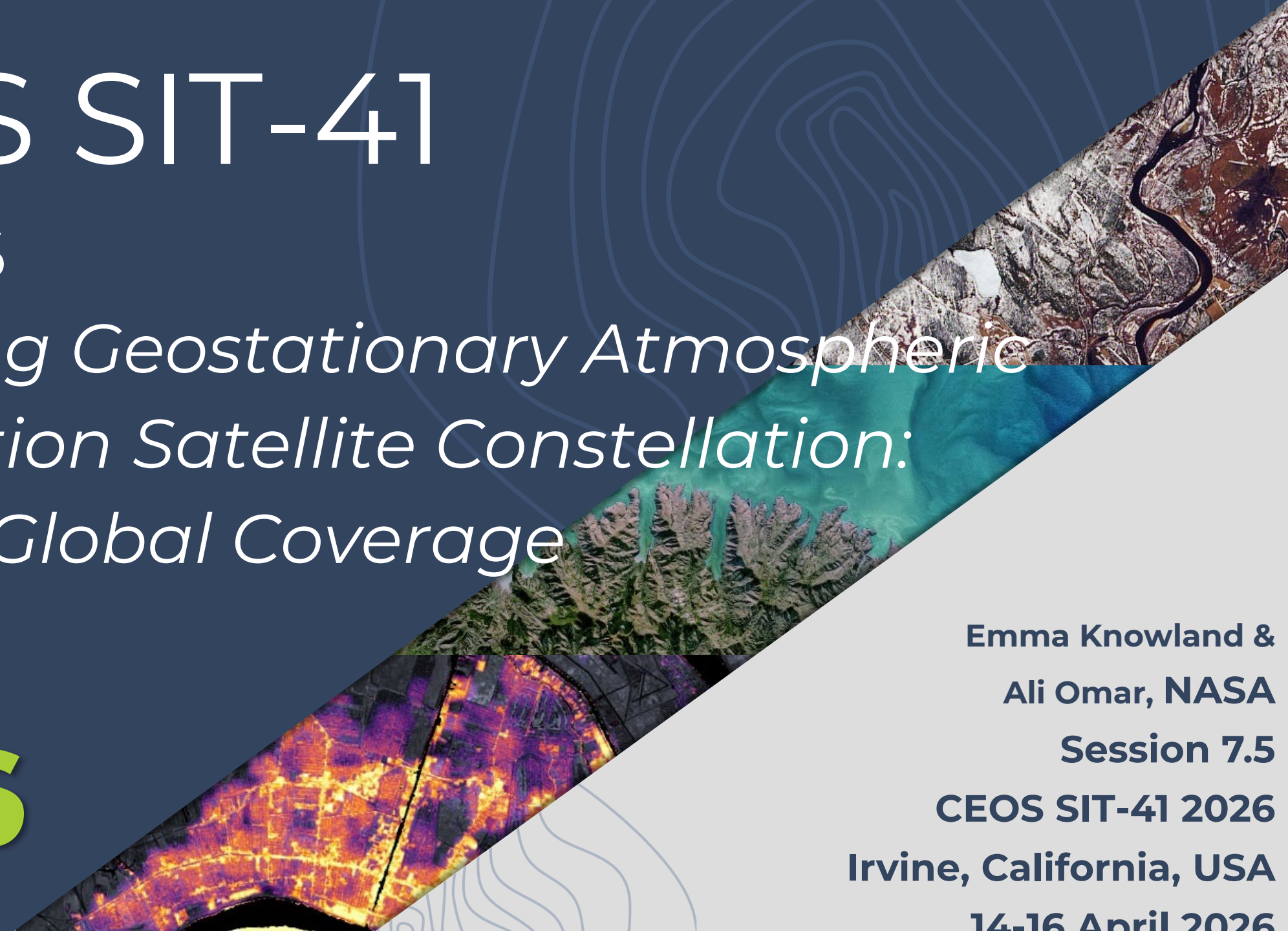
CEOS SIT-41

April 2026

Expanding Geostationary Atmospheric Composition Satellite Constellation: Towards Global Coverage



Emma Knowland &

Ali Omar, NASA

Session 7.5

CEOS SIT-41 2026

Irvine, California, USA

14-16 April 2026

CEOS

Committee on Earth Observation Satellites

GENESIS

- In 2024, CEOS AC-VC commissioned a new White Paper
- The initial goal was to complement GEMS, TEMPO, and Sentinel-4 with global air quality and greenhouse gas observations
- A dedicated team has been meeting bi-weekly to draft the document
- The initial plan was presented at the October 2025 CEOS SIT Meeting
- Following this meeting, the scope was reduced to focus exclusively on air quality

A finalized White Paper will be ready for the **2026 SIT Fall meeting** for review by the Principals.

Study Co-Authors

Ali Omar, Emma Knowland, Jonathan Hickman, Barry Lefer, **NASA**

Shobha Kondragunta*, Owen Cooper, **NOAA**

Pieternel Levelt *, **UCAR/NCAR, KNMI, TU Delft**

Shima Shams, Helen Worden, James Hannigan, **UCAR/NCAR**

Arlindo DaSilva, **NASA Emeritus**

Sheldon Drobot, Dennis Nicks, **BAE**

Raid M Suleiman, Xiong Liu, **CfA | Harvard & Smithsonian**

Omar Emam, **Intopass, UK**

Ray Nassar, Chris Sioris, **ECCC**

Dominika Czyzewska, **EUMETSAT**

Ben Veihelmann, **ESA, the Netherlands**

Paulo Artaxo, **University of Sao Paulo, Brazil**

Betsy Farris, **University of Colorado, Boulder**

Sara Basart, **WMO, Geneva**

Ana Andries, **Surrey University, UK**

Jun Wang, **University of Iowa**

Dylan Millet, **University of Minnesota, Twin Cities**

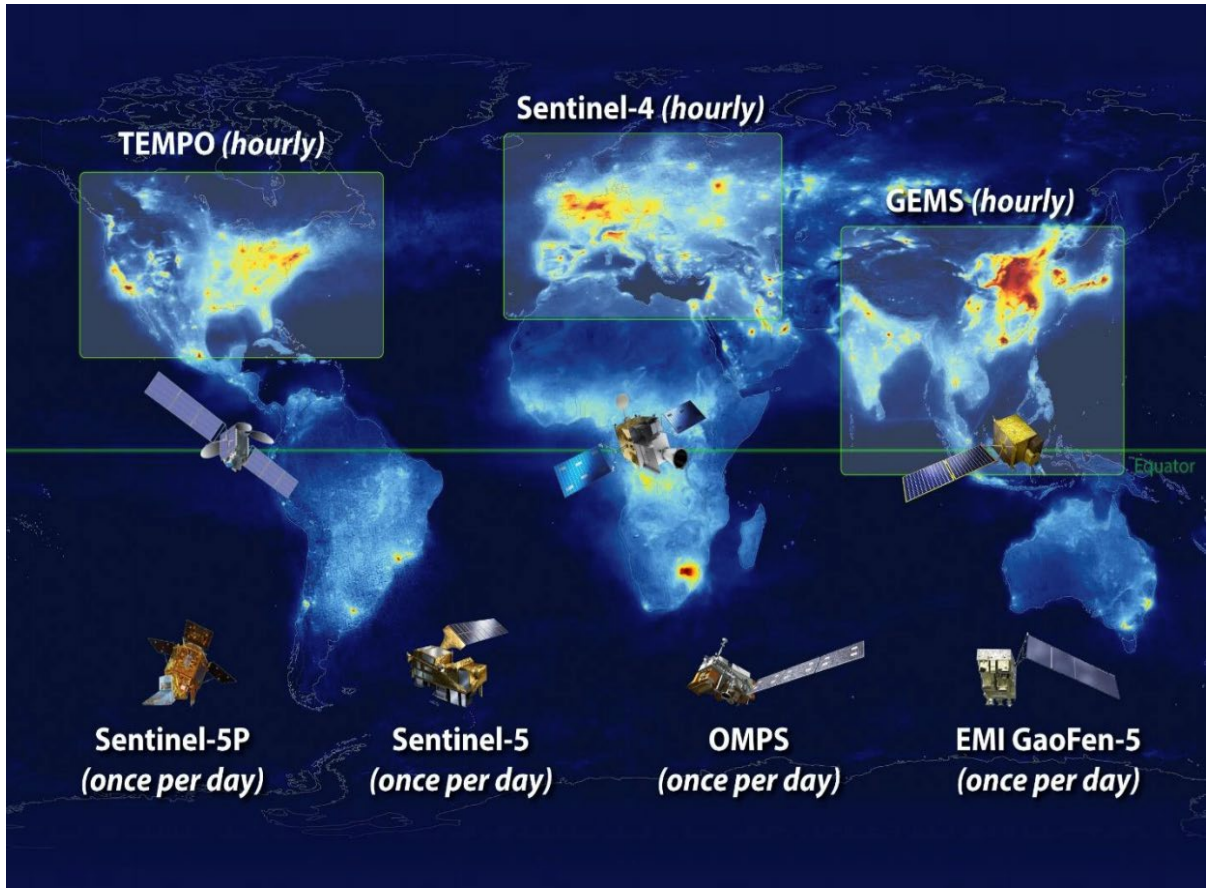
⭐**White Paper Co-Leads**

The Challenge – Addressing the Gap in Observations

- Human activities drive rapid atmospheric changes.
- The fast pace of change requires hourly observations.
- These shifts directly impact air quality and human health.
- Accurate measurements are vital to guide actions and evaluate the success of current strategies

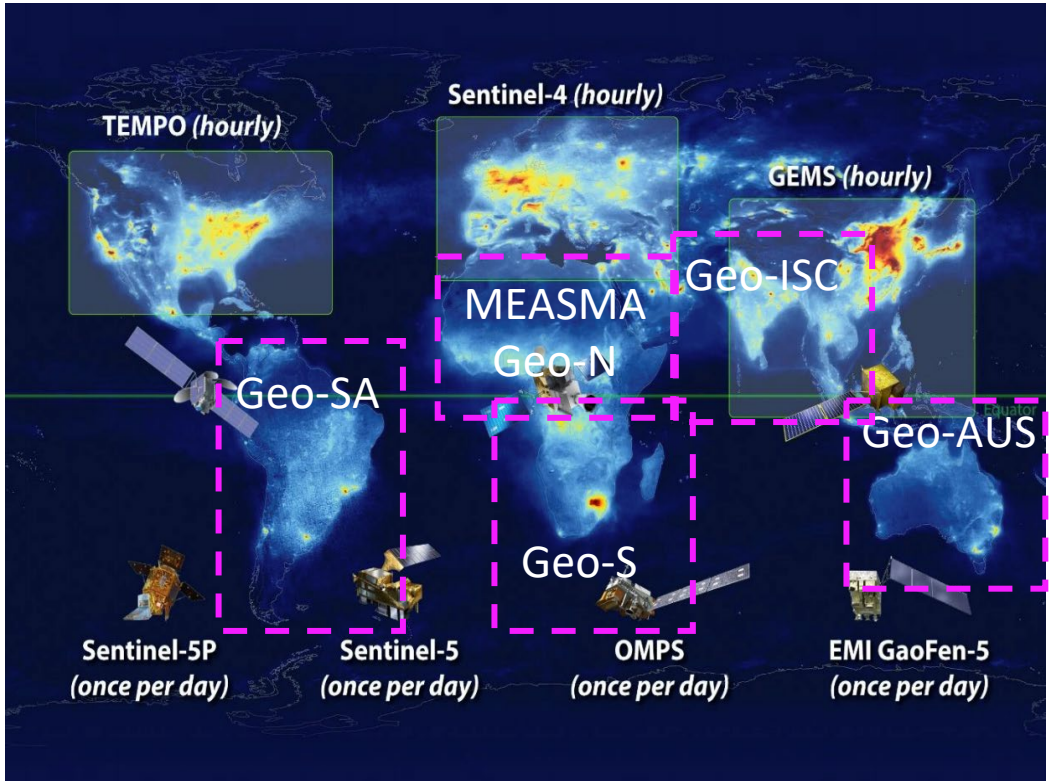
Tropospheric Nitrogen dioxide (NO_2) column concentration retrieved by Sentinel 5P for the month of June 2024. High column densities (denoted by bright red colors) over the South Africa are associated with high power plant and industrial emissions in the region. Elevated column densities over south equatorial Africa are associated with dry season biomass burning activity

The Current Landscape



- The CEOS Atmospheric Composition Virtual Constellation (AC-VC) partners provide valuable data
- Gaps remain in observing diurnal cycles, rapidly changing events, and specific pollutants in the SH and populated NH regions
- Polar-orbiting satellites offer global coverage, but limited temporal resolution

Closing the Gap: The Global Geostationary Satellite Solution



- Five new geostationary satellites identified to cover the gaps
- Continuous, wide-area coverage over currently undermonitored regions
- Complementing and enhancing existing constellation
- Significant ownership and participation at the regional level to build capacity
- Leverage the Analysis Ready Data (ARD) concepts for Geo

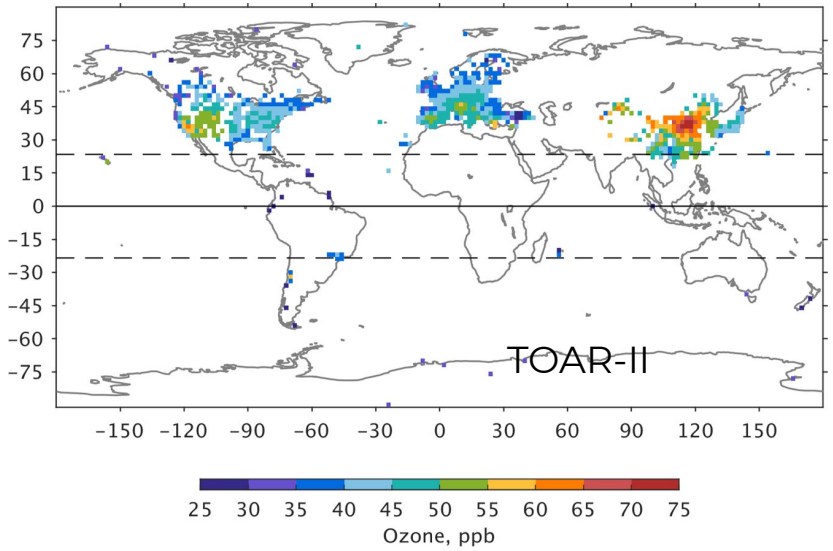
The benefits of investing in geostationary atmospheric composition monitoring extend far beyond the science. By improving our ability to predict and respond to environmental challenges, we can realize significant economic savings in areas such as healthcare, agriculture, and resource management.

Strengthening Ground-Based Measurements for Calibration/Validation

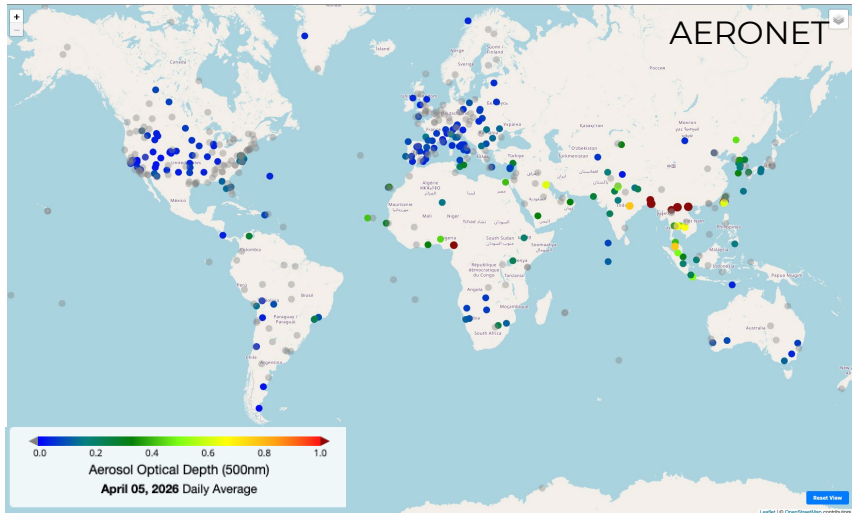
- Leverage existing ground-based networks (e.g., AERONET, Pandonia, NDACC).
- Establish strategically located collection of instruments at relevant sites
- Focus on comprehensive instrumentation and local capacity building.
- Engage diaspora scientists to reach local institutions (e.g., AMS Townhall Jan 2025) in developing countries

The disparity in atmospheric composition ground-based measurements around the globe creates an issue, as unmonitored regions are often disproportionately impacted by pollution but lack the resources to monitor and mitigate the impacts effectively.

Ground Stations for Monitoring Ozone, Nitrogen dioxide, and Particulate Matter



- All available surface ozone (O_3) observations from the Tropospheric Ozone Assessment Report (TOAR). Note that Ozone monitors exist in Australia but are not yet in the open-access TOAR-II database (Szopa et al., 2026)
- Pandonia Global Network (PGN) – Trace gases NO_2, O_3, HCHO, etc
- AERONET – Optical Depth (proxy for PM)



Strengths

Uniform and standardized

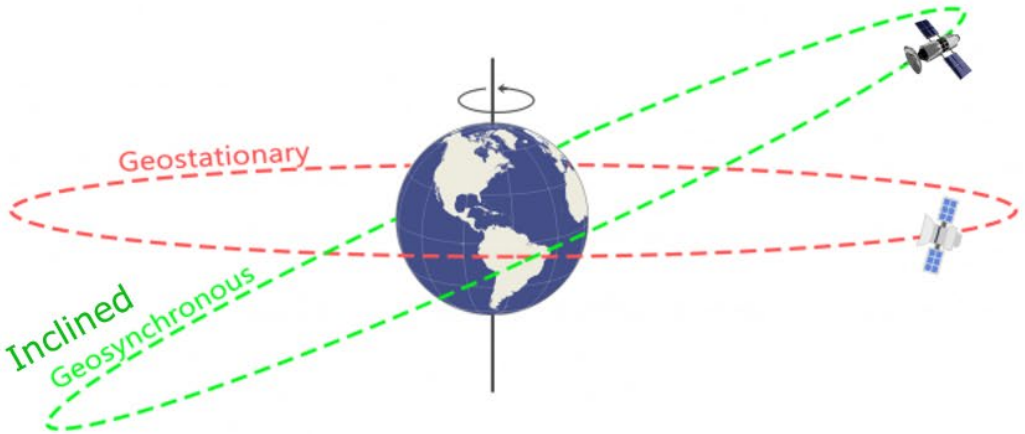
- Algorithms /data processing
- Instrument operating routines
- Quality control

Real-time data processing

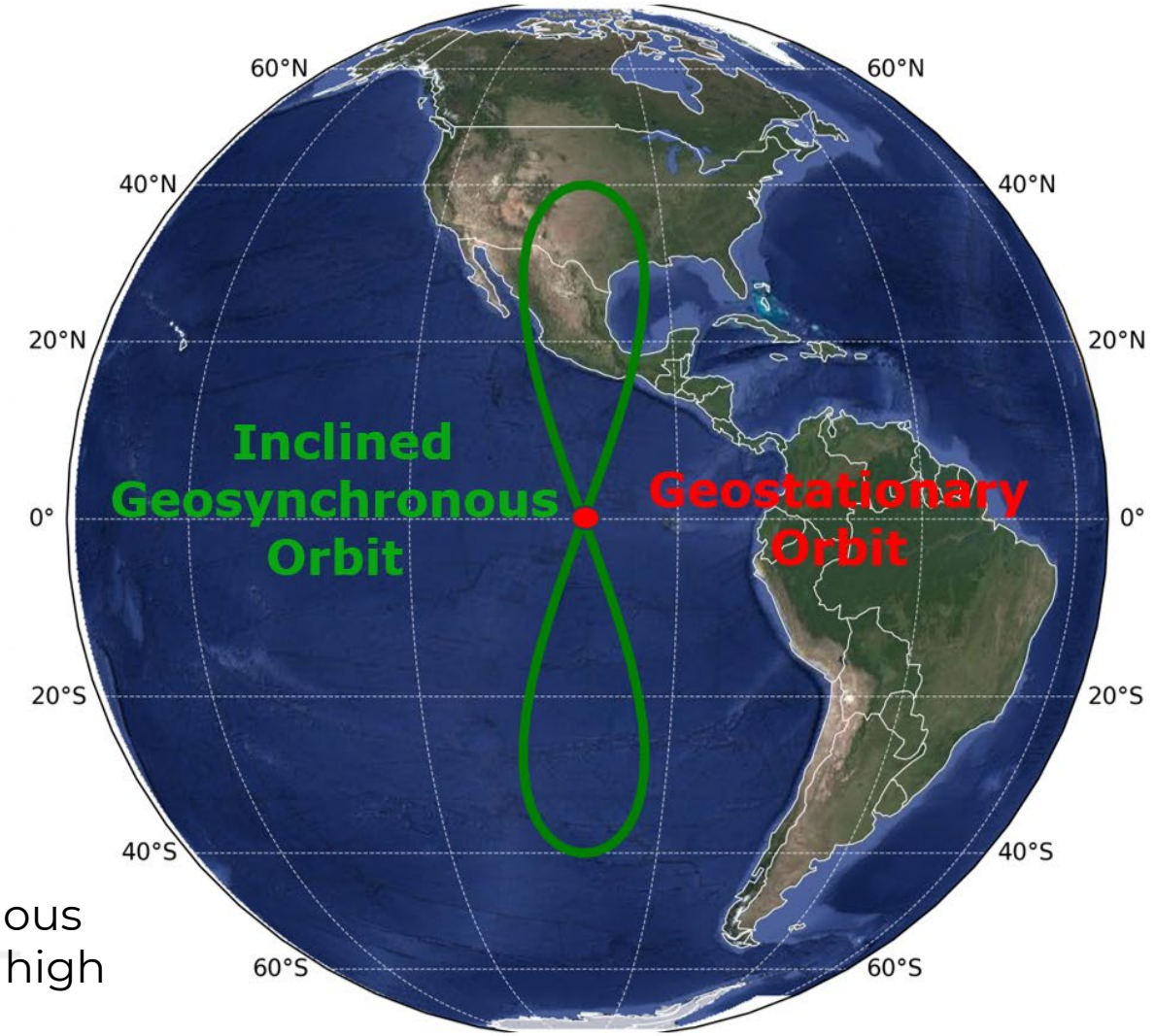
Data archiving

Geostationary observations will provide data in regions not covered by ground networks

Inclined Geosynchronous Orbits (IGOs)

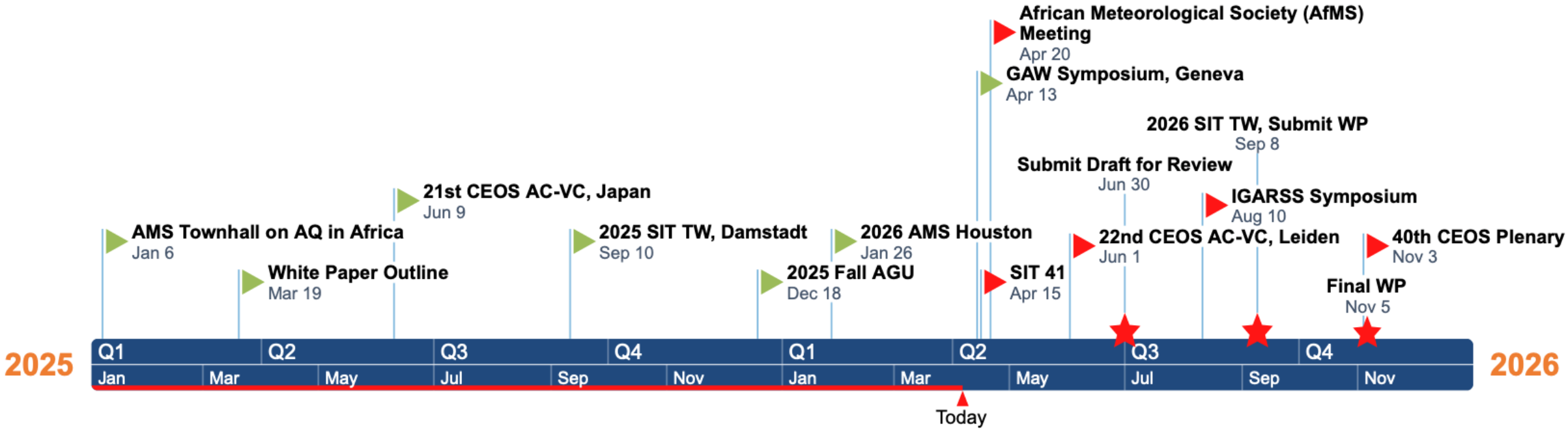


Altitude = 35,786 km



ECCC has proposed the use of Inclined Geosynchronous Orbits (IGOs) to observe under monitored regions at high northern latitudes

Schedule



AQ Community Review WhitePaper — Jul 1 - Aug 14

Prepare Draft Final White Paper — Aug 17 - Sep 3

★ Major Milestone/Deliverable

Decisions, outcomes, or actions sought

- Update the SIT on current status and strategic objectives of the *Expanding Geostationary Atmospheric Composition Satellite Constellation: Towards Global Coverage* white paper.

- Highlight the urgent, global need for improved atmospheric composition monitoring capabilities.

- Emphasize the vital importance of deploying geostationary satellites to complement existing polar-orbiting systems.

- Solicit volunteer subject matter experts and reviewers to author and review sections of the white paper

End goal – Gain SIT endorsement of the White Paper (Oct 2026)

Join our team if you want to participate as author or reviewer
Write to: ali.h.omar@nasa.gov

Backup slides

Presenter Guidelines

- **Presenters should name their file using the following convention:**
  - AgendaItemNumber_LastName_Subject *(e.g., 1.1_Surname_Welcome)*

- ***Documents and presentations should be uploaded to the shared folder to allow for streamlined self service***
  - **Shared Presentation Folder (default view only, ask for upload/edit permission as required)**
  - **For support** contact the SIT Chair Team: nasa-sit-chair-2026-27@googlegroups.com
  - **Presentations** and **documents for information** should be submitted by **7 April 2026**
  - **Documents to support decision-making** should be submitted to the SIT Chair Team by **31 March 2026**

- *Reporting to engage discussion or decision is encouraged*, but detailed reporting should be provided as pre-meeting reading material or in background slides.

- **Please explicitly highlight the decisions, outcomes, or actions you are seeking.** The more explicit you are, the better. i.e., feel free to provide text for a proposed action – it may be revised later, but this approach will help with the efficient preparation of the actions record of the SIT meeting.

Outline of White Paper and this Presentation

01 **THE CHALLENGE**
Observation Gap

02 **CURRENT LANDSCAPE**
Limitations of existing observations

03 **CLOSING THE GAP**
Geostationary Solution

04 **Air Quality GAPS**
The case for Geo Observations

05 **COMMERCIAL DATA**
Opportunities and Limitations

06 **GROUND TRUTH**
Strengthening ground-based monitoring in undermonitored regions

07 **SYNEGISTIC BENEFITS**
Integrated Observations plus Modeling

08 **A CALL TO ACTION**
Case for improved atmos. composition observations