



ARSET

Applied Remote Sensing Training

<http://arset.gsfc.nasa.gov>

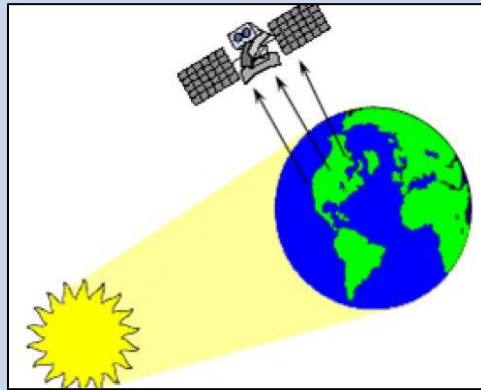
 @NASAARSET

Introduction to Satellite Remote Sensing for Air Quality Applications

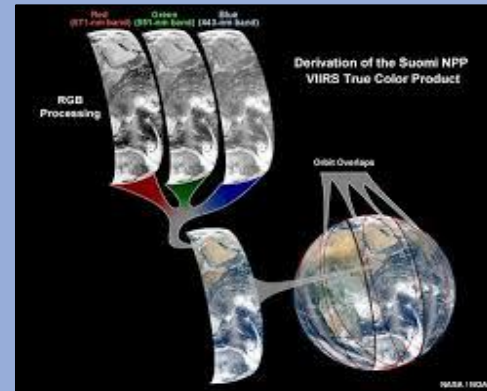
Webinar Session 5 – August 03, 2016

**Future Satellite Capabilities for Air
Quality Monitoring and Webinar Review**

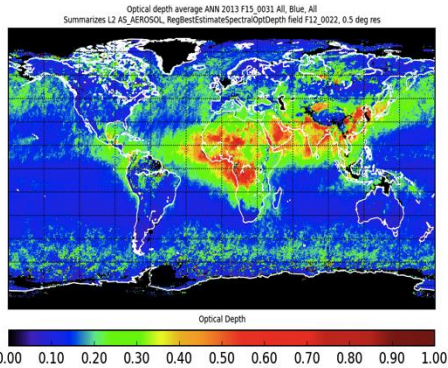
5 Weeks Webinar Series: Agenda



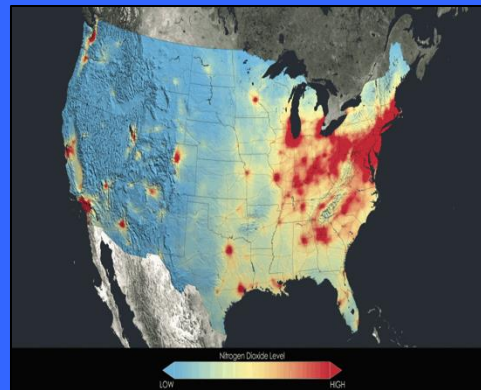
Week 1: Fundamentals of Remote Sensing



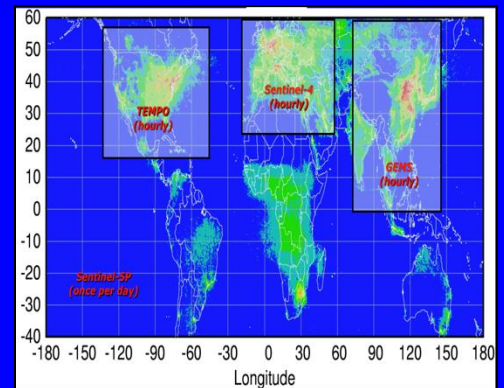
Week 2: Satellite Imagery



Week 3: Aerosol Data



Week 4: Trace Gas Data



Week 5: Future Capabilities

Session 5 - Outline

- **Overview of Future Satellite Capabilities**
- **Example of Aerosol Product from Geostationary Orbit**
- **Review of Webinar Series**
- **Future Training Opportunities**

Today's Instructor: **Pawan Gupta**
GESTAR/USRA, Code 614
NASA Goddard Space Flight Center
Greenbelt, MD 20771, USA
pawan.gupta@nasa.gov
<http://arset.gsfc.nasa.gov/people/pawan-gupta-0>

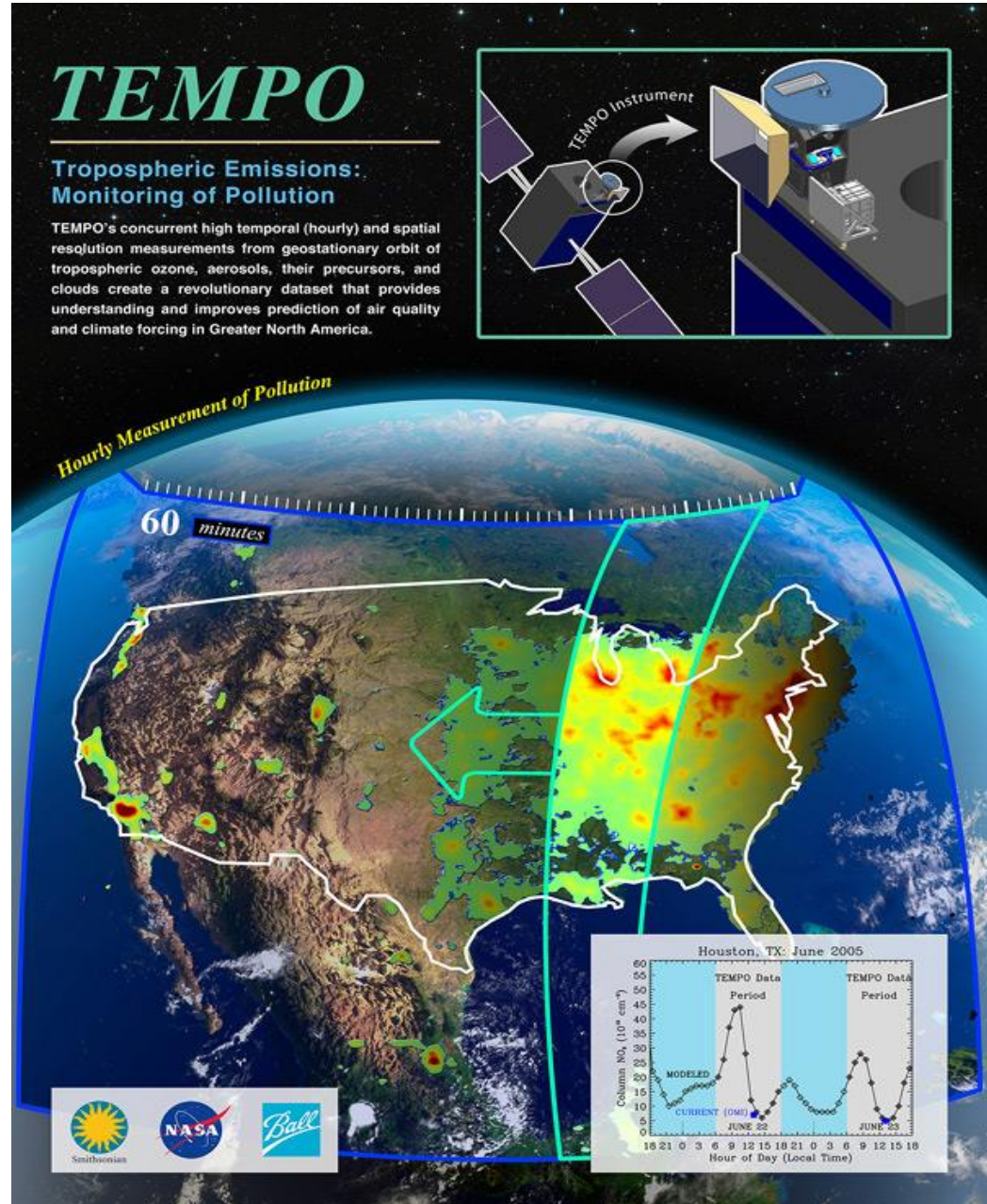
Current and Planned Missions

- Formulation
- Implementation
- Primary Ops
- Extended Ops

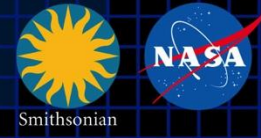


TEMPO

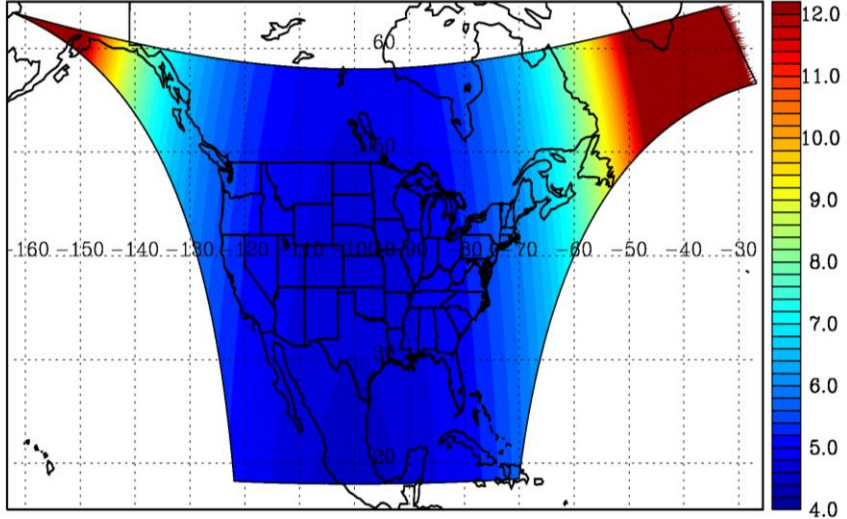
- Geostationary over North America
- High Temporal Resolution: 1 hour
- High Spatial Resolution: 2.2x4.7km
- Spectral Range: 290-740nm
- Data Products: O₃, NO₂, SO₂, H₂CO, C₂H₂O₂, aerosols, cloud parameters, and UVB radiation
- Expected Launch: 2020



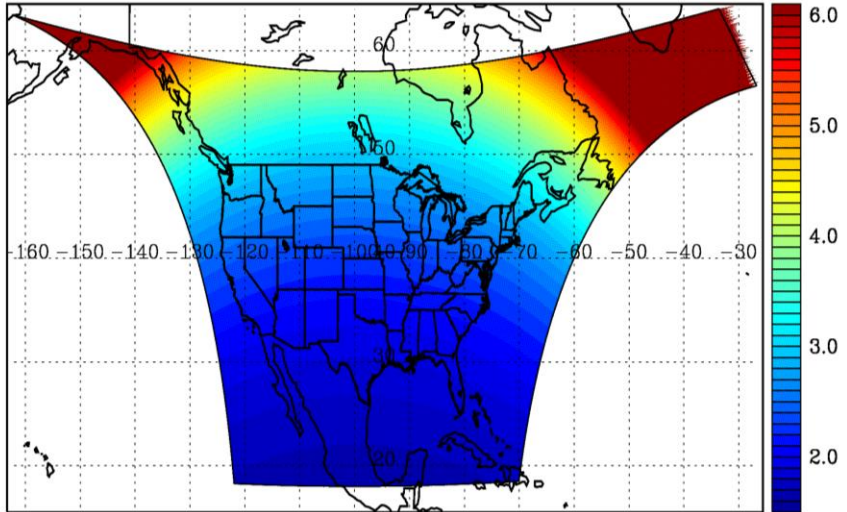
TEMPO footprint (GEO at 100° W)



TEMPO East/West Pixel Size



TEMPO North/South Pixel Size



Location	N/S (km)	E/W (km)	GSA (km ²)
36.5°N, 100°W	2.11	4.65	9.8
Washington, DC	2.37	5.36	11.9
Seattle	2.99	5.46	14.9
Los Angeles	2.09	5.04	10.2
Boston	2.71	5.90	14.1
Miami	1.83	5.04	9.0
Mexico City	1.65	4.54	7.5
Canadian tar sands	3.94	5.05	19.2

Assumes 2000 N/S pixels

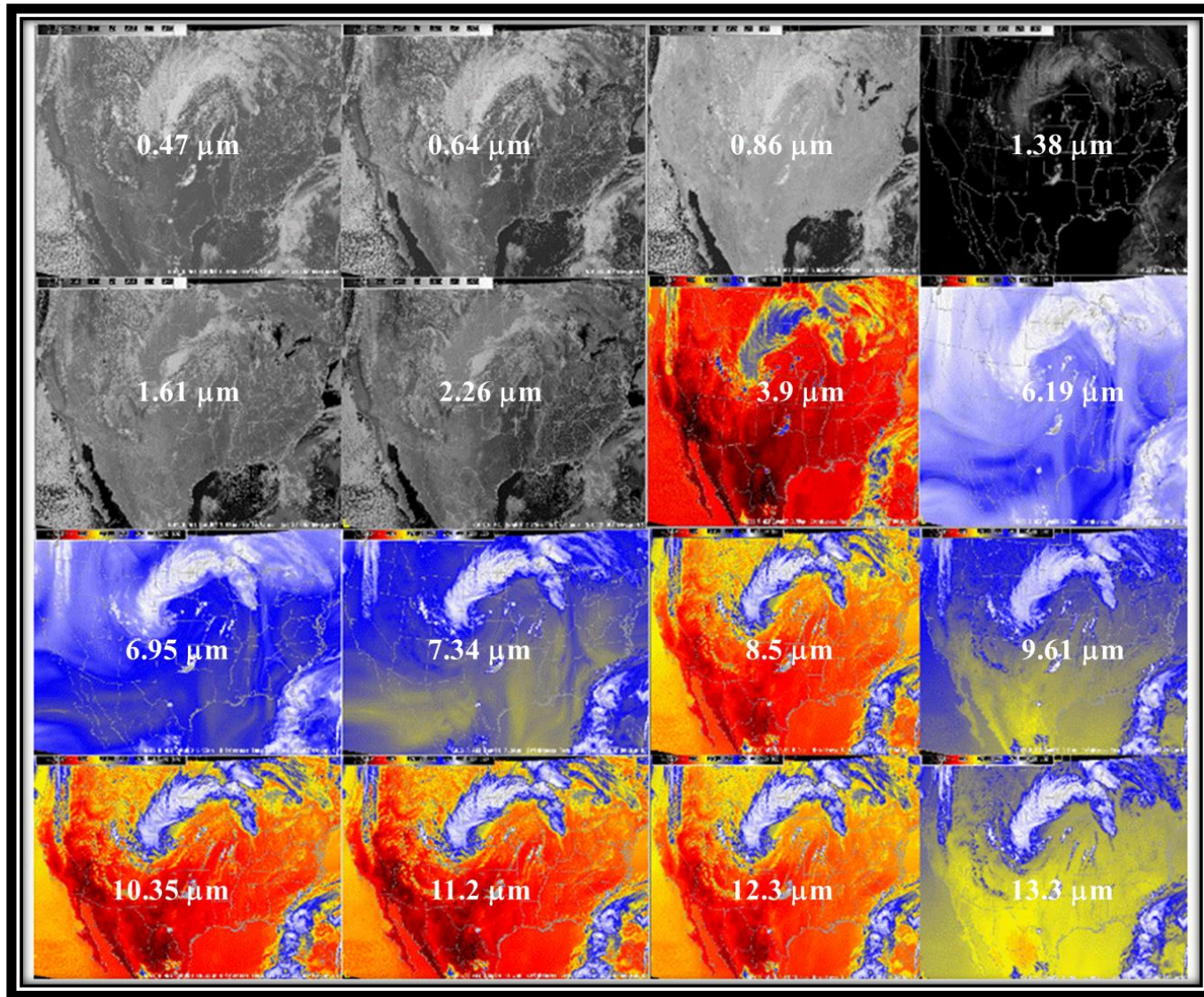
For GEO at 80°W, pixel size at 36.5°N, 100°W is 2.2 km × 5.2 km.

GOES-R



- **Expected Launch: 2016**
- **Advance Baseline Imager (ABI): 16 Spectral Bands**
- **Very High Temporal Resolution: 15 min – 30 seconds**

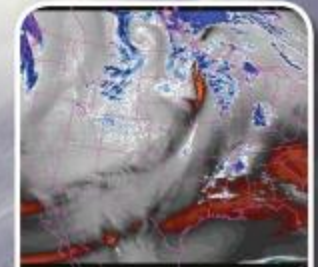
GOES-R Spectral Coverage



	ABI	Current GOES Imager
Spectral Coverage	16 bands	5 bands
Spatial Resolution		
0.64 μm Visible	0.5 km	~ 1 km
Other visible/near-IR	1.0 km	n/a
Bands ($>2 \mu\text{m}$)	2 km	~ 4 km
Spatial Coverage		
Full Disk	4 per hour	Scheduled (3 hrly)
CONUS	12 per hour	~4 per hour
Mesoscale	Every 30 sec	n/a
Visible (reflective bands)		
On-orbit calibration	Yes	No

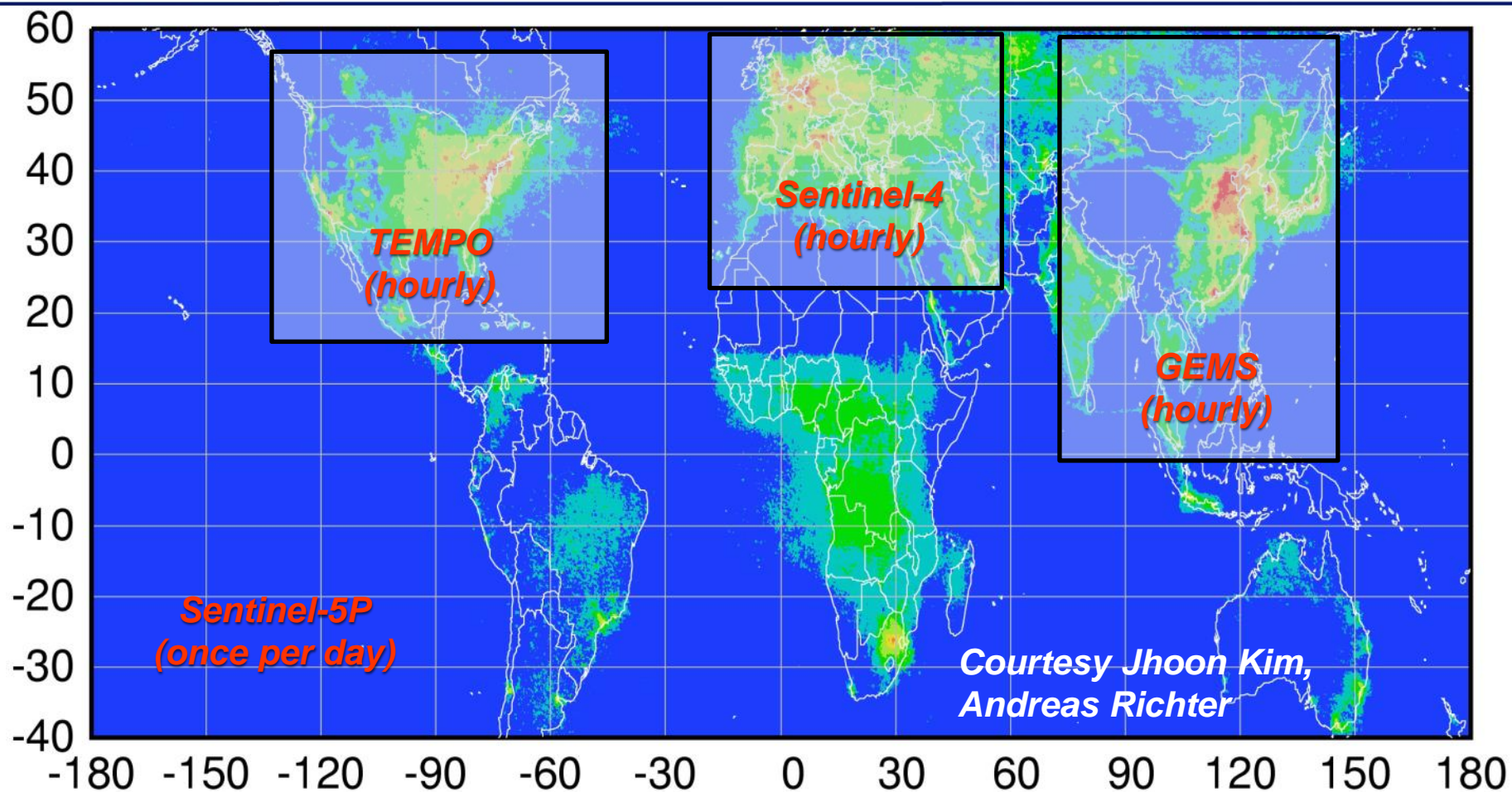
GOES-R

Advanced Baseline Imager (ABI)



*New capabilities.
Higher resolution.
Faster coverage.*





Policy-relevant science and environmental services enabled by common observations

- Improved emissions, at common confidence levels, over industrialized Northern Hemisphere
- Improved air quality forecasts and assimilation systems
- Improved assessment, e.g., observations to support United Nations Convention on Long Range Transboundary Air Pollution

TROPOMI

<http://www.tropomi.eu/>

Global Coverage at 7 km

OBSERVING OUR FUTURE



TROPOMI
TROPOspheric Monitoring
Instrument

SCIENCE WEBSITE

VISIT PUBLIC TROPOMI WEBSITE

Himawari 8

<http://himawari8.nict.go.jp/>

Launch date: October 7, 2014

Himawari Real-time

2016/07/27 00:30:00

Japan Area

Asia-Oceania Area

Asia-Oceania 24h

Animation

Download

Help

7.5K

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NICT ScienceCloud

CEReS 高知大学 Kochi University


名古屋科学館 NAGOYA CITY SCIENCE MUSEUM

Ver.5.0.0

Last Modified 2016/07/15

Japan Meteorological Agency

12:00 24:00



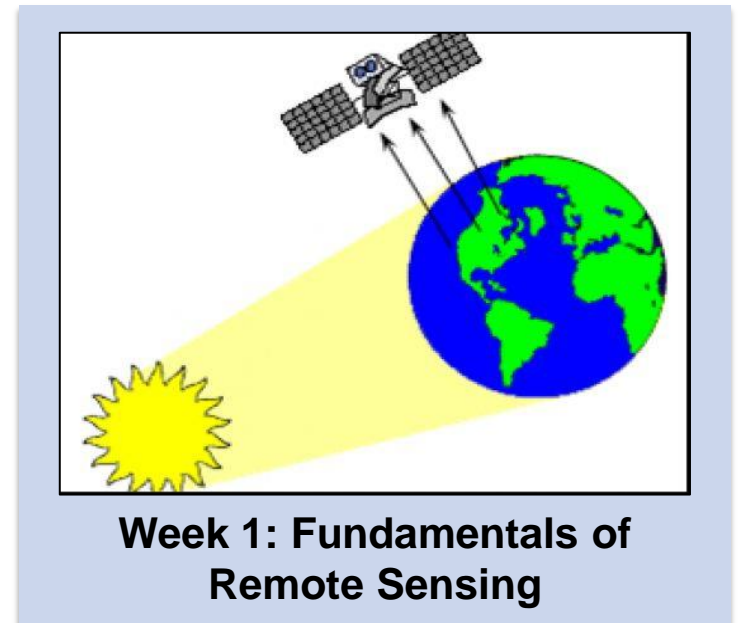
Aerosol Data from Himawari-8
by Dr. Aaron Naeger

An aerial satellite image of a coastal region, likely the Gulf of Mexico, showing a mix of brownish land, blue-green water, and white clouds. A semi-transparent grey rectangular box is overlaid on the center of the image, containing the text 'Review of Webinar Series' in a bold, black, sans-serif font. Below the text is a solid black horizontal line.

Review of Webinar Series

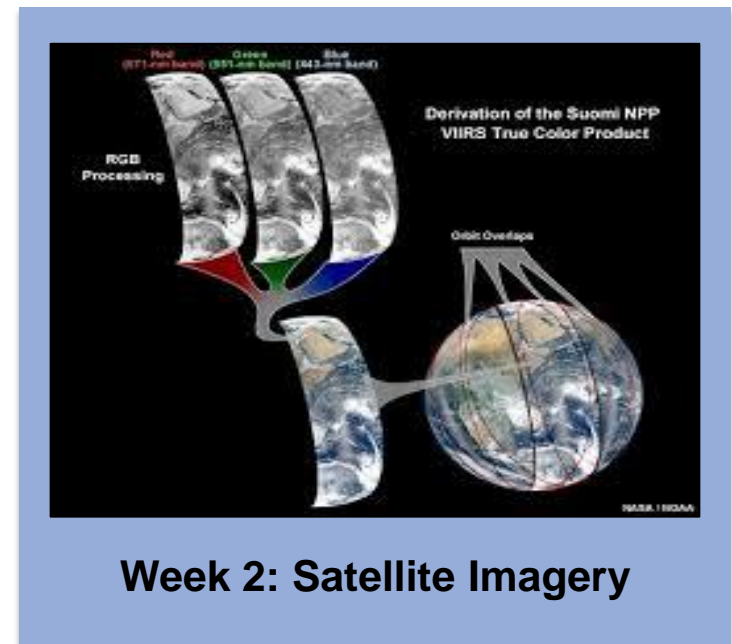
Week 1

- **Fundamentals of satellite remote sensing**
- **Satellites, sensors, and orbits**
- **Spectral, spatial, radiometric, and temporal resolutions**
- **Advantages and limitations of remote sensing**



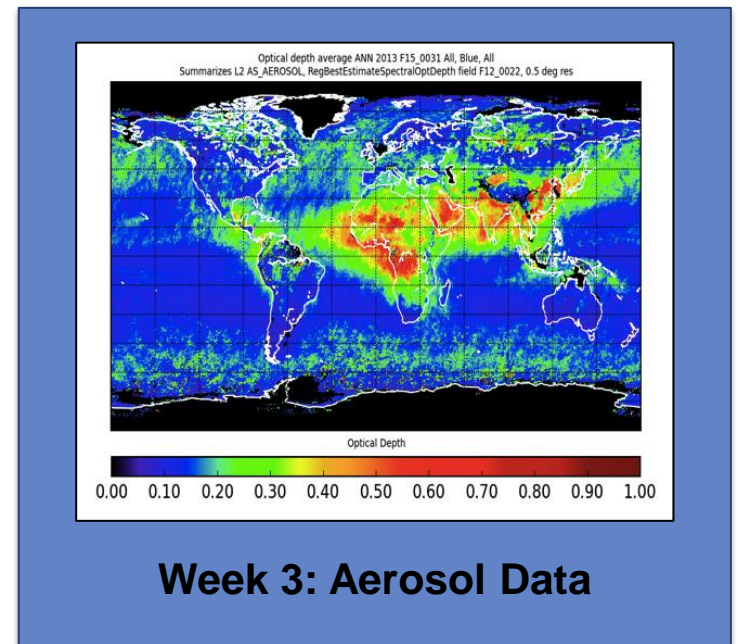
Week 2

- Visible satellite imagery and air quality applications
- Image information content, feature identification, and image archives
- Near real-time image access exercise



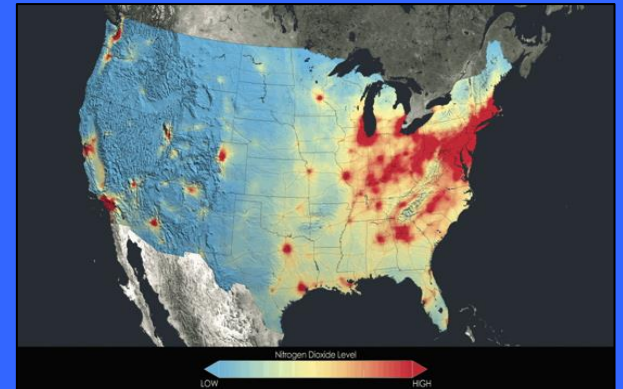
Week 3

- Remote sensing of aerosols
- NASA satellite aerosol products
- Aerosol products as a surrogate for PM2.5



Week 4

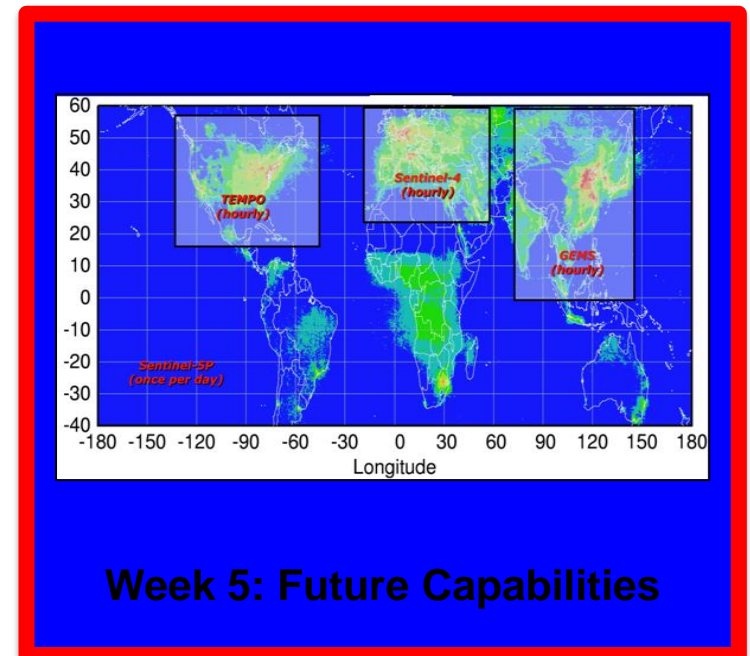
- Background information on trace gas detection and products
- Applications of trace gas products



Week 4: Trace Gas Data

Week 5

- Overview of future satellite capabilities
- Example of aerosol product from geostationary orbit
- Review of webinar series
- Future training opportunities



Future Training Opportunity

<http://arset.gsfc.nasa.gov/airquality/>

Upcoming Trainings

Stay Informed

If you would like information on upcoming trainings please sign up for the listserv:

<http://lists.nasa.gov/mailman/listinfo/arset>



The screenshot shows the ARSET website with the following content:

- Header:** NASA ARSET Applied Remote Sensing Training. Navigation links: Home, About, Trainings. Search bar: Search this site.
- Section: Health & Air Quality**
 - Image: Air quality visualization from EPA and MODIS 11 Sept 2003.
 - Text: ARSET provides in-person and online trainings focusing on remote sensing applications for health and air quality. Topics can include:
 - Satellite observations of aerosols and trace gases, data access and applications
 - Smoke and dust detection and monitoring
 - Satellite based surface particulate matter (PM2.5, PM10) data sets and applications
 - Air quality case study analysis using satellite, surface and model data sets
 - Long range transport of atmospheric aerosols and trace gases
 - Surface and satellite data inter-comparisons
 - Comparisons between regional and global air quality models and satellite data
 - Long term air quality trends
 - Online and offline tools to read, map and analyze satellite data sets
 - Health & Air Quality Features**
 - ARSET Completes Its First Advanced Webinar Series**

Jan. 11, 2016
Last October, ARSET hosted its first advanced online webinar, providing detailed instruction on available remote sensing resources for addressing particulate matter air quality. [Read More »](#)
 - Stay Informed**

If you would like information on upcoming trainings please sign up for the [listserv](#).
 - Contact**

To partner with ARSET for training, or to request a topic, please visit [training suggestions](#). For more information about air quality trainings and materials, contact: [Pawan Gupta](#).
- Right Sidebar:**
 - Health & Air Quality
 - Air Quality Webinars
 - Air Quality Workshops
 - Applications
 - Tools
 - Upcoming Training**
 - Land, Water**
 - [Introduction to Remote Sensing for Coastal and Ocean Applications](#)
07/06/2016 to 07/27/2016
 - Airquality**
 - [Introduction to Satellite Remote Sensing for Air Quality Applications](#)
07/06/2016 to 08/03/2016
 - Airquality**
 - [NASA Earth Observations, Data and Tools for Air Quality Applications](#)
08/28/2016 to 08/29/2016

Upcoming Training

<http://arset.gsfc.nasa.gov/airquality/workshops/awma16/>

The Practical Use of Satellite Observations for Visibility and Air Quality Analysis

Host: Air & Waste Management Association

Location: Jackson Hole, WY

Date: Monday, September 26, 2016

This course will provide an overview of satellite data and its application in visibility and air quality data analysis. The focus will be on understanding what present satellite measurements can and can't provide, and how to use them. In addition to an overview of satellite data and terminology, we will explore common and achievable uses for satellite data in air quality analysis through a series of case studies. This course will also cover current methods for discovering, acquiring and processing satellite data.

United Nations Sustainable Development Goals

<http://sustainabledevelopment.un.org/sdgs/>



United Nations Sustainable Development Goals

- **Goal 11, Target 11.6, Indicator 11.6.2**
 - Level of ambient particulate matter (PM 10 and PM 2.5)
 - Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
- **Goal 3, Target 3.9, Indicator 3.9.1**
 - Population in urban areas exposed to outdoor air pollution levels above WHO guideline values
 - Mean annual levels of air pollution level (fine particulate matter [PM2.5])

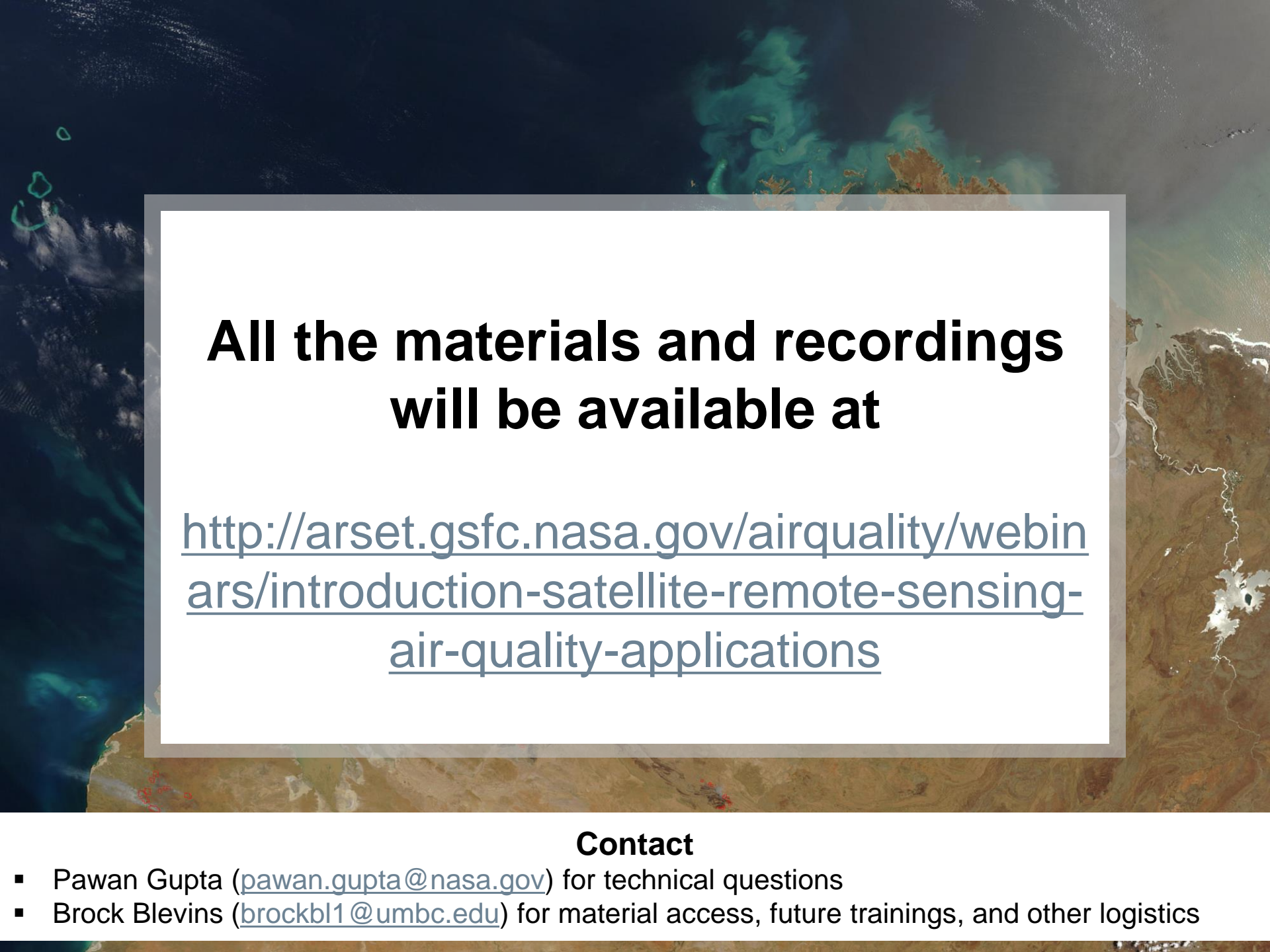
Upcoming Training

Satellite Derived Annual PM2.5 Data Sets in Support of United Nations Sustainable Development Goals

Online Webinar Series – January 2017

A satellite-style map of the Pacific Ocean region, showing the western coast of North America, the Hawaiian Islands, and the eastern coast of Asia. The map is overlaid with a semi-transparent grey rectangle. The text "NO ASSIGNMENTS" is centered within this rectangle, underlined.

NO ASSIGNMENTS

A satellite image of Earth showing a coastline and ocean. The image is used as a background for the slide. The text is overlaid on a white rectangular box with a grey border.

**All the materials and recordings
will be available at**

<http://arset.gsfc.nasa.gov/airquality/webinars/introduction-satellite-remote-sensing-air-quality-applications>

Contact

- Pawan Gupta (pawan.gupta@nasa.gov) for technical questions
- Brock Blevins (brockbl1@umbc.edu) for material access, future trainings, and other logistics