Kurzfassungen der Meteorologentagung DACH
Berlin, Deutschland, 14.–18. März 2016
DACH2016-130-1

Boundary layer investigation in the Laptev Sea area by means of ground-based remote sensing techniques and regional climate simulations

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In the winter season 2014/2015 a field campaign at the Tiksi observatory (71°38'N, 128°52'E) was carried out by the University of Trier with support of the Arctic and Antarctic Research Institute (AARI) and the GEOMAR Kiel in framework of the interdisciplinary Transdrift project. One goal of the campaign is to help to improve the understanding of processes within the Arctic stable boundary layer (SBL). Within the SBL, there are several important phenomena and processes like low-level jets, surface and lifted inversions, the development of the mixing height or the determination of the energy balance, which can be best investigated with a mix of high-resolution ground-based remote sensing systems and flux tower measurements. We used a SODAR/RASS, a scintillometer, a ceilometer as well as the local flux tower to investigate the SBL for the Arctic winter. Baroclinity is found to be the main driven mechanism for low-level jets with jet core heights above 200 m due to the strong temperature gradient between the Laptev Sea and the Siberian continent. Strong temperature changes at short time scale (few hours) were often closely related to a change of wind direction and therefore advection. LLJs with heights below 200 m are likely influenced by local topography. In addition, regional climate model simulations using the COSMO-CLM (consortium for small-scale modelling – climate limited area modelling) driven by Era-Interim reanalysis data have been performed. The COSMO-CLM simulations show a good agreement with the ERA-Interim data and in-situ measurements (tower, soundings).