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Long-term analysis of Atmosphere-Ocean-Ice interactions in Laptev Sea polynyas using high-resolution NWP simulations

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The Laptev Sea area of the Siberian Arctic is known as a region of high polynya activities throughout the winter season. We analyze the impact of open-water and thin-ice covered polynyas on heat and moisture fluxes and the atmospheric boundary layer (ABL) using downscaled NWP simulations. ERA-Interim reanalysis data are used as forcing for dynamically downscaled COSMO runs with 15 and 5 km horizontal resolution. Sea ice information is taken from AMSR-E data and the period of investigation is 2002-2011.

Our results clearly prove that polynyas moisten and heat the air downwind the polynya (up to several hundred kilometers) and additionally increase cloudiness. The analysis of surface energy balance components shows the sensible heat flux H0 as the largest contributor to ice production. Mean monthly H0 over polynyas is about 150 W/m^2 for Dec.-Feb. 2002-2011. This is about three times higher than the energy loss by net radiation. Small polynyas have the largest heat loss (and ice production) per surface unit. In comparison with most previous studies our results suggest that most preceding studies overestimated the polynya ice production of the Laptev Sea.