

STUDY ON AIRGLOW VARIABILITIES USING SATELLITE OBSERVATIONS

**(Under TDP/Adv. R&D programme, “Study on airglow using satellite observations
and model simulations: Precursor study for UrVASI/DISHA”)**

Work, Schedule, Responsibility, and Fund Allocation for project period
September 2024 – August 2025



Space Applications Centre, ISRO, Ahmedabad

and

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August 2024

Space Applications Centre, ISRO, Ahmedabad

Project Investigator from ISRO

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1. Scope of Work

Airglow is a faint emission of light by atmosphere, and its study helps to understand various processes/phenomena of the upper atmosphere (~80-500 km). The emissions (line, band, and continuum) occur in ultraviolet to infrared regime from different altitude range. Airglow is classified as night airglow, day airglow and twilight airglow. Various satellites have measured airglow intensity in different wavelength regime. In present project, multiple satellite observations of visible airglow will be analyzed to understand its spatial and vertical distributions, and associated upper atmospheric processes. Airglow intensities will be simulated globally using numerical model.

2. Objectives

Present project aims to study the airglow in visible range using satellite observations, and modeling with the following objectives:

- Global distributions (spatial and vertical) of visible airglow using multiple satellite observations
- Global simulation of visible airglow using numerical model
- Analysis of associated upper atmospheric processes

3. Study area & Data Requirement

- Study region is entire globe.
- Use of available satellite datasets: MIGHTI (Michelson Interferometer for Global High-resolution Thermospheric imaging) aboard ICON (Ionospheric Connection Explorer); TIDI (TIMED Doppler Interferometer) aboard TIMED (Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics); VISI (Visible and near-Infrared Spectral Imager) aboard ISS-IMAP (Ionosphere, Mesosphere, upper Atmosphere and Plasmasphere mapping mission from the International Space Station); WINDII (Wind Imaging Interferometer) aboard UARS (Upper Atmosphere Research Satellite), etc. In addition, other supporting satellite observations to be used.
- Use of model: IRI (International Reference Ionosphere) and GLOW (GLobal AirglOW).

4. Methodology

Following datasets and tools are planned to be utilized to understand the airglow variabilities and associated upper-atmospheric processes.

- Satellite observations (MIGHTI, TIDI, VISI, WINDII, etc.) for regional-to-global scale understanding
- Simulations of airglow intensity using GLOW model at prominent five visible wavelengths (Blue: 427.8 nm, Green: 520.0 nm, Green: 557.7 nm, Red: 630.0 nm, Dark Red: 732.0 nm).
- Obtain spatial/vertical distributions for different seasons using aforementioned satellite observations and model simulations and investigate the variabilities linking it with atmospheric processes.

5. Responsibilities/Role of CA

- Global distribution (spatial and vertical) of visible airglow intensities using multiple satellite data
- Investigations on upper-atmospheric processes based on airglow variabilities
- Official approval from funding agency- SAC, ISRO is must prior to any publication (report, paper, book chapter, conference paper, abstract, etc.).

6. Work plan and Schedule (Timeline)

Sr. No	Activities	Start	End	Responsibility
1	Literature Review of airglow observations and processes	T ₀	T ₀ + 01	Gujarat University and SAC
2	Model simulations, and analysis of their variabilities, etc.	T ₀ + 02	T ₀ + 04	Gujarat University and SAC
3	Analysis of multiple satellite observations and investigations of processes associated with airglow	T ₀ + 05	T ₀ + 11	Gujarat University
4	Report writing and final documentation	T ₀ + 11	T ₀ + 12	Gujarat University

7. Manpower and Resources Requirement:

Manpower: One research fellow at Gujarat University will be required.

Qualification : JRF with an M. Sc. (Physics) (55%) with NET or GATE is needed.

Fellowship : The JRF will be paid Rs. 37,000 per month with 27% additional for paying house rent as per UGC/CSIR/DST/ISRO-SAC/GU norms.

Model/Programming language: (a) Python/MATLAB (b) IRI and GLOW models desirables

8. Total Budget to CA


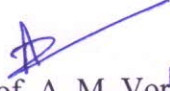
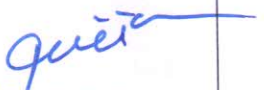

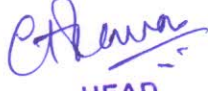
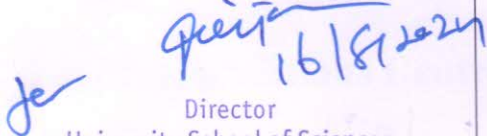

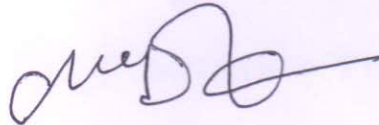
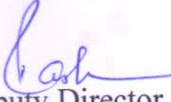
Sr. No.	Item Description	1 st year (Sep 2024 – Mar 2025)	2 st year (Apr 2025 – Aug 2025)	Total
1	Salary of JRF/SRF (37000 + 9990 (HRA) = 46,990 per month)	2,59,000 + 69,930 (HRA@27%) = 3,28,930	1,85,000 + 49,950 (HRA@27%) = 2,34,950	5,63,880
2	Travel	25,000	25,000	50,000
3	Contingency	25,000	25,000	50,000
3	Total (without institutional overhead)	3,78,930	2,84,950	6,63,880
4	Institutional overhead (@10%)	37,893	28,495	66,388
5	Total (with institutional overhead)	4,16,823	3,13,445	7,30,268

Total: 7,30,268/-

9. Expected results /deliverables

- Intensities of airglow at different wavelengths in visible regime, global distributions and vertical profiles.
- Role of different upper-atmospheric processes responsible for observed changes in airglow intensities.

Signatures:

 21 Aug 2024 Principal Investigator (SAC, Ahmedabad)	  Prof. A. M. Vora / Prof. P. N. Gajjar Department of Physics Principal Investigators, School of Sciences, (Gujarat University), Ahmedabad-380009.
 Head, Environmental Sciences Division (SAC, Ahmedabad)	 HEAD DEPARTMENT OF PHYSICS Head, Department of Physics SCHOOL OF SCIENCES (Gujarat University) GUJARAT UNIVERSITY AHMEDABAD-380009.
 Director University School of Sciences Director, School of Sciences (Gujarat University) 09.	 Registrar Gujarat University, Ahmedabad-380009. Registrar (Gujarat University)
 Group Director, SESG (SAC-Ahmedabad)	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;"> डॉ. मेहुल आर. पंड्या Dr. Mehul R. Pandya समूह निदेशक / Group Director एसईएसजी-ईपीएसए / SESG-EPSA </p> </div>
 Deputy Director, EPSA (SAC-Ahmedabad) डॉ. रश्मि शर्मा / Dr. Rashmi Sharma उप निदेशक / Dy. Director ईपीएसए/EPSA	

