Firn Model v1.3

This is the surface energy and mass balance and firn model used for:

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Please cite that study whenever using pieces of the script.

This work is part of the Retain project funded by the Danish Council for Independent research (Grant no. 4002-00234). The GC-Net data is available at <http://cires1.colorado.edu/steffen/gcnet>. The data produced by this study (processed gap-filled hourly standardized weather data and SEB and firn model output) are available for download at <https://arcticdata.io> . The scripts used for this study are available at at <https://github.com/BaptisteVandecrux/SEB_Firn_model>. The PARCA cores are available at <http://research.bpcrc.osu.edu/Icecore/data/> and their collection was supported by NASA grants NAG5-5032, 6817, 5031, 6779, NAGW-4248 and NSF/OPP grant 9423530. KAN\_U weather station data is funded by the Greenland Analogue Project (GAP), and made available through the Programme for Monitoring of the Greenland Ice Sheet (PROMICE). PROMICE data is freely accessible at <http://promice.org>. HIRHAM5 output is available at <http://prudence.dmi.dk/data/temp/RUM/HIRHAM/>.

All the scripts were developed on Matlab 2015b.

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# Structure of the program:

The working folder should contain:

* “**Input**” folder. It should contain the three foldes:
  + Constants. Containing different csv files where the value of the constants used by the model are defined. If the user wants to change these constant values, it can either be done in the csv files or in the main script of the model.
  + Initial state. Contains the initial density and temperature profiles used for the various stations. They can be generated using the InitialDensityProfileGenerator.m script.
  + Weather data. Contains all the weather station data. The weather data files that I used as input contain too much GCnet data to be distributed. Yet I provide one year of my input files to give an outlook of the model. Please contact me if you need the original input files. An alternative is to feed the model with the standardized weather data that is freely available on <https://arcticdata.io> (needs some formatting).
* “**Output**” folder

Where all output plots and documents will be placed. For each new run a new folder is created.

* “**lib**” folder

Collection of various functions used by the model. Each of them should contain a short description.

* “**main.m**” script

Main script for running the model. It is possible to modify some options within that script. The output of the model is saved in nc format in the output folder.

* “**ComparisonPlots.m**” script

Generate the plots used in the publication.

* “**GenerateOutputFiles.m**” script

Generate the standardized weather data files and output from the firn model.

# Coding and running tips

* I have divided every scripts into sections using the command ‘%%’. Matlab allow to expend or collapse each section using the ‘+’ or ‘-‘ sign next to ‘%%’. This works also for ‘for’ loops and ‘if’ loops. For better visibility, you can always start by collapsing all sections (‘View’ tab> collapse all) and open only the section that you are interested in. Each section should have a clear name to help you navigate into the script. This should avoid you to scroll up and down all day.
* ‘ctr + d’ when you have your cursor on a function will open the function script in Matlab. A description of the function is available at the beginning of every function script. When used on a variable, will display its content in the variable tab of Matlab.
* ‘F9’ when you have selected a command, one or multiple lines will run only what was selected.
* ‘ctr + enter’ will run the section in which your cursor is located (from previous ‘%%’ to next ‘%%’ command). This tip and the previous ones are useful for running your script step by step and debug it.
* Stop points (red dot that you insert/remove by clicking on the left side of a line) makes Matlab stop every time it comes across that point. Useful to debug a loop or see what happens in a function.
* I use Matlab structure objects, for example to simplify the input/output of functions or group some variables together. I also used time series objects and table objects. They all allow an to manipulate complex data in an easier way. Read the online documentation about these different objects to know how to use them.
* ‘ctr + c’ when the cursor is in the command prompt to interrupt whatever Matlab is doing.