

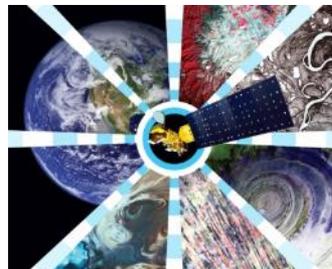
DEVELOP National Program



NASA Health and Air Quality Applications Program Annual Review

Beth Brumbaugh, MSPH

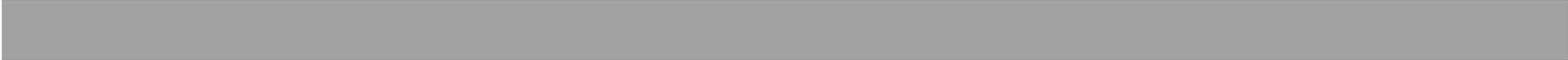
Saint Paul, MN - September 26, 2013



Agenda



About DEVELOP
FY13 DEVELOP Health & Air Quality Projects
Fall 2013 Project Portfolio
Virtual Poster Sessions





- ▶ What is DEVELOP?
- ▶ History
- ▶ Mission, Vision & Core Values
- ▶ Locations
- ▶ Benefits to Participants & Partners
- ▶ Participant Requirements
- ▶ Project Lifecycle
- ▶ Project Characteristics



About DEVELOP

NASA Organization

NASA Administrator

Deputy Administrator

Mission Directorates

Exploration
Systems

Space
Technology

Science

Mission
Support

Aeronautics

Joint Agency
Satellite Div.

Heliophysics
Division

**Earth Science
Division**

Planetary
Science Div.

Astrophysics
Division

Applied Sciences Program

Capacity Building Program

DEVELOP National Program

Applied Sciences' National Applications

Agriculture



Climate



Disasters



Ecological Forecasting



Energy



Health & Air Quality



Oceans



Water Resources



Weather



Applied Sciences' Capacity Building

ARSET

(Applied Remote Sensing Training)

Increases utilization of NASA observational and model data for decision-support through the dissemination of training for the usage of existing NASA data, webtools, Decision Support Systems and applied research.

DEVELOP

A dual capacity building training and development program that enables the next generation to apply Earth science to prototype applications. DEVELOP addresses needs for long-term capabilities within the workforce to use Earth science results in enhanced decision making.

GOMI

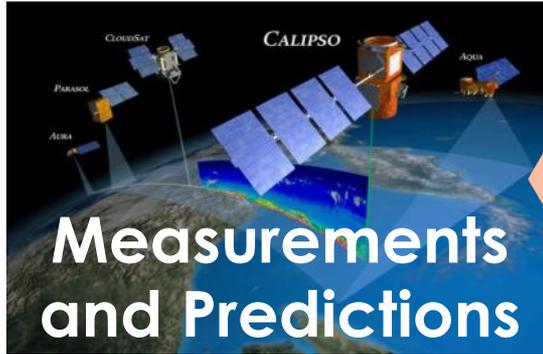
(Gulf of Mexico Initiative)

Advances societal and economic benefits from NASA Earth science in the Gulf Coast region to demonstrate the utility of NASA Earth science products for improved decision making and more effective coastal resources management.

SERVIR

A NASA-USAID project designed to improve environmental management and resilience to climate change by strengthening the capacity of governments and other key stakeholders to integrate earth observation information and geospatial technologies into development decision making.

What is DEVELOP?



NASA's Applied Sciences'
DEVELOP National Program



DEVELOP addresses environmental and public policy issues through interdisciplinary research projects that apply the lens of NASA Earth observations to community concerns around the globe. Bridging the gap between NASA Earth Science and society, DEVELOP builds capacity in both participants and partner organizations to better prepare them to handle the challenges that face our society and future generations. With the competitive nature and growing societal role of science and technology in today's global workplace, DEVELOP is fostering an adept corps of tomorrow's scientists and leaders.

DEVELOP History

DEVELOP began in 1998

In 1998, three interns at NASA Langley Research Center co-authored the white paper **“Practical Applications of Remote Sensing”** (Bauer et al., 1998). At that time, the Digital Earth Initiative, a federal interagency project dedicated to creating a virtual representation of the Earth to further human understanding of the world, was piloting an effort to increase public access to federal information about the Earth and the environment. A proposal combining NASA's Digital Earth Initiative and the students' paper advocated the formation of a program, and in 1999 DEVELOP was officially formed.

DEVELOP Timeline



Langley
Summer
Est. 1998



Wise
Summer
Est. 2001



Stennis
Fall
Est. 2002



Ames
Summer
Est. 2003



Mobile
Fall
Est. 2003



Goddard
Fall
Est. 2004



Marshall
Summer
Est. 2008



JPL
Summer
Est. 2008



Mexico
Spring
Est. 2011



Ft. Collins
Spring
Est. 2012



ICIMOD
Fall
Est. 2012



IRI
Spring
Est. 2013



UGA
Summer
Est. 2013



Richmond
Summer
Est. 2013

DEVELOP's Mission, Vision & Core Values

MISSION

Uniting NASA Earth observations with society to foster future innovation and cultivate the professionals of tomorrow by addressing diverse environmental issues today.

VISION

To maximize NASA's Earth science investments by enabling the next generation to accelerate innovative applications in technology, resource management, policy development, and decision making.

INNOVATION

Generate new and creative Earth science applications to meet societal needs by utilizing existing technologies

SERVICE

Devote ourselves to the success of our people and the communities we serve

INTEGRITY

Define ourselves by truth, honor, character, and ethical conduct

PASSION

Pursue all endeavors with energy, excitement, and enthusiasm

PROFESSIONALISM

Maintain a high level of excellence and respect in work, actions, and appearance

STEWARDSHIP

Utilize resources and talents to benefit society and the environment

SCHOLARSHIP

Foster an organizational culture where continued learning is a priority

COLLABORATION

Promote teamwork, open communication, and shared resources

DEVELOP Office Locations

NASA Centers

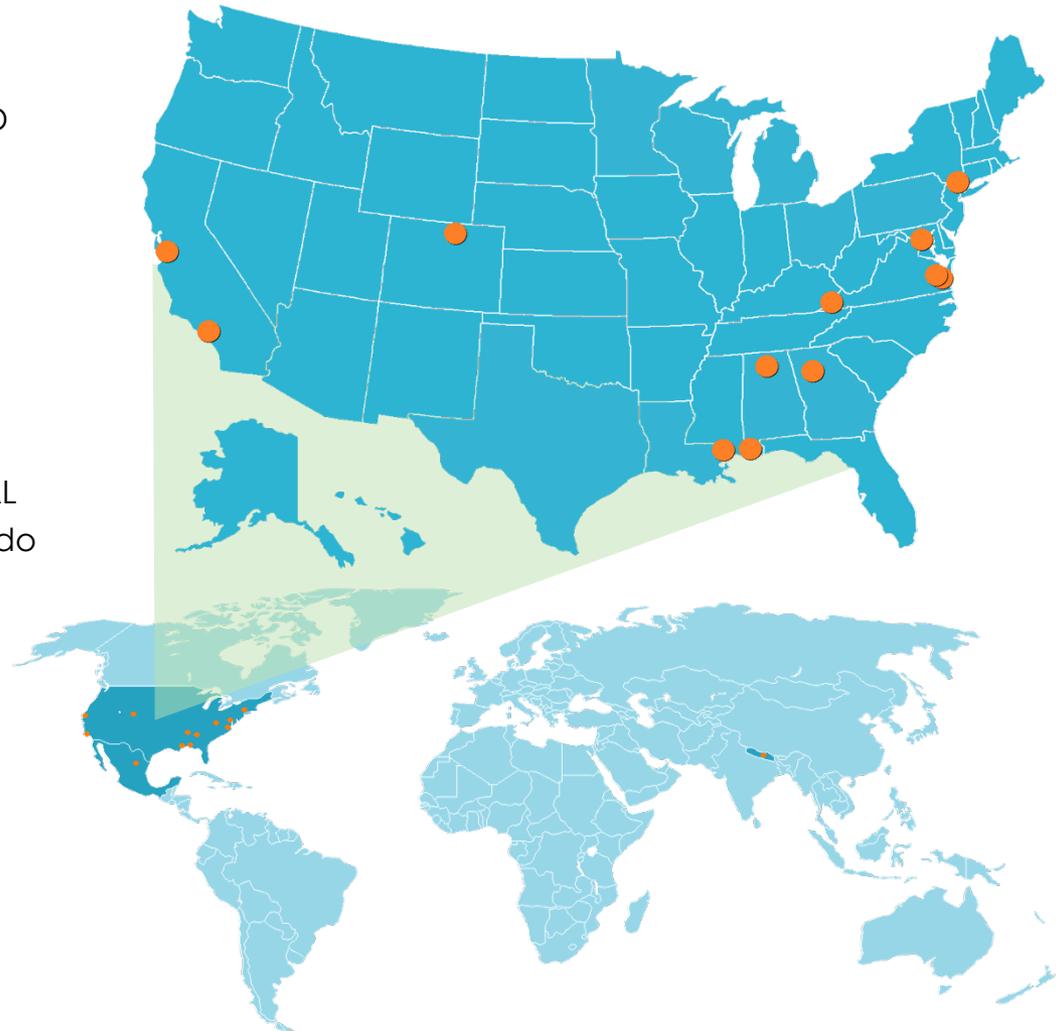
- Ames Research Center – Moffett Field, CA
- Goddard Space Flight Center – Greenbelt, MD
- Jet Propulsion Laboratory – Pasadena, CA
- Langley Research Center – Hampton, VA
- Marshall Space Flight Center – Huntsville, AL
- Stennis Space Center – Stennis, MS

Regional & Academic Locations

- International Research Institute – Palisades, NY
- Mobile County Health Department – Mobile, AL
- North Central Climate Science Center/Colorado State University– Fort Collins, CO
- Patrick Henry Building – Richmond, VA
- University of Georgia – Athens, GA
- Wise County Clerk of Court's Office – Wise, VA

International Locations

- International Centre for Integrated Mountain Development – Kathmandu, NP
- Tecnológico de Monterrey Saltillo Campus – Saltillo, MX



Benefits to Participants

Scientific/Professional Development:

- Experience using Earth observations
- GIS and Remote Sensing
- Working in a group environment
- Management and leadership skills

Personal Development:

- Presentation and communication skills
- Proper business place etiquette and dress
- Personality typing and working with diverse groups

Professional Networking:

- NASA scientists and managers
- Partner organizations
- Peers – teams, center, and national

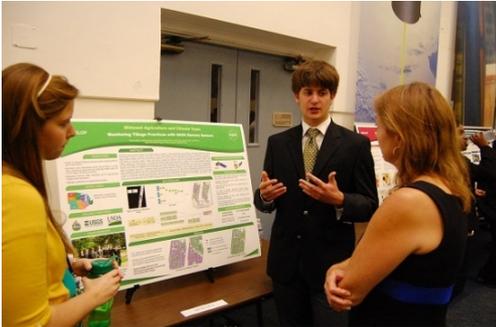


Benefits to Partners



- Introduction to new methods to augment current practices: **Cost-saving & time-saving**
- Enhanced **decision support** through use of NASA EOS
- **Increased exposure** to NASA Earth Science technologies and capabilities
- Introduction to **NASA's Applied Sciences Program** and its contributions to local communities, the country, and the world
- **Hands-on training** with practical applications of remote sensing and NASA Earth science
- Improved remote sensing and geographic information science (GIS) capabilities
- Interaction with bright and innovative young professionals
- Opportunities for **networking with the NASA community**
- **Strong recruiting pool** of early career professionals with a knowledge of Earth observations and their capabilities

Participant Requirements



- Current students: high school, college, and graduate level
- Age 18+ with a minimum GPA of 3.0 GPA (cumulative or most recent semester)
- Recent graduates are eligible for three terms within two years of graduation date
- Interdisciplinary backgrounds (majority from STEM fields)
- US Citizens & Foreign Nationals*
- Interns come from diverse background, no experience is required but a strong interest in GIS, remote sensing, and science is important

**US citizenship required to apply to DEVELOP locations at NASA Centers*

Three 10-week terms per year
Spring, Summer, and Fall

Students must reapply each term

Project Lifecycle

Science

- National science objectives
- Program Managers
- Science advisors
- Decadal Survey

Applied Sciences Program

State & Local

- Community demand
- SGPB
- CSG
- NACo, etc.

DEVELOP Project Execution

- Partner with stakeholder
- Identify & collaborate with science advisors

Present at State & Local Public Policy and Science Forums (AGU, AMS, SGPB, CSG, etc.)

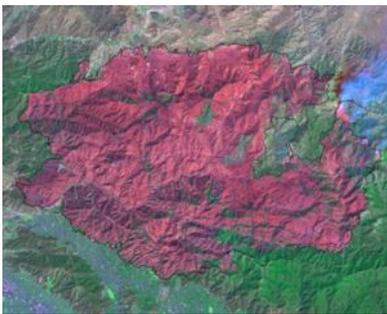
Capacity Built:
Future Workforce

Capacity Built:
Partner Organizations

Capacity Built:
State & Local Governments

Capacity Built:
General Public

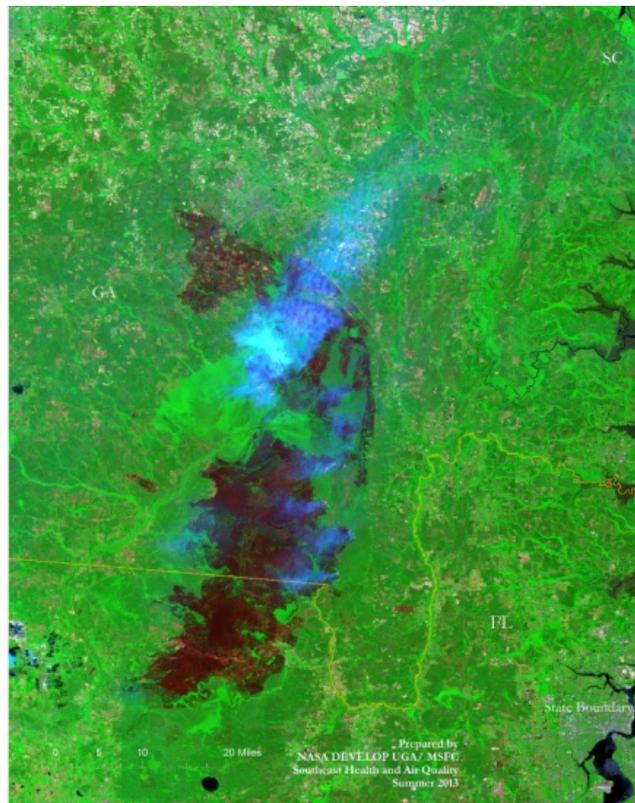
Project Characteristics



- ✓ Focus on the **utilization of NASA Earth observations**
- ✓ **Highlight the capabilities** of NASA satellite and airborne Earth remote sensing science and technology
- ✓ Address a **community concern** relating to environmental issues
- ✓ **Partner with local, state, federal and/or international organizations** who can **benefit** from using NASA EOS to **enhance decision making**
- ✓ Meet partner needs by **providing decision support tools**
- ✓ Research is conducted by student teams with **diverse backgrounds**
- ✓ Science advisors and mentors from NASA and partner organizations provide guidance
- ✓ All projects culminate in a set of deliverables (technical report, poster, presentation, video, etc.)



- ▶ Appalachian Mtns Health & Air Quality
- ▶ Oregon Health & Air Quality
- ▶ Ethiopia Health
- ▶ Sudan Health
- ▶ Southeast Health & Air Quality
- ▶ Sahel Health



FY 2013 Health & Air Quality Projects



Appalachian Mountains Health & Air Quality



Comparison of NASA OMI and MLS Ozone Products with USDA Forest Service Ground-based Ozone Monitoring Data for Forest Management Decision Support

Aaron Brooks, Tulane University
Shelby Barrett, William Carey University
Jamie Thompson, University of Southern Mississippi

Yaseen Moussa, Southeastern Louisiana University
Teneala Spencer, Gulfport High School

Joseph Spruce, CSC, NASA John C. Stennis Space Center



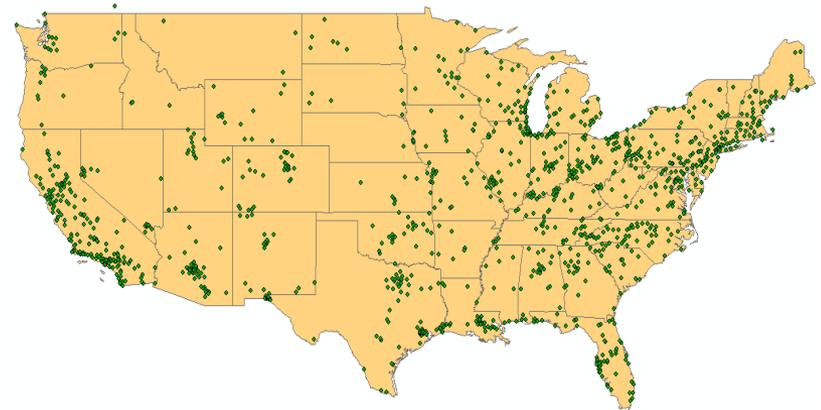
Appalachian Mountains Health & Air Quality

Community Concerns

- Congressional mandate for monitoring air pollution impacts
- Damage to plants caused by ozone
- Sparseness of ozone measurement stations
- High cost of ozone monitoring



USDA Forest Service O₃ Monitoring Points

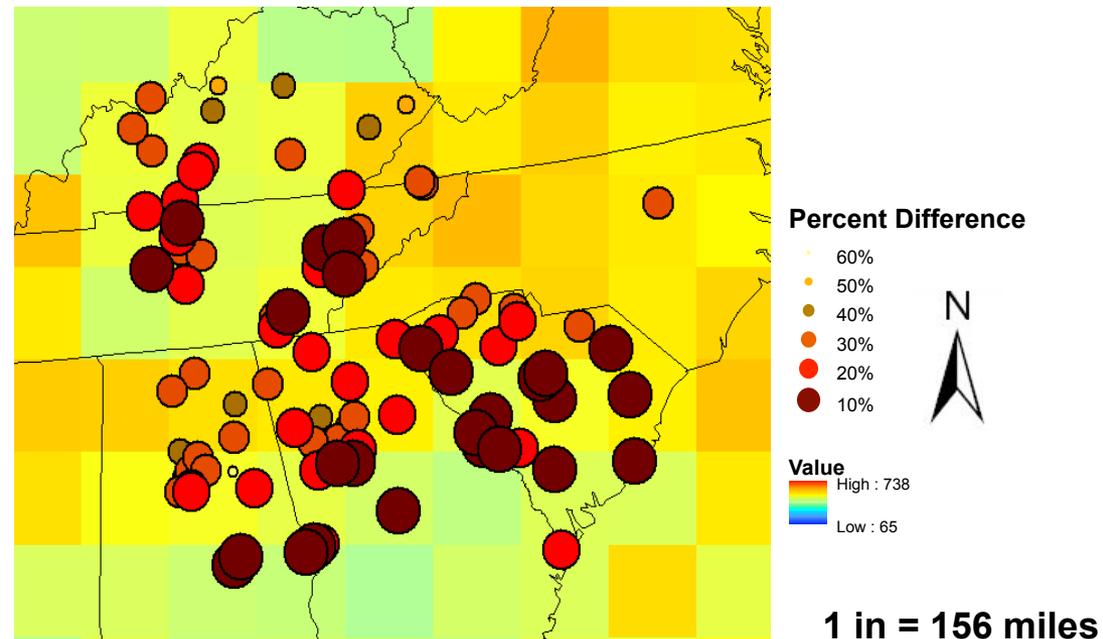


Appalachian Mountains Health & Air Quality

Results

- Large variability of measurements taken by USFS and the OMI/MLS GSFC product
- OMI/MLS product values generally higher than observed USFS values

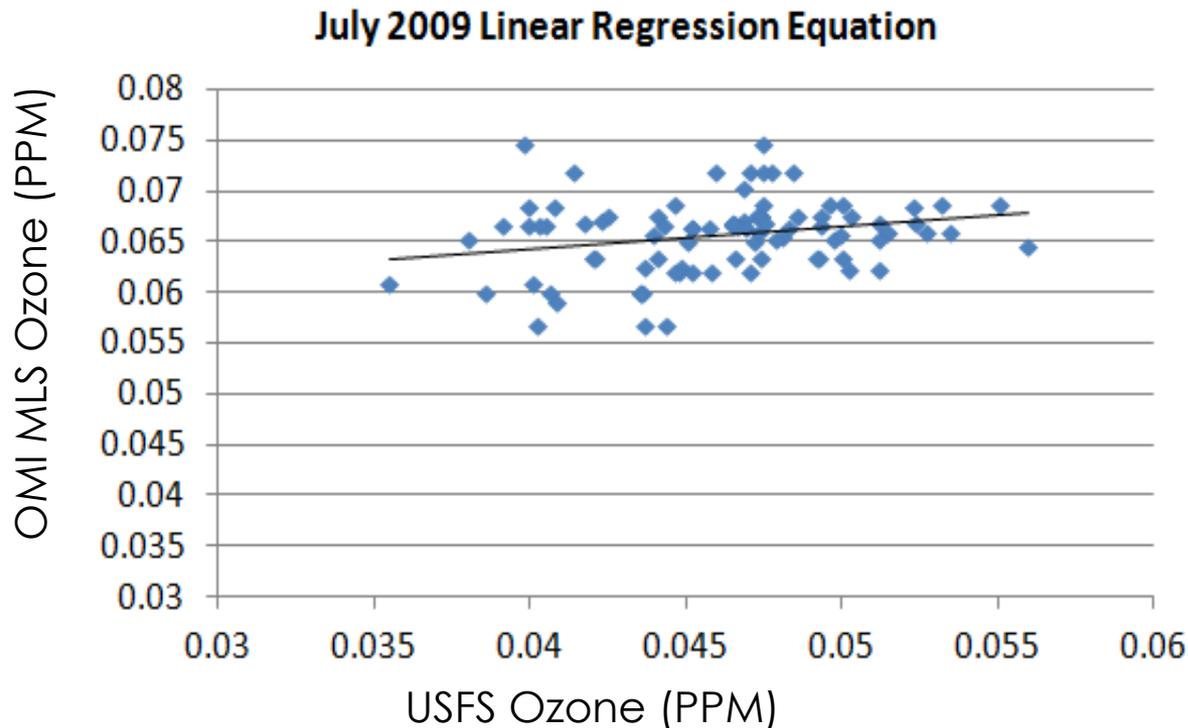
OMI/MLS Ozone Measurements vs
Forest Service Monthly Means
March 2005



Appalachian Mountains Health & Air Quality

Conclusions

- OMI/MLS ozone data product could be useful in areas where monitors are sparse
- Cloud cover and adverse weather may lead to few viable daily measurements



Oregon Health & Air Quality



Utilizing NASA EOS to Assess Effects on Air Quality Caused by Western United States Wildfires

Stephen Quinn, Plymouth State University Brittany Parsons, Old Dominion University
Zachary Toll, University of California, Santa Barbara Carrea M. Dye, Hampton University
Amanda Gray, Christopher Newport University Marlene Lichty, Christopher Newport University
Dr. Kenton Ross, NASA Langley Research Center



Oregon Health & Air Quality

Community Concerns

- Pole Creek Fire burned over 27,000 acres
- In 2012, Oregon spent \$1.6 billion in wildfire mitigation costs



Pole Creek Fire
near Sisters, Oregon



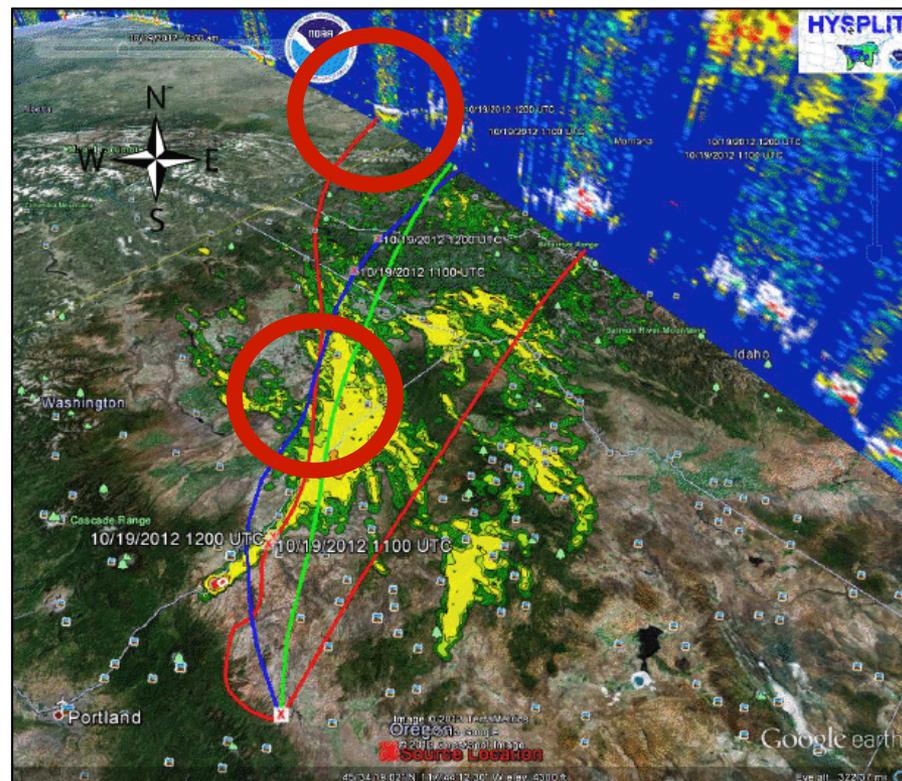
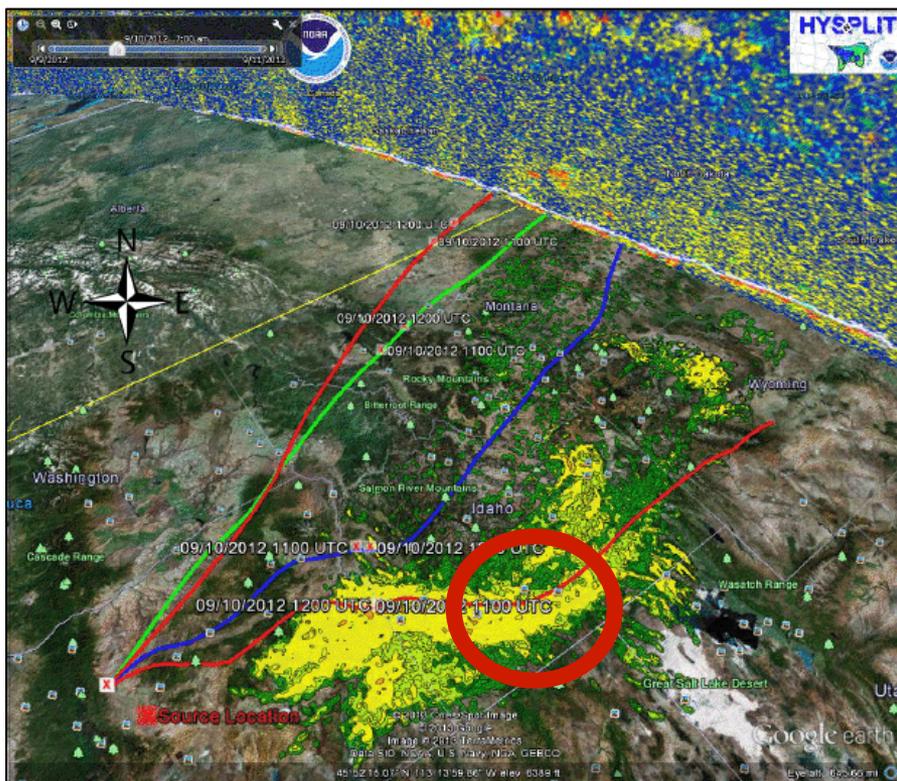
- Particulate matter is often emitted from wildfires at dangerous levels

Oregon Health & Air Quality

NOAA HYSPLIT/NASA-CNES CALIPSO Google Earth Images

September 9, 2012

October 18, 2012



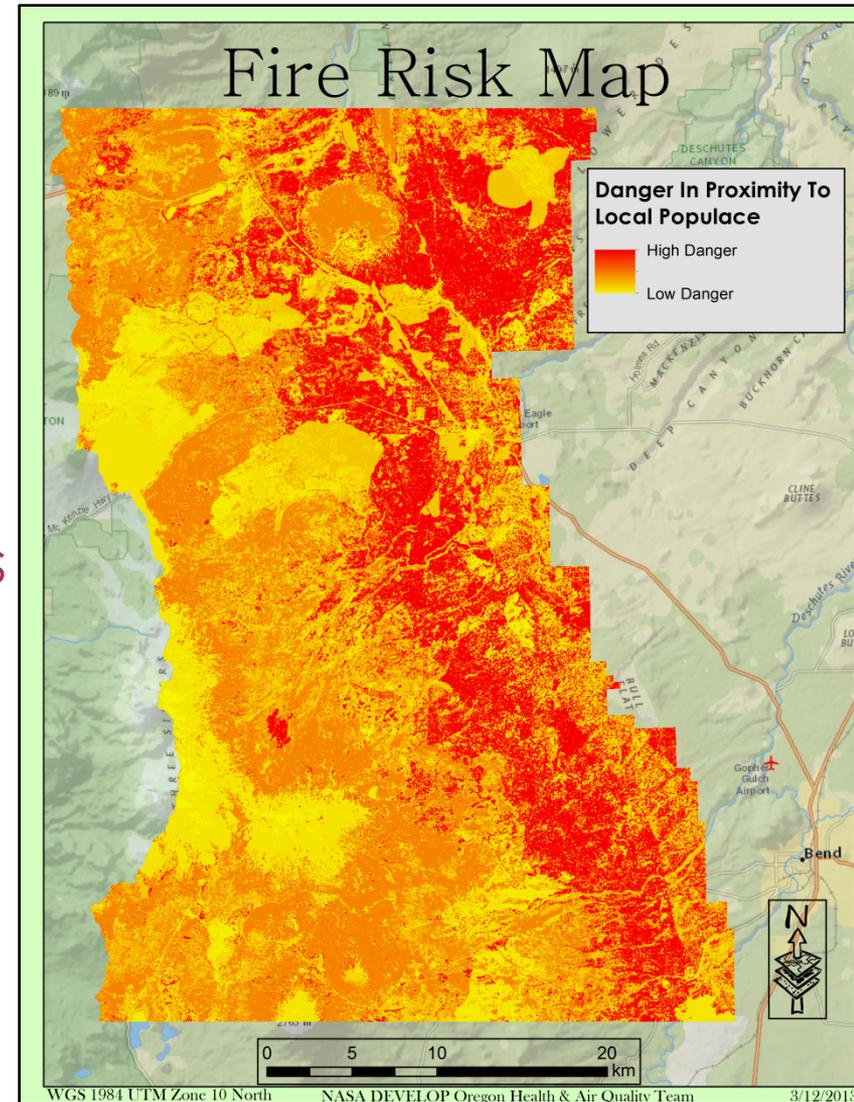
Oregon Health & Air Quality

Conclusions

- Highest amounts of PM occurred mid-fire
- VIIRS Day/Night and M13 bands demonstrate ability to visualize a fire
- Fire Risk Map may improve allocation of monitoring resources

VIIRS Day/ Night Band

VIIRS Fire Band



Ethiopia Health & Climate



Using Remote Sensing Data Analysis to Develop a Malaria Early Warning System in East Shewa, Ethiopia

Caitlin Reid, Columbia University

Dr. Pietro Ceccato, International Research Institute for Climate and Society

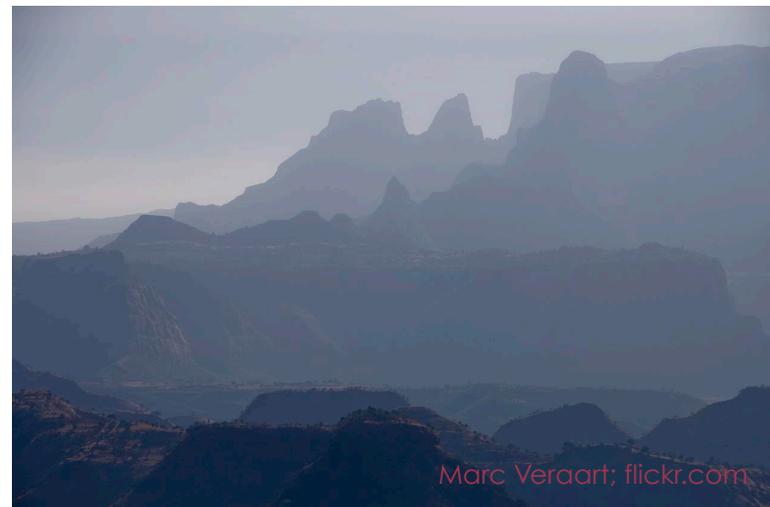
Dr. Madeleine Thompson, International Research Institute for Climate and Society



Ethiopia Health & Climate

Community Concerns

- Malaria is the leading cause of morbidity and mortality
- Large-scale epidemics occur every 5-8 years
- Need for a Malaria Early Warning System (MEWS)
- Transmission highly sensitive to temperature and precipitation



The Center for
National Health
Development in
Ethiopia



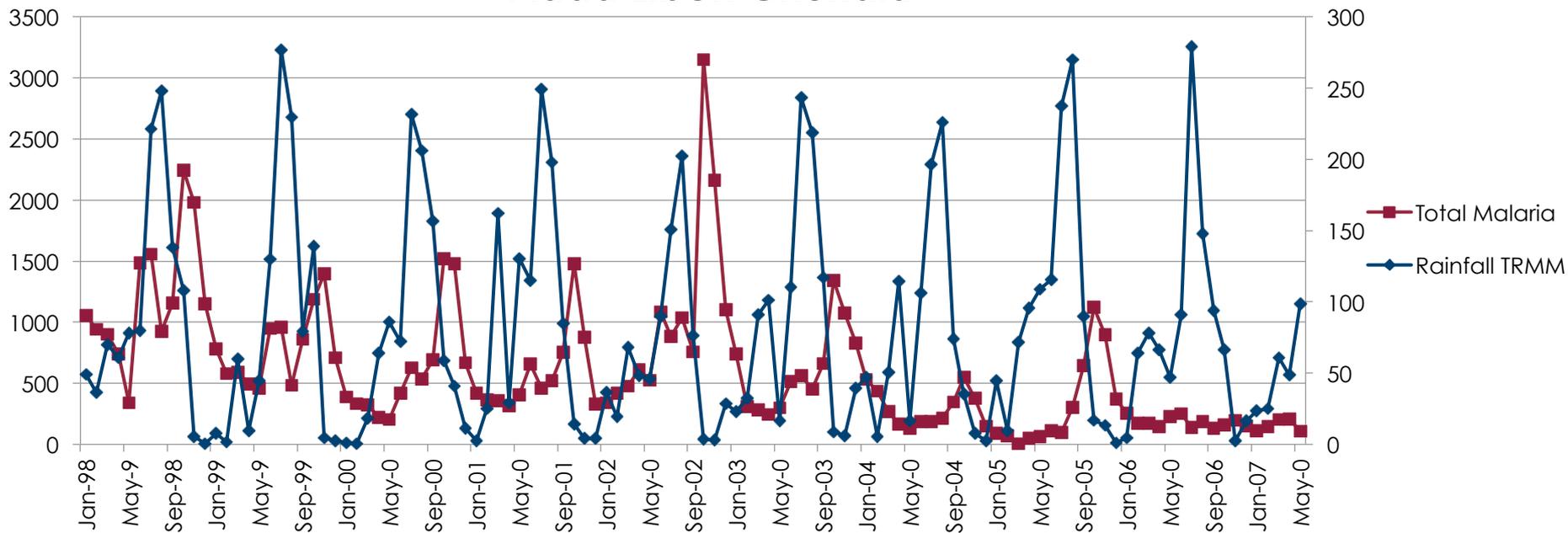
The International
Research Institute
for Climate and
Society

Ethiopia Health & Climate

Results

- Seasonality in rainfall, temperature and vegetation corresponded with seasonality of malaria cases
- Malaria was found above 2,000m
- Increase in irrigation by farmers

Adaa Liben Chukala

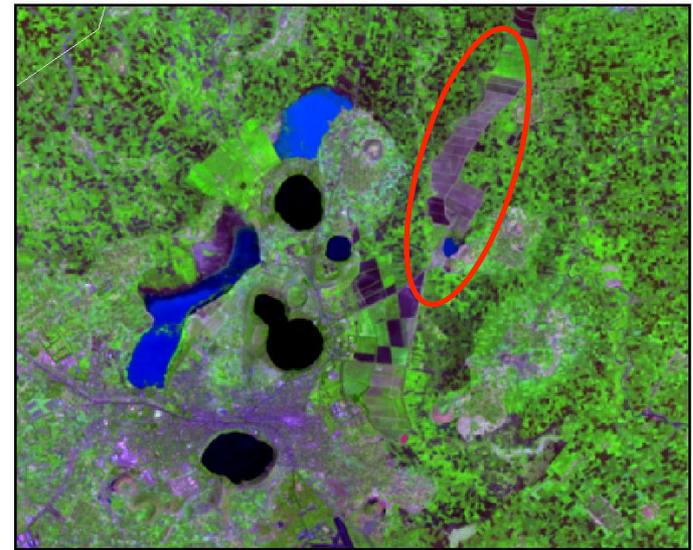


Ethiopia Health & Climate

Conclusions

- Areas above 2,000m had temperature highs above or at 18°C
- Outbreaks of malaria were observed after drought, rather than high rainfall
- Increase in irrigation may extend malaria-conducive conditions
- Many districts must be evaluated at the village level

Landsat 7 Image Showing Dammed River



0 5 Kilometers

Sudan Health



Utilizing NASA Earth Observations to Determine the Relationship
Between Environmental Factors and Leishmaniasis in Sudan

Alex Sweeney, Columbia University

Caitlin Reid, Columbia University

Dr. Pietro Ceccato, International Research Institute for Climate and Society

Dr. Madeleine Thompson, International Research Institute for Climate and Society



Sudan Health

Community Concerns

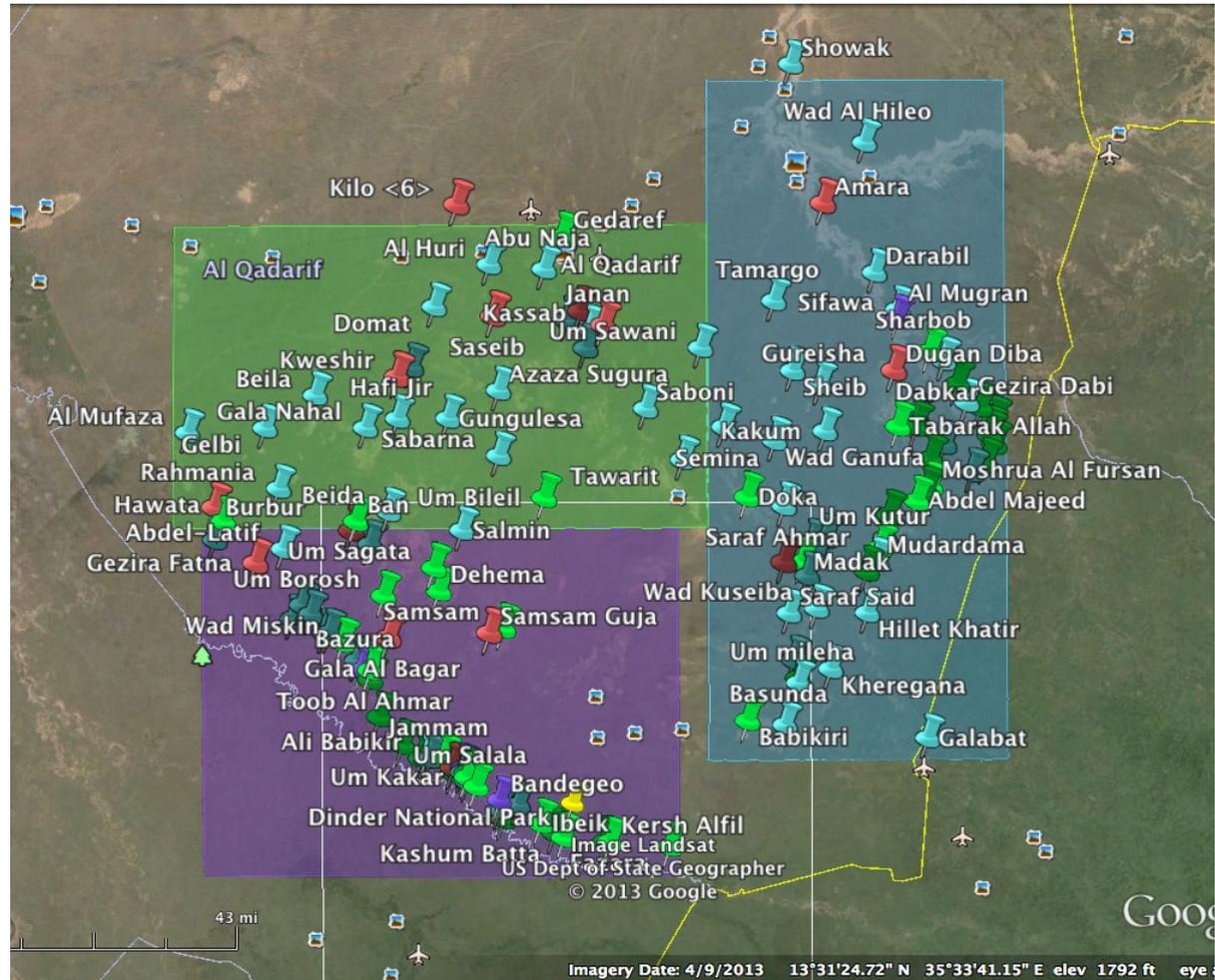
- Visceral Leishmaniasis (VL) transmitted by the bite of female sand fly
- Almost always fatal if left untreated
- Long incubation period (2 to 6 months)
- >13% of population has experienced VL
- No vaccine



Sudan Health

Results

- VL cases peaked in SONDJ
- Three regional clusters of VL cases
- Environmental and climatic variables can inform a VL Early Warning System



Sudan Health

Conclusions

- March/April/May climate variables can be predictive of sand fly activity:
 - Below normal rainfall
 - Inundation delayed
 - High mean max daily temperature
- Results will inform predictive model to assist the development of a VL Early Warning System



Southeast US Health & Air Quality



Infusing NASA Satellite Data to Model Air Quality for Southeast United States: A Wildfire, Aerosol Transport, and Respiratory Health Case Study

Binita KC, University of Georgia (Project Lead)

Jennifer Bell, University of Georgia

Swatantra Kethireddy, JSU (Project Lead)

Eric Dobbs, University of Alabama, Huntsville

Dr. Jeff Luvall (Global Hydrology and Climate Center, MSFC)

Dr. J. Marshall Shepherd (Department of Geography, UGA)

Dr. Thomas L. Mote (Department of Geography, UGA)

Dr. Mohammad Al-hamdan (Research Scientist, USRA)

Dr. Sundar A. Christopher (UAH)

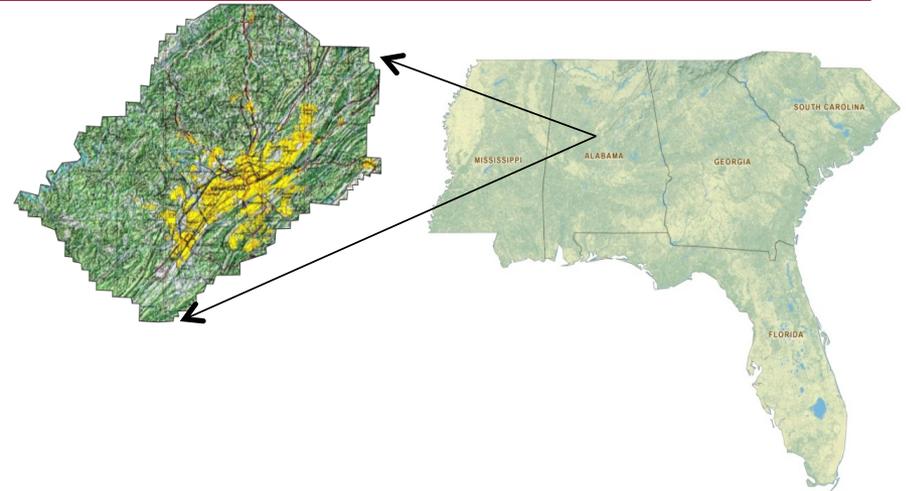
Steve Padgett Vasquez (UGA)



Southeast Health & Air Quality

Community Concerns

- The Okefenokee Swamp fires burned from April to early July 2007
- Impacted ambient air quality measurements in Jefferson County, AL
- Adverse health effects such as upper respiratory and cardiovascular disorders



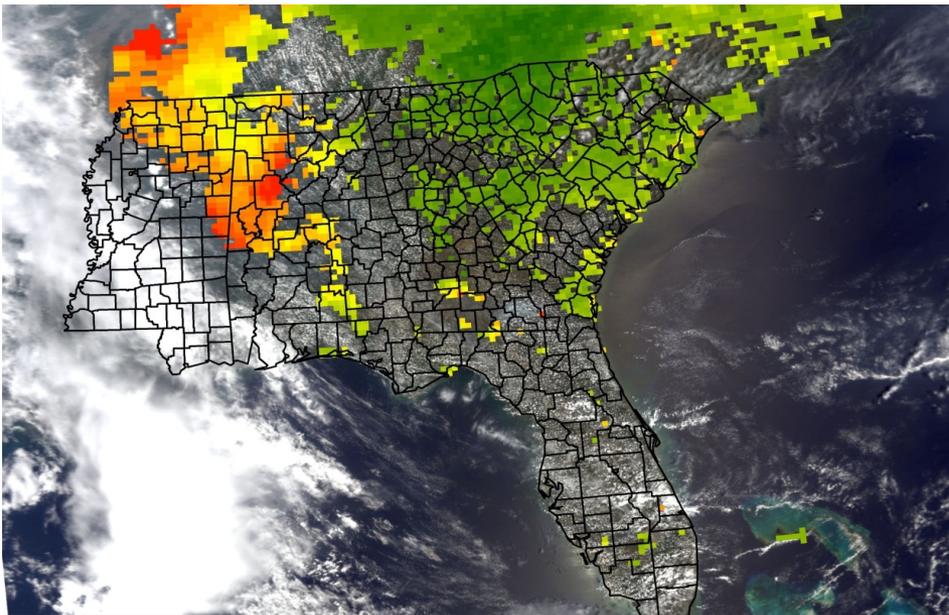
JEFFERSON COUNTY
DEPARTMENT OF HEALTH
ALABAMA

Southeast Health & Air Quality

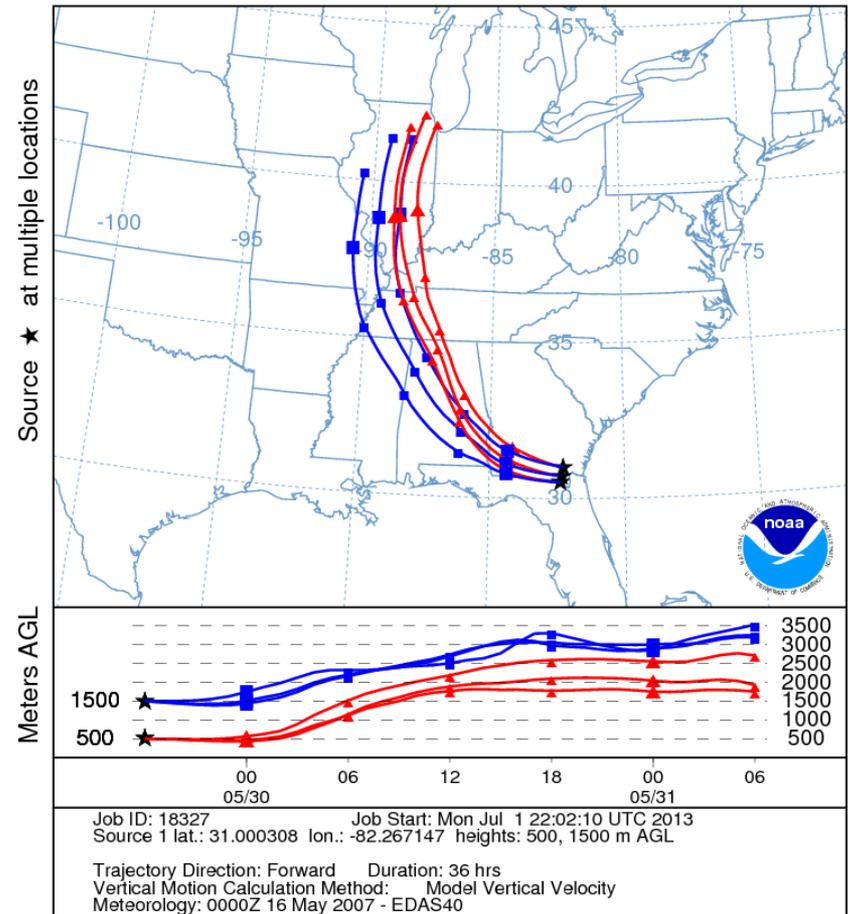
Results

- HYSPLIT model run with True-Color, AOD, and $PM_{2.5}$ surface maps for qualitative assessment

Terra MODIS Level 2 AOD, May 29, 2007



NOAA HYSPLIT MODEL
Forward trajectories starting at 1800 UTC 29 May 07
EDAS Meteorological Data



Southeast Health & Air Quality

Conclusions

- MODIS aerosol product can play a vital role in determining and managing AQ over a region
- Flux modeling improves analysis of aero
- Useful methods for in predicting $PM_{2.5}$ that can be used to improve health department air quality warning



Sahel Health



Examining Meningococcal Meningitis and Climate in the Sahel

Elisabeth Gawthrop, Columbia University

Tam Tran, Columbia University

Dr. Pietro Ceccato, International Research Institute for Climate and Society



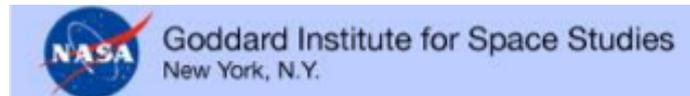
Sahel Health

Community Concerns

- Meningococcal Meningitis (MM) is a bacterial cerebrospinal infection
- Global, highest incidence in “Meningitis Belt”
- 5-10% mortality, debilitating lasting effects in survivors
- Transmitted person-to-person via respiratory droplets



Source: flickr.com/sanofi-pasteur

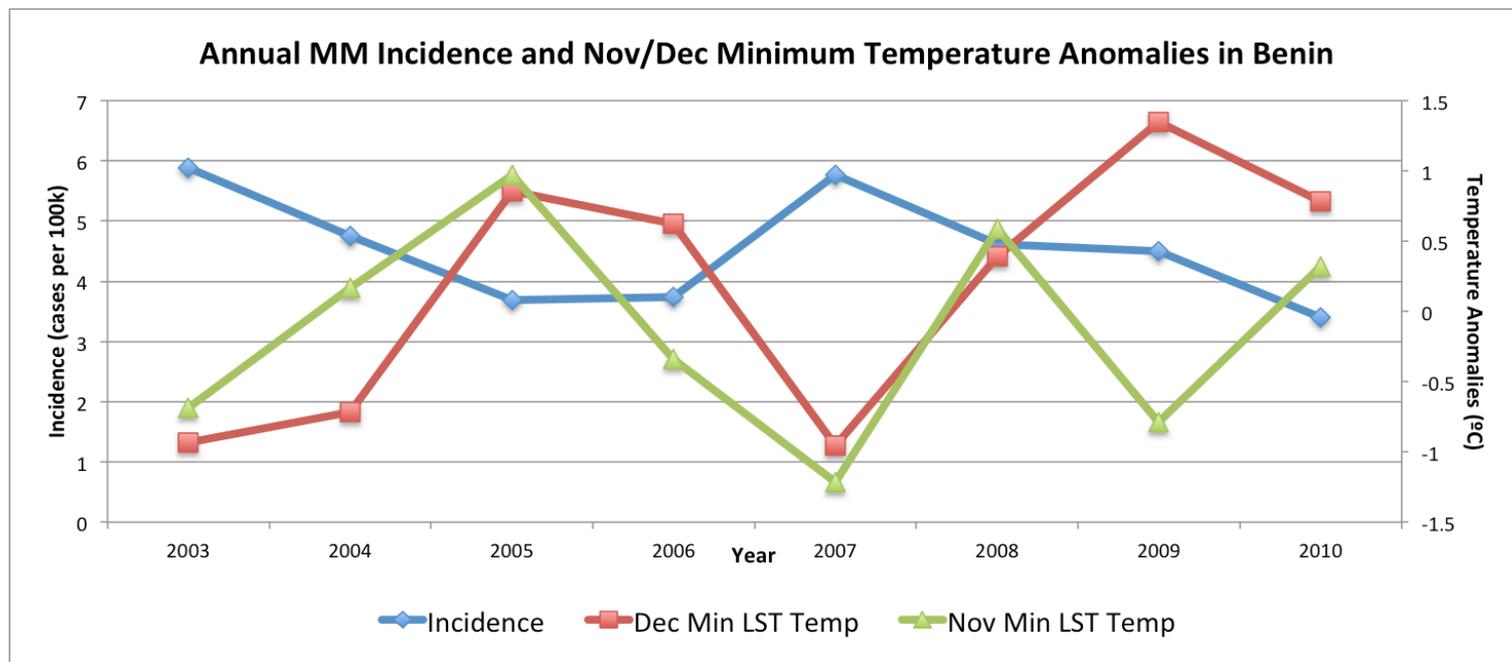


Source: CDC

Sahel Health

Results

- Humidity and temperature from Earth observation data can be used to inform predictive models
- Trend observed that when temperature is lower, incidence is higher



Sahel Health

Conclusions

- Identified areas where more studies need to be performed on smaller spatial scale
- Humidity and temperature show potential for prediction of seasons at high-risk for MM
 - Correlation generally stronger in western part of the “Belt”



Fall 2013 Project Portfolio

Ecological Forecasting

Bhutan Eco Forecasting (ICIMOD)
Costa Rica Eco Forecasting (UGA)
Cumberland Plateau Eco Forecasting (MSFC)
Georgia Eco Forecasting II (UGA)
Great Smoky Mountain National Park Eco Forecasting II (UGA)
Myanmar Eco Forecasting (GSFC)
Rocky Mountain Eco Forecasting (NCCSC)
Sierra Nevada Eco Forecasting (ARC)

Water Resources

Colorado Water Resources (NCCSC)
Chile Water Resources & Agriculture (LaRC)
Kenya Water Resources (GSFC)

Disasters

U.S. Disasters (JPL)
Western U.S. Disasters (National Collaboration)

Agriculture

Virginia Agriculture (LaRC)
Great Plains Agriculture (LaRC)
Coahuila Agriculture (WC/MT)
Alabama Agriculture (MCHD)
Uruguay Agriculture (IRI)

Health and Air Quality

California Health & Air Quality (JPL)
Gulf Coast Health & Air Quality (MCHD)
Sudan Health & Air Quality II (IRI)
U.S. Health & Air Quality (SSC)

Energy

Rwanda Energy (WC)

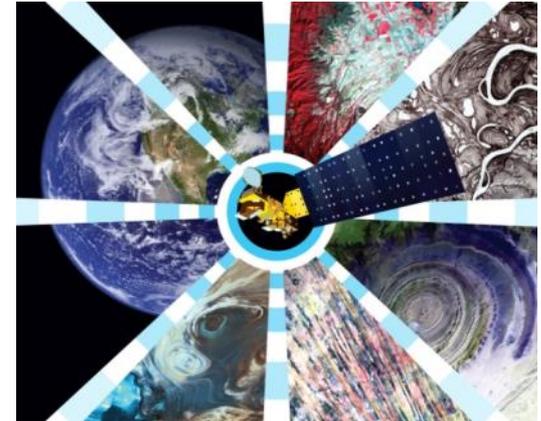
Oceans

Texas Oceans (SSC)



Virtual Poster Session (VPS)

- The VPS is DEVELOP's means of demonstrating project results and methodologies to a global audience
- Thousands of visitors from all around the world
 - Ex. Fall 2011 VPS had over 5k visitors from 81 different countries
- **What is a “virtual poster session”?**
 - www.nasa.gov/topics/earth/features/develop-virtual-poster.html
- **Past Virtual Poster Sessions**
 - www.earthzine.org/vps-archive/
- **Earthzine website:** www.earthzine.org/



Screenshot of the Earthzine website showing the NASA DEVELOP Fall 2012 Virtual Poster Session announcement. The page features the Earthzine logo, navigation links, and a main article titled "NASA DEVELOP Fall 2012 Virtual Poster Session". The article text describes the competition and its goals. A sidebar on the right contains "More Pages" and "Earthzine Friends" links. The bottom section highlights "Assessing Ecosystems for Conservation" with a sub-image of a forest.

Thank You!



Beth Brumbaugh

DEVELOP National Program

Elizabeth.J.Brumbaugh@nasa.gov

DEVELOP National Program

<http://develop.larc.nasa.gov/>