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Characteristics of early winter high Arctic atmospheric boundary layer profiles

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For a large part of the year, the Arctic climate system is characterised by a stably stratified atmospheric boundary layer, with strong temperature inversions isolating the surface from the air aloft. These nversions are typically driven by longwave radiative cooling, warm-air advection aloft,
or subsidence. All these mechanisms are affected by the synoptic sate of the atmosphere in the high Arctic.

In this study we present data from an intensive measurement campaign in Svalbard in October 2014, when atmospheric profiles were measured with a tethered balloon in Adventdalen and Hornsund. In addition radiosonde soundings from Ny-Ålesund were analysed. A total of 115 individual profiles were analysed, almost all of them showing a surface-based temperature inversion. Our preliminary results show that the strongest and deepest inversions are observed at the beginning of a warm-air advection event, but as the temperature, wind and cloudiness increase the inversion strength and depth decrease rapidly. The inversion curvature parameter seems to be strongly dependent on the longwave radiative balance with the highest curvatures (strongest vertical temperature gradient close to the surface) associated with strong longwave radiative heat loss from the surface. The different processes affecting the stable atmospheric boundary layer during a low-pressure passage are determined, and the effects of the synoptic scale changes are isolated from those caused by local topographic forcing.