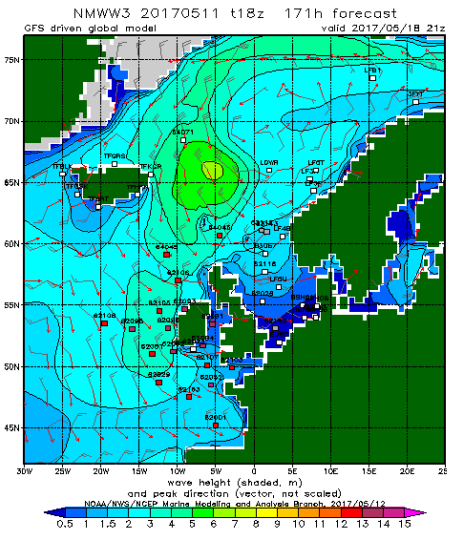
Current topic for a Master's Thesis

Variability of coastal significant wave height from models and satellite altimetry

The predictability of the wave climate up to the coastlines is essential for maritime and coastal security and a common way to validate the model predictions is to run it in the past and check the outputs against the observations. Satellite Altimetry (SA) provides since 25 years remotely sensed Significant Wave Height (SWH) at high resolution and regular along-track sampling. Some models assimilate the SWH from SA to adjust the outputs according to the observations. Nevertheless, SWH at the coast is never included in neither assimilation nor validation experiments due to the scarce quality of the standard SA in the proximity of land. Moreover, the variability observed by SA could be smoothed out in the models by weighting and interpolation.

Figure: SWH prediction from WaveWatch III, http://polar.ncep.noaa.gov/waves/viewer.shtml?-multi_1-latest-hs-NE_atlantic-



DGFI-TUM is at the forefront of coastal altimetry research and produces its own reprocessed SWH dataset based on the Adaptive Leading Edge Subwaveform (ALES) retracker, an algorithm that fits a modelled waveform to the real signal. Previous validation efforts with in-situ buoys have demonstrated that SWH from ALES is more precise and accurate than the standard product, both in open and coastal waters. The objective of this thesis is to study the scales of variability of SWH from ALES and the standard altimetry product in space and time and to evaluate whether the model outputs (from WaveWatch III) are able to represent them. Two test regions are selected to observe two different wave climates: the North Sea (SWH prevalently due to local wind) and the Indonesian Throughflow region (swells predominants). SWH from ALES and from Wavewatch III will be provided to the student, who will focus the effort on the data analysis and comparison.

Main tasks:

- Theory: Understand the factors that affect the wave climate, the expected differences between open ocean and coast and the measurement techniques.
- Dataset: Learn the spatial and temporal characteristics of altimetry (Jason missions) and modelled data, familiarise with data formats and filtering.
- Scales of variability: Determine the seasonality and trend of sea state, underlining differences between the two data sources and between open ocean and coast.

References:

- Passaro M., Fenoglio-Marc L., Cipollini P.: Validation of significant wave height from improved satellite altimetry in the German bight. IEEE Transactions on Geoscience and Remote Sensing 53(4): 2146-2156, 10.1109/TGRS.2014.2356331, 2015
- Queffeulou P. and Bentamy A.: Analysis of wave height variability using altimeter measurements: application to the Mediterranean Sea. Journal of atmospheric and oceanic technology 24.12, 2078-2092, 2007.
- Akpinar A. and Ponce de León S.: An assessment of the wind re-analyses in the modelling of an extreme sea state in the Black Sea. Dynamics of Atmospheres and Oceans 73: 61-75, 2016.

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