



## **The diurnal cycle of the summer cloud-capped Arctic boundary layer**

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We investigate the diurnal cycle of the summer Arctic cloud-capped boundary layer, in a sense a marine cloud-capped PBL but different in several aspects from the prototypical marine stratocumulus-capped PBL that has previously been extensively studied. Through much of summer, the surface net radiation remains positive through the whole day, but the available radiative energy goes into latent heat of melting ice and snow; thus there is an efficient control of the surface temperature. The sun remains above the horizon through the whole diurnal cycle, but the insolation remains relatively weak and the zenith angle high. The cloud-capping inversion is often accompanied with an increase in moisture, rather than a drying as in subtropical stratocumulus

Our observations indicate that there is in fact a substantial diurnal cycle in this boundary layer. In terms of low-level temperature, the magnitude is small but significant with slightly higher temperatures during the day. Depending only on standard near-surface weather station data, it is easily missed. The top of the boundary layer, however, is slightly cooler in the early morning and the warmest late in the evening. The result is a bulk destabilisation during the day with a more intense mixing during the day manifested in, among other things, lower a wind speed and a smaller turning angle of the wind. The cloud layer is the deepest in the middle of the day and into the afternoon and the maximum incoming radiation is therefore biased to before noon while drizzle is most common in the afternoon and evening. This cycle is almost opposite to that in the prototypical marine stratocumulus-capped PBL.