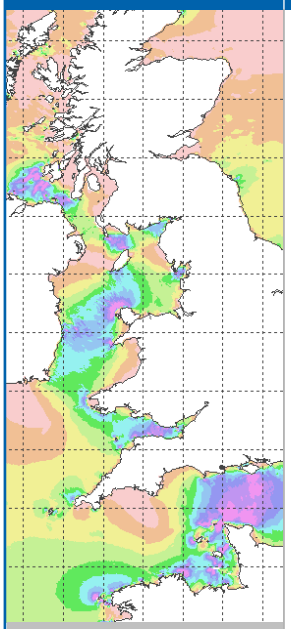


Bathymetry and Coastline

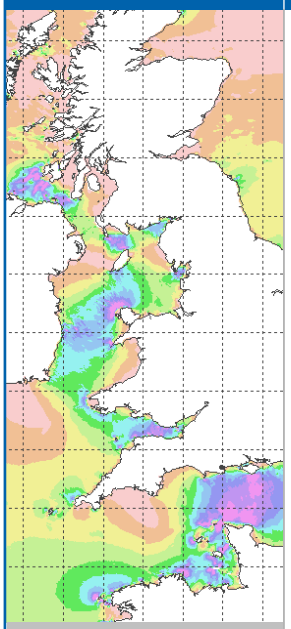
The dataset of bathymetric information used in the CS20 model was constructed from a variety of sources. This dataset covers all locations shallower than 200m water depth. The underlying bathymetry originates from the GEBCO (General Bathymetric Chart of the Oceans) 1 minute digitised bathymetry. This data source is state-of-the-art, having been produced through an initiative to assist the numerical modelling of surges studies in the North Sea. This data set was interpolated onto the model grid and the coastline guided (but not defined) by the World Vector Shoreline (WVS). Where possible, the bathymetry has been improved by the replacement of the GEBCO depths with bathymetry from higher resolution datasets available to NOC (POL). This has provided significant improvements over GEBCO bathymetry in near-shore inter-tidal regions[1]

The coastline would be setup by the modeller, the model resolutions for the CS20 and CS3 model (1.8km and 12km, respectively) give slight differences in the coastline (ie the edges of the model grid around the coast), however, this does not have any effect on the model itself. The model coastline runs along the edges of the grid cells with valid cells being any with an average depth greater than 0m. This has been altered in the latest version of CS20 with some wetting/drying areas removed from the model so as to improve the accuracy of the nearby model grid cells which are outside of the wetting/drying zone. Wetting/drying can, in some circumstances, produce unphysical behaviours in models in very shallow areas (e.g. see-saw oscillations) and impact on the accuracy of surrounding grid cells. It was for this reason that some very shallow areas where removed from the CS20 model in the latest version. The majority of the locations removed were around the Morecombe Bay and The Wash areas. POLPRED uses the WVS from GEBCO when plotting the coastline and this is shown for geographic reference only - it does not affect the model output in any way and was not used in the creation of the model data sets.

Coordinate System

The only connection that hydrodynamic models have with any physical datum is their bathymetry (water depth data), which is typically synthesised from a number of charts (Admiralty Charts in our case). This also defines the sea/land boundary in numerical models. The charts (and therefore the horizontal coordinates) used in any models predating 2000 are to OSGB36. Since 2000, the Admiralty has been adjusting charts to WGS84: were we to reconstruct all of our bathymetric datasets today, then WGS84 coordinates could be directly related to our models. As it is - formally one should apply the WGS84/OSGB36 correction. Practically, this will make little difference since the separation is of the order 100m worst case and none of the models within POLPRED is this well resolved horizontally. Therefore for practical purposes we can treat the latitudes and longitudes of our POLPRED software as being WGS84.

[1]source: Atlas of UK Marine Renewable Energy Resources: Technical Report www.renewables-atlas.info



Predictions

Predictions are derived for a particular location from a set of harmonic constants which have been interpolated from the harmonic constants for the four surrounding grid squares

Reference Datum

The reference datum an 'undisturbed sea surface parallel to the geoid' which we approximate to Mean Sea Level. Within the POLPRED software, computed data can be changed to Lowest Astronomical Tide (LAT) datum. The value used for LAT is only an estimate based on the model data set.

Accuracy in shallow/coastal waters

The higher the model resolution is then the more accurate the results will be for shallow/coastal waters. Higher resolution models also perform better where local features such as sandbanks might be a cause of concern.

Validation

Model validation is carried out during the setup process with standard validation techniques. Both CS3 and CS20 model would have been fine tuned with tide gauge data at coastal locations during the initial runs of the model. CS20 validation is documented in the Technical Report for the Atlas of UK Marine Renewable Energy Resources.

3-D Models

The CS3 provides depth-averaged currents. The CS3-3D model is a pseudo 3-D models which can provide current data at six different depth (sigma) levels deduced from the depth-averaged currents using a set of vertical current profiles. The CS20 is a true 3-D model. The CS20 has a higher resolution in the vertical. Running the CS20 model with 32 sigma levels used an improved vertical mixing scheme – the general ocean turbulence model[2]. This gives more accurate tidal currents, although it tends to have higher friction, hence slower currents in many regions. Vertical profiles are determined by how the bottom friction is transmitted through the water column by turbulent mixing (hence the importance of the turbulence model). If you require more info on the CS20 Sigma levels ask for the CS20 Sigma Levels Information Sheet available from the Marine Data Products Team at the National Oceanography Centre.

[2] Umlauf, L., Burchard, H. and Bolding, K., 2005. GOTM – Scientific Documentation Version 3.2. No. 63 of Marine Science Reports, Baltic Sea Research Institute, Warnemünde, Germany