Advanced Visualization of CCMC Simulations

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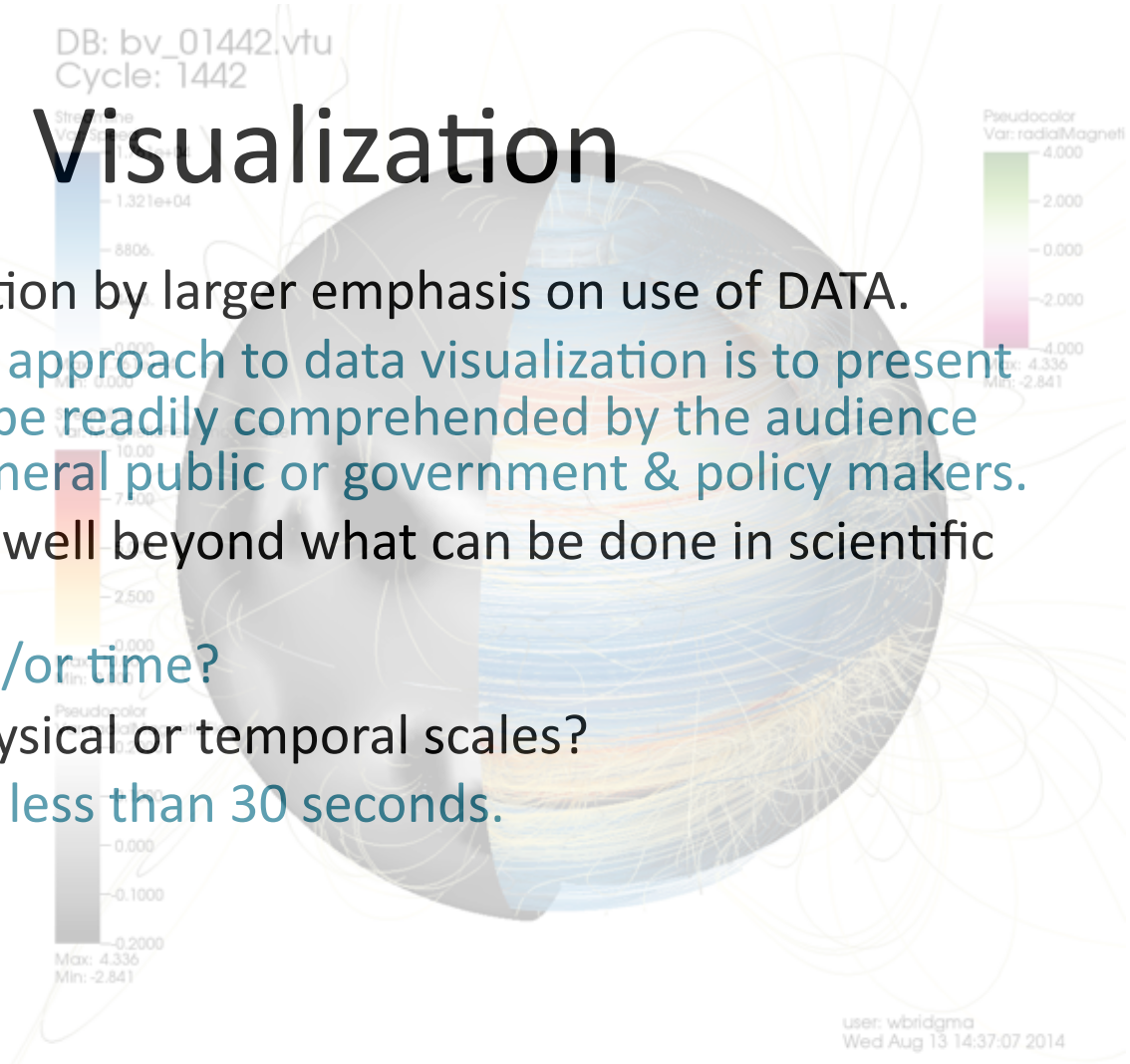
Data Visualization

- Distinguish from animation by larger emphasis on use of DATA.
- The primary goal in SVS approach to data visualization is to present data in a form that can be readily comprehended by the audience whether they be the general public or government & policy makers.
- Data in context, usually well beyond what can be done in scientific data visualization tools.
- Where is it in space and/or time?
- Are we exaggerating physical or temporal scales?
- Many of our visuals last less than 30 seconds.

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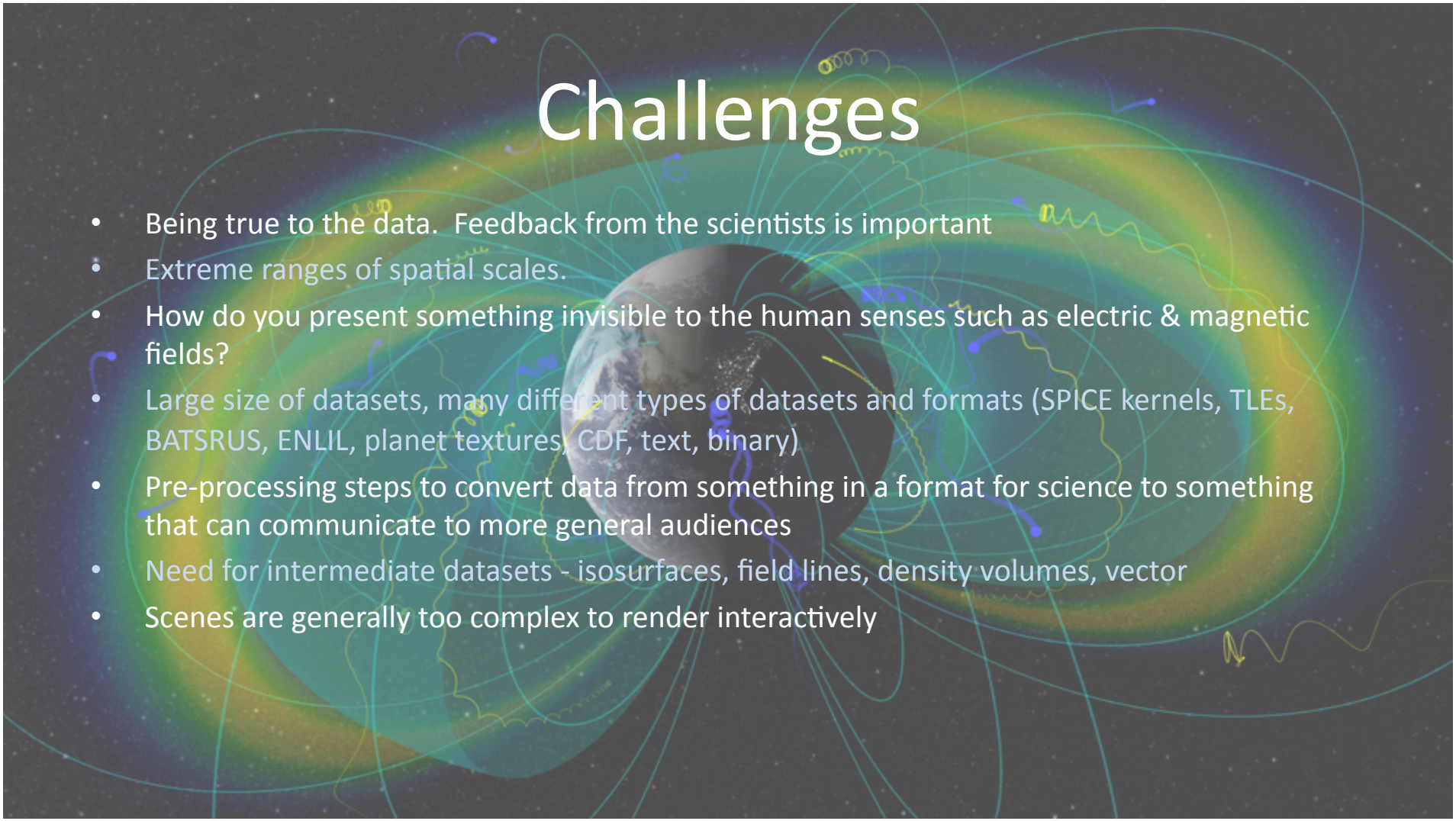
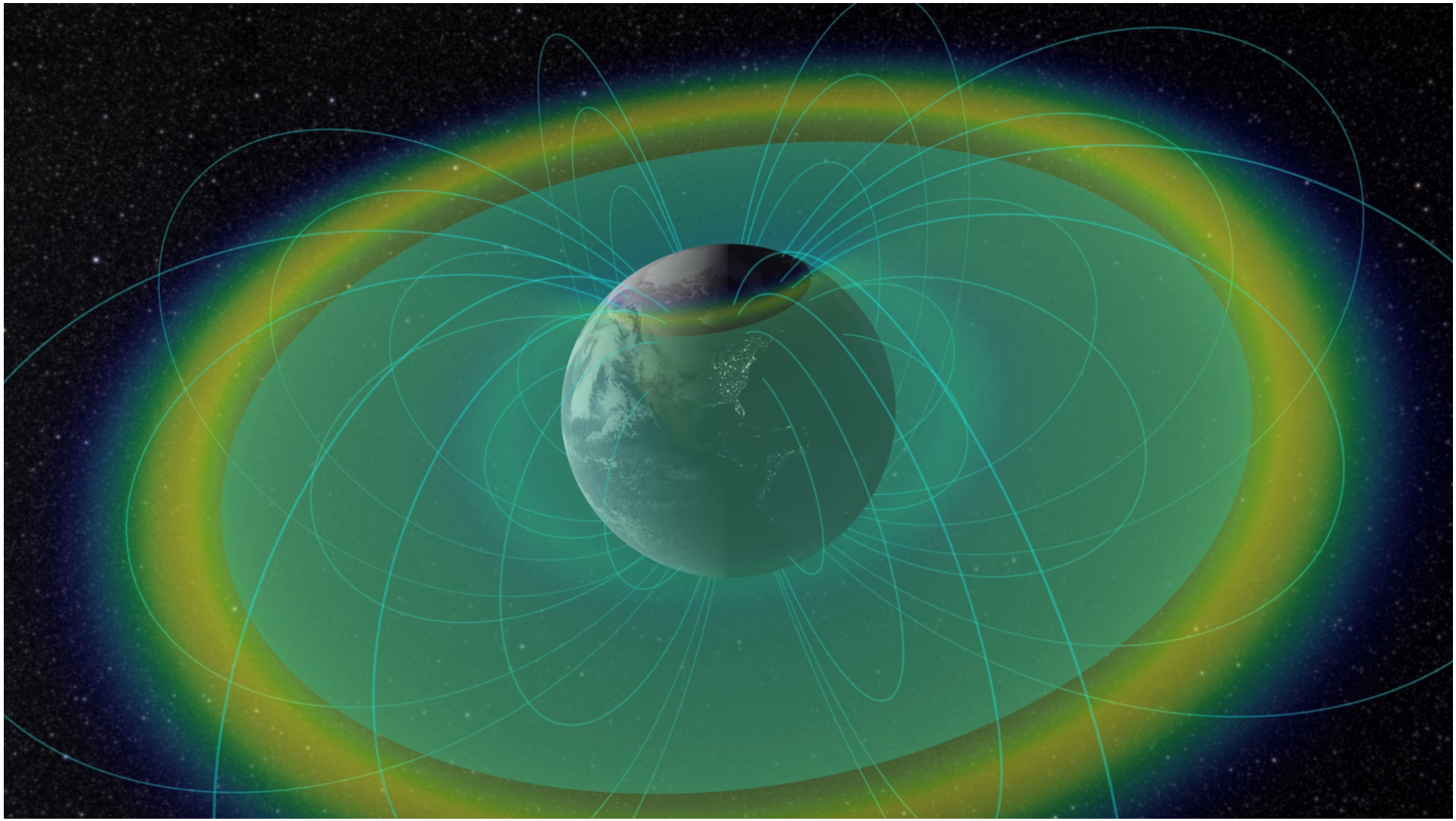


Challenges

- Being true to the data. Feedback from the scientists is important
- Extreme ranges of spatial scales.
- How do you present something invisible to the human senses such as electric & magnetic fields?
- Large size of datasets, many different types of datasets and formats (SPICE kernels, TLEs, BATSRUS, ENLIL, planet textures, CDF, text, binary)
- Pre-processing steps to convert data from something in a format for science to something that can communicate to more general audiences
- Need for intermediate datasets - isosurfaces, field lines, density volumes, vector
- Scenes are generally too complex to render interactively

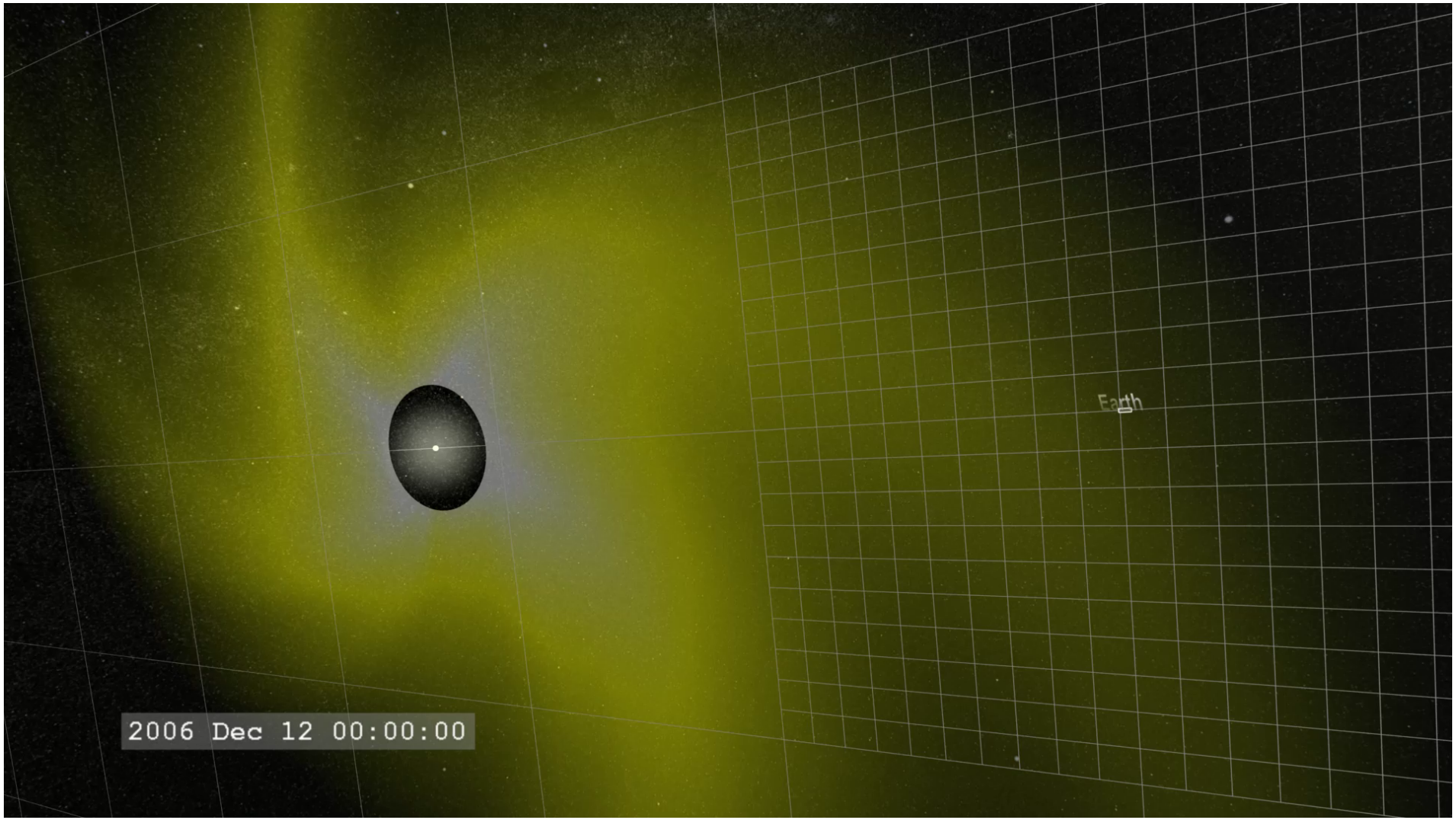


Requirements for Good Visuals

Models or data that might be perfectly satisfactory for scientific analysis may not be suitable for high-quality visualizations for public consumption

- Good time resolution. Shocks do not interpolate well
- Good spatial resolution.
- Good time and spatial COVERAGE
- Co-registration of different datasets. Does the cause from one dataset propagate cleanly to the next dataset?

Artifacts that look odd or unexpected can detract and/or distract the audience from your message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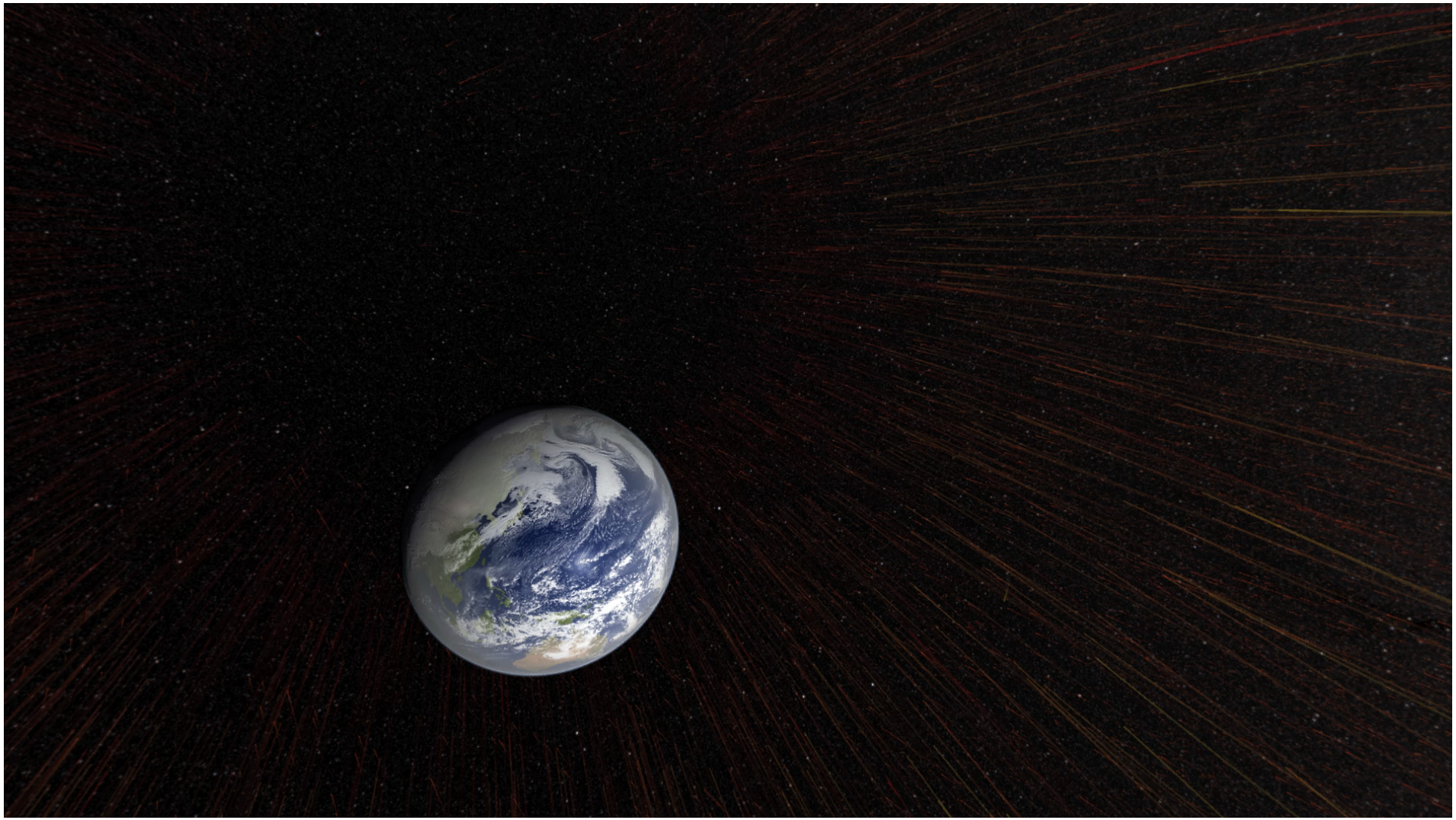
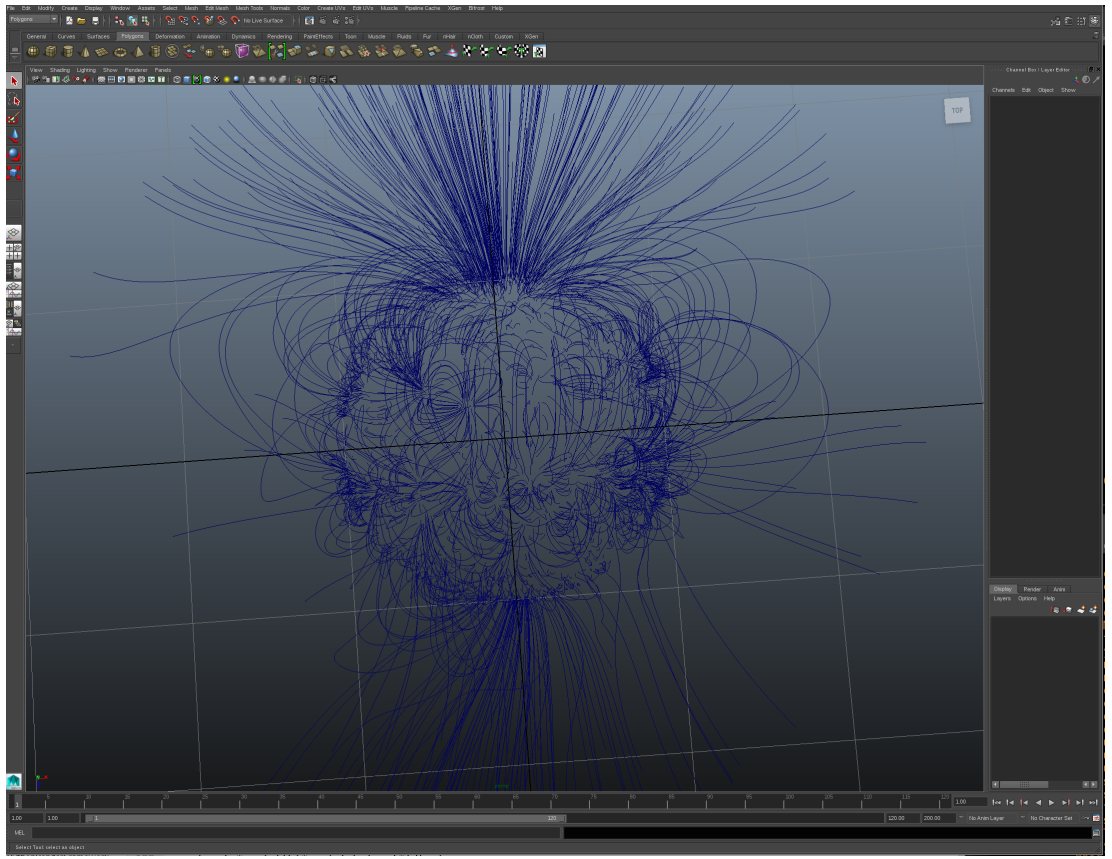


‘Standard’ Tools

Maya & RenderMan. Scripting in MEL. Data preprocessing using IDL, C

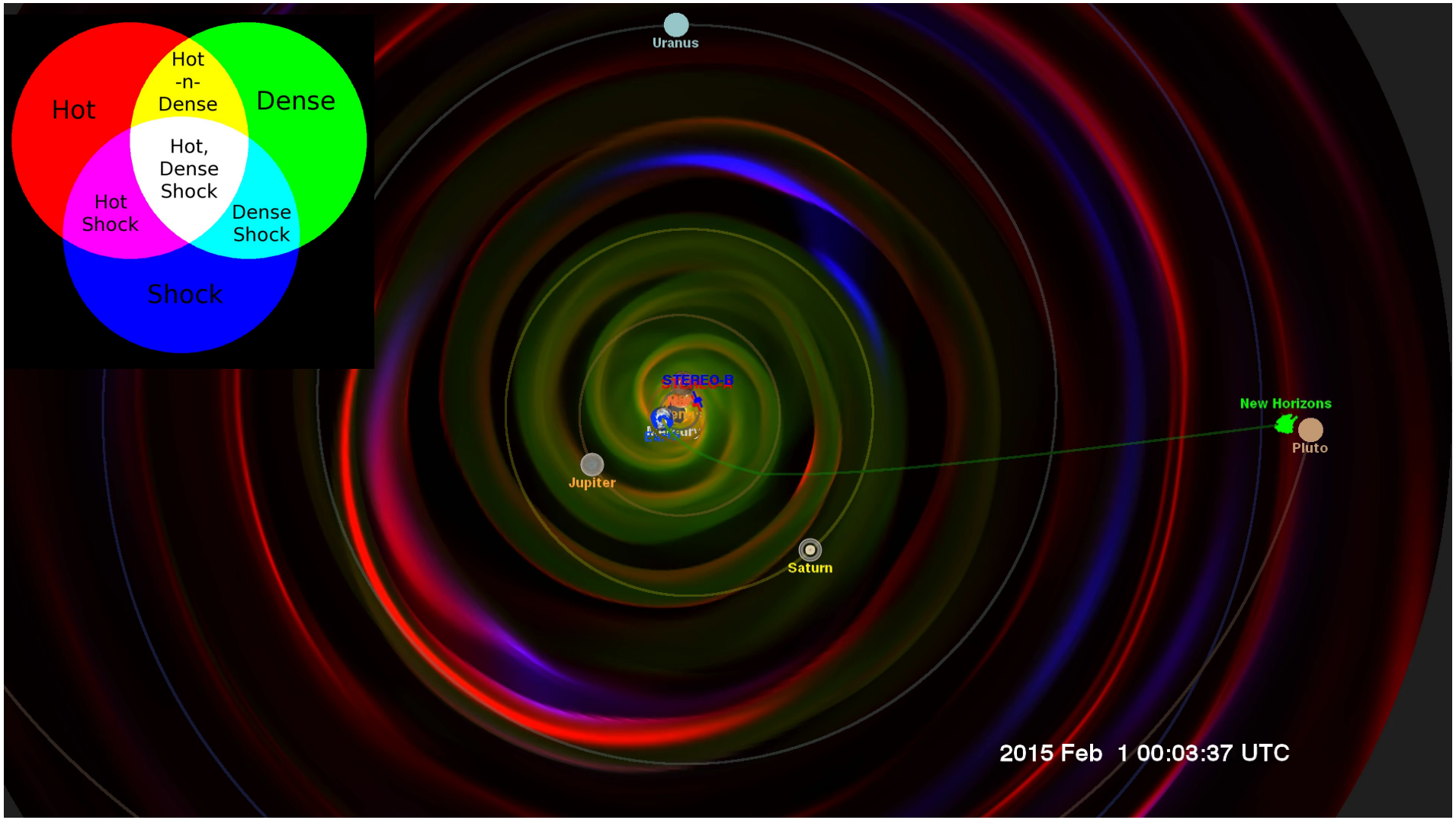
- Good: Camera control. ‘Preview' capability
- Bad: PRECISION motion control. Might need to convert many different datasets to different importable formats requiring more compute time and disk space.



My Tools

Python & RenderMan

- Good: Precise motion control. Some data processing performed at render time. Easier to integrate many different types of datasets through abstraction. Easier to make stand-alone pipelines.
- Bad: Difficult camera control. No preview capability.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New Horizons
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Jupiter
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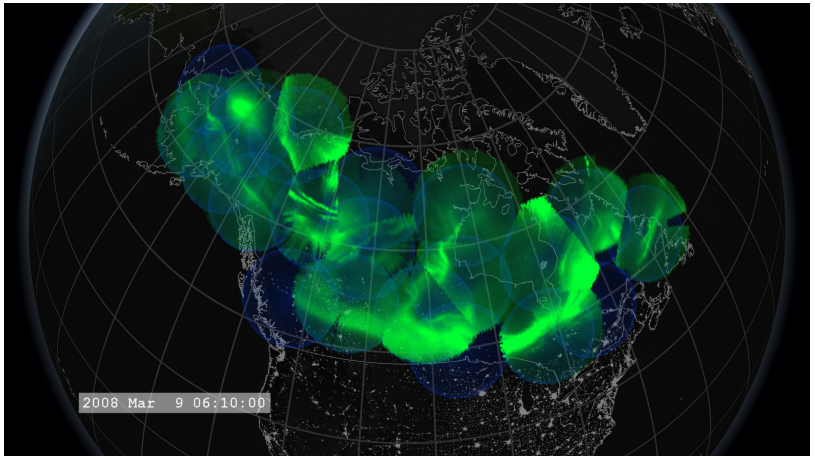
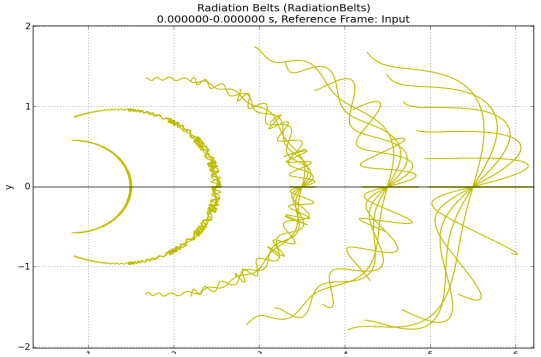
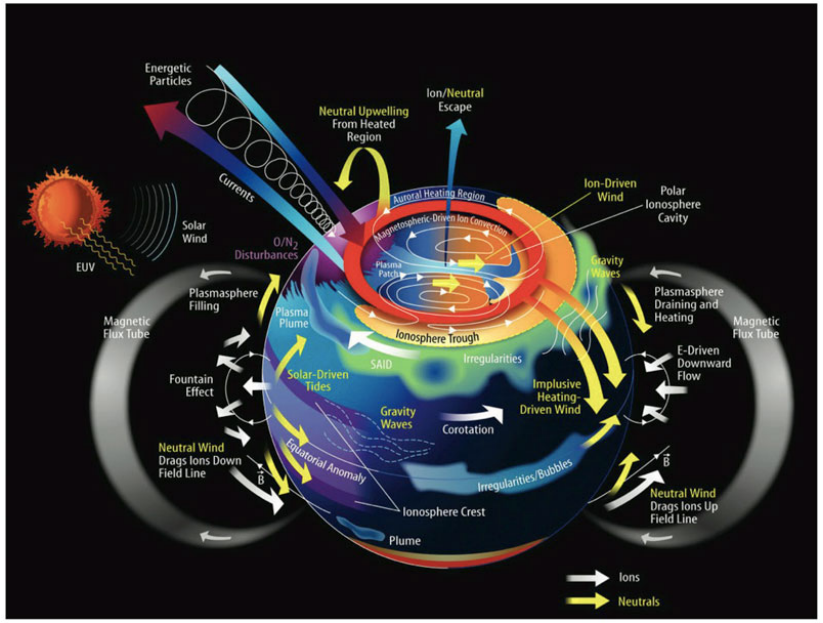
Wish List Items

By no means exhaustive…

- Aurora generator
- More realistic radiation belts
- Improved ‘Generalized’ magnetosphere model







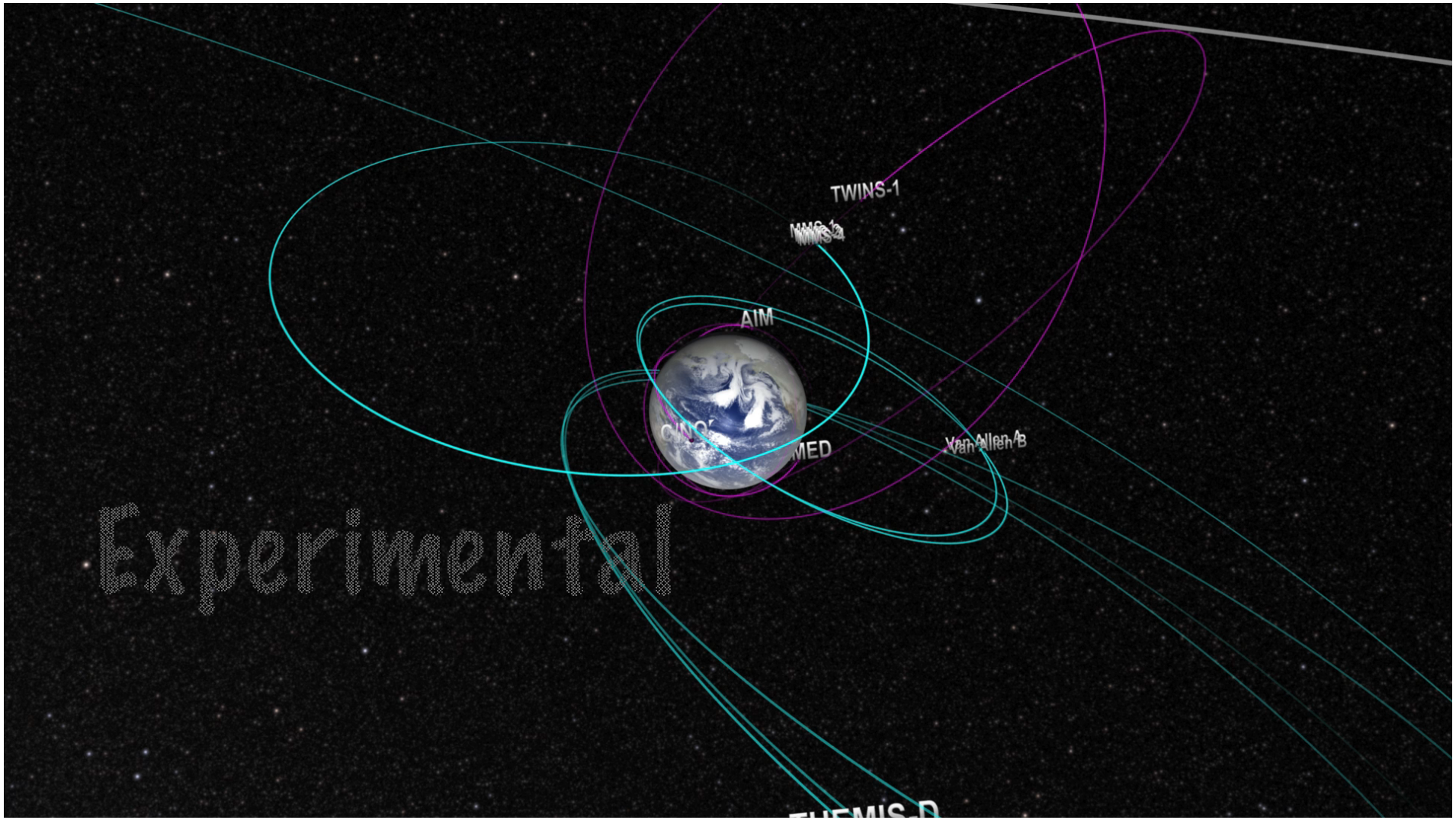
HOLY GRAIL

Datasets and models covering from the beginning of an event on the Sun

(a flare or CME)

to its terrestrial impacts

(magnetosphere, aurora)


TWINS-1
AIM
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Van Allen B
Experimental