

Quantification of sea ice production at coastal polynyas in the southern Weddell Sea

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Sea ice production and associated High Salinity Shelf Water (HSSW) formation in the southern Weddell Sea is an important driver for the global thermohaline ocean circulation and determines the properties of shelf water inflow that fuels ice shelf basal melting. In the southern Weddell Sea, coastal polynyas cover 1% of the area, but contribute about 10% to the total winter sea ice production. This project aims to improve estimates of the sea ice production and HSSW formation in the southern Weddell Sea coastal polynyas by a synergy of numerical simulations and remote sensing data.

Sea ice-ocean simulations are performed with the Finite Element Sea ice–Ocean Model (FESOM) with a horizontal resolution close to the Rossby radius over the whole Weddell Sea to better represent eddy dynamics. In order to assess sensitivity of polynya characteristics and HSSW formation rates to the atmospheric forcing, FESOM is forced with different reanalysis data (ERA-Interim, NCEP-CFSR). Mean sea ice growth for the simulated period (1979–2012) is lower and more localized along the coastline/ice shelf front in the NCEP-CFSR run. Differences may be attributed to the colder air temperatures and stronger offshore winds in ERA-Interim forcing. FESOM will be forced with output from the regional atmospheric model COSMO-CLM (CCLM) to further investigate sensitivity with respect to different atmospheric forcing.

The best and most realistic ice production and HSSW formation estimates are expected to be obtained by assimilation of thin ice thickness data derived from MODIS retrievals into FESOM. This will lead to a high resolution data set of sea ice coverage and ice thickness fields that can be used as reference data set for other sea ice models and as an input for high-resolution atmospheric models.