Comparison of NOAA Near-surface Temperatures and MODerate-resolution Imaging Spectroradiometer (MODIS) Ice-Surface Temperatures (IST) at Summit, Greenland

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The availability of climate-quality data from NOAA/Earth System Research Laboratory Global Monitoring Division's (GMD) air temperature sensors at Greenland's Summit Station has enabled a multi-year comparison with MODerate-resolution Imaging Spectroradiometer (MODIS) infrared-derived Ice-Surface Temperatures (IST) from NASA's Terra satellite. Over 2008-2013, 2536 IST values were compared with ±3-minute average temperatures (TA) derived from NOAA's primary 2-m air temperature sensor. These data capture overall temperature variability and allowed investigation of an expected offset between air and surface temperatures (IST < TA) over multiple annual cycles.

Our findings are compatible with previous research but also suggest the cause of the 'cold bias'. We find that: 1) IST values are colder than the ±3-minute average TA values and that this difference increases as temperatures decrease; 2) IST-TA differences vary slightly with distance near the *in situ* data; 3) there is a small but detectable decrease in IST-TA as the sensor's zenith angle increases relative to the site; and 4) there is a pattern in IST-TA differences as the solar zenith angle increases especially during the polar night. This result explains the progressive offset from the TA data at colder temperatures but also indicates that the MODIS cloud mask is less effective in periods of low solar zenith angle.

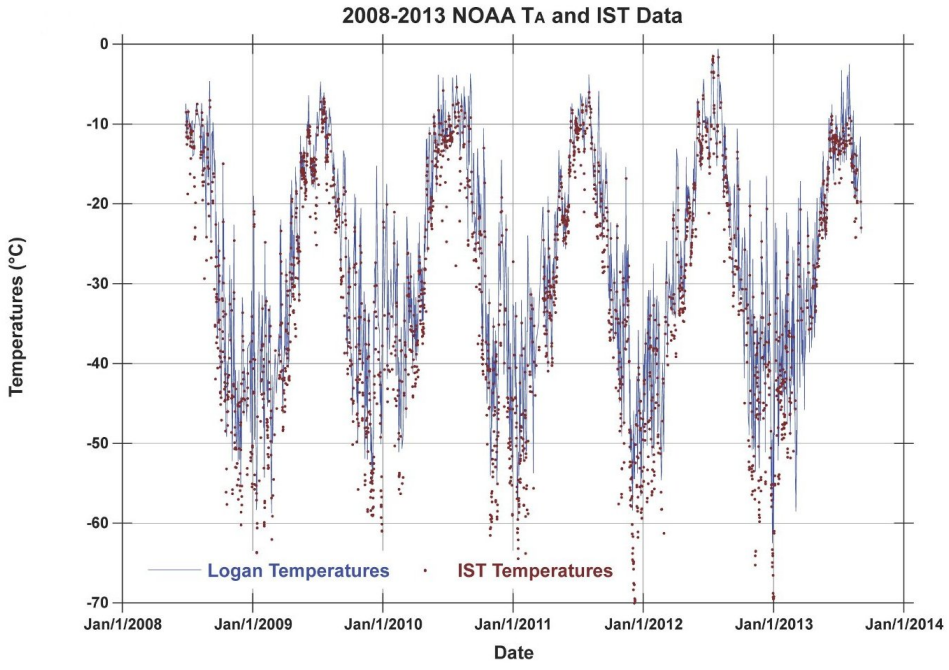

Figure 1. Comparison of NOAA/ESRL/GMD 2 meter temperature at the Temporary Atmospheric Watch Observatory and MODIS infrared-derived ice surface temperatures from 2008 - 2013.