Tiger Team Interim Update: Web-Enabled Tools for Air Quality Management Decision Support

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TT Specific Members: Todd Plessel and Matt Freeman (USEPA/NCC/L-M), Hyun-Deok Choi (NIA NASA-LaRC), Andrew Lynch (Iowa)

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What AQ managers request

- Products for using satellite retrievals of atmospheric composition in model evaluation and regulatory applications
- “presenting the data in a manner that is policy-relevant” and “creating targeted, processed and user-friendly datasets…that will help AQ agencies and the private sector meet their regulatory, monitoring, and permitting requirements”

(Duncan and Prados, 2012)

Objective: interoperable web-based infrastructure to provide added value from NASA satellite data for model evaluation, routine regulatory activities, constraining emission fields, and presenting data in an accessible user-ready and policy relevant manner

Tiger Team as integration: Leverage AQAST expertise, connections, and efforts
- model evaluation, adjoint and S-R calculations for Task Force on Hemispheric Transport of Air Pollution and UNEP Climate and Clean Air Coalition
- UAH model evaluation with GOES and MODIS cloud and land surface retrievals
- EPA funded development of Remote Sensing Information Gateway (RSIG) Application and Cyberinfrastructure Best Practices under CyAir

Outcome: Initial basis for a user-agency supported common infrastructure for productizing satellite and model datasets and tools from AQAST
The foundation: RSIG
www.epa.gov/rsig
Visualize, regrid, overplot

12km CMAQ AQMEII 4.7.1 AOD

Aqua MODIS AOD on the same grid

CMAQ AQMEII 5.0 AOD and CALIOP L2 AOD (532 nm)

MODIS L2 AOD (550nm) and CALIOP L2 AOD (532 nm)
Save as …

**Data**
- OGC−WCS/XML
- OGC−WCS
- OGC−WMS
- ASCII
- IEEE−754
- XDR
- NetCDF
- NetCDF/COARDS
- NetCDF/IOAPI

**Rasters, Images, Movies**
- HDF
- HDF−EOS
- PNG
- MPEG
- KML/KMZ
- HTML
- PDF
- HTTP/80
- SI
2014 Development: Now in 3D!
Visualizing both CMAQ and MODIS cell bounds in RSIG 3D allows the user to “zoom” into reveal how the MODIS pixels change in size from nadir to edge of swath.
New features

- User-provided files: MM5, WRF, CMAQ, CAMx
- Spatial Allocator under script control
- Data server: US EPA CMAQ, AQS, MODIS, CALIOP, VIIRS
Year 3 Tiger Team Extensions

**Satellite data for AQM**
- GOES clouds & land surface products
- Legacy retrievals
  - (OMI NO$_2$, TES CO, NH$_3$)

**Features to support AQM**
- Satellite-measurement model evaluation
- Pre-configured instances

**Value added processing**
- QC (AQAST)
- Data filtering (User)
- Multiple retrievals (MODIS AOD, VIIRS AOT)

**AQM Engagement**
- Inclusion in 9/14 ARSET
- Beta testing
- TF-HTAP & CCAC data
- AQAST8 Survey
TF HTAP regional & hemispheric model repositories: adjoint sensitivities & source-receptor relationships
Satellite visualization for exceptional events
Satellite visualization for exceptional events
Episode Analysis & Evaluation

CMAQ AQMEII 4.7.1 AOD over-plotted with CALIOP AOD

With a few clicks, RSIG provides quick access to model:obs comparison on the model grid
Preliminary results from exported data:
CMAQ AQMEII 4.7.1 recon_ext vs CALIOP ext_coeff
Western U.S. averages, August 2006
UAH Archive Subsetter & Server

- Develop and implement UAH-RSIG web service (OGC-WCS) to increase user access to satellite products for use in WRF/CMAQ/CAMx.
- Add functionally for user to use local model grid definition files to re-ridge satellite data to model domain.

New UAH Archive Products to be served via RSIG

1. GOES Cloud Albedo
2. GOES Surface Albedo
3. GOES Cloud Top temperature
4. GOES Optical Cloud Depth
5. GOES Photosynthetic Active Radiation (PAR)
6. GOES Land Surface (skin) Temperature
7. MODIS Land Surface (skin) Temperature

For Photolysis Calculations
For Biogenic Emissions
For model Evaluation

Model Input File

User's Desktop/Laptop Computer

UAH Archive Subsetter & Server

Data request with grid definitions

Satellite Data in Model Grid

User

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
Year 4 Tiger Team Extensions

**Emerging platforms**
- MOPITT CO
- ISS-RapidScat, ISS-CATS
- Sentinel-5 Precursor (TROPOMI)

**Features to support AQM**
- TF-HTAP & CCAC instances
- User-provided response surfaces, S-R relationships

**Value added AQAST data**
- TT Reanalysis
  - + your requests

**AQM Engagement**
- Beta testing
- ARSET integration
  - + your requests