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Comparison of Model Temperatures to NOAA In Situ Data at the Greenland Summit

Christopher Shuman (1), Richard Cullather (2), Sophie Nowicki (3), and Michael Schnaubelt (4)

(1) University of Maryland, Baltimore County, Goddard Earth Science & Technology Center, Greenbelt, United States (christopher.a.shuman@nasa.gov), (2) University of Maryland, College Park, Earth System Science Interdisciplinary Center, Greenbelt, United States (richard.cullather@nasa.gov), (3) NASA Goddard Space Flight Center, Cryospheric Sciences Laboratory, Greenbelt, United States (sophie.nowicki@nasa.gov), (4) University of Maryland, Baltimore County, Goddard Earth Science & Technology Center, Baltimore, United States (sc6@umbc.edu)

In our study, two temperature values were extracted from model data fields for comparisons to NOAA's near-surface temperature data at the Greenland Summit. For each model, a 2-m temperature (interpolated between the surface and 1st model layer) and the modeled surface temperature were extracted. Five models were studied for the following dates, resolutions, grid sizes, and model elevations.
The models investigated are: 1) NASA's Modern-Era Retrospective Analysis for Research and Applications (MERRA, 2008-2013, 1 hr, $\frac{1}{2}$ deg. lat. by 2/3 deg. lon., 3184.94 m); 2) MERRA-Replay, (2008-2013, 3 hr, 1 degree, 3157.2 m); 3) the
Ohio State University's Arctic System Reanalysis (ASR, 2008-2012, 3 hr, 30x30 km, 3121.75 m); 4) the NCEP Climate Forecast System Reanalysis (CFSR, 2008-2009, 6 hr, $\sim$0.25 degree, 3167.99 m); and 5) the ECMWF-Interim Re-Analysis (ERAI, 2008-2014, 6 hr, $\sim$1/2 degree, 3168.78 m). Temperature comparisons were done by aligning the closest 1-minute mean temperatures from the in situ sensor with the model temperatures (all times are UTC).

Preliminary results were assessed primarily from scatter plots and detailed temperature comparisons during the unusual July 2012 melt event at Summit. Our results show considerable spread in the modeled temperatures across the annual temp range ($\pm$10K) relative to the NOAA data. Curiously, the 2-meter temperatures are typically at a different slope than surface temperatures (i.e. rotation of the point cloud). In general, MERRA surface temperatures are too cold whereas the 2-m temperatures are too cold at the upper end of the temperature range and too warm at the low end (point cloud rotation). ASR surface temps are too cold at the lower end and slightly too warm at the upper end and also have an imposed 273.15 K maximum temperature at this location. ASR 2-meter temperatures are very close to the NOAA values overall but have a curving structure to the point cloud across the temperature range. CFSR surface temperatures are slightly warm at the low end, and too cool at the high end while the 2-meter temperatures exaggerate this offset (rotation). ERAI surface temps are slightly too warm at the low end but are fairly close across the full range but their derived 2-meter temps become even warmer at low end of the range. Additional analyses are anticipated including assessing if the elevation differences between the gridded data and the in situ instruments can explain some of the observed differences.