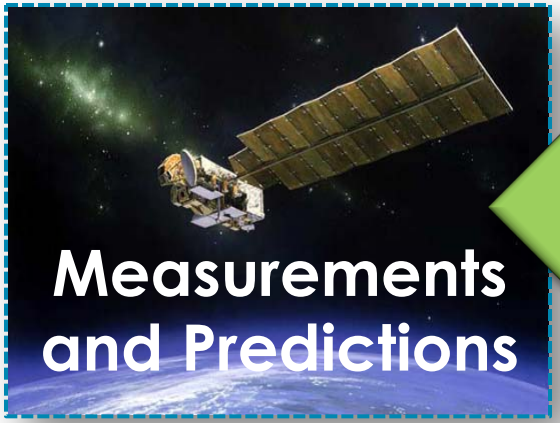
What is DEVELOP?



NASA's Applied Sciences' DEVELOP National Program

DEVELOP is a training and development internship enabling students and young professionals to learn about Earth science and develop prototype applications. Advisors from NASA and partner organizations assist students (high school through graduate school) to apply Earth science in hands-on projects with state, local and tribal governments. DEVELOP addresses needs for long-term capabilities within the workforce to use Earth science results in decision making.

DEVELOP Website: http://develop.larc.nasa.gov

National Projects

Ames Research Center
- Alaska Climate
- California Coast Oceans & Eco Forecasting
- Central Valley Water Resources
- Pacific Crest Trail Climate & Eco Forecasting

Fort Collins Science Center
- Colorado Ecological Forecasting

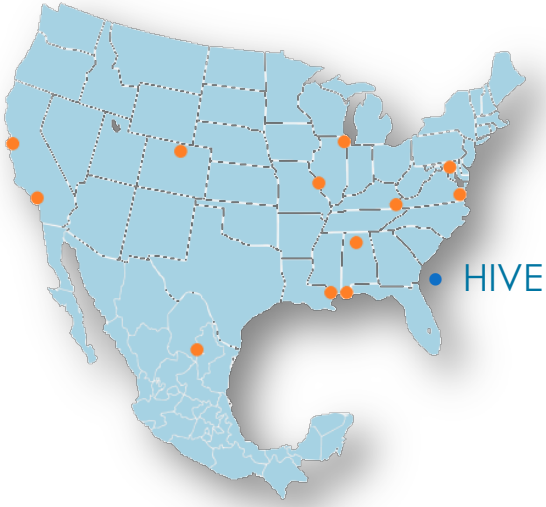
Goddard Space Flight Center
- Upper Missouri River Disasters
- Southwest Water Resources

Jet Propulsion Laboratory
- California Disasters
- Los Angeles Health & Air Quality

Mobile County Health Dept.
- Brazil Health and Air Quality

Saint Louis University
- New England Weather & Disasters

Wise County & Mexico
- Mexico City Disasters
- Mexico Water Resources



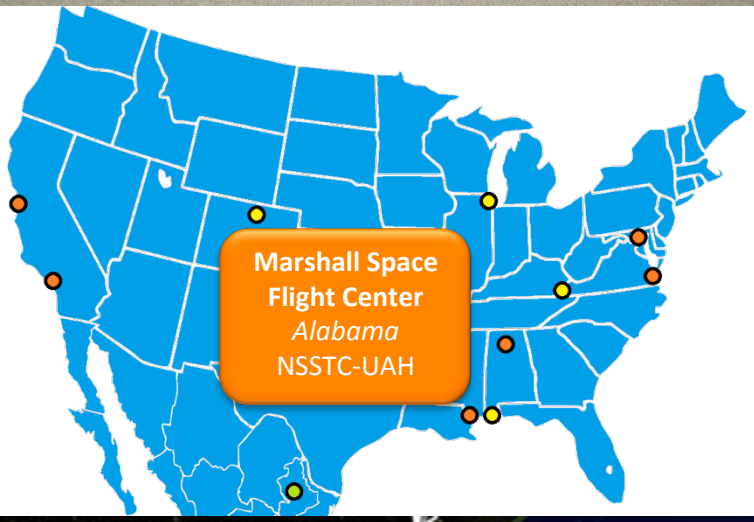
Langley Research Center
- Alaska Disasters
- Amazon Delta Oceans
- Amazon Eco Forecasting
- Dismal Swamp Health & AQ
- North Carolina Agriculture
- North Carolina Disasters & Eco Forecasting
- Rwanda Agriculture
- Rwanda Eco Forecasting
- CALIPSO Climate
- HIVE: Highly-portable Immersive Virtual Environment
- Outreach

Marshall Space Flight Center
- Alabama Agriculture
- Middle East Health and Air Quality
- Southeast Eco Forecasting
- Colombia Disasters
- Nepal Agriculture

Stennis Space Center
- Louisiana Eco Forecasting
- Oklahoma Agriculture

NASA-DEVELOP Research Internships MSFC

DEVELOP is a ***training and development internship*** enabling students and young professionals to learn about Earth science and develop prototype applications. DEVELOP addresses needs for long-term capabilities within the workforce to use Earth science results in ***decision making***. Advisors from NASA and partner organizations assist students in using NASA data in fields such as: ***Agriculture***, ***Climate***, ***Disasters***, ***Ecological Forecasting***, Energy, ***Health & Air Quality***, Oceans, Water Resources, Weather.



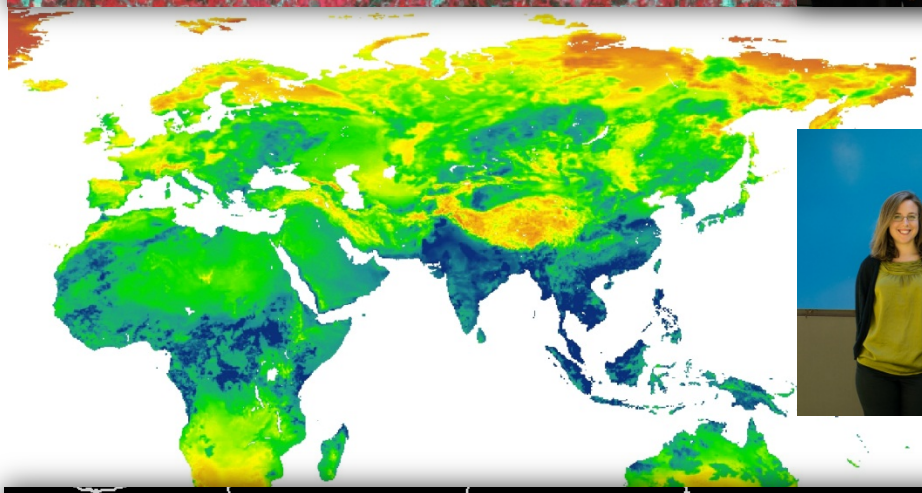
Claire Herdy, *Center Lead* UAHuntsville (ESS)
Dr. Jeff Luvall, *NASA-MSFC Science Advisor*
Dr. Rob Griffin, *UAH-ESSC Project Mentor*

NASA-DEVELOP Research Internships

2011/2012 MSFC

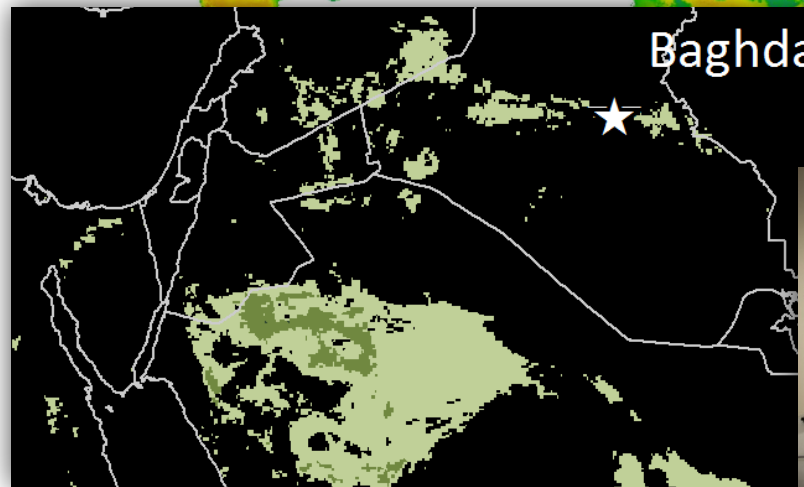
Research Projects Highlights

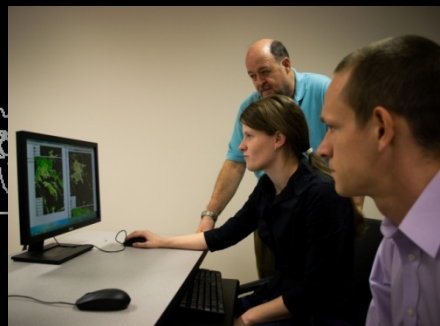
Estimation of Urban Growth Impact on Fish Habitats Using Spatial Analysis Techniques: A Case Study of the Cahaba Watershed Area



Colombia Fire Forecasting:
Utilizing NASA EOS data for fire management in el Departamento del Valle del Cauca,Colombia

Middle East Public Health & Air Quality:
Using NASA EOS to Identify and Monitor Pathogenic Dust in the Middle East





MSFC DEVELOP Students

	Total	Graduate	Undergraduate	HS	Volunteer
Fall 2011	4	3	1	0	0
Spring 2012	8	2	6	0	0
Summer 2012	16	7	7	1	1
Fall 2012	17*	4	12	1	0

Schools

UGA, UAH, UAB, Fl. State U., U of Arkansas, U of Thomasville (GA), Bob Jones High School (Madison, AL),

*3 Undergraduate students, Universidad Autónoma de Occidente, Colombia

Alabama Water and Ecology

Community Concerns

- The Cahaba River is one of the main sources of drinking water for the Greater Metropolitan Area of Birmingham.
- The Cahaba River supports rich biodiversity and is home to species that cannot be found elsewhere.
- Urbanization and industrial development have begun to degrade the quality of the rivers.

Potential Partners

- The Cahaba River Society (CRS)
- The Fresh Water Land Trust (FWLT)
- The Alabama Department of Environmental Management (ADEM)

Science Advisors

Jeff Luvall, Ph.D
Marshall Space Flight Center

Donna Burnett, Ph.D
University of Montevallo

Randy Haddock, Ph.D
Cahaba River Society

ADEM Alabama Department of Environmental Management

FRESHWATER LAND TRUST

Cahaba River Society

Alabama Water and Ecology

Decision Making Process & Partner Needs

- The Cahaba River Society works with the EPA and ADEM to identify areas of concern on the Cahaba River and implement solutions
- The CRS works closely with the FWLT whose mission is the acquisition and stewardship of lands that enhance water quality and preserve open space
- CRS could benefit from remotely sensed data for identification of areas of concern to maximize resources and restoration efforts

Science Advisors

Jeff Luvall, Ph.D
Marshall Space Flight Center

Donna Burnett, Ph.D
University of Montevallo

Randy Haddock, Ph.D
Cahaba River Society

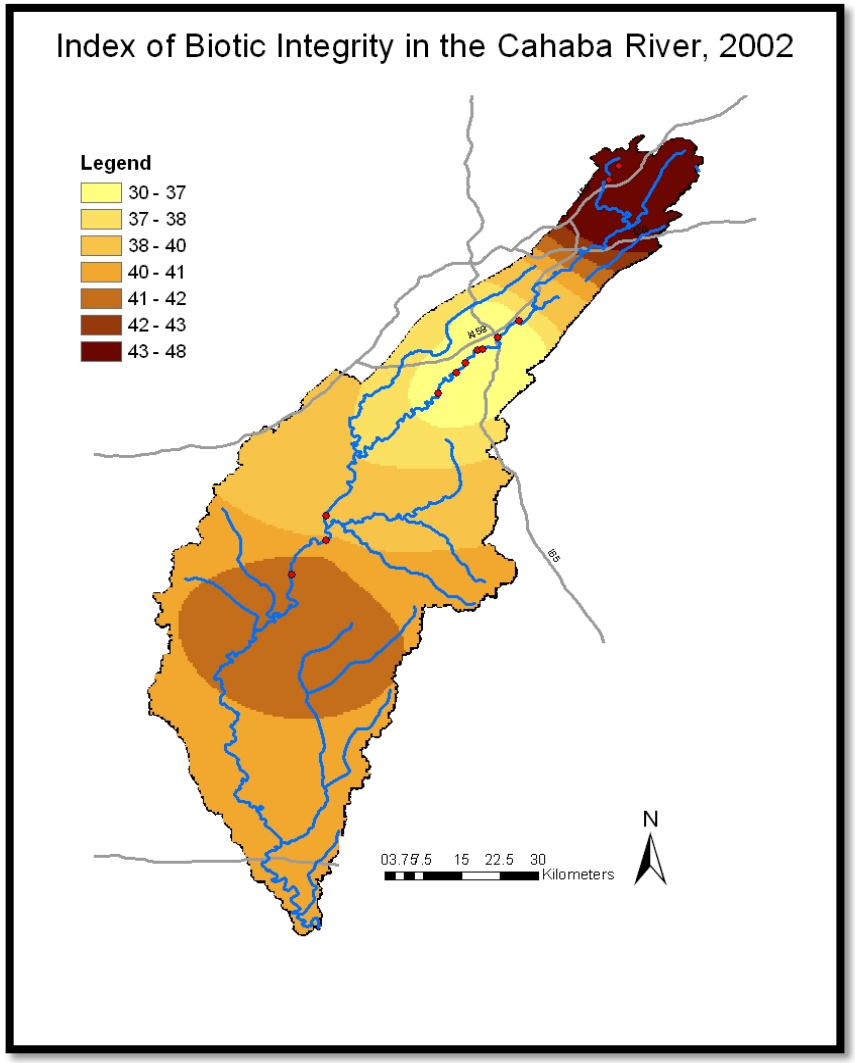
ADEM
Alabama Department of Environmental Management

FRESHWATER
LAND TRUST

Cahaba
River
Society

Alabama Water and Ecology

Results



Alabama Water and Ecology

Conclusion and Transition to Partner

Conclusions

- Landsat TM imagery proved very effective to monitor vegetation across the Cahaba River Watershed
- ASTER imagery offers greater resolution but provides less consistent data and limited coverage area
- Spatial Analysis in the form of Ordinary Kriging shows that lower levels of biodiversity are found around the I-65 and I-459 junction in the Greater Birmingham Metropolitan Area
- Change detection analysis reveals areas of concern due to rapid change in land cover and can help localize restoration efforts

Transition to Partner

- Conservation efforts will be maximized by focusing conservation efforts on the identified interest areas resulting from this study
- Findings and end products will be vital to policy makers for the Cahaba River Society, The Freshwater Land Trust, and Alabama Department of Environmental Management in development of conservation strategies and new land-use plans pertaining to the Cahaba River watershed

DEVELOP

NASA

Colombia Disasters

Utilizing NASA EOS data for fire management in el Departamento del Valle del Cauca, Colombia

Marshall Space Flight Center

James Brenton – Project Lead, University of Alabama in Huntsville
Khameis Alabdouli, Florida State University
Nathan Bledsoe, University of Alabama in Huntsville
Victoria Florence, Bob Jones High School
Kirstin Cooksey, University of Alabama in Huntsville
Claire Herdy, University of Alabama in Huntsville
Steve Padgett-Vasquez, University of Georgia

Colombia Disasters

Project Partners

- Universidad Autónoma de Occidente, Colombia
- Wildlife Conservation Society
- Corporación Autónoma Regional Del Valle de Cauca
- Gobernación del Valle del Cauca
- SERVIR

Advisors

- Dr. Jeff Luvall
- Dr. Max J. Moreno Madriñán
- Mr. Victor Hugo Ramos

End–User Involvement

Transition Approach to End-User

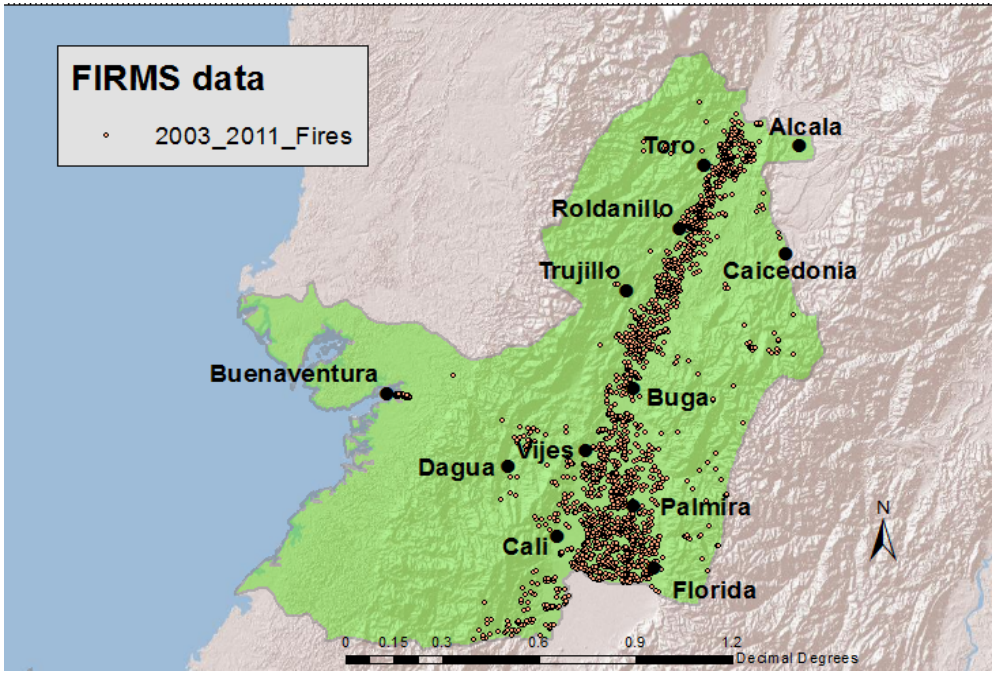
- Methodology and results provided to end-user in a conference and through various regional agencies
- SERVIR provides a platform for dissemination of results to local decision-makers, scientists, and the general public in Colombia at no cost

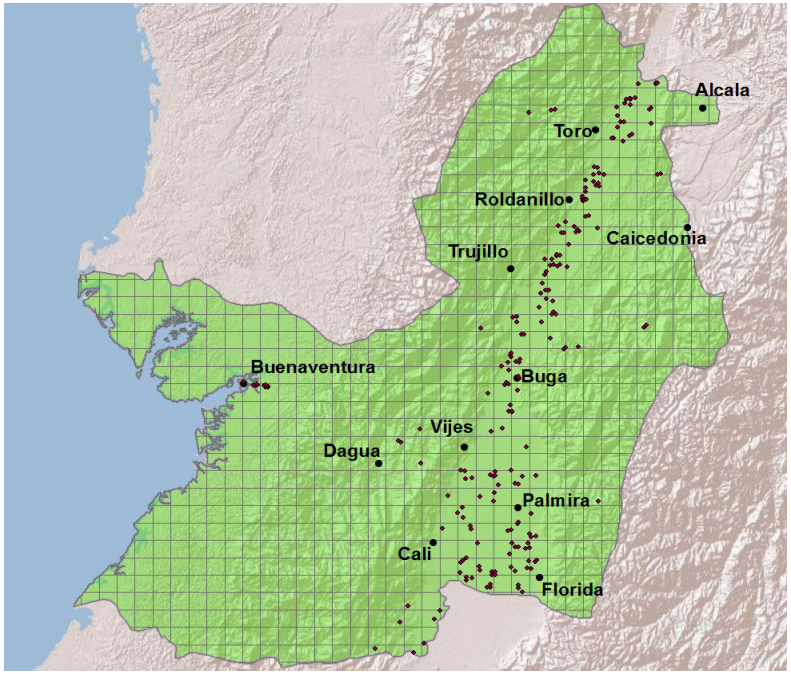
Benefit to End-User

- Relevant statistics on fire risk in Colombia
- Methodology for future assessment of fire disasters

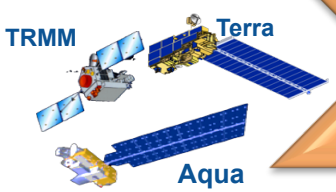
Methodology: Hot Spot Map

Acquire FIRMS data MOD14 MYD14 → Clip FIRMS Data with Valle de Cauca shapefile → Overlay and spatially join 0.01° x 0.01° fishnet → Create classification based on fire quantity → **Hot Spot Map**





Methodology: Ignition Cause Model

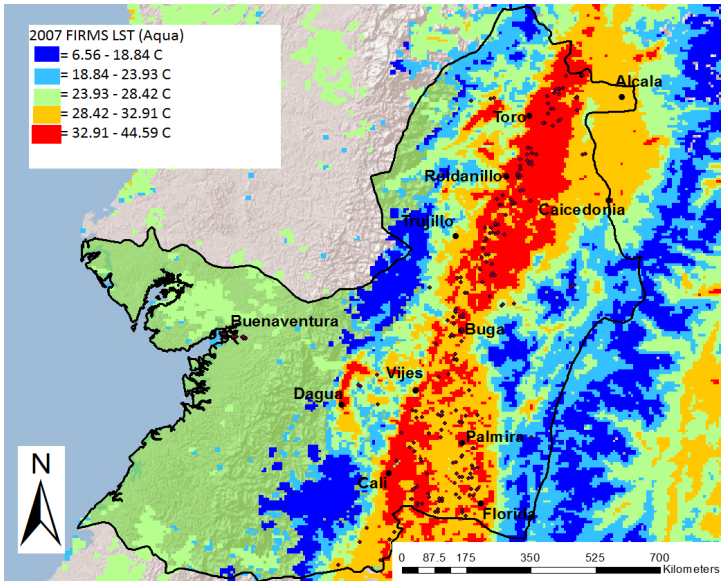


Land Surface Temperature and Precipitation data inputs

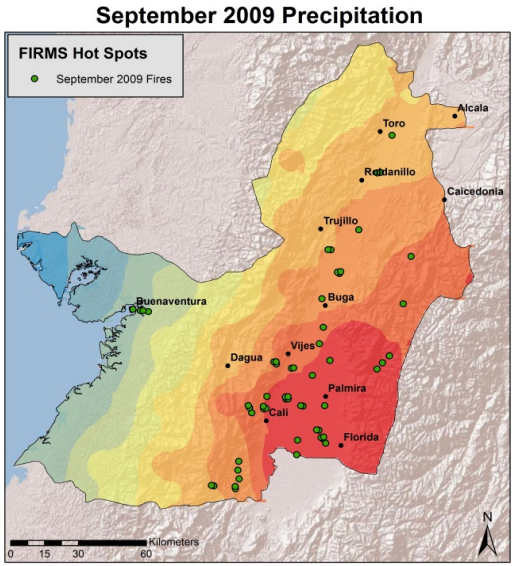
Run statistical analysis to determine correlation

Create weighted model of the analysis results

Ignition Cause Model (in gress)



MODIS Derived Land Surface Temperature

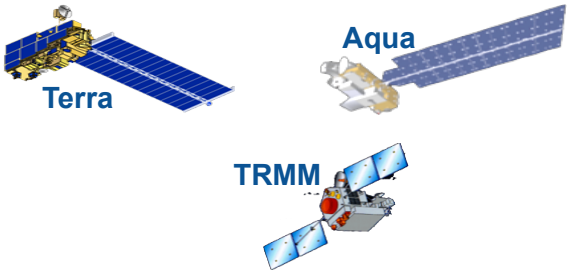


TRMM Precipitation

Goals

Final results for this term will include

- Hot Spot Map
  - FIRMS data (MOD14/MYD14, Active Fire Locations)
- Burn Scars Map
  - MOD45 Burn Data
  - Aster Data - NDVI



- Ignition Cause Model
  - Will utilize various NASA EOS products possibly including TRMM, and MODIS - Terra and Aqua (MCD13, MOD11A1, MYD11A1) to define model inputs

DEVELOP

NASA

Middle East Health & Air Quality

Utilizing NASA EOS in the Saharan and Arabian Deserts to Examine Dust Particle Size and Identify Spectral Signatures of Aerosols

Tiffany Keeton, University of Alabama in Huntsville (Team Lead)
Brad Barrick, University of Alabama in Huntsville
Kirstin Cooksey, University of Alabama in Huntsville
Kevin Cowart, University of Alabama in Huntsville
Tori Florence, Bob Jones High School

Claire Herdy, University of Alabama in Huntsville (Co-center lead)
Steve Padgett-Vasquez, University of Georgia (Co-center lead)

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

Middle East Health & Air Quality Community Concerns

- A number of soldiers returning from Iraq and Afghanistan suffer from new-onset respiratory complications preventing them from meeting the U.S. Army's standards for physical fitness (King et al. 2011).

- Studies show potential threats to human health related to dust storm exposure (Cook et al. 2005).

Image Source: King, A., 2008. Dust Storm Convoy.

Middle East Health & Air Quality Project Partners

- **U.S. Naval War College**
  - Dr. Mark Lyles, Captain and VADM Joel T. Boone Chair of Health and Security Studies
- **United States Geological Survey (USGS)**
  - Dr. Dale Griffin, Environmental and Public Health Microbiologist
- **Cold Regions Research and Engineering Laboratory (CRREL)**, U.S. Army Corps of Engineers
  - Dr. Terry Sobecki, Chief of the Biogeochemical Sciences Branch
  - Mr. Dave Ringelberg, Soil Microbiologist

Middle East Health & Air Quality Partner Decision Making Process & Needs

- Partners use only in-situ data to look at dust pathogens.
  - Costly and time consuming
- Use of NASA Earth Observing System (EOS) will aid end users by:
  - Providing a methodology to determine aerosolized mineral distributions within dust storms.
  - Determining *particle sizes* of aerosols within the storms.

State, U.S.D. of, 2010. Dust Storm at Camp Ramadi in Anbar Province.

Middle East Health & Air Quality Methodology

Differentiate Dust from Clouds

Brightness Temperature Difference (BTD)

Terra - MODIS

$BTD = T_{31} - T_{32}$

Δ BTD= BTD (day) - BTD (night)

Identify Spectral Signatures of Mineral Dust

Atmospherically Corrected Hyperion Data

E0-1 Hyperion

Built Spectral Library from USGS/ JPL Spectral Library

Compare endmembers to reference spectra

Particle Size/Distribution Calculations

Utilize Angström Exponent

SeaWiFS

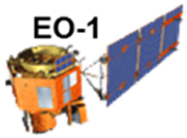
Utilize Aerosol Optical Depth (AOD)

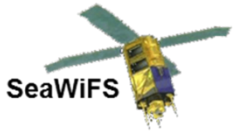
GOCART & SeaWiFS

Aerosol Size Distribution

Terra MODIS

$\eta = 1 - [\rho_{0.66}/\rho_{0.87} - 0.72]/[0.9 - 0.01(\theta - 150°) - 0.72$





Middle East Health & Air Quality