



NASA Satellite and Model Data and Services to Support NEESPI and MAIRS Projects

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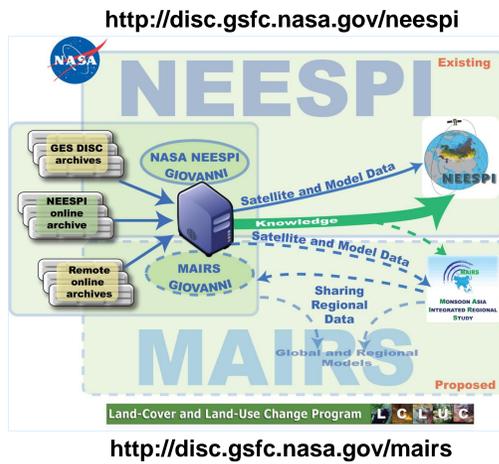
Overview

During the past three decades, the Northern Eurasia and Asian Monsoon regions have experienced significant changes in agriculture, industry and economics. Studies have indicated that land use and land cover changes due to climate change and human activities not only affects local climate but also influence global climate system. However, the understandings of the interaction between human activity, land processes, and climate change are limited. Having integrated interdisciplinary multi-sensor data are important for studies of climate and environmental changes.

Large amount of monthly and daily global satellite datasets for atmospheric, land surface, and cryosphere were collected during last three years and an automated data managing system was established in supporting the Northern Eurasia Earth Science Partnership Initiative (NEESPI) project. Data tools and services, such as temporal and spatial search, parameter and spatial subsetting, advanced data downloading, are available. Most data have been integrated into the easy use Web-based online data analyses and visualizations system, Giovanni.

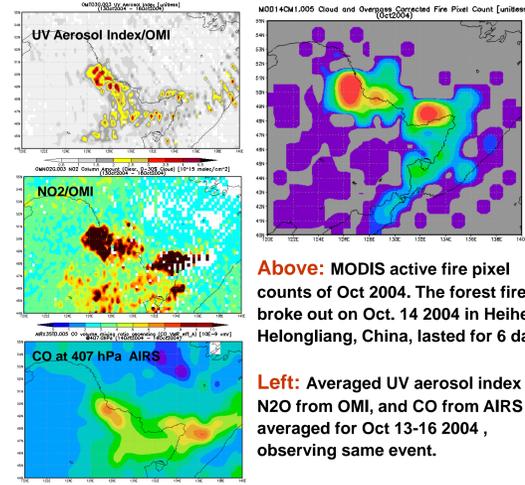
The established data services infrastructure will be used and improved further for supporting Monsoon Asia Integrated Regional Study (MAIRS) project. 30 years selected parameters from NASA land model (GLDAS) and atmospheric reanalysis model (MERRA) products have been integrated into Giovanni MAIRS; higher resolution (5km and 1km) land process data will be integrated. Due to the large overlap of the geographic coverage and many similar interesting of NEESPI and MAIRS, collected data and information serve for both projects.

International collaborations through our project have been initiated. As decided on the MAIRS 2nd dry-land international workshop [1], July 2009, working with MAIRS scientists, a product metadata portal will be created for promoting data sharing. In October, we have met the project partner at NADSC [2] on an online data sharing infrastructure kickoff meeting. The English version of NADSC web page has been created as a starting step.



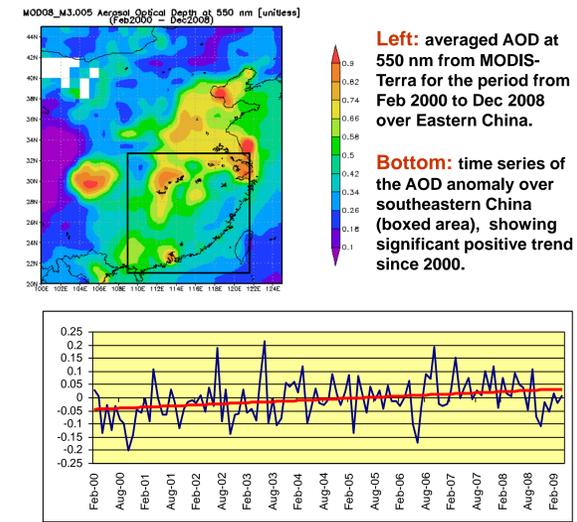
Sample Data Exploration through Giovanni: Online Visualization and Analysis System

Fires in Northeast China Oct 14-19 2004



Above: MODIS active fire pixel counts of Oct 2004. The forest fire broke out on Oct. 14 2004 in Heihe, Helongliang, China, lasted for 6 days.
Left: Averaged UV aerosol index and N2O from OMI, and CO from AIRS averaged for Oct 13-16 2004, observing same event.

Interannual Variations of Aerosol over East China



Left: averaged AOD at 550 nm from MODIS-Terra for the period from Feb 2000 to Dec 2008 over Eastern China.
Bottom: time series of the AOD anomaly over southeastern China (boxed area), showing significant positive trend since 2000.

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 by define time span, and location. Other features include project navigation, and semantic oriented parameter navigation based on science areas. The data can be downloaded through FTP, HTTP, DownThemAll, etc. Spatial and parameter subset function is available for some products.



Online Visualization and Analysis Tool: 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

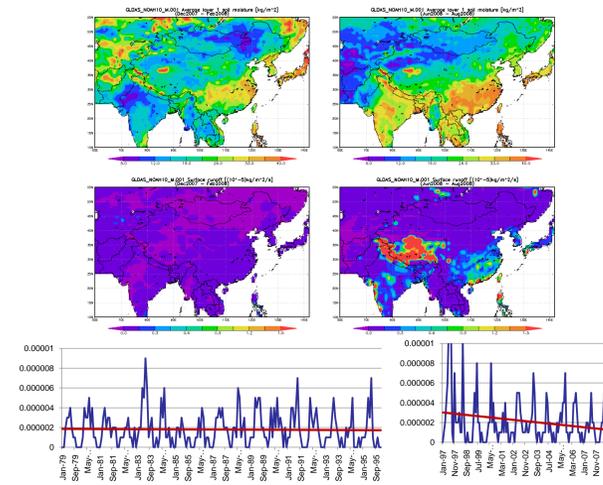
Other Features:

- 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 through FTP, OPeNDAP, and GDS.

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



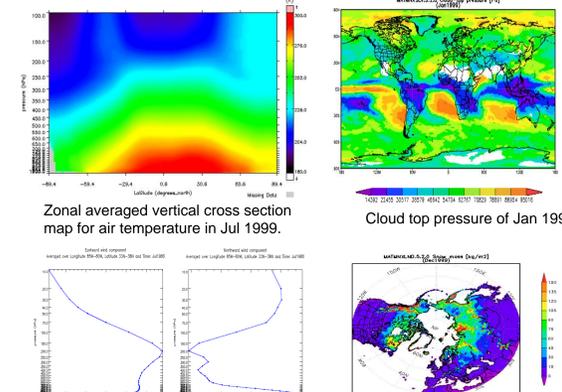
Land Surface Model Products



30 years (1979-present) monthly NOAA land surface model products, generated by NASA GLDAS project, have been integrated into Giovanni MAIRS. Sample images above are soil moisture and surface runoff data over Monsoon Asia region for the winter (2007.12-2008.02) and summer (2008.06-2008.08). Time series shows the surface runoff at mid-low branch of Yangtze River (29°N, 33°N, 115°E, 122°E), indicating a significant decrease since 1997.

NASA Reanalysis Products

30 years MERRA products (1979-present, monthly, hourly, 3-hourly) are created by the NASA reanalysis project for the satellite era using GEOS-5, focusing on historical analyses of the hydrological cycle on a broad range of weather and climate time scales.



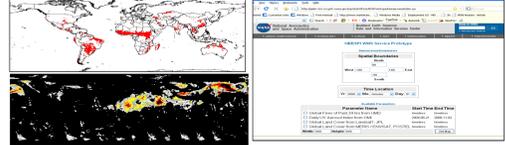
Wind vertical profiles over an area (80° W - 85°W, 33°N-38°N) for U component (left panel) and V component (right panel) in July 1980.

Other Data Access Services:

- OPeNDAP:** Provides remote access to a variable within a data file directly or via analysis tools, such as , IDV, Panoply, Ferret, and GrADS
- GDS (GrADS Data Server):** Provides remote access and analysis service through GrADS
- WMS:** Serves images generated from data from different remote sources
- WCS:** Serves data to OGC clients (allows netCDF)

Online Visualization: WMS Service Prototype

<http://neespi.gsfc.nasa.gov/cgi-bin/wms/index.py>



This service allows a user to access data and images from other data service centers through the Web Map Service (WMS). Through the current prototype, user can access fire-related data and images within 24 hours from Web Fire Mapper at Univ. of Maryland; high resolution land cover map from JPL (LandSat7, highest 15m); POSTEL (MERIS/ENVISAT,300m); and daily UV aerosol index from GES DISC (OMI, 1x1 deg), etc.

Products in Giovanni NEESPI

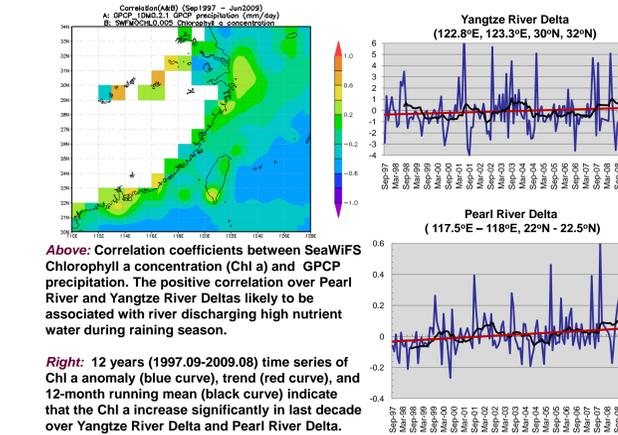
Group	Parameter Name	Sensor Name	Available since	Time Interval	Spatial Resolution (deg)
Atmosphere	Aerosol Optical Depth at 0.55 micron and small mode fraction	MODIS-Terra MODIS-Aqua	2000.02 2002.07	Monthly Daily	1x1
	Atmospheric Water Vapor	MODIS-Terra MODIS-Aqua	2000.02 2002.07	Monthly Daily	1x1
	Cloud 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 Name	Available Since	Time Interval	Spatial res.(deg)
Meteorology	Winds, Pressure, Geopotential Height	MERRA	1979.01	Monthly	2/3 x 1/2
	Air Temperature , Water Vapor	MERRA	1979.01	Monthly	2/3 x 1/2
	GPCP precipitation	GPCP	1979.01	Monthly Daily	1.0x1.0
Atmospheric Chemistry	Aerosol Optical Depth	MODIS	2000.02	Monthly Daily	1.0x1.0
	Column Ozone	TOMS	1996.07-2005.12	Daily	1.0x1.25
	NO2	OMI	2004.08	Daily	0.25x0.25
	CH4, CO	AIRS	2002.08	Monthly Daily	1x1
Land Surface (Higher Resolution)	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
	Burned area	MODIS (MCD45A1)	2000.03	Monthly	500m
	Total Evapotranspiration, Snow Water Equivalent	GLDAS	1979.01	Monthly	1x1
Ocean	Surface Runoff, Soil Moisture	GLDAS	1979.01	Monthly	1x1
	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

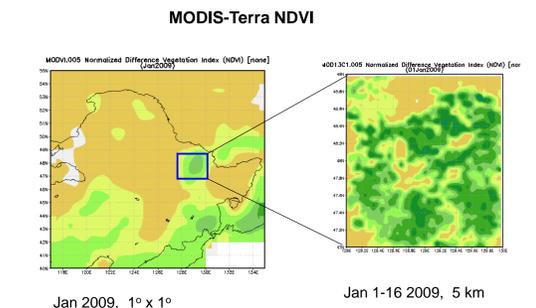
(Product of time interval in Red will be added in the future)

Monitoring Coastal Water Quality



Above: Correlation coefficients between SeaWiFS Chlorophyll a concentration (Chl a) and GPCP precipitation. The positive correlation over Pearl River and Yangtze River Deltas likely to be associated with river discharging high nutrient water during raining season.
Right: 12 years (1997.09-2009.08) time series of Chl a anomaly (blue curve), trend (red curve), and 12-month running mean (black curve) indicate that the Chl a increase significantly in last decade over Yangtze River Delta and Pearl River Delta.

Low and Higher Resolution Data Sample



References:

- [1] Shen, S., Leptoukh, G., Gerasimov, I. (2009). NASA Data and Services to Support MAIRS, 2nd MAIRS International Workshop on Asian Dryland Study, Changchun, China, July 23-25 2009
- [2] Nanjing Atmospheric Data Service Center, Nanjing University of Information Science & Technology, Nanjing, China: <http://nadsc.nuist.edu.cn/Endex.php>

Acknowledgments:

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