

Integrating Satellite Observations into AIRNow

*Providing Real Time Air Quality and Forecasts
in the US and elsewhere*



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AIRNow Overview

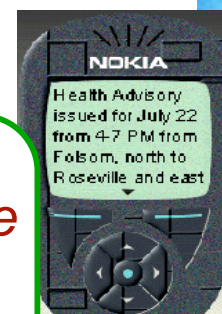
Inputs from Partners

- Real-time, hourly concentrations for O₃, PM from **Ambient** Monitors
- Forecasts for 300 cities
- Daily National Outlooks



AIRNow

- Collects AQ data, forecasts (from 120+ partners)
- Checks data
- Converts data to AQI
- Maps data
- Distributes data



AIRNow Outputs

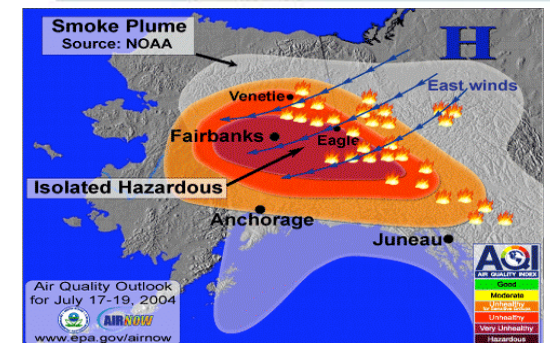
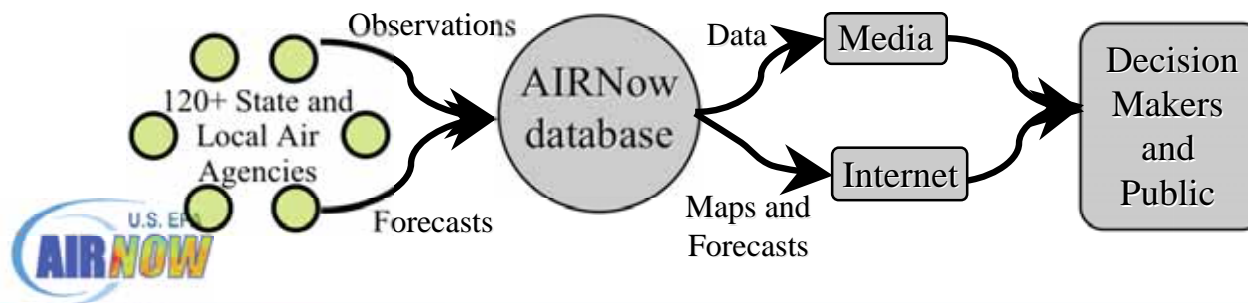
- Real-time Maps, Website
- Email, SMS alerts
- Target info / formats for media, health



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AIRNow History & Approach

- Started in 1995 by Maryland
- Since 1997, funded by U.S. EPA, but stakeholder involvement is voluntary
- Broad, diverse stakeholder community
 - Federal, state, provincial, Tribal, and local air agencies (120+)
 - Scientific and health research organizations (15+)
 - Media and public outreach groups (30+)



AIRNow's Future Directions

- Integration of Satellite Observations

- improve spatial coverage

- make satellite products available to forecasters, managers

- creation of [AIRNow Satellite Data Processor \(ASDP\)](#)

- funded by recent NASA award

- participants include EPA, NASA, NOAA, and Harvard-Smithsonian/Dalhousie University

- AIRNow-International

- currently focused on ambient + forecasts

- Fall 2009: [live in Shanghai](#) (EPA funded)

- EPA plans to continue growing AIRNow

- highly visible internationally / in GEOSS



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Operational Satellite Integration: Motivation

Using satellite data to improve the spatial coverage of AQI maps and integrating satellite data into AIRNow-Tech, we envision the following improvements to decision-making activities:

- **Improved protection of public health**
- **Increase media coverage**
- **Improved data during exceptional events**
- **More accurate air quality forecasts**
- **Higher quality data products for distribution**
- **Improved systems for international applications**



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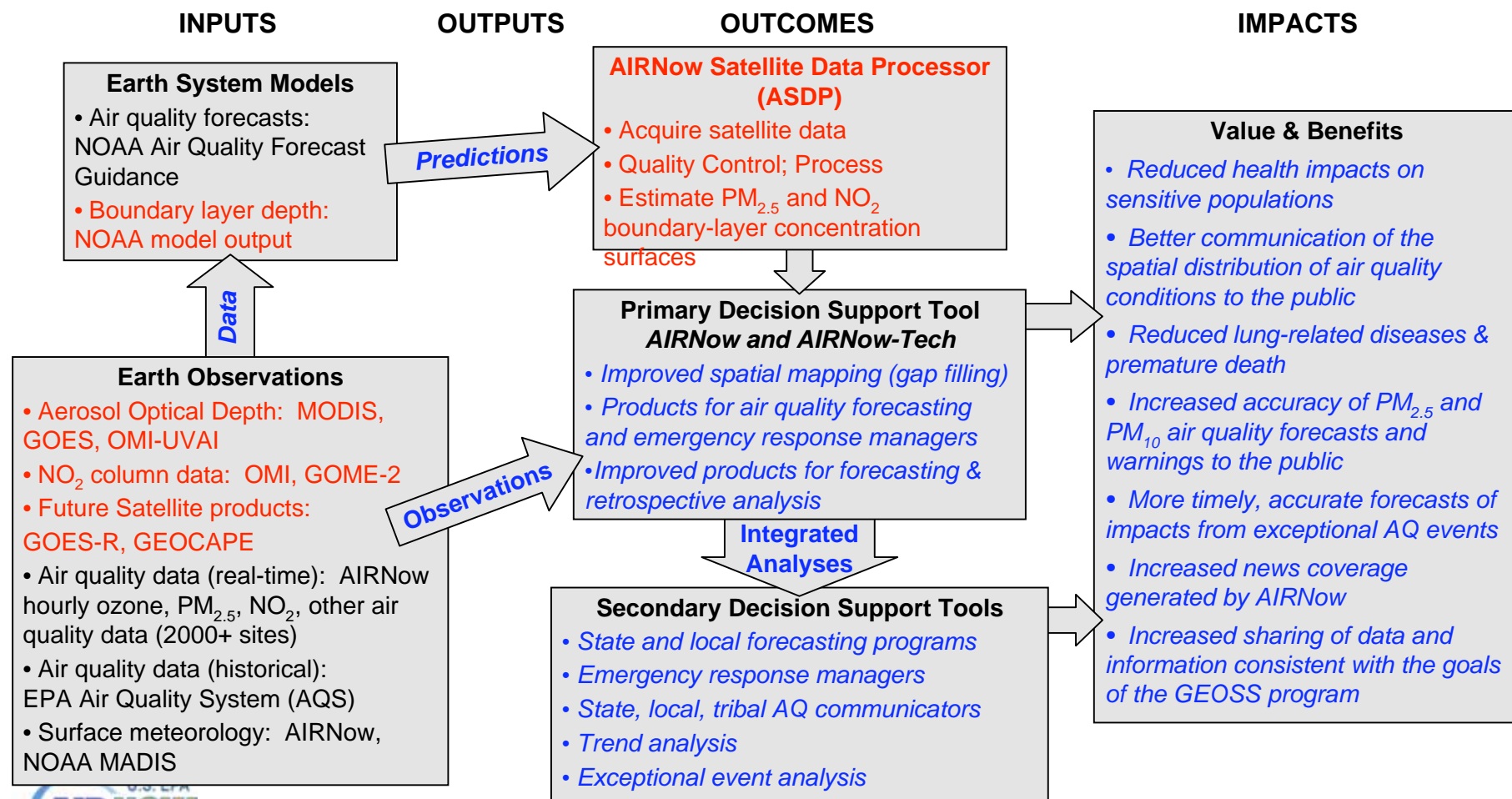


ASDP: Information flow diagram

Black text: Existing components

Blue text: revised or improved components, functions, or benefits of the current system

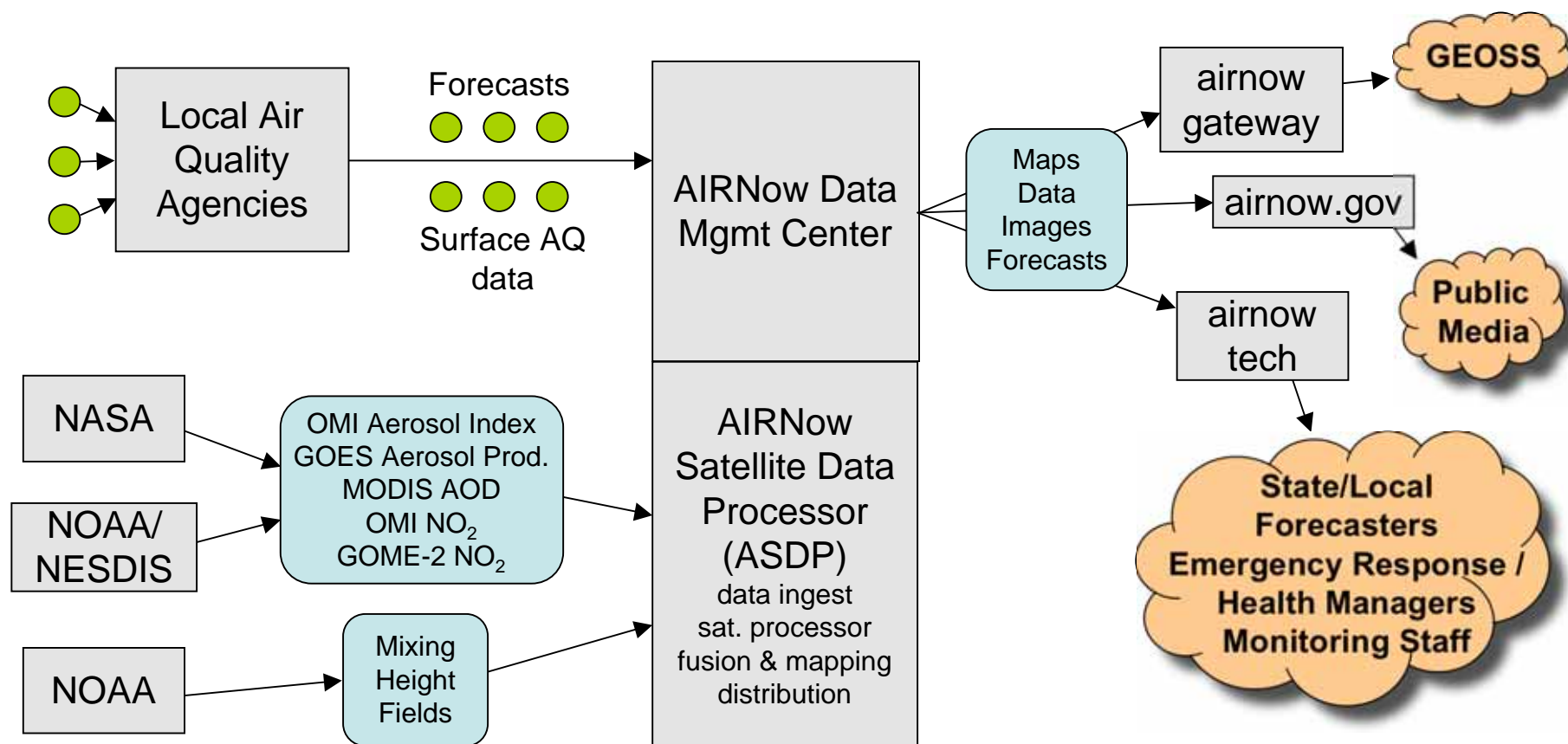
Red text: components being newly created or brought into AIRNow



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ASDP: Organizational diagram



key:

● ● ●
Point Data

System

Data /
Information

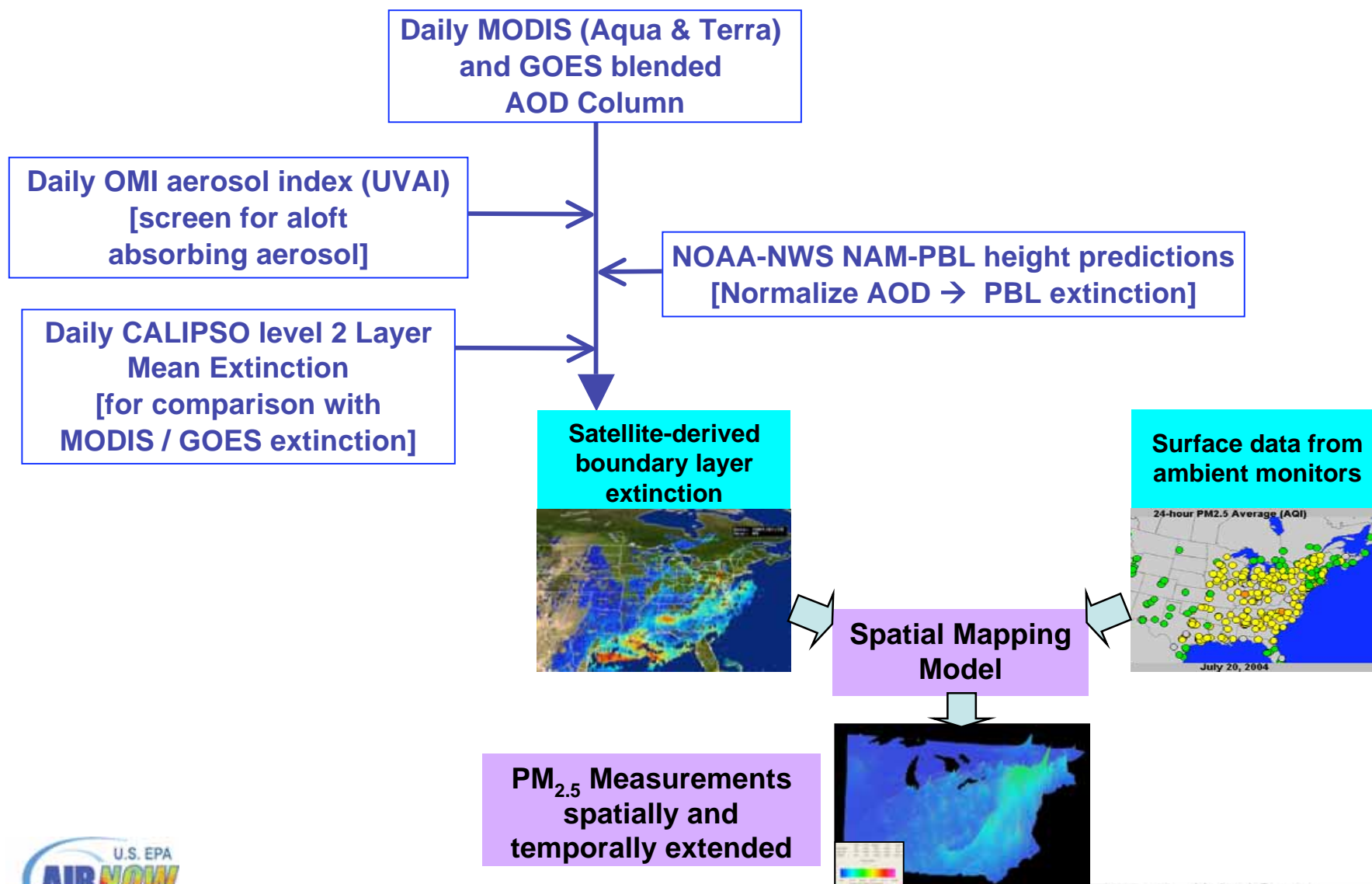
Orgs.
People



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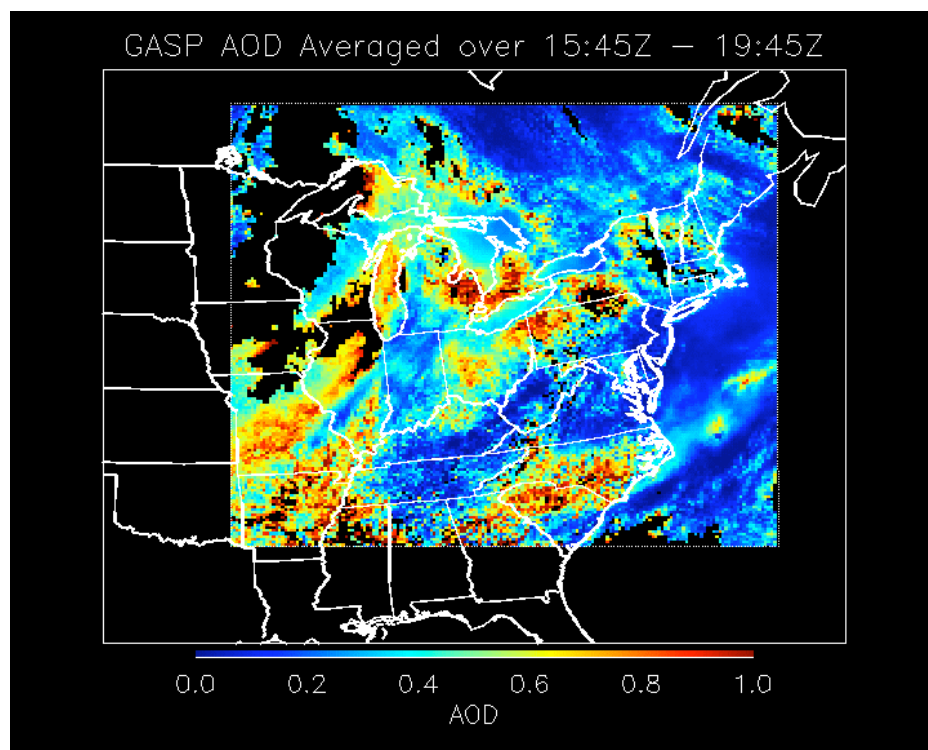


Satellite-Based Estimate of Ground-level PM_{2.5}

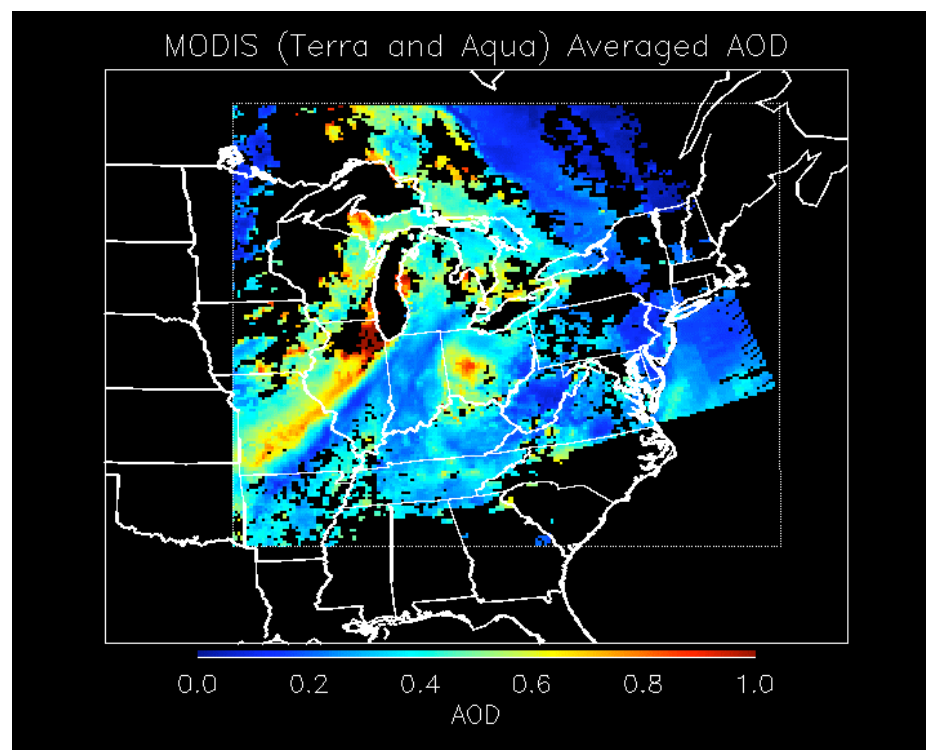


Using GOES AOD to fill spatial gaps & improve spatial modeling of $PM_{2.5}$

GASP Aug. 3, 2005 on CMAQ grid



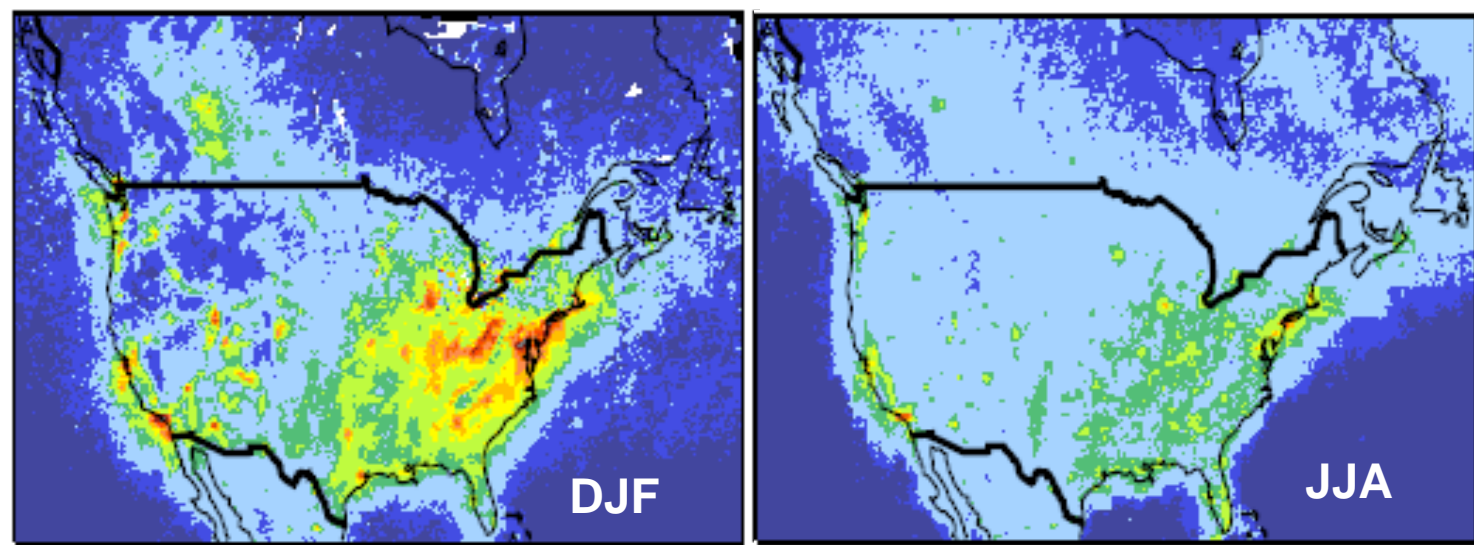
MODIS AOD Aug. 3, 2005 on CMAQ grid



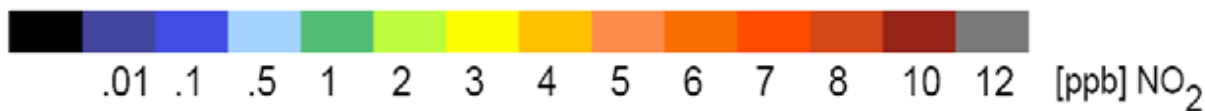
Surface NO₂ Concentration Inferred from OMI for 2005

Daily OMI
Tropospheric NO₂ Column

Coincident Modeled
(GEOS-Chem) NO₂ Vertical Profile



Spatial
correlation
with *in-situ*
measurements:
0.78



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Lamsal et al., JGR, 2008

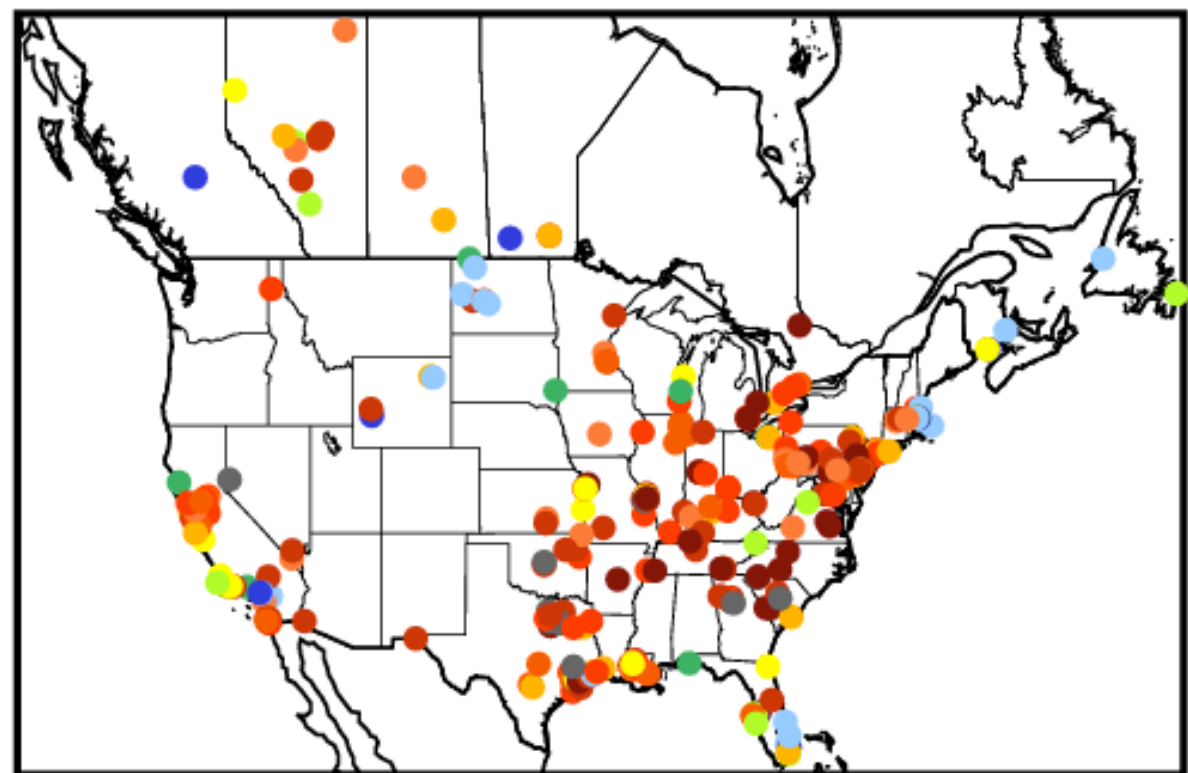


United States
Environmental Protection
Agency

Significant Temporal Correlation Between *in-situ* and OMI-derived Surface NO₂

Future work:

- Extend to operational with OMI and GOME-2 using monthly GEOS-CHEM NO₂ profiles
- Continue developing relationship between column and surface NO₂ (challenges: lightning, clouds, spatial resolution)
- Evaluation against surface NO₂ measurements:
 - SEARCH Network (photolytic converter analyzers)
 - SLAMS / EPA Network (Mo converter analyzers)
 - Langley / Virginia DEQ / EPA site (Fishman talk)



.1 .2 .3 .4 .45 .5 .55 .6 .65 .7 .75 .8 .85

Correlation of Coincident Observations over 2005

Lamsal et al., JGR, 2008



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AIRNow International

Vision: Provide real-time air quality information, worldwide

Mission: Promote protection of air quality by leading & supporting a worldwide community of AQ data sharing

Approach:

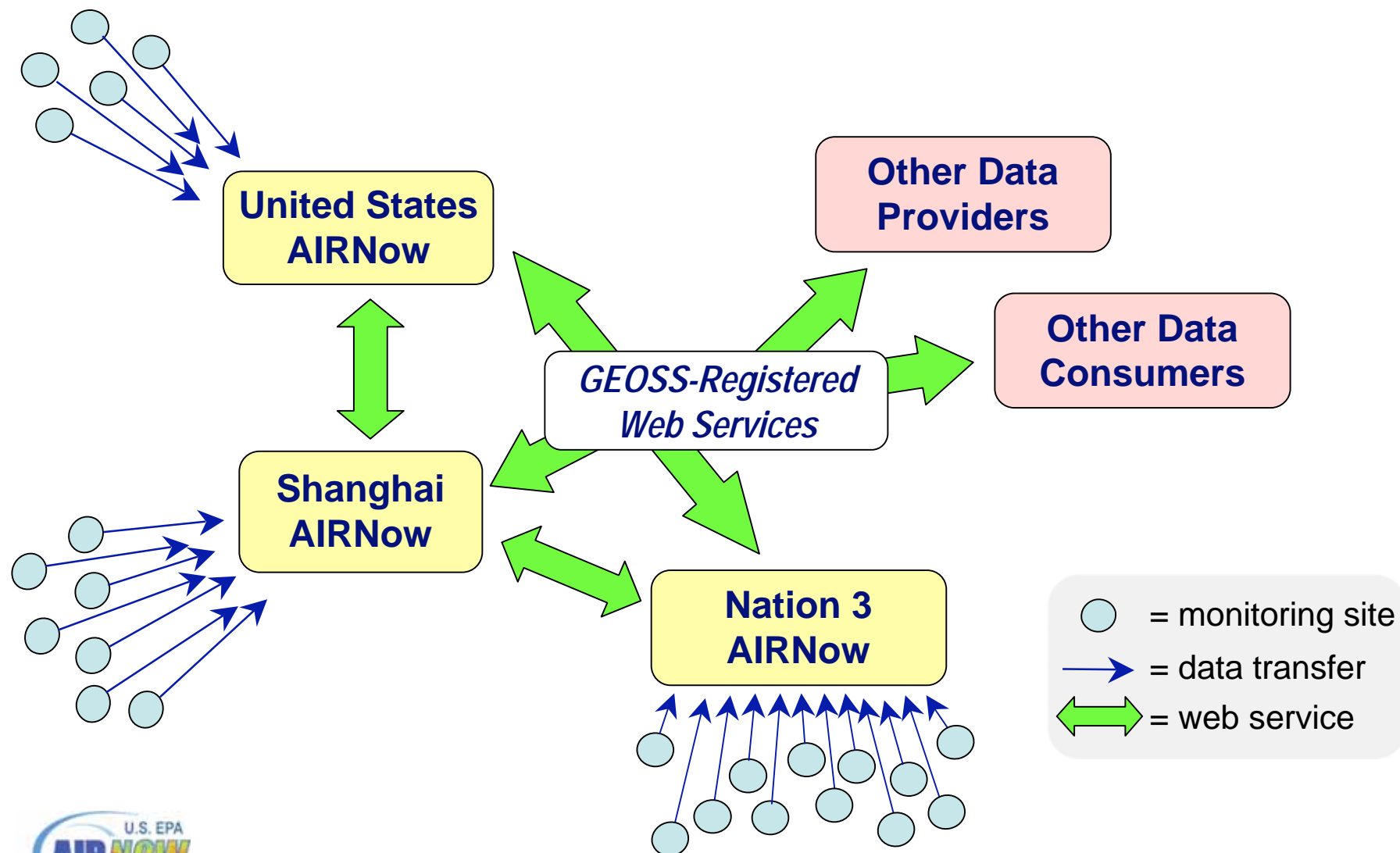
- Produce AIRNow 2.0
 - improve software with a focus on standardization, interoperability
 - make the software and system portable, keep overhead low
 - open-source, to the extent practical
- Pilot implementation in Shanghai by Fall, 2009
- Planning to implement AIRNow with other partners after successful installation in Shanghai



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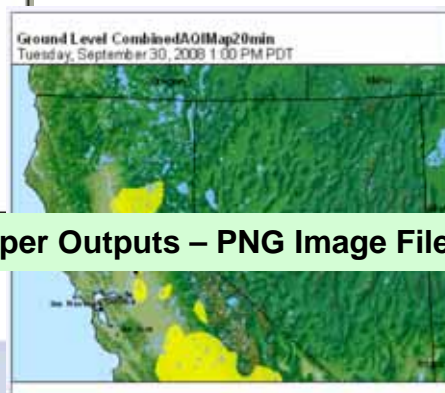


AIRNow International Concept

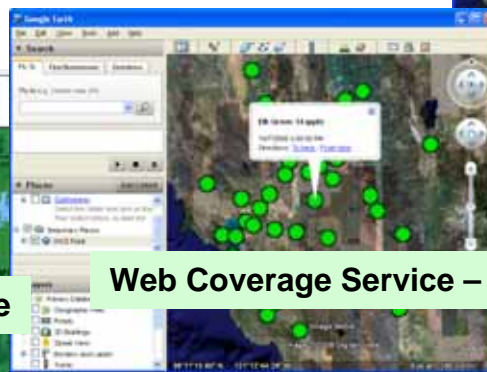


AIRNow – International Timeline

Concept & Prototype	Development	Beta Release & Testing	Final Release
2007	2008	2009	2010
<p>Create specification document</p> <p>GEO-IV Plenary</p>	<p>Development of AIRNow-I:</p> <ul style="list-style-type: none"> • Data Management System • Mapper • InfoService <p>Shanghai collaboration</p> <p>MOUs signed</p> <ul style="list-style-type: none"> • USEPA – Shanghai EPB • Shanghai EPB – Shanghai Reg. Met. Bureau 	<p>Complete AIRNow-I</p> <p>Launch AIRNow-I in U.S.</p> <p>Test AIRNow-I in Shanghai</p> <p>Begin building community</p>	<p>Operation at World Expo in Shanghai</p> <p>Deploy to other countries</p> <p>Grow community</p>



Mapper Outputs – PNG Image File



Web Coverage Service – Point: KML Output



Mapper Outputs – KML

Further & Future Directions

IDEA-International

Use IDEA code for near-real-time use of MODIS direct broadcast products in Shanghai, in conjunction with AIRNow-International pilot

- Additional tool for decision-makers
- Expands the data pool for analyzing satellite / ambient relationship
- Pursuing funding & GEO tie-in



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On building a Community (of Practice)

- International collaboration needed at many levels – beyond researcher - researcher
 - High level: future space mission goals
 - Programmatic level: perhaps AQ public information systems can learn from each other?
 - Technical level: metadata standards for ACC applications



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On future collaborations...

- USEPA interested in convening international AQ community at next GEO Plenary: 19-20(?) Nov. 2009 in Washington.
 - Satellite AQ: Status, programs, future missions
 - GEOSS and Air Quality
 - AQ Model Evaluation: AQMEII, HTAP
 - AQ Public Information & Forecasting
 - etc.



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Extra Slides



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AIRNow Requirements

- Monitors
 - Continuous instruments are needed for real-time, but non-continuous can still be useful
 - Density is good, but we can start with whatever is available
- Hardware/Software
 - Shanghai Pilot will solidify the requirements
 - Each pilot region will need to purchase their own hardware and commercial software – EPA would provide AIRNow software, technical expertise, and information
- SERVIR
 - NASA, EPA, and CATHALAC need to work on how best to connect AIRNow-International and SERVIR; seeking a common pilot region



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EOS Terra
10:30am local overpass

EOS Aqua
1:30pm local overpass

