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Arctic atmospheric surface layer in spring during expedition “Transarctica-2019”

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Polar expedition “Transarctica-2019” worked in the northern part of the Barents Sea in April 2019. One of the main goals was to study the interaction processes in the system “atmosphere – sea ice – ocean upper layer”. Complex synchronous observations in atmosphere, snow-ice cover and ocean were performed. Present study describes characteristics of atmospheric surface layer and heat balance of snow-ice cover during drift of RV “Akademik Treshnikov” to the north of the Archipelagos Franz Josef Land and Svalbard, in the area 80 – 82N, 30 – 45E, in comparison with observations at drifting station “North Pole-35”, worked in the same area in April 2008, and Research station “Ice Base Cape Baranova” in April 2019.

The characteristics of the near-ice atmospheric layer and energy exchange processes during the drift of the expedition Transarctica-2019 were significantly affected by the presence of clouds and the state of the ice cover. The influence of these factors led to decrease of radiative cooling of the surface, formation of warmer and wetter atmospheric boundary layer and to a weakening of the turbulent exchange between the atmosphere and the snow-ice cover.

Comparison of energy exchange characteristics calculated for the Bolshevik Island (79° N) and area, where expedition “Transarctica 2019” worked, showed good agreement between the monthly averaged values and trends in heat fluxes, despite the fact that in the first case the underlying surface was land surface, and in the second - sea ice cover.

Significantly different conditions were observed in the area of the drifting station “North Pole-35”, drifted in April 2008 about 300 km to the north of the “Transarctica 2019” area. The older and thicker sea ice cover and frequent occurrence of cloudless days, characterized by negative long-wave balance, caused here cooling of the surface, formation of a stable boundary layer, and large values of the sensible heat flux compared to observed during the expedition 2019. Position of “Transarctica-2019” to the south of the massifs of old and thick ice, in an area, characterized by medium-thick ice and, as consequence, more intense heat flux through sea ice cover, as well as the presence of leads, determined higher air and surface temperatures and relative humidity.

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