Giovanni as a Tool for Teaching Remote Sensing Applications

2012 Gregory G. Leptoukh Giovanni Workshop

Rich Kleidman
Science Systems and Applications, Inc

ARSET - AQ
Applied Remote SEnsing Training – Air Quality
A project of NASA Applied Sciences
Applications to Decision Making: Eight Thematic Areas

- Agricultural Efficiency
- Air Quality
- Climate
- Disaster Management
- Ecological Forecasting
- Public Health
- Water Resources
- Weather (Aviation)
Who are we training?

- **Air Quality Managers and Regulators**: EPA, state and local regulatory agencies, US Forest Service

- **Scientists/Technical**: Meteorologists, air quality forecasters and modelers, health scientists, AQ researchers

- **Other/public**: project managers, reps. from health agencies, World Bank
Expertise

ANY Audience can span a large range in expertise:

- No background in remote sensing and little science background

- No background in remote sensing and some science background

- Introductory expertise with satellite data

- Moderate expertise with satellite data
NASA Satellite Products for Air Quality Applications

• **Particulate Pollution** (dust, haze, smoke)
  - Qualitative: Visual imagery
  - Quantitative*: Column Products and vertical extinction profiles

• **Fire Products**: Fire locations or ‘hot spots’

• **Trace Gases**
  - Quantitative*: Column Products
  - Vertical profiles: mostly mid-troposphere
  - Some layer products
Giovanni Instances Used in ARSET-AQ Training

- Terra and Aqua MODIS Daily
- Aura OMI Level 2G
- Aqua/AIRS Global Daily
- Air Quality
- A-Train Along CloudSat Track
- MISR Daily
Our principal uses for Giovanni - conceptual organization

First exposure to hands on use of satellite data.

Illustrating proper use of data

Quick access to data for exploratory analysis

Comparison of coincident data sets
Introductory Activity

Used to:
1) Provide a first exposure to satellite data products.

1) Begin the process of educating our users about how to evaluate the quality of satellite remote sensing products and proper and improper uses of data and tools.

3) Illustrate the strengths and limitations of Giovanni.

The document which provides instructions on how to produce the plots used in the activity as well as the presentation used to guide the follow up discussion can be found on our website.

http://Airquality.gsfc.nasa.gov/Tool

The activity is called “Giovanni Beginning Exploration”
Evaluating Remote Sensing Data

Or

How to Avoid Making Great Discoveries by Misinterpreting Data

Richard Kleidman

ARSET-AQ
Applied Remote Sensing Education and Training
OH MY! THIS IS SHOCKING!

WHAT?

40% OF ALL SICK DAYS TAKEN BY YOUR STAFF ARE FRIDAYS AND MONDAYS!

WHAT KIND OF IDIOT DO THEY THINK I AM?

NOT AN IDIOT SAVANT. THEY CAN DO MATH.
AOD at 550 nm Area Average Plot
Giovanni MODIS Daily Instance
June 15 - 30, 2008

Terra
Daily Overpass ~ 10:30 AM local time

Aqua
Daily Overpass ~ 1:30 PM local time
A Potential Discovery!

Real or Not Real?
You Decide!

Terra
Daily Overpass ~ 10:30 AM local time

Aqua
Daily Overpass ~ 1:30 PM local time
Hypothesis 1:

The differences in aerosol concentration represent a Diurnal Cycle with different amounts of aerosol being produced or transported afternoon and morning.

Hypothesis 2:

The differences in aerosol concentration are either not real or not significant and could be caused by:

- Sensor error
- Algorithm error
- Sampling error
- ?
Possible ways to interpret these differences

- Real world differences
  - Leads to a conclusion(s) about aerosols
  - Can lead to further research about aerosols

- Differences due to other factors
  - Can lead to false conclusion about aerosols
  - Need to be explored and understood to avoid similar problems in the future
  - Can lead to advances in remote sensing capabilities!
Important Factors to Understand

Analysis Tool

Giovanni - provides data in 1 degree resolution

Data Products -
Aqua and Terra Level 2 Products are from a single overpass 10 KM resolution
Aqua and Terra Level 3 Products are global composites in 1 Degree resolution
Important Factors to Understand

Mid-latitude $1^\circ \times 1^\circ$ is about $85$ Km x $110$ Km

- $45$ $10$ Km MODIS retrievals possible
- $90$ $10$ Km MODIS retrievals possible
Important Factors to Understand

One MODIS 10 Km Retrieval

Begins life as 400.5 km (at nadir) pixels

And ends as a product composed of 12 - 120 pixels
Information Necessary to Understand the Results

Data Products-
Aqua and Terra Level 2 Products are in 10 KM resolution
Aqua and Terra Level 3 Products are in 1 Degree resolution

Giovanni provides Level 3 Data in 1 Degree resolution.

Sensor Characteristics -
Aqua and Terra are identical designs
There are some small differences in sensor performance

Algorithm Details-
Aqua and Terra use the same algorithm.
Examining other features in this data set and using our knowledge of the sensor and products can help us to understand the cause of the differences in mean aerosol.

A blank (white) square has no retrievals for the entire time period.
Evaluating Data

• Understand the sensor characteristics

• Understand the product details

• Understand the data visualization tools and outputs.
Giovanni helps us turn indiscriminate consumers of satellite data products into connoisseurs