

Scaling Reproducible Research



Carol Willing

@WillingCarol

Workshop: Building reproducible
workflows for earth sciences

ECMWF

October 15, 2019

San Diego, CA









Tokyo



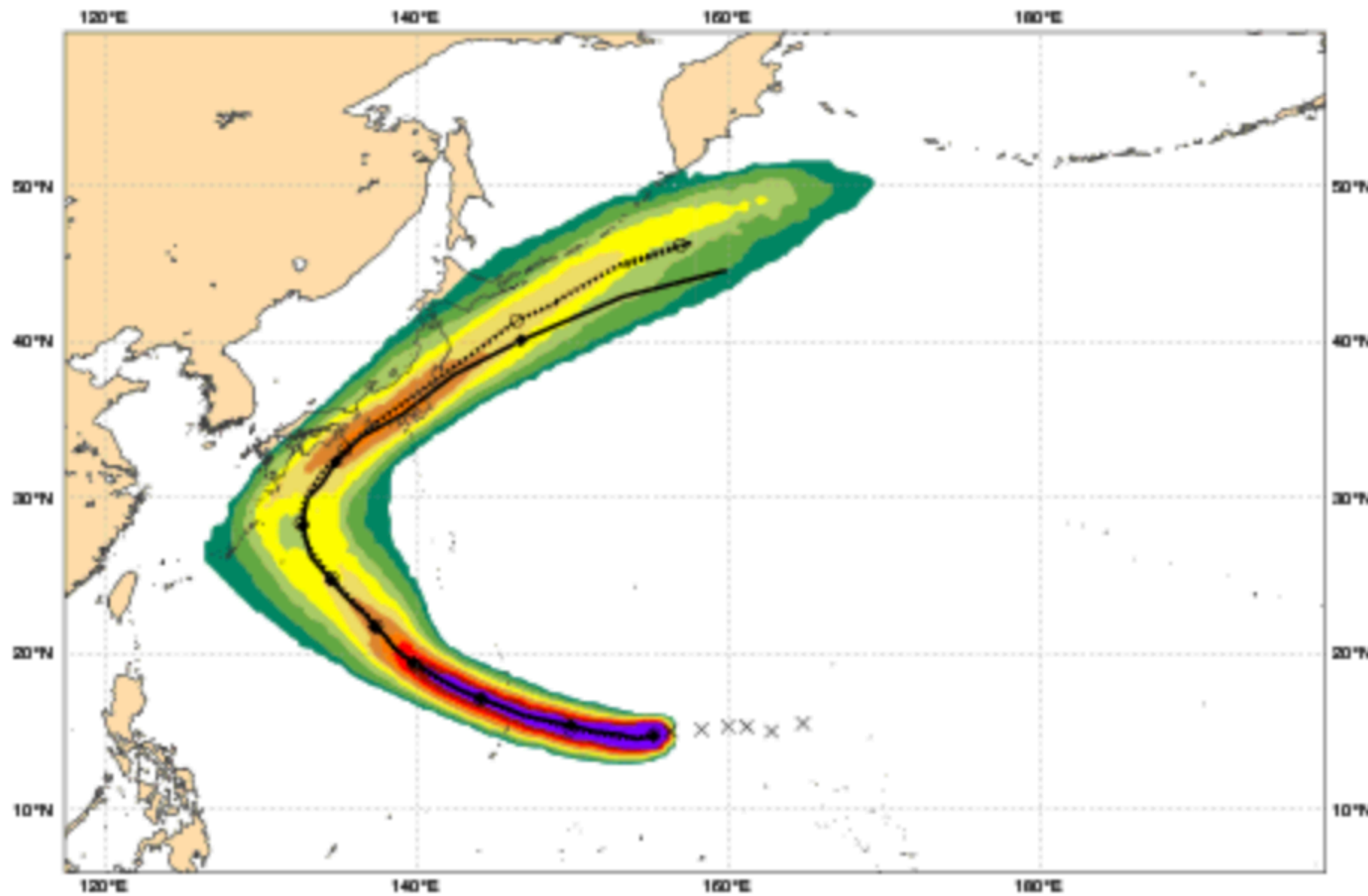
The **typhoon** came out of the sea
first as a deep hollow roar.

-Pearl S. Buck



Date 20191006 00 UTC @ECMWF

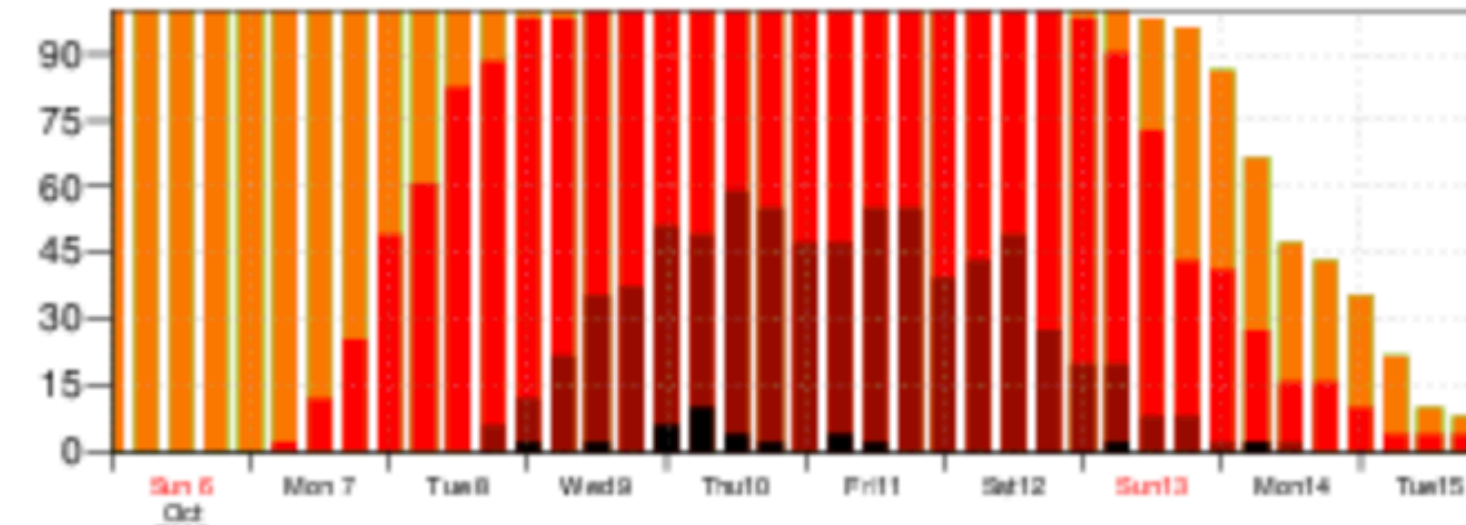
Probability that **HAGIBIS** will pass within 120 km radius during the next 240 hours
 tracks: **solid**=HRES; **dot**=Ens Mean [reported minimum central pressure (hPa) **996**]



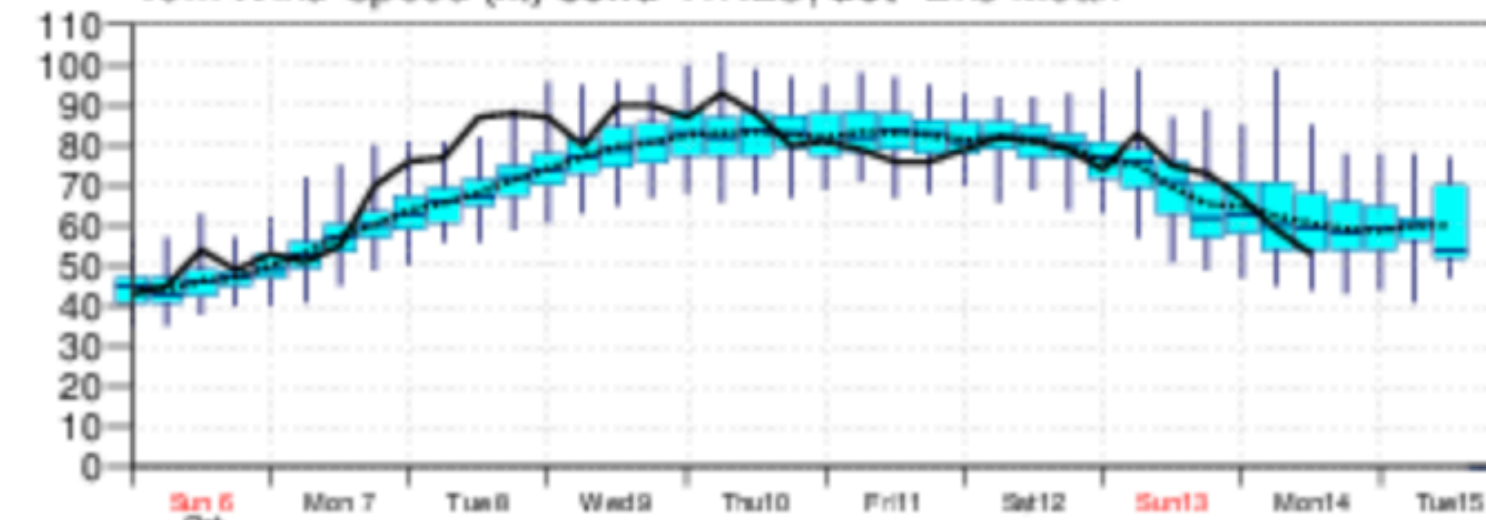
List of ensemble members numbers forecast Tropical Cyclone
 Intensity category in colours: **TD**[up to 33] **TS**[34-63] **HR1**[64-82] **HR2**[83-95] **HR3**[> 95 kt]

+024 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+048 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+072 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+096 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+120 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+144 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+168 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+192 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	44	45	46	47	48	49	50		
+216 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	44	45	46	47	48	49	50		
+240 h	hr	cd	01	02	03	04	05	06	07	08	09	10	11	12	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	44	45	46	47	48	49	50		

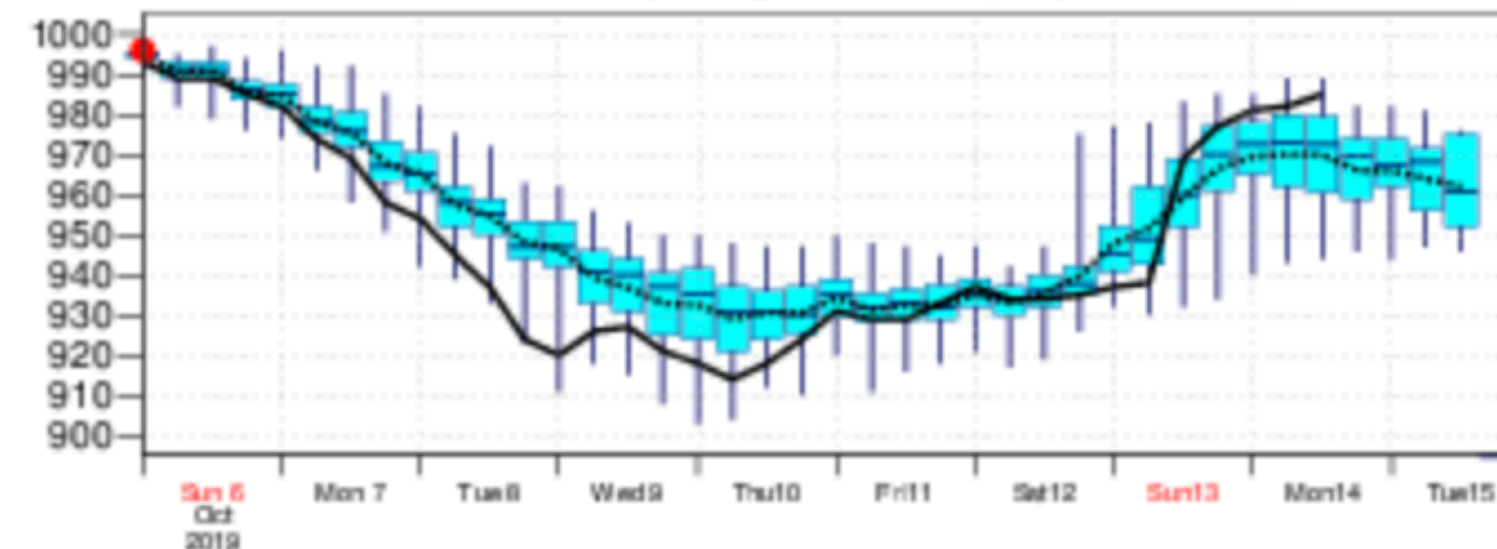
Probability (%) of Tropical Cyclone Intensity falling in each category
TD[up to 33] **TS** [34-63] **HR1**[64-82] **HR2** [83-95] **HR3** [> 95 kt]



10m Wind Speed (kt) **solid**=HRES; **dot**=Ens Mean



Mean Sea Level Pressure in Tropical Cyclone Centre (hPa) **solid**=HRES; **dot**=Ens Mean



These charts show the evolution of the position and intensity of tropical cyclones (TCs) in the ECMWF high-resolution (HRES) and ensemble (ENS) forecasts. They provide an objective measure of the uncertainty in the current forecast. These products are generated for all TCs that have been officially observed at the initial time of the forecast.

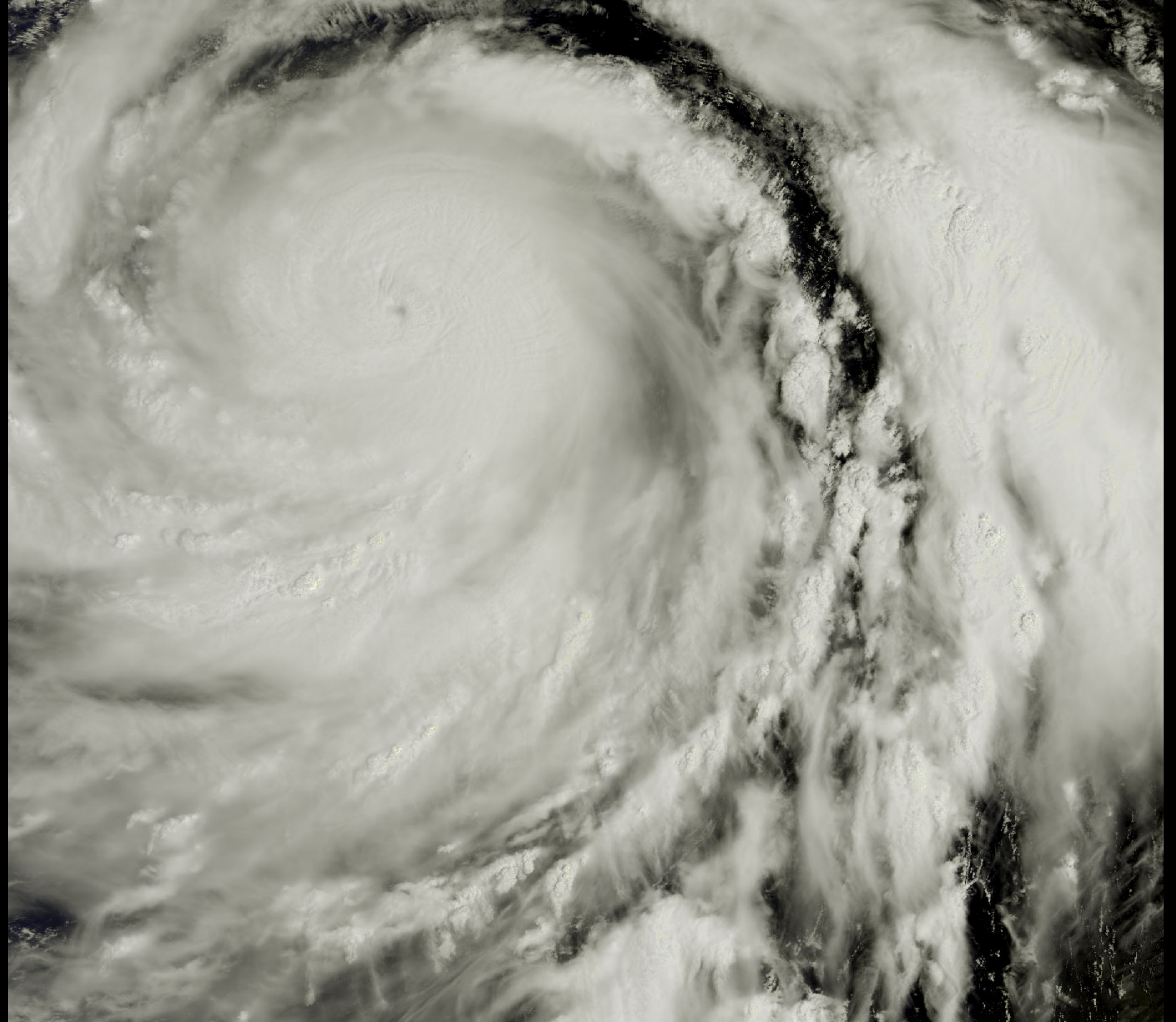
I was surrounded by the madness,
the **unreason**, of **uncontrolled**,
undisciplined energy.

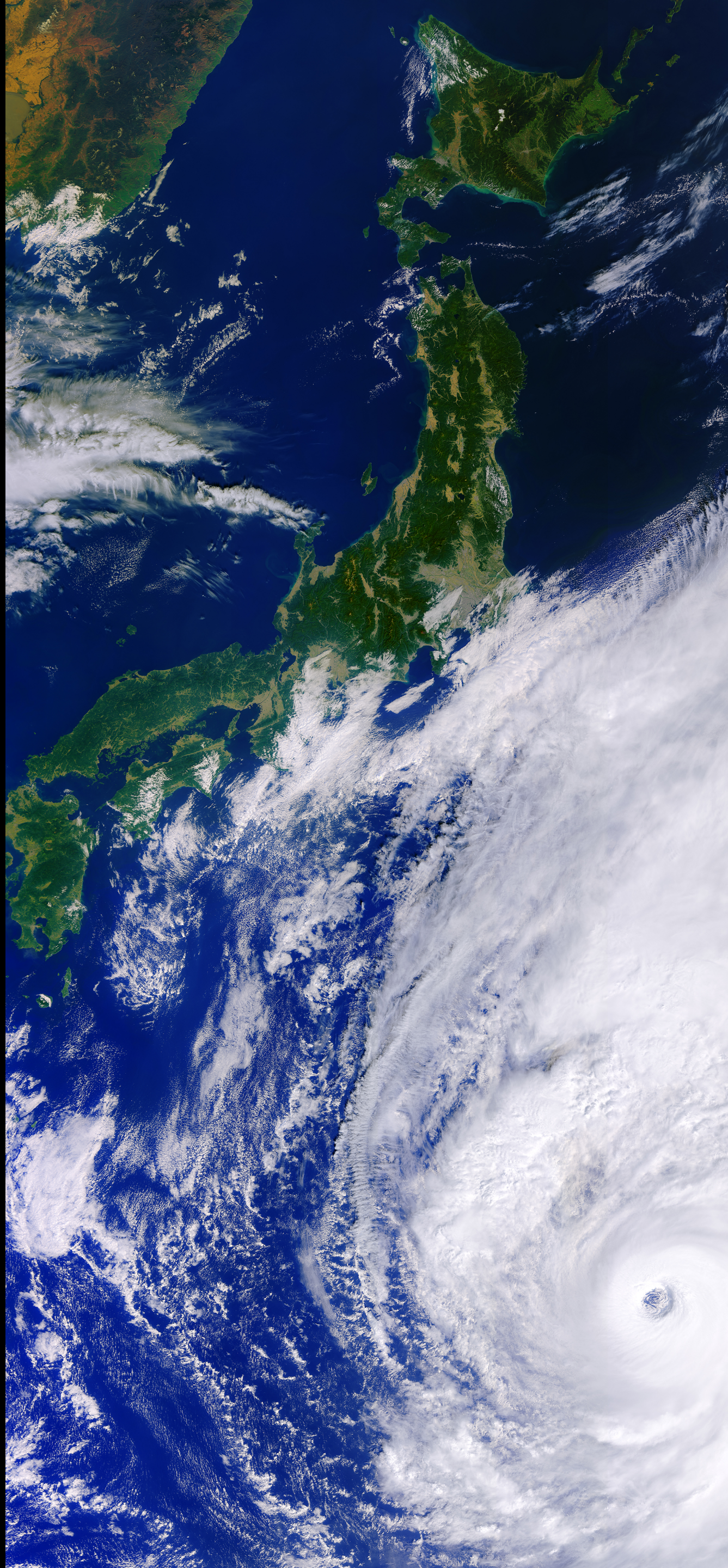
-Pearl S. Buck

Super Typhoon Hagibis

View of Super Typhoon
Hagibis south-west of
Japan, as captured by
the Copernicus
Sentinel-3 satellite on
08 October at 00:16
UTC.

**Copyright: 2019 European
Union, contains modified
Copernicus Sentinel data
2019, processed by
EUMETSAT**





Title Typhoon Hagibis

Released 10/10/2019 4:45 pm

Copyright contains modified Copernicus
Sentinel data (2019), processed by ESA,
CC BY-SA 3.0 IGO



FUKUYA

クリニック

婦人科・内科
しおしおマイスタークリニック
3F

大京

Hair Make

美顔教室

3F
prior
プリオール

R

美容専門学校
FUKUYA

株式会社エムエフケー
大幸産業株式会社
2F

MFK.BLDG.

7

celevec

Source: Twitter



A sign is partially submerged as the Tama River floods during Typhoon Hagibis. Source: Getty Images



Linnea/リンネ

In the end japan had a record typhoon, whirlwinds, tsunami, volcanic eruption, and earthquakes all at once

1:40 PM



Linnea/リンネ

Wind, water, earth, and fire. All that's left is for godzilla to crawl out of the bay and vaporize chiba

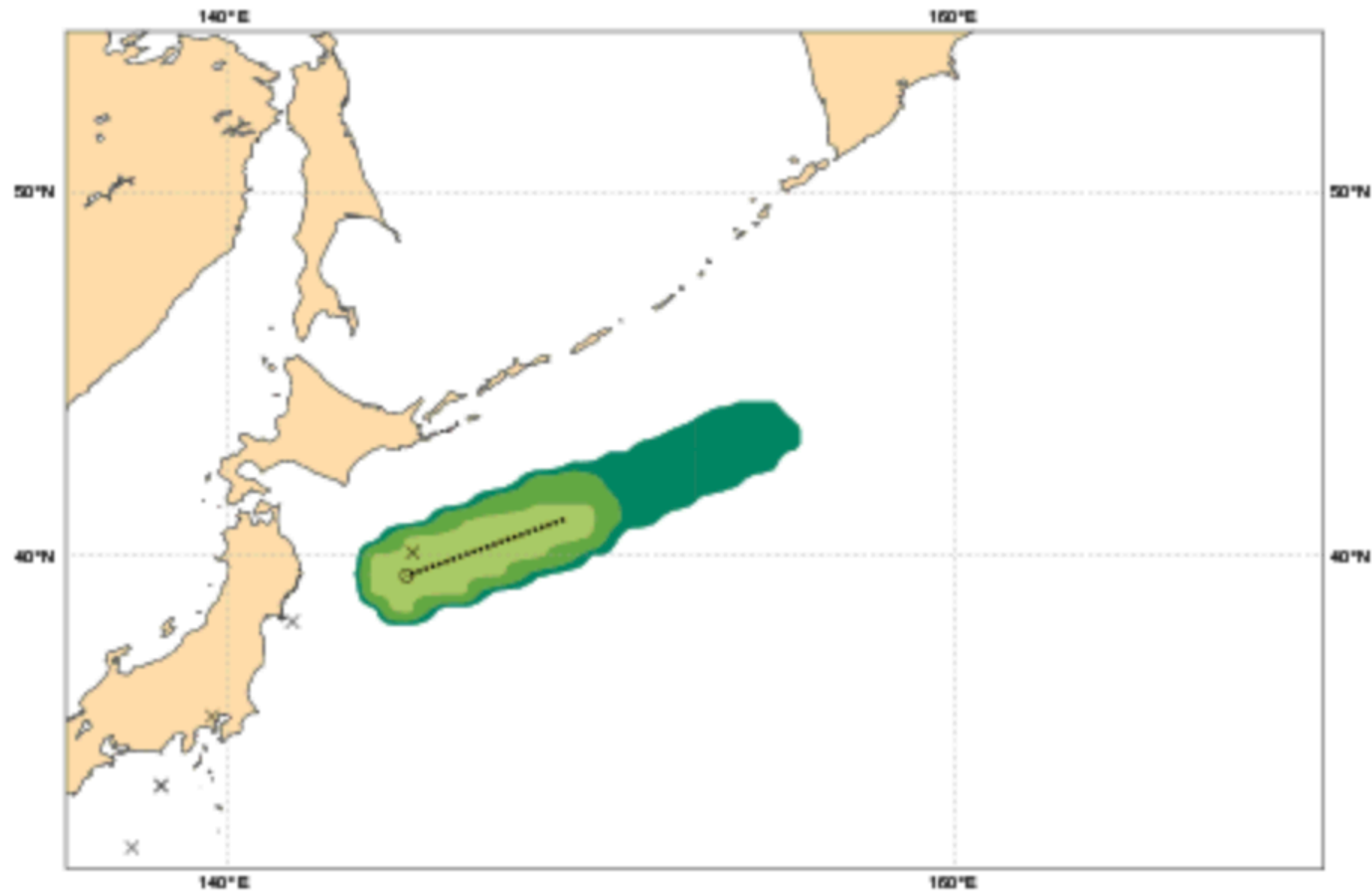
1:41 PM

Read 2
1:41 PM

That's quite the day. I am using that quote in my keynote

Base time: Sun 13 Oct 2019 00 UTC ▾

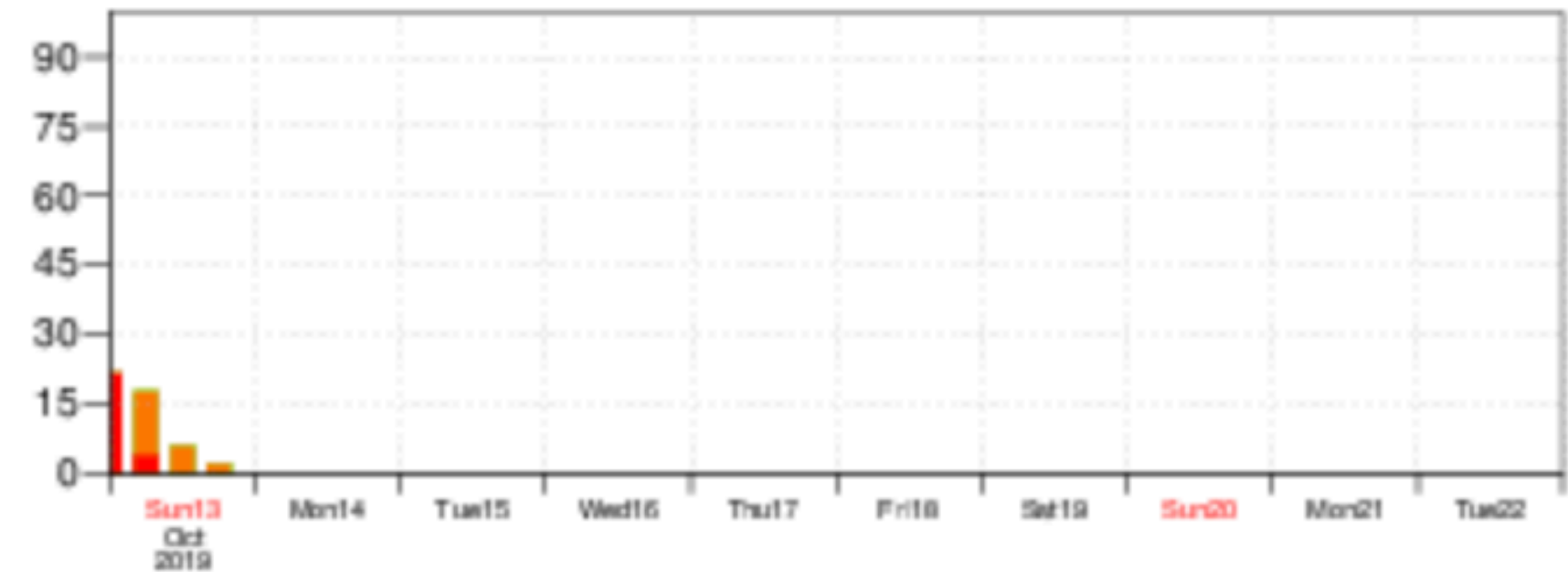
Date 20191013 00 UTC @ECMWF
 Probability that **HAGIBIS** will pass within 120 km radius during the next 240 hours
 tracks: **solid**=HRES; **dot**=Ens Mean [reported minimum central pressure (hPa) **975**]



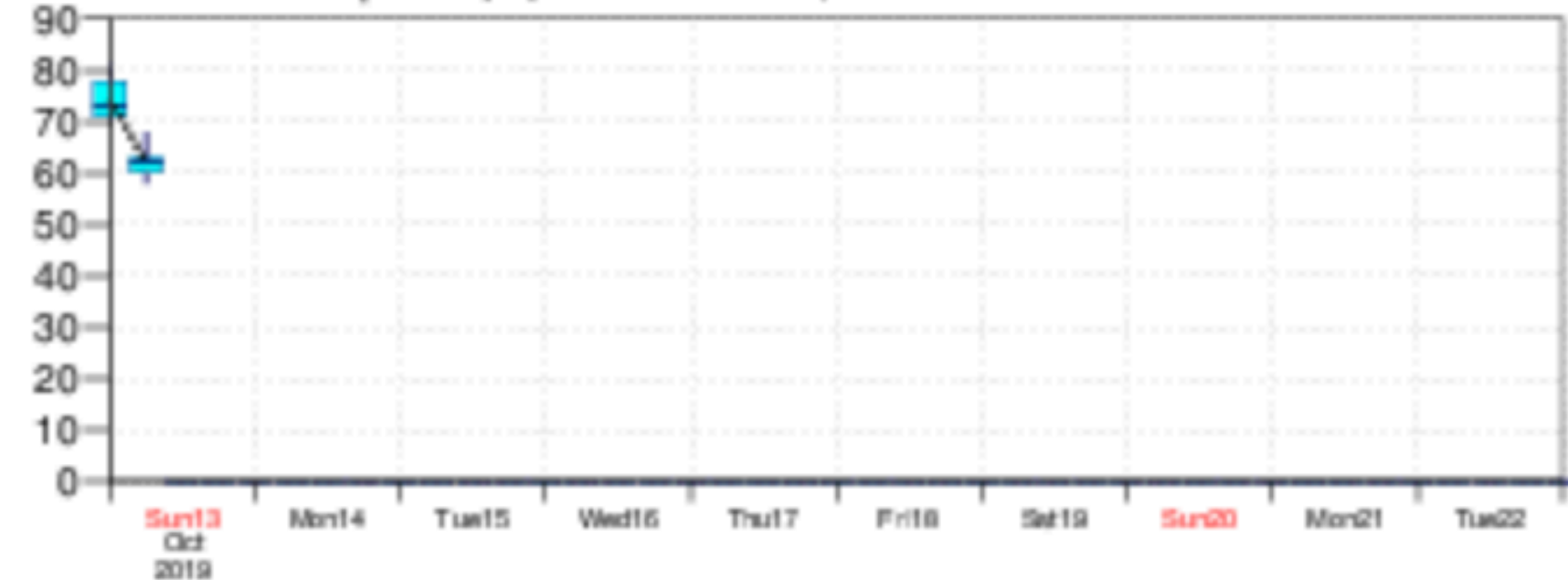
List of ensemble members numbers forecast Tropical Cyclone
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- v024 h :
- v048 h :
- v072 h :
- v096 h :
- v120 h :
- v144 h :
- v168 h :
- v192 h :
- v216 h :
- v240 h :

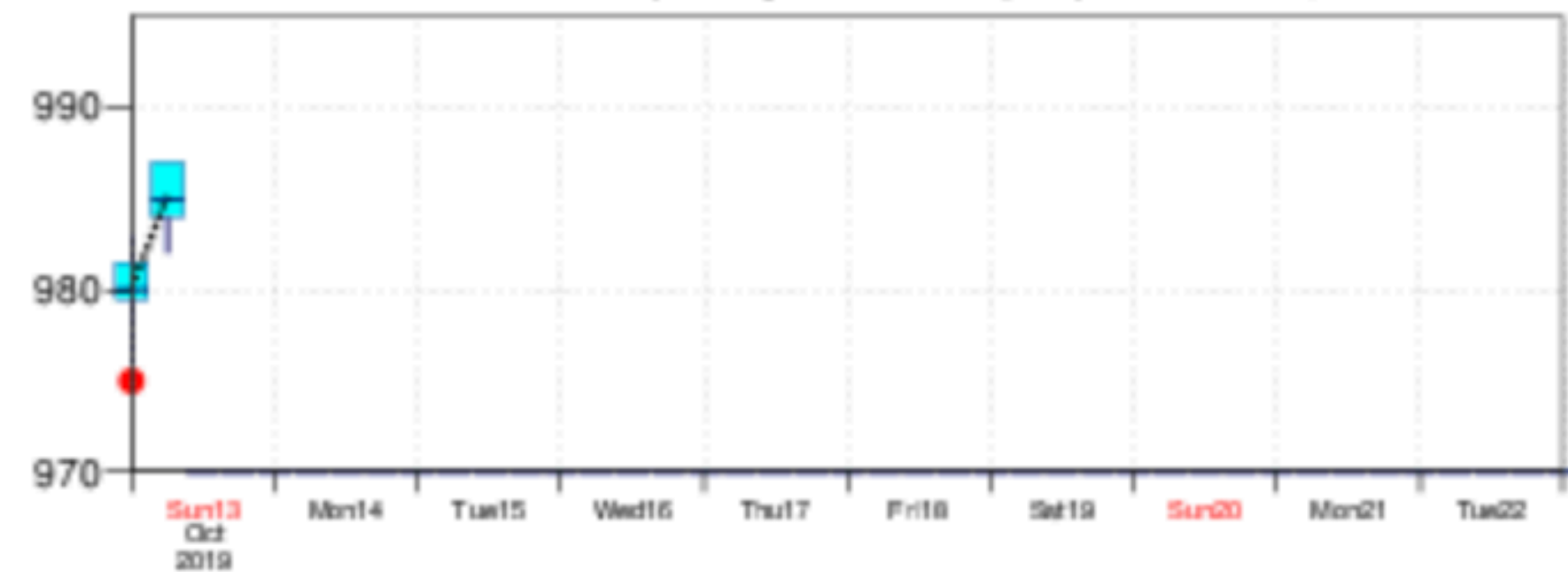
Probability (%) of Tropical Cyclone Intensity falling in each category
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10m Wind Speed (kt) **solid**=HRES; **dot**=Ens Mean



Mean Sea Level Pressure in Tropical Cyclone Centre (hPa) **solid**=HRES; **dot**=Ens Mean



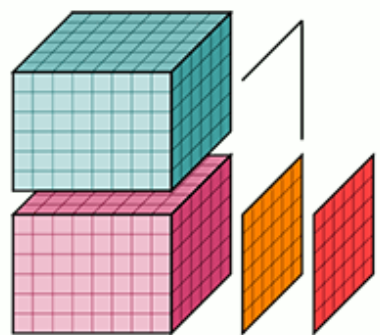
Lives depend on

scaling reproducible research

Tools

Processes

Communication



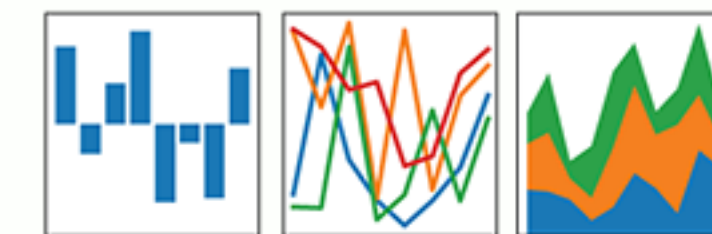
xarray



IP[y]:
IPython



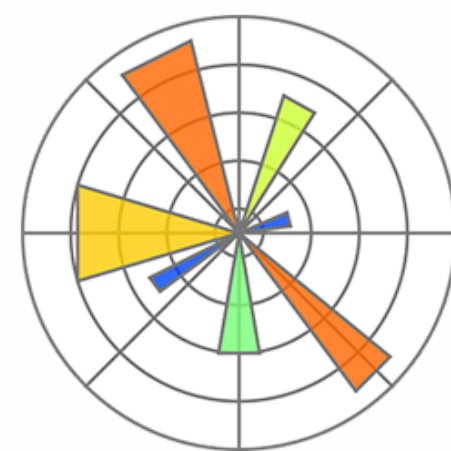
pandas
 $y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$



julia



QuantEcon



OpenSci

yt

Econ-ARK

將軍
sho gun

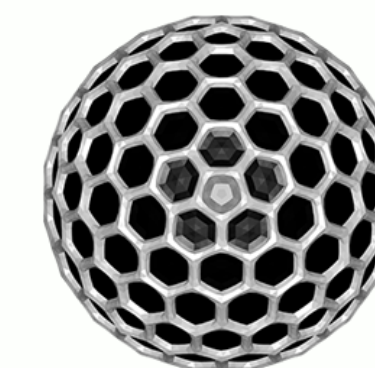
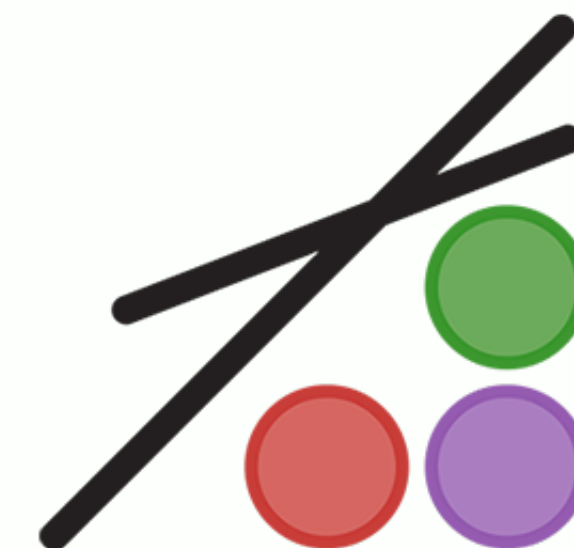


MathJax

THE CARPENTRIES

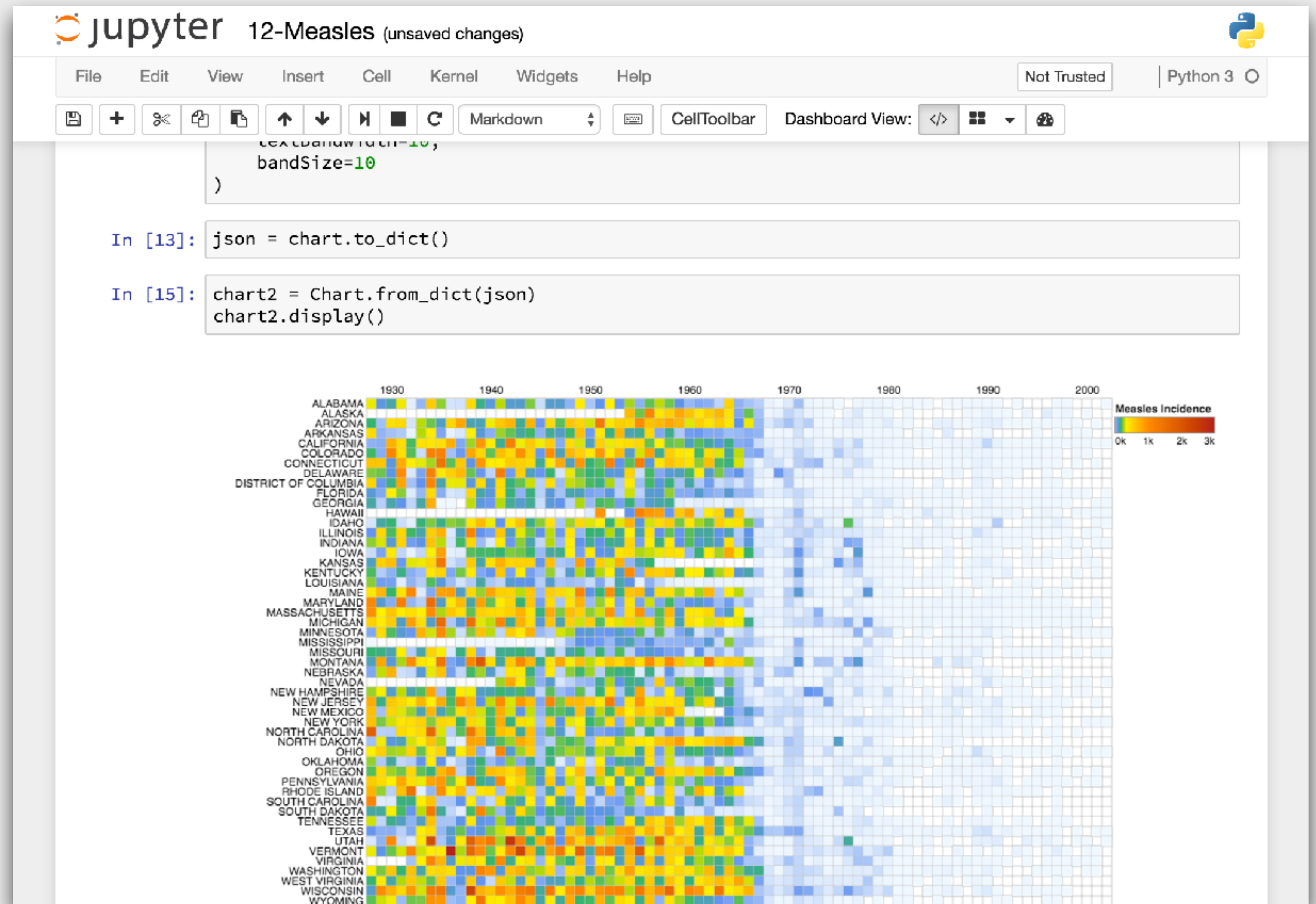


PyTables



NUMFOCUS
OPEN CODE = BETTER SCIENCE

Jupyter Notebook

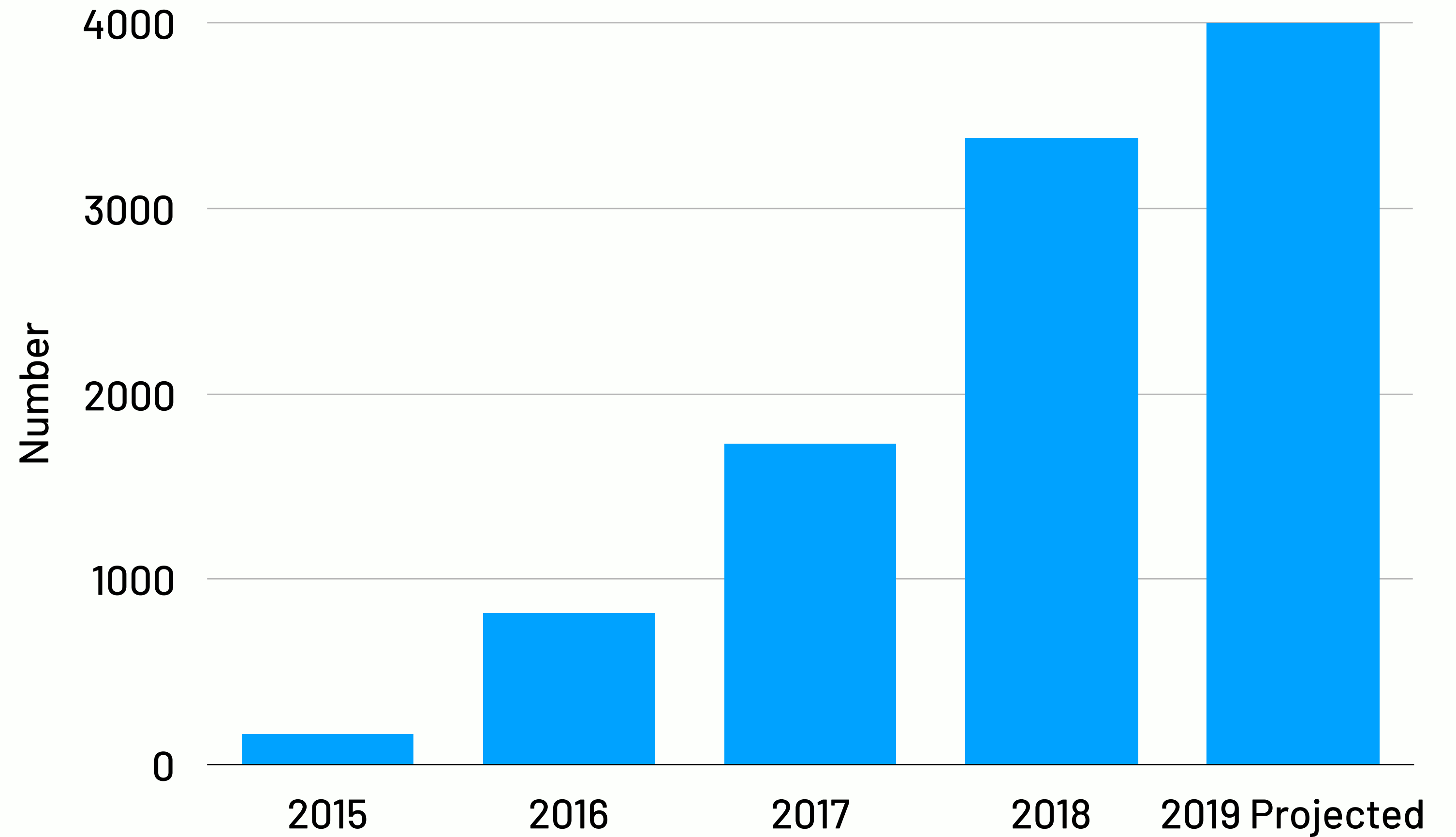


A Jupyter Notebook document with a visualization of measles data.



Research

Jupyter Citations



Millions of Notebooks

Trending in open source

See what the GitHub community is most excited about today.

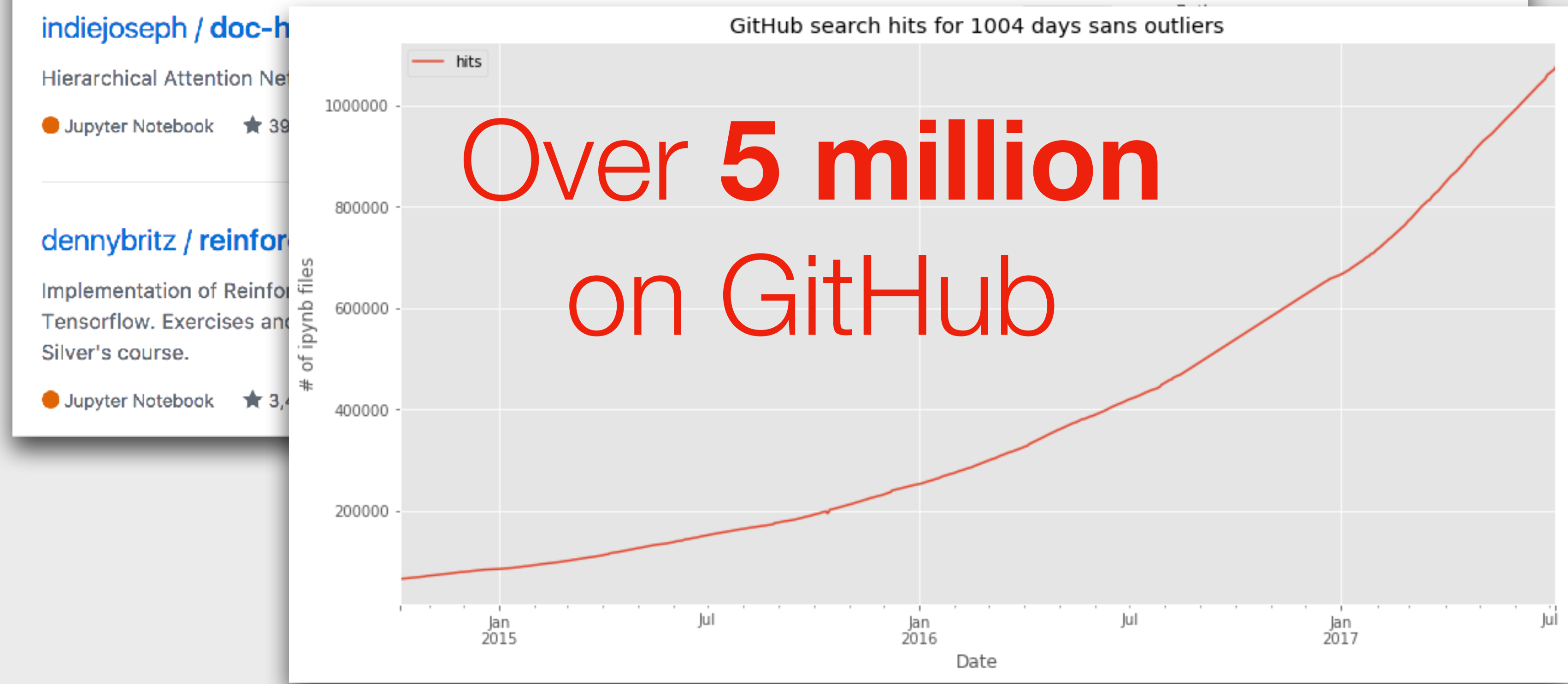
Repositories Developers Trending: today

All languages
Unknown languages
C++
JavaScript
Jupyter Notebook
Makefile
Objective-C++

aymericdamien / TensorFlow-Examples ★ Star

TensorFlow Tutorial and Examples for beginners

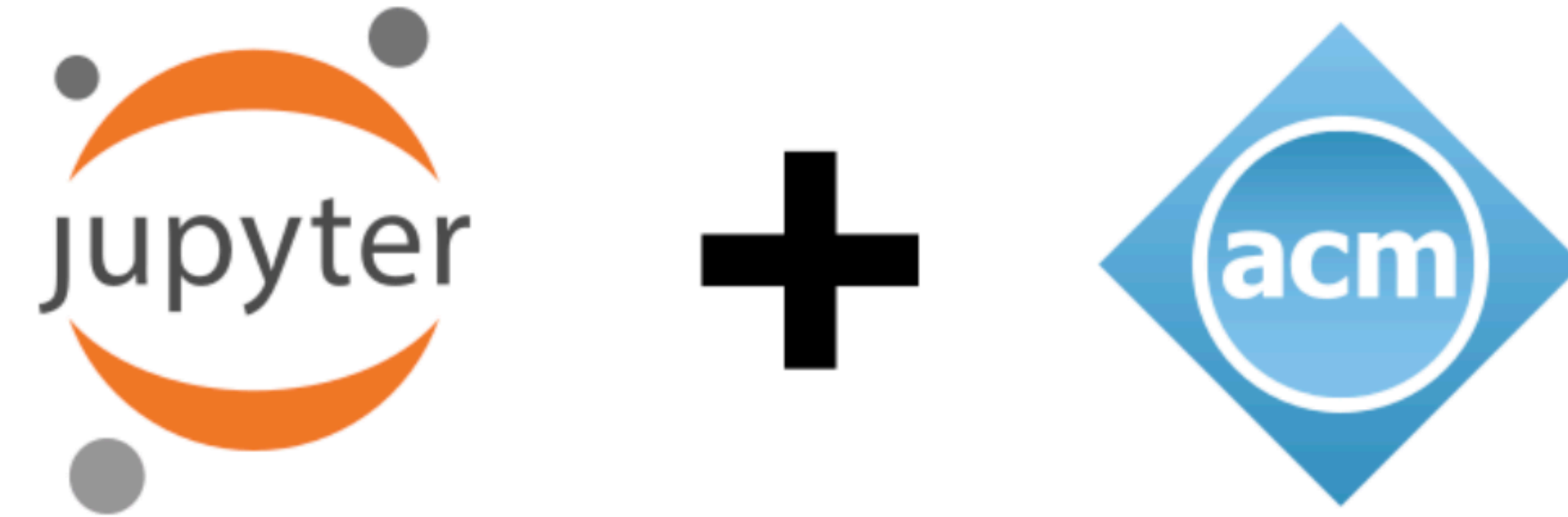
Jupyter Notebook ★ 12,340 4,115 Built by ★ 23 stars today



<https://github.com/trending/jupyter-notebook>



- ▶ **Growth**
- ▶ **ACM Award**
- ▶ **Industry adoption**
- ▶ **Creative uses**
- ▶ **Open Source Book**



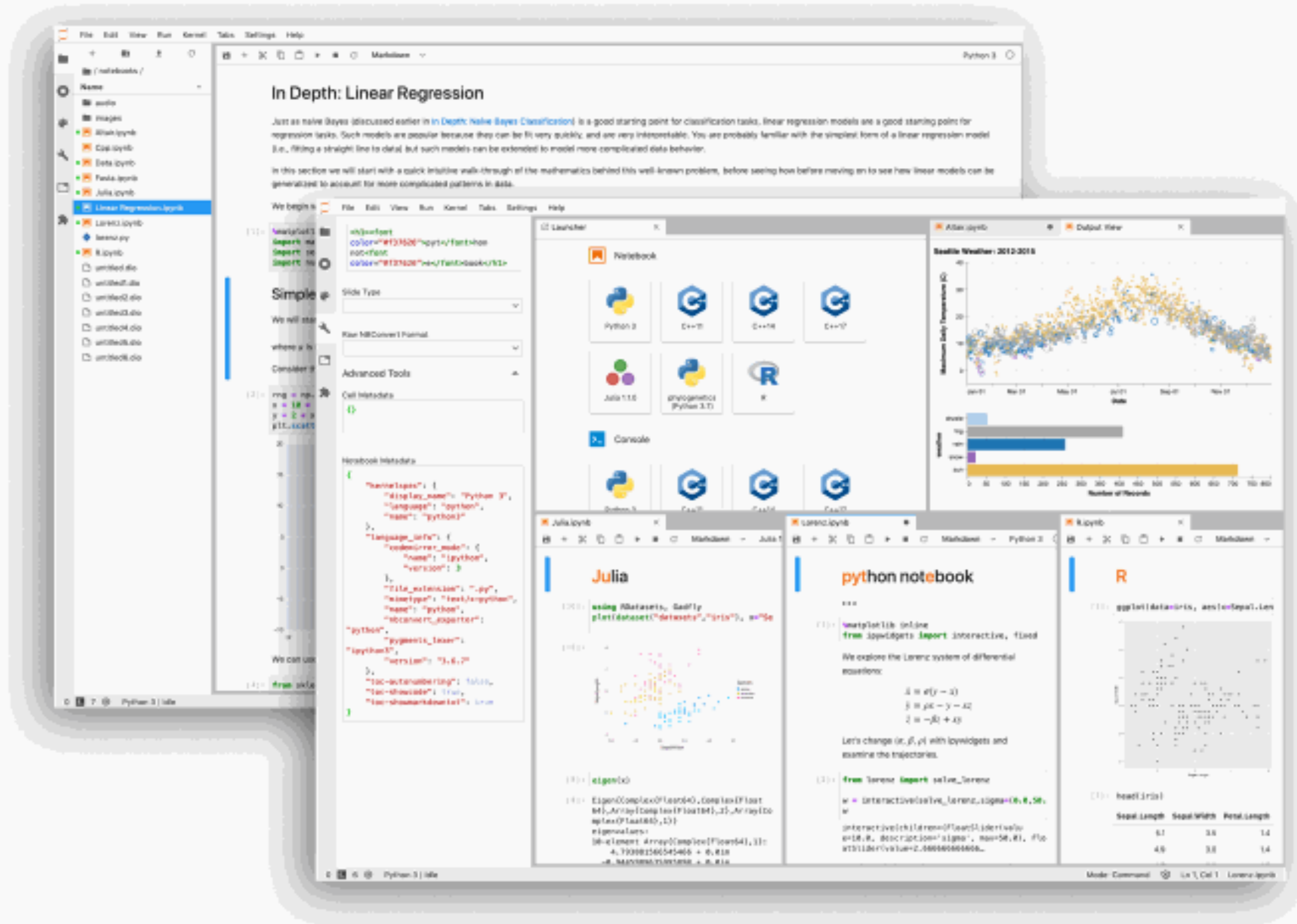
Jupyter receives the ACM Software System Award

It is our pleasure to announce that Project Jupyter has been awarded the 2017 ACM Software System Award, a significant honor for the project. We are humbled to join an illustrious list of projects that contains major highlights of computing history, including Unix, TeX, S (R's predecessor), the Web, Mosaic, Java, INGRES (modern databases) and more.

Officially, the recipients of the award are the fifteen members of the Jupyter steering council as of November 2016, the date of nomination (listed in chronological order of joining the project): Fernando Pérez, Brian Granger, Min Ragan-Kelley, Paul Ivanov, Thomas Kluyver, Jason Grout, Matthias Bussonnier, Damián Avila, Steven Silvester, Jonathan Frederic, Kyle Kelley, Jessica Hamrick, Carol Willing, Sylvain Corlay and Peter Parente.

JupyterLab

The screenshot displays the JupyterLab environment with several open notebooks and a central launcher. The main notebook, 'Linear Regression.ipynb', is open in the background, showing text and code cells. The foreground features a 'Launcher' panel with icons for Python 3, C++11, C++14, C++17, Julia 1.1.0, phylogenetics (Python 3.7), and R. Below the launcher are three smaller notebook windows: 'Julia.ipynb' showing a scatter plot and eigenvalue calculation, 'python notebook' showing the Lorenz attractor equations and a plot, and 'R.ipynb' showing a ggplot of the iris dataset. The interface includes a file browser on the left, a top menu bar, and a status bar at the bottom.

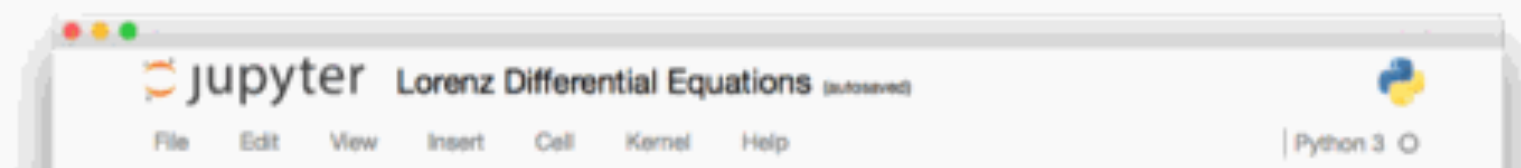


JupyterLab 1.0: Jupyter's Next-Generation Notebook Interface

JupyterLab is a web-based interactive development environment for Jupyter notebooks, code, and data. JupyterLab is flexible: configure and arrange the user interface to support a wide range of workflows in data science, scientific computing, and machine learning. JupyterLab is extensible and modular: write plugins that add new components and integrate with existing ones.

Try it in your browser

Install JupyterLab





yt and jupyter widgets

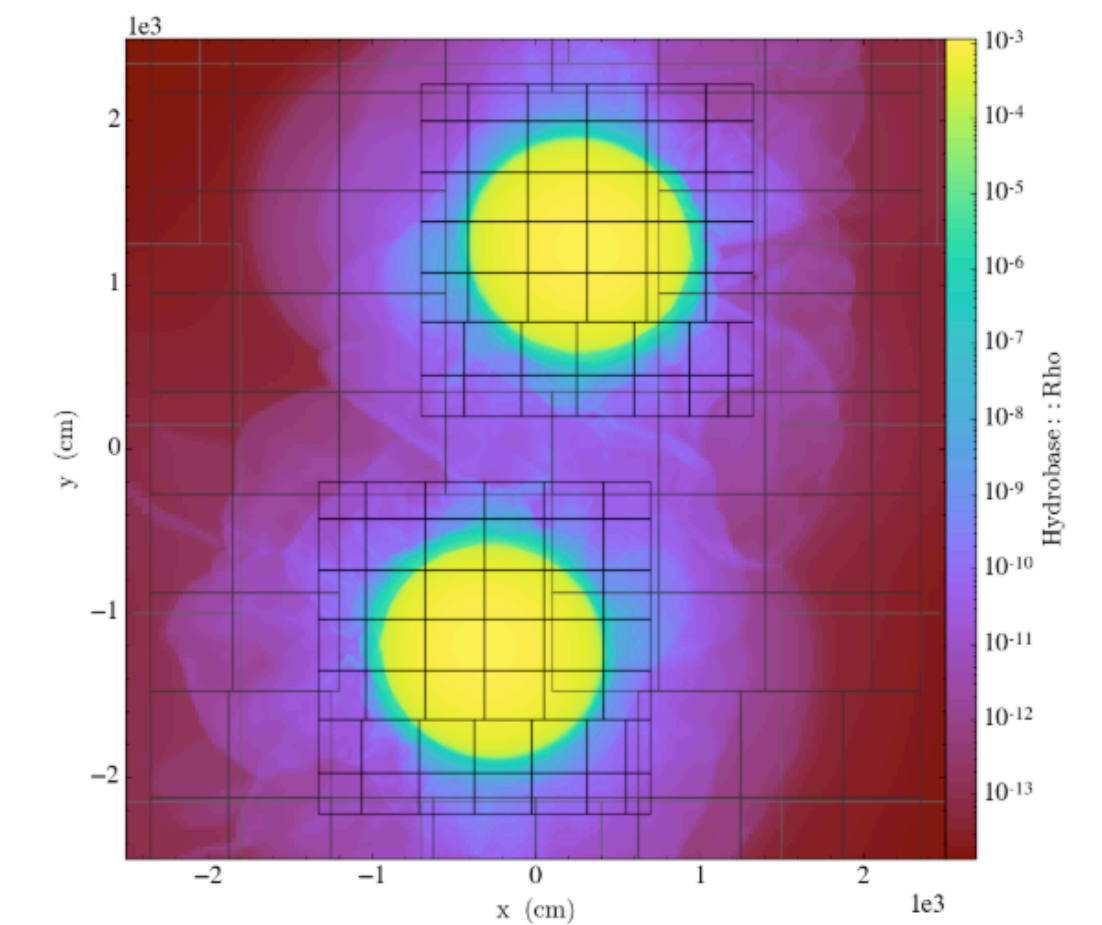
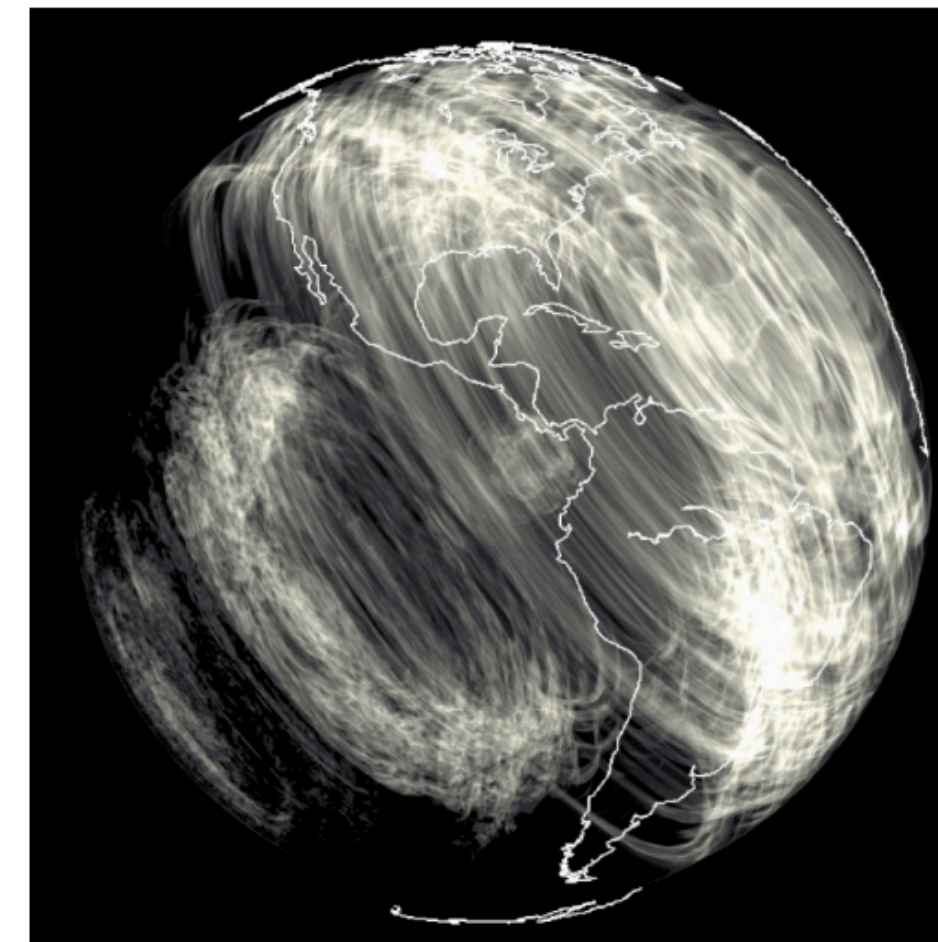
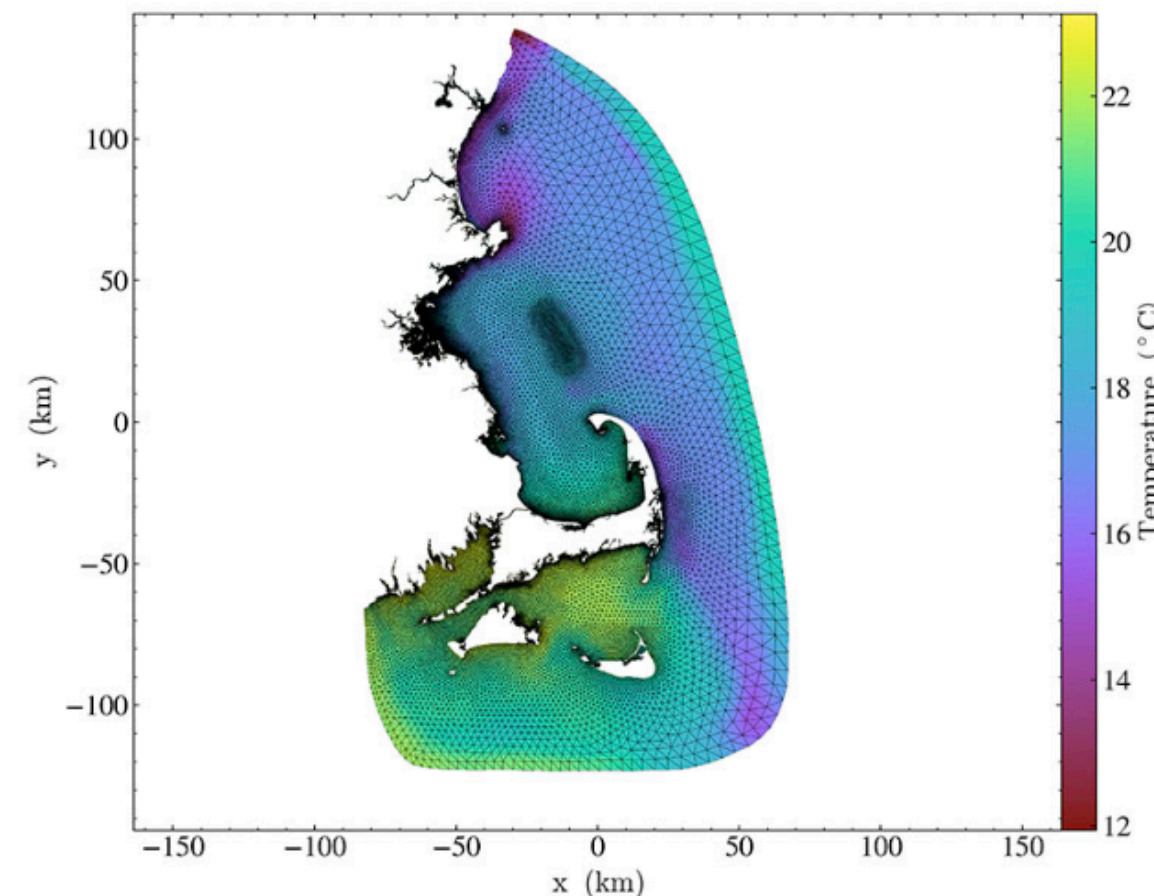
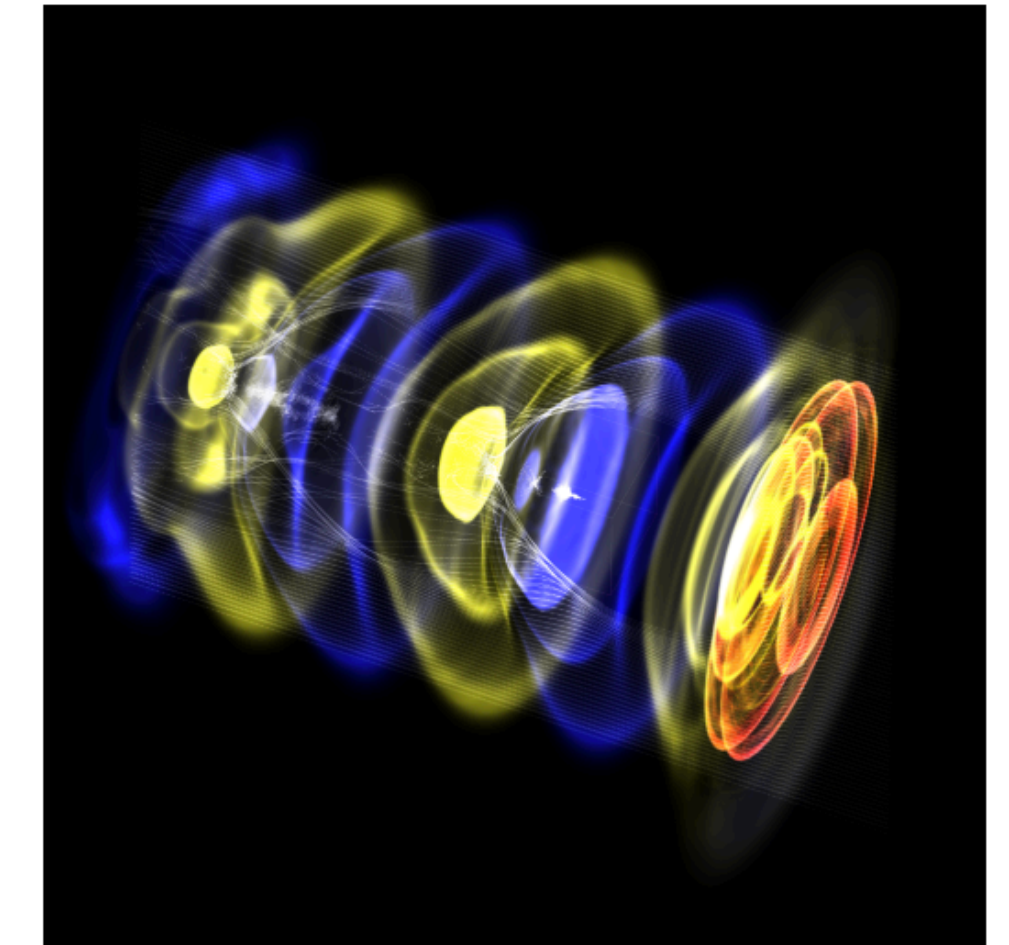
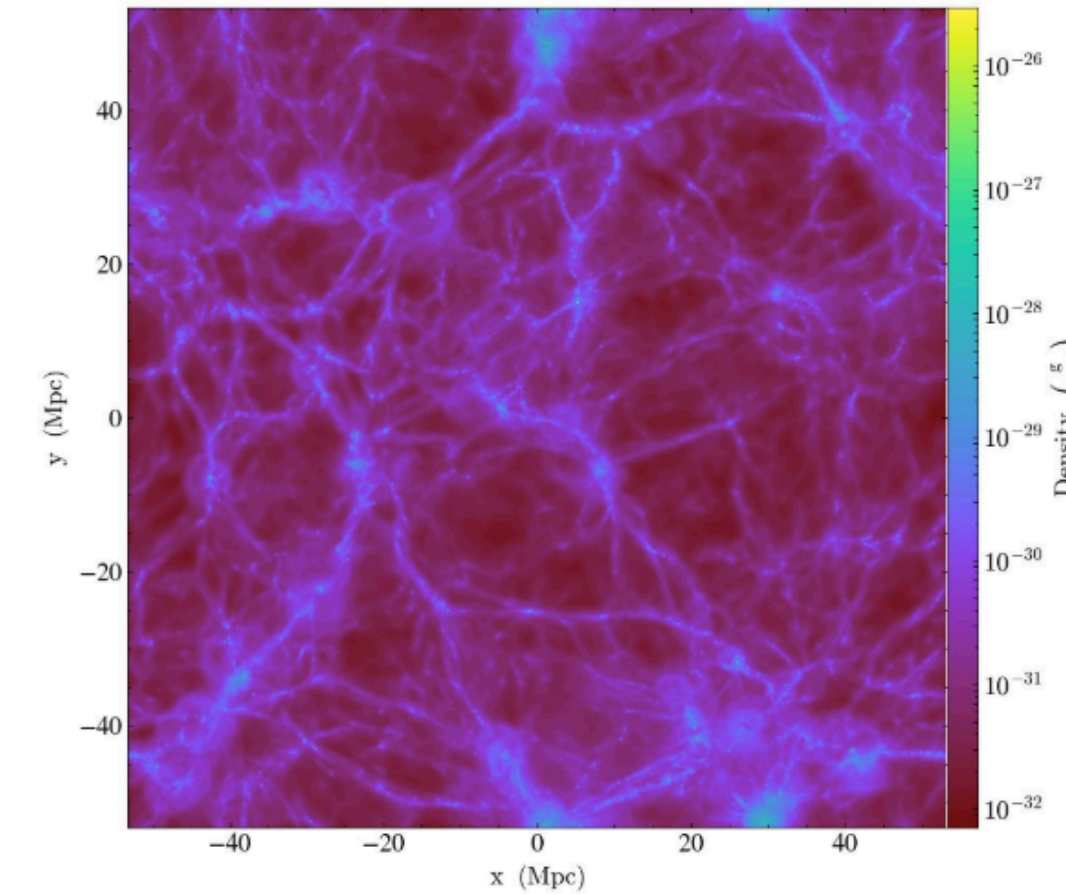
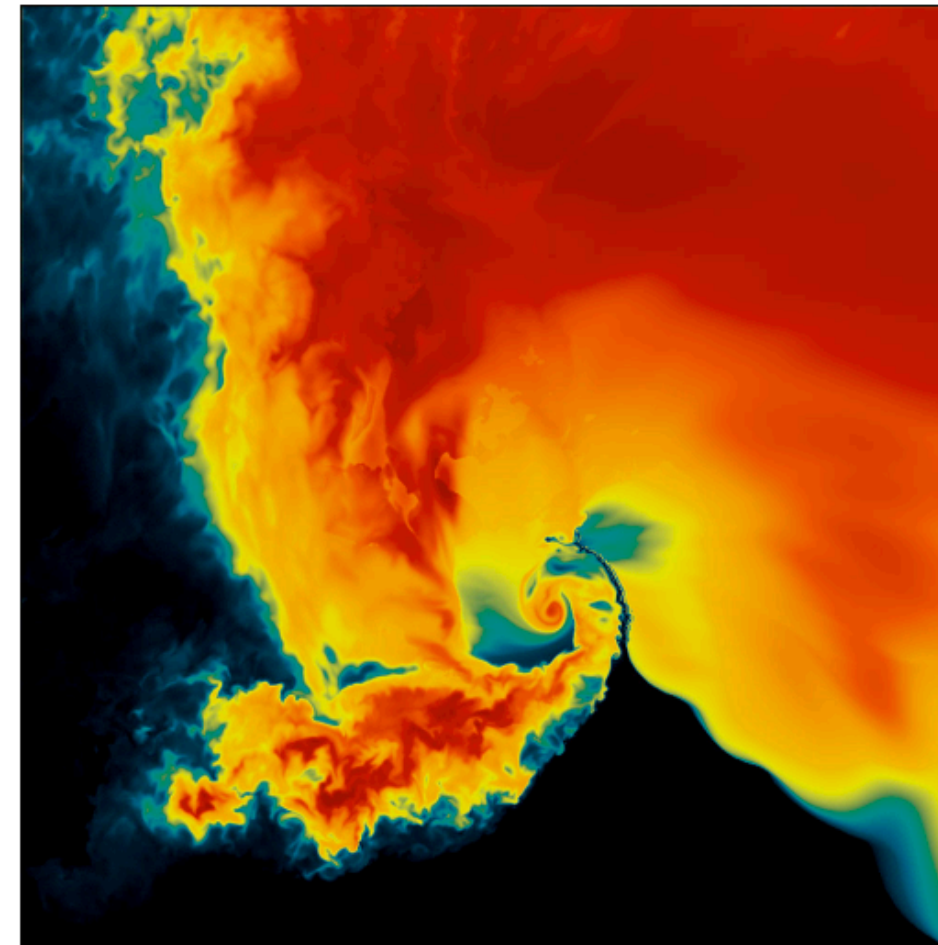
VISUALIZING OUR DATA

<https://github.com/munkm/widgyts>

npm package [@data-exp-lab/yt-tools](https://github.com/data-exp-lab/yt-tools)

<https://github.com/data-exp-lab/rust-yt-tools/>

[Irber Junior LC. Oxidizing Python: writing extensions in Rust \[version 1; not peer reviewed\]. F1000Research 2018, 7\(ISCB Comm J\):955 \(poster\) \(https://doi.org/10.7490/f1000research.1115726.1\)](#)



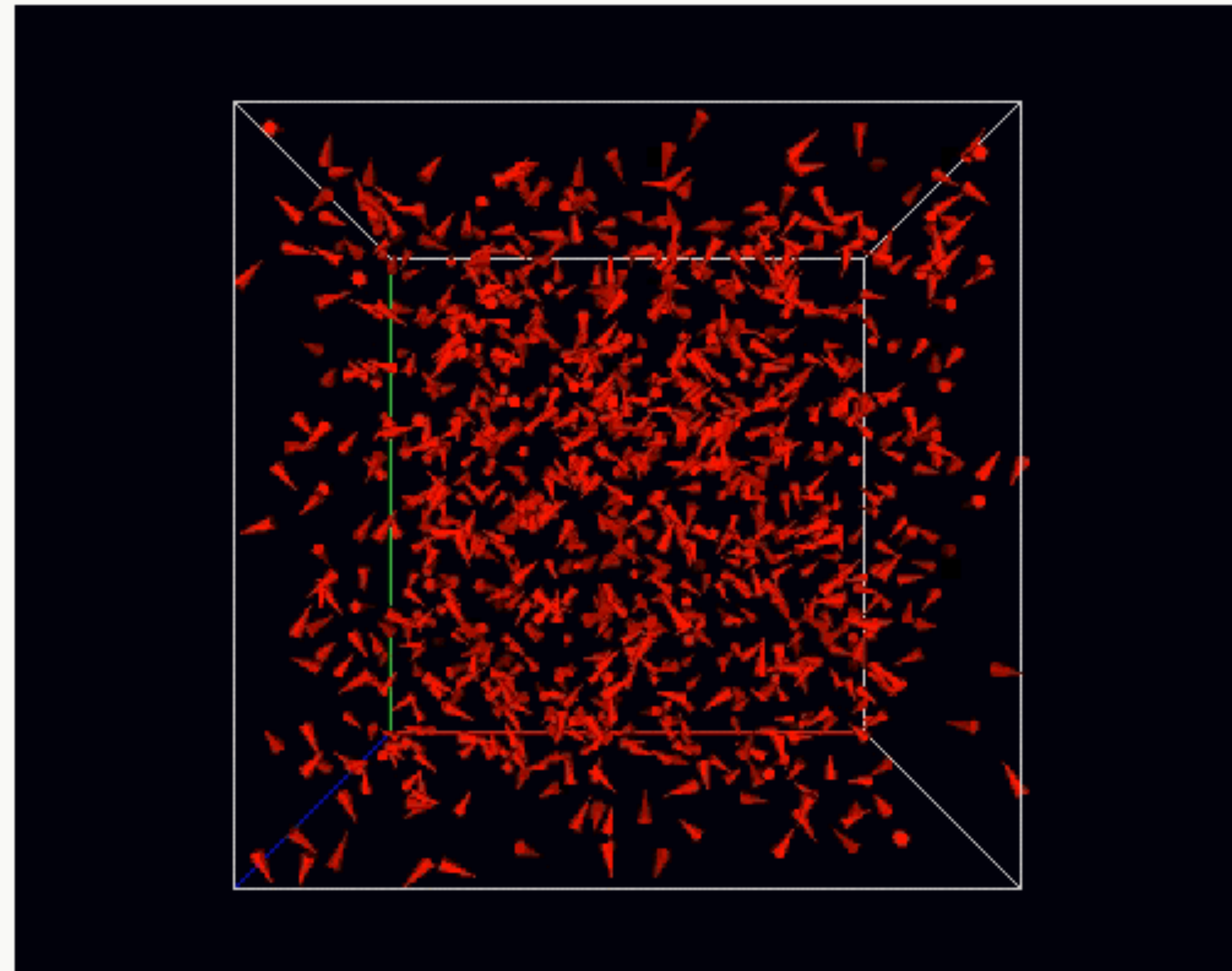
```
hdz = ipyvolume.datasets.hdz2000.fetch()
```

```
p3.clear()
```

```
p3.figure(controls=False)  
p3.volshow(hdz.data.T, level=[0.6, 0.8, 0.9],  
           | opacity=[0.01, 0.03, 0.05], controls=False)  
x, y, z, u, v, w = np.random.random((6, 1000))*2-1  
quiver = p3.quiver(x, y, z, u, v, w, s=0.05, ss=0.1)  
p3.show()
```

ipyvolume

<https://towardsdatascience.com/multivolume-rendering-in-jupyter-with-ipyvolume-cross-language-3d-visualization-64389047634a>



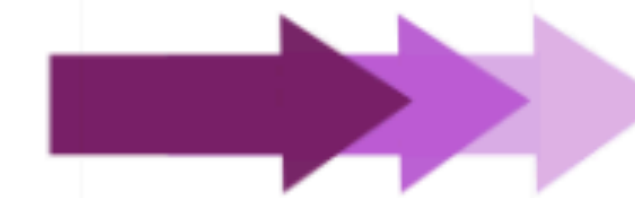
Healthy Best Practices

Simplified Notebook Cycle



Ten Simple Rules for Reproducible Research in Jupyter Notebooks

Adam Rule et al.



Build a pipeline

<https://github.com/jupyter-guide/jupyter-guide>

<https://github.com/jupyter-guide/ten-rules-jupyter>

Keep up with changes

Proceed cautiously
with pseudo-open
projects



Ask why

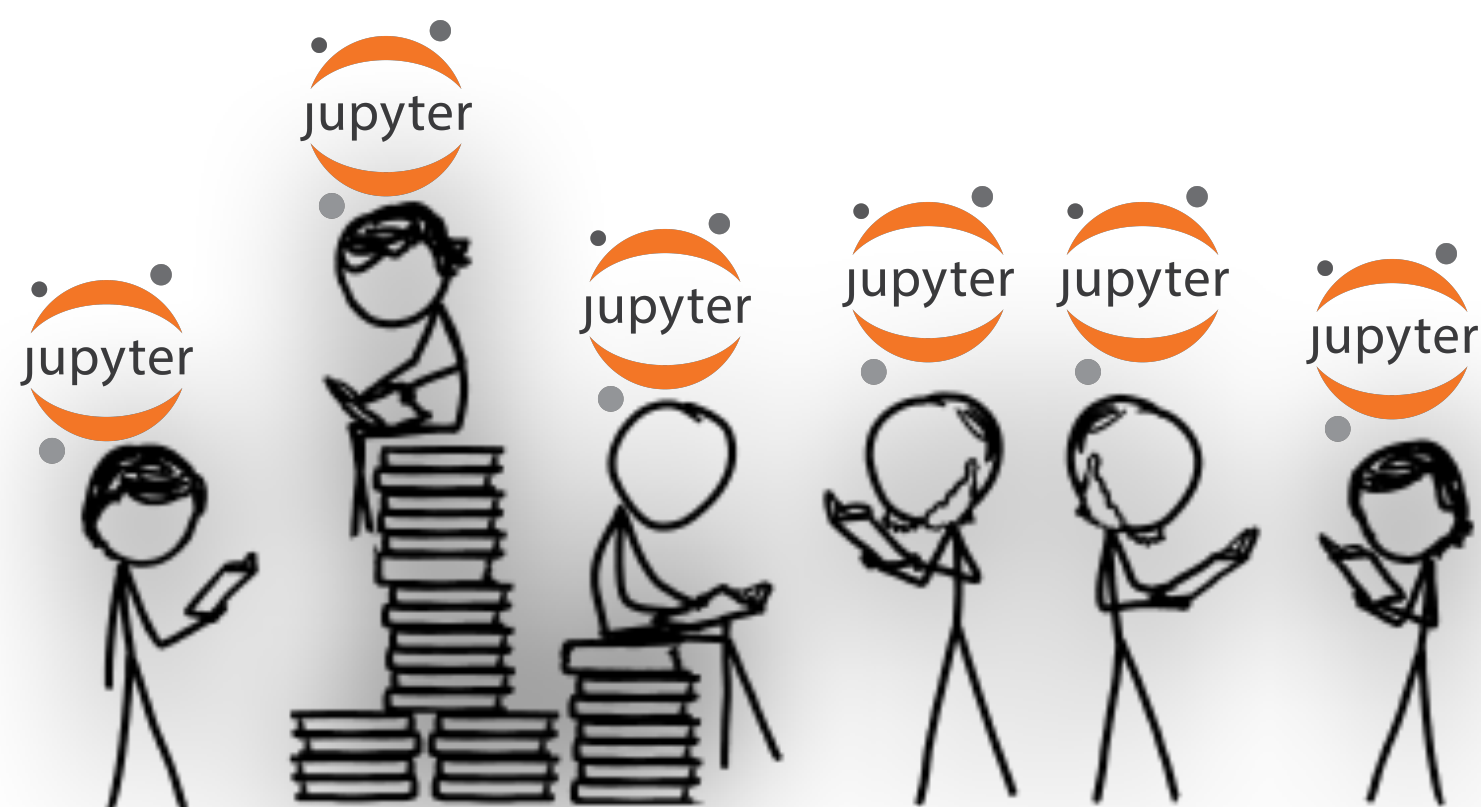
Tools

Processes

Communication

jupyterhub

[Next »](#)



Zero to JupyterHub with Kubernetes

A tutorial to help install and manage JupyterHub with Kubernetes

Quick search

Zero to JupyterHub

JupyterHub is a tool that allows you to quickly utilize cloud computing infrastructure to manage a hub that enables users to interact remotely with a computing environment that you specify. JupyterHub offers a useful way to standardize the computing environment of a group of people (e.g., for a class of students or an analytics team), as well as allowing people to access the hub remotely.

This growing collection of information will help you set up your own JupyterHub instance. It is in an early stage, so the information and tools may change quickly. If you see anything that is incorrect or have any questions, feel free to reach out at the [issues page](#).

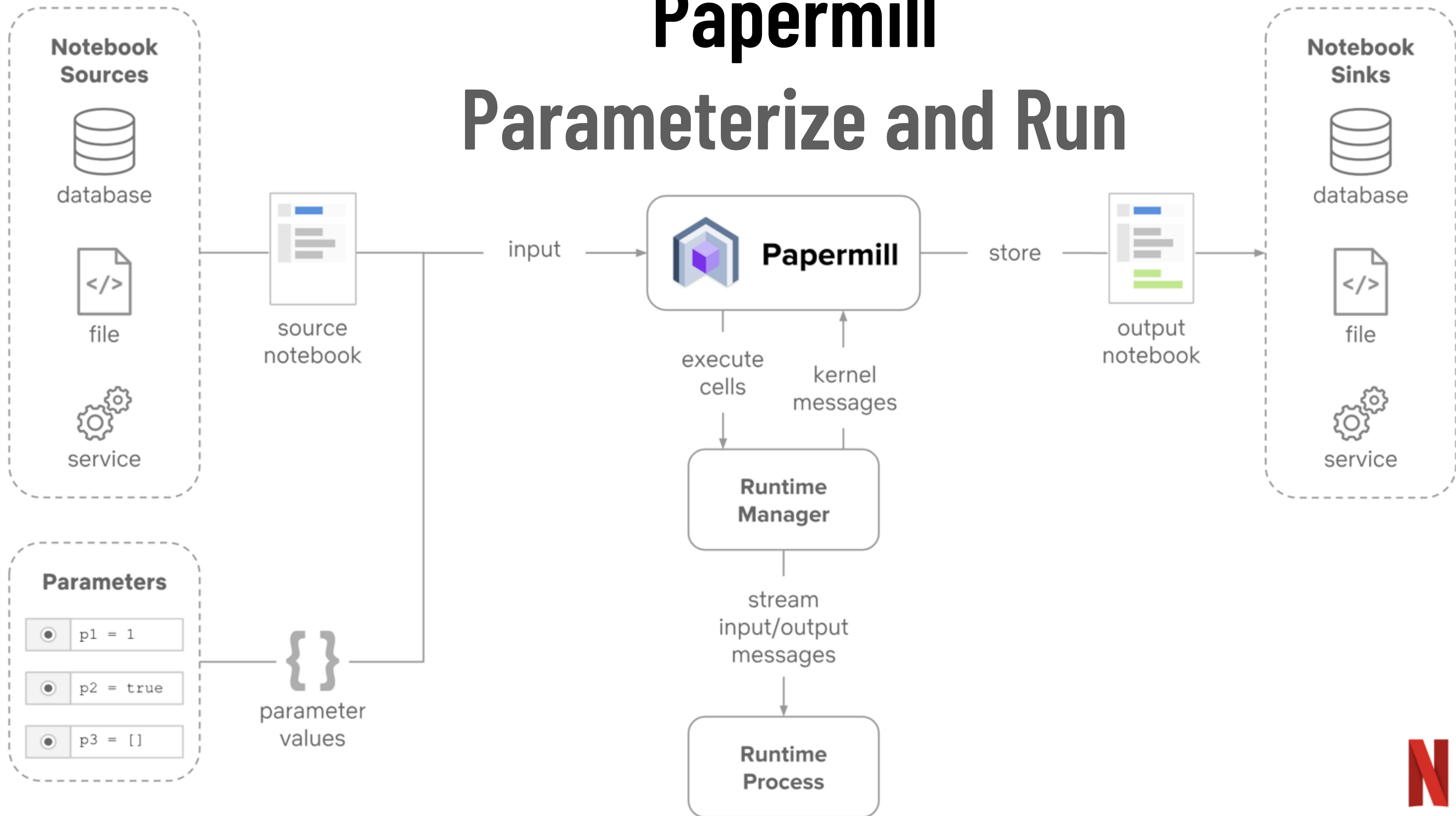
Creating your JupyterHub

This tutorial starts from “step zero” and walks through how to install and configure a complete JupyterHub deployment in the cloud. Using Kubernetes and the JupyterHub Helm chart provides sensible defaults for an initial deployment.

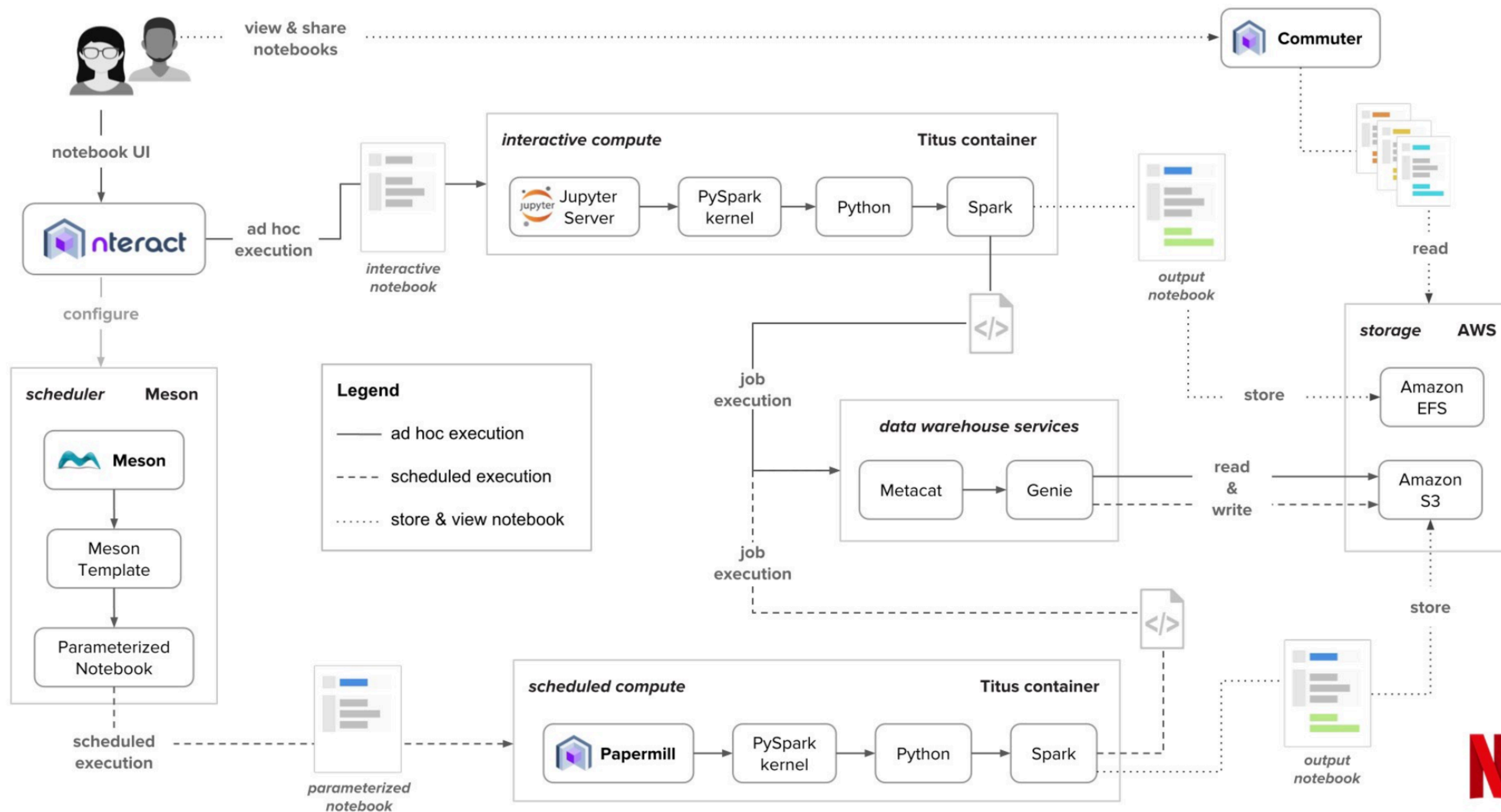
zero-to-jupyterhub.readthedocs.io

Papermill

Parameterize and Run



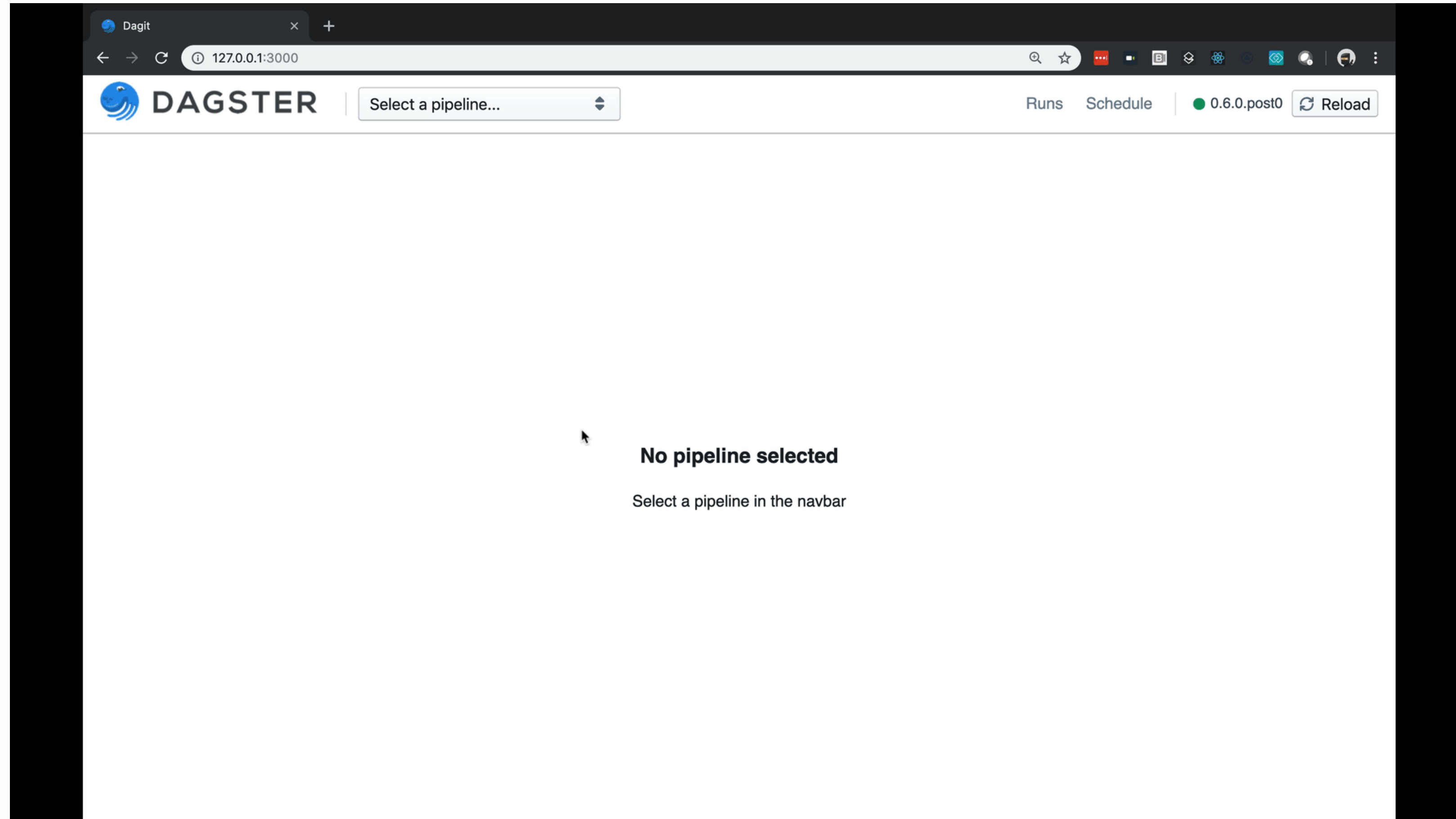
Data at scale - Netflix



Interact
Papermill
Scrapbook
Bookstore
Commuter



Pipelines

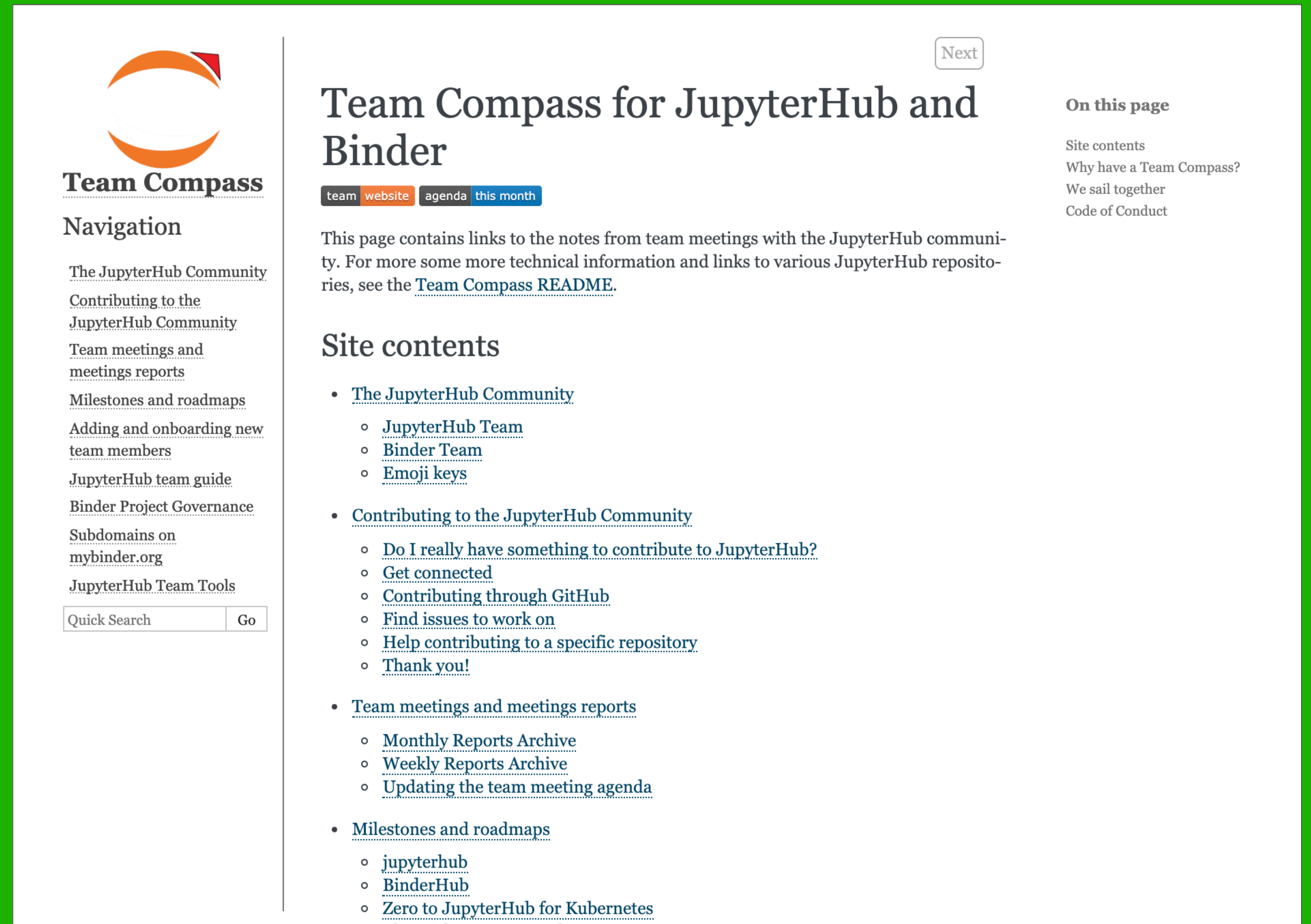


<https://medium.com/dagster-io/dagster-0-6-0-impossible-princess-898b459375e0>

Create a Reproducibility Pipeline

Decouple steps for flexibility

Plan Execute Change



The screenshot shows the 'Team Compass' website. At the top left is the logo, a stylized orange and white circle. Below it is the title 'Team Compass' and a navigation menu with links: 'The JupyterHub Community', 'Contributing to the JupyterHub Community', 'Team meetings and meetings reports', 'Milestones and roadmaps', 'Adding and onboarding new team members', 'JupyterHub team guide', 'Binder Project Governance', 'Subdomains on mybinder.org', and 'JupyterHub Team Tools'. There is also a search bar with 'Quick Search' and 'Go' buttons. On the right side, there is a 'Next' button and a 'Site contents' section with a list of links: 'The JupyterHub Community', 'Contributing to the JupyterHub Community', 'Team meetings and meetings reports', and 'Milestones and roadmaps'. Each of these has sub-links. For example, 'Contributing to the JupyterHub Community' has sub-links like 'Do I really have something to contribute to JupyterHub?', 'Get connected', 'Contributing through GitHub', 'Find issues to work on', 'Help contributing to a specific repository', and 'Thank you!'. The main content area has a heading 'Team Compass for JupyterHub and Binder' and a paragraph: 'This page contains links to the notes from team meetings with the JupyterHub community. For more some more technical information and links to various JupyterHub repositories, see the [Team Compass README](#).' At the bottom right, there is a 'On this page' section with links: 'Site contents', 'Why have a Team Compass?', 'We sail together', and 'Code of Conduct'.

<https://jupyterhub-team-compass.readthedocs.io>

<https://github.com/jupyterhub/team-compass>

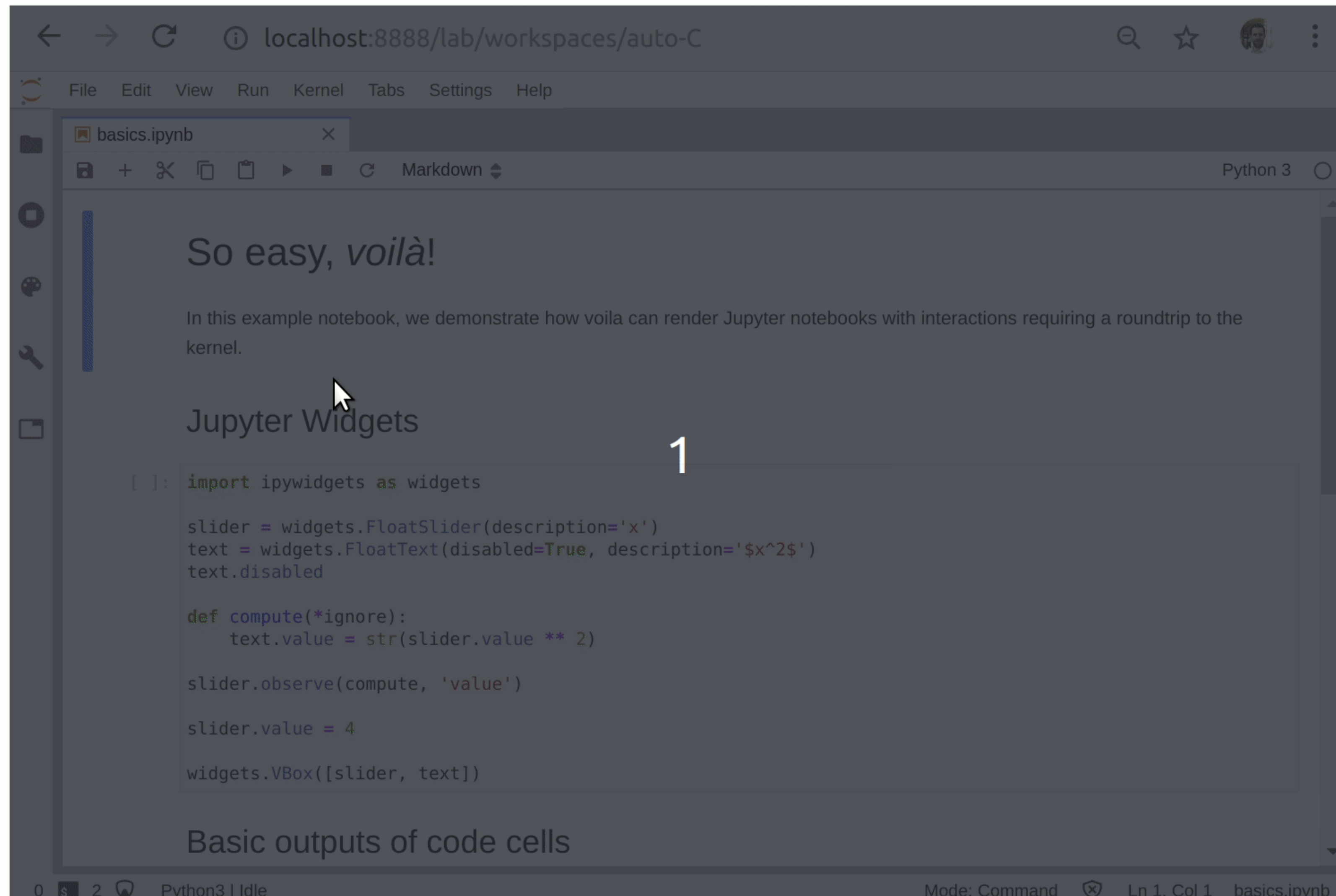
Tools

Processes

Communication

Notebooks to web

voilà



The screenshot shows a JupyterLab notebook titled 'basics.ipynb' running on 'localhost:8888/lab/workspaces/auto-C'. The notebook content includes:

- A heading: *So easy, voilà!*
- Text: "In this example notebook, we demonstrate how *voilà* can render Jupyter notebooks with interactions requiring a roundtrip to the kernel."
- A heading: Jupyter Widgets
- A code cell (labeled '1') containing the following Python code:

```
[ ]: import ipywidgets as widgets

slider = widgets.FloatSlider(description='x')
text = widgets.FloatText(disabled=True, description='$x^2$')
text.disabled

def compute(*ignore):
    text.value = str(slider.value ** 2)

slider.observe(compute, 'value')

slider.value = 4

widgets.VBox([slider, text])
```
- A heading: Basic outputs of code cells

The status bar at the bottom indicates 'Mode: Command', 'Ln 1, Col 1', and 'basics.ipynb'.

<https://blog.jupyter.org/and-voil%C3%A0-f6a2c08a4a93>

Binder

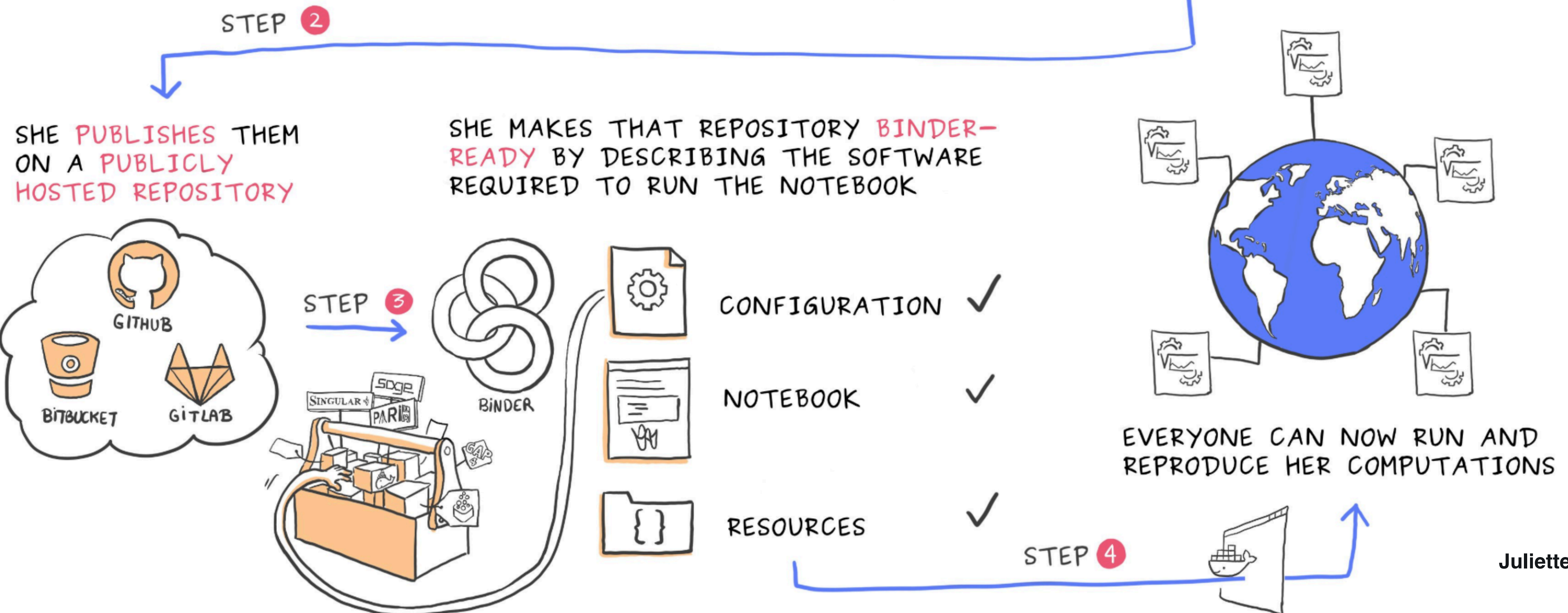
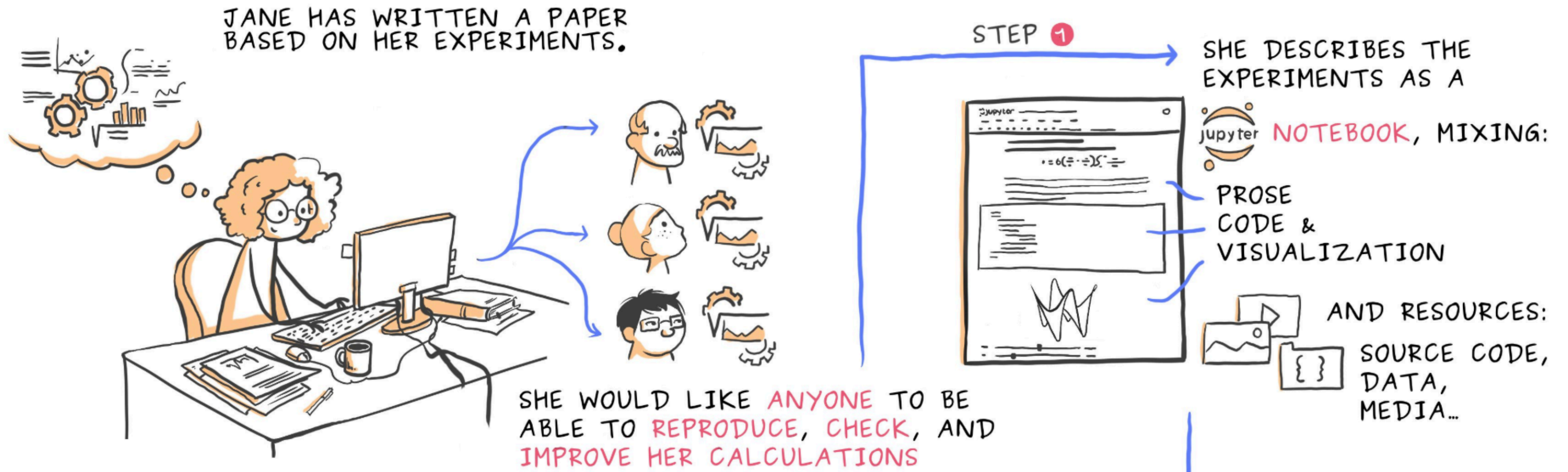
mybinder.org

[Binder 2.0 blog post](#)

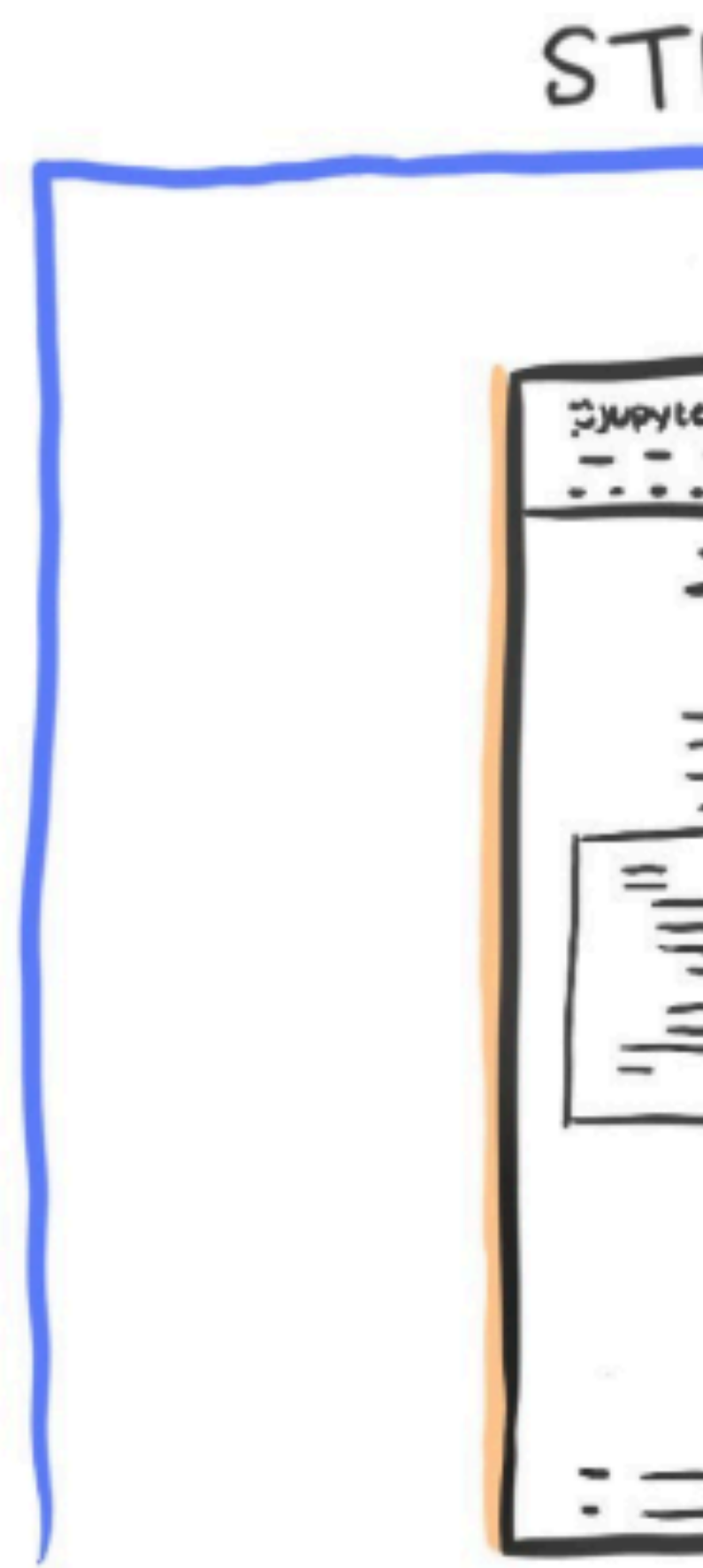
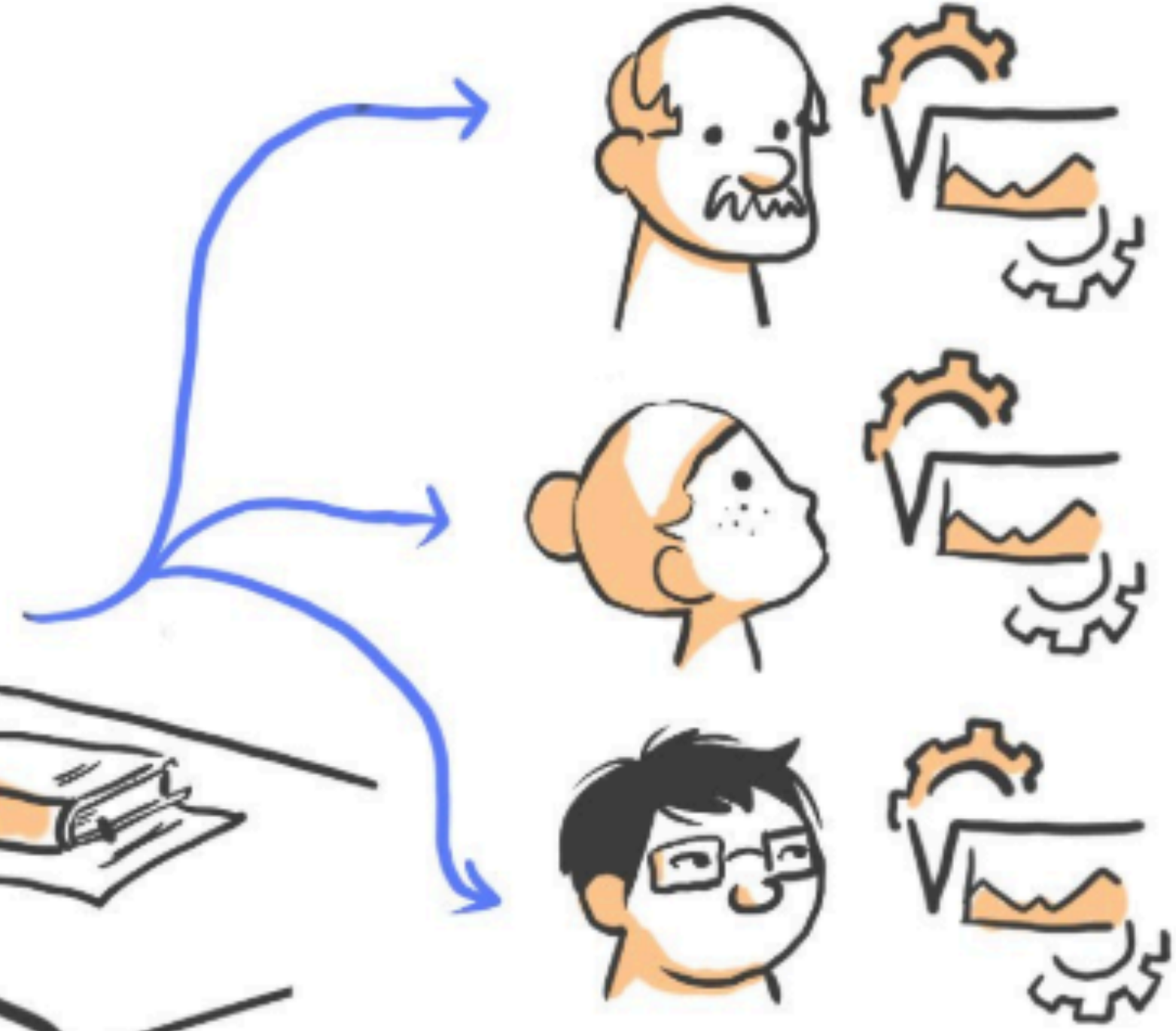
[elifesciences: Share your interactive research environment](#)

[Nature article about Binder](#)

The screenshot shows the mybinder.org website. At the top, the browser address bar displays "mybinder.org". Below the address bar, a message reads "Thanks to Google Cloud and OVH for sponsoring our computers 🙌!". The main heading is the "binder" logo, which consists of three interlocking circles in orange, blue, and red. Below the logo, the text says "Turn a Git repo into a collection of interactive notebooks". A sub-heading explains: "Have a repository full of Jupyter notebooks? With Binder, open those notebooks in an executable environment, making your code immediately reproducible by anyone, anywhere." The central part of the page is a form titled "Build and launch a repository". It includes a "GitHub repository name or URL" field with a "GitHub" dropdown, a "Git branch, tag, or commit" field, a "Path to a notebook file (optional)" field with a "File" dropdown, and a prominent orange "launch" button. Below the form, there is a section for sharing: "Copy the URL below and share your Binder with others:" followed by a text box containing "Fill in the fields to see a URL for sharing your Binder." and a clipboard icon. At the bottom of this section, it says "Copy the text below, then paste into your README to show a binder badge:" followed by a badge that says "launch binder" and a right-pointing arrow.



JANE HAS WRITTEN A PAPER
BASED ON HER EXPERIMENTS.



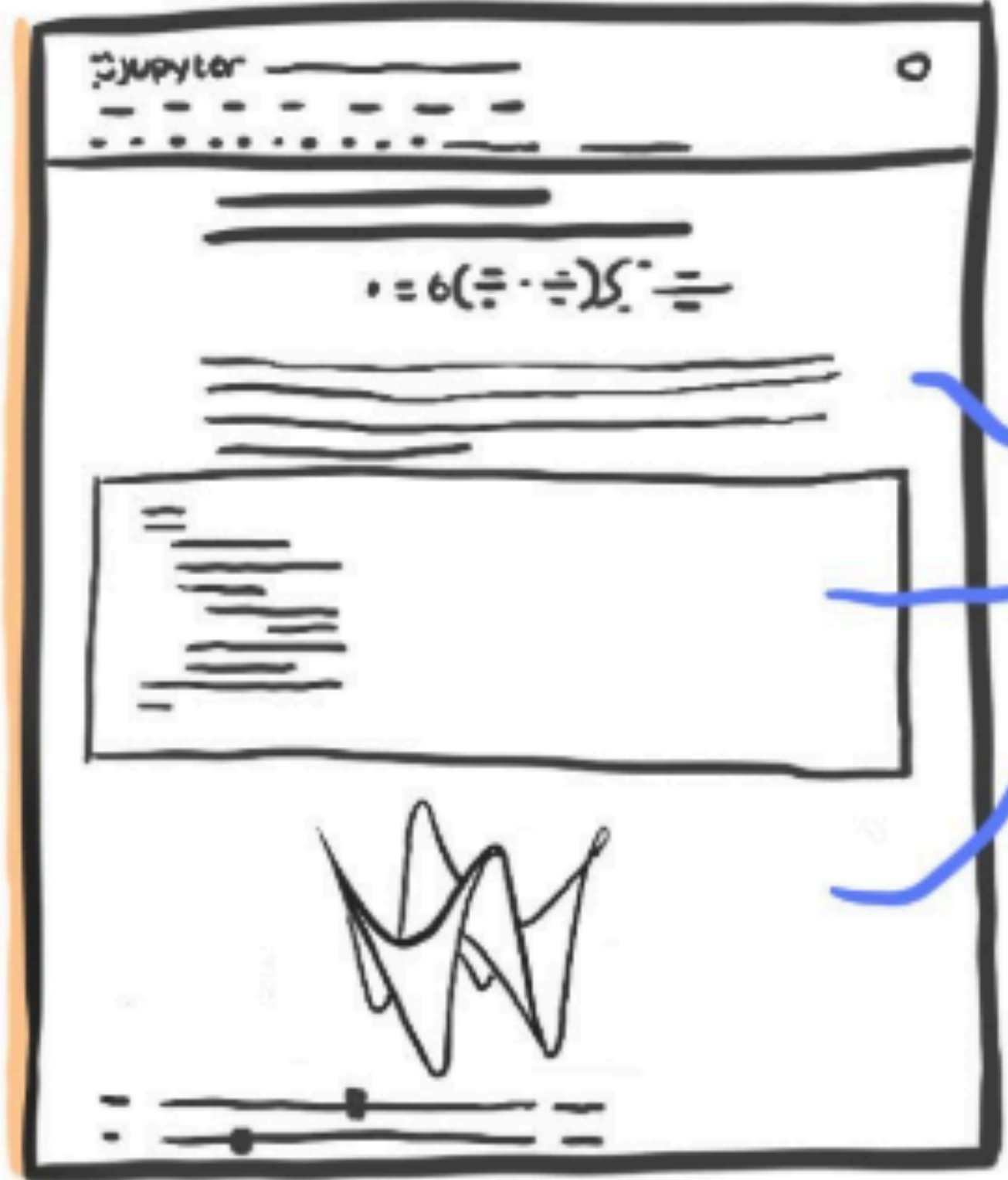
SHE WOULD LIKE ANYONE TO BE
ABLE TO REPRODUCE, CHECK, AND
IMPROVE HER CALCULATIONS

STEP 1

SHE DESCRIBES THE EXPERIMENTS AS A

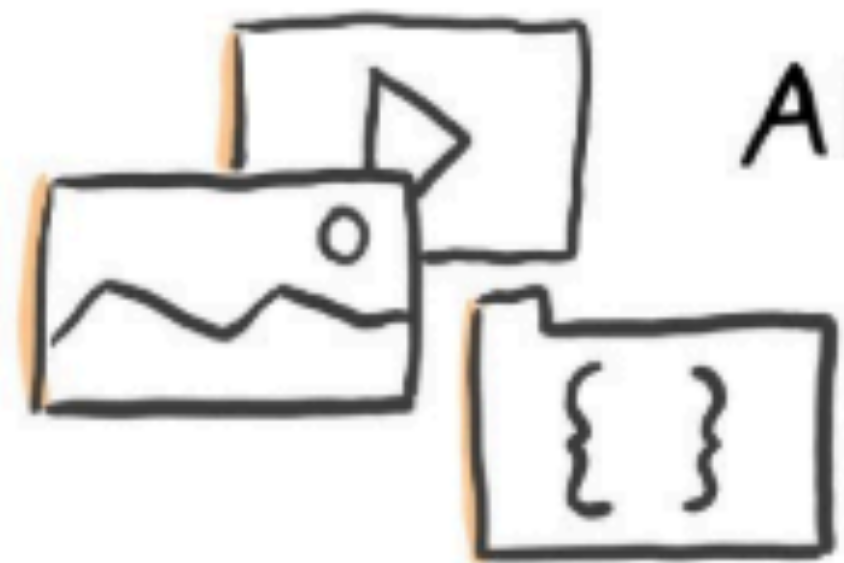


NOTEBOOK, MIXING:



PROSE
CODE &
VISUALIZATION

AND RESOURCES:



SOURCE CODE,
DATA,
MEDIA...

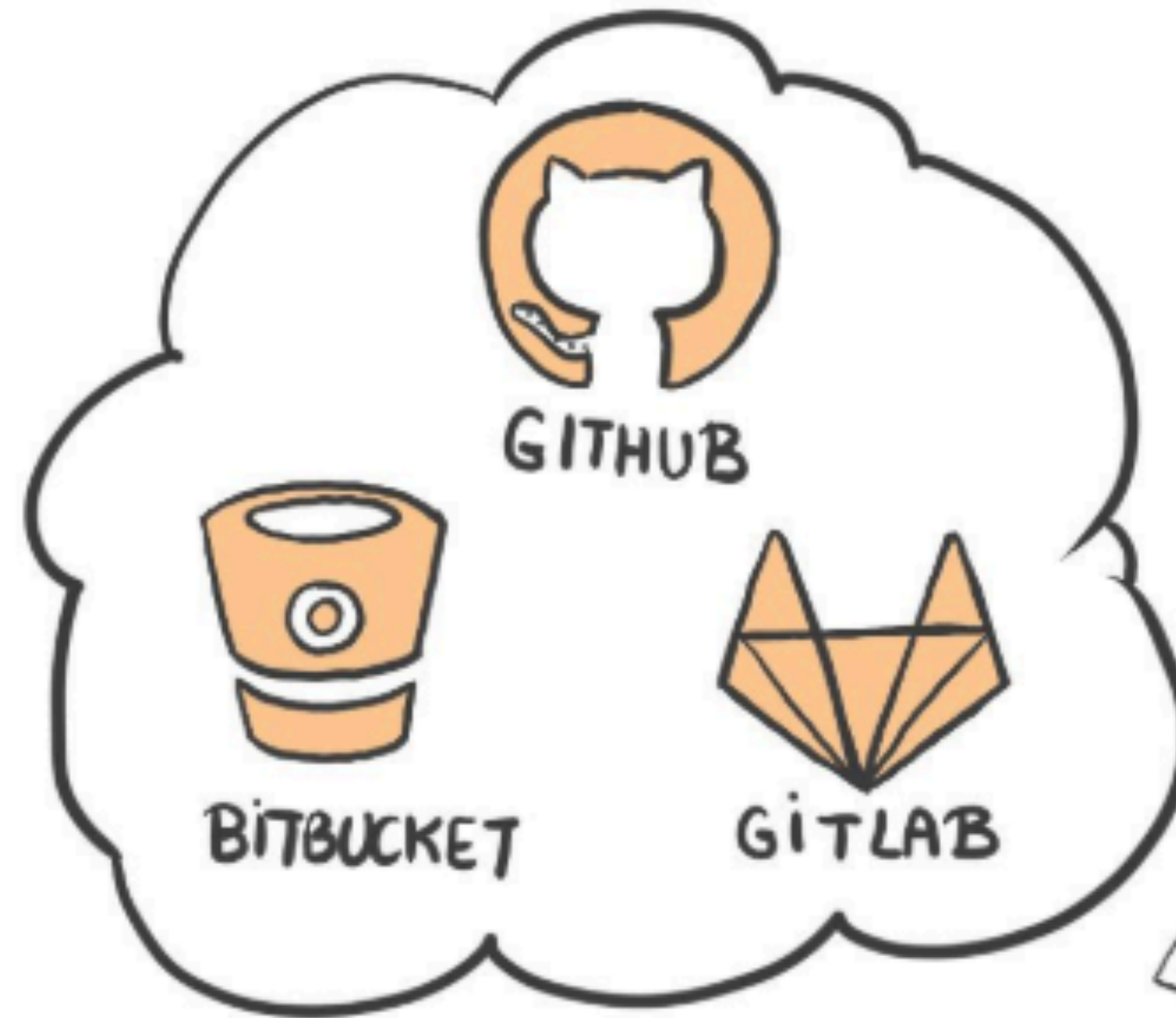
ANYONE TO BE
CHECK, AND

STEP 2

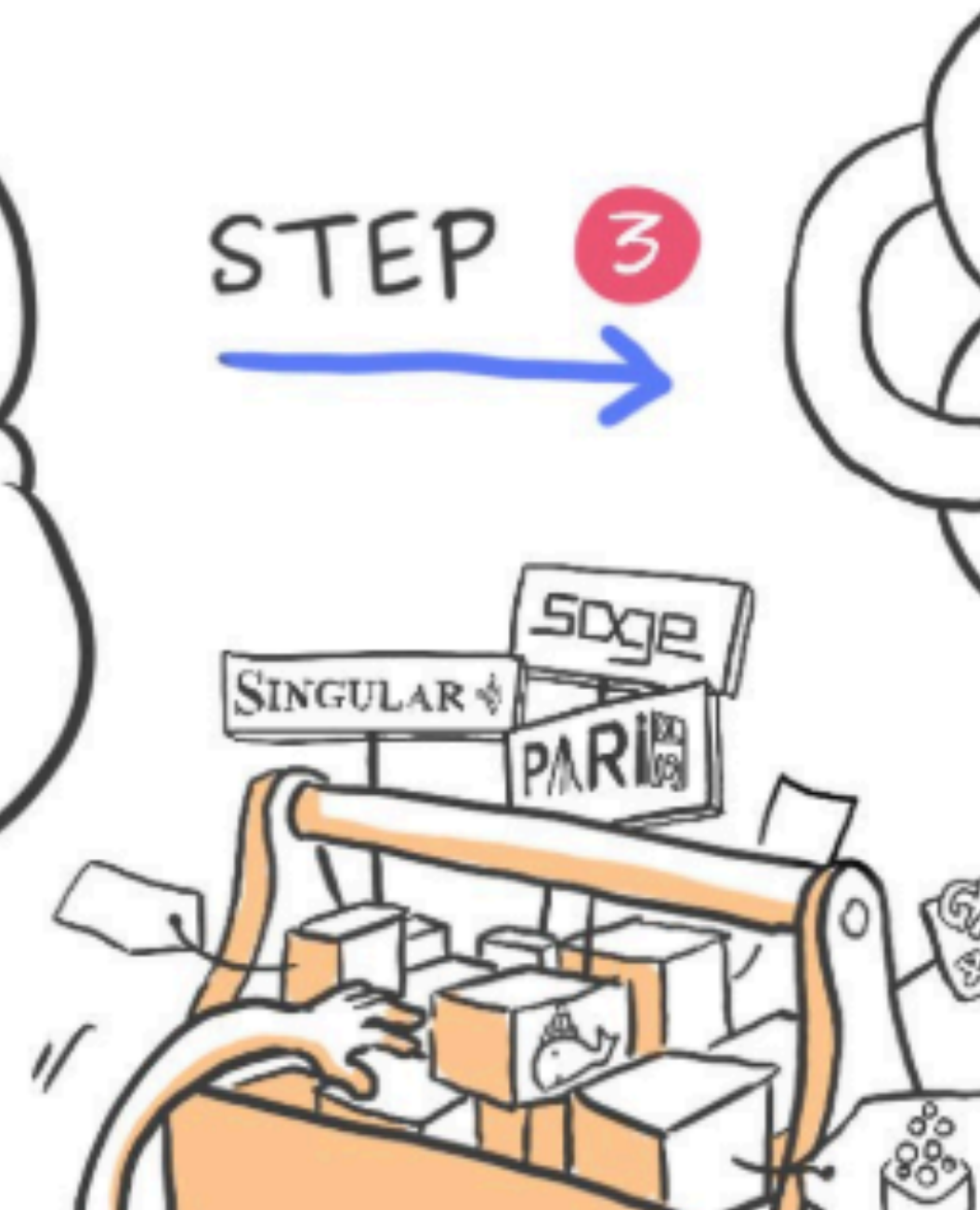


SHE PUBLISHES THEM
ON A PUBLICLY
HOSTED REPOSITORY

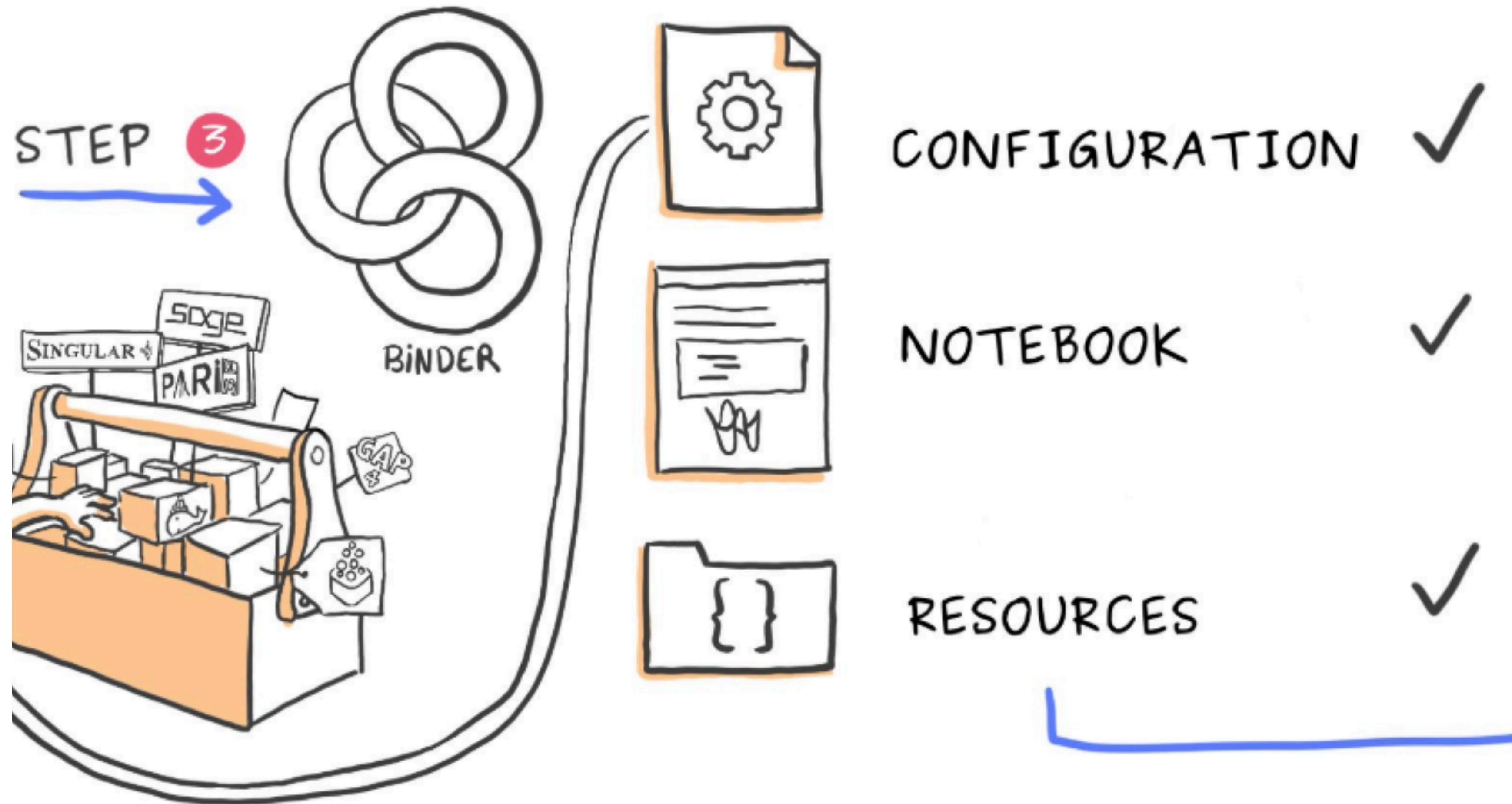
SH
RE
RE

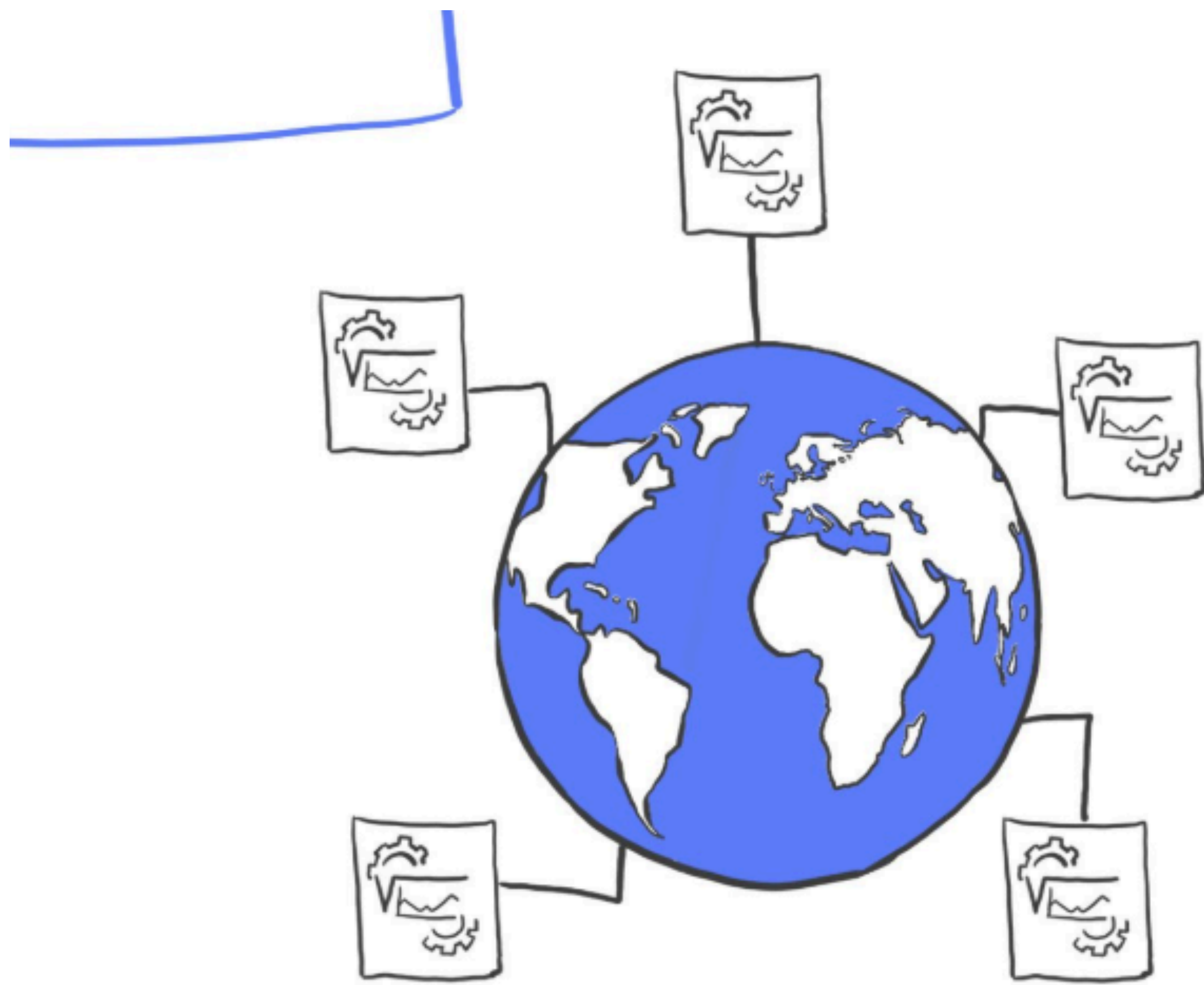


STEP 3

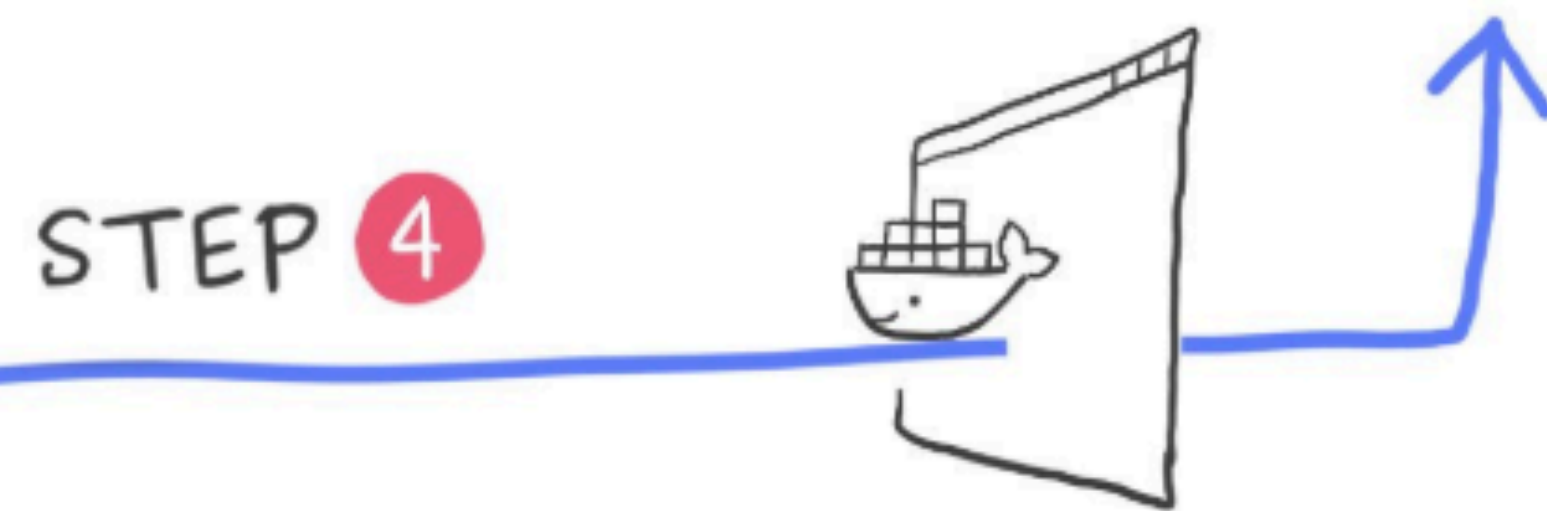


SHE MAKES THAT REPOSITORY **BINDER-READY** BY DESCRIBING THE SOFTWARE REQUIRED TO RUN THE NOTEBOOK





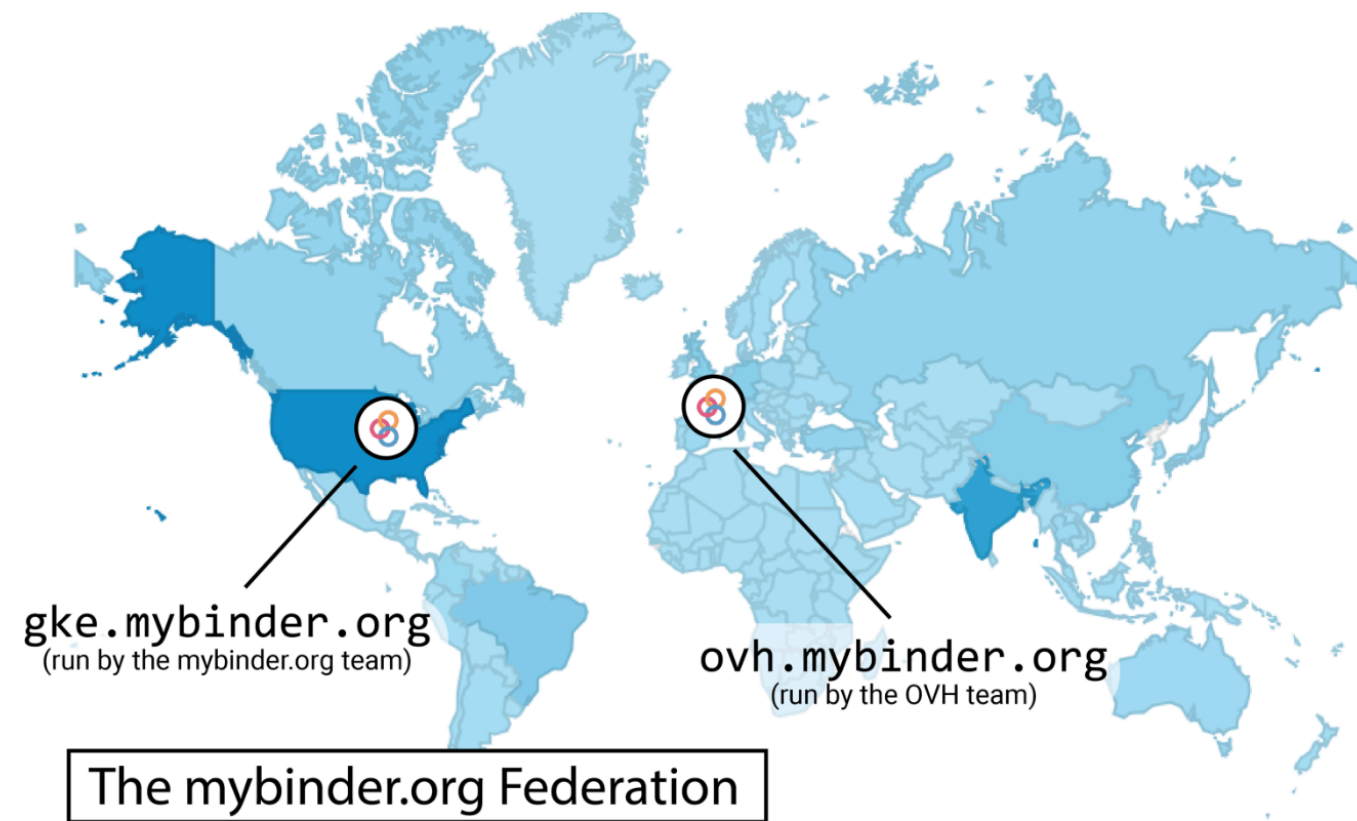
EVERYONE CAN NOW RUN AND
REPRODUCE HER COMPUTATIONS
















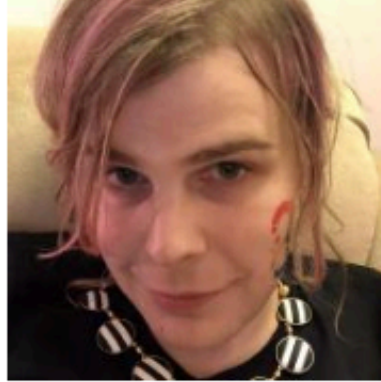
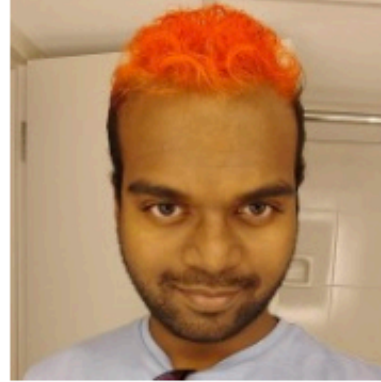














Binder



Zenodo DOIs now work with BinderHub



 Jessica Forde UC Berkeley team red 	 Sarah Gibson The Alan Turing Institute team blue  ,  , 	 Tim Head Wild Tree Tech team red	 Lindsey Heagy UC Berkeley team blue  , 
 Chris Holdgraf Berkeley Institute for Data Science team red  ,  ,  , 	 M Pacer Netflix team blue	 Yuvi Panda UC Berkeley team blue  , 	 Min Ragan-Kelley Simula team lead data, 
 Zach Sailer Project Jupyter team blue  ,  , 	 Erik Sundell Sandvik CODE team blue  , 	 Carol Willing Project Jupyter team red Python, Community	

Binder

mybinder.org

README.md

BrainViz

build unknown launch binder

This project was created as part of [Neurohackademy 2019](#).

Contributors: [Anna Jafarpour](#), [Matan Mazor](#), [Liberty Hamilton](#). Thanks also to [Noah Benson](#), developer of [neuropythy](#).

Description of project: With BrainViz we can visualize neural activity in selected ECOG contacts.

How to get involved: Please get in touch with one of the contributors.

This is a tool to create an interactive 3D brain in your browser. You can select points (or electrodes) on the brain to look at activity from those points. A dropdown menu will allow you to select the stimulus for which you are plotting a response.

input

Example Brain image is from https://zenodo.org/record/996814#.XU29UZNKi_s for 3D visualization. ECOG data is synthetic for demonstration, that is from a hf5 format file containing: `data['ecog/condition1'] = numpy array of dim [elecs x time]` `data['ecog/condition2'] = numpy array of dim [elecs x time]` `data['times'] = vector of times`

interactive visualization

The electrodes of interest can be selected by mouse or dropdown menu. There is also a dropdown menu to select conditions.

output

3D brain with electrodes overlay. The color of selected electrodes changes.

↳ Binder Team Retweeted

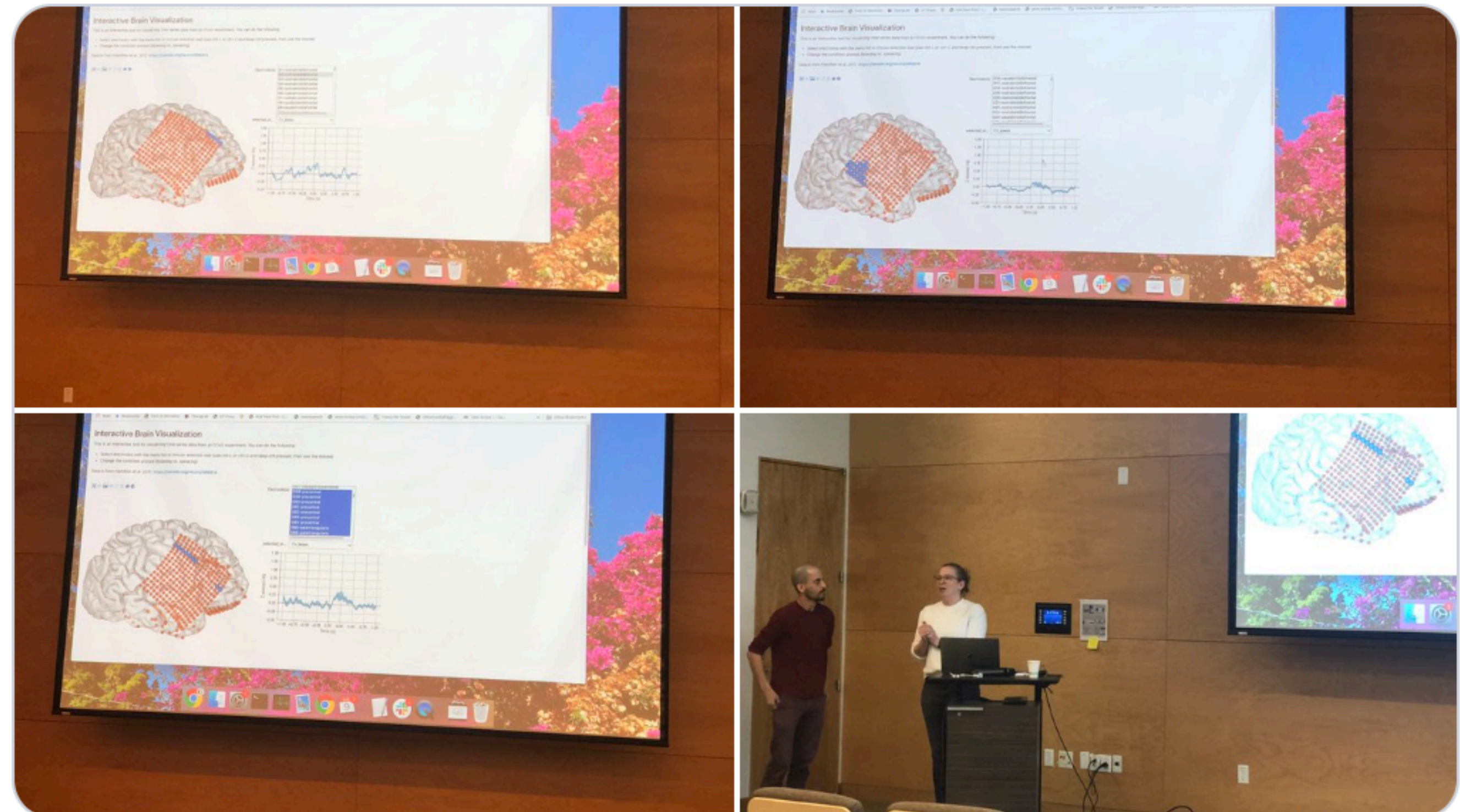


Kirstie Whitaker @kirstie_j · Aug 10

The first [#NeuroHack19](#) project team built an awesome brain visualisation too! It's so BEAUTIFUL 🥰🥰🥰

Check it out for yourself via [@mybinderteam](#) at mybinder.org/v2/gh/matanmazor/Bra...

Code at: github.com/matanmazor/Bra...



Binder Team Retweeted

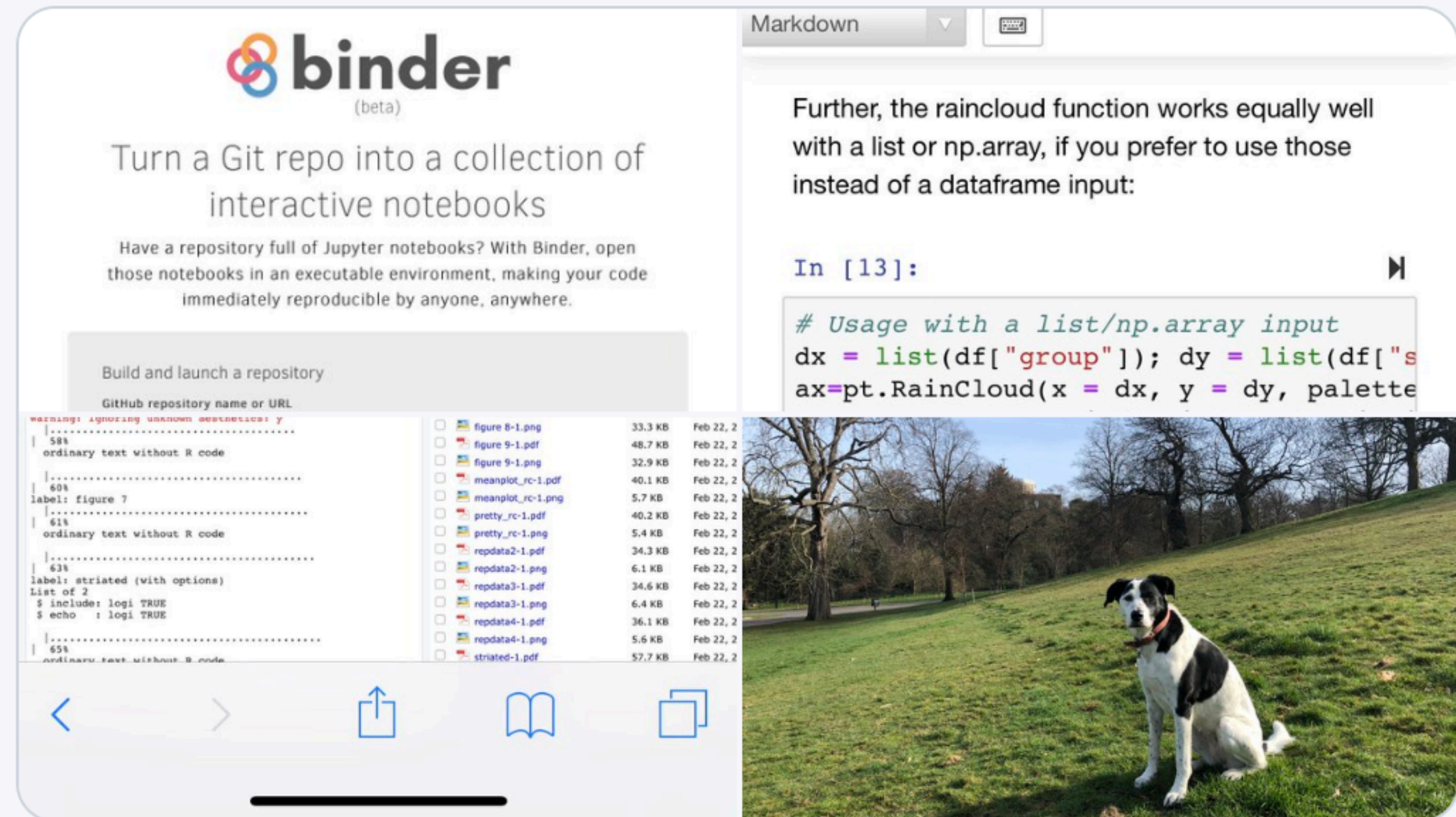


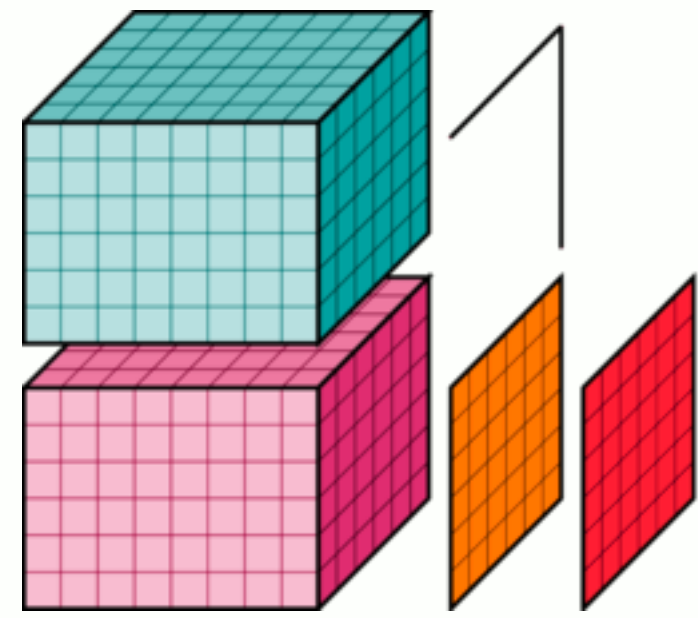
Kirstie Whitaker @kirstie_j · Feb 22

WHAT A GREAT FRIDAY! #RainCloudPlots in a @turinginst hosted @mybinderteam instance!! FROM MY PHONE in the park! 🙌🤖🚀🌟❤️🥳😄🌟 Way to go Sarah!

#TuringWay #BinderHub #ComeToOurWorkshops: eventbrite.co.uk/o/the-turing-w... 😊😄🙌

From a phone in the park!





xarray



Pangeo



Iris

<https://pangeo.io>





Jupyter meets the Earth: we got an NSF grant!



Research use-cases

- CMIP6 Climate data analysis
- Large scale hydrological modelling
- Geophysical simulations and inversions



Tech developments

- Data discovery through JupyterLab
- Interactivity: Widgets & Dashboards
- JupyterHub: Using and managing shared computational infrastructure



Fernando
Perez



Joe
Hamman



Laurel
Larsen



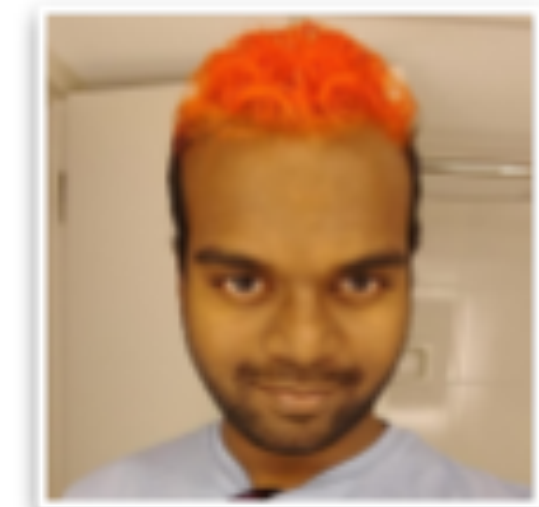
Kevin Paul



Lindsey
Heagy



Chris
Holdgraf



Yuvi
Panda

Canadian Open Neuroscience Platform



Signature of Alzheimer disease

[Home](#)

Simulating signature of Alzheimer

Powered by [Jupyter Book](#)

← TOGGLE SIDEBAR

Signature of Alzheimer disease

This work includes packages, scripts, and notebooks for the following article [A signature of cognitive deficits and brain atrophy that is highly predictive of progression to Alzheimer's dementia](#).

Here is a brief description of each item in the repository:

- **Proteus** - a Python package by [Christian Dansereau](#). Proteus was built on [scikit-learn](#) and it offers machine learning tools to make highly confident predictions
- **vcog_hpc_prediction_simulated_data.ipynb** - a Jupyter notebook containing analyses that give a highly predictive signature (HPS) of Alzheimer's disease dementia from cognitive and structural features using *simulated data*
- **simulation_script.py** - a Python script that generates simulated data from raw data
- **simulated_data.csv** - a comma separated value file that contains simulated data
- **spm_container** - an Octave package containing wrappers for [SPM12](#) functions for segmentation and DARTEL

It is rendered here using [Jupyter Book](#), with compute infrastructure provided by the [Canadian Open Neuroscience Platform \(CONP\)](#).

< Signature of Alzheimer >

https://simexp.github.io/vcog_hps_ad_book/intro.html

Jupyter Book
Binder
Jupyter
pandas
scipy
scikit learn
matplotlib
numpy
seaborn

Build Communities



jupyter.org

**Leverage solutions
across disciplines**

**Share binders.
Foster scientific
research.**

Tools

Processes

Communication

**Why strive for
reproducible research?**

Reproducible research
improves prediction

prediction =

impact

Scaling reproducible
research improves science
and **our world**



後長岡
百俵まつり

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Thank you

ECMWF Workshop Organizers

Claudia Vitolo

Project Jupyter Team

Min Ragan-Kelly

GORDON AND BETTY
MOORE
FOUNDATION



Alfred P. Sloan
FOUNDATION

THE LEONA M. AND HARRY B.
HELMSLEY
CHARITABLE TRUST

Attributions

References to published research, projects, and drawings (and marked on slides)

- [2] Statistics: <https://fivethirtyeight.com/features/which-city-has-the-most-unpredictable-weather/>
- [7, 11] A Bridge for Passing, Pearl S. Buck
- [8, 9, 18] ECMWF
- [12] Copyright: 2019 European Union, contains modified Copernicus Sentinel data 2019, processed by EUMETSAT
- [13] Copyright contains modified Copernicus Sentinel data (2019), processed by ESA, CC BY-SA 3.0 IGO
- [30] Madicken Munk
- [31] Maarten Breddels
- [33] Adam Rule et al.
- [46] Quantstack - Voila
- [48-53] Juliette Taka
- [57] Pangeo
- [58] Lindsey Heagy
- [59] Canadian Open Neuroscience Platform

Photos

- [2-6, 10, 16-17, 69, 70] Source: Carol Willing and Linnea Willing
- [14] Twitter
- [15] Getty Images
- [55, 56] Kirstie Whitaker
- [23-29, 38, 44, 47, 54, 61] Project Jupyter
- [39-40] nteract and Netflix
- [41] Nick Shrock, Dagster

15 October - 9:10

Carol Willing (Willing Consulting / Project Jupyter; Twitter: @WillingCarol)

Scaling reproducible research with Project Jupyter

Jupyter notebooks have become the de-facto standard as a scientific and data science tool for producing computational narratives. Over five million Jupyter notebooks exist on GitHub today. Beyond the classic Jupyter notebook, Project Jupyter's tools have evolved to provide end to end workflows for research that enable scientists to prototype, collaborate, and scale with ease. JupyterLab, a web-based, extensible, next generation interactive development environment enables researchers to combine Jupyter notebooks, code and data to form computational narratives. JupyterHub brings the power of notebooks to groups of users. It gives users access to computational environments and resources without burdening the users with installation and maintenance tasks. Binder builds upon JupyterHub and provides free, sharable, interactive computing environments to people all around the world.