Annual Evolution of Surface Energy Flux at Summit, Greenland

N. Miller[1,2], M. Shupe[1,3], C.J. Cox[1,3], D. Noone[4,1] and O. Persson[1,3]

[1]Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309; 303-497-6902, E-mail: millernb@colorado.edu
[2]University of Colorado, Department of Atmospheric and Oceanic Sciences, Boulder, CO 80309
[3]NOAA Earth System Research Laboratory, Physical Sciences Division (PSD), Boulder, CO 80305
[4]Oregon State University, College of Earth, Ocean and Atmospheric Sciences, Corvallis, OR 97331

The Greenland ice sheet surface temperatures and melt processes are controlled by an exchange of energy at the surface, which includes radiative, turbulent and conductive heat fluxes. In order to constrain the relevant ice sheet/atmosphere energy exchange processes, observations of all the terms are needed at once for a range of conditions and months. Here, we leverage data collected by multiple projects, to calculate diurnal estimates of all the surface energy budget (SEB) terms at Summit, Greenland, for an annual cycle from July 2013 - June 2014 (Figure 1).

Clouds exert a strong radiative influence on the surface energy budget, warming the surface throughout the year. Generally, the other SEB terms respond to changes in net radiation, compensating for an increase in the total radiation due the presence of clouds. Substantial surface warming from these clouds typically leads to the degradation of a surface-based temperature inversion and a change from a stable to unstable regime near the surface. Relationships between radiative forcing terms and non-radiative surface fluxes are investigated at Summit, Greenland throughout the annual cycle.

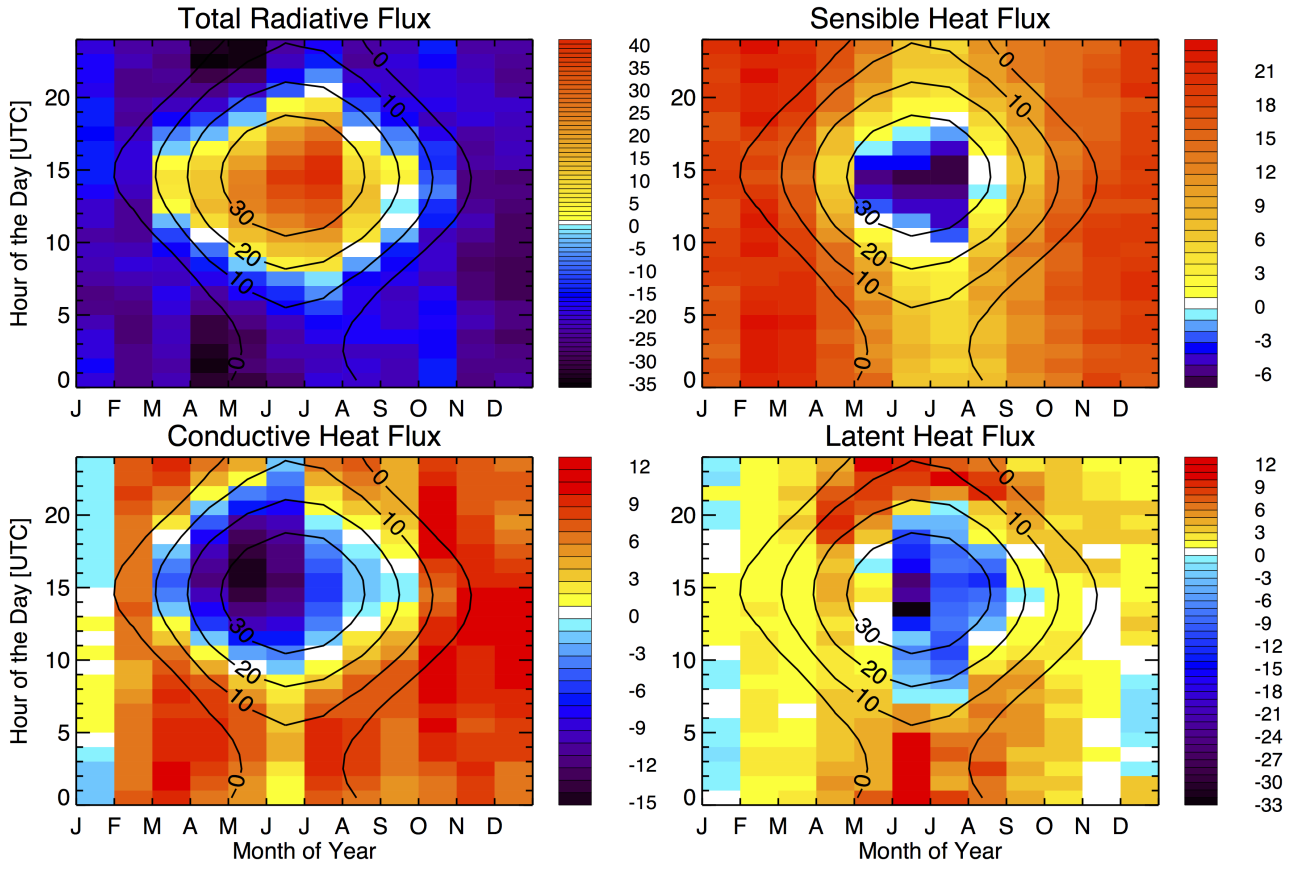

Figure 1. Hourly mean values from July 2013 - June 2014. Black contour lines indicate the solar elevation angle. Units on the colorbars are all in W m^{-2}.