Geophysical Research Abstracts
Vol. 20, EGU2018-2742, 2018
EGU General Assembly 2018

Modeling and parametrization of the impact of lead width on turbulent processes in the atmospheric boundary layer over sea-ice

Janosch Michaelis and Christof Lüpkes

Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Polar Meteorology, Germany (janosch.michaelis@awi.de)

In polar regions open-water channels in sea ice, so called leads, play an important role for surface-atmosphere interactions. These are especially pronounced during winter since then the temperature differences between the surface of leads and the near-surface atmosphere cause strong turbulent convective plumes which modify the flow in the atmospheric boundary layer (ABL). In this study we aim to quantify the effect of the lead width on those processes.

Our work is based on simulations with a microscale atmospheric model resolving the entire convective plume with horizontal grid sizes in the range of L/5 where L is the lead width. Using this resolution, the transport caused by smaller scale eddies forming the plume has to be parametrized to close the system of the governing equations. Based on an existing closure by Lüpkes et al. (2008) a modified nonlocal parametrization is proposed for the lead-generated turbulent heat flux. Unlike the original parametrization, it includes now the effects of the lead width. The parametrization will be explained and results of model simulations with the new and previous parametrizations will be discussed. The considered cases represent measured springtime conditions with a neutrally stratified ABL capped by an inversion at 300 m height. The initial temperature difference between air and lead-surface amounts to 20 K. It is shown that for these conditions the lead width is a dominating parameter when L is larger than 2 km.

References: Lüpkes, C., V. M. Gryanik, B. Witha, M. Gryschka, S. Raasch, and T. Gollnik (2008), Modeling convection over arctic leads with LES and a non-eddy-resolving microscale model, *J. Geophys. Res., 113*, C09028, doi:10.1029/2007JC004099.