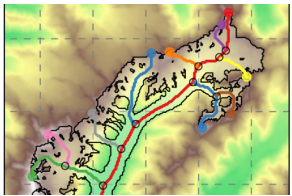
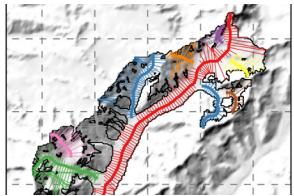
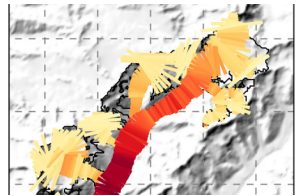
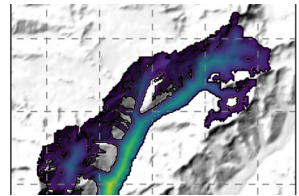
universität innsbruck

Glaciology on the cloud

Research and education in your web browser

Fabien Maussion, Joe Hamman, Ryan Abernathey

University of Innsbruck (AT), National Center for Atmospheric Research (USA), Lamont-Doherty Earth Observatory (USA)

My take home messages for today

1. Cloud (or HPC) computing **in your web browser** is the future of geoscientific data analysis, possibly of (glaciological) modelling as well
2. **Emerging technologies make the cloud welcoming to all**, even for us glaciologists who like to play outside more than on computers
3. For big data / modelling deployments: don't try this at home! You probably want to **convince your institution** to deploy for you instead
4. **Try the tools, learn about them and join us:** `http://edu.oggm.org`

Stories

- **Open Science**
  code alongside papers to allow peer-review and collaboration
- **Reproducible Science**
  encapsulation of computational environments as safeguard against “chaos”
- **Knowledge Transfer**
  web browser and cloud resources for universal access to education
- **Big Data**
  bring your analysis workflow *to the data*, not the other way around

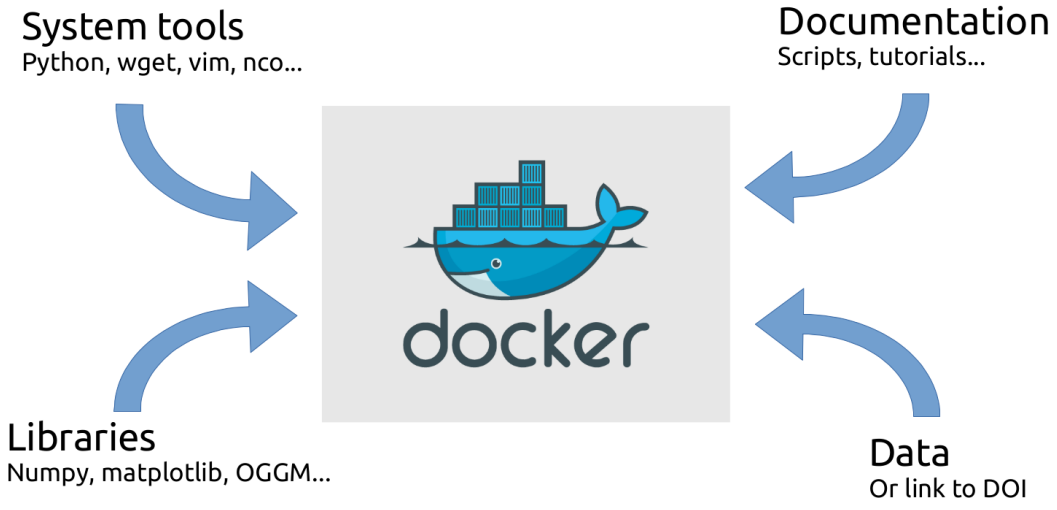
Open Science

- **Collaborative platforms**: GitHub, GitLab. . .
- **Archiving tools**: Zenodo. . .
- **Attribution**: OS Licenses, DOIs. . .
- **Enforcement from publishers**:
  new GMD editorial (v1.2)

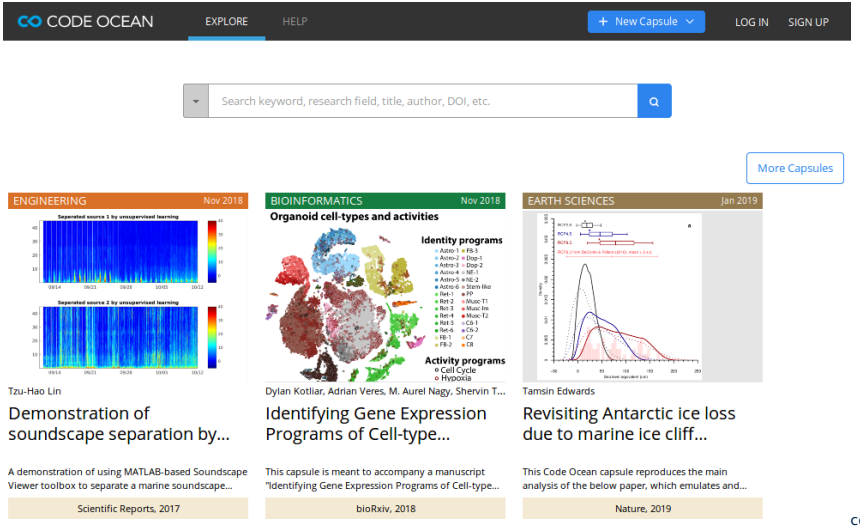
Take home

There is no **practical** obstacle to open-science software any more
$\rightarrow$ **Open Science is becoming “the rule”**

Software “capsules”: container technologies



New market: example Code Ocean

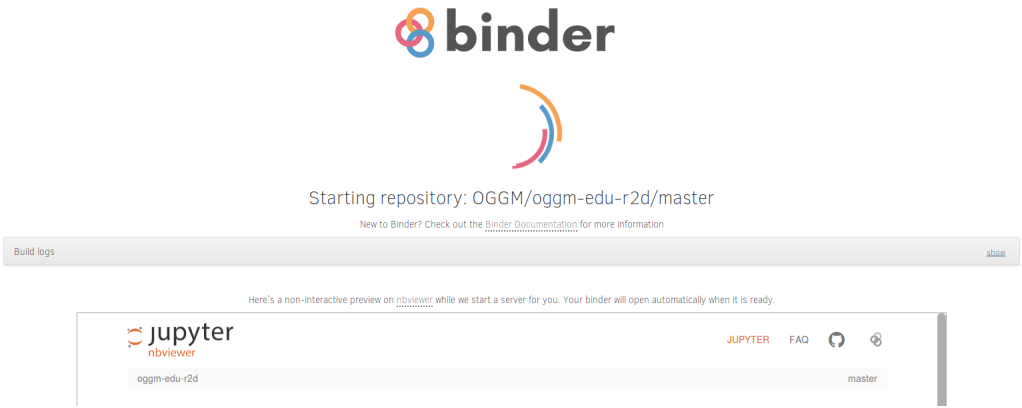


codeocean.com

Open source model

http://edu.oggm.org

Demo


binder
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New to Binder? Check out the Binder Documentation for more information
Build logs
show
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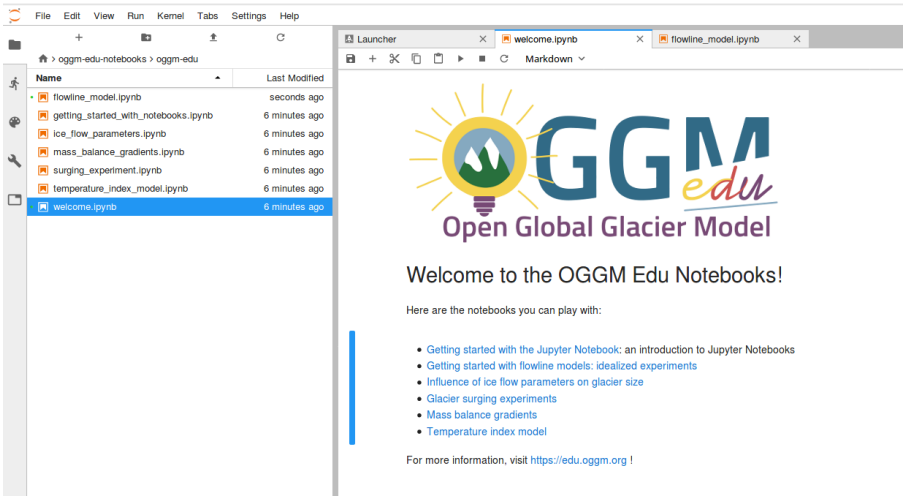
jupyter
nbviewer
JUPYTER
FAQ
oggm-edu-r2d
master

Demo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Launcher
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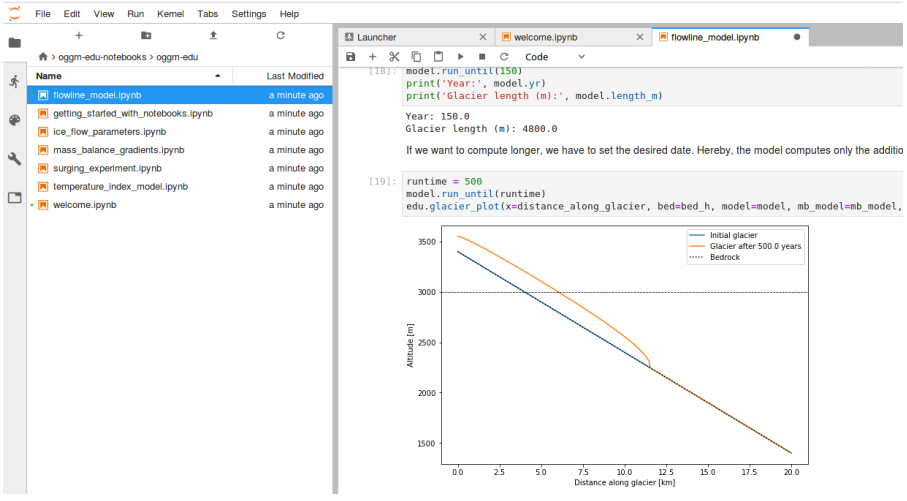
Markdown
OGGM edu
Open Global Glacier Model
Welcome to the OGGM Edu Notebooks!
Here are the notebooks you can play with:
Getting started with the Jupyter Notebook: an introduction to Jupyter Notebooks
Getting started with flowline models: idealized experiments
Influence of ice flow parameters on glacier size
Glacier surging experiments
Mass balance gradients
Temperature index model
For more information, visit https://edu.oggm.org !

Demo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welcome.ipynb
a minute ago
Launcher
welcome.ipynb
flowline_model.ipynb
Code
[18]:
model.run_until(150)
print('Year:', model.yr)
print('Glacier length (m):', model.length_m)
Year: 150.0
Glacier length (m): 4800.0
If we want to compute longer, we have to set the desired date. Hereby, the model computes only the additio
[19]:
runtime = 500
model.run_until(runtime)
edu.glacier_plot(x=distance_along_glacier, bed=bed_h, model=model, mb_model=mb_model,
Initial glacier
Glacier after 500.0 years
Bedrock
Altitude [m]
Distance along glacier [km]

The challenge of big data. Solutions. . .

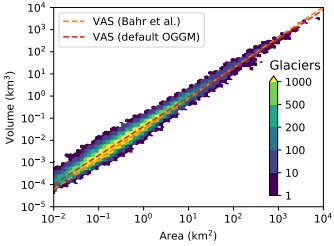
- . . . from business / closed source: Google Earth Engine, Climate Data Store

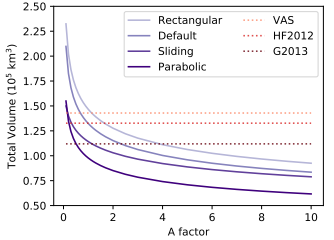
  (CDS relies heavily on OS tools though)
- . . . from the scientific community: Pangeo.io

A community platform for Big Data geoscience

And because I feel sorry for this geeky talk

Here is a graph . . .

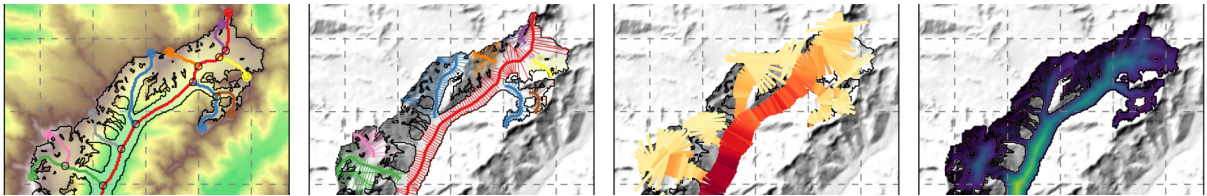




. . . and a glacier in the cloud:

Advantages / disadvantages of cloud computing

- allows to use familiar tools in a browser and reduces the tech entry level bar
- accessible to all
- facilitates discovery and collaboration
- a great step forward for reproducible science
- the only viable solution to current and future big data problems
- economy of scale (hardware / software / knowledge)
- numerical modelling and I/O remains a challenge (people are working on it)
- requires an internet connection
- requires support from IT to set your own deployment up
- universities and HPCs are behind



Thank you for your attention!

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