
# Kaipy

M. Wiltberger, E. Winter and N. Rao
and the CGS Team

Innovate – Empower - Discover

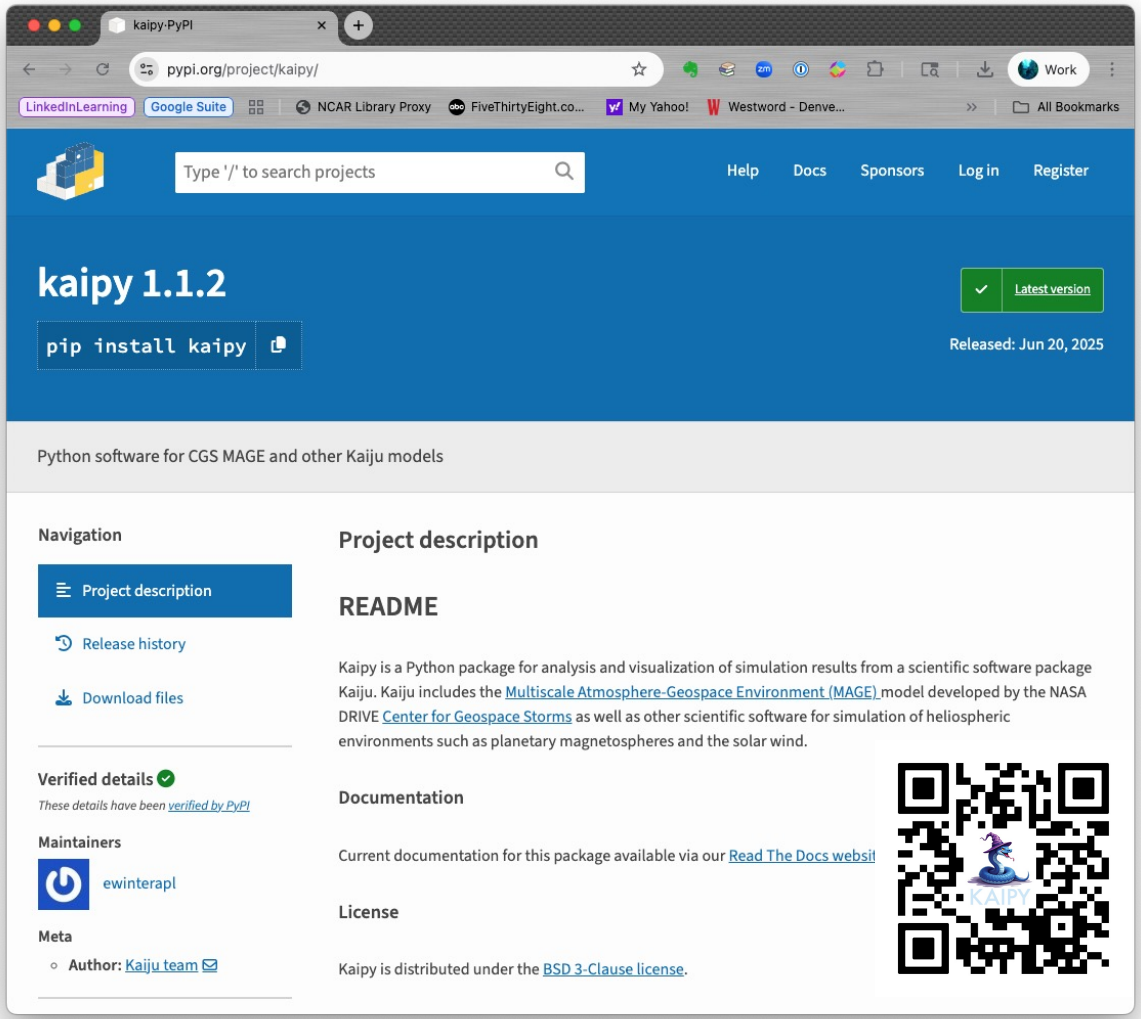
# KAIPY

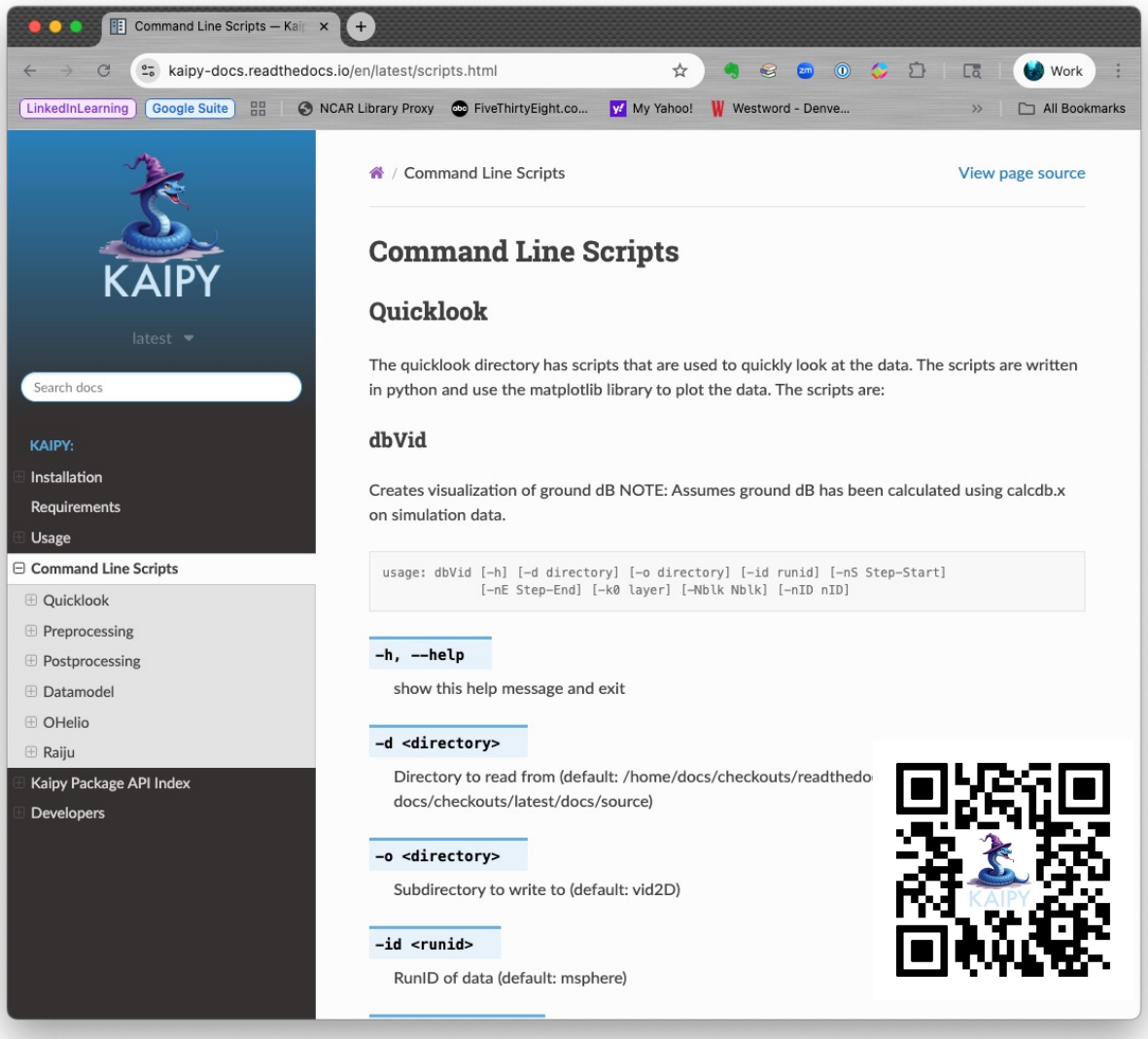
Analysis and visualization of MAGE simulation results

Works with Python 3.10-3.12

API and command line scripts

# Kaipy

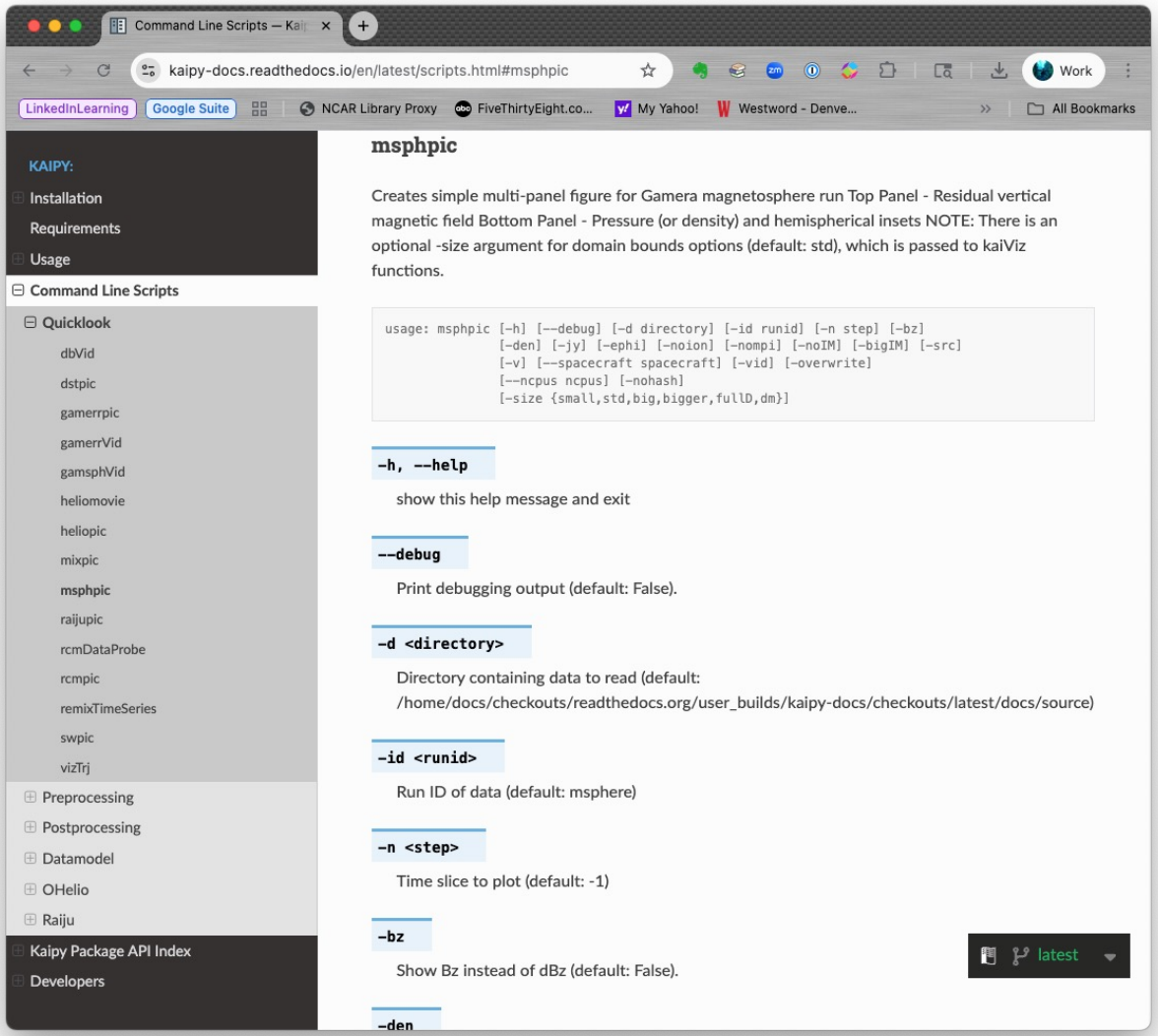


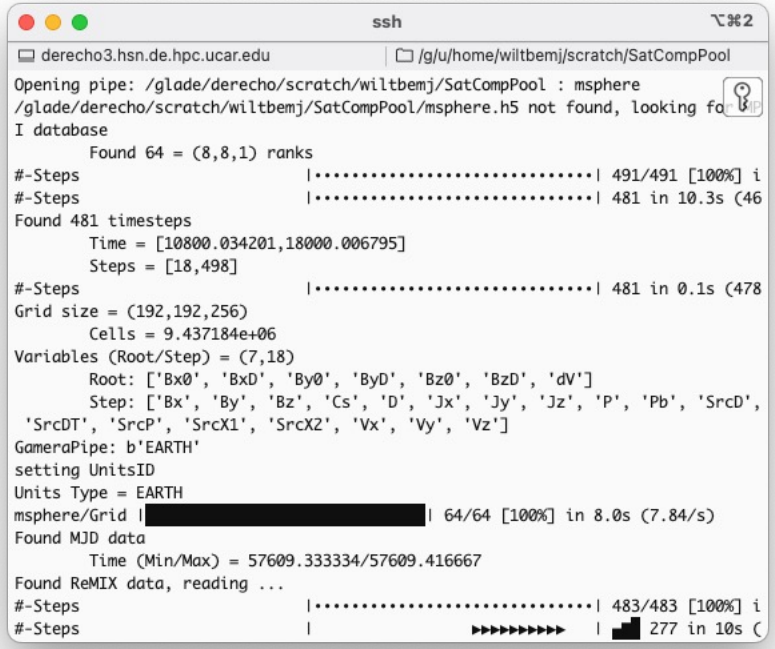



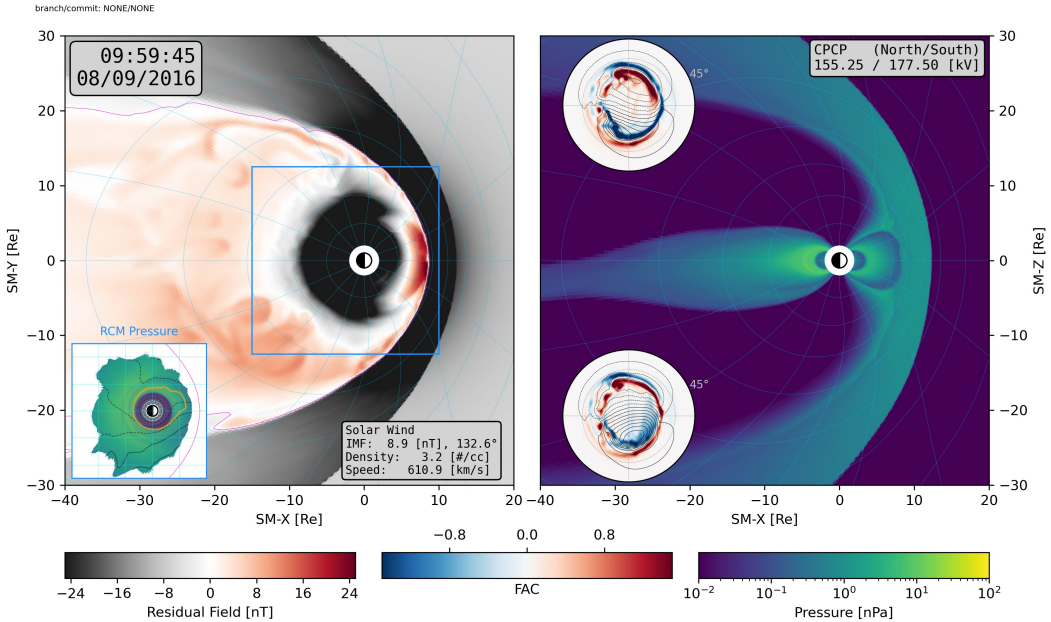

https://pypi.org/project/kaipy/

https://kaipy-docs.readthedocs.io

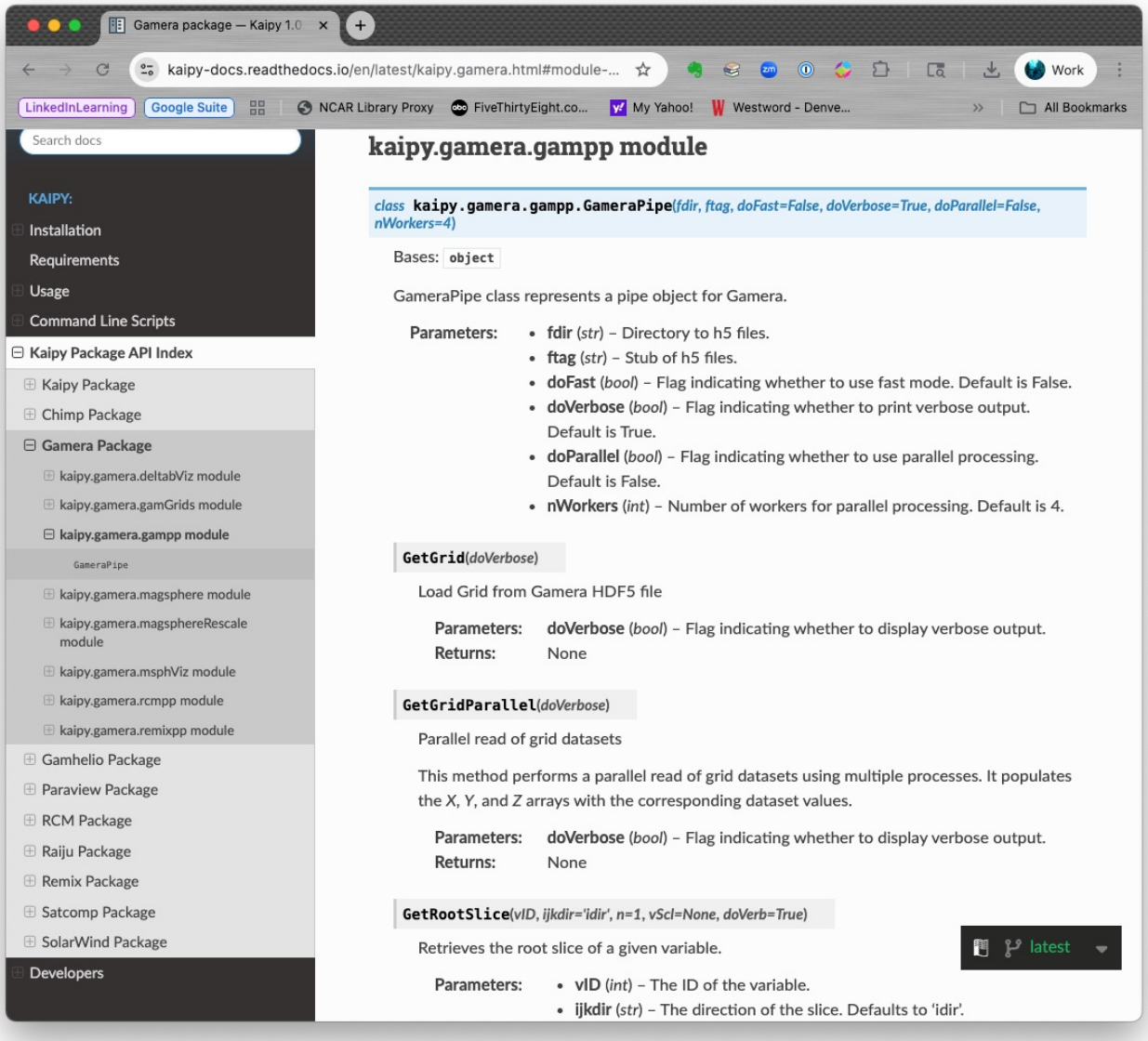
# Command Line Scripts



# API


Gamera package — Kaipy 1.0
kaipy-docs.readthedocs.io/en/latest/kaipy.gamera.html#module-...
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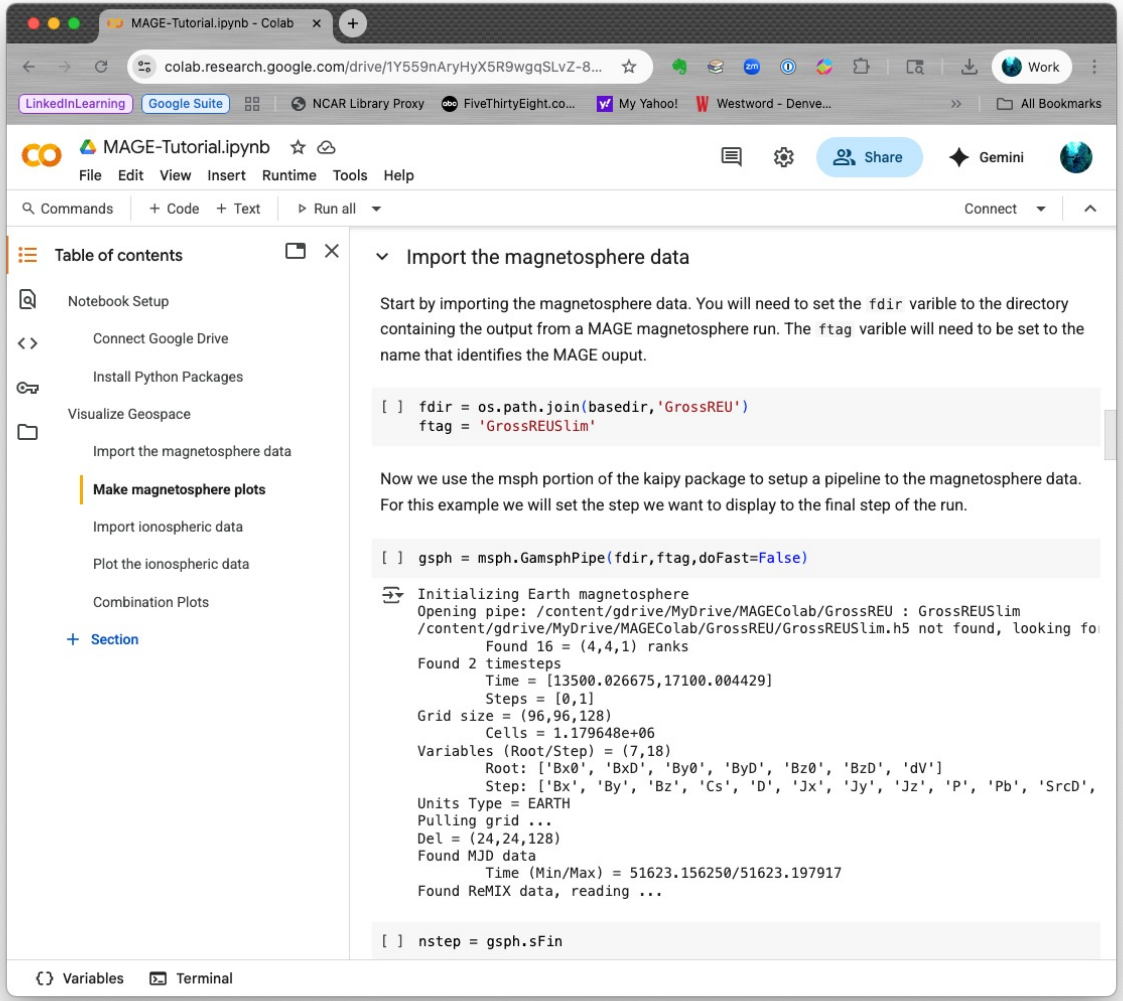
kaipy.gamera.gampp module
class kaipy.gamera.gampp.GameraPipe(fdir, ftag, doFast=False, doVerbose=True, doParallel=False, nWorkers=4)
Bases: object
GameraPipe class represents a pipe object for Gamera.
Parameters:
fdir (str) – Directory to h5 files.
ftag (str) – Stub of h5 files.
doFast (bool) – Flag indicating whether to use fast mode. Default is False.
doVerbose (bool) – Flag indicating whether to print verbose output. Default is True.
doParallel (bool) – Flag indicating whether to use parallel processing. Default is False.
nWorkers (int) – Number of workers for parallel processing. Default is 4.
GetGrid(doVerbose)
Load Grid from Gamera HDF5 file
Parameters: doVerbose (bool) – Flag indicating whether to display verbose output.
Returns: None
GetGridParallel(doVerbose)
Parallel read of grid datasets
This method performs a parallel read of grid datasets using multiple processes. It populates the X, Y, and Z arrays with the corresponding dataset values.
Parameters: doVerbose (bool) – Flag indicating whether to display verbose output.
Returns: None
GetRootSlice(vID, ijkdir='idir', n=1, vScl=None, doVerb=True)
Retrieves the root slice of a given variable.
Parameters:
vID (int) – The ID of the variable.
ijkdir (str) – The direction of the slice. Defaults to 'idir'.


MAGE-Tutorial.ipynb - Colab
colab.research.google.com/drive/1Y559nAryHyX5R9wgqSLvZ-8...
MAGE-Tutorial.ipynb
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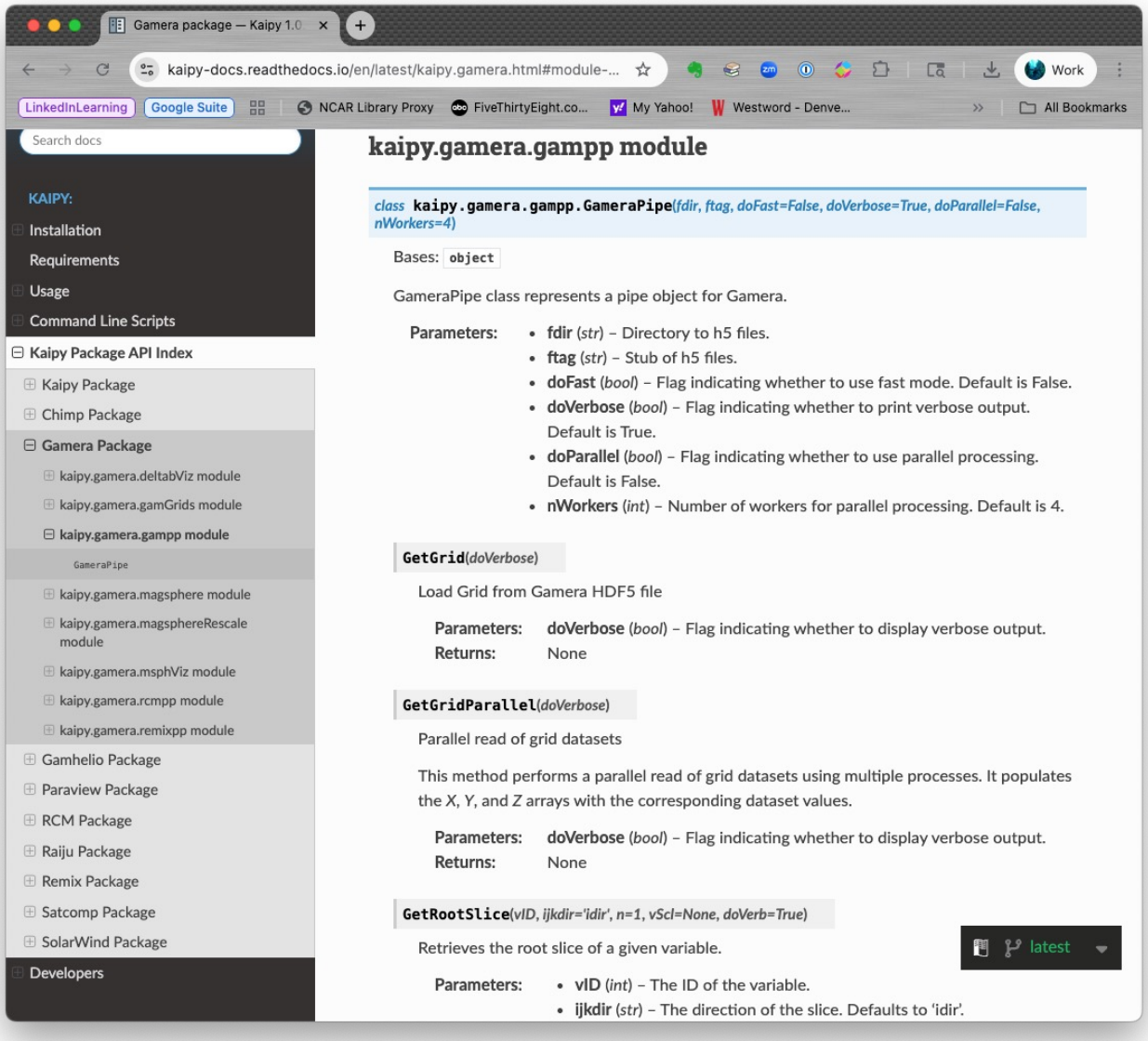
Import the magnetosphere data
Start by importing the magnetosphere data. You will need to set the fdir varible to the directory containing the output from a MAGE magnetosphere run. The ftag varible will need to be set to the name that identifies the MAGE ouput.
[ ] fdir = os.path.join(basedir,'GrossREU')
ftag = 'GrossREUSlim'
Now we use the msph portion of the kaipy package to setup a pipeline to the magnetosphere data. For this example we will set the step we want to display to the final step of the run.
[ ] gsph = msph.GamsphPipe(fdir,ftag,doFast=False)
Initializing Earth magnetosphere
Opening pipe: /content/gdrive/MyDrive/MAGEColab/GrossREU : GrossREUSlim
/content/gdrive/MyDrive/MAGEColab/GrossREU/GrossREUSlim.h5 not found, looking fo
Found 16 = (4,4,1) ranks
Found 2 timesteps
Time = [13500.026675,17100.004429]
Steps = [0,1]
Grid size = (96,96,128)
Cells = 1.179648e+06
Variables (Root/Step) = (7,18)
Root: ['Bx0', 'BxD', 'By0', 'ByD', 'Bz0', 'BzD', 'dV']
Step: ['Bx', 'By', 'Bz', 'Cs', 'D', 'Jx', 'Jy', 'Jz', 'P', 'Pb', 'SrcD',
Units Type = EARTH
Pulling grid ...
Del = (24,24,128)
Found MJD data
Time (Min/Max) = 51623.156250/51623.197917
Found ReMIX data, reading ...
[ ] nstep = gsph.sFin
Variables
Terminal

# API


Gamera package — Kaipy 1.0
kaipy-docs.readthedocs.io/en/latest/kaipy.gamera.html#module-...
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kaipy.gamera.msphViz module
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kaipy.gamera.remixpp module
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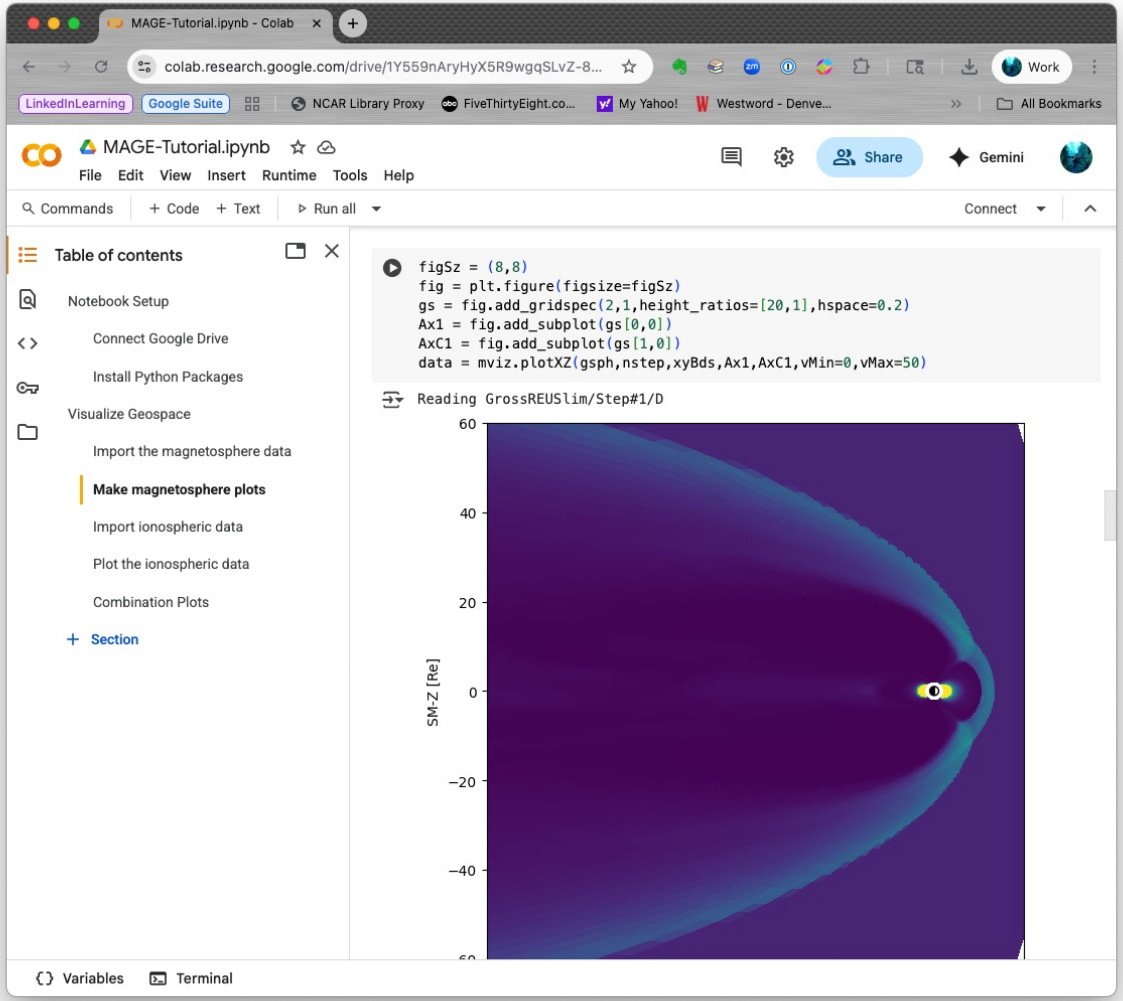
Retrieves the root slice of a given variable.
Parameters:
vID (int) – The ID of the variable.
ijkdir (str) – The direction of the slice. Defaults to 'idir'.
latest


MAGE-Tutorial.ipynb - Colab
colab.research.google.com/drive/1Y559nAryHyX5R9wgqSLvZ-8...
MAGE-Tutorial.ipynb
File Edit View Insert Runtime Tools Help
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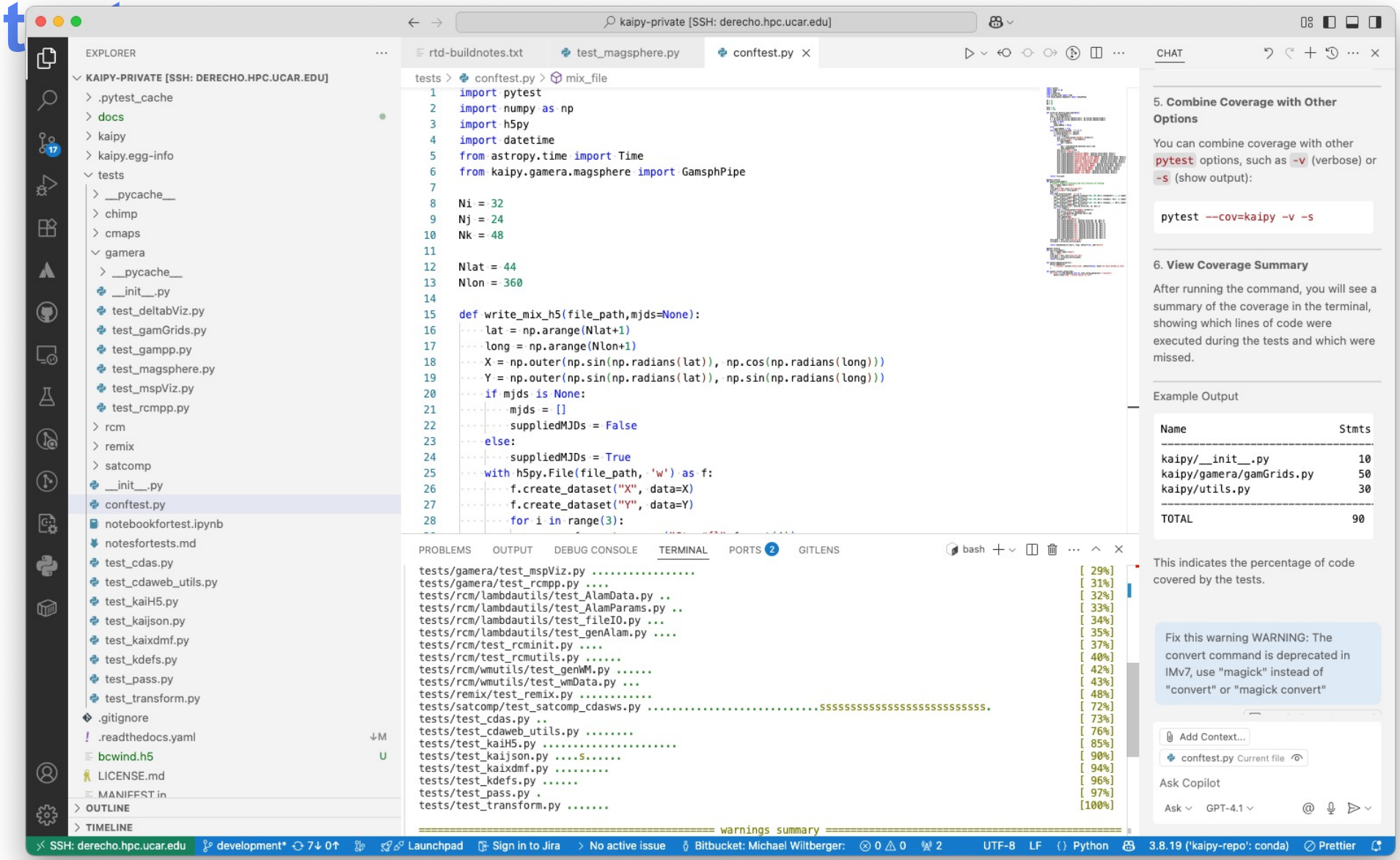
Combination Plots
+ Section
figSz = (8,8)
fig = plt.figure(figsize=figSz)
gs = fig.add_gridspec(2,1,height_ratios=[20,1],hspace=0.2)
Ax1 = fig.add_subplot(gs[0,0])
AxC1 = fig.add_subplot(gs[1,0])
data = mviz.plotXZ(gsph,nstep,xyBds,Ax1,AxC1,vMin=0,vMax=50)
Reading GrossREUSlim/Step#1/D
60
40
20
0
−20
−40
SM-Z [Re]
Variables
Terminal

# Unit t


kaipy-private [SSH: derecho.hpc.ucar.edu]
EXPLORER
KAIPY-PRIVATE [SSH: DERECHO.HPC.UCAR.EDU]
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cmaps
gamera
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test_gampp.py
test_magsphere.py
test_mspViz.py
test_rcmpp.py
rcm
remix
satcomp
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conftest.py
notebookfortest.ipynb
notesfortests.md
test_cdas.py
test_cdaweb_utils.py
test_kaiH5.py
test_kaijson.py
test_kaixdmf.py
test_kdefs.py
test_pass.py
test_transform.py
.gitignore
.readthedocs.yaml
bcwind.h5
LICENSE.md
MANIFEST.in
OUTLINE
TIMELINE
rtd-buildnotes.txt
test_magsphere.py
conftest.py
tests > conftest.py > mix_file
import pytest
import numpy as np
import h5py
import datetime
from astropy.time import Time
from kaipy.gamera.magsphere import GamsphPipe
Ni = 32
Nj = 24
Nk = 48
Nlat = 44
Nlon = 360
def write_mix_h5(file_path,mjds=None):
lat = np.arange(Nlat+1)
long = np.arange(Nlon+1)
X = np.outer(np.sin(np.radians(lat)), np.cos(np.radians(long)))
Y = np.outer(np.sin(np.radians(lat)), np.sin(np.radians(long)))
if mjds is None:
mjds = []
suppliedMJDs = False
else:
suppliedMJDs = True
with h5py.File(file_path, 'w') as f:
f.create_dataset("X", data=X)
f.create_dataset("Y", data=Y)
for i in range(3):
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS 2
GITLENS
bash
tests/gamera/test_mspViz.py ..... [ 29%]
tests/gamera/test_rcmpp.py .... [ 31%]
tests/rcm/lambdautils/test_AlamData.py .. [ 32%]
tests/rcm/lambdautils/test_AlamParams.py .. [ 33%]
tests/rcm/lambdautils/test_fileIO.py ... [ 34%]
tests/rcm/lambdautils/test_genAlam.py .... [ 35%]
tests/rcm/test_rcminit.py .... [ 37%]
tests/rcm/test_rcmutils.py ..... [ 40%]
tests/rcm/wmutils/test_genWM.py ..... [ 42%]
tests/rcm/wmutils/test_wmData.py ... [ 43%]
tests/remix/test_remix.py ..... [ 48%]
tests/satcomp/test_satcomp_cdasws.py .....sssssssssssssssssssssssss. [ 72%]
tests/test_cdas.py .. [ 73%]
tests/test_cdaweb_utils.py ..... [ 76%]
tests/test_kaiH5.py ..... [ 85%]
tests/test_kaijson.py ....s..... [ 90%]
tests/test_kaixdmf.py ..... [ 94%]
tests/test_kdefs.py ..... [ 96%]
tests/test_pass.py . [ 97%]
tests/test_transform.py ..... [100%]
warnings summary
CHAT
5. Combine Coverage with Other Options
You can combine coverage with other pytest options, such as -v (verbose) or -s (show output):
pytest --cov=kaipy -v -s
6. View Coverage Summary
After running the command, you will see a summary of the coverage in the terminal, showing which lines of code were executed during the tests and which were missed.
Example Output
Name Stmts
kaipy/__init__.py 10
kaipy/gamera/gamGrids.py 50
kaipy/utils.py 30
TOTAL 90
This indicates the percentage of code covered by the tests.
Fix this warning WARNING: The convert command is deprecated in IMv7, use "magick" instead of "convert" or "magick convert"
Add Context...
conftest.py Current file
Ask Copilot
Ask
GPT-4.1
SSH: derecho.hpc.ucar.edu
development*
Launchpad
Sign in to Jira
No active issue
Bitbucket: Michael Wiltberger:
UTF-8
LF
Python
3.8.19 ('kaipy-repo': conda)
Prettier

# MAGE Open-Source and CCMC Release

Center for Geospace Storms (CGS): A Major Milestone Reached

## Open-Source Release

**MAGE 1.25 GAMERA+REMIX+DK+RAIJU+TIEGCM**

- **Includes full rewrite of the Rice Convection Model (RCM), now called RAIJU**
- **New auroral precipitation model (Dragon King, DK)**
- This is a brand-new, cutting-edge model. Testing by the team is still ongoing
- Make sure to check for updates regularly and reach out to us if you would like to use the model for a scientific study

## CCMC Release

**MAGE 1.0 GAMERA+REMIX+RCM+TIEGCM**

- Available for runs on request at the CCMC imminently
- MAGE 0.75 (GAMERA+REMIX+RCM) has been available for runs on request at the CCMC since May 2024 with >400 runs / year
- Tested by the team, ready for science production
- Make sure to follow the CCMC rules of the road

| **GAMERA** | **RCM/RAIJU** | **Dragon King (DK)** | **REMIX** | **TIEGCM** |
|---|---|---|---|---|
| Global magnetosphere | Inner magnetosphere | Auroral precipitation | Ionospheric electrodynamics | Ionosphere-Thermosphere |

**Repository:**
github.com/JHUAPL/kaiju

**Documentation:**
kaiju-docs.readthedocs.io

**Reach out:**
cgs.jhuapl.edu/feedback

# We want you to work with CGS!