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The observed vertical structure of longwave radiative flux divergence in the atmospheric boundary layer at Summit, Greenland

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During the Greenland Summit Experiment of the Swiss Federal Institute of Technology (ETH) at the Greenland Summit Environmental Observatory (72°35'N, 38°30'W, 3203 m.a.s.l.) the vertical structure of longwave radiative flux divergence was investigated. In the summer months of 2002, longwave radiative fluxes were measured at up to 6 levels on a 50 m meteorological tower. Observed longwave radiative flux divergence corresponds to heating or cooling rates in the order of the observed temperature tendency, stressing its importance for the thermodynamics of near surface air layers. During the summer months, when a diurnal stability cycle develops, observations reveal a characteristic profile of longwave radiative flux divergence related to stratification. When the surface is colder (warmer) than the overlying air, a thin layer (0-2 m) of heating (cooling) is induced. Above this layer, the sign of the divergence changes, and radiative cooling (heating) results. Parallel observations of the fine structure of the temperature profile reveal characteristic patterns. During daytime, an elevated surface inversion is observed within the lowest meter, while nighttime inversions exhibit a layer of reduced stability between 0.3 m and 5 m. The profile of longwave radiative flux divergence is suggested to play a significant role in the formation of these patterns.