



# Advanced NASA Data Acquisition, Information Exploration, Discovery, Access and Retrieval Services for Studying Public Health

Steven Kempler, NASA GSFC

*Steven.J.Kempler@nasa.gov*

with contributions from:

Pietro Ceccato, Columbia University

Susan Maxwell, BioMedware

Karl Benedict, University of New Mexico

Meredith Golden, CIESIN at Columbia University

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ISPRS, Santa Fe



# Presentation Purpose

- To discuss the availability and usefulness of remote sensing data in support of public health research, surveillance, and modeling
- To discuss NASA developed remote sensing tools and services that facilitate finding, accessing and using remote sensing ... in support of public health research, surveillance, and modeling

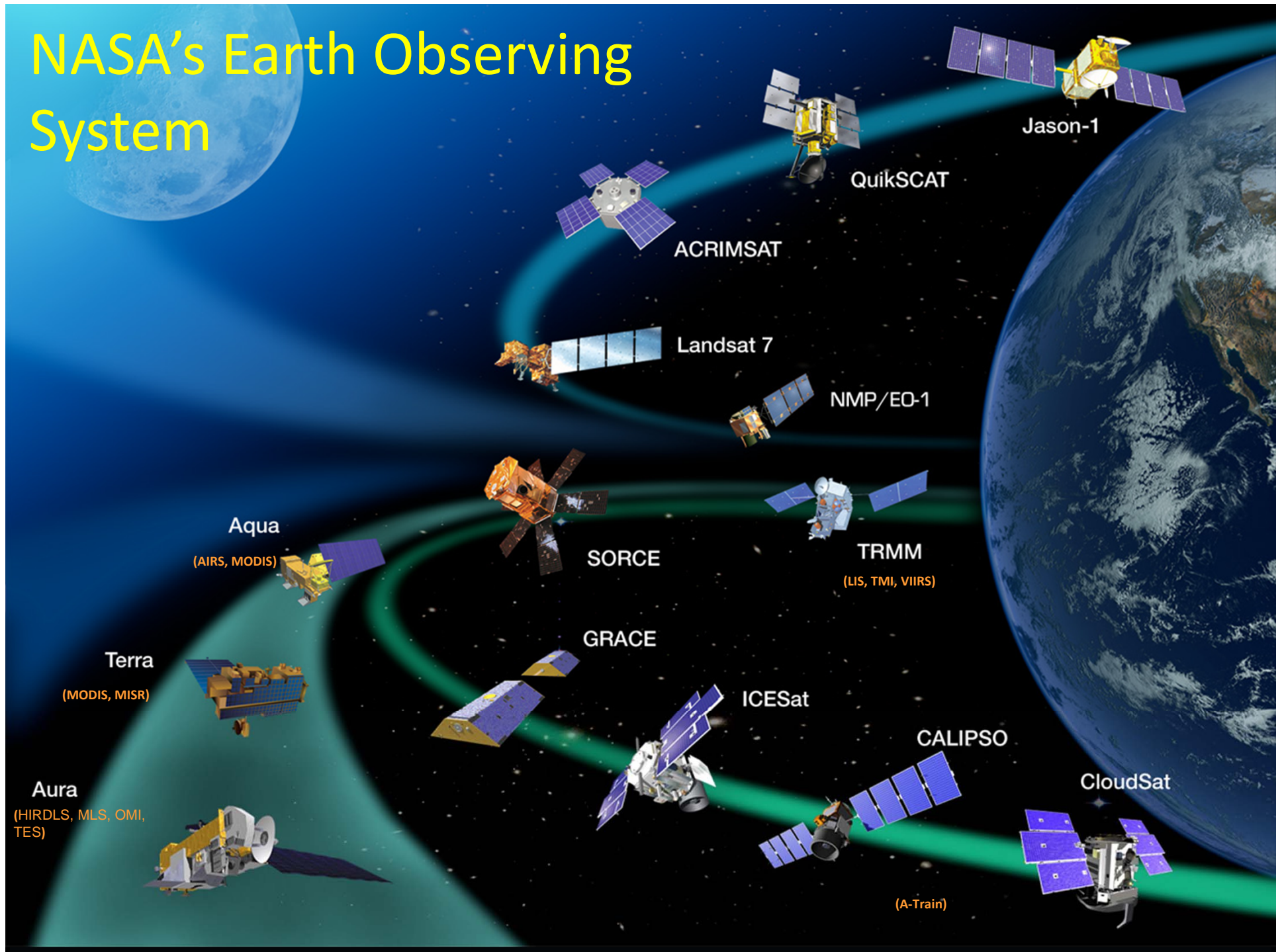


## Remote Sensing Data and Public Health

Key information required by epidemiological studies is the spatial and temporal distributions of environmental agents and their proximity to concerned cohorts. (D. Tong, et al)

- Remote sensing data provides evenly gridded spatial coverage
- Collection is quick and systematic
- Provides global coverage

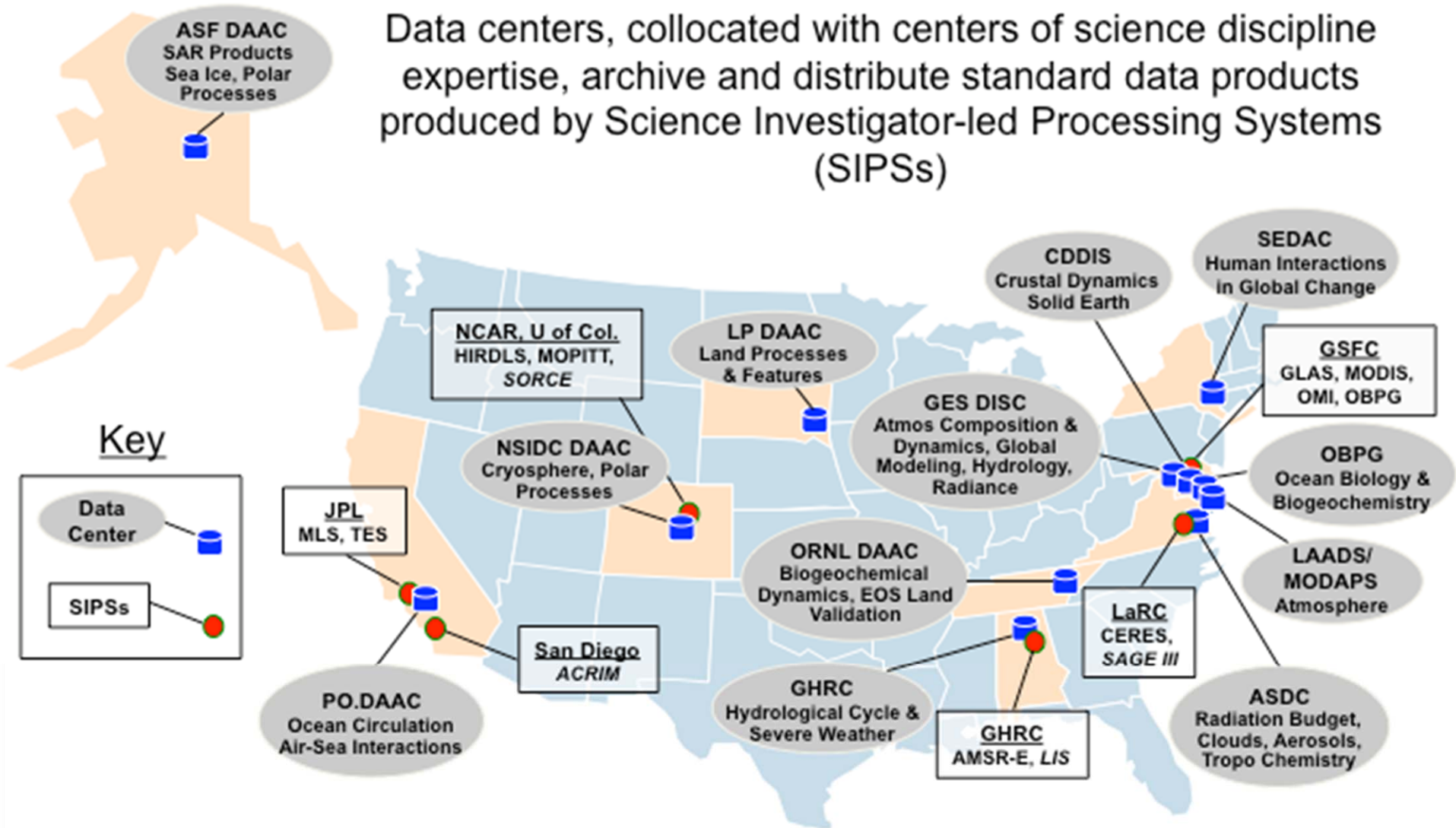
# NASA's Earth Observing System





# EOSDIS Facilities

Data centers, collocated with centers of science discipline expertise, archive and distribute standard data products produced by Science Investigator-led Processing Systems (SIPs)



EOSDIS – Earth Observing System Data and Information System  
DAAC – Distributed Active Archive Center



NASA's Earth Science Data Centers	Discipline
Alaska Satellite Facility SAR Data Center (ASF SDC) website: <a href="http://www.asf.alaska.edu">http://www.asf.alaska.edu</a>	<ul style="list-style-type: none"><li>• Synthetic Aperture Radar (SAR)</li><li>• Sea Ice</li><li>• Polar Processes</li><li>• Geophysics</li></ul>
Crustal Dynamics Data Information System (CDDIS) website: <a href="http://cddis.gsfc.nasa.gov/">http://cddis.gsfc.nasa.gov/</a>	<ul style="list-style-type: none"><li>• Space Geodesy</li></ul>
Global Hydrology Resource Center (GHRC) website: <a href="http://ghrc.msfc.nasa.gov/">http://ghrc.msfc.nasa.gov/</a>	<ul style="list-style-type: none"><li>• Hydrologic Cycle</li><li>• Severe Weather Interactions</li><li>• Lightning</li><li>• Atmospheric Convection</li></ul>
Goddard Earth Sciences Data and Information Services Center (GES DISC) website: <a href="http://disc.sci.gsfc.nasa.gov/">http://disc.sci.gsfc.nasa.gov/</a>	<ul style="list-style-type: none"><li>• Global Precipitation</li><li>• Solar Irradiance</li><li>• Atmospheric Composition</li><li>• Atmospheric Dynamics</li><li>• Global Modeling</li></ul>
Land Processes (LP) DAAC website: <a href="https://lpdaac.usgs.gov/">https://lpdaac.usgs.gov/</a>	<ul style="list-style-type: none"><li>• Surface Reflectance</li><li>• Land Cover</li><li>• Vegetation Indices</li></ul>
Level 1 Atmosphere Archive and Distribution System (MODAPS LAADS) website: <a href="http://ladsweb.nascom.nasa.gov/">http://ladsweb.nascom.nasa.gov/</a>	<ul style="list-style-type: none"><li>• Radiance</li><li>• Atmosphere</li></ul>



<p>NASA Langley Research Center Atmospheric Science Data Center (LaRC ASDC) website: <a href="http://eosweb.larc.nasa.gov/">http://eosweb.larc.nasa.gov/</a></p>	<ul style="list-style-type: none"><li>• Radiation Budget</li><li>• Clouds</li><li>• Aerosols</li><li>• Tropospheric Chemistry</li></ul>
<p>National Snow and Ice Data Center (NSIDC) DAAC website: <a href="http://nsidc.org/">http://nsidc.org/</a></p>	<ul style="list-style-type: none"><li>• Snow</li><li>• Ice</li><li>• Cryosphere</li><li>• Climate</li></ul>
<p>Oak Ridge National Laboratory (ORNL) DAAC website: <a href="http://daac.ornl.gov/">http://daac.ornl.gov/</a></p>	<ul style="list-style-type: none"><li>• Biogeochemical Dynamics</li><li>• Ecological Data</li><li>• Environmental Processes</li></ul>
<p>Ocean Biology Processing Group (OBPG) website: <a href="http://oceancolor.gsfc.nasa.gov/">http://oceancolor.gsfc.nasa.gov/</a></p>	<ul style="list-style-type: none"><li>• Ocean Biology</li><li>• Ocean Color</li><li>• Biogeochemistry</li><li>• Sea Surface Temperature</li></ul>
<p>Physical Oceanography (PO) DAAC website: <a href="http://podaac.jpl.nasa.gov/">http://podaac.jpl.nasa.gov/</a></p>	<ul style="list-style-type: none"><li>• Sea Surface Temperature</li><li>• Ocean Winds</li><li>• Circulation and Currents</li><li>• Topography and Gravity</li></ul>
<p>Socioeconomic Data and Applications Data Center (SEDAC) website: <a href="http://sedac.ciesin.columbia.edu/">http://sedac.ciesin.columbia.edu/</a></p>	<ul style="list-style-type: none"><li>• Human Interactions</li><li>• Land Use</li><li>• Environmental Sustainability</li><li>• Geospatial Data</li><li>• Multilateral Environmental Agreements</li></ul>



# Remote Sensing Measurements Found Useful for Public Health Research and Modeling

(not exhaustive)

## Vector Borne Disease Research

- Precipitation
- Land Cover Type
- Normalized Difference Vegetation Index (NDVI)
- Leaf Area Index
- Soil Moisture
- Terrestrial Water Storage
- Surface Temperature
- Relative Humidity
- Wind
- Surface Reflectance
- Solar Radiation
- Topography (Digital Elevation Maps)





# Exemplary NASA Vector Borne Disease Research Using Remote Sensing Data

- *Jorge Pinzon/Science System and Applications, Inc (SSAI)*, Predicting Zoonotic Hemorrhagic Fever Events in Sub-Saharan Africa using NASA Earth Science Data for DoD - Global Emerging Infections Surveillance and Response System
- *Benjamin Zaitchik/Johns Hopkins University*, Development of a Detection and Early Warning System for Malaria Risk in the Amazon
- *Daniel Irwin and John Kessler/NASA Marshall Space Flight Center*, SERVIR Africa
- *Sue Estes/NASA/USRA*, Investigating the Potential Range Expansion of the Vector Mosquito *Aedes aegypti* in Mexico with NASA Earth Science Remote Sensing Results.
- *Michael Wimberly/South Dakota State University*, Enhanced Forecasting of Mosquito-Borne Disease Outbreaks Using AMSR-E
- *Richard Kiang/NASA Goddard Space Flight Center*, Modeling Global Influenza Risks using NASA Data
- *Richard Kiang/NASA Goddard Space Flight Center*, Avian Influenza Risk Prediction in Southeast Asia and Early Warning of Pandemic Influenza
- *Xiangming Xiao/University of Oklahoma*, Integrating Earth observations and satellite telemetry of wild birds for decision support system of avian influenza
- *Katia Charland/Children's Hospital Boston*, Application of NASA Data to Develop an Influenza Forecasting System



# Remote Sensing Measurements Found Useful for Public Health Research and Modeling

(not exhaustive)

## Water Borne Disease Research

- Precipitation
- Land Use/Cover Type
- Ocean Color
- Temperature



# Exemplary NASA Water Borne Disease Research Using Remote Sensing Data

- *Richard Stumpf and Timothy Wynne/National Oceanic Atmospheric Administration Ocean Service*, Monitoring and Forecasting Cyanobacterial Blooms for Public Health Protection and Response
- *Zhiqiang Deng/Louisiana State University*, Feasibility Study of Satellite-Assisted Detection and Forecasting of Oyster Norovirus Outbreak
- *Charles Tilburg/University of New England*, Influence of Land-Use and Precipitation on Regional Hydrology and Public Health



# Remote Sensing Measurements Found Useful for Public Health Research and Modeling

(not exhaustive)

## Air Pollution Related Disease Research

- Aerosol
- Normalized Difference Vegetation Index (NDVI)
- Surface Temperature
- Solar Insolation
- Relative Humidity



# Exemplary NASA Air Pollution Relate Disease Research Using Remote Sensing Data

- *Yang Liu/Harvard School of Public Health*, Enhancing Environmental Public Health Tracking with Satellite-Driven Particle Exposure Modeling and Epidemiology
- *Jeffrey Luvall/NASA Marshall Space Flight Center*, Integration of Airborne Dust Prediction Systems and Vegetation Phenology to Track Pollen for Asthma Alerts in Public Health Decision Support Systems
- *Leslie McClure/University of Alabama at Birmingham*, Linking NASA Environmental Data with a National Public Health Cohort Study to Enhance Public Health Decision Making
- *Stanley Morain/University of New Mexico*, Adding NASA Earth Science Results to EPHTN via the NM/EPHT System
- *Amy Huff/Battelle Memorial Institute*, Using NASA Satellite Aerosol Optical Depth Data to Create Representative PM<sub>2.5</sub> Fields for Use in Human Health and Epidemiology Studies in Support of State and National Environmental Public Health Tracking Programs



## Public Health Services

Developed by NASA ROSES Decision Support  
Projects and EOSDIS Data Centers

The public health community has become better served with remote sensing data, tools and information services through NASA projects that address specific research and facilitate data acquisition.



# Exemplary Public Health Services Developed by NASA ROSES Decision Support Projects and EOSDIS Data Centers

- **Remote sensing data and associated tools utilized in monitoring geophysical measurements for malaria surveillance (P. Ceccato, Columbia University)**
- **Evaluation and assessment tool that uses environmental measurements for preparing for, and responding to, extreme heat events (S. Maxwell, BioMedware)**
- **Feasibility of improving dust forecasting leveraging existing technologies (K. Bendict, EDAC University of New Mexico)**
- **Interactive tools and information services for visualizing and analyzing health related socioeconomic data integrated with remote sensing data (M. Golden, R. Chen, SEDAC CEISEN Columbia University)**
- **Interactive tools and information services for accessing, discovering, visualizing, and analyzing remote sensing environmental data used by public health researchers and modelers (S. Kempler, C. Lynnes, GES DISC NASA/GSFC)**



# The Use of Remote Sensing Data for Monitoring Rainfall, Vegetation and Water Bodies for Malaria Surveillance

Pietro Ceccato, Columbia University

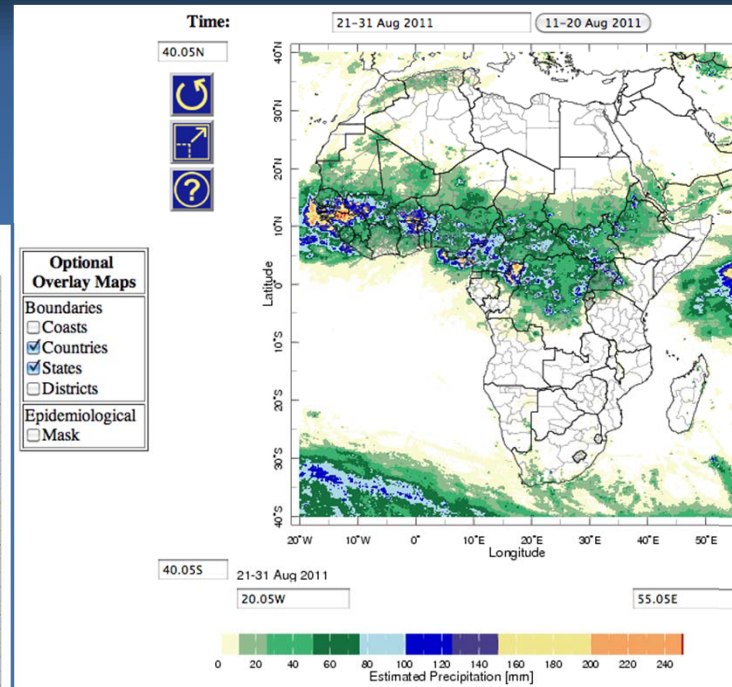
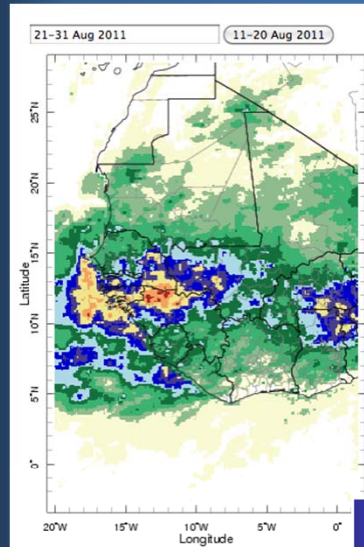
- Monitoring variations in environmental conditions such as rainfall and vegetation helps decision-makers to assess the risk levels of malaria epidemics.
- The International Research Institute for Climate and Society (IRI) has developed the Malaria Early Warning System (MEWS) to enable users to gain a contextual perspective of the current rainfall.
- MEWS uses data from located in the IRI Data Library, which includes remote sensing data such as from TRMM and MODIS



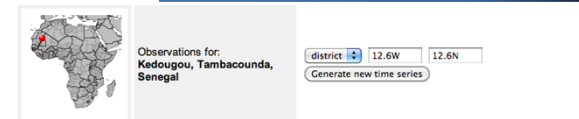


# Malaria Early Warning System (MEWS)

click for information;  
click and drag to zoom



**Time Series Region**  
Spatially average data over the following region:  
 district boundary  
 11x11 km box  
 33x33 km box  
 55x55 km box  
 111x111 km box



**IRI**

Data Library  
expert  
Finding Datasets  
Browse Datasets  
Browse Maproom  
By Category  
By Source  
By Search  
Help Resources  
Tutorial  
Statistical Analysis Tutorial  
Ingrid Function Documentation  
Questions and Answers  
help

## IRI/LDEO Climate Data Library

The IRI/LDEO Climate Data Library contains over 300 datasets from a variety of earth science disciplines and climate-related topics. It is a powerful tool that offers the following capabilities at no cost to the user:

- access any number of datasets;
- create analyses of data ranging from simple averaging to more advanced EOF analyses using the Ingrid Data Analysis Language;
- monitor present climate conditions with maps and analyses in the **Maproom**;
- create visual representations of data, including animations;
- download data in a variety of commonly-used **formats**, including GIS-compatible formats.

Are you new to the world of climate data? Check out our [Introduction to Climate Data](#) page.

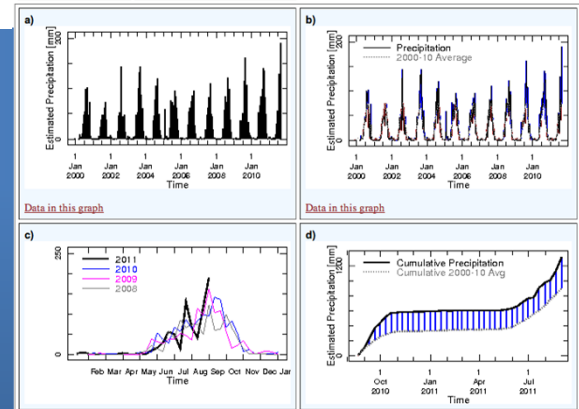
### What's New

**CPC Unified Gauge-Based Analysis of Global Daily Precipitation** The Climate Prediction Center (CPC) Unified Gauge-Based Analysis of Global Daily Precipitation is an optimal interpolation objective analysis of global daily station precipitation data available at the CPC. It is divided into a retrospective version (RETRO) covering 1979 to 2005, derived from more than 30,000 gauges, and a real-time version (REALTIME) covering 2006 to present, derived from approximately 17,000 gauges. The real-time version is available at <http://www.cgd.ccr.gov/realtime/precip/realtime.shtml>.

**Monitoring Global Climate**

**Map Room**  
A collection of maps and analyses used to monitor climate conditions. Click on any of the maps to modify the figures or access the source data.

**ENSO Web**  
Information about El Niño-Southern Oscillation.



From: <http://iridl.ldeo.columbia.edu/maproom/.Health/.Regional/.Africa/.Malaria/.MEWS/>



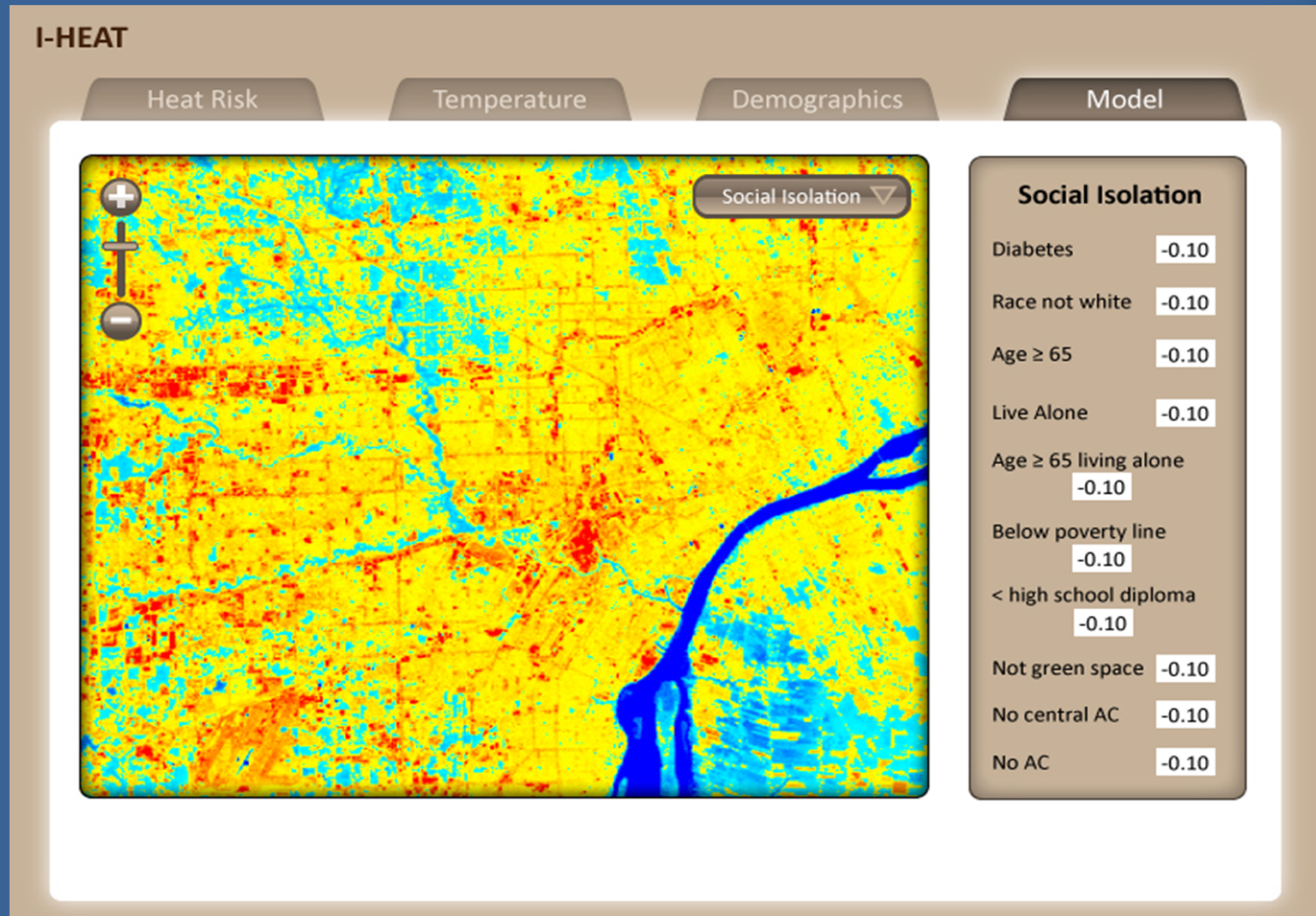
# Internet-based Heat Evaluation and Assessment Tool (I-HEAT)

Susan Maxwell, et al, BioMedware

- Heat Evaluation and Assessment Tool (I-HEAT) will provide health professionals and risk assessors with an advanced geospatial web-based system for preparing and responding to emergency heat events, developing mitigation strategies, and educating the public.
- The system couples demographic and environmental data obtained from Landsat satellite imagery with browser-based software to model and map heat-related morbidity and mortality risks at the neighborhood level.
- Landsat data will be integrated with demographic, socio-economic, and health data in a heat-risk model.



# I-HEAT interface showing a heat-risk map of Detroit, Michigan and modeling controls



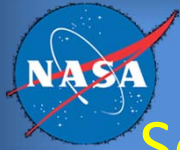
From: S. Maxwell



# The Feasibility of Interoperable Multi-resolution Dust Modeling for Accelerated Forecast Availability

Karl Benedict, Earth Data Analysis Center (EDAC), University of New Mexico

- An information technology study to analyze the feasibility of developing a dust forecasting system with improved system performance and utility:
  - Timeliness to create forecast products after event has been identified
  - Spatial resolution of the forecast products relative to the preferred analytic and alert units (i.e. county, zip-code, etc.)
  - Utility of the forecast products – that they are in form usable by public health system users
- Conclusions:
  - Demonstrated efficient transfer of remote, remote sensing data
  - Alternate data transfer protocols & connectivity models are feasible
  - Simplified parallel execution has significant potential for deploying scalable modeling systems into commodity computing environments



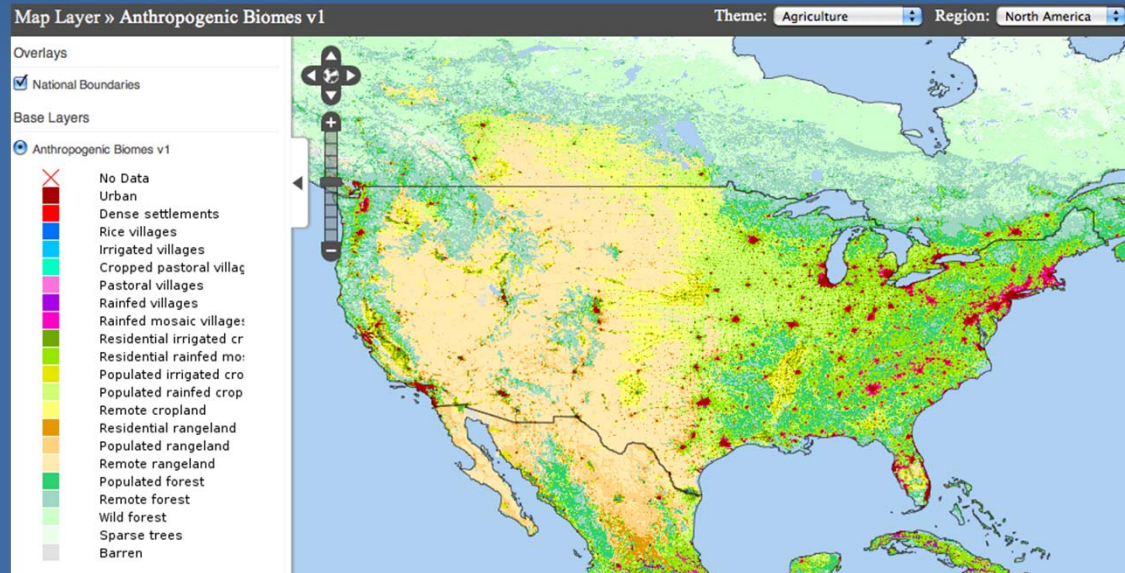
# Health-related Data and Services from the NASA Socioeconomic Data and Applications Center (SEDAC)

Meredith L. Golden, Robert S. Chen, Socioeconomic Data and Applications Center (SEDAC), Center for International Earth Science Information Network (CIESIN) at Columbia University

- SEDAC is a NASA Earth Science Data Center specializing in data related to human interactions in the environment, and in particular on demographic and socioeconomic data that can be integrated with remote sensing data
- SEDAC provides interactive tools and resources for the visualization and analysis of interdisciplinary data
- SEDAC has developed data and information resources used extensively in public health research and surveillance



# SEDAC's Interactive Data Visualization Tools and Resources



SEDAC Interactive Map Client

<http://sedac.ciesin.columbia.edu/maps/client>

## Themes:

- Agriculture
- Climate
- Conservation
- Governance
- Hazards
- Health
- Land Use
- Marine and Coastal
- Population
- Poverty
- Remote Sensing
- Sustainability
- Urban
- Water

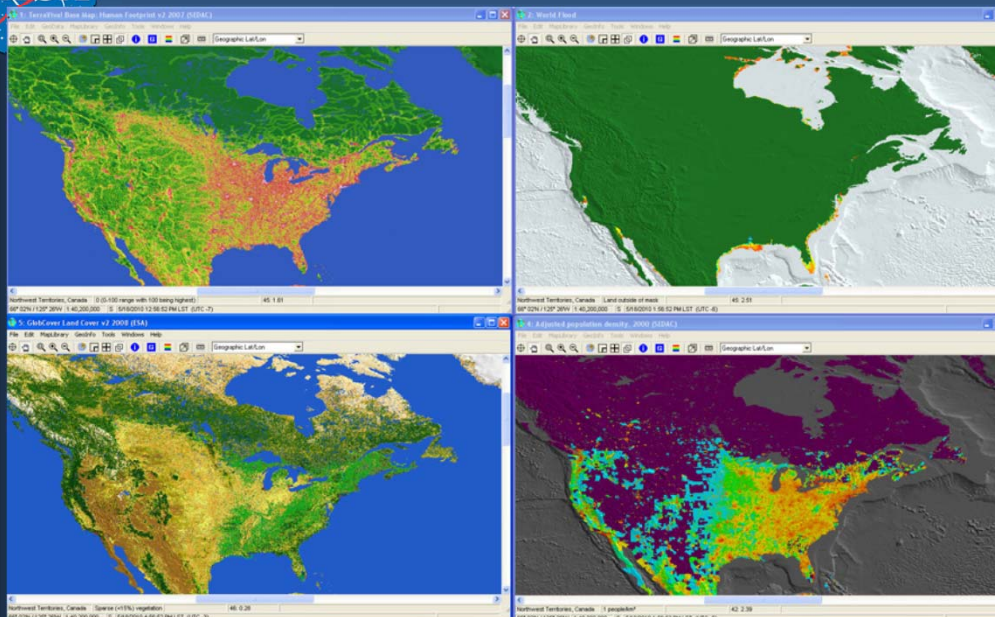


SEDAC Population Estimation Service

<http://sedac.ciesin.columbia.edu/gpw/wps.jsp>



# SEDAC's Interactive Data Visualization Tools and Resources



*TerraViva! SEDAC: Standalone data and viewer*

<http://sedac.ciesin.columbia.edu/terraVivaUserWeb/>

## Global Agricultural Lands



Images (14)

## Anthropogenic Biomes, v1



Images (7)

WMS Layers (1)

## Environmental Sustainability Index (ESI)



Images (2)

WMS Layers (22)

## Gridded Population of the World (GPW), v3



Images (483)

WMS Layers (9)

## SEDAC Map Gallery

<http://sedac.ciesin.columbia.edu/maps/gallery/browse>



# Selected Data and Information Resources Useful for Public Health Applications

## Gridded Population of the World and the Global Rural-Urban Mapping Project

<http://sedac.ciesin.columbia.edu/gpw>

## Poverty mapping

<http://sedac.ciesin.columbia.edu/povmap/>

## Population, Landscape, and Climate Estimates (PLACE)

<http://sedac.ciesin.columbia.edu/place/>

## Indicators of Coastal Water Quality

<http://sedac.ciesin.columbia.edu/es/seawifs.html>

## Environmental Performance Index 2010

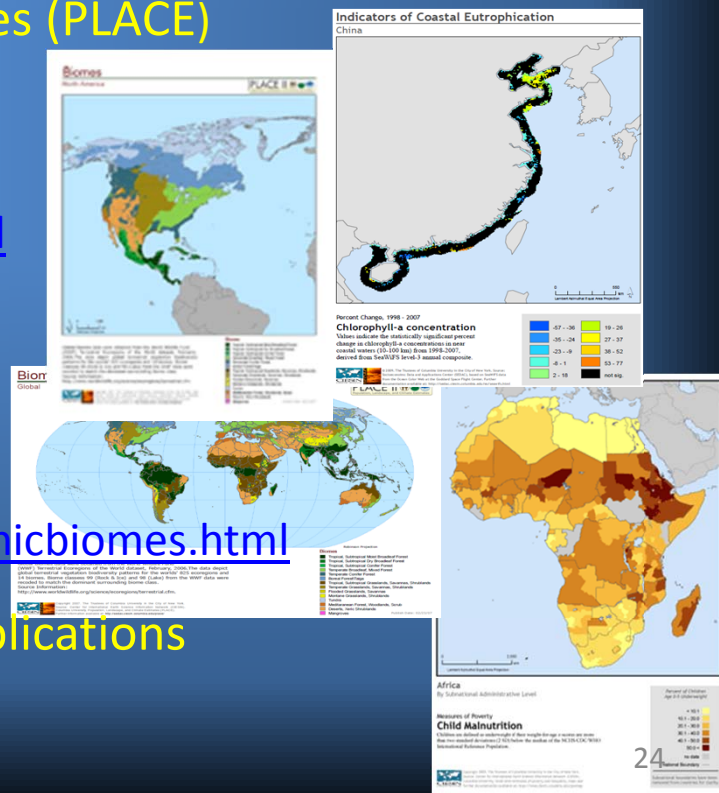
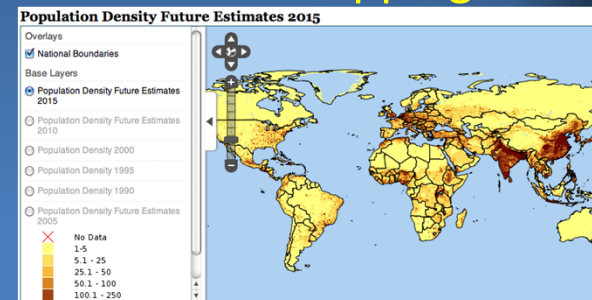
<http://sedac.ciesin.columbia.edu/es/epi/>

## Anthropogenic Biomes

<http://sedac.ciesin.columbia.edu/es/anthropogenicbiomes.html>

## Confidentiality Issues in Geospatial Data Applications

<http://sedac.ciesin.columbia.edu/confidentiality/>







# Remote Sensing Data and Information Services at the Goddard Earth Science Data and Information Services Center (GES DISC) Related to Public Health Research

Steven Kempler, Chris Lynnes GES DISC, NASA/GSFC

- GES DISC is a NASA Earth Science Data Center specializing in servicing atmospheric, hydrologic, and precipitation remote sensing, and remote sensing based assimilated, data
- GES DISC provides data access, discovery, visualization, retrieval, and analysis services to glean information from data
- Many GES DISC datasets are useful for public health research, modeling, surveillance, and decision support systems



# Relating Remote Sensing Data to Public Health Research

## Temporal Coverage, Temporal Resolution, Spatial Resolution Considerations:

- Measurements with long temporal coverage are useful for long term studies and health trend relationships.
- High temporal resolution measurements support short term health variability studies.
- High spatial resolution measurements are used for relating to local, small region health studies.
- Lower resolution remote sensing measurements are sufficient for wider, regional public health studies



# GES DISC Data Holdings Relevant to Public Health Research and Modeling

(See backup slides for spatial resolution, temporal coverage, usage, and health relevance... and acronym list)

	Remote Sensing Data	Assimilated Data
Precipitation	TRMM	GLDAS, NLDAS, MERRA
Water Runoff		GLDAS, NLDAS, MERRA
Vegetation Index		NLDAS, MERRA
Soil Moisture	AMSR-E	GLDAS, NLDAS, MERRA
Surface Air Temperature	AIRS, TOVS	GLDAS, NLDAS, MERRA
Aerosol	OMI, TOMS	MERRA, GOCART
Wind		GLDAS, NLDAS, MERRA, GSSTF2b
Solar Irradiance	SORCE, OMI	



# GES DISC Data Search and Access Services

Mirador

<http://mirador.gsfc.nasa.gov/>

Choose:  
Keyword search, Time  
Location...  
or Project...  
or Science Area

NASA National Aeronautics and Space Administration  
Goddard Earth Sciences Data and Information Services Center

Search DISC  
+ Advanced Search + GO

+ ATMOS COMPOSITION + HYDROLOGY + A-TRAIN + AIRS + MODELING + NEESPI + PRECIPITATION

+ GES DISC Home  
**Mirador**  
Data Access Made Simple  
You are here: [Keyword Search](#)

Keyword: precipitation Location: [-10.96],[20.122]

Time Span  
From: 6/1/10 To: 11/1/10

Search GES-DISC

Advanced Search

Available: [AIRS, OMI, MLS, HIRDLS, TOMS, UARS, TRMM, GLDAS, SORCE, Subset Sensors \(e.g. MODIS, AIRS, OMI and MLS\), MERRA, GOCART, LIMS, MSU, SSBV, SBUV, TOVS ACOS MEASURES](#)

What's New: [Quality Screening for AIRS Level 2 Products is now combined with Variable NetCDF Conversion](#)

Acknowledgements:  
Location Gazetteer data from: [National GeoSpatial Information Agency](#)  
Events Gazetteer data from: [Univisys](#), [EPA](#) and [Smithsonian Global Program](#)

LATEST NEWS  
[+ Mirador News Archive](#)

NASA National Aeronautics and Space Administration  
Goddard Earth Sciences Data and Information Services Center

Search DISC  
+ Advanced Search + GO

+ ATMOS COMPOSITION + HYDROLOGY + A-TRAIN + AIRS + MODELING + NEESPI + PRECIPITATION

+ GES DISC Home  
**Mirador**  
Data Access Made Simple  
You are here: [Keyword Search](#) » [Data sets from precipitation search](#) » [File Listing](#) » [Service Selection](#) » [Your Cart](#) » [Checkout](#)

Keyword: precipitation

More Search Options

Search GES-DISC

Overview  
Help Center  
Data Holdings  
View Cart

Additional Features  
News  
Restricted Data  
Feedback  
FAQ

Data Sets  
Results 1 - 10 of 64 for precipitation (2 seconds)

-More Services (e.g. http download, format conversion, subsets etc) are available for the data set(s). Whenever you add files to the shopping cart, you will be presented with options for selecting a service and service parameters for any data set which has these services.

- TRMM Precipitation Radar (PR) Level 2 Rainfall Rate and Profile Product (TRMM Product 2A25) (TRMM\_2A25)  
[View Files](#) | [Info](#) | [Data Calendar](#)  
Approx. 1095 files found (Avg Size: 19.162 MB)  
Parameters: PRECIPITATION AMOUNT, PRECIPITATION ANOMALIES, PRECIPITATION RATE  
Spatial Resolution: 4 km x 4 km  
Temporal Resolution: 1 Hour(s)
- TRMM Combined Precipitation Radar (PR) and TRMM Microwave Imager (TMI) Rainfall Profile Product (TRMM Product 2B31) (TRMM\_2B31)   
[View Files](#): [66](#) | [607](#) | [Info](#): [606](#) | [607](#) | [Data Calendar](#): [606](#) | [607](#)  
Approx. 1124 files found (Avg Size: 8.346 MB)  
Parameters: CLOUD LIQUID WATER/ICE, PRECIPITATION AMOUNT, RAIN  
Spatial Resolution: 5 degrees x 5 degrees  
Temporal Resolution: 1 Hour(s)
- Combined TRMM Microwave Imager (TMI) and Precipitation Radar (PR) Gridded Orbital Data Set (G2A12) (TRMM\_G2A12)   
[View Files](#) | [Info](#) | [Data Calendar](#)  
Approx. 1095 files found (Avg Size: 0.127 MB)  
Parameters: LATENT HEATING, LATENT HEATING, LATENT HEATING, CLOUD LIQUID WATER/ICE, CLOUD PRECIPITABLE WATER, LIQUID WATER EQUIVALENT, LATENT HEATING...  
Spatial Resolution: 0.5 degree x 0.5 degree  
Temporal Resolution: 1 Hour(s)
- TRMM Precipitation Radar (PR) Gridded Rainfall Product (TRMM Product 3A25) (TRMM\_3A25)  
[View Files](#) | [Info](#) | [Data Calendar](#)  
Approx. 7 files found (Avg Size: 39.064 MB)  
Parameters: PRECIPITATION RATE  
Spatial Resolution: 5 degrees x 5 degrees  
Temporal Resolution: 31 Day(s)
- TRMM Combined Precipitation Radar (PR) and TRMM Microwave Imager (TMI) Gridded Rainfall Product (TRMM Product 3B31) (TRMM\_3B31)



## Other GES DISC Data Search and Access Services

### OPenDAP

<http://disc.sci.gsfc.nasa.gov/services/opendap/>

### GrADS Data Server (GDS)

<http://disc.sci.gsfc.nasa.gov/services/grads-gds>

### Web Map Service (WMS)

[http://disc.sci.gsfc.nasa.gov/services/ogc\\_wms](http://disc.sci.gsfc.nasa.gov/services/ogc_wms)

### Simple Subset Wizard

<http://disc.gsfc.nasa.gov/SSW/>



# GES DISC Information Exploration and Discovery Services

## Giovanni - Goddard Interactive Online Visualization ANd aNalysis Infrastructure

<http://giovanni.gsfc.nasa.gov/>

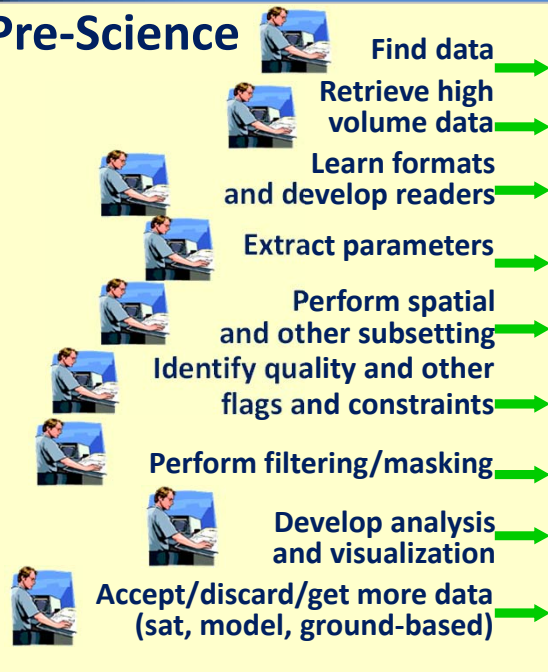
- Provides a simple and easy way to explore, visualize, analyze, and access vast amounts of Earth science remote sensing and model data.
- Is a Web-based application.
- Supported by NASA EOSDIS and several NASA-funded projects.



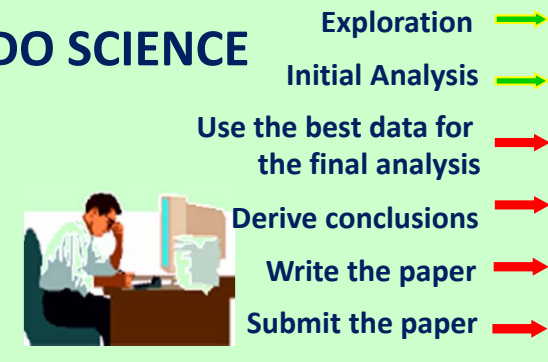
# Giovanni Allows Researchers to Concentrate on the *Research*

*The Old Way:*

## Pre-Science



## DO SCIENCE



*Web-based Services:*

Jan

Feb

Mar

Apr

May

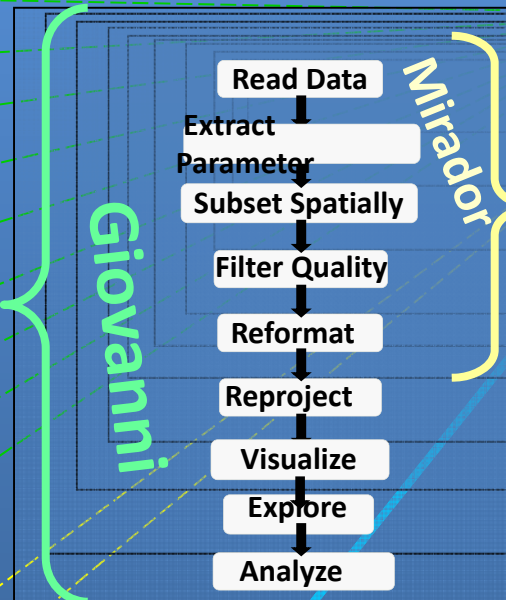
Jun

Jul

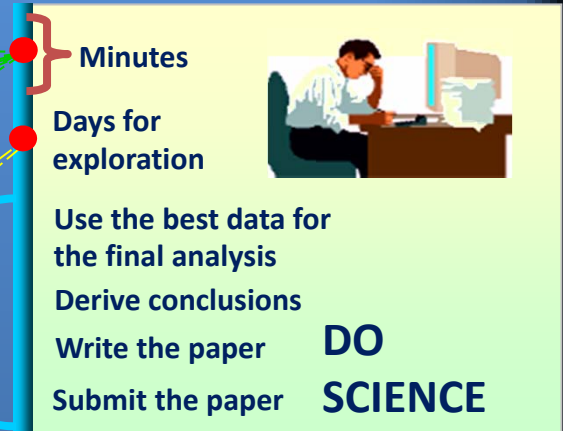
Aug

Sep

Oct



*The Giovanni Way:*



Giovanni and other web-based tools allow scientists to **compress** the time needed for pre-science preliminary tasks: *data discovery, access, manipulation, visualization, and basic statistical analysis.*



# Choose Giovanni instance...

# select location, time,

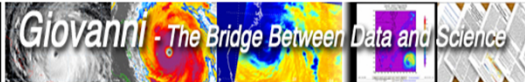
# and



Goddard Earth Sciences  
Data and Information Services Center

Search DISC  
+ GO  
+ Advanced Search

- + ATMOS COMPOSITION
- + HYDROLOGY
- + A-TRAIN
- + AIRS
- + MODELING
- + MAIRS
- + MEASURES
- + PRECIPITATION



## Giovanni

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### GIOVANNI

Giovanni is a Web-based application developed by the GES DISC that provides a simple and intuitive interface to analyze, and access vast amounts of Earth science remote sensing data without having to download the data.

Giovanni is comprised of a number of interfaces, called instances, each tailored to meet the needs of different science research communities. To access a Giovanni instance, click on one of the four categories:

- Atmospheric Instances:** A-Train along CloudSat Track; Aerosol Optical Thickness Measurement Comparison Daily and Monthly; Aqua/AIRS Global Daily and Monthly; Aura High Resolution Doppler Sounder (HIRDLS); Aura Microwave Limb Sounder (MLS); Aura OMI Level 3 and Level 2G; MIP Clouds and the Earth's Radiant Energy System (CERES FM4); Modern Era Retrospective-Analytical Reanalysis (MERRA) 3D Monthly and 2D Monthly; MODIS Terra and Aqua Daily and Monthly; Nimbus-7 TOMS; Tropospheric Emission Spectrometer (TES); Upper Atmosphere Research Satellite Halogen Occultation Experiment (HALOE).
- Environmental Instances:** Agriculture; Air Quality; Monsoon Asia Integrated Regional Study (MAIRS); Northern Eurasia Earth Science Partnership Initiative (NEESPI) Daily and Monthly
- Ocean Instances:** Ocean Color Radiometry (SeaWiFS, MODIS, and derived and model products) Daily and Monthly.
- Hydrology Instances:** Modern Era Retrospective-Analytical Reanalysis for Research and Applications (MERRA) Monthly, Monthly Analysis, and Chemical Forcing; MODIS Terra and Aqua Daily and Monthly; TRMM Science Partnership Initiative (NEESPI) Daily and Monthly; TRMM Online Visualization and Analysis (TOVAS); Global Land Data Assimilation System (GLDAS) Monthly.

If you already know which instance to choose, please select it from the table below.

A-Train	Aerosol Daily	Aerosol Monthly	Agriculture	Air Quality
Aqua/AIRS Daily	Aqua/AIRS Monthly	Aura HIRDLS	Aura MLS	Aura OMI L2G
Aura OMI L2G	CERES (FM4)	GLDAS Monthly	MAIRS Monthly	MERRA MONTH 2D
MERRA MONTH 2D	MERRA MONTH 3D	MERRA MONTH ANA	MERRA MONTH CHM	MERRA MONTH 3D
MERRA HOUR 3D	MISR Daily	MISR Monthly	MODIS Daily	MODIS Monthly
NEESPI Daily	NEESPI Monthly	Ocean Color Radiometry	Ocean Model Daily	Ocean Model Monthly
TOMS	TRMM/TOVAS	TES	UARS HALOE	

## Global Land Data Assimilation System 1.0 Degree Monthly Products

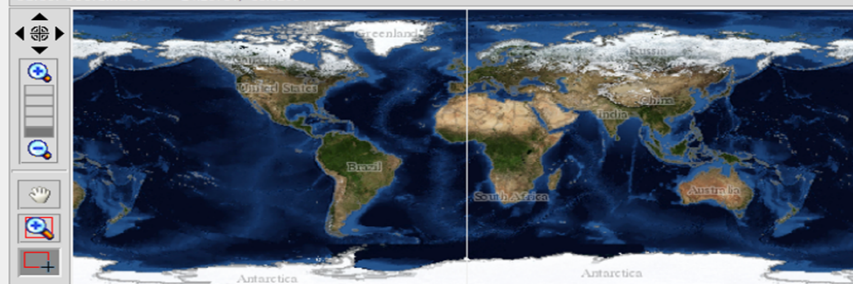
Remove All

The Global Land Data Assimilation System (GLDAS) is generating a series of land surface state (e.g., soil moisture and surface temperature) and flux (e.g., evaporation and sensible heat flux) products simulated by four land surface models (CLM, Mosaic, Noah and VIC). Current data holdings include a set of 1.0 degree resolution data products from the four models, covering 1979 to the present; and a 0.25 degree data product from the Noah model, covering 2000 to the present. This instance focuses on the 1.0 degree monthly products.

### Select:

#### Spatial

Cursor Coordinates: -24.25781, -83.32031



Area of Interest: West: -103.7109375 North: 40.4296875 South: 28.4765625 East: -76.2890625 Update Map

#### Parameters

Display:  Data Product Info  Units

CLM Model (1979/01/01 - 2011/06/01)

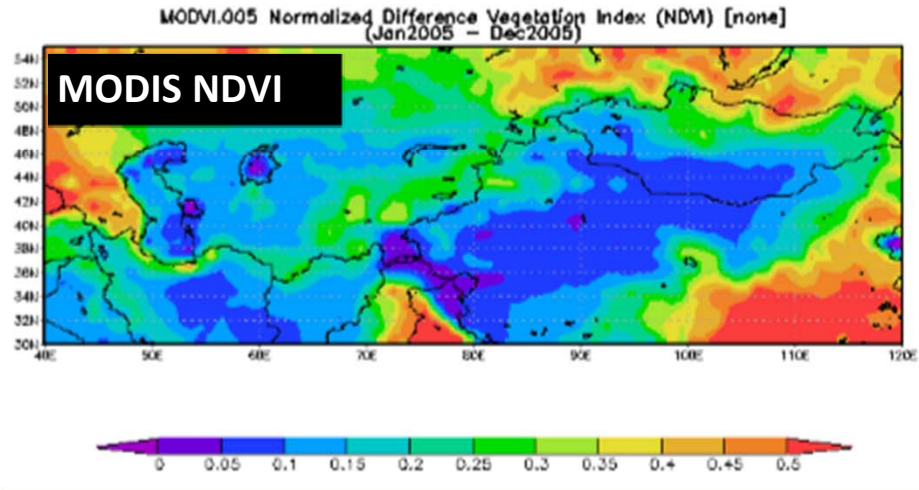
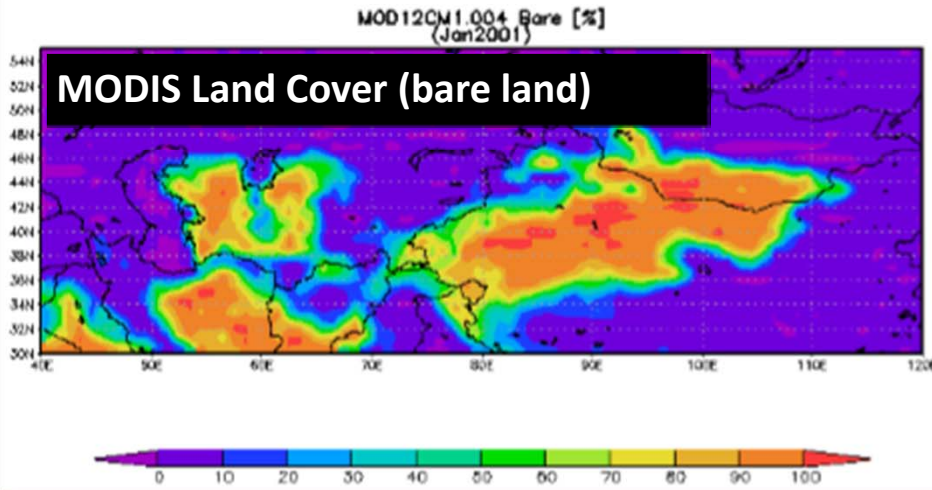
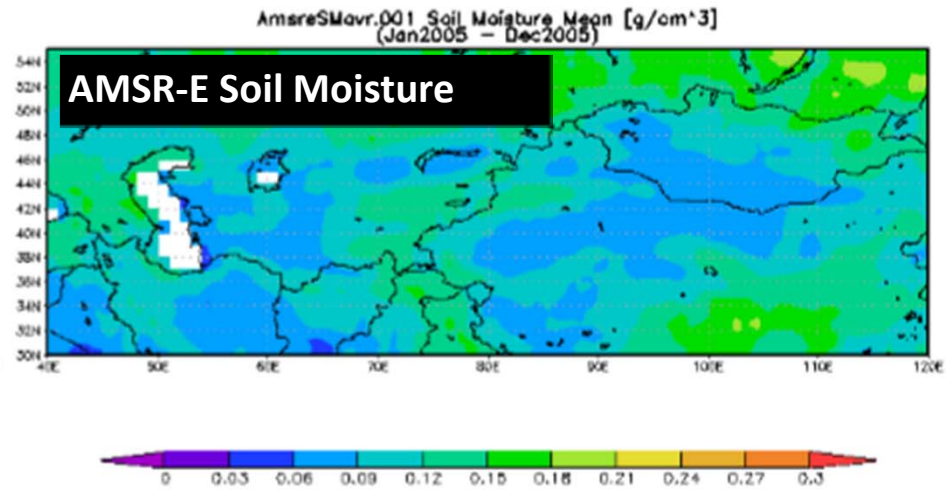
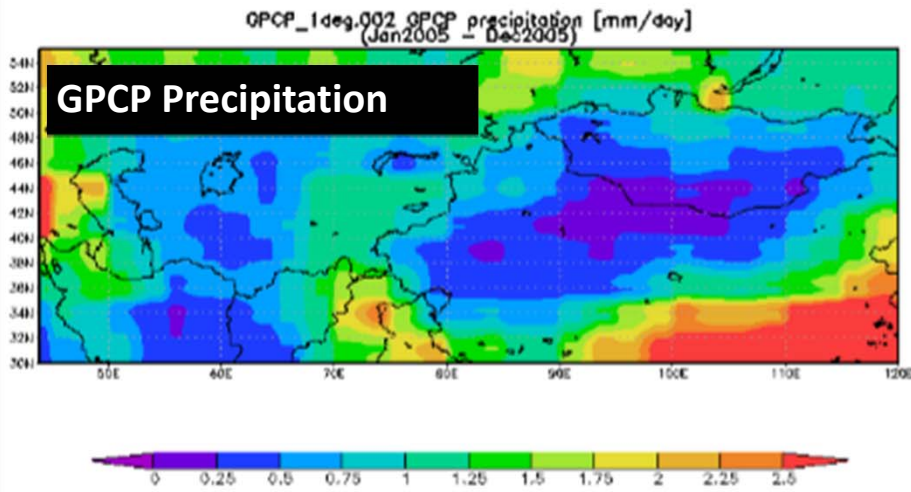
<input type="checkbox"/> Average layer 9 soil moisture	GLDAS_CLM10_M.001	CLM Model	1979/01 - 2011/06
<input type="checkbox"/> Average layer 9 soil temperature	GLDAS_CLM10_M.001	CLM Model	1979/01 - 2011/06
<input type="checkbox"/> Average surface temperature	GLDAS_CLM10_M.001	CLM Model	1979/01 - 2011/06
<input type="checkbox"/> Ground heat flux	GLDAS_CLM10_M.001	CLM Model	1979/01 - 2011/06
<input type="checkbox"/> Latent heat flux	GLDAS_CLM10_M.001	CLM Model	1979/01 - 2011/06
<input checked="" type="checkbox"/> Near surface air temperature	GLDAS_CLM10_M.001	CLM Model	1979/01 - 2011/06
<input type="checkbox"/> Near surface specific humidity	GLDAS_CLM10_M.001	CLM Model	1979/01 - 2011/06

Mosaic Model(1979/01/01 - 2011/06/01)

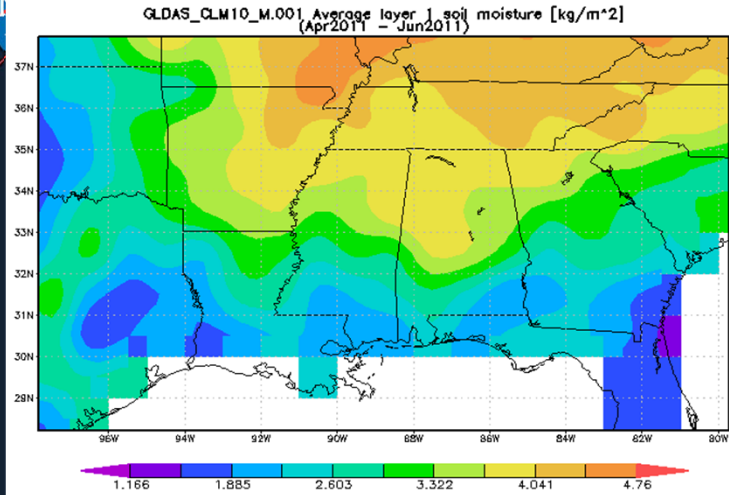




# Multi-sensor view mid-Asia, northwestern China, and Mongolia

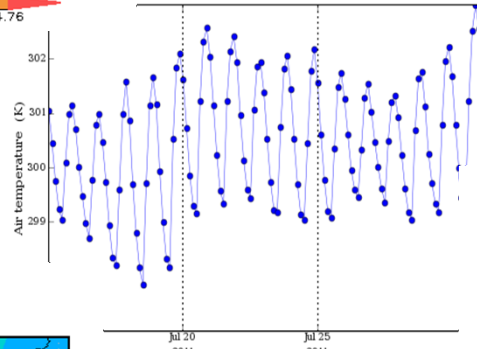


From: Leptoukh



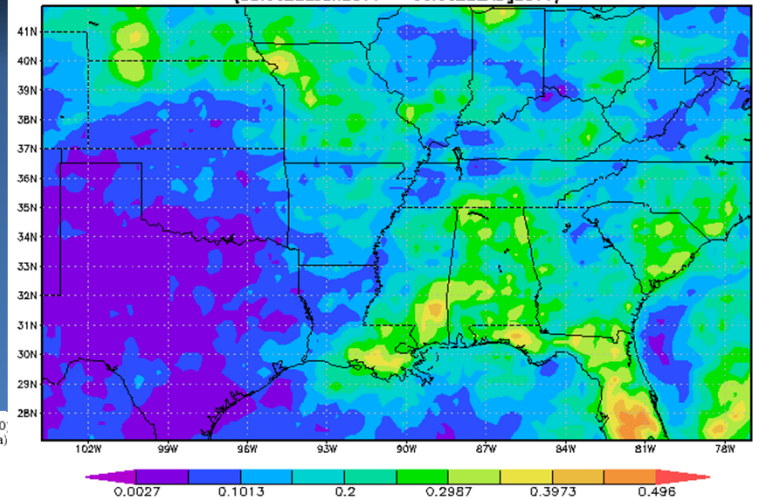
**GLDAS  
soil moisture  
and  
surface runoff**

Area-Averaged Time Series (MAI3CPASM 5.2.0  
Region: 98W-78W, 26N-36N Level: 1000hPa)



**MERRA  
assimilated  
surface air  
temperature**

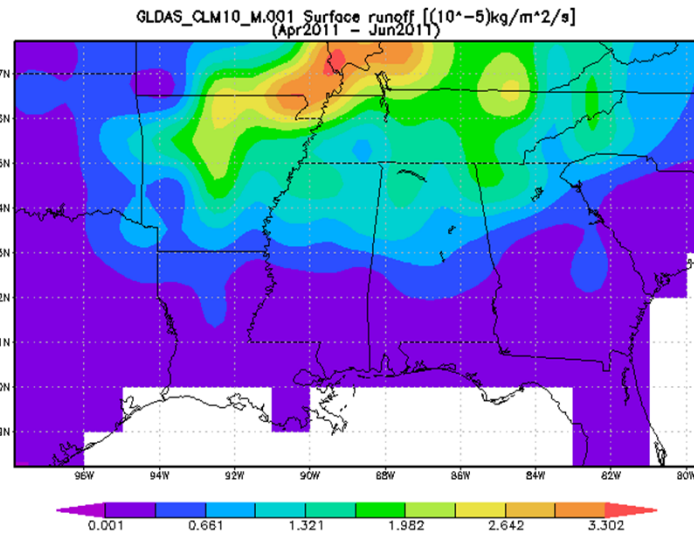
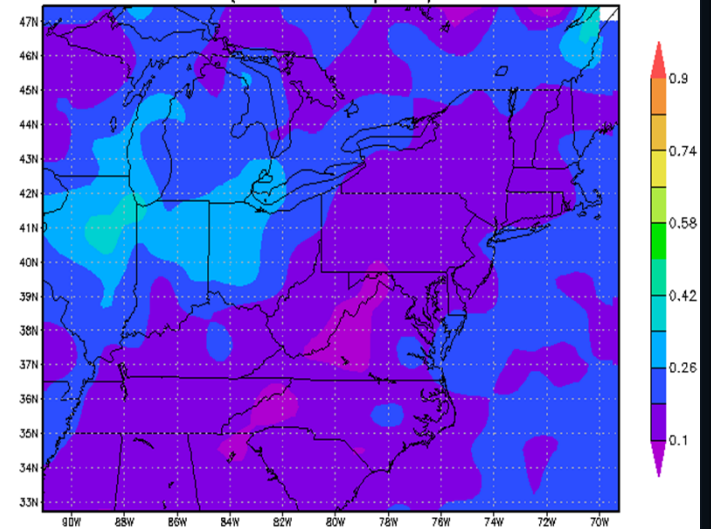
TRMM\_3B42RT.006 precipitation [mm/hr]  
(00:00Z22Jun2011 - 00:00Z22Aug2011)



**TRMM precipitation rate**

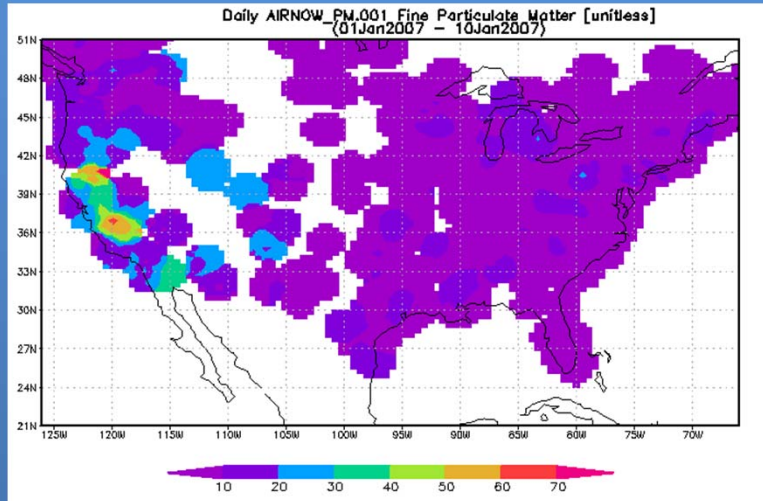
**MODIS aerosol optical depth**

MOD08\_D3.051 Aerosol Optical Depth at 550 nm [unitless]  
(14Mar2010 - 14Apr2010)

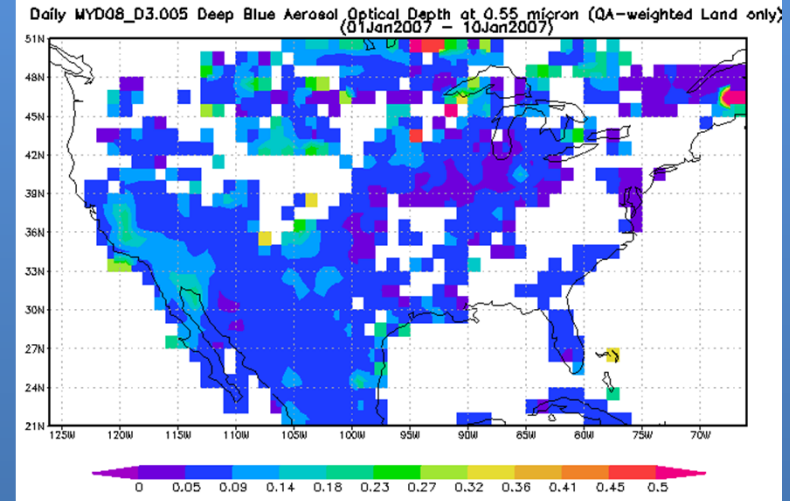




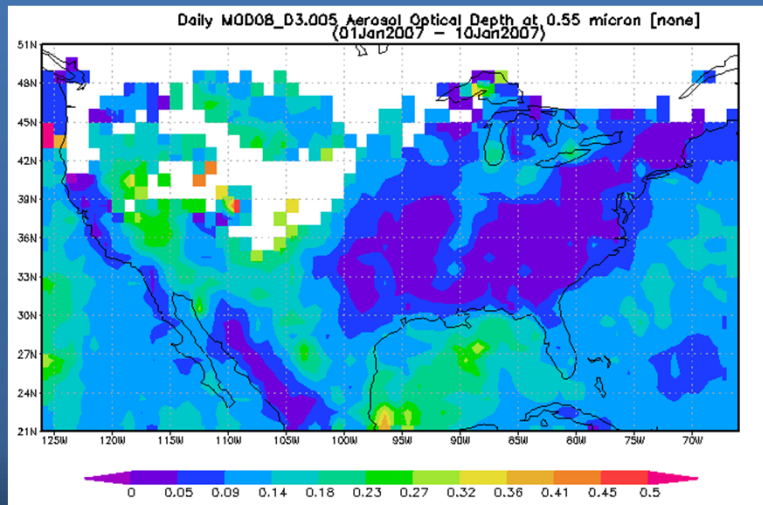
# PM25 data in Giovanni



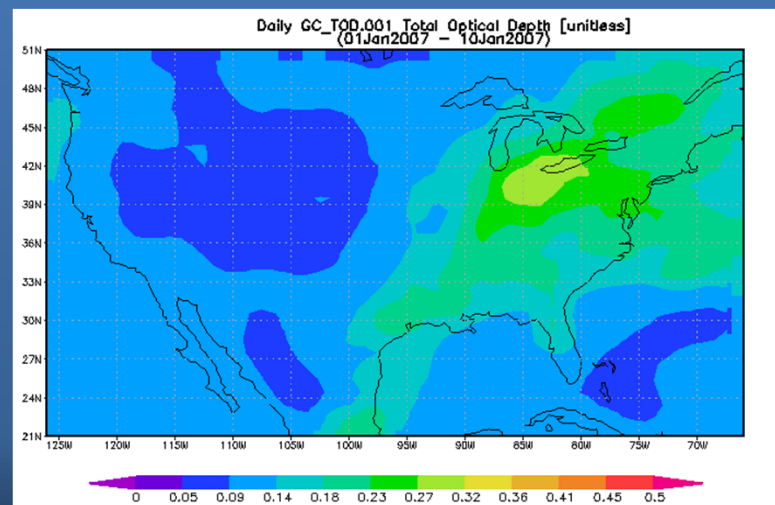
PM2.5 (EPA → DataFed → Giovanni)



Deep Blue MODIS Aerosol Optical Depth



The standard MODIS AOT

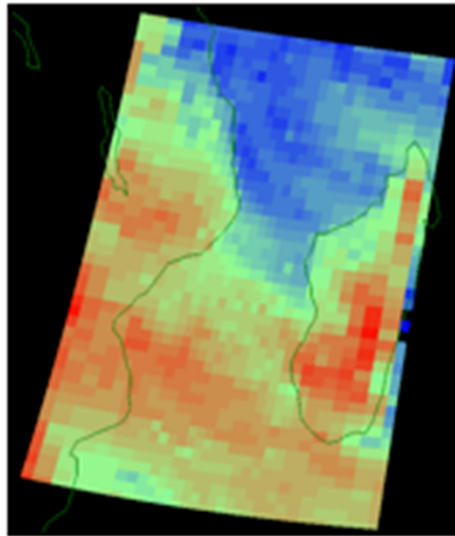


GOCART AOT



# Data Quality Screening Service

Before Screening

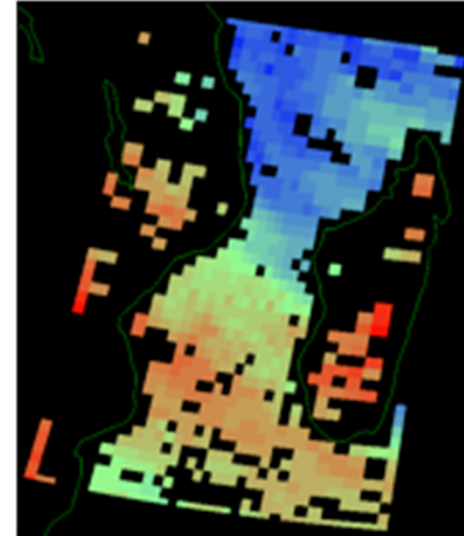


5 kg/m<sup>2</sup> 50

Quality Mask



After Screening



5 kg/m<sup>2</sup> 50

## Quality Screening Process

Total Column Precipitable Water from Atmospheric Infrared Sounder (AIRS) near Madagascar, 4 Jun 2009



# Conclusions

- Satellite remote sensing data and services hold great promise to alleviate limitations of monitor-based environmental data collecting
- Obstacles such as uncertainties in methodology, data accessibility (for epidemiologists) and data quality are being addressed
- Numerous community efforts are addressing these issues on local and global levels
- A further increase in health research and modeling nurtured by more satellite products, reduced uncertainties, as well as user-oriented data services is on the horizon



***Thank You***

***Backup...***



# GES DISC Data Useful for Public Health Research Activities

Measurement	GES DISC Dataset*	Spatial Resolution	Temporal Coverage	Current Usage/ Potential Usage	Health Relevance
Precipitation	TRMM	1/4 deg - 1 deg	1997 - present	See Pinzon, Zaitchik, Kiang, Tilburg	Vector Borne Diseases; Water Borne Diseases
	GPM	1/4 deg X 1/4 deg	Starting 2013		
	GLDAS	1/4 deg X 1/4 deg; 1 deg X 1 deg	1979 - present	GLDAS, MERRA NLDAS are of comparable resolution to TRMM	
	NLDAS	1/8 deg X 1/8 deg	1979 - present North America		
	MERRA	1.25 deg X 1.25 deg	1979 - present		
Water Runoff	<i>Non GES DISC product often used</i>			USGS derived products (Tilburg)	Vector Borne Diseases; Water Borne Diseases
	GLDAS	1/4 deg X 1/4 deg; 1 deg X 1 deg	1979 - present	GLDAS, MERRA NLDAS provide assimilated alternatives	
	MERRA	2/3 deg X 1/2 deg	1979 - present		
	NLDAS	1/8 deg X 1/8 deg	1979 - present North America		
Vegetation Index	<i>Non GES DISC product often used</i>			MODIS derived data has set the standard (Ponzon, Estes, Kiang)	Vector Borne Diseases; Air Pollution
	NLDAS	1/8 deg X 1/8 deg	1979 - present North America	NLDAS, MERRA provide alternatives with higher temporal resolution	
	MERRA	2/3 deg X 1/2 deg	1979 - present		



Soil Moisture	NEESPI – AMSR-E	1 deg X 1 deg	2002 - present	See Zaitchik, Estes, Wimberly (uses AMSR-E)	Vector Borne Diseases
	LPRM using AMSR-E	25 km X 25 km	2002 - present	LPRM provides higher spatial resolution based on AMSR-E	
	NLDAS	1/8 deg X 1/8 deg	1979 - present North America	GLDAS, MERRA NLDAS provide higher temporal resolution	
	GLDAS	1/4 deg X 1/4 deg; 1 deg X 1 deg	1979 - present		
	MERRA	2/3 deg X 1/2 deg	1979 - present		
Surface Air Temperature	<i>Non GES DISC product often used</i>			MODIS generated data has set the standard (Pinzon, Zaitchik, Estes, Kiang, Stumpf, McClure, Ceccato)	Vector Borne Diseases; Air Pollution
	AIRS	1 deg X 1 deg	2002 - present	See reference: Wallace	
	TOVS	1 deg X 1 deg	1984 - 1995	TOVS: Historical data	
	MERRA	2/3 deg X 1/2 deg; 1.25 deg X 1.25 deg	1979 - present	GLDAS, MERRA NLDAS provide higher temporal resolution data	
	GLDAS	1/4 deg X 1/4 deg; 1 deg X 1 deg	1979 - present		
	NLDAS	1/8 deg X 1/8 deg	1979 - present North America		





Aerosols	<i>Non GES DISC product often used</i>			MODIS generated data (Liu, Morain)	Air Pollution
	OMI	24 km X 13 km; 1/4 deg X 1/4 deg	2004 - present	OMI is useful for low resolution applications	
	TOMS	1.25 deg X 1.0 deg	1978 - 2005	TOMS: Historical data	
	MERRA	2/3 deg X 1/2 deg; 1.25 deg X 2.0 deg	1979 - present	MERRA, GOCART provide higher temporal resolution	
	GOCART	2.5 deg X 2.0 deg	2000 - 2007		
Wind	<i>Non GES DISC product often used</i>			Local records used (Kiang)	Vector Borne
	MERRA	2/3 deg X 1/2 deg; 1.25 deg X 1.25 deg	1979 - present	See reference: Lau	Diseases; Air Pollution
	GLDAS	1/4 deg X 1/4 deg; 1 deg X 1 deg	1979 - present	GLDAS, NLDAS, GSSTF2b provide assimilated alternatives	
	NLDAS	1/8 deg X 1/8 deg	1979 - present North America		
	GSSTF2b	1 deg X 1 deg	1988 - 2008		
Solar Irradiance	<i>Non GES DISC products often used</i>			Local records used (Kiang); TOPS (Charland)	Air Pollution; Vector Borne Diseases
	SORCE		2003 - present	SORCE, OMI provide alternative global measurements	
	OMI	1/4 deg X 1/4 deg; 1 deg X 1 deg	2004 - present		



\* Acronyms:

- AIRS - The Atmospheric Infrared Sounder
- AMSR-E - Advanced Microwave Scanning Radiometer-Earth Observing System
- GLDAS - Global Land Data Assimilation System
- GOCART - The Goddard Chemistry Aerosol Radiation and Transport model
- GPM - The Global Precipitation Measurement
- GSSTF2b - Goddard Satellite-based Surface Turbulent Fluxes Version-2b (Produced through a NASA MEaSURES funded project led by Dr. Chung-Lin Shie, UMBC/GEST, NASA/GSFC)
- LPRM - Land Parameter Retrieval Model
- MERRA - Modern Era Retrospective-Analysis for Research and Applications
- MISR – Multi-angle Imaging Spectroradiometer
- MLS - Microwave Limb Sounder
- MODIS - Moderate Resolution Imaging Spectroradiometer
- NEESPI - Northern Eurasia Earth Science Partnership Initiative (Provided through a NASA MEaSURES funded project led by Dr. Gregory Leptoukh, NASA/GSFC)
- NLDAS - North American Land Data Assimilation System
- OMI - Ozone Monitoring Instrument
- SORCE- The Solar Radiation and Climate Experiment
- TES – Tropospheric Emission Spectrometer
- TOMS - Total Ozone Mapping Spectrometer
- TOPS - Terrestrial Observation and Prediction System
- TOVS - TIROS Operational Vertical Sounder
- TRMM - Tropical Rainfall Measuring Mission