The DTU15 MSS (Mean Sea Surface) and DTU15LAT (Lowest Astronomical Tide) reference surface

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INTRODUCTION

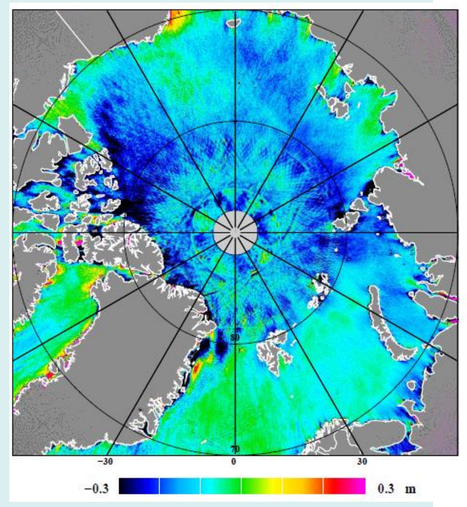
The DTU15MSS is the latest release of the global high resolution mean sea surface from DTU Space. The major new advance leading up to the release of this DTU15MSS the use of an improved 4 years Cryosat-2 LRM, SAR and SAR-In data record and the downweighting of ICESat data used previously in the Arctic Ocean for DTU10MSS and DTU13MSS.
A new reference surface for off-shore vertical referencing is introduced. This is called the DTU15LAT.
The surface is derived from the DTU15MSS and the DTU10 Global ocean tide to give a 19 year Lowest Astronomical Tide referenced to either the Mean sea surface or to the reference Ellipsoid via the use of the DTU15MSS.
The presentation will also focus on the difficult issues as consolidating Cryosat-2 onto a 20 year mean sea surface derived using multiple satellites (but only at low to medium latitude) as well as the importance of merging Cryosat-2 data from different operating modes like LRM, SAR and SAR-In as these requires different retrackers. Also the importance of downweighting the ICESat data is highlighted.

ARCTIC AND ANTARCTIC IMPROVEMENT (DTU15MSS)

The direct comparison between Cryosat-2 and DTU13
Is shown to the right.
This displays several problems in the Arctic Ocean.
Among these are:

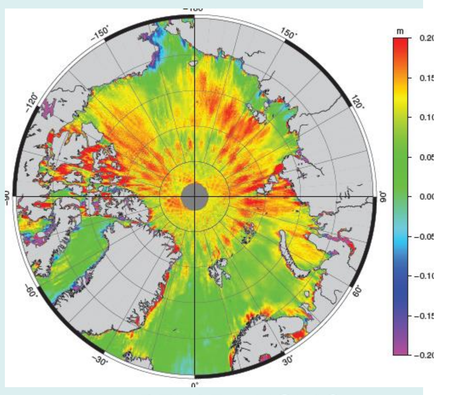
- ICESat data used for DTU13 (trackiness)
- Lack of coastal data in DTU13
- ERS-1 data used in DTU13.
- The polar GAP in DTU13 (from 86N onwards)

The inclusion of almost four years of CryoSat-2 data in the new DTU15 models have proven to be major steps forward for altimetric MSS determination and subsequent for estimating Mean Dynamic Topography.



Cryosat-2 relative to DTU13

The difference with former MSS models like DTU13 or UCL13 (shown to the right) agrees on the 20 cm level in the Arctic Ocean

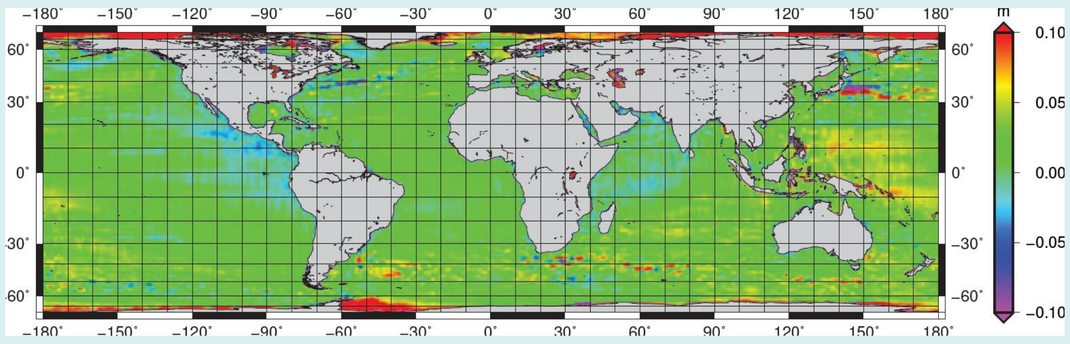


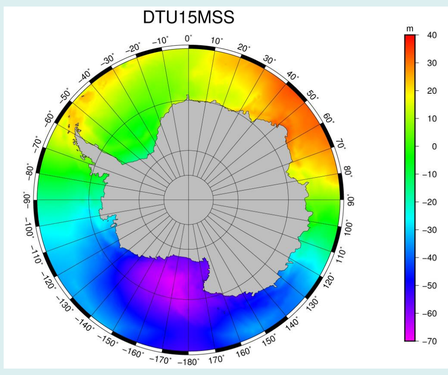
DTU15 – UCL13

Around Antarctica the new DTU15 is also provides a huge step forward. Again the inclusion of 4 years of data clearly reveals the huge impact on MSS determination in the Figure to the right-.comparison between Cryosat-2

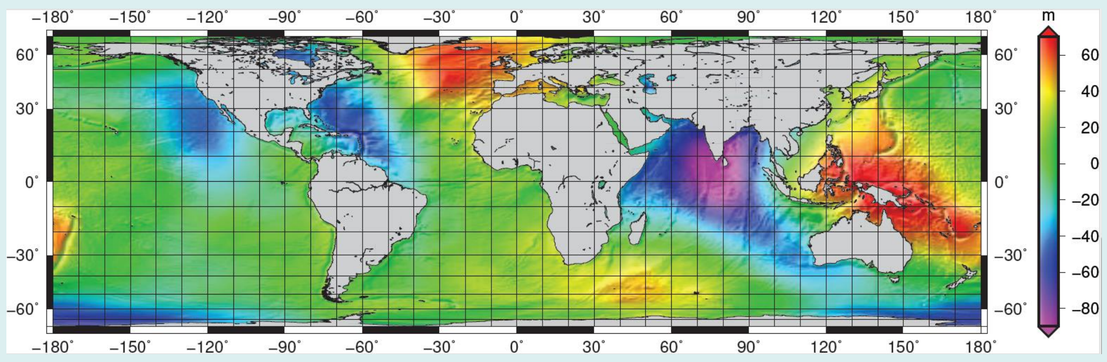
DTU15MSS

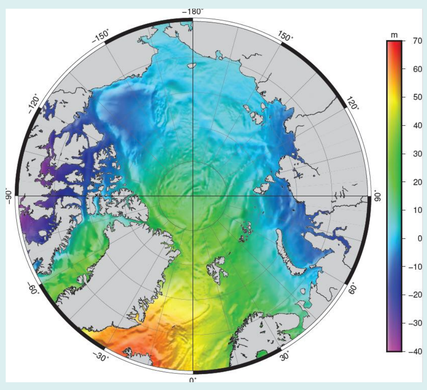
To minimize the effect of orbit errors, tilt and bias are removed from the individual tracks. Next short wavelength tilt and bias are removed to minimize residual errors and finally the corrected heights are interpolated onto a regular grid and merged with available satellite radar altimetry product.
For the entire operation the data are tightly connected to the DTU13 in order to maintain The 20 years averaging period.

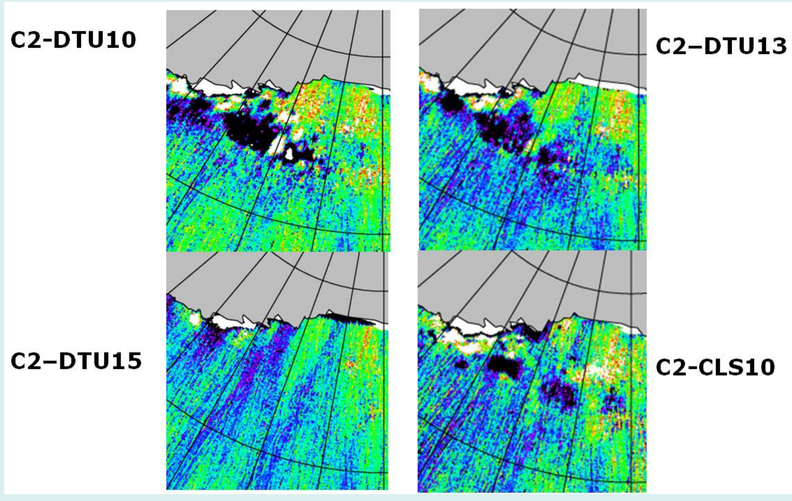




Difference - DTU15-DTU13 (upper picture)
DTU15MSS (lower picture)

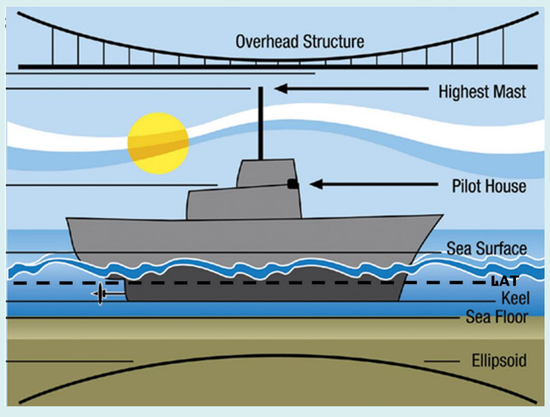






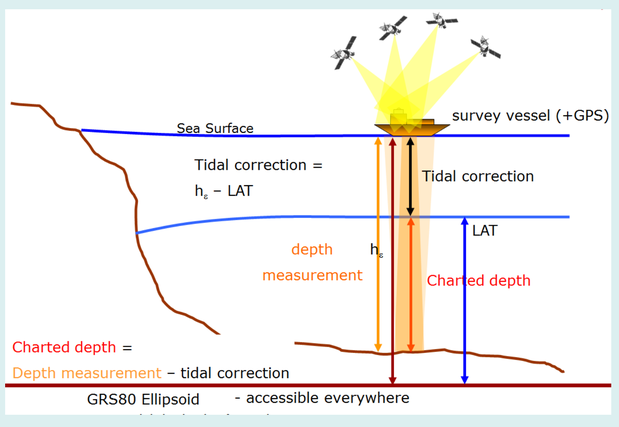
Comparison between Cryosat-2 and various MSS (scale +/- 20 cm)

DTU15LAT

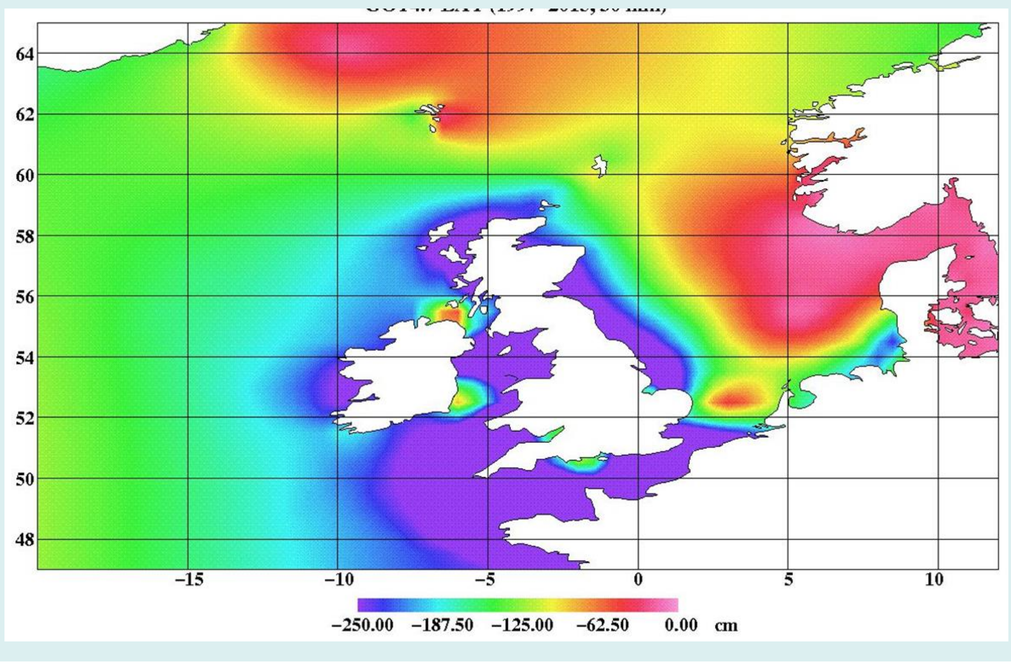


A special variant of the Mean sea surface is used for Charting of Ocean Depth.
This is the Mean sea surface minus the lowest astronomical tide. In this way charting accounts for the well known tides and provide ocean depth to the lowest tide. Hence provide the minimum depth to ensure ship safety.

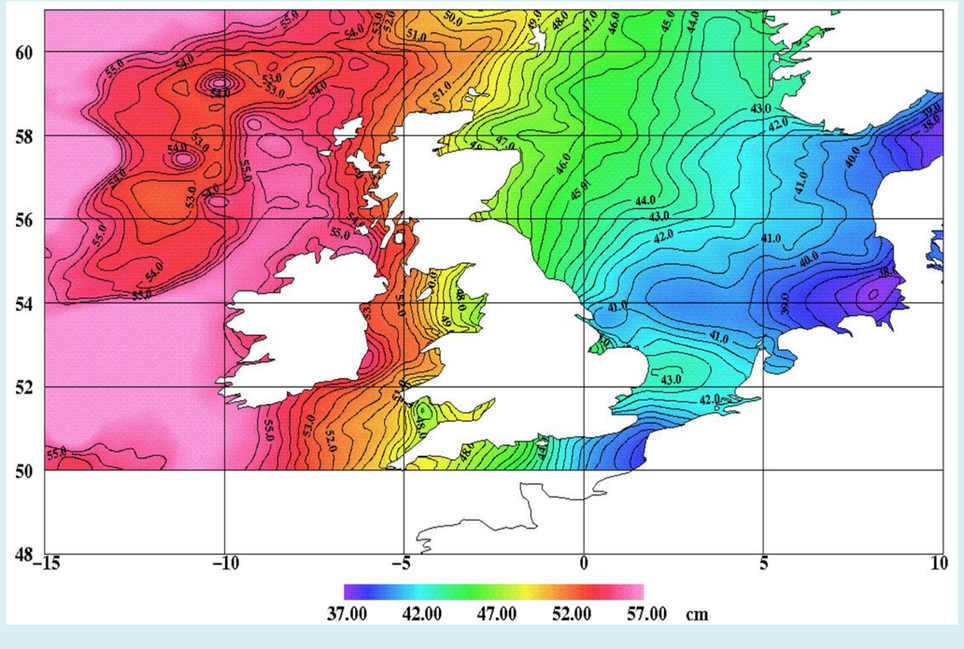
For the DTU15LAT this was computed using the DTU15MSS and the DTU10 ocean tide modelling. Initially the DTU10 ocean tide modell was run over the 19 year period (2000-2019) and the minimum depth was found.
Subsequently theis surface was used to correct the DTU15MSS to create the DTU15LAT surface. This surface then provides the ellipsoidal height of sea level at lowest possible tide.



LAT (lowest astronomical tide) for NW Europe



LAT relative to the Ellipsoid (TOPEX or GRS80/WGS84)



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