



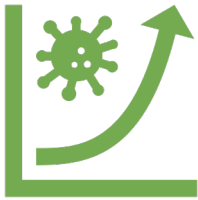
CENTER FOR
GEOSPACE STORMS

Kaipy

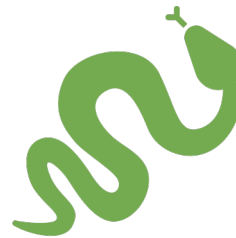
M. Wiltberger, E. Winter and N. Rao
and the CGS Team

Innovate – Empower - Discover





Analysis and visualization of
MAGE simulation results

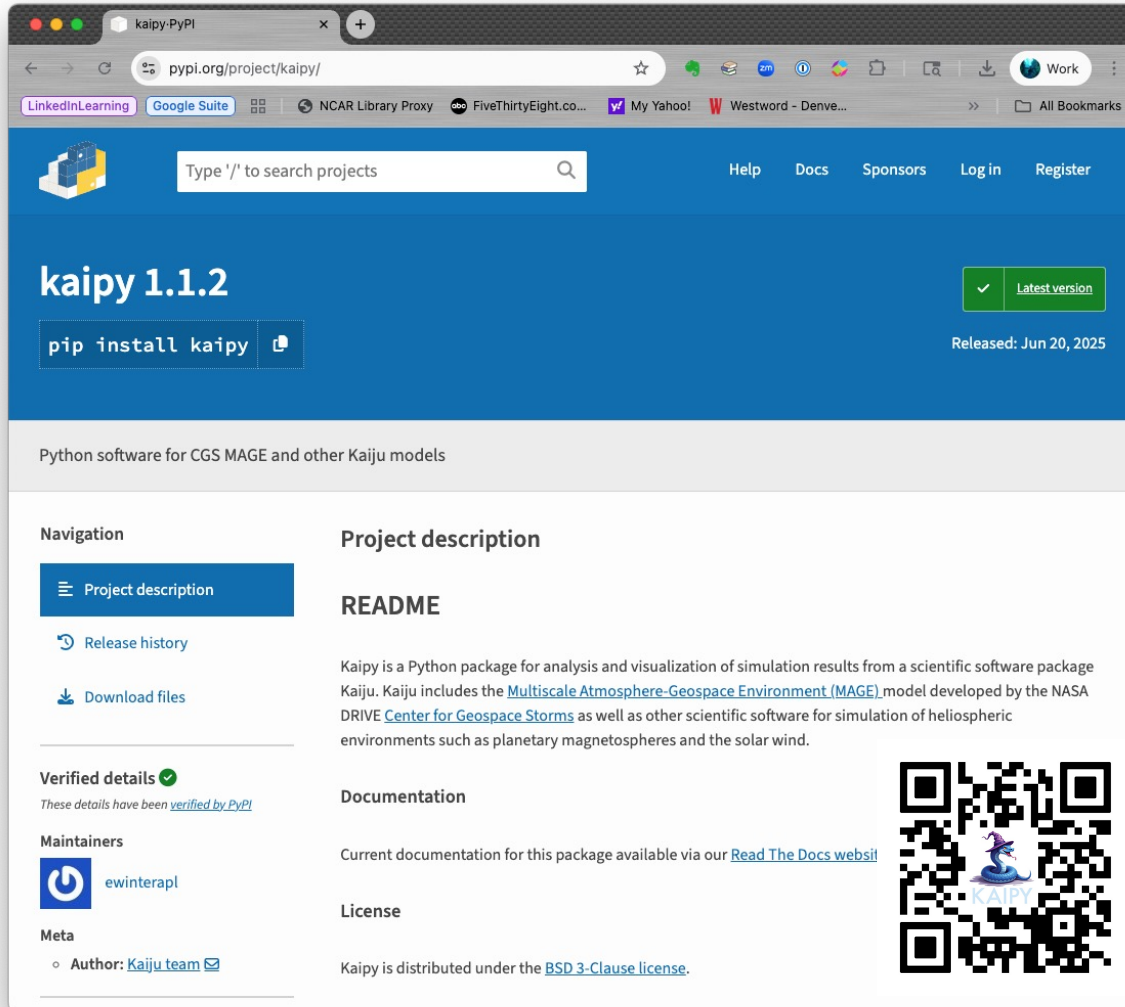


Works with Python 3.10-
3.12



API and command line
scripts

Kaipy



The screenshot shows the PyPI page for Kaipy. The header includes a search bar and navigation links. The main section displays 'kaipy 1.1.2' with a 'pip install kaipy' button and a 'Latest version' badge. Below this, it states 'Python software for CGS MAGE and other Kaiju models'. The left sidebar contains navigation links for Project description, Release history, and Download files. The main content area includes a Project description, README, Documentation, and License section. A QR code is visible in the bottom right corner of the main content area.

kaipy-PyPI

pypi.org/project/kaipy/

Type '/' to search projects

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kaipy 1.1.2

pip install kaipy

Released: Jun 20, 2025

Python software for CGS MAGE and other Kaiju models

Navigation

- Project description
- Release history
- Download files

Project description

README

Kaipy is a Python package for analysis and visualization of simulation results from a scientific software package Kaiju. Kaiju includes the [Multiscale Atmosphere-Geospace Environment \(MAGE\)](#) model developed by the NASA DRIVE [Center for Geospace Storms](#) as well as other scientific software for simulation of heliospheric environments such as planetary magnetospheres and the solar wind.

Documentation

Current documentation for this package available via our [Read The Docs website](#)

License

Kaipy is distributed under the [BSD 3-Clause license](#).

Verified details ✓
These details have been verified by PyPI

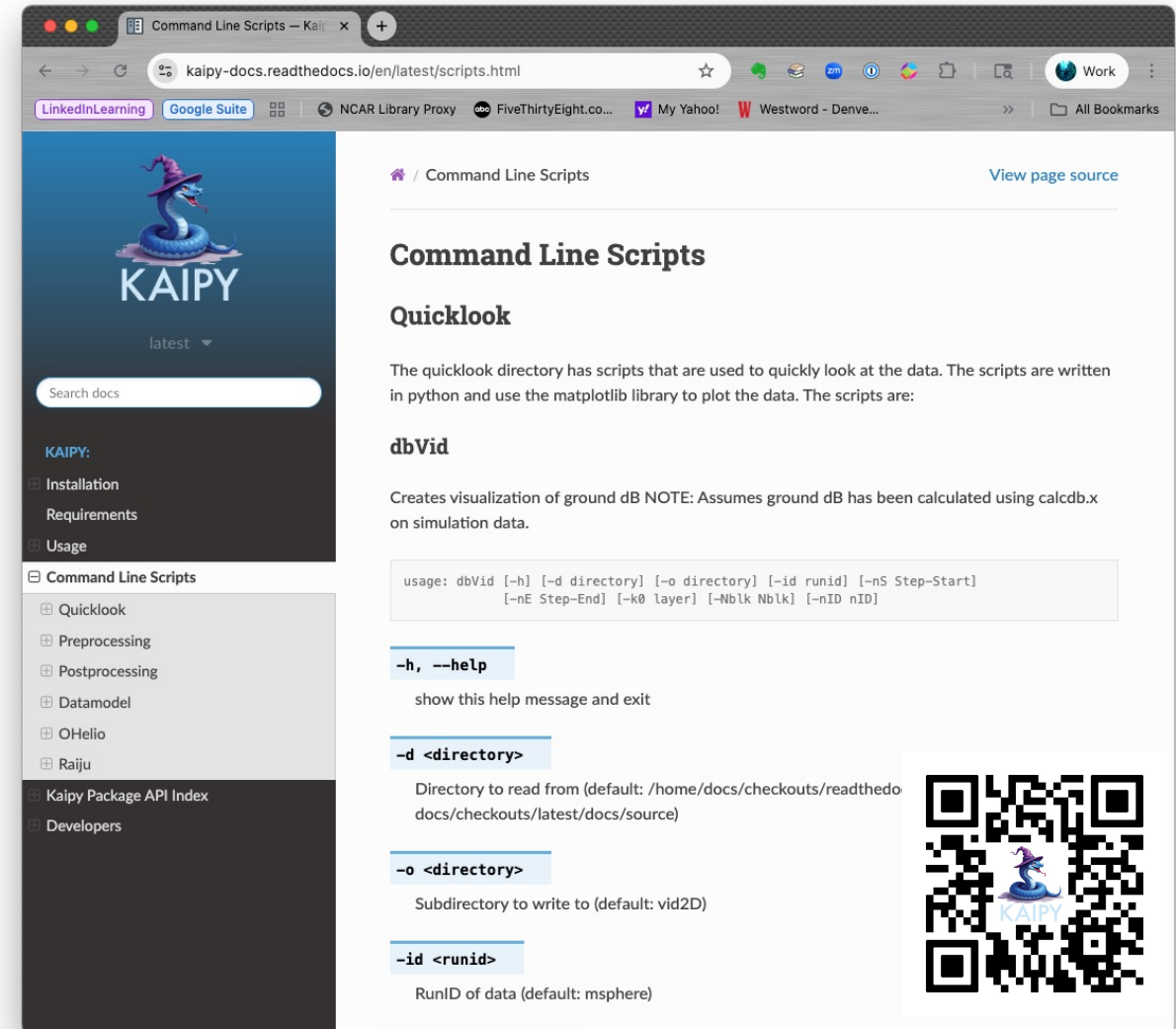
Maintainers

- ewinterapl

Meta

- Author: [Kaiju team](#)

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



The screenshot shows the 'Command Line Scripts' page on the Kaipy documentation site. The left sidebar contains a search bar and a list of navigation links. The main content area includes a 'Quicklook' section with a description of the quicklook directory, a 'dbVid' section with a description of the dbVid script, and a 'usage' section with command-line options. A QR code is visible in the bottom right corner of the main content area.

Command Line Scripts — Kaiju

kaipy-docs.readthedocs.io/en/latest/scripts.html

View page source

Command Line Scripts

Quicklook

The quicklook directory has scripts that are used to quickly look at the data. The scripts are written in python and use the matplotlib library to plot the data. The scripts are:

dbVid

Creates visualization of ground dB NOTE: Assumes ground dB has been calculated using calcdB.x on simulation data.

usage: dbVid [-h] [-d directory] [-o directory] [-id runid] [-nS Step-Start] [-nE Step-End] [-k0 layer] [-Nblk Nblk] [-nID nID]

-h, --help

show this help message and exit

-d <directory>

Directory to read from (default: /home/docs/checkouts/readthedocs/checkouts/latest/docs/source)

-o <directory>

Subdirectory to write to (default: vid2D)

-id <runid>

RunID of data (default: msphere)

<https://kaipy-docs.readthedocs.io>

Command Line Scripts

Command Line Scripts — KaiPy

kaipy-docs.readthedocs.io/en/latest/scripts.html#msphpic

LinkedIn Learning Google Suite NCAR Library Proxy FiveThirtyEight.com My Yahoo! Westword - Denve...

KAIPY:

Installation Requirements Usage

Command Line Scripts

Quicklook

dbVid

dstpic

gamerrpic

gamerrVid

gamsphVid

heliomovie

heliopic

mixpic

msphpic

raijupic

rcmDataProbe

rcmpic

remixTimeSeries

swpic

vizTrj

Preprocessing

Postprocessing

Datamodel

OHelio

Raiju

Kaipy Package API Index

Developers

msphpic

Creates simple multi-panel figure for Gamera magnetosphere run Top Panel - Residual vertical magnetic field Bottom Panel - Pressure (or density) and hemispherical insets NOTE: There is an optional -size argument for domain bounds options (default: std), which is passed to kaiViz functions.

usage: msphpic [-h] [--debug] [-d directory] [--id runid] [-n step] [-bz] [-den] [-jy] [-epi] [-noion] [-nomp] [-noIM] [-bigIM] [--src] [-v] [--spacecraft spacecraft] [--vid] [--overwrite] [--ncpus ncpus] [--nohash] [-size {small,std,big,bigger,full,dm}]

-h, --help

show this help message and exit

--debug

Print debugging output (default: False).

-d <directory>

Directory containing data to read (default: /home/docs/checkouts/readthedocs.org/user_builds/kaipy-docs/checkouts/latest/docs/source)

-id <runid>

Run ID of data (default: msphere)

-n <step>

Time slice to plot (default: -1)

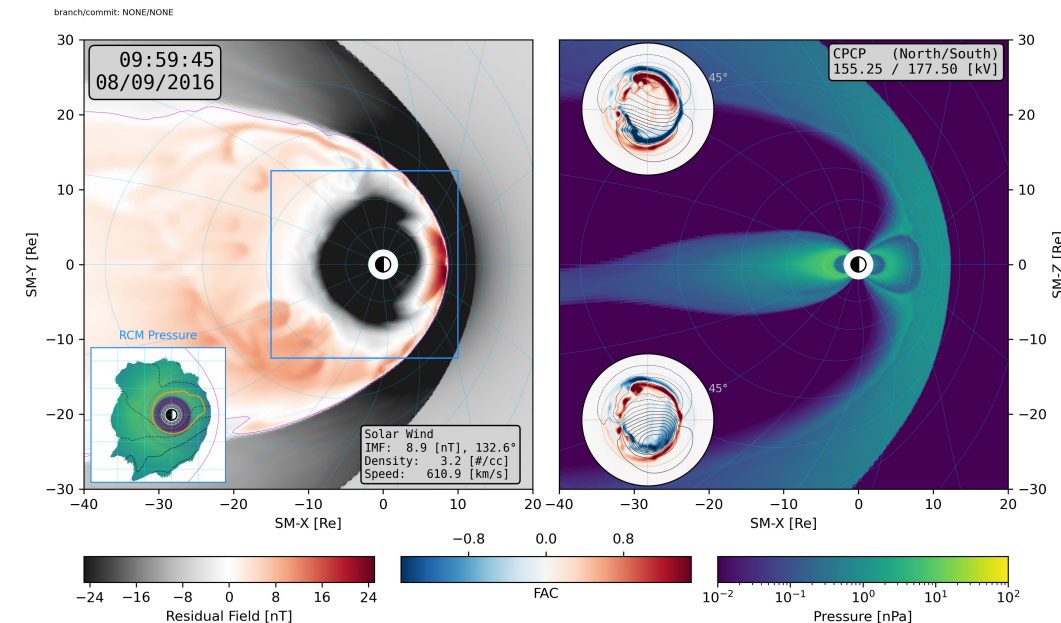
-bz

Show Bz instead of dBz (default: False).

-den

latest

```
ssh
derecho3.hsn.de.hpc.ucar.edu
/g/u/home/wiltbemj/scratch/SatCompPool
Opening pipe: /glade/derecho/scratch/wiltbemj/SatCompPool : msphere
/glade/derecho/scratch/wiltbemj/SatCompPool/msphere.h5 not found, looking for
I database
Found 64 = (8,8,1) ranks
#-Steps |.....| 491/491 [100%] i
#-Steps |.....| 481 in 10.3s (46
Found 481 timesteps
Time = [10800.034201,18000.006795]
Steps = [18,498]
#-Steps |.....| 481 in 0.1s (478
Grid size = (192,192,256)
Cells = 9.437184e+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',
'SrcDT', 'SrcP', 'SrcX1', 'SrcX2', 'Vx', 'Vy', 'Vz']
GameraPipe: b'EARTH'
setting UnitsID
Units Type = EARTH
msphere/Grid |.....| 64/64 [100%] in 8.0s (7.84/s)
Found MJD data
Time (Min/Max) = 57609.333334/57609.416667
Found ReMIX data, reading ...
#-Steps |.....| 483/483 [100%] i
#-Steps |.....| 277 in 10s (
```



Gameara package — Kaipy 1.0

kaipy-docs.readthedocs.io/en/latest/kaipy.gamera.html#module-...

Search docs

KAIPY:

- Installation
- Requirements
- Usage
- Command Line Scripts

Kaipy Package API Index

- Kaipy Package
- Chimp Package
- Gamera Package**
 - kaipy.gamera.deltabViz module
 - kaipy.gamera.gamGrids module
 - kaipy.gamera.gampp module**
- GameraPipe
- kaipy.gamera.magsphere module
- kaipy.gamera.magsphereRescale module
- kaipy.gamera.msphViz module
- kaipy.gamera.rcmpp module
- kaipy.gamera.remixpp module
- Gamhelio Package
- Paraview Package
- RCM Package
- Raiju Package
- Remix Package
- Satcomp Package
- SolarWind Package
- Developers

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'.

latest

MAGE-Tutorial.ipynb - Colab

colab.research.google.com/drive/1Y559nAryHyX5R9wgqSLvZ-8...

File Edit View Insert Runtime Tools Help

Commands + Code + Text Run all Connect

Table of contents

- Notebook Setup
- Connect Google Drive
- Install Python Packages
- Visualize Geospace
- Import the magnetosphere data
- Make magnetosphere plots**
- Import ionospheric data
- Plot the ionospheric data
- Combination Plots
- + Section

Import the magnetosphere data

Start by importing the magnetosphere data. You will need to set the `fdir` variable to the directory containing the output from a MAGE magnetosphere run. The `ftag` variable 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

Gameara package — Kaipy 1.0

kaipy-docs.readthedocs.io/en/latest/kaipy.gamera.html#module-...

Search docs

KAIPY:

- Installation
- Requirements
- Usage
- Command Line Scripts

Kaipy Package API Index

- Kaipy Package
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 - kaipy.gamera.deltabViz module
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 - kaipy.gamera.msphViz module
 - kaipy.gamera.rcmpp module
 - kaipy.gamera.remixpp module
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- Developers

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latest

MAGE-Tutorial.ipynb - Colab

colab.research.google.com/drive/1Y559nAryHyX5R9wgqSLvZ-8...

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MAGE-Tutorial.ipynb

File Edit View Insert Runtime Tools Help

Commands + Code + Text Run all Connect

Table of contents

- Notebook Setup
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```
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])
Ax1 = fig.add_subplot(gs[1,0])
data = mviz.plotXZ(gsph,nstep,xyBds,Ax1,Ax1,vMin=0,vMax=50)
```

Reading GrossREUSlim/Step#1/D

Variables Terminal

The screenshot shows a VS Code editor window with the file `conftest.py` open. The file contains Python code for testing, including imports for `pytest`, `numpy`, `h5py`, `datetime`, and `astropy.time`. It defines variables `Ni`, `Nj`, `Nk`, `Nlat`, and `Nlon`, and a function `write_mix_h5` that writes data to an HDF5 file.

On the right side of the editor, a panel displays the coverage summary for the tests. It shows the percentage of code covered by the tests for various files.

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/utis.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"`

Ask Copilot

Ask GPT-4.1

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 Global magnetosphere	•	RCM/RAIJU Inner magnetosphere	•	Dragon King (DK) Auroral precipitation	•	REMIX Ionospheric electrodynamics	•	TIEGCM 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!

