



# Visualization and Analysis of Multi-scale Land Surface Products via Giovanni

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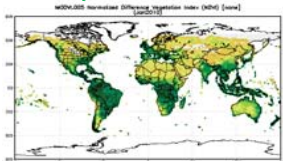
## Abstract

Large volumes of MODIS land data products at multiple spatial resolutions have been integrated into the Giovanni online analysis system to support studies on land cover and land use changes, focused on the Northern Eurasia and Monsoon Asia regions through the LCLUC program. Giovanni (Goddard Interactive Online Visualization ANd aNalysis Infrastructure) is a Web-based application developed by the NASA Goddard Earth Sciences Data and Information Services Center (GES DISC), providing a simple and intuitive way to visualize, analyze, and access Earth science remotely-sensed and modeled data.

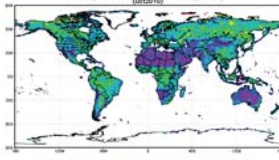
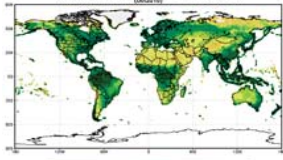
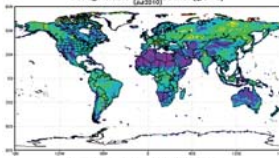
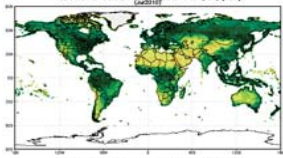
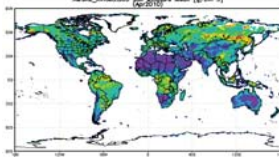
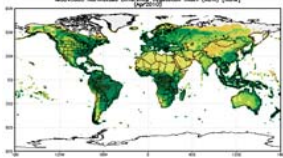
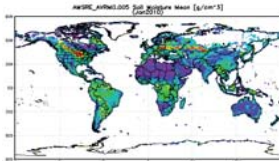
Customized Giovanni Web portals (Giovanni-NEESPI and Giovanni-MAIRS) have been created to integrate land, atmospheric, cryospheric, and societal products, enabling researchers to do quick exploration and basic analyses of land surface changes, and their relationships to climate, at global and regional scales. This presentation shows a sample Giovanni portal page, lists selected data products in the system, and illustrates potential analyses with images and time-series at global and regional scales, focusing on climatology and anomaly analysis. More information is available at the GES DISC MAIRS data support project portal: <http://disc.sci.gsfc.nasa.gov/mairs>.

## Observations at Global-scale with 1°x1° Data

### Monthly NDVI from MODIS-Terra



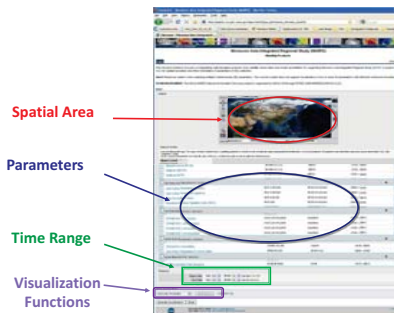
### Monthly Soil Moisture from AMSR-E



Coarse resolution (1°x1°) monthly products in Giovanni enable one to explore seasonal and interannual variability at global scales. The figure above shows sample images of monthly Normalized Difference Vegetation Index (NDVI) and soil moisture for January, April, July, and October of 2010.

## Giovanni Portals to Support NEESPI and MAIRS Programs

<http://disc.sci.gsfc.nasa.gov/mairs/visualization/>



Spatial Area

Parameters

Time Range

Visualization Functions

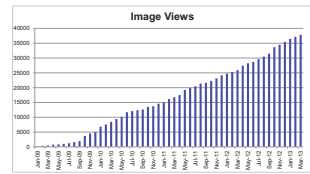
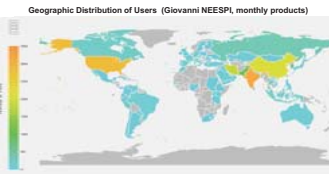
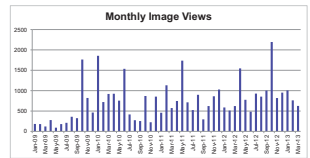
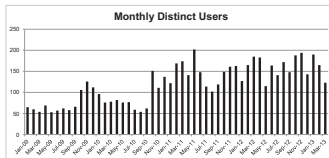
- Customizable portals
- No need to install software; no need to download and process data
- Provide visualization and basic statistical analysis functions (map, animation, time-series, scatter plot, cross-section, difference, etc.)
- Download images and data in different formats (png, KMZ, netCDF)

## Land and Societal Products

Spatial coverage of data is global for 1x1 degree and 5.6km, and over Monsoon Asia region for 1km  
Product name in red indicates monthly climatology and anomaly analysis available in Giovanni

Parameter Name	Product Name	Available Since	Time Interval	Spatial Resolution
Vegetation Indices	MODV1005, MYDV1005	2000.03 -	Monthly 16 days	1.0° 1 km, 5.6km
	MOD13C2.005			
	MOD13A3_MAIRS.005			
	MYD13A3_MAIRS.005			
	MOD11C1.005, MYD11C1.005			
Land Surface Temperature	MOD11C3.005	2001.03 -	Monthly 8-Day	1.0° 1 km, 5.6km
	MOD11C2.005			
	MOD11A2_MAIRS.005			
	MYD11A2_MAIRS.005			
Thermal anomalies/Fire	MOD14CM1.005, MYD14CM1.005	2000.03 -	Monthly 8-Day	1.0° 1 km
	MOD14A2_MAIRS.005, MYD14A2_MAIRS.005			
Albedo	MCD43C3.005	2000.02 -	16 day	5.6km
Land Cover Types	MCD12C1.005, MCD12Q1_MAIRS.005	2001 -	Yearly	5.6 km 500m
Land Cover Dynamics	MCD12Q2_MAIRS.005	2001 -	Yearly	500m
Soil Moisture	AMSRE_AVRMO.005	2002.10 -	Monthly	1.0°
Snow/Ice	NESDIS/IMS	2000.01 -	Monthly	1.0°
Total Evapotranspiration, Snow Water Equivalent	GLDAS	1979.01 -	Monthly	1.0°
Surface Runoff, Soil Moisture	GLDAS	1979.01 -	Monthly	1.0°
Nighttime Lights	DMSP-OLS v4	1992-2010	Yearly	1km 5.6km

## Access Statistics of Giovanni NEESPI and MAIRS Portals



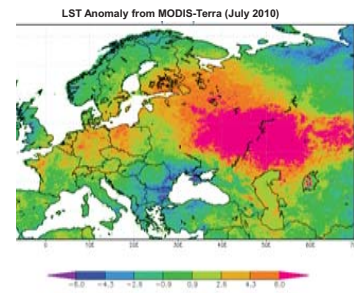
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## Portals

2013 NASA LCLUC Spring Science Team Meeting  
April 2-4, 2012, Maryland  
[Suhung\\_Shen@nasa.gov](mailto:Suhung_Shen@nasa.gov)  
<http://disc.gsfc.nasa.gov/mairs>

sity, <sup>3</sup>ADNET

## Regional Variations with 5km Data

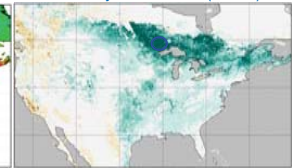


Extremely hot summer weather was reported in 2010 at many locations across Europe. The hot conditions caused health problems and huge economic losses. Land surface temperatures (LST) measured by MODIS reveal detailed spatial features of this abnormal event. Figure at left displays the daytime LST anomaly of July 2010 at 5.6 km resolution from MODIS-Terra generated with Giovanni. The base-period of the climatology is from 2000.03 to 2011.02 (12 years).

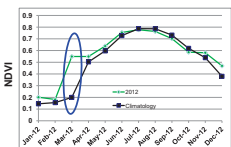
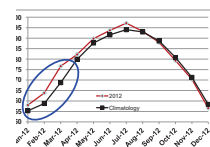
LST Anomaly from MODIS-Terra (Mar 2012)



NDVI Anomaly from MODIS-Terra (Mar 2012)

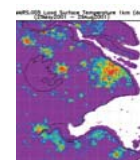
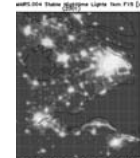


Extremely warm weather also occurred during early spring 2012 over large areas of North America. The monthly MODIS daytime LST (5.6km) anomaly for March 2012 was more than 8 K above-normal temperatures over large areas of northeast North America. Interestingly, NDVI (5.6km) for March 2012 is above normal over most of warmer regions. Images above and time-series below (which are averaged over circled area above) indicate that the spring vegetation greening occurred much earlier than normal, due to the warmer weather in both winter and spring. The base-period of both LST and NDVI climatology are 2000-2011.

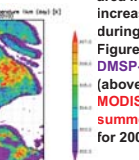
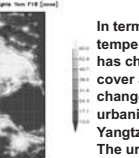


## Local Changes over Asia with 1km Data

### 2001



### 2010



In terms of average surface temperature, local climate has changed due to land cover and land use changes associated with urbanization over the Yangtze River Delta, China. The urban heat island (UHI) area indicated by LST has increased significantly during the last 10 years. Figures show the 1km DMSP-OLS nighttime lights (above at left) and 1km MODIS-Terra daytime summer LST (lower at left) for 2001 and 2010.

## Acknowledgments:

Products are integrated into the Giovanni system through NASA ROSES 2008 (NNH062DA001N-LCLUC). The authors wish to express great appreciation for technical support from Giovanni, Mirador and S4PA teams at GES DISC.

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