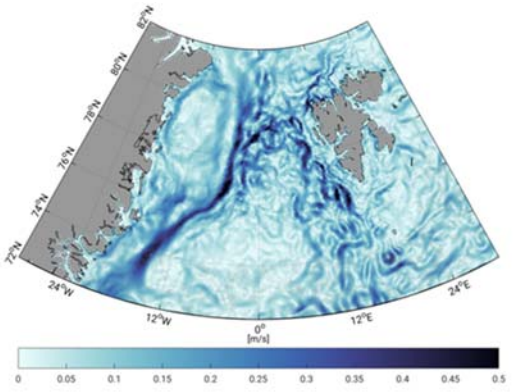
Current topic for a Master's Thesis

Signatures of global warming: Long-term changes of sea level and surface currents in the Greenland Sea

Satellite altimetry has been providing important information on sea level and its variations for about three decades. This radar technique was designed for open ocean applications where the full footprint, i.e. the surface area illuminated by the radar pulse, is covered by water. In Arctic areas, however, sea ice extensively hinders the reliable estimation of sea surface heights and leads to erroneous signatures in the reflected radar signals. To overcome this problem, specific algorithms have been developed recently. They allow for extracting highly accurate information on changes in sea level and surface currents also in polar oceans (e.g. Müller et al., 2017; Rose et al., 2019).

In high latitudes, only few satellite altimeter missions are providing data, and large areas remain unobserved. By introducing additional information from ocean models, such data gaps can be filled, and sea level estimates at dense spatial resolution can be derived (Müller et al., 2019a).

Recently, DGFI-TUM published a new dataset of sea surface heights in the Greenland Sea and surrounding regions (Müller et al., 2019b). It is based on a combination of along-track satellite altimetry and the Finite Element Sea ice Ocean Model (FESOM). The data covers the period between 1995 and 2012. Due to its decadal time span and its high resolution it enables investigations on climate-induced changes in the ice covered regions of the northern Nordic Seas. Along with the time-variable sea level also information on ocean topography (i.e. sea surface heights with respect to the geoid) is provided. Hence the data set also allows for the analysis of variations of geostrophic ocean currents.



Absolute geostrophic surface velocities on July 18, 2008 based on a combination of satellite altimetry and FESOM model

Within this master thesis, the new data set shall be analysed with regard to long-term changes of the sea level and of surface currents in the Greenland Sea. The findings shall finally be put in the context of a changing climate.

Main tasks:

- Analysis of the newly released data set with respect to long-term changes in sea level and location and magnitude of the main surface currents.
- Investigation of climate-induced changes by comparing the results to external climate-related data, such as climate indices, sea surface temperatures, or ice cover.

References:

Müller, F. L., Dettmering, D., Wekerle, C., Schwatke, C., Passaro, M., Bosch, W., and Seitz, F.: Geostrophic Currents in the northern Nordic Seas from a Combination of Multi-Mission Satellite Altimetry and Ocean Modeling, Earth Syst. Sci. Data Discuss., doi:10.5194/essd-2019-102, in review, 2019a.

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