Space Weather During the Summer of 2017

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Background

As part of the Ionospheric Connection Explorer (ICON) mission, the Space Sciences Laboratory runs a simulation model of the near-Earth space environment, fed by recently collected data from several different sources. ICON will study the coupling that occurs between the thermosphere and ionosphere by measuring key parameters. The task is to gain a familiarity with the Thermosphere Ionosphere Electrodynamics General Circulation Model (TIEGCM) , the UNIX environment that it is run in, the necessary inputs for it to be run (including solar EUV flux), and develop the capability to run the GCM daily to produce a space weather summary for each week of the summer and beyond. In the end result, the GCM will be able to be used to process data and output results automatically as new data is collected and inputted.

TIEGCM

To meet one of the mission's objectives, the Thermosphere Ionosphere Electrodynamics General Circulation Model (TIEGCM) will also incorporate data from the mission while it's in flight and be used in determining how the ionosphere at low latitudes is affected by large-scale atmospheric waves. Before the launch in November 2017, this modeling environment needs to be set up and tested, configured to run automatically when new data are downloaded, and produce summary plots of its different data fields. These include parameters as specific as the height of the ionospheric peak around the planet to its density, or the total abundance of plasma around the planet. The neutral atmospheric parameters can also be plotted: the zonal wind, the mean of the zonal wind, the abundance of oxygen vs the abundance of nitrogen, etc. In preparation for the arrival of mission data and regular running of the model, the TIEGCM can be run with real-time sources that are already prepared for the mission and being generated/delivered today.

Requirements

Objectives

- Create a TIEGCM startfile for the summer that would evaluate conditions from May to June and setup the TIEGCM run to use them
- Develop tools to automatically run TIEGCM long-term
- Setup scripts and file handling to run a simulation day when updated inputs are available
- Create long-term trending and plots to show solar rotation effects and other periodic forcing

Tools

- UNIX environment with optimal memory disk space
- Python
- TIEGCM files

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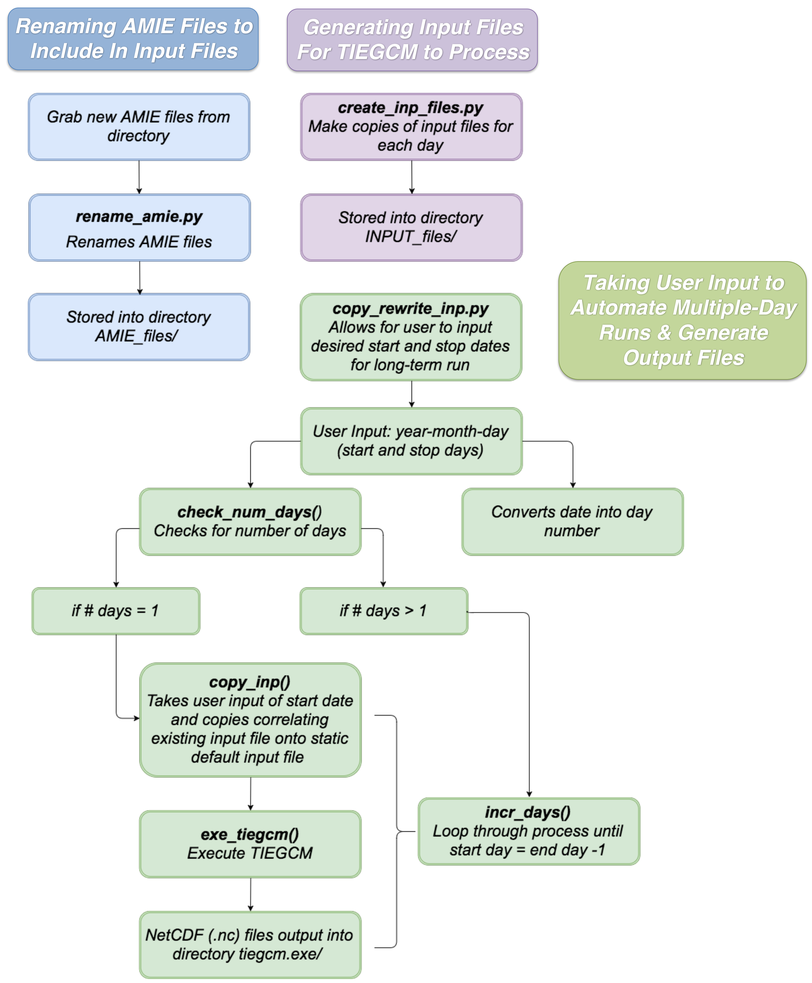
Architecture



Acknowledgements

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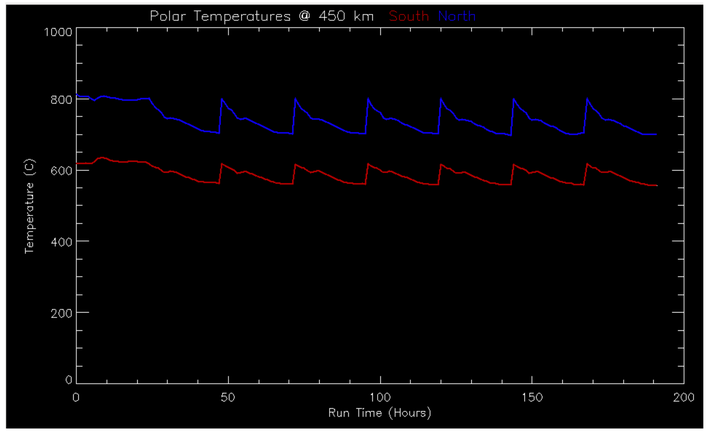
Results



North & South Polar Temperatures—*Plot shows the temperatures at both of the poles over a span of 8 days*

Conclusion & Future Work

The plot above depicts the data that can be produced by the TIEGCM over a span of eight days. During the long-term, TIEGCM runs can be automated to produce runs with several months' worth of data from AMIE files to show the effects of high latitude forcing and, eventually, HME files to show the effects of lower boundary forcing.

Future Work

- Incorporate leap years into the code
- Optimize user input validation
- Incorporate lower boundary forcing from Hough-Mode Extensions (HME)

References

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