

Introduction to Geostationary Satellites and Their Data Analysis & Interpretation Techniques

Prepared by

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FAIR Science in Climate

Objective

This course is designed for students and researchers who are eager to engage with the practical aspects of geostationary satellite data manipulation using Python. Through comprehensive, hands-on Jupyter notebooks, participants will gain fluency in the tools and techniques essential for the analysis and interpretation of data from specific satellites covered in the course materials.

Overview of steps

Students are encouraged to utilize the Jupyter notebooks and accompanying PDF solution files to navigate the course content step-by-step. These resources are structured to guide learners through the process of analyzing data from various geostationary satellites, including Advanced Himawari Imager, Advanced Meteorological Imager, and Geostationary Operational Environmental Satellite. Each notebook is enriched with comments that not only explain the code but also contextualize the data handling techniques applied. This structured approach ensures that students not only learn how to execute data analysis tasks but also understand the underlying principles and applications of the data they work with.

Resources

Part 1: Fundamentals of remote sensing

[Remote Sensing Tutorials](#)

Part 2: Introduction to Geostationary Satellites

1. Introduction to Geostationary Satellites:

- **Geostationary Satellites:** These satellites orbit the Earth at the same rotational speed as the planet, allowing them to remain fixed over a specific geographic

region. They provide continuous monitoring of atmospheric conditions and space weather. [You can find more information about NASA satellites.](#)

- **Geostationary Orbit:** Learn about the unique characteristics of geostationary orbits and how these satellites maintain their positions above specific regions on Earth. [Read more here.](#)

2. **Advanced Himawari Imager (AHI):**

- **Overview:** [The Advanced Himawari Imager \(AHI\)](#) is part of the Himawari series of geostationary satellites. It provides data for better forecasting, improved numerical weather prediction accuracy, and enhanced environmental monitoring. AHI data is crucial for advanced warning during dangerous weather events.
- **Himawari-8:** [Himawari-8](#), equipped with AHI, captures visible light and infrared images of the Asia-Pacific region.

3. **Advanced Meteorological Imager (AMI):**

- **Geo-Kompsat-2A (GK2A):** The [GK2A](#) satellite features the new Advanced Meteorological Imager (AMI) with significantly higher radiometric, spectral, and spatial resolution than its predecessor. AMI provides critical data for weather forecasting, climate monitoring, and environmental observation.

4. **Geostationary Operational Environmental Satellites (GOES):**

- **Overview:** [GOES satellites](#) provide advanced imagery and atmospheric measurements of Earth's Western Hemisphere. They offer real-time mapping of lightning activity, solar monitoring, and space weather observations. GOES-East (formerly GOES-R) and GOES-West (formerly GOES-U) watch over more than half the globe.
- **GOES-R Series:** The GOES-R Series includes GOES-16 (East) and GOES-17 (West). These satellites significantly improve detection and observation of environmental phenomena affecting public safety, property, and economic health.

[Guide to GOES-R Series Data](#)

[GOES ABI \(Advanced Baseline Imager\) Realtime Imagery](#)

[GOES Image Viewer](#)

Instructions

The course is organized around a series of lectures, each corresponding to specific satellite data and accompanied by detailed Jupyter notebooks and solution PDFs. Here's how to navigate the materials:

- Lecture 1: Advanced Himawari Imager (AHI) Data Analysis
- Notebook: Introduction to AHI data manipulation.
- Solution PDF: Detailed step-by-step solutions for AHI data analysis.

- Lecture 2: Advanced Meteorological Imager (AMI) Data Analysis
- Notebook: Techniques for processing AMI satellite data.
- Solution PDF: Comprehensive solutions for exercises on AMI data.

- Lecture 3: Geostationary Operational Environmental Satellite (GOES) Data Analysis
- Notebook: Exploration of GOES satellite data handling.
- Solution PDF: Step-by-step guide through GOES data analysis tasks.