Satellite thermal mapping of the lowest surface temperatures in Greenland

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276.54 268.56 260.59

252.61

244.64 236.66

228.68

220.71

212.73

204.76

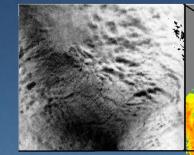
196.78

Questions?

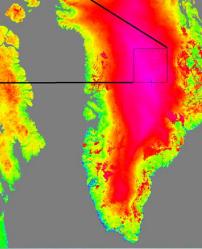
Resolve air puddling

Correlation map

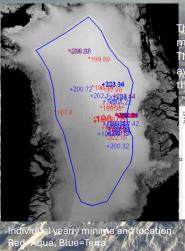
relation between cold



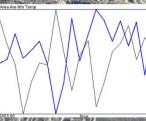
The minimum temperature for winters 2003 to 2024. The actual minimum values was 196.8 K. Substantially lower than any station data.



The minimum temperature shows the small scale geographic connection between temperature and hills and valleys.



There is also some connection between nean weather and minimum temperature. he time series plot shows the regional average of the minimums for eash wheter vs he North Atlantic Oscillation (Blue).



temperatures and NAO Check Modis data against station data.

. Extant Stations Install new station in Antarctica

DATA: MODIS LST

2024

Land Surface Temperature swath products MYD11_L2 and MOD11_L2 Remapped to the MODIS Mosaic of Greenland 500m grid (nside.org). Extracted monthly and seasonal lowest values per grid cell

Lowest surface 'skin' and air temperatures The map colors indicate lowest MODIS LST temperature at each grid cell for Dec-Jan-Feb 2003-Lowest surface 'skin' temperature, 2003-2024 -76.4C ± 1C; 13 Jan 2007 (-105.5F) There are 6 sites (~10 to 20 km²) that reach -76±1C Thermal emission temperatures are lower than air temperature by 3 to 6 C vest AWS 2m air temp *Klinck AWS* -69.6C; 22 Dec 1991 (-93F) [Weidner et al., 2020 QJRMS] The lowest temperatures always occur under clear skies when the elevation is >2000 m Also the site of the lowest MODIS Terra temperature in 2020 -74.1C (-101.4F) The lowest temperatures are closely tied to local topography

Cold events (-70C and below)

The map contours show the number of occurrences of surface 'skin' temperatures of -70C and below. for Dec-Jan-Feb 2003-2024 in the MODIS archive

Distribution of the cold events a broad area to the west of summit, distinctly bounded to the east by the ice divide;

> and a cluster of topographically low sites to north of Summit on either side of the divide

The greatest number is 115 times in the 21-year period -this occurs in a ~8 m topographic low north of Summit Station

rence -70°C - 2023 (20 yrs) >20 ->60 -

Conceptual model of processes for the valley sites

