



# **Global Air Quality Assessment and Forecasting**

Terry J. Keating, Ph.D.  
Office of Air and Radiation  
U.S. Environmental Protection Agency

**Proposed Topic for the 2007 GEO Ministerial Meeting**

# Proposed U.S. Priorities at GEO Summit

- **Global Air Quality Assessment and Forecasting**
- **Drought Early Warning**
- **Global Land Characterization**
- **Global Environmental Information Delivery System**
- **Framework for Integrated Disaster Risk Reduction**



# Global Air Quality Assessment and Forecasting

- Air pollution is a serious global public health and environmental quality issue. Air pollution causes premature mortality and morbidity, damages crops and ecosystems, and contributes to and is affected by climate change.
- Improved air quality information and forecasts can help officials and individuals take appropriate management actions and avoid exposures.
- Regional and long-range transport of pollutants is significant and creates a need for international implementation of integrated monitoring and assessment approaches.
- Forecasts and real-time information are especially useful for dealing with events, such as intense pollution episodes, fires, and dust storms, and are critical for individuals suffering from respiratory diseases.

In the U.S., poor air quality is estimated to cause tens of thousands of deaths and cost society \$100B annually.

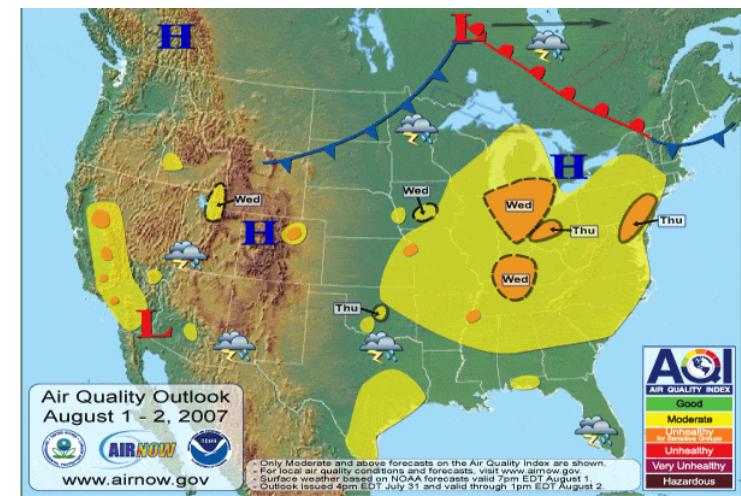
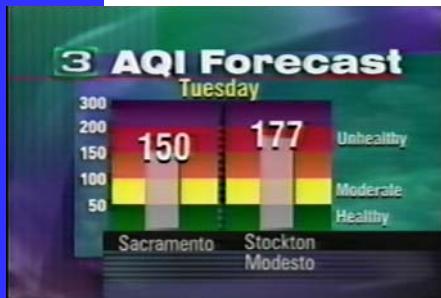
Globally, air pollution contributes to the deaths of more than 800,000 people annually, most in the developing world.

# Global Air Quality Assessment and Forecasting

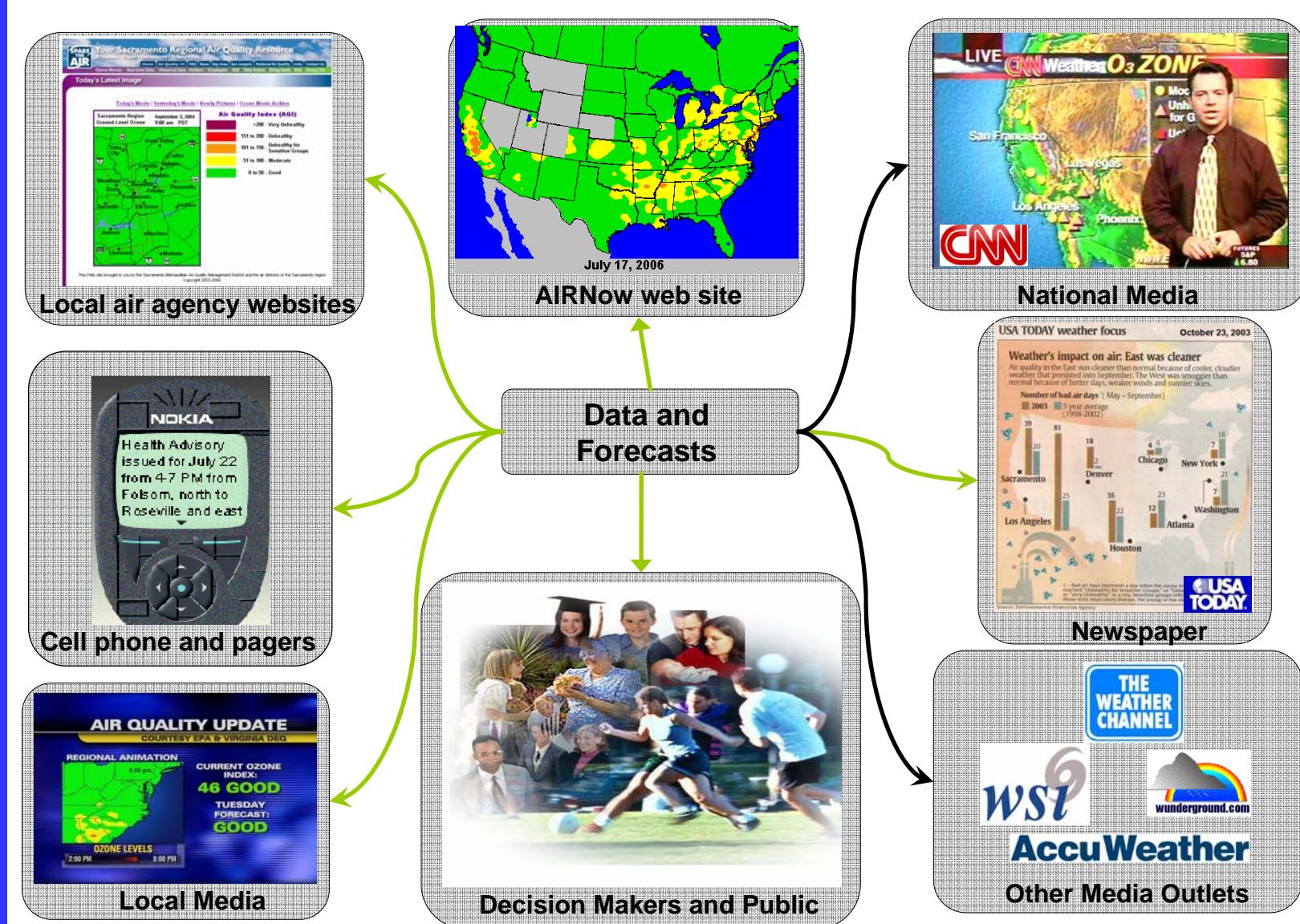
- Creating “international versions” of U.S. tools
  - AIRNow International (EPA)
    - Near real-time management and mapping of surface air quality data
    - Pilot international application in Shanghai, China
  - IDEA/3-d Air Quality System (NASA)
    - Near real-time integration of satellite and surface air quality data
    - Pilot international application in Central America through SERVIR
  - Geostationary Satellite AOD Algorithms (NOAA)

# AIRNow Overview

- AIRNow ([www.airnow.gov](http://www.airnow.gov))
  - Centralized, nationwide system for surface air quality monitoring data and forecasts
  - Main purpose – to provide data to public (AQI)
  - 120+ federal, state, provincial, tribal, and local air agencies participate
  - Real-time products (maps, data feeds, forecasts)
- Serves as a conduit for communications and support between EPA and federal, state, local, tribal, and international agencies
- An air quality resource for public, media, researchers, ...



# AIRNow - Product Distribution



# Global Air Quality Assessment and Forecasting

- AIRNow-International Scoping Study
  - Develop the initial specifications for a software package to collect, process, map, and distribute real-time surface air quality information
  - Design to maximize portability, interoperability, flexibility, and sustainability
  - Initial target implementation: Shanghai, China

# Infusing satellite Data into Environmental Applications (IDEA)

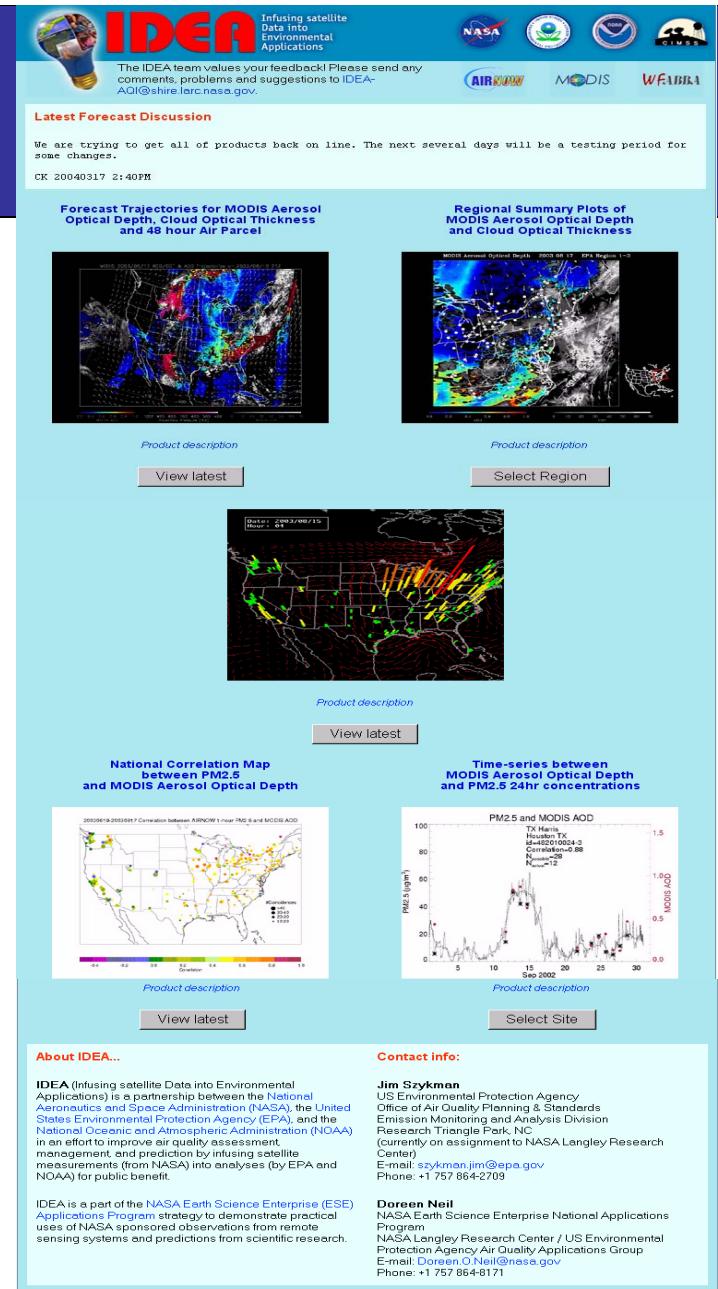
**A joint NASA-NOAA-EPA initiative:**

**Objective** - Prototype a near-real-time MODIS trajectory forecast product using MODIS direct broadcast aerosol optical depth over CONUS.

**Goal** - Improve accuracy of next day PM<sub>2.5</sub> Air Quality Index (AQI) by providing pseudo-synoptic aerosol observations and trajectory forecast during large aerosol events.

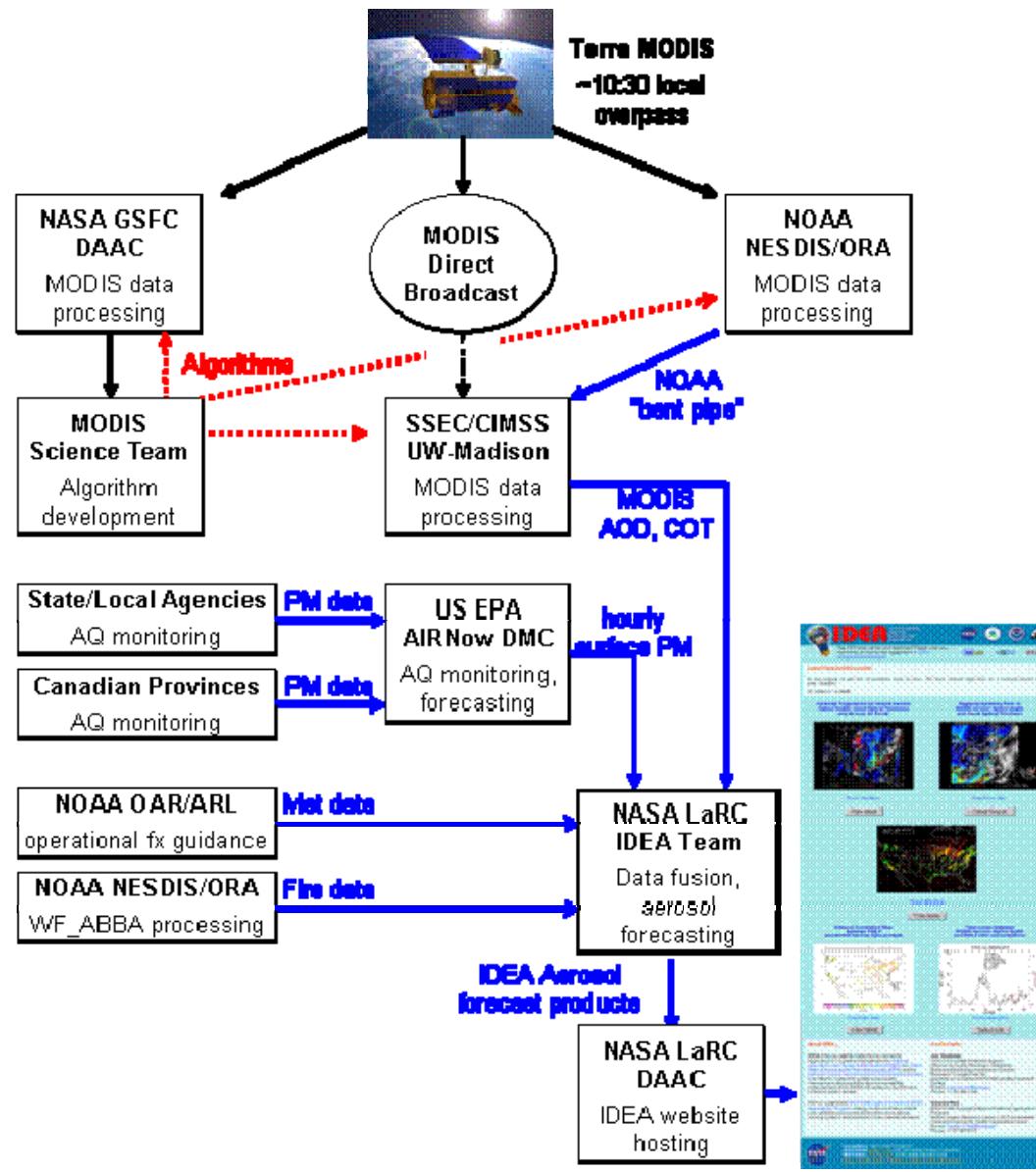
- *EPA, NOAA, NASA, University Researchers, and Air Quality Forecasters prototyped a system demonstrated during Summer 2003.*
- *Pseudo-operational System implemented at CIMSS May 2004. Forecast tool for AQ forecasters through direct link with AIRNow-TECH.*
- *Currently in pre-operational mode at NESDIS.*

**Benefit** - Enable improved mitigation of health effects caused by episodes of poor air quality



Al-Saadi et. al., September 2005,  
*Bulletin of American Meteorological Society*

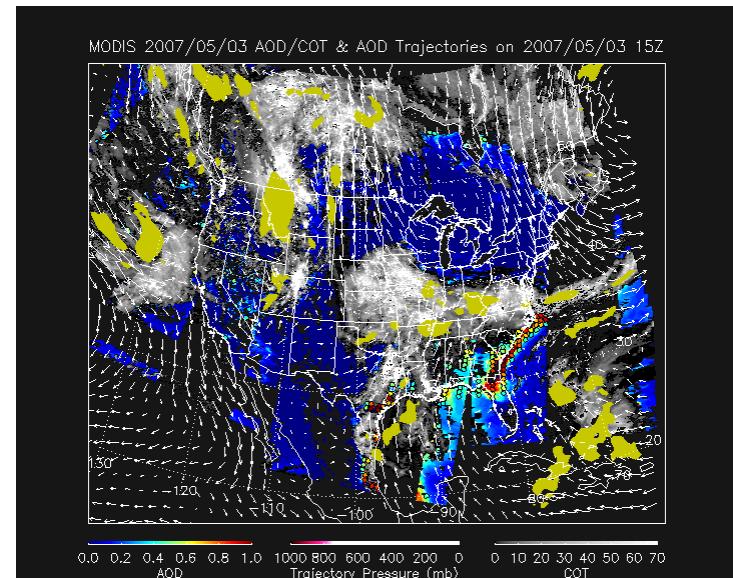
# IDEA Data Architecture



# IDEA Products

- Provides forecast guidance for surface air quality (PM2.5)
  - Dust storms, Smoke, Haze
- AOD moved forward with forecast model
  - Trajectories are initialized at locations with aerosol optical depth > 0.4 at 50, 100, 150, and 200mb
  - Run using 12Z NOAA/NCEP NAM forecast data providing 48 hr forecast
- System requirements
  - Direct broadcast receiving station for satellite data
  - Trajectory model
  - Regional meteorological forecast model output
  - Algorithms to derive aerosol optical depth or related parameters
  - Surface mass aerosol monitors
- System flexibility
  - Easily adaptable to other regions of the globe or input from other satellites
  - Easy to modify to input other satellite data (e.g., FY or GMS satellite data products)

## *Forecast Product for May 3, 2007*



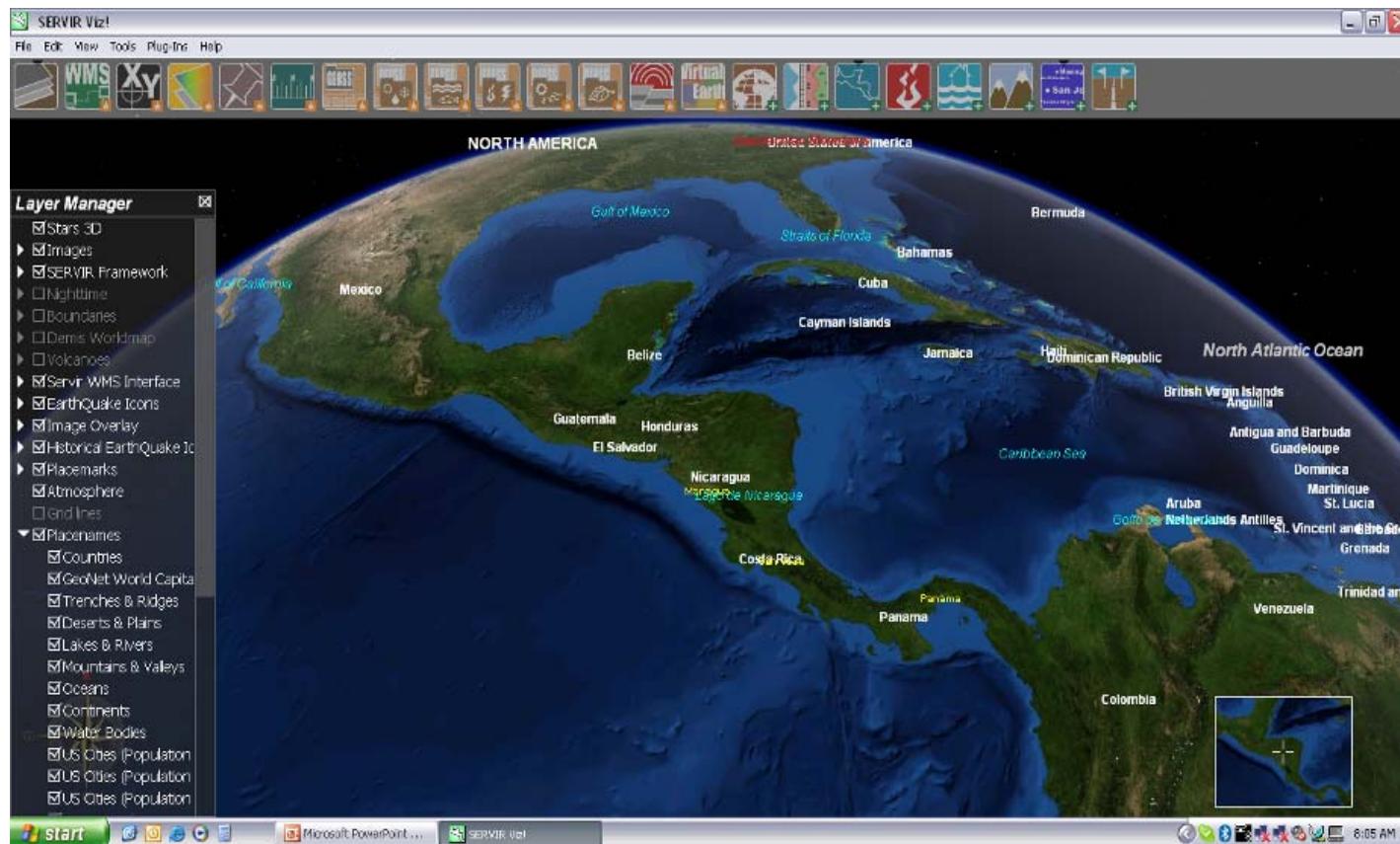
48-hr trajectory forecast initialized with satellite (MODIS) observations of Aerosol Optical Depth. Pink color in the forecast trajectories indicates pollution will be closer to the ground

# 3D-AQS

- UMBC and Battelle with funding from NASA's Applications Program
- Objectives:
  - Expand IDEA and migrate to NOAA
    - Add ground based lidar and other satellite data
    - Migrate from UW Madison to operational status at NESDIS
  - Incorporate satellite data into EPA's air quality data system
  - Improve 3-D Visualizations

# SERVIR

**SERVIR**, a web-based system that integrates remote sensing data (satellite and *in situ*) and geospatial information for mapping, monitoring, and 3-D visualization of the earth



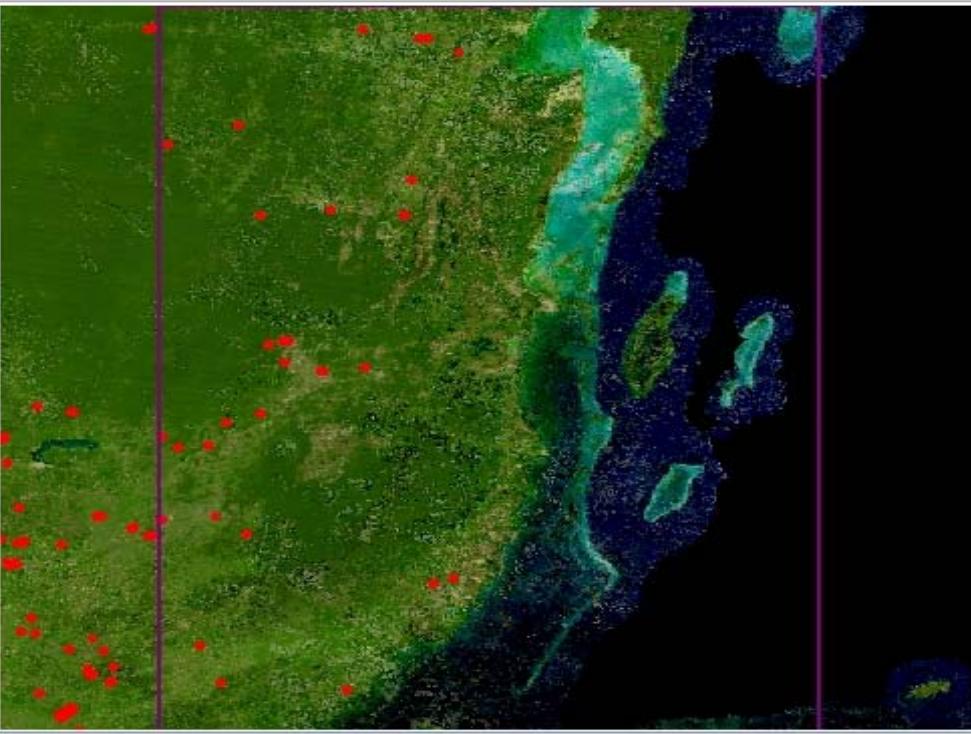
# SERVIR Web Fire Mapper:

## Just One Example of a Disseminated Product

**ALERTA DE INCENDIOS EN MESOAMÉRICA**

**SERVIR**  
*Sistema de Monitoreo y Visualización para Mesoamérica*

**SERVIR WEB FIRE MAPPER**  
Correo Electrónico generado 4/23/2006 1:23:41 AM



18.425 -88.502 317.6 1.3 1.8 2006-04-22 1935 A 0

El número de incendios activos detectados/procesados en su área de interés es: 34  
**Región de Interés:**

BT= Temperatura de brillo(Kelvin)  
Date= Fecha de adquisición de MODIS  
Sat= Satélite(A=Aqua and T=Terra)  
Conf= Confianza  
Scan= Recorrido  
Track= Pista

Para ver información de incendios activos con otras coberturas SIG o para consultar la base de datos completa visite [Central-America- Web Fire Mapper](#)

Para mayor información vaya a [preguntas frecuentes](#) o [Contáctenos](#)

Por favor tenga presente que las nubes pueden afectar la detección de incendios activos. Para poder consultar incendios activos en otras regiones vaya a [Web Fire Mapper](#)

Por favor tenga en cuenta que el archivo jgw adjunto es un documento de World que contiene información de georeferenciación para la imagen jpeg. Para ver la imagen jpeg en un SIG local, grabe el archivo jgw y jpeg con el mismo nombre (e.g.,AlertaIncendio.jpg y AlertaIncendio.jgw) a un folder común.

**Descargo:** Conservación Internacional (CI) y la Universidad de Maryland (UMD) no garantizan que los datos, la base de datos o cualquier información generada usando estos datos o la base de datos estén exentos de error. Los datos se suministran 'como están' y ni CI ni UMD hacen declaraciones que expresen o impliquen garantías de ninguna clase, incluyendo aunque no se limite a cualquier garantía implicada en la comerciabilidad o aptitud de los datos para un propósito particular. La institución receptora consiente en no proporcionar ningún tipo de garantía referente a los datos o a bases de datos a terceros en nombre de CI o UMD.

Satellite-derived Fire Maps & E-mail alerts for the People of Central America

# Global Air Quality Assessment and Forecasting

- SERVIR-Air Quality Pilot Study
  - Currently in the planning stage
    - NASA, EPA, USAID, and the SERVIR partners
  - Potential tasks:
    - Provision of Air Quality Products through SERVIR integrating capabilities from IDEA, 3D-AQS, and other relevant products
    - Establishment of Additional Ground-Based Monitoring and Data Management System (i.e. AIRNow-I)
    - Training and Outreach

# Global Air Quality Assessment and Forecasting

- Creating “international versions” of U.S. tools
  - AIRNow-International Pilot
  - SERVIR-Air Quality Pilot Study
  - Geostationary Satellite Retrieval Algorithms
- Call for ministers to support development of air quality information systems and to make relevant data available
- Seek international participation and coordination

# Global Air Quality Assessment and Forecasting

- Form an Advisory/Coordination Committee
  - Gather input from other countries on design of the systems
  - Seek standardization and interoperability
  - As part of an AQ/Health Community of Practice
  - Connect to CEOS Atmospheric Composition Constellation, ADM interoperability efforts, and other related efforts
  - Possible meeting at the GEO Plenary/Summit
  - Use of web-based collaboration

# Global Air Quality Assessment and Forecasting

- Suggestions from the UIC?
  - Considerations for forming an advisory/coordination group
  - Role within an Air Quality Community of Practice
  - Individuals or programs to connect with
  - Relationships to other parts of GEO