Application and limitations of RO data for the detection of Arctic boundary layer properties

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Abstract

Due to recent sea ice loss, it is important to monitor the sensitivity (and feedback) of Arctic clouds and atmospheric boundary layer (ABL) to the changing environment. Owing to its high vertical and temporal resolution, an independent algorithm for detecting ABL properties using GPS refractivity is explored. Similar RO algorithms developed previously typically define the level of the most negative moisture gradient as the stratocumulus cloud top or ABL height. This definition is favorable for subtropical oceans where a stratocumulus-topped ABL is often capped by a layer of sharp moisture lapse rate (coincident with the temperature inversion). The Arctic Ocean also has stratocumulus clouds, however, the specific humidity does not frequently decrease in the ABL capping inversion. The use of GPS-derived refractivity for ABL height retrieval therefore becomes more complex. For winter months, when the precipitable water is a minimum (December-February), a fairly straightforward algorithm is developed to retrieve properties of the 1st temperature inversion from the surface. A second approach using the variance of the GPS refractivity is explored in order to identify horizontally uniform stable layers. This method appears to be more suitable to obtain Arctic ABL information, especially during summer.