Incorporation of Satellite Data for Improving AIRPACT

Joe Vaughan, Farren Thorpe, George Mount, Brian Lamb
Laboratory for Atmospheric Research, WSU-Pullman
Cliff Mass and Greg Hakim, UW, Seattle
Louisa Emmons and David Edwards, NCAR
Ray Peterson, Pasayten Consulting
Research Opportunities in Sun-Earth System Science (ROSES) and NW-AIRQUEST

Decision Support Systems and ROSES
AIRPACT-3 overview
Aura satellite and OMI instrument background
OMI and AIRPACT-3 NO2 comparison
OMI and AIRPACT-3 Aerosol Optical Depth
MOPITT CO for boundary conditions

Figure 1. Integrated systems solution for a comprehensive air quality decision support system in the Pacific Northwest that is enhanced through the use of NASA Earth-Sun system observations for meteorology, land-cover, and atmospheric trace species. NASA operations appear against a mint-green background; NW-AIRQUEST operations appear against a pink background.
AIRPACT-3 w/ SMOKE and CMAQ

MM5 / WRF 12km forecast

MCIP

Verify / Statistics CCTM with Obs.

Output to Web

ICON (for next day)

CMAQ CCTM

RUNTIME: ~4 hrs on 4 nodes (8 CPU)

BCON (MOZART monthly)

ICON (previous day)

SMOKE

Area Mobile Point Biogenic Wild Fire

UW

WSU
Ozone Monitoring Instrument OMI
Flying on Aura

Theory
Instrument
Aura Orbital
Engineering of Observations
Sensitivity
trace gas measurements: observing the Earth’s backscattered uv/visible radiation

Sunlight passes through the atmosphere, reflects off clouds and the surface, and is scattered back into the instrument field of view. Molecular spectral absorption is proportional to the concentration of the gas doing the absorbing.
Period: ~100 minutes
Return time: ~16 days
Equator x-ing: ~1:45 PM
Observing Principle for OMI

- 2-dimensional CCD
  - swath ~ 580 pixels
  - wavelength ~ 780 pixels
- flight direction » 7 km/sec
- viewing angle ± 57 deg
- 12 km/24 km (binned & co-added)
- 2600 km
- 13 km
Ozone Monitoring Instrument (OMI)

- Nadir viewing spectrometer
- Wavelength Range: 270 - 500 nm
- Spectral Resolution: ~0.5 nm
- FOV width: 2600 km
- Spatial Resolution: 13 x 24 km²
- Trace gases observed:
  - $O_3$: 1 ppbv
  - $CH_2O$: 1 ppbv
  - $NO_2$: 500 pptv
  - $SO_2$: 1 ppbv
  - $OClO$
  - BrO
  - Aerosol optical depth
March OMI vs AIRPACT-3 tropospheric column NO2

Monthly means ratio and residual
May OMI vs AIRPACT-3 tropospheric column NO2

Monthly means ratio and residual
July OMI vs AIRPACT-3 tropospheric column NO2

Monthly means ratio and residual
We are very interested in tropospheric O3 products! But...
MOPPIT CO Retrievals and AIRPACT

DAY

NIGHT
What else?

• Application of AIRPACT-3 w/ CMAQ for Lewiston Air Toxics Study with IDEQ, Nez Perce Tribe and RJ Lee Group.

• Proposing to PSCAA the use of AIRPACT-3 for evaluating the sensitivity of AQ to woodstove numbers by type.

• AIRPACT-3 Emissions Inventory is being updated.
What is NW-AIRQUEST?

- Named the Northwest and International Air Quality, Environmental Science and Technology Consortium
- Organized in response to results of the Northwest Air Summit of June 2003
- Inspired by Northwest Regional Technical Center’s success in supporting and exploiting regional meteorological forecasting (MM5 at UW).
- Working to supporting air quality policy with best available science
Who does it serve?

• NW-AIRQUEST serves its members by providing a forum for exploring technical issues in emissions inventory development, monitoring, data sharing and modeling?

• NW-AIRQUEST serves the region by supporting proposals to fund work with regional implications.
What does it do?

- NW-AIRQUEST fosters collaborations to bring resources to bear on regional problems, e.g. NASA ROSES proposal.
- NW-AIRQUEST organizes teleconferences to share reports on projects and share technical information.
- NW-AIRQUEST holds an annual science meeting to further collaboration, cooperation and the sharing of scientific and technical information.
We’re working to exploit NASA satellite data, as well as we can!!

Thank You!

JVAUGHAN@WSU.EDU