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Sea ice edge position impact on the atmospheric boundary layer temperature structure

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Processes happening in the Arctic region nowadays strongly influence global climate system; the polar amplification effect can be considered one of the main indicators of ongoing changes. Dramatic increase in amount of ice-free areas in the Arctic Ocean, which took place in 2000s, is one of the most significant examples of climate system dynamic in polar region. High amplitude of changes in Arctic climate, both observed and predicted, and existing inaccuracies of climate and weather forecasting models, enforce the development of a more accurate one. It is essential to understand the physics of the interaction between atmosphere and ocean in the Northern Polar area (particularly in boundary layer of the atmosphere) to improve the models.

Ice conditions have a great influence on the atmospheric boundary layer in the Arctic. Sea ice inhibits the heat exchange between atmosphere and ocean water during the polar winter, while the heat exchange above the ice-free areas increases rapidly. Due to those significant temperature fluctuations, turbulence of heat fluxes grows greatly. The most intensive interaction takes place at marginal ice zones, especially in case of the cold outbreak - intrusion of cooled air mass from the ice to free water area. Still, thermal structure and dynamic of the atmosphere boundary layer are not researched and described thoroughly enough. Single radio sounding observations from the planes being done, bur they do not provide high-resolution data which is necessary for study.

This research is based on continuous atmosphere boundary layer temperature and sea ice observation collected in the Arctic Ocean during the two NABOS expeditions in August and September in 2013 and 2015, as well as on ice conditions satellite data (NASA TEAM 2 and VASIA 2 data processing). Atmosphere temperature data has been obtained with Meteorological Temperature Profiler MTP-5 (ATTEX, Russia). It is a passive radiometer, which provides continuous data of atmospheric temperature on heights from 0 to 1000 m. (time resolution 5 min., height resolution 50 m.).

Results: 1) The structure of atmospheric temperature changes rapidly while the vessel is crossing the sea ice edge; 2) The impact of the underlying surface on the atmosphere above it was registered on the heights from 0 to 1000 meters; 3) The data on ice edge position obtained from the satellite and from the vessel varies greatly.

Those discrepancies affect the further processing and analysis of data significantly and might cause the errors in models' development.