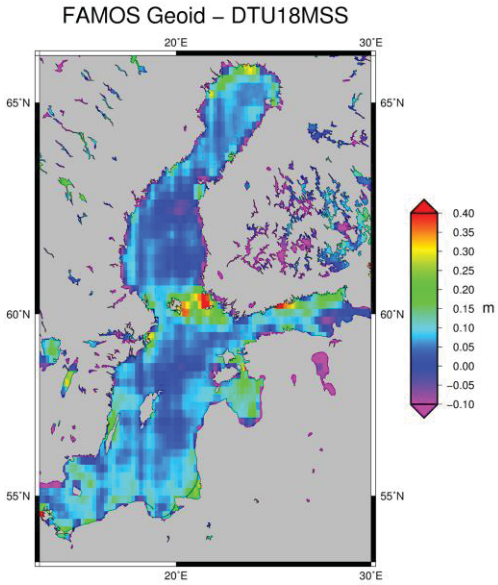
Current topic for a Master's Thesis

Using coastal altimetry data to improve the knowledge of the mean ocean circulation

Satellite Altimetry (SA) provides since 25 years remotely sensed sea level data at high resolution and regular along-track sampling. Based on long-term averages of these data, scientists have compiled Mean Sea Surface (MSS) models. A MSS model describes the average state of the ocean, while the anomalies with respect to it can be used to observe the variability of the sea level and currents. Oceanographers are particularly interested in the Mean Dynamic Topography (MDT), which is the deviation of the MSS from the geoid model and is mainly attributable to stable ocean currents. The quality of standard SA data is known to decrease in the coastal zone, which causes a decrease in the reliability of MSS and MDT models and derived surface currents in this area of high societal interest.

The recent availability of new techniques to improve the quality and the quantity of coastal altimetry data is a chance of improvement for the description of the coastal ocean dynamics in terms of MSS and MDT. DGFI-TUM is at the forefront of this research and produces its own reprocessed coastal sea level dataset (ALES in https://openadb.dgfi.tum.de).

The objective of this thesis is to understand whether coastal altimetry can provide a more reliable source to compute the mean sea surface and, consequently, the mean dynamic topography. The thesis will be focused on one or more test regions, such as the Baltic Sea and the US Middle Atlantic Bight.



Difference between the DTU18 MSS model and a regional Geoid. Unrealistic features can be seen, for example, near the archipelago around 60°N, 20°E

Main tasks:

- Theory: Understand the difference between gridded and along-track altimetry dataset and the concepts of geoid, mean sea surface and mean dynamic topography.
- Software: Use Python or MATLAB for data analysis, learn how to use GMT (http://gmt.soest.hawaii.edu/) to handle visualisation of large gridded dataset.
- Dataset: Familiarise with MSS and Geoid models, learn to interpolate gridded and along-track dataset, recognise potential errors of current models in the coastal zone
- Methodology: Create a new MSS along Jason-1/2 satellite tracks in the region of study, interpolate it onto a grid and compare both versions with an existing MSS model (DTU18)
- Evaluation: Use a geoid model to derive the MDT using the new MSS and the DTU18, analyse and discuss the differences, also considering, where possible, other MDT models.

References:

- Andersen, O. B., and Knudsen P.: DNSC08 mean sea surface and mean dynamic topography models. Journal of Geophysical Research: Oceans 114.C11, 2009.
- Passaro M. and Nuñez A.: ALES and Coastal Sea Level, in: Coastal Altimetry Training, 12th June 2018, ESA ESRIN: https://www.dropbox.com/s/ozg44ie63icgljb/5_Passaro.pdf?dl=0

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