Community Firn Model (CFM)

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1 Download Required Software

- Download individually

  1. Download Python at www.python.org/getit/.

     Choose version 2.7.x as it is more stable than version 3.3.x.

     For Mac users, MacPorts is a useful way to maintain software that includes Python. Download MacPorts at www.macports.org/install.php.
  2. Download NumPy and SciPy using the Anaconda distribution at continuum.io/downloads.

     More detailed instructions for installation can be found at docs.continuum.io/anaconda/install.html.
  3. Download matplotlib at matplotlib.org/downloads.html.

- Download everything (and more) in one package

  1. Enthought is a Python distribution that includes Python, NumPy, SciPy, and matplotlib, as well as a GUI, IPython console, and other features. Download Enthought at www.enthought.com/store/.

     The free download contains everything we need.

2 Download the firn model

- Directly from the website

  1. Windows: (link to zip file).
  2. Mac OS/UNIX/LINUX: (link to tar ball).

- Using the GitHub repository

  1. Find our GitHub repository at github.com/jessicalundin/FMbeta/.
  2. Clone in Desktop or Download ZIP.
  3. You should now have a folder "FMbeta" that contains the whole project.

3 Files and Folders in "FMbeta"

- code

  The "code" folder contains the files needed to run the model.

  1. firnmodel.py is the main model code.
  2. config.json is a list of variables that are used by firnmodel.py (This is what you will change.)
  3. plot.py produces plots from data files created by firnmodel.py.

- manual

  The "manual" folder contains a manual with instructions, variable descriptions and other information.

  1. manual.tex is the LaTeX document containing the manual for the model.
  2. manual.pdf is the PDF of the manual produced by manual.tex.
  3. Any other files are produced by manual.tex and are generally unimportant.

4 How to Run an Experiment

The model runs in python. Running the model from the command line is simplest. Make sure that the python that is called from the command line is the python installation that includes numpy and scipy modules. First you must run a spin up, and then you run the main model run.

From the command line, type:

```
python firnmodel.py config.json -s
```

to run the spin up. The -s is the option to run the spin up. The spin-up output will be stored in the results folder that you specify in the config.json file that you are calling. Then, to run the main model run, type:

```
python firnmodel.py config.json
```

If you are in ipython, you use the same commands except replace "python" with "run" at the start.

5 Output Files and Plots

- Data Files

  Each output file consists of comma seperated values. The first element in each row represents the time step in years. The remaining elements in the row represent the value of the chosen element of the firn at each point along the grid. These output files are:

  1. age.csv
     How old the firn is in ($years$).
  2. density.csv
     The density of the firn in ($kg\, m^{-3}$)
  3. depth.csv
     The depth of the firn in (m)

4. temp.csv

   The temperature of the firn in (K)

5. r2.csv (only if grain growth is turned on)
6.

- Plots

  Plots of output data are produced by setting "plotting" to "on" in config.json. Each plot consists of the inital and final profiles of the data plotted against depth.

A Model Variable Appendix

Variable	Description	Options
BCtemp	–	
BCbdot	–	
BCrho	–	
physRho	–	
physGrain	Turns grain physics calculations on or off.	"on", "off"
heatDiff	Turns heat diffusion calculations on or off.	"on", "off"
Ts0	Beginning Surface Temperature	
rhos0	Beginning Surface Density	
bdot0	Beginning Accumulation Rate	
r2s0	Beginning r^2	
years	Number of years to run the experiment.	
stpsPerYear	Number of steps for each year the experiment is run.	
gridH	Grid Height	
gridbase	–	
gridlen	Grid Length	
sPerYear	Seconds Per Year	
rhoi	Density of ice	
rhoiMgm	Density of ice in $(Mg\,m^{-3})$	
rho1	–	
rho2	–	
Q1	–	
Q2	–	
k1	–	
k2	–	
a	–	
b	–	
R	–	
g	Acceleration of Gravity	
H	–	
kg	Grain Growth Constant	
Eg	Grain Growth Activation Energy	