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# Multidecadal changes of temperature inversions in Greenland and the associated attenuation of longwave radiation to space

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The arctic planetary boundary layer provides a favorable condition for the formation of tropospheric temperature inversions, a situation in which temperature increases with elevation forming inherently stable atmospheric configuration restricting the boundary layer mixing. This study focuses on both surface-base (SBI) and elevated inversions (EI). At the surface level, the presence of SBI is relevant to radiative imbalance between emitted longwave from the snow and ice surfaces and incoming solar and longwave radiation, particularly in the (polar) night; EI are a result of two mechanisms: subsidence of the air in anticyclones and warm air advection over underlying cold air masses. The intensity and thickness of EI are considerably less than SBI.

Strong and thick temperature inversions are predominantly persistent in large parts of Greenland, because 80% of it is ice covered and hence cooling radiatively, manifested as quasi-permanent anticyclone in its central and northern parts; while the southern part of Greenland is mainly influenced by the Icelandic low and shows comparatively weak and thin inversions. This heterogeneity of inversion parameters is observable in macroclimatic scales and thus, highlights the necessity for climatic regionalization for studying inversions, e.g. as precondition for ice melt models or ecological studies.

In this respect, we analyze the spatial and temporal variations of temperature inversion parameters in different climatic regions of Greenland based on the ERA-Interim dataset over the past four decades (1979 - 2017). Additionally, we quantify the effect of changing temperature inversion strength on longwave cooling efficiency at the top of atmosphere over Greenland including the role of clouds at different heights.

Preliminary results show that SBI occurred more frequently and intensively than EI in all climatic regions for all seasons. SBI are more frequent during winter than summer whereas EI show an opposite pattern. Furthermore, we found statistically different magnitude of inversion parameters in different regions of Greenland for different seasons. During winter SBI are stronger and thicker in northern region with the median SBI strength and thickness oscillating between 10-15 ˚C and 252-307 m respectively, whereas, the western part exhibit three times weaker and eight times thinner SBI (5-5.6 ˚C and 32-55 m). However, in summer, SBI show highest intensity in southeastern part compared to other regions. Moreover, EI parameters depict similar regional difference as SBI. Additionally, time evolution of efficiency of atmospheric cooling to space shows decreasing trend in all the regions.