Attendees: 82

aurora-asi-lib
Mike Shumko

aurora-asi-lib is a library for auroral all-sky imager (ASI) data. It downloads, plots, animates, and analyses the auroral ASI data. There are a lot of common analysis techniques that are used to analyse auroral ASI data, and this library aims to provide you with these tools. It can:
- plot fish-eye data,
- make movies of images,
- create keograms,
- map spacecraft locations to ASI images (requires IRBEM),
- download data (bulk downloads are allowed), and
- load data (will automatically download if not available).

Documentation is available on readthedocs and is still being expanded. Data is loaded into class called `Imager` that will allow the user to efficiently manipulate the data. Future development aims to:
- add other imager arrays as plug ins,
- handle computer resources more efficiently,
- project fisheye data into a map,
- read model output as ASI data,
- doesn't yet have functions to get the boundaries of the auroral oval,
- etc.

For help or to contribute, please contact mykhaylo.shumko@nasa.gov.

pysat 3.0: A bridge between worlds
Russell Stoneback

pysat aims to solve the problem in space science of using data from a lot of different sources. This ended up having a lot of scope creep, so in version 3.0 things changed. Now pysat acts as a framework and umbrella packages contain data and/or analysis from similar sources or purposes.

Regardless of the data source, it is loaded into a common class, `Instrument`. This means that your loading, downloading, cleaning, and custom analysis commands can be more easily reused on different data sources. You can use pysat with or without the umbrella packages.

HIME
Doğa Ozturk

HIME framework enables using local measurements to drive global circulation models (GCMs). It uses primarily ISR data. Can use either 3D "imaging" or profile data. The data is incorporated into the GCM by locally modifying the estimates, adding local

meso-scale specifications.

The correction of the model input seeks to minimize the difference between simulated and measured electron densities. This is performed below 250 km, as suggested by the PFISR data providers.

HIME depends on Spacepy and apexpy, as well as Weimer (Fortran). It creates ASCII output. Currently you can use model data as input, as well as SuperDARN data, or other ISRs.

sami2py - overview and applications
Jeff Klenzing

SAMI2 is an open source 2D model of the ionosphere along closed field lines. sami2py ports this code to a python interface, improving user access. This allows the user to more easily modify inputs, running the Fortran code entirely from Python. You can adjust any of the potential inputs as kwargs. The output is saved in a managed directory structure that includes both data and metadata.

This uses a compiled Fortran executable instead of wrapping the Fortran code. The python wrapper creates a namelist and then runs the Fortran executable. This can be used for research and teaching. The project is ready for community use and feedback.

IGRF in Python
Ashley Smith and Leslie Lamarche

IGRF is used for many different purposes. We need a simple reference Pythin implementation of IGRF, but efforts are largely decentralized. It is used for model evaluation, field-line tracing, a basis for coordinate systems, and more.

IGRF is an empirical model of the Earth's magnetic field from the Earths core. It's defined from 1900-2025, and updated regularly (every 5 years). It uses spherical harmonics up to the 13th degree (195 Gauss coefficients).

Depending on your needs, IGRF may not be sufficiently accurate. Especially when studying weak currents (e.g., SWARM). We need a pathway for people to understand when to move beyond IGRF to more complicated models.

There are at least 45 places on GitHub that come up when you search IGRF! Determining which one you actually need can be difficult.

Needs:
- ease of uses (simple install and interface)
- performance (pure python is slower, but wrappers can be harder to install)
- features
- maintainability (clean code base, avoid scope creep, well documented, support for continuous development)

Discussion: (27% men talking, 73% not men talking)

Questions posed by Ashley and Leslie for discussion:
- is having may “python IGRFs” a problem?
- Can we as a community coordinate our efforts better?
- Who should be in charge of the “standard” library?
- How should this effort be organized/funded?
- How can this apply to other similar tools (IRI, MSIS, etc)?

Astrid: NGDC provides a python package, how is this different?

Leslie: Yes, there is a link to a python package. But the package isn’t well documented, so is harder to use than some of the other packages.

Astrid: Great to know!

Russell: Would be good to have an IGRF model or a source of multiple magnetic field models. It would be good to have the official people (IAGA) involved or contribute, but efforts shouldn’t be hamstrung by waiting for them if they aren’t interested.

Ashley: Can contact IAGA about endorsing a package. They don’t have many python users.

Leslie: People have done this, clearly it’s not difficult, we just need to bring things into one place. CCMC does have a nice web interface for IGRF and other models.

Angeline: CCMC is great, but many of us want to do research offline and not rely on a web interface.

Alexa: Should we be trying to have a central ionosphere package?

Russell: Presented pysat as nexus package for the ionosphere community. It has been presented as this option to the PyHC community.

Jeff: One of the issues of having a centralized package is dependencies, maintenance, and unit testing. Each code has its own requirements and it can make it more difficult to use.

Doga: When applying for NSF grants, we had to come up with a way to bring all of the models together. There is currently a call out for mission planning, and we need funding to avoid creating vaporwear.

Alexa: There are small pots of money through this, primarily through PyHC and NASA. Perhaps a white paper for the decadal survey could put this forward as an important source of funding.

Russell: Didn't want to say pysat should be central, just that pysat could be a common framework for distributed packages. It doesn't require people to explicitly coordinate.

Alexa: I like the idea of decentralization. We're a more specialized field and it's good to have things that easily talk to each other without being explicitly part of the same thing.

Liam: Machine Learning (ML) ready-concept. There's a possibility of us as developers to demonstrate the advantages of open source to create ML ready-data sets.

Alexa: Yes, having ML ready testing and training data sets would be invaluable!

Also, please speak up! Everyone here is interested in community input.

Leslie: Put a link in the chat to the IGRF issue that spawned the presentation.

Astrid: An important thing is to consider publication. Jupyter notebooks can be a useful resource to ensure people get credit for their work.

Alexa: Yes, there are also journals that allow you to publish your code. This may be something our community to consider. Also, Angeline let a group paper about MIT packages

Angeline: That's right! But that was before journals were really accepting package papers. Now it's best for each person to publish their own paper.

Astrid: Some journals are treating the Jupyter notebooks as the paper itself and peer-reviewing them.

Angeline: Oh no, now I have to learn how to use Jupyter notebooks!

Alexa: We should probably have a special issue.

Angeline: Yeah, that would be a good idea. I suppose that's something I could lead.

Mike: Thanks Angeline!

Alexa: More comments? Please keep the conversation going! Also, include links on the slack channel. And let us know if you're interested in being involved next year.

Comments from the chat log:

Hyunju Kim Connor
1:25 PM
You mentioned about the ASI delivered model. What kind of models are available in your library?

Rebecca Ringuette

1:28 PM
You mentioned having memory problems with plotting. Kamodo uses Dask for exactly this issue. We could either work together for you to use Kamodo to help with this issue, or you could look at the code (open source) for ideas (https://github.com/nasa/Kamodo)

Ana Georgina Elias
1:28 PM
Is it possible to obtain the latitudes of the auroral boundary from the images you showed ?

Alec Engell
1:28 PM
xarray + Dask + geoviews + aurora-asi-lib = goodness! :). especially with dealing with huge data. Nice talk!

Hirani Sattenapalli
1:31 PM
does the library provide any functions that can use auroral radio emissions?

Doğa Can Su Öztürk
1:32 PM
models like GLOW?

Hyunju Kim Connor
1:32 PM
thank you.

Eric Donovan
1:34 PM
Good job Mike!

Ashton Reimer
1:34 PM
Can continue conversations in the Slack channel too! That persists.

Angeline Burrell
1:34 PM
Ana, do you have code that finds the polar/equatorward boundaries from the ASI images?
Excellent point Ashton!

Ana Georgina Elias
1:35 PM

Angeline: No, I don't. In fact I do not know how to work with images
And also in what coordinates are the "dots". Geomagnetic or geographic ?

Angeline Burrell
1:38 PM

Ana: A good place to start might be Boakes (2008) doi: 10.5194/angeo-26-2759-2008

Mykhaylo Shumko
1:40 PM

Ana and Angeline: Thanks for the reference! My first approach looks similar to the referenced approach: to collapse the image into an intensity-latitude line and identify the boundary from the shape.

Ana Georgina Elias
1:40 PM
Thank you !!

Angeline Burrell
1:40 PM
Ana and Mike: Once you have a routine to do this, I would love to incorporate it into OCBpy!

Rebecca Ringuette
1:41 PM
Russell, Kamodo will be able to do the interpolations you spoke of quite soon for a variety of models hosted at CCMC. See the presentation on June 24 3pm in the Model Software Engineering section.
Less for you to maintain (eventually)

Mykhaylo Shumko
1:44 PM
Rebecca: thank you for the idea. I have not heard of Kamodo, but I am interested in learning more about it.

Rebecca Ringuette
1:45 PM
Mykhaylo: You can reach us at the website I gave, or in Slack.

Rebecca Ringuette
1:46 PM
Lutz, Darren, and I are representing the Kamodo team at CEDAR

Hyunju Kim Connor
1:48 PM
what is role of pysatmodels? is this for running a model or for providing/analyzing existing model results? can it be used for other IT models like GTIM and CTIPe?

Angeline Burrell

1:50 PM
Hyunju: It is for analysing model data, but also for using model data in conjunction with observations. There are also some validation tools. Currently, it only has Instruments for TIE-GCM, DINEOFs, and sami2 (through sami2py). But it also allows you to use model data loaded into an xarray Dataset.

Rebecca Ringuette
1:51 PM
Russell: We currently have GITM, CTIPe, TIEGCM, IRI, and SWMF_IE integrated into a satellite flythrough software package in Kamodo. We should work together, Angeline!

Rebecca Ringuette
1:52 PM
https://github.com/rebeccaringuette/Kamodo

Angeline Burrell
1:53 PM
Rebecca: Absolutely! We've worked with another Kamodo person in the past. Would you like to email us? Then we can set a time to discuss future work :)
pysat.developers@gmail.com

Rebecca Ringuette
1:57 PM
Email sent.

Hyunju Kim Connor
2:00 PM
when you assimilate the electron density difference, electron flows are assumed to be negligible. is this good assumption?

Jason Derr
2:02 PM
Have you examined the modification of Poynting flux because of the corrections your model provides for smaller scale structures?

Leslie Lamarche
2:04 PM
Can you provide a link to that page?

Ashton Reimer
2:04 PM
https://github.com/dcsozturk/hime

Ana Georgina Elias
2:07 PM
Yes

Ana Georgina Elias
2:15 PM
The Earth's magnetic field you consider in SAMI2 is that from IGRF or a dipolar field ? Can you modify this field ? For example the dipole inclination or increase the mutipolar components importance ?

Astrid Maute
2:30 PM
NGDC provides a python package- how is this different?

Rebecca Ringuette
2:31 PM
CCMC provides user access to models, including IRI.

Rebecca Ringuette
2:33 PM
They could host the IGRF model

Angeline Burrell
2:42 PM
I agree!

Mykhaylo Shumko
2:42 PM
I agree Alexa. Well stated!

Angeline Burrell
2:45 PM
What does "ML" stand for?

Rebecca Ringuette
2:45 PM
machine learning

Astrid Maute
2:45 PM
IMO publication of the software is important since this is still a metric often used.

Ashton Reimer
2:46 PM
Agree with Astrid. It also is important from several other aspects, including reproducibility

Jeff Klenzing
2:47 PM
https://github.com/sami2py/sami2py

Mykhaylo Shumko
2:47 PM
aurora-asi-lib: https://aurora-asi-lib.readthedocs.io/en/latest/

Ashton Reimer
2:47 PM
Here's the slack invite link: https://join.slack.com/t/cedarscience/shared_invite/zt-q4e0zf11-83oGO~wy7jxlUzrn680Kwg

Astrid Maute
2:47 PM
Is there a slack channel for python?

Leslie Lamarche
2:48 PM
https://github.com/ciaranbe/pyIGRF/issues/2

Benjamin Johnson
2:48 PM
is that the general CEDAR slack?

Ashton Reimer
2:48 PM
There is a slack channel for this session #snakes_on_a_spaceship. I think that's as close to a "python" channel as there is.

Astrid Maute
2:49 PM
Great!

Rebecca Ringuette
2:49 PM
https://app.slack.com/client/T0155SNDV46/C016CCDL2DN
This is the link to this session's Slack channel

Leslie Lamarche
2:50 PM
Journal of Open Source Software: https://joss.theoj.org/

Ashton Reimer
2:52 PM
Has anyone here published in JOSS?

Alexa Halford
2:52 PM
I believe SunPy did but I haven't yet.

Liam Kilcommons
2:52 PM
NSF Earthcube has been soliciting Jupyter Notebooks as conference publications

Mykhaylo Shumko
2:52 PM
Agree!
Thank you for volunteering!

Rebecca Ringuette
2:53 PM
They should be containerized notebooks to guarantee it will run

Liam Kilcommons
2:53 PM
Angeline, I can connect you with existing resources on this notebook publication

Ashton Reimer
2:53 PM
At least 5

Liam Kilcommons
2:53 PM
Earthcube has a pretty structured template and review process

Ashley Smith
2:54 PM
a paper about publishing an executable paper: https://www.nature.com/articles/s42005-020-00403-4

Angeline Burrell
2:55 PM
Thanks Ashley!