Community interactive webtool to explore Greenland datasets

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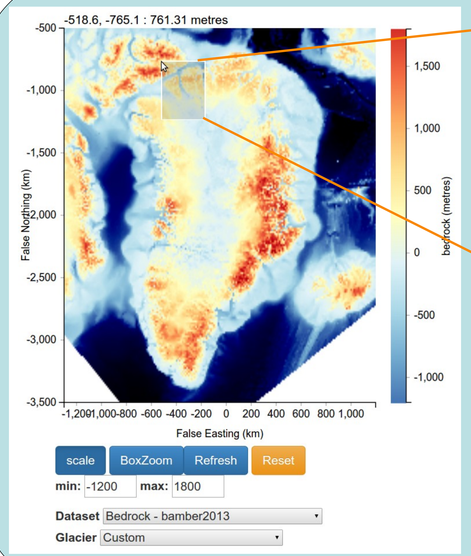
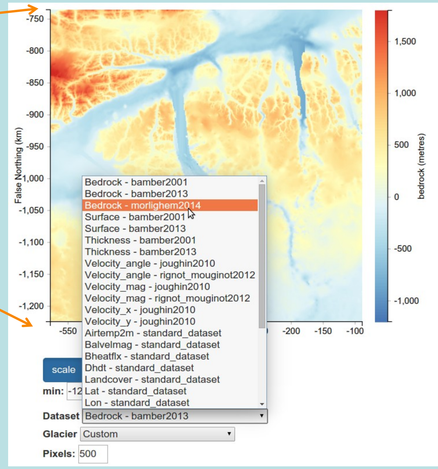
Motivation

Marine-terminating, outlet glaciers are challenging to include in conventional Greenland-wide ice sheet models because of the large variation in scale between model grid size (typically 10 km) and outlet glacier width (typically 1-5km), making it a subgrid scale feature. A possible approach to tackle this problem is to use one-dimensional flowline models for the individual glaciers (e.g. Nick et al., 2013; Enderlin et al 2013).

Here we present a python- and javascript- based webtool to prepare data required to feed in or validate a flowline model. It is designed primarily to outline the glacier geometry and returns relevant data averaged over cross-sections.



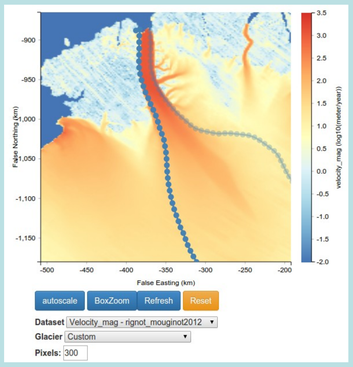


Explore datasets

- zoom / pan tools
- adjustable color scale
- **dynamic loading of netCDF** datasets with appropriate **sub-sampling**
- **coordinate transformation** onto visualization grid
- **multiple datasets**:
  - Present-day Greenland
  - Bamber et al. (2013)
  - Rignot and Mouginot (2012)
  - Morlighem et al (2014) (user-extendable)

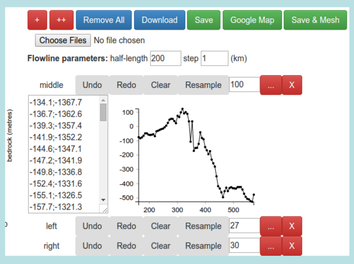
References

- Bamber, J. L., et al. (2013), 'A New Bed Elevation Dataset for Greenland', TC, DOI:10.5194/tc-7-499-2013
- CISM, 'Present Day Greenland', 2015 http://websrv.cs.umt.edu/isis/index.php/Present_Day_Greenland
- Enderlin, E. M. et al. (2013), 'High Sensitivity of Tidewater Outlet Glacier Dynamics to Shape', TC, DOI:10.5194/tc-7-1007-2013
- Morlighem, M, E et al. (2014), 'Deeply Incised Submarine Glacial Valleys beneath the Greenland Ice Sheet', NGeo, DOI:0.1038/ngeo2167
- Nick, Faezeh M. et al. (2013), 'Future Sea-Level Rise from Greenland's Main Outlet Glaciers in a Warming Climate', Nature, DOI:10.1038/nature12068
- Rignot, E., and J. Mouginot (2012), 'Ice Flow in Greenland for the International Polar Year 2008–2009', GRL DOI:10.1029/2012GL051634



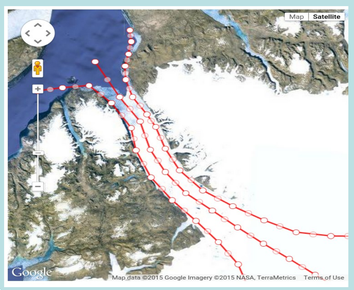
Compute flowlines based on velocity field

- Mouse-click to define a starting point
- Flowlines computed based on surface velocity field (Rignot and Mouginot, 2012)



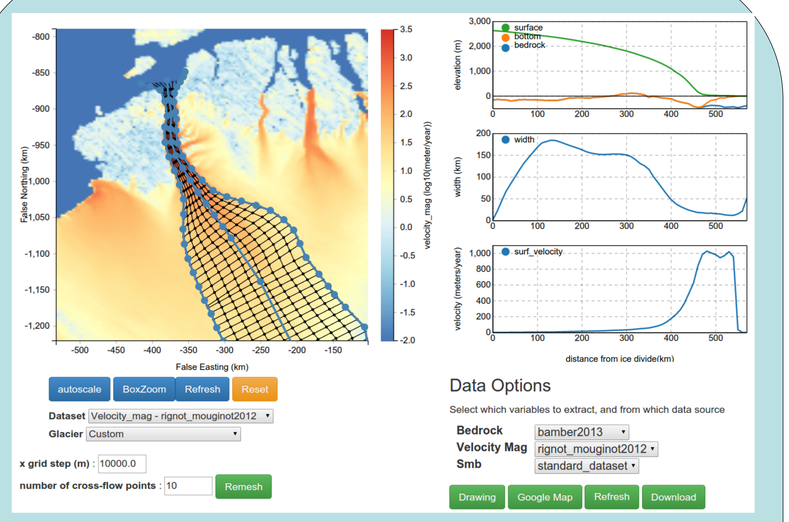
Toolkit to edit lines and sample data underneath

- Edit flowlines by hand to fix data error
- Resample lines
- Embedded panel to vizualize the data underneath, modify coordinates by hand



Google Map interface

- Visualization can be switched to Google Map interface, to compare with satellite images.
- Lines are editable in this view using Google polyline tools, which some might find more intuitive...



Export as 1-D geometry: mesh generation

- Requires three lines: left, middle, right (downstream looking)
- Generate orthogonal segments to the middle line at regular intervals, and find the intersection points with the side lines.
- Admittedly a crude approach, see webglacier1d/issues for interactive discussion.
- export as 1-D geometry by averaging along cross-sections
- download the result as netCDF4

Technical notes

- project is hosted on github/perrette/webglacier1d, under the open-source MIT Licence.
- server-side written in python (open-source) using the web-framework flask (and also : netCDF4, dimarray, caropty…)
- client-side (javascript) makes use of the d3 library for interactive figures, and jQuery for requests, as well as bootstrap
- for now it only runs locally in a web browser, after downloading source code and datasets (not included)

Conclusions

- The tool is handy at exploring datasets and extracting relevant data to netCDF as 1-D geometry, for further study and modelling.
- It can be extendable to more datasets (digging a bit in the code)
- There is room for improvement and github offers an online platform for discussion under webglacier1d/issues
- Open question: how to improve mesh generation?
- Let's start modelling....come and see related posters !

Related posters (GREENRISE Project)

David Alexander: EGU2015-7677 (Y224)
Johanna Beckmann: EGU2015-6856 (Y223)
Mahé Perrette: EGU2015-6311 (Thu. 17:30, Y79)

https://github.com/perrette/webglacier1d