geosciences

*Article*

# Legacy Data: How Decades of Seabed Sampling can Produce Robust Predictions and Versatile Products

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## Supplement S1:

**Table S1.** Seabed sediment groundtruth data prior to filtering out problematic samples.

| Source | National Maritime Boundaries Covered | Number of Samples |
|---|---|---|
| British Geological Survey | UK | 58 |
| Cefas [1] | UK | 21,227 |
| dbSeabed | Belgium, Denmark, France, Germany, Guernsey. Jersey, Netherlands, Norway, Republic of Ireland, Sweden, UK | 4820 |
| Federal Maritime and Hydrographic Agency of Germany | Belgium, Denmark, Germany, Netherlands, Norway, Sweden, UK | 27,806 |
| Geological Survey of Denmark and Greenland | Denmark, Germany, Netherlands, Norway, UK | 474 |
| Geological Survey of the Netherlands | Belgium, Germany, Netherlands, UK | 5921 |
| INFOMAR (Ireland) | Republic of Ireland, UK | 1441 |
| Ifremer (France) | France, Germany, Guernsey, Jersey | 551 |
| Netherlands Institute of Sea Research | Belgium, Denmark, Germany, Netherlands, Norway, UK | 85 |
| MOD web portal (https://mod.dnvgl.com/) | Norway | 3390 |
| UK Regional Environmental Assessments | UK | 24 |
| Rikswaterstaat Netherlands | Germany, Netherlands | 4219 |
| Royal Belgian Institute of Natural Sciences | Belgium, France, Netherlands, UK | 3074 |
| Total | | 68,270 |

## Supplement S2:

### Preparation of Mean Tidal Currents and Peak Wave Velocities data for the UK Continental Shelf

*Mean Tidal Current Velocity*

Tidal flow information was generated using the finite element TELEMAC2D model run over a high-resolution shelf-wide unstructured mesh derived from the Defra funded 'Astrium' dataset (Figure S1). The unstructured mesh allows freedom to spatially vary resolution. In the coastal zone the mesh spacing was designed to be in the range 0.5 km to 1.0 km to enable good resolution of tidal flows along the coast and in estuaries. Away from the coast resolution decreased to around 10 km. The time average of the dominant M2 tidal constituent current speed was used as an approximation for the total mean tidal current speed. The other smaller tidal constituents will cause variations around the M2 component but will be expected to make only a small contribution to the long-term average.

**Figure S1.** Shelf wide finite element mesh used for tidal currents.

Validation was carried out using a database of current measurements (Figure S1, S2) obtained from the British Oceanographic Data Centre. Geographic distribution of errors (Figure S2) show good agreement in the North Sea, Celtic and Irish Seas, with largest relative errors in low tidal flow areas to the north of Scotland. Errors are approximately evenly spread around the zero line although with a suggestion of a small bias to overprediction based on relative differences (Figure S2a). Regions with very small observed currents tended to have large relative errors as would be expected.

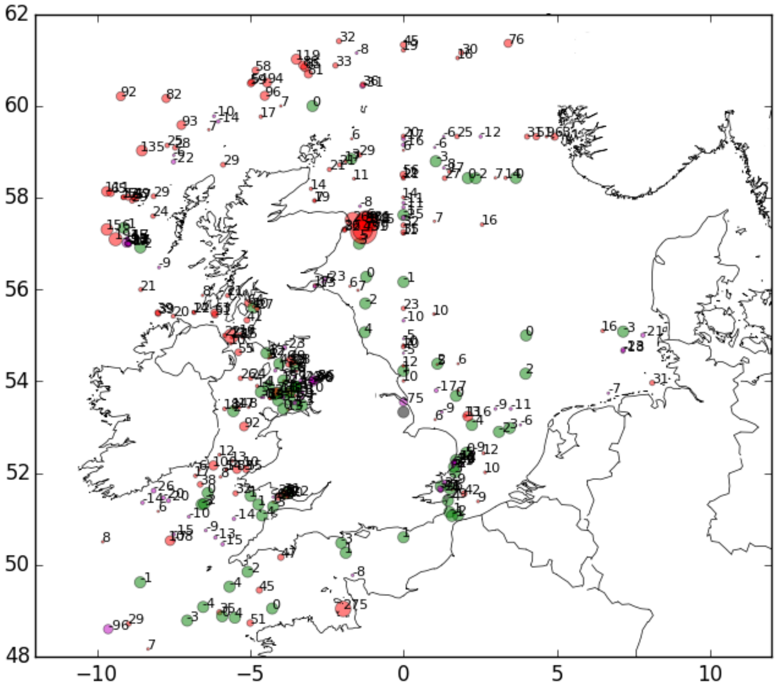

**Figure S2.** Percentage relative errors in predicted maximum M2 tidal current speed compared to observations (100 x (Model-Obs)/Obs). Green indicates agreement within 10%. Red indicates model overprediction. Mauve indicates model underprediction.

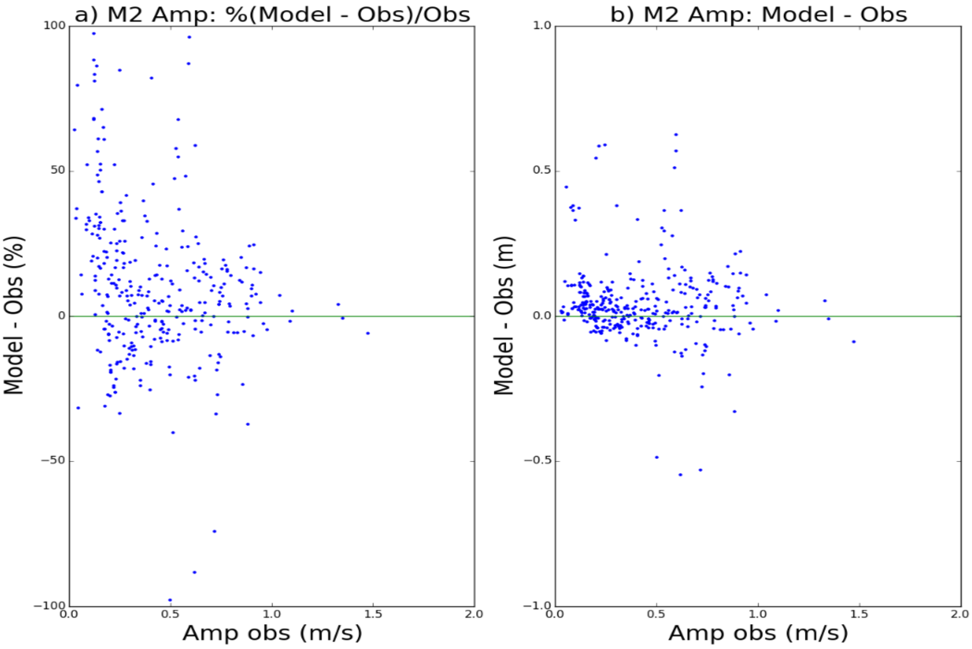

**Figure S3.** (**a**) Percentage relative error on M2 current magnitude, (**b**) absolute error on M2 current magnitude.

### *Peak Orbital Velocity of Waves at the Seabed*

Wave were modelled on the European continental shelf from January 2001 to December 2010 at a grid resolution 1/6 degree east-west, 1/9 of a degree north-south (approximately 11 km). The WAM spectral wave model [2–4] was forced with hourly wind from 12 km the UK meteorological office mesoscale atmospheric model. Output from the wave model included hourly values of significant wave height ($H_s$), mean zero crossing wave period ($T_z$) and bed wave orbital velocity ($U_{orb}$). At each grid point and for each year, $H_s$ and $T_z$ were recorded at the time of maximum wave orbital velocity. Simulations modelled here used the average value over the years 2001–2010. Although the resolution of the wave model was relatively coarse, full use was taken of the high-resolution EMODnet-Bathymetry to compute wave orbital velocity at the bed. The approach took advantage of the relatively low spatial variation in wave parameters compared to typical bathymetric variations. Peak wave height and period was interpolated to the bathymetric grid and combined with the depth information using the method of Soulsby [5] (Section 3.2) to give an estimate of peak wave orbital velocity amplitude at the bed.

## Supplement References:

1. Cooper, K.M.; Barry, J. A big data approach to macrofaunal baseline assessment, monitoring and sustainable exploitation of the seabed. *Sci. Rep.* **2017**, *7*, 12431.
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3. Bricheno, L.M.; Wolf, J.; Aldridge, J. Distribution of natural disturbance due to wave and tidal bed currents around the UK. *Cont. Shelf Res.***2015**, *109*, 67–77. doi: 10.1016/j.csr.2015.09.013.
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5. Soulsby, R. L. Simplified calculation of wave orbital velocities. HR Wallingford Report Tr155. Available online: http://eprints.hrwallingford.co.uk/692/1/TR155.pdf (accessed on 19 April 2019).