Geophysical Research Abstracts
Vol. 15, EGU2013-10277, 2013
EGU General Assembly 2013

Influence of coastal polynyas on heat flux and sea ice production in the southwestern Weddell Sea

Verena Haid (1), Ralph Timmermann (1), Lars Ebner (2), and Guenther Heinemann (2)

(1) Alfred Wegener Institute, Climate Sciences, Bremerhaven, Germany (verena.haid@awi.de), (2) University of Trier, Environmental Meteorology, Trier, Germany

A coastal polynya occurs where off-shore winds cause the sea ice to drift away from the coastline. The reduced or removed ice cover allows an almost unobstructed ocean-atmosphere heat exchange and in the winter months very high ice production rates are induced. Therefore, coastal polynyas are often referred to as 'ice factories'.

With the Finite Element Sea ice-Ocean Model (FESOM) we investigate the coastal polynyas in the southwestern Weddell Sea. The combination of a primitive-equation, hydrostatic ocean model and a dynamic-thermodynamic sea ice model was set up with a global, unstructured grid that features a horizontal resolution of up to 3 km along the southwestern Weddell Sea coastline. The 37 depth levels have increased resolution toward the surface. The model was initialized on 01/01/1980 with data from the Polar Hydrographic Climatology and the boundary conditions were supplied by the NCEP/NCAR Reanalysis.

Our analysis of the period 1990-2009 indicates that in an average winter season coastal polynyas cover an area of 9000 km^2 and facilitate an ocean-to-atmosphere heat transport of 370 W/m^2, which splits into about 61% of sensible heat, 24% latent heat, 16% longwave radiation and -1.5% shortwave radiation. The ocean provides 50 W/m^2 by cooling the water column, the rest is supplied from latent heat released in the process of 9 cm/d ice production (accumulating to $1 \cdot 10^{11}$ m^3/season). Interannual variability, however, is high. An evaluation of additional simulations with three higher-resolution atmospheric forcing dataset, including two regional configurations of the COSMO atmosphere model, yields local differences but robustness and consistency on a larger scale.