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Boundary-layer dynamics and evaluation of micrometeorological approaches for determining sensible heat at Summit, Greenland

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Sonic anemometer turbulence measurements were made at Summit, Greenland during summer 2004 and spring 2005 in support of studies that sought to interpret surface ozone fluxes. These measurements allowed for the characterization of the variability of the atmospheric boundary layer at this site by describing seasonal and diurnal changes in sensible heat flux and boundary layer stability as well as providing inferences of mixing layer height. Diurnal sensible heat flux values at Summit range from ˜ -18 W m-2 to -2 W m-2 in the spring and from ˜ -7 W m-2 to +10 W m-2 in the summer. Sustained stable boundary layer conditions and low wind speeds can occur during the spring but do not occur during the summer months at Summit. Unstable conditions were not observed at Summit until late April. Boundary layer heights, which were calculated for neutral to stable conditions at Summit, averaged 156 m for the spring 2005 observations. Tower gradient measurements of temperature, wind speed were made at Summit, Greenland from June 29 to August 14, 2004. Comparisons of sensible heat fluxes, stability correction terms, and the equivalence of the Richardson number, Ri, and the Monin-Obukhov length ratio, z/L, are used to describe flux-profile relationships. Gradient-derived sensible heat fluxes compare well during nighttime with gradient fluxes overestimated ˜26% compared to eddy-correlation sensible heat fluxes. During daytime unstable conditions, gradient-derived fluxes are overestimated by ˜234% compared to eddy-correlation sensible heat fluxes.