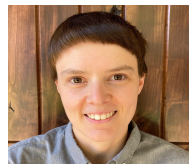# Resen: REproducible Software ENvironment

Integrated Geoscience Observatory (InGeO)
An NSF EarthCube and Cyberinfrastructure for Sustained Scientific Innovation (CSSI) project

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2020 Virtual CEDAR Workshop
June 22 - June 26, 2020

Integrated Geoscience Observatory (InGeO)

- Awards to SRI:
  - NSF EarthCube
  - Cyberinfrastructure for Sustained Scientific Innovation(CSSI)
- Two main goals:
  - Create tools that facilitate computational reproducibility and collaboration among geospace scientists.
  - Promote best practices for software development, data analysis and archiving.
- Resources found in the InGeO webpage:
  - https://ingeo.datatransport.org

Reproducible Software Environment (RESEN)

- CLI written in Python with commands to create, start, stop, export, and import bundles called "buckets" with software and data necessary to reproduce a scientific result.
- Buckets are based on Docker images called "resen-cores"
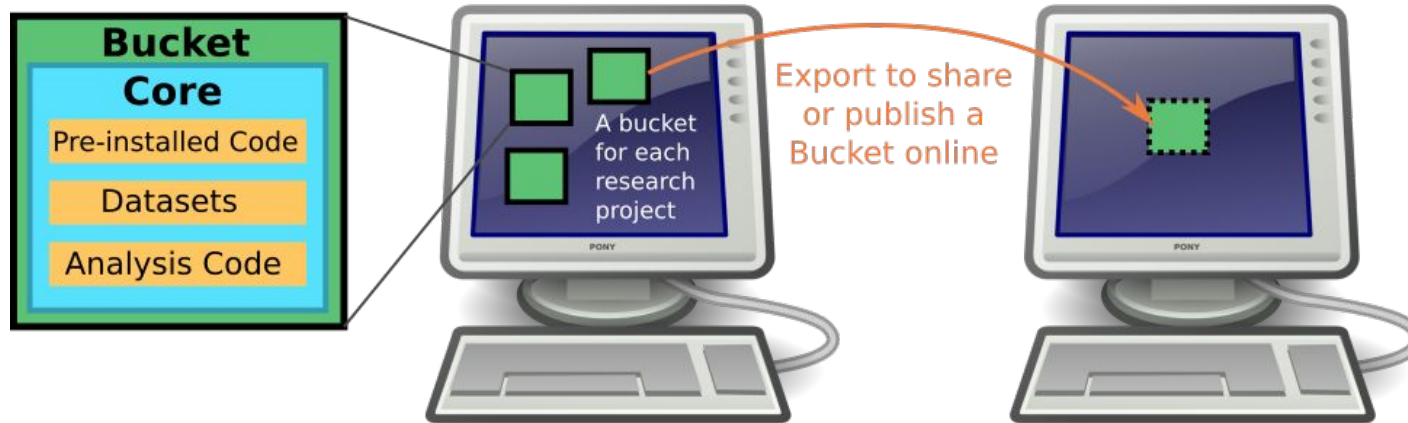
Bhatt A, Valentic T, Reimer A, Lamarche L, Reyes P, et al. 2020. Reproducible Software Environment: a tool enabling computational reproducibility in geospace sciences and facilitating collaboration. *J.Space Weather Space Clim.*10, 12. https://doi.org/10.1051/swsc/2020011
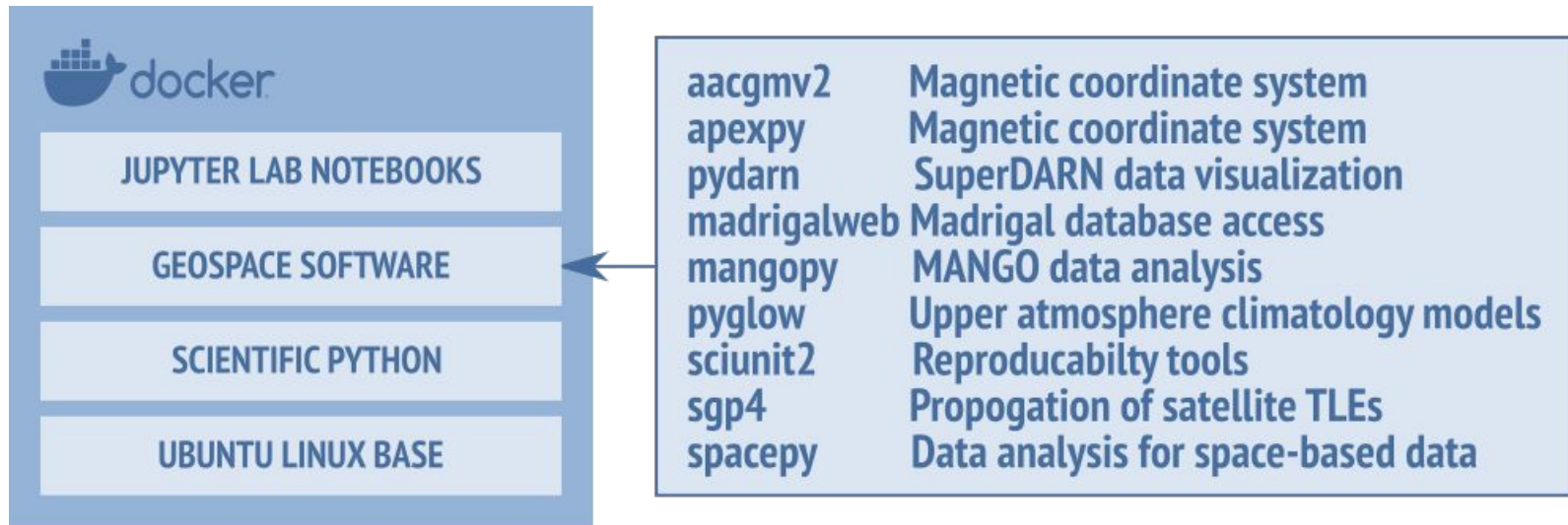
BUCKETS AND RESEN-CORE
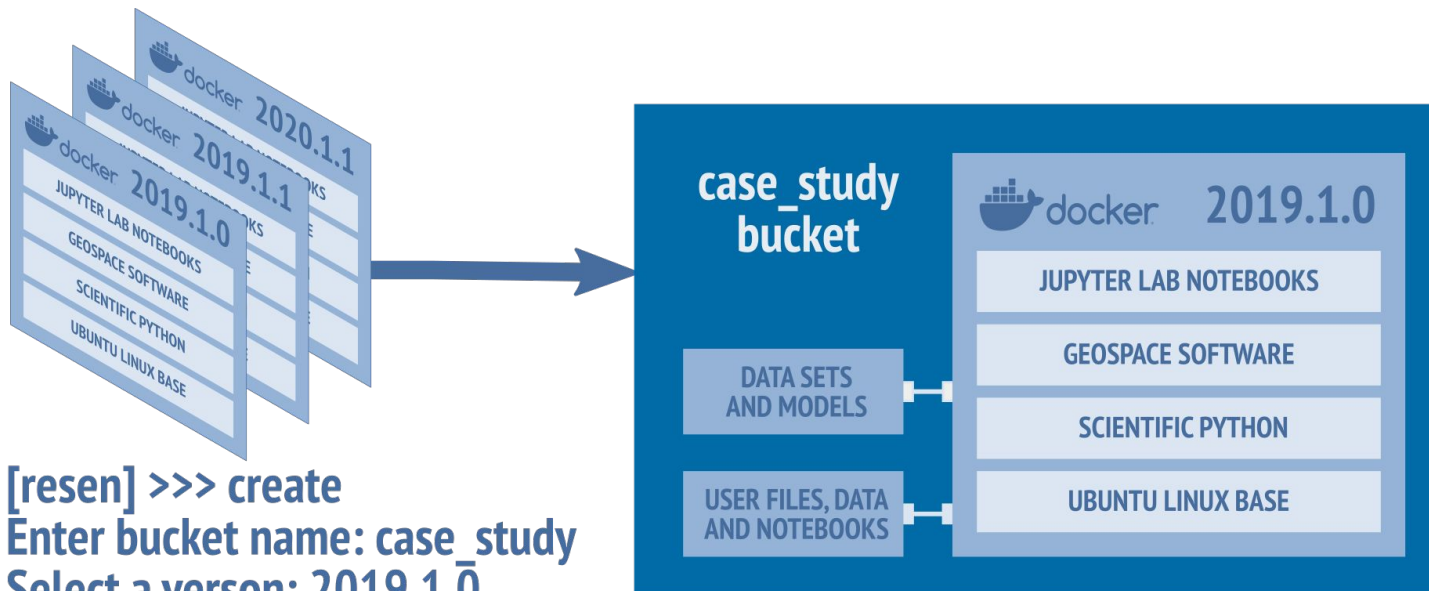
[resen] >>> create
Enter bucket name: case_study
Select a verson: 2019.1.0
Mount storage? yes

AGU 2019 Poster: IN33B-0827 - T. Valentic, The Integrated Geoscience Observatory (InGeO)
https://ingeo.datatransport.org/home/resources/media-and-publications/agu-ingeo-2019-v2.pdf

RESEN-CORE

aacgmv2	Magnetic coordinate system
apexpy	Magnetic coordinate system
pydarn	SuperDARN data visualization
madrigalweb	Madrigal database access
mangopy	MANGO data analysis
pyglow	Upper atmosphere climatology models
sciunit2	Reproducabilty tools
sgp4	Propogation of satellite TLEs
spacepy	Data analysis for space-based data

Docker layers:
- JUPYTER LAB NOTEBOOKS
- GEOSPACE SOFTWARE
- SCIENTIFIC PYTHON
- UBUNTU LINUX BASE

DockerHub: earthcubeingeo/resen-core

AGU 2019 Poster: IN33B-0827 - T. Valentic, The Integrated Geoscience Observatory (InGeO)
https://ingeo.datatransport.org/home/resources/media-and-publications/agu-ingeo-2019-v2.pdf

Resen Online

- Resen is available through an online interface to make it easier for new users to get started with geospace software packages
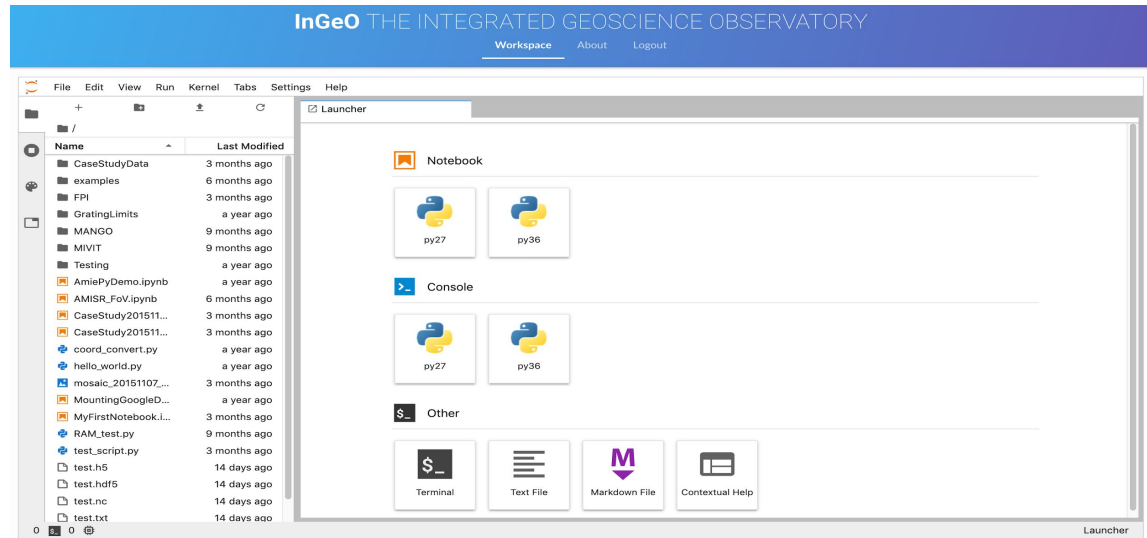- Log in through web browser - no installation required
- Sign up/log in: https://ingeo.datatransport.org/home/ -> "Sign In"

Application of Resen Locally (Running IPWM)

- The Ionosphere/Polar Wind Model (IPWM) is a 3D model of plasma dynamics and ion outflow in the polar cap (Varney et al., 2015)
- Leslie Lamarche installed the model in a resen-core that was used in her 2020 GC PoyntingFlux presentation: "Observations of Ion Heating with the Resolute Bay Incoherent Scatter Radar" and exported the bucket that I'll show here.
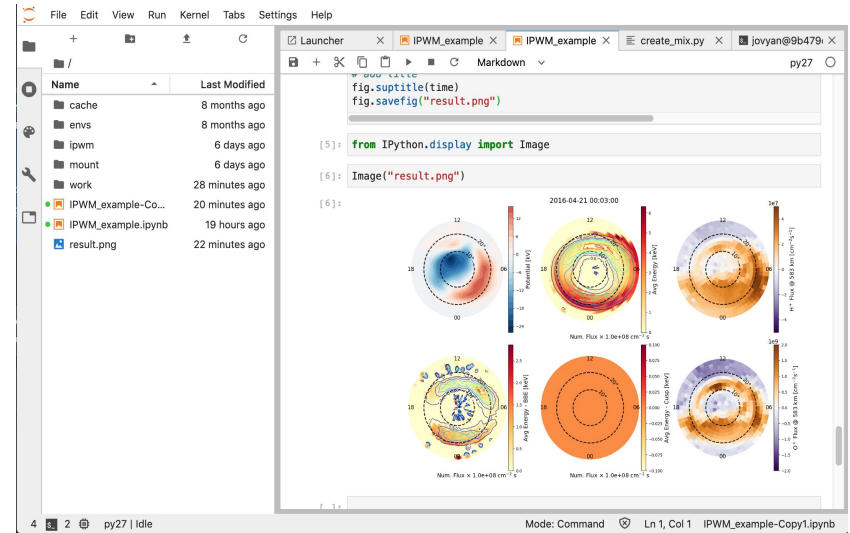
Varney, R. H., Wiltberger, M., and Lotko, W. (2015). Modeling the interaction between convection and nonthermal ion outflows. J. Geophys. Res. Space Physics, 120:2353–2362. https://doi.org/10.1002/2014JA020769

Application of RESEN Locally (Running IPWM)

- Computational resources of host computer environment.
- Persistent pip install … to py27 or py36 python environments
- Sudo privileges to the buckets started with resen.
- Lieve demo: http://localhost:9006/lab
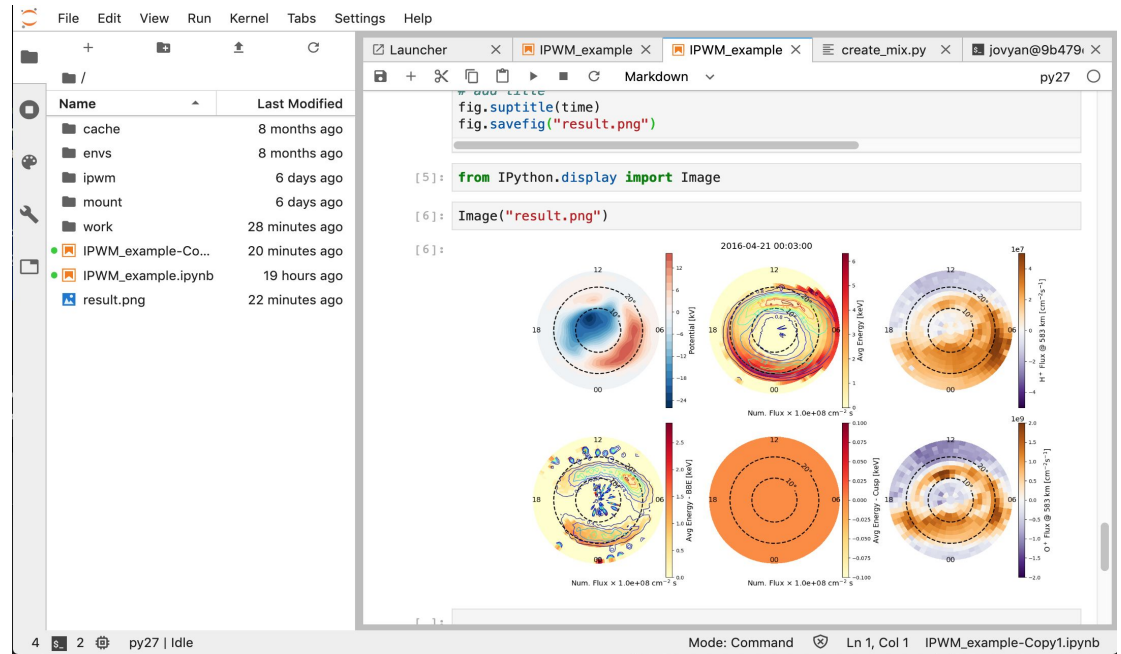
New release: resen-core 2020.1.0

- Update on packages installed
  - New packages installed:
    - plasmapy 0.3.1 (Package for plasma research)
    - pydarn 1.0.0.1 (Library for data visualization of SuperDARN data.)
    - viresclient 0.6.1 (Interface to access ESA's swarm data and models)
    - visuamisr 2.0.3 (Read and visualize AMISR data)
  - py27 and py36 environment packages versions have been upgraded
  - davitpy has been removed on this resen-core version
- Update on utilities
  - matplotlib widgets are available which enables the interactive features of matplotlib in the Jupyter notebook and JupyterLab. To enable the ipympl backend in notebooks: either %matplotlib widget or %pylab widget.
  - citationhelper 0.2 (Citation helper utility that list the imports in the users' python scripts and notebooks)

RESEN RESOURCES

- InGeO website: https://ingeo.datatransport.org
- Resen tool documentation: https://resen.readthedocs.io
- Resen-core documentation: https://resen-core.readthedocs.io
- Resen and Resen-core in EarthCube InGeO GitHub:
  https://github.com/EarthCubeInGeo
- Youtube channel with tutorials, webinars, science highlights:
  https://www.youtube.com/channel/UCqS6q_1IP3rGFOEPB9t090g
- Team email:
  ingeo-team@ingeo.datatransport.org