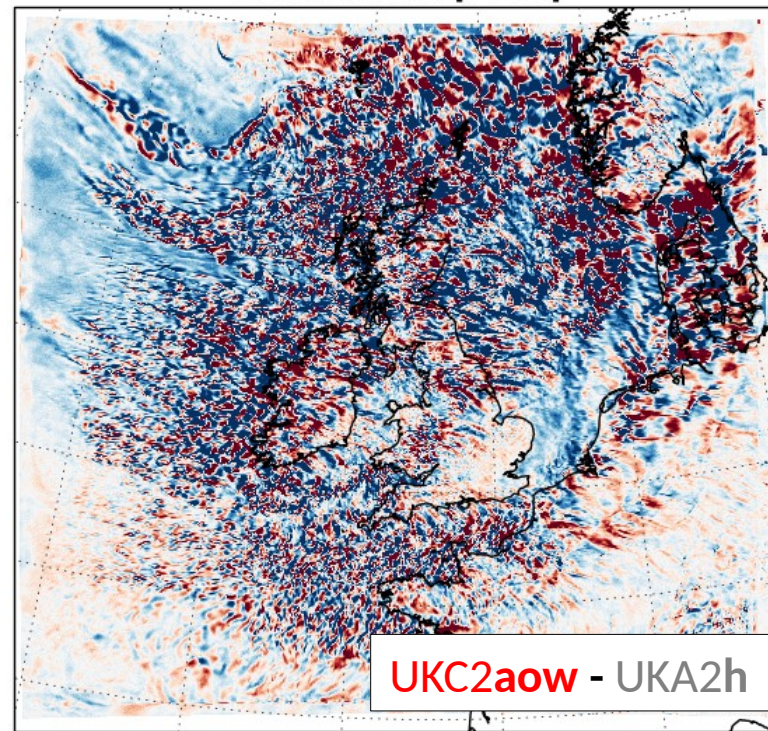


Impact of atm-wave coupling on winds

Dec 2014



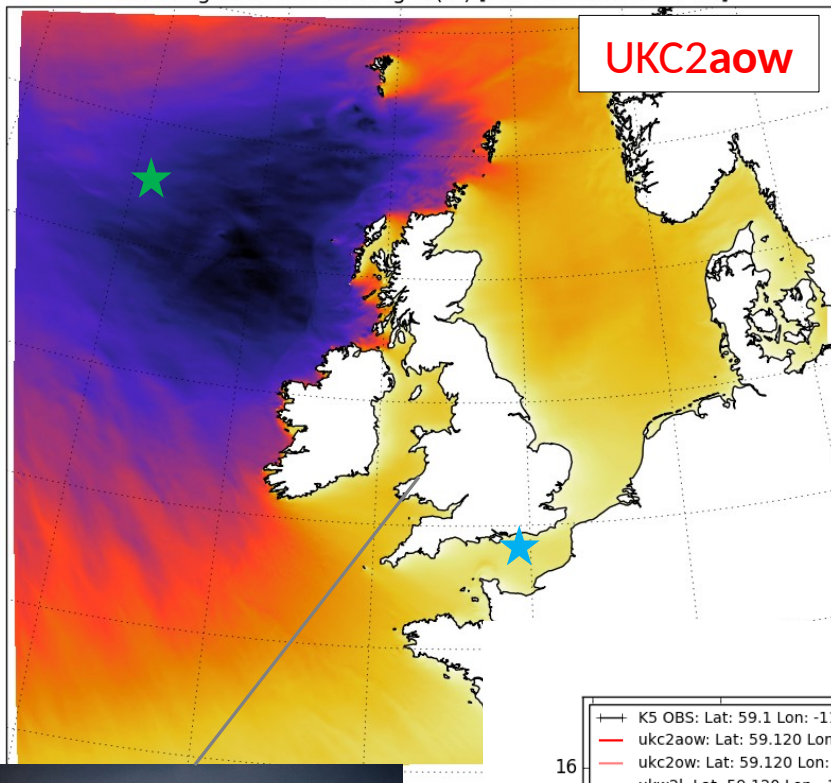
mi-am057-mi-al191h DIFF Wind speed (m s-1)
201412101200 [T+ 84]



Rougher surface than control constant
Smoother surface than control constant

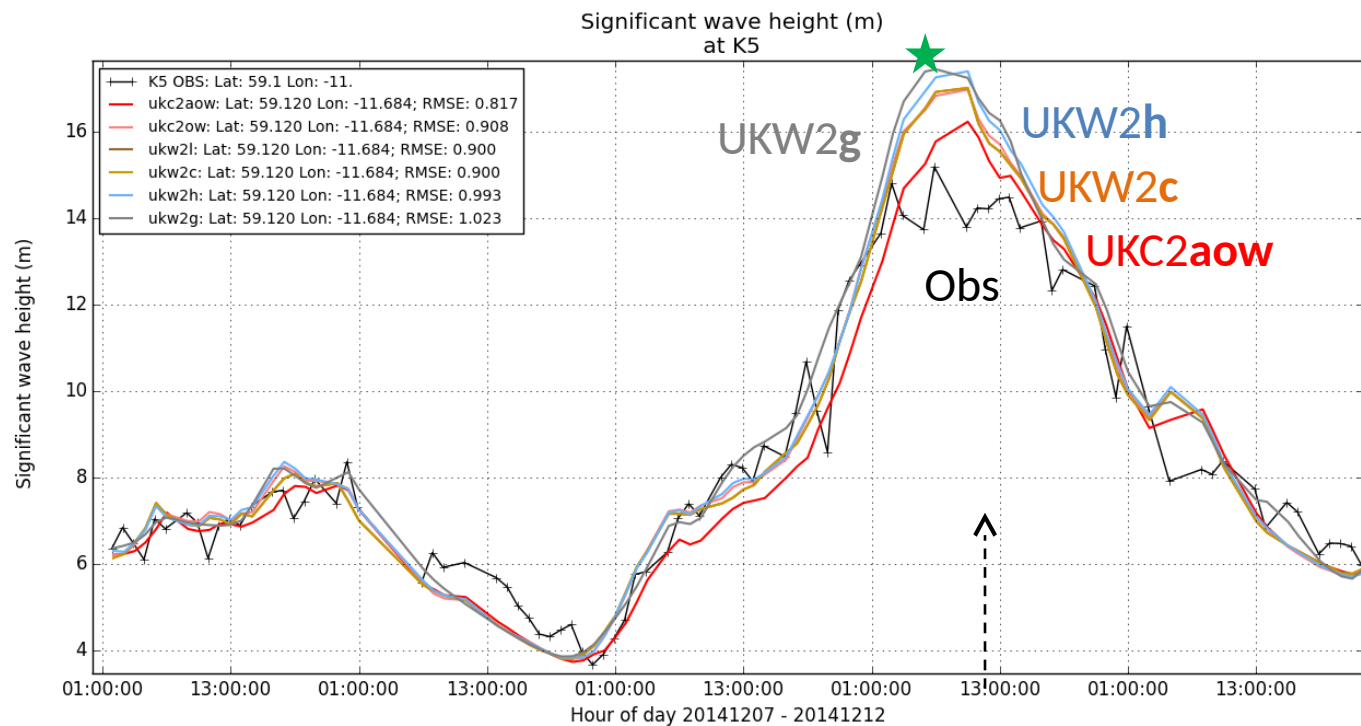
$$z_{0m(sea)} = \frac{1.54 \times 10^{-6}}{u_*} + \frac{\alpha}{g} u_*^2$$

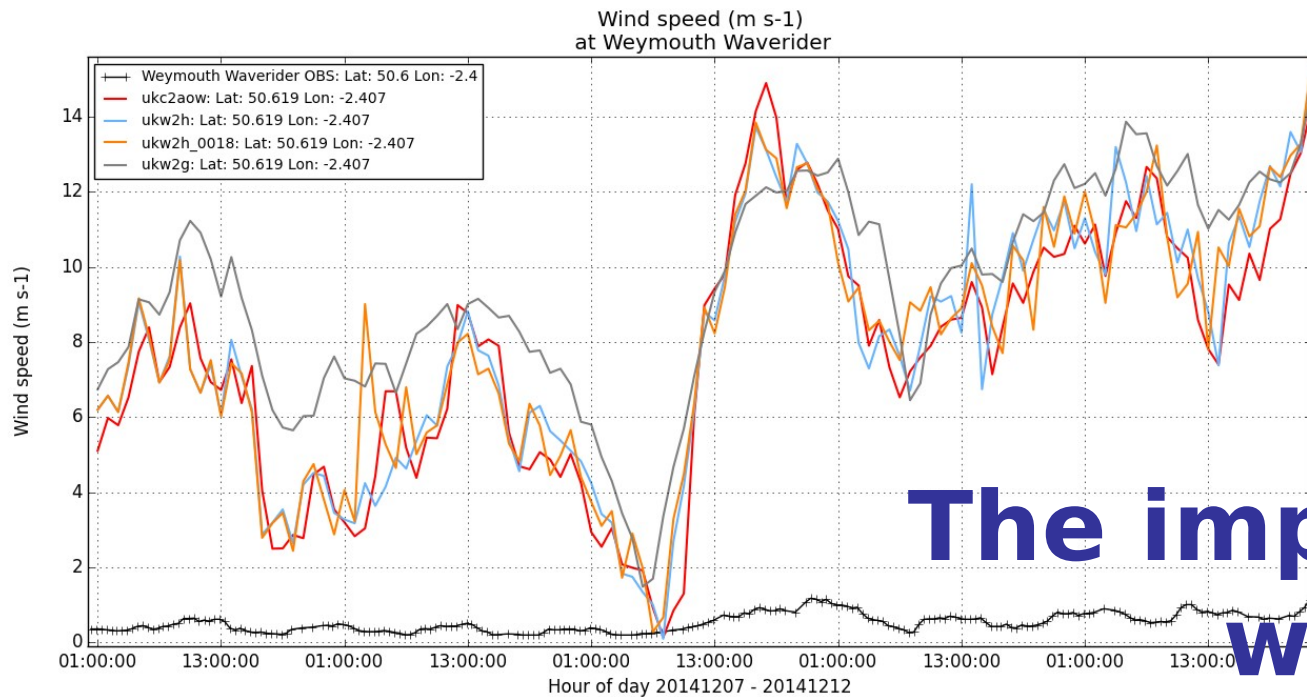
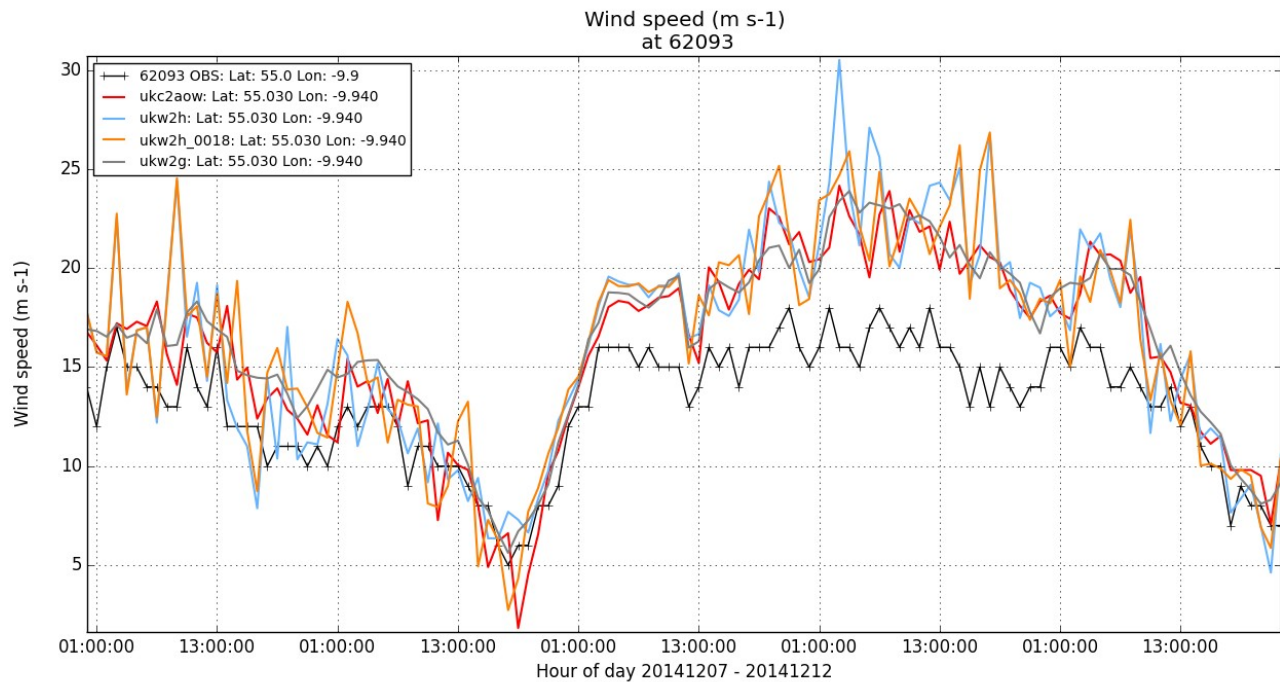
UKC2 Significant wave height (m) [201412101200 T+ 12]



Impact of atm-wave coupling on waves

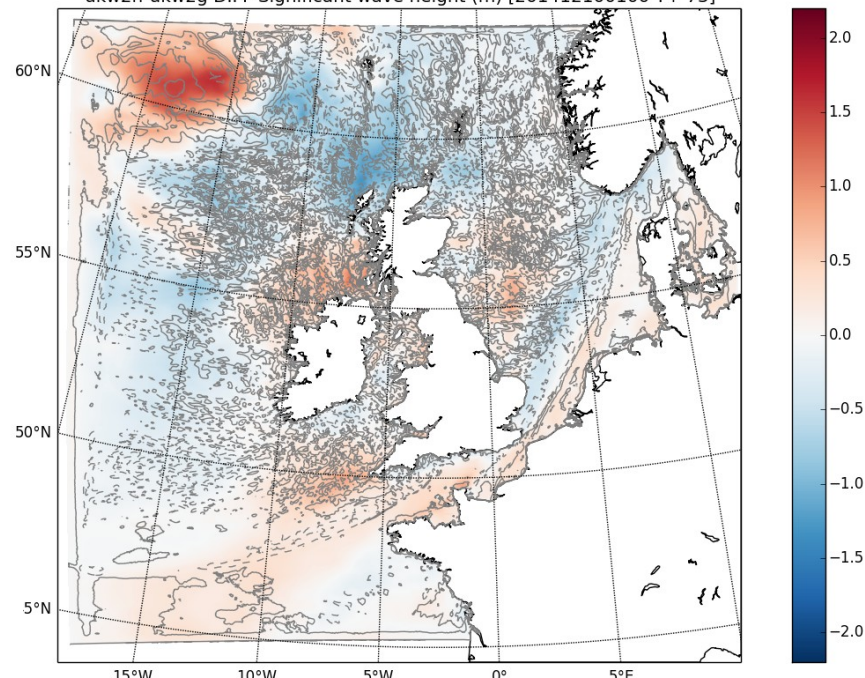
Winter storm Dec 2014



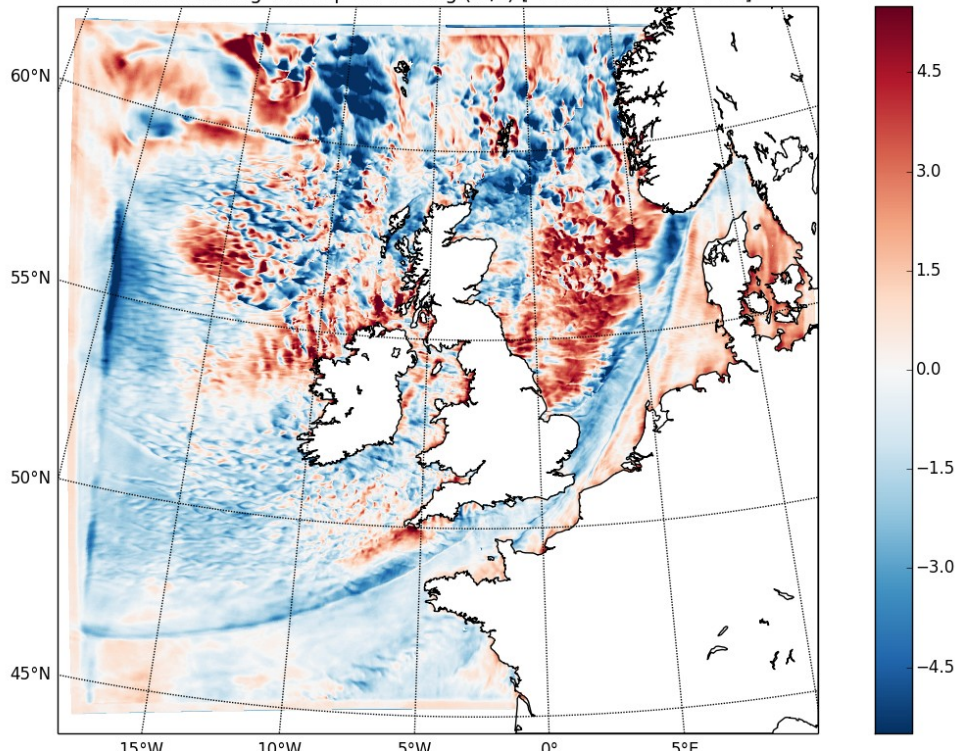


**The importance of
wind forcing**

ukw2h-ukw2g DIFF Significant wave height (m) [201412100100 T+ 73]

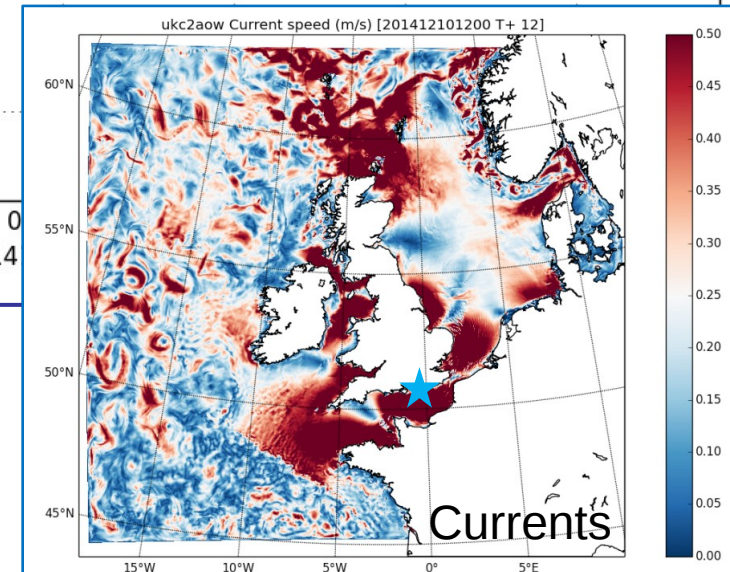
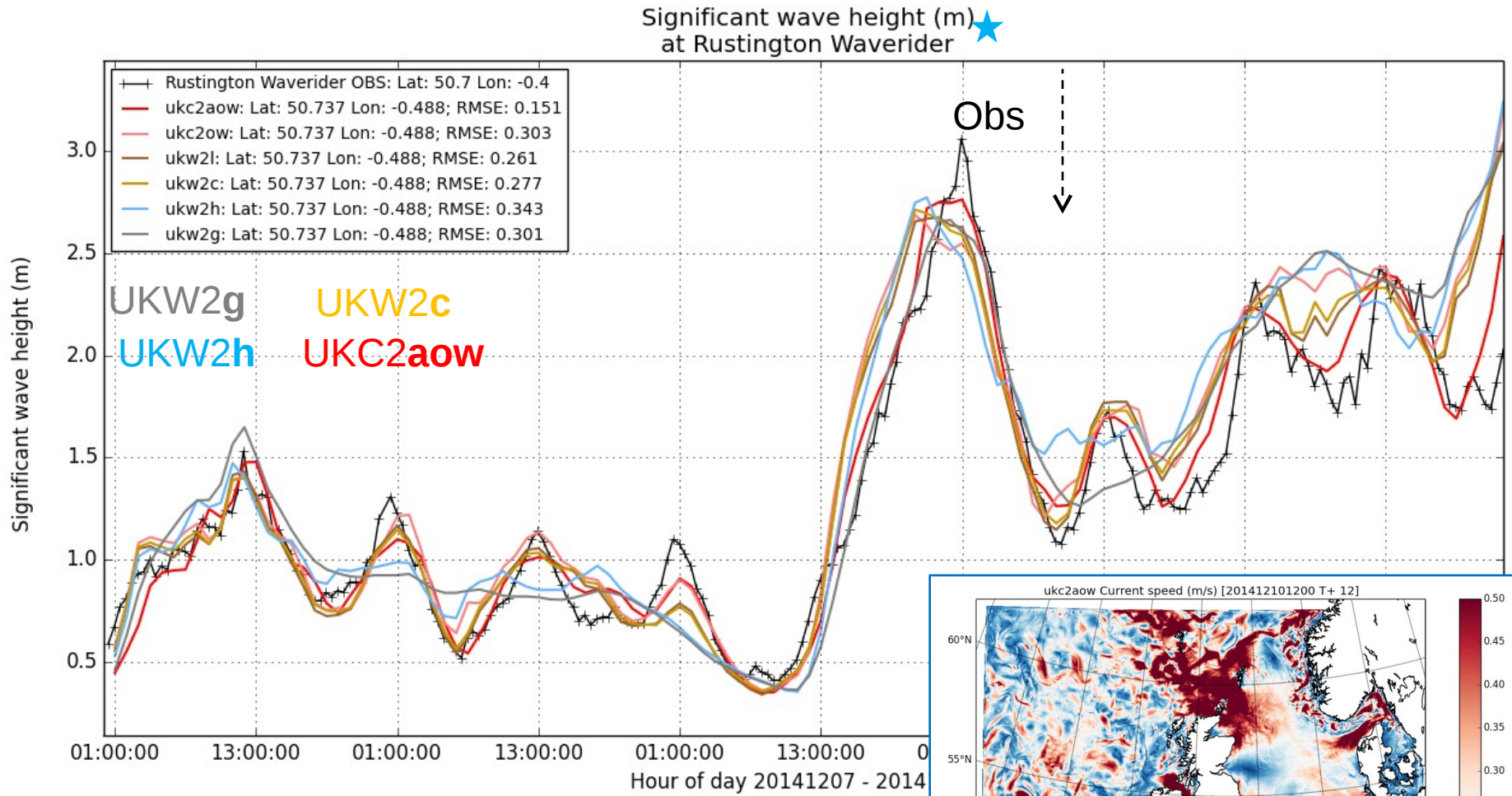


ukw2h-ukw2g Wind speed forcing (m/s) [201412100100 T+ 73]

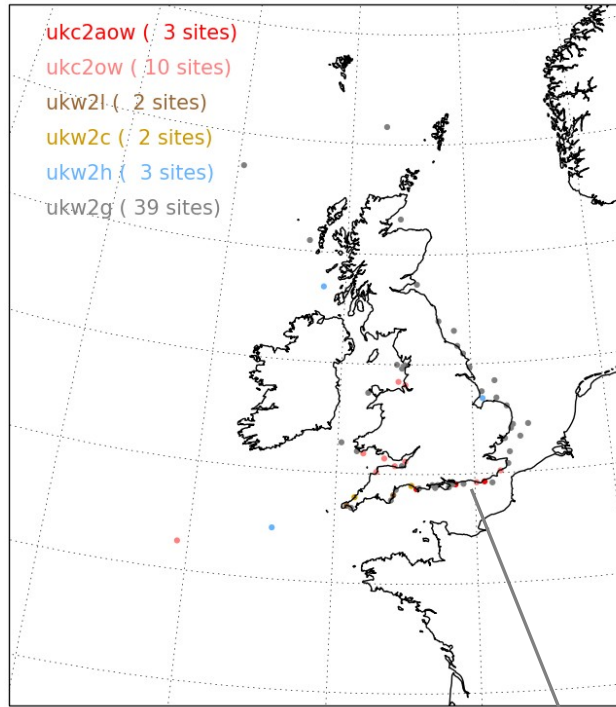


**the importance of
wind forcing**

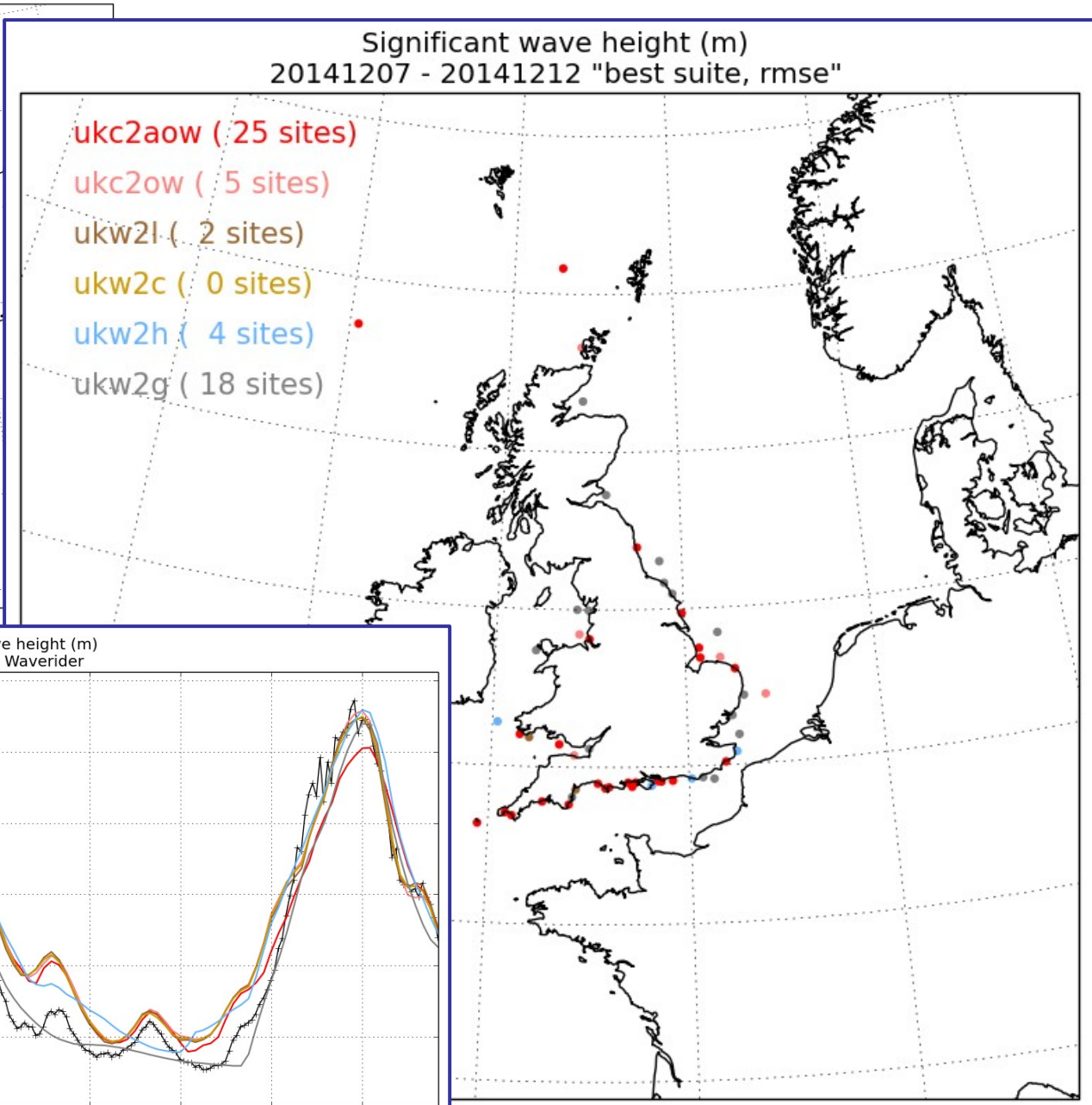
Current - wave interaction



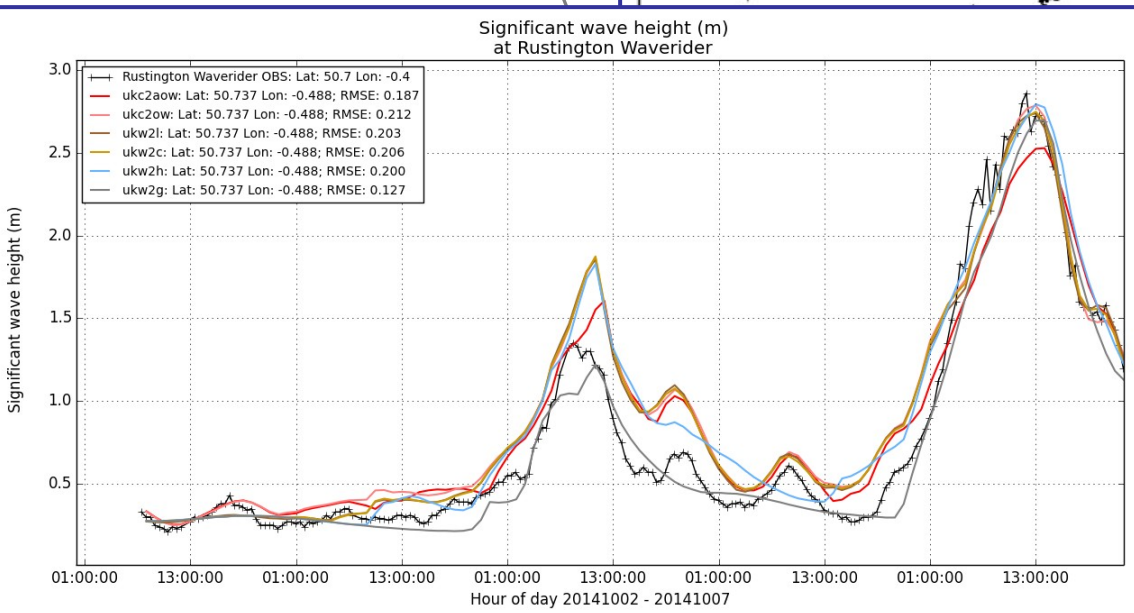
Significant wave height (m)
20141002 - 20141007 "best suite, rmse"



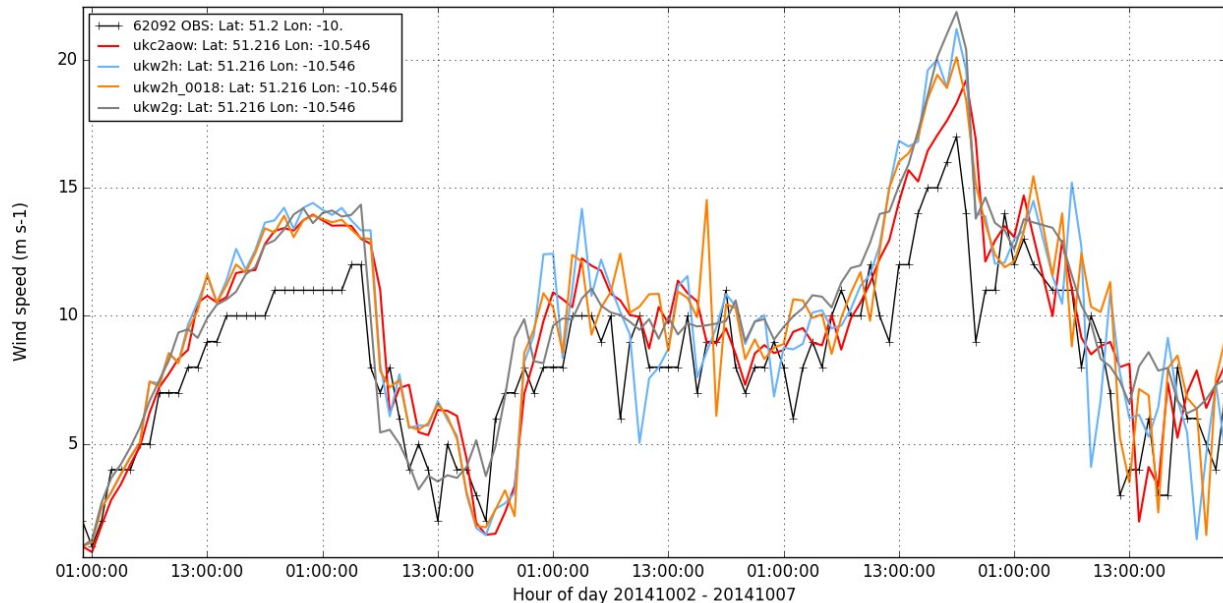
Significant wave height (m)
20141207 - 20141212 "best suite, rmse"



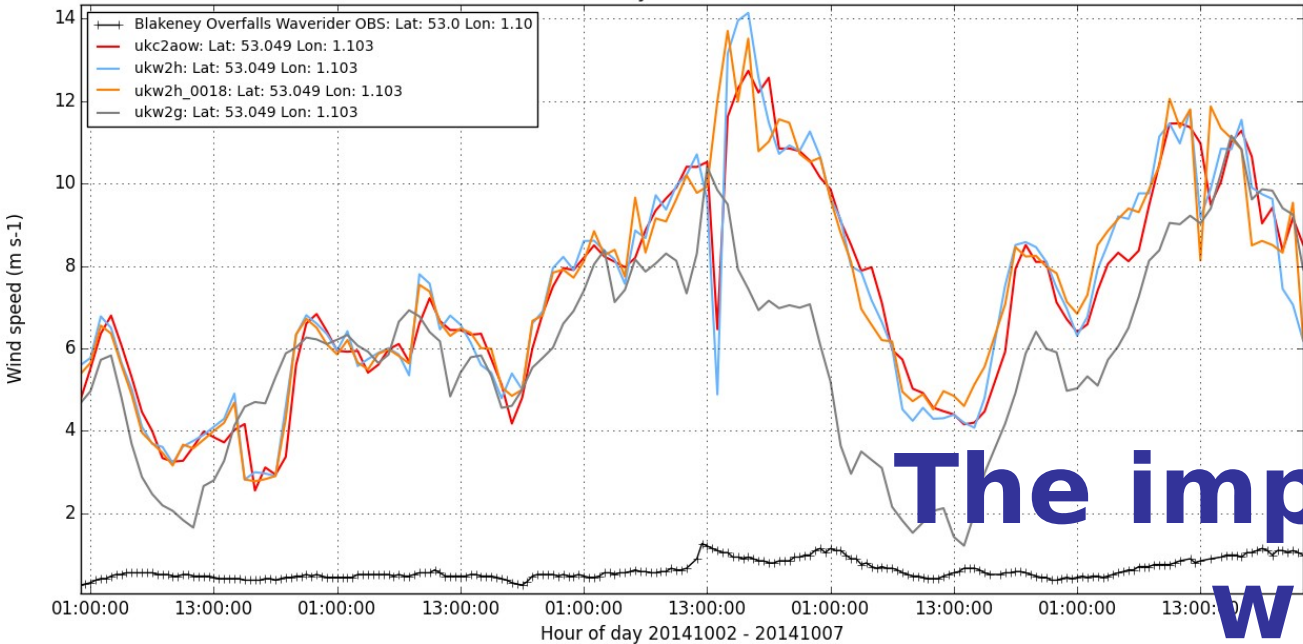
Significant wave height (m)
at Rustington Waverider



Wind speed (m s⁻¹)
at 62092

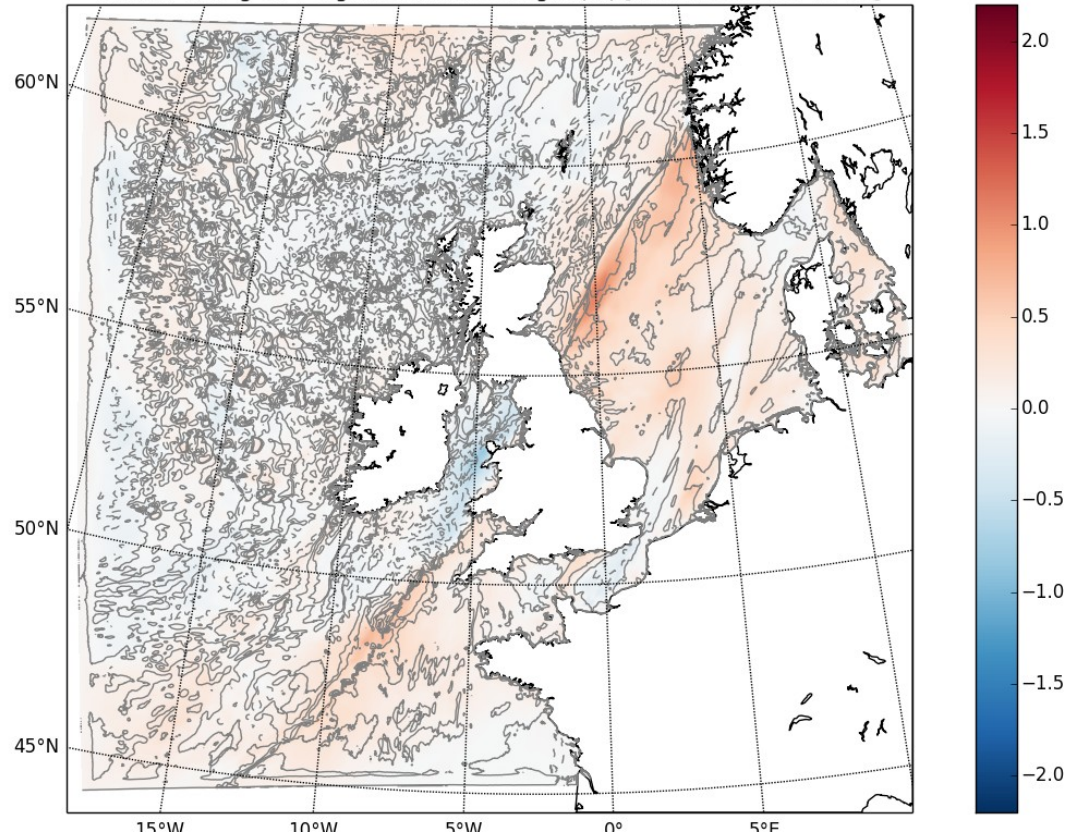


Wind speed (m s⁻¹)
at Blakeney Overfalls Waverider

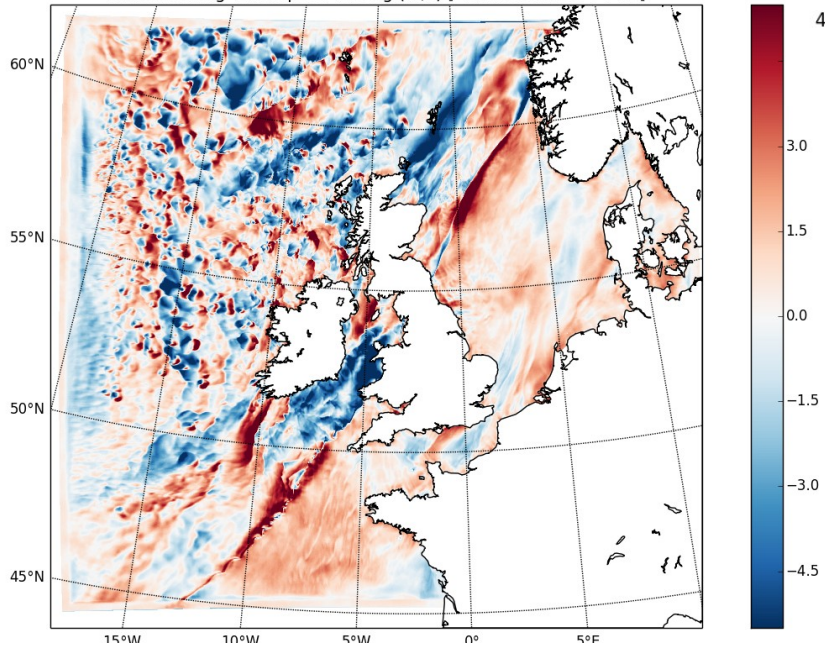


**The importance of
wind forcing**

ukw2h-ukw2g DIFF Significant wave height (m) [201410040100 T+ 73]



ukw2h-ukw2g Wind speed forcing (m/s) [201410040100 T+ 73]



**The importance of
wind forcing**

Summary

- UKC2 system provides valuable research tools to study air-sea-land interactions at high resolution
- Initial studies illustrate a range of sensitivities to closer integration between model components
- Evaluation of impacts requires suitable experimental design and detailed analysis at local scales
- We are only just starting to scratch the surface here...

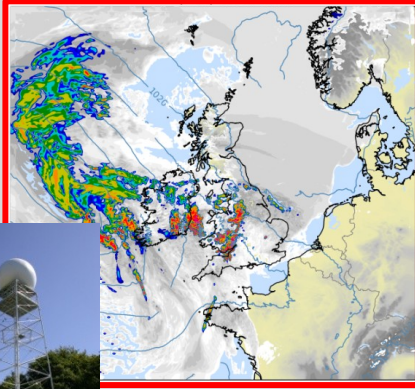


What's next?

Putting it all together

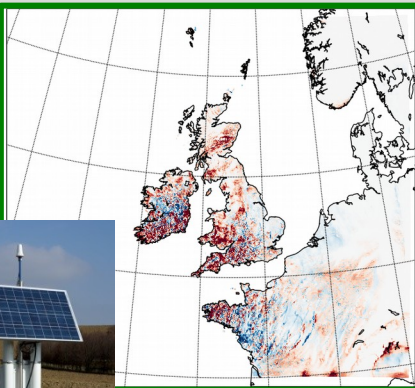
RT5

ATMOSPHERE



Atmosphere-Surface
feedbacks

RT1

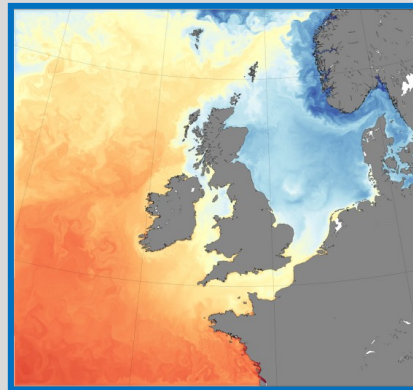


LAND SURFACE



Surface wave
interactions

RT3



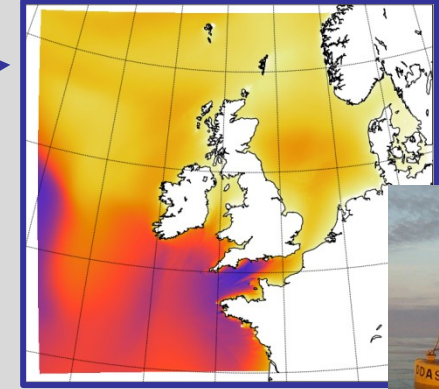
OCEAN

The coastal
environment

RT2

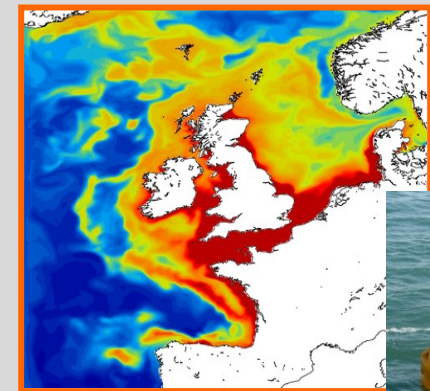
MARINE ENVIRONMENT

WAVES



Marine
ecosystem
feedbacks

RT4



RT5