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Tropospheric characteristics over sea ice during N-ICE2015

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Over recent years, the Arctic Ocean region has shifted towards a younger and thinner sea-ice regime. The Norwegian young sea ICE (N-ICE2015) expedition was designed to investigate the atmosphere-snow-ice-ocean interactions in this new ice regime north of Svalbard. Here we analyze upper-air measurements made by radiosondes launched twice daily together with surface meteorology observations during N-ICE2015 from January to June 2015. We study the multiple cyclonic events observed during N-ICE2015 with respect to changes in the vertical thermodynamic structure, sudden increases in moisture content and temperature, temperature inversions and boundary layer dynamics. The influence of synoptic cyclones is strongest under polar night conditions, when radiative cooling is most effective and the moisture content is low. We find that transitions between the radiatively clear and opaque state are the largest drivers of changes to temperature inversion and stability characteristics in the boundary layer during winter. In spring radiative fluxes warm the surface leading to lifted temperature inversions and a statically unstable boundary layer. The unique N-ICE2015 dataset is used for case studies investigating changes in the vertical structure of the atmosphere under varying synoptic conditions. The goal is to deepen our understanding of synoptic interactions within the Arctic climate system, to improve model performance, as well as to identify gaps in instrumentation, which precludes further investigations.