Updates of Land Surface and Air Quality Products in NASA MAIRS and NEESPI Data Portals

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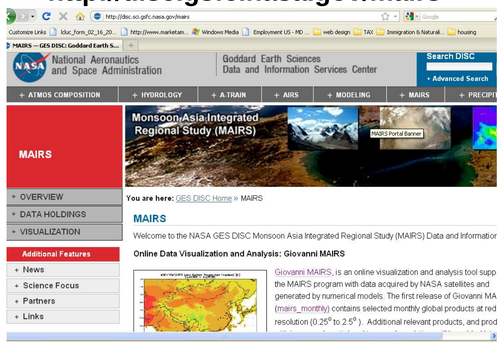
Overview

Following successful support of the Northern Eurasia Earth Sciences Partner Initiative (NEESPI) project with NASA satellite remote sensing data, from Spring 2009 the NASA GES DISC (Goddard Earth Sciences Data and Information Services Center) has been working on collecting more satellite and model data to support the Monsoon Asia Integrated Regional Study (MAIRS) project. The established data management and service infrastructure developed for NEESPI has been used and improved for MAIRS support. Data search, subsetting, and download functions are available through a single system. A customized Giovanni system has been created for MAIRS. The Web-based online data analysis and visualization system, Giovanni (Goddard Interactive Online Visualization ANd aNalysis Infrastructure) allows scientists to explore, quickly analyze, and download data easily without learning the original data structure and format. Giovanni MAIRS includes satellite observations from multiple sensors and model output from the NASA Global Land Data Assimilation System (GLDAS), and from the NASA atmospheric reanalysis project, MERRA. Currently, we are working on processing and integrating higher resolution land data into Giovanni, such as vegetation index, land surface temperature, and active fire at 5km or 1km from the standard MODIS products. For data that are not archived at the GES DISC, a product metadata portal is under development to serve as a gateway for providing product level information and data access links, which include both satellite, model products and ground-based measurements information collected from MAIRS scientists. Due to the large overlap of geographic coverage and many similar scientific interests of NEESPI and MAIRS, these data and tools will serve both projects.

http://disc.gsfc.nasa.gov/mairs



http://disc.gsfc.nasa.gov/neespi

Products in Giovanni NEESPI for MAIRS

Group	Parameter Name	Sensor Name	Available since	Time Interval	Spatial Resolution (deg)
Atmosphere	Aerosol Optical Depth at 0.55 micron and small mode fraction	MODIS-Terra MODIS-Aqua	2000.02 2002.07	Monthly Daily	1x1
	Atmospheric Water Vapor	MODIS-Terra MODIS-Aqua	2000.02 2002.07	Monthly Daily	1x1
	Cloud Fraction, Cloud Optical Depth	MODIS-Terra MODIS-Aqua	2000.02 2002.07	Monthly Daily	1x1
	Column Amount Ozone	Aura OMI	2004.08	Daily	1x1
	UV Aerosol Index	Aura OMI	2004.08	Daily	1x1
	Optical Depth of Dust, Black Carbon, Sulfate	GOCART	2000.01	Monthly Daily	2.5x2
	GPCP precipitation	GPCP Derived	1979.01	Monthly Daily	1x1
Land Surface	Fire Pixel Count/Fire radiative power	MODIS-Terra MODIS-Aqua	2000.11 2002.07	Monthly	1x1
	Enhanced Vegetation Index (EVI)	MODIS-Terra MODIS-Aqua	2000.02 2002.07	Monthly	1x1
	Normalized Difference Vegetation Index (NDVI)	MODIS-Terra MODIS-Aqua	2000.02 2002.07	Monthly	1x1
	Land Surface Temperature	MODIS-Terra	2000.03	Monthly	1x1
	Soil Moisture	AMSR-E	2002.10	Monthly	1x1
	Surface Air/Skin Temperature	AIRS	2002.08	Monthly Daily	1x1
	Land Cover Type	MODIS Terra	2001.01	Monthly	1x1
Cryosphere	Ice Occurrence Frequency	NESDIS/IMS	2000.01	Monthly	1x1
	Snow Occurrence Frequency	NESDIS/IMS	2000.01	monthly	1x1

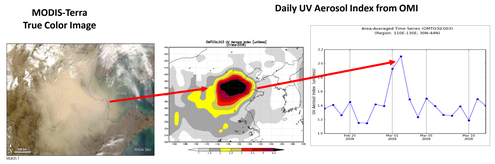
Products in Giovanni MAIRS

Group	Parameter Name	Sensor/Model	Available Since	Time Interval	Spatial res.(deg)
Meteorology & Atmospheric Chemistry	Winds, Pressure, Geopotential Height, Air Temperature , Water Vapor	MERRA	1979.01	Monthly	2/3 x 1/2
	GPCP precipitation	GPCP	1979.01	Monthly Daily	1.0x1.0
	Aerosol Optical Depth	MODIS	2000.02	Monthly Daily	1.0x1.0
	NO2	OMI	2004.08	Daily	0.25x0.25
	CH4, CO, O_3	AIRS	2002.08	Monthly Daily	1x1
Land Surface	Land Cover Type &Dynamics	MODIS (MOD12Q1)	2001	Yearly	1 km
	Vegetation Indices	MODIS (MOD13A1)	2000.03	Monthly 16-day	1.0x1.0 1 km, 5 km
	Land Surface Temperature	MODIS (MOD11A2)	2001.03	Monthly 8-Day	1.0x1.0 1 km
	Thermal anomalies/Fire	MODIS (MOD14A2)	2000.03	Monthly 8-Day	1.0x1.0 1 km
	Total Evapotranspiration, Snow Water Equivalent	GLDAS	1979.01	Monthly	1x1
	Surface Runoff, Soil Moisture	GLDAS	1979.01	Monthly	1x1
Ocean	Chlorophyll a concentration	SeaWiFS	1997.09	Monthly	9 km
	Sea surface temperature	MODIS-Terra	2000.02	Monthly	9 km
Socio-economic	Nighttime Lights	DMSP-OLS	1992-2003	yearly	1 km

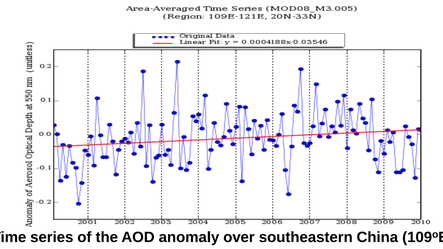
Note: Products of temporal interval with text color in RED are future products

Sample Plots through Giovanni: Online Visualization and Analysis System

Dust Storm and Variations of Aerosols



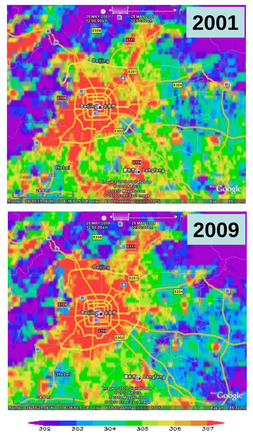
A dust storm observed from MODIS (left, true color image) and OMI UV aerosol index (middle and right)



Time series of the AOD anomaly over southeastern China (109ºE-121ºE, 20ºN-33ºN), showing a significant positive trend since 2000.

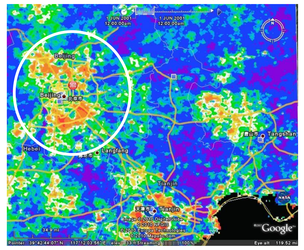
Recent Land Surface Temperature Changes associated with Urbanization over Eastern China

Beijing

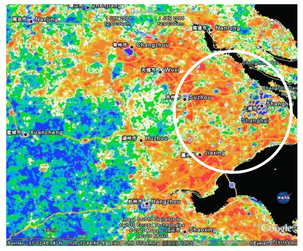


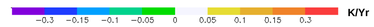
Summer Daytime LST Trend, 2001-2009 MODIS-Terra

Beijing-Tianjing



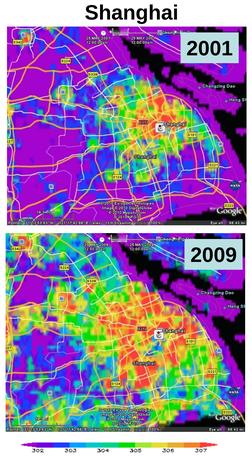
Yangtze River Delta





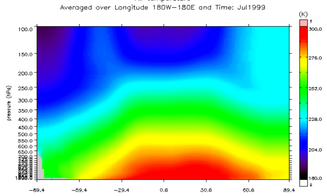
MODIS Terra 1km resolution summer (Jun, Jul, Aug) daytime Land Surface Temperature (LST) trend for years from 2001 – 2009 over eastern China, near Beijing-Tianjing and Yangtze River Delta shows warming trends in the rapid urbanization zone (surrounding area of cities), and slightly cooling trends in the originally developed (center of city) and less developed rural areas. The images are displayed in GoogleEarth and with an added layer "Road" (orange lines).

Shanghai

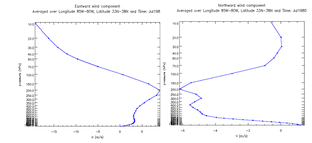


NASA Assimilation Models: MERRA and GLDAS

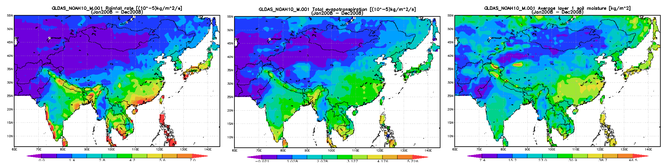
Selected NASA thirty-year (1979-present) atmospheric observation reanalysis products (MERRA) and land surface assimilation models (GLDAS) products are integrated into Giovanni MAIRS.



Zonal averaged vertical cross section map for air temperature in Jul 1999 (MERRA).



Wind vertical profiles over an area (80º W – 85ºW, 33ºN-38ºN) for U component (left panel) and V component (right panel) in July 1980 (MERRA).



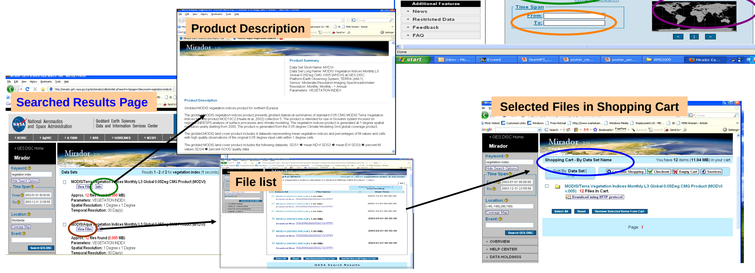
From left to right, annual mean of rain rate, total evapotranspiration, and soil moisture for year 2008 over Asia Monsoon region (GLDAS).

Advanced Data Access Tools and Services

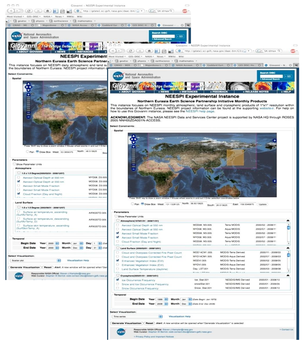
Search and Download Data using Mirador

Mirador is a new search and order Web tool developed by the GES DISC. It has a drastically simplified, clean interface and employs the Google mini appliance for metadata keyword searches. Other features include project navigation, and semantic oriented parameter navigation based on science areas.

Mirador supports search by keyword, time span, and location. Keywords can be parameter names; science discipline areas (such as *atmosphere*); instrument, sensor, or model names; or data product short names such as *MOD14CM1*. Time spans can be specified in any unambiguous way (e.g. *Sep 1, 2005* or *9/1/05*). Location can be specified by area name (e.g. Black Sea) or by geographic coordinates. Mirador is supported by a geographic feature Gazetteer.



http://gsfc.nasa.gov/giovanni



Single Parameter Exploration:

- Lat–Lon area plots of time-averaged parameters
- Time-series plots of area-averaged parameters
- Latitude/Longitude–Time Hovmöller diagram
- Animations of consecutive Lat–Lon area plots

Multi-parameter Intercomparison:

- Lat–Lon area plots of overlain time-averaged parameters
- Time-series plots of multiple parameters
- Time-series of two-parameter differences
- Lat–Lon area plot of two-parameter differences
- Scatter plots with regression statistics
- Temporal correlation maps

Download:

- data in formats: ASCII, HDF, netCDF
- image: PNG, KMZ for Google Earth

Other Features:

- Provides WMS: allows other web server to generate maps by using Giovanni as a back engine
- Current Input data formats: HDF-4, HDF-5, HDF-EOS, netCDF, and binary
- Able to fetch input data from local and different remote systems

Future Service: Metadata Gateway

Satellite Measurement Metadata

Model Data Metadata

Ground-based Measurement Metadata

Project Name: Watershed Airborne Telemetry Experimental Research (WATER)
Summary: Watershed Airborne Telemetry Experimental Research (WATER) is program to conduct simultaneous airborne, satellite-borne and ground-based remote sensing experiments in the Heihe (Black) River Basin, …….
Location: Heihe (Black) River Basin in Northern China
Measurements:

Experiment period -- snow (snow depth, density, temperature, liquid water equivalent and grain size), frozen soil (surface temperature, liquid water content and ice content), vegetation

Long-term ground -- snow cover, snow depth, snow density, soil moisture (liquid water and ice equivalent of frost), soil temperature, frost depth, precipitation (rainfall and snowfall), evapotranspiration, infiltration, hydraulic conductivity, …….

Hydro-meteorological observation stations – profile of wind, air temperature, air relative humidity; solar and longwave radiation; multilayer soil temperature, water content of soil and thermal flux; vegetation growth condition, ……..

Temporal Coverage: 2007 August-September and October-November, pre-experiment
2008 March-April and June-July, airborne remote sensing and ground observation

Data Policy: Contact project PI
Project web page: http://water.westgis.ac.cn http://water.westgis.ac.cn/indexenglish.asp
Person of Contact: Xin Li, lixin@lzb.ac.cn, Cold and Arid Regions Environmental and Engineering Research Institute, CAS

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