

M.Sc. Topic in Polar Oceanography

(open to PEP and German Physics master students)

“Transport and circulation in the upper Central Arctic Ocean and the Transpolar Drift”

Supervisors:

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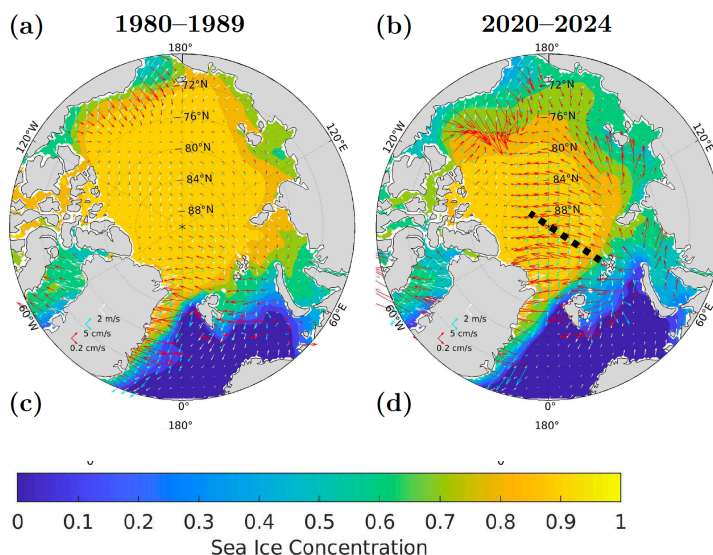
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Background: The central Arctic Ocean is a region that is not only important for global climate but is inherently complex due to feedbacks in the atmosphere-ice-ocean system. Changes in wind forcing and ice cover influence not only the surface ocean but also the layers underneath. Various analyses of in-situ temperature and salinity observations have shown the importance of the regional circulation for the transport of nutrients, trace metals and pollutants. These observations are sparse relative to the majority of the world’s oceans, and in situ velocity observations have scarcely been analysed at all.

Goal:

- Familiarise with surface fields of sea surface height, wind and ice motion
- Conglomerate all available Acoustic Doppler Current Profiler and temperature/salinity data along key sections across the Transpolar Drift
- Process any no-yet-processed ADCP data
- Estimate transports across the Transpolar Drift using an inverse model
- Discuss the results with respect to literature on Arctic circulation based on water masses, remote sensing and in-situ velocity observations



Near-surface circulation across the Arctic Ocean mean for the time periods shown: wind velocity (white), ice drift (cyan) and calculated Ekman ocean velocity (red). Sea ice concentration as background contours. Ice drift from OSISAF-405-series and NSIDC, sea ice concentration and 10-m wind from ERA5. Plots from BSc thesis of M. Wrissenberg (2025). One important section marked by dashed, black line.

Data and Methods: Processed ADCP data from various Polarstern expeditions exists, largely in processed (geo-referenced) form. Additional data is available from other Arctic expeditions in different public databases. The data would be further processed and analysed using Matlab or Python on the AWI computing system. The analysis would involve an inverse estimate of velocity and transports using surface and in situ observations in an ocean dynamics framework. A comparison of the data with available surface fields of sea-ice and wind (reanalysis) and discussion in the context of existing publications on upper Arctic Ocean circulation would complete the thesis.

Requirements: The successful candidate will learn to process and analyse physical ocean velocity and temperature/salinity data using known dynamical theory and statistics. A good basic knowledge of ocean physics and advanced programming skills (preferably MATLAB or PYTHON) are required. The publication of results in a peer-reviewed journal will be encouraged. The incumbent will have access to the AWI as a guest scientist, including computing and library resources.