2026 Workshop: GLOW Up: Community input and Code Development

Long title
Community-Driven maintenance and enhancement of GLobal AirglOW Model for Ionosphere-Thermosphere Science
Conveners
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Description

The GLobal AirglOW (GLOW) model, developed by Stan Solomon, calculates optical emissions from atmospheric species from ~100 km upward across the UV–NIR spectral range. While GLOW remains a foundational tool for connecting airglow and auroral intensities to the state of the ionosphere–thermosphere system, its development and usage have become fragmented. The original FORTRAN implementation (last formally updated in 2017) has since evolved through independent modifications, local Python wrappers, and user-specific workflows. As a result, it has become increasingly difficult to establish a consistent standard for comparison, validation, and reproducibility across studies.

Through this session, we will introduce a user-friendly version of GLOW that preserves the numerical accuracy of the original model while providing a transparent Python front-end and modular infrastructure. The updated framework supports a 2-dimensional calculation of column-integrated densities/volume emission rates and provides the option to use newer models for the atmosphere (MSIS-2.1), ionosphere (IRI-2020), and magnetic fields (WMM-2020) of your choosing. We will present the structure of the updated code, demonstrate setup and execution through a short tutorial with a Jupyter notebook example. In addition, we invite community members to share how they are currently using GLOW, what scientific insights they have gained, and what capabilities they would like to see implemented.

The broader goal of this session is to assess the current state of GLOW usage within the community, gather feedback on scientific and technical needs, and identify priorities for coordinated development.

Zoom Link: https://uml.zoom.us/j/92125954909

Agenda

1:30-1:31 Opening Remarks

Presentations:
1:33 - 1:47 Scott England [Virgina Tech] - ***Exploring the Quasi-6-day wave in the thermosphere with GLOW, ICON, and SD-WACCM-X***
1:48 - 2:02 Cameron Westerlund [University of Alaska Fairbanks - Geophysical Institute] - ***Modeling and inverting auroral imagery with GLOW***
2:03 - 2:18 Saurav Aryal [CU Boulder/LASP] - ***Quantifying Radiative Recombination contribution on GOLD observed O/N2 Ratio during Eclipses using GLOW***
2:19 - 2:34 Sunip Mukherjee [University of Massachusetts Lowell] - ***Probing Aeronomy: My Journey with GLOW***
3:18 - 3:30 Jun Liang [University of Calgary] - ***GLOW: Cross-model comparison of transport solver and auroral emission rate*** (end of session)

Tutorial:
2:35 - 3:15 glowpython2D hands on tutorial. To get the most out of the workshop, please
follow the installation instructions here [https://pypi.org/project/glowpython2/]. Instructions for both macOS and windows are provided.

Justification

GLOW remains a widely used and trusted tool for modeling airglow and auroral emissions and plays an important role in addressing key CEDAR science questions.

Over time, independent updates and customized implementations across the community have expanded its capabilities and applications. Bringing these developments together into a consolidated, community-supported version will strengthen GLOW as a shared scientific standard and facilitate consistent comparison and coordinated progress across studies. This session will provide a forum to (1) present a user-friendly yet performant implementation, (2) discuss priorities for future physics and infrastructure development, and (3) explore the formation of a working group to guide community-driven updates. By aligning model development with shared scientific objectives, this effort supports CEDAR's goals of collaborative model advancement and improved understanding of the ionosphere–thermosphere system.

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Explore exchange processes at boundaries and transitions in geospace
Manage, mine, and manipulate geoscience/geospace data and models
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Keywords
GLOW Model, Airglow, Aeronomy
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