README

Modeled Greenland firn properties in warming and cooling experiments
Thompson-Munson, Megan; Kay, Jennifer E.; Markle, Bradley R.

Please contact Megan Thompson-Munson (metm9666@colorado.edu) with any questions concerning this dataset.

This dataset contains processed model output from idealized temperature perturbation experiments performed with the SNOWPACK firn model. The associated manuscript will be submitted to *The Cryosphere*. A detailed description of the files contained in this dataset are below. For synthetic model forcing data or raw model output, please contact Megan.

This dataset also contains a Jupyter notebook for creating the figures used in the associated manuscript. For all of the code used in this study, please see the GitHub repository for this work https://github.com/MeganTM/greenland-firn-experiments.

plot-figures.ipynb
This Jupyter notebook creates the figures used for the associated manuscript. It relies on all of the data within this dataset to completely run.

FAC-DEC-smooth.nc and FAC-INC-smooth.nc
These two netCDF files contain the calculated firn air content (FAC) from the cooling ("DEC") and warming ("INC") experiments. The coordinates are latitude, longitude, and time, and they cover the Greenland Ice Sheet over a 200-year period. Note that the timestamps range from the year 1980 through 2179, but the data do not represent those actual years. It is instead the year 1991 repeated 200 times with warming and cooling temperature perturbations applied halfway through. The data variables are FAC, smoothed FAC (for cleaner plotting and smoothing of seasonality for calculations), area of each grid cell, weights for calculating a weighted mean, and volume of firn air content (fac x area).

smet-DEC.nc and smet-INC.nc
These two netCDF files contain the meteorological data from the cooling ("DEC") and warming ("INC") experiments. Some of these variables are used to inform the SNOWPACK model (e.g., air temperature), and some are calculated by the model itself (e.g., sublimation). The coordinates are latitude, longitude, and time, and they cover the Greenland Ice Sheet over a 200-year period. Note that the timestamps range from the year 1980 through 2179, but the data do not represent those actual years. It is instead the year 1991 repeated 200 times with warming and cooling temperature perturbations applied halfway through. The data variables are air temperature, snowfall, rainfall, evaporation, sublimation, runoff, melt, surface mass balance (SMB), wind speed, incoming shortwave radiation (ISWR), incoming longwave radiation (ILWR), and relative humidity (RH). Units are retained as data attributes within the file.

dec_025pct.csv, dec_05pct.csv, dec_10pct.csv, inc_025pct.csv, inc_05pct.csv, inc_10pct.csv
These three spreadsheets contain 2-D arrays (lat, lon) of elapsed time until a percent change (2.5%, 5%, 10%) in firn air content has occurred due to cooling (“dec”) or warming (“inc”).

FAC-change_vs_atm.csv
This spread sheet contains annual averages/sums of firn and atmospheric variables from the control period, cooling experiment, and warming experiment for each grid cell. The data variables are latitude, longitude, arbitrary index assigned to each grid cell, firn air content (FAC) in control, FAC in cooling, FAC in warming, summer air temperature in control, summer air temperature in cooling, summer air temperature in warming, melt in control, melt in cooling, melt in warming, snow in control, snow in cooling, snow in warming, rain in control, rain in cooling, rain in warming, area, liquid-to-solid-ratio (LTSR), FAC change due to cooling, FAC change due to warming, percent FAC change due to cooling, percent FAC change due to warming, absolute difference between cooling and warming FAC, percent difference between cooling and warming FAC, assigned response category, assigned response category with 5% buffer.

pro-files_processed.zip
This zip file contains pickle files (*.p) with data from example locations used to create two figures. The files contain firn density, temperature, and liquid water content, and there is an vertically interpolated version of each file in order to plot the subsurface properties.