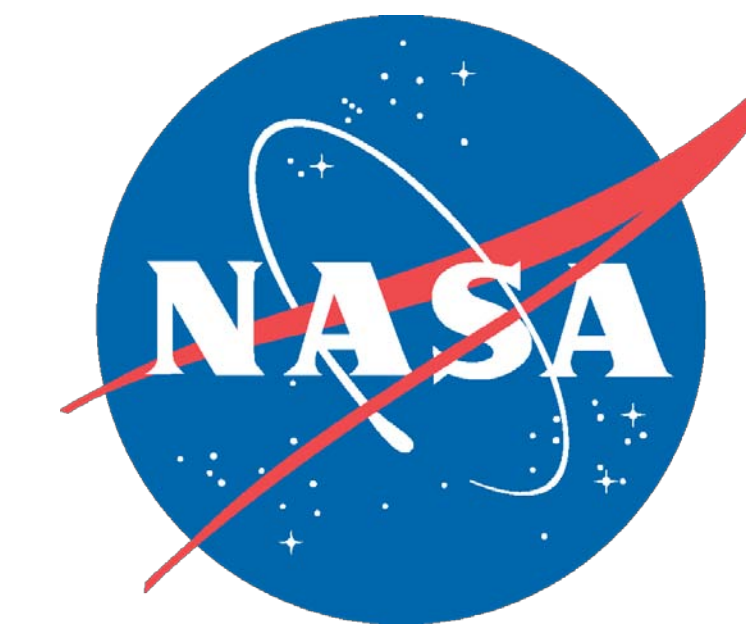




ORNL DAAC MODIS Tools – Status and future developments¹

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Introduction

MODIS (Moderate Resolution Imaging Spectroradiometer) sensor data are highly useful for field research. However, the volume of MODIS data and the complexity in data format makes MODIS data less usable by field researchers in some cases.

To solve this usability issue, the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) prepares and distributes subsets of selected MODIS Land Products in a scale and format useful for field researchers. MODIS subsets are provided for more than 1,000 sites across the globe. The subsets are offered in tabular ASCII format and in image GeoTIFF format. Time series plots and grid visualizations to help characterize field sites are also provided.

The ORNL DAAC also offers the capability to create user-defined subsets for any location worldwide. The custom subsetting tool provides subsets from a single pixel up to 201 x 201 km for user-defined time range. Statistics, time series plots, ASCII and GeoTIFF files for the customized subsets are also distributed through this tool.

A Web service based MODIS subsetter is also provided for users to obtain MODIS subsets programmatically. The Web service is a machine to machine interface that facilitates integration of Web service into workflow.

<http://daac.ornl.gov/MODIS>

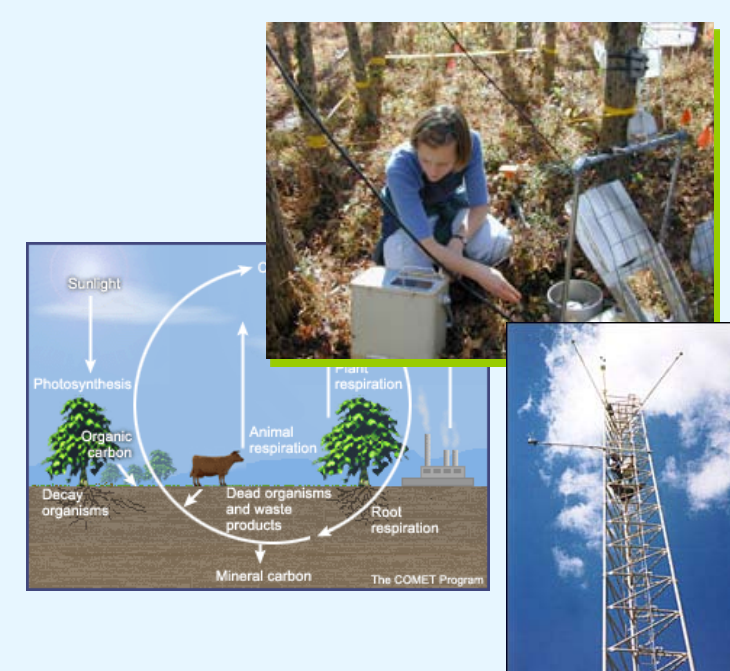
Background

The ORNL DAAC archives and distributes terrestrial biogeochemical dynamics data collected as part of the NASA's Earth Observing System (EOS) Program. ORNL DAAC's data sets are primarily from ground-based field investigations and augmented by data collected through remote-sensing techniques. The types of data held by the ORNL DAAC are Field Campaign, Land Validation, Regional and Global Data, and Model Products.

<http://daac.ornl.gov/>

MODIS is a key sensor aboard the Terra and Aqua satellites. Terra MODIS and Aqua MODIS view the entire Earth's surface every 1 to 2 days, acquiring data in 36 spectral bands, or groups of wavelengths. These data will improve our understanding of global dynamics and processes occurring on the land, in the oceans, and in the lower atmosphere.

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



MODIS Subset: Details

- Products Subsetted: Terra and Aqua MODIS
- Sinusoidal Projection
- 2000 to present
- 8-day, 16-day, and annual composite periods
- 250-m, 500-m, or 1000-m resolution (depends on product)
- Documentation provided to describe the subsetted products; links are provided to full documentation at MODIS Web sites

MODIS Products Subsetted	
Surface Reflectance	
Surface Temperature	
Land Cover	
Phenology	
NDVI / EVI	
LAI / fPAR	
Gap-Filled and Smoothed LAI/fPAR	
Net Photosynthesis	
Annual NPP	
Albedo (Model and Calculated)	
Reflectance – BRDF Adjusted	

Data Processing

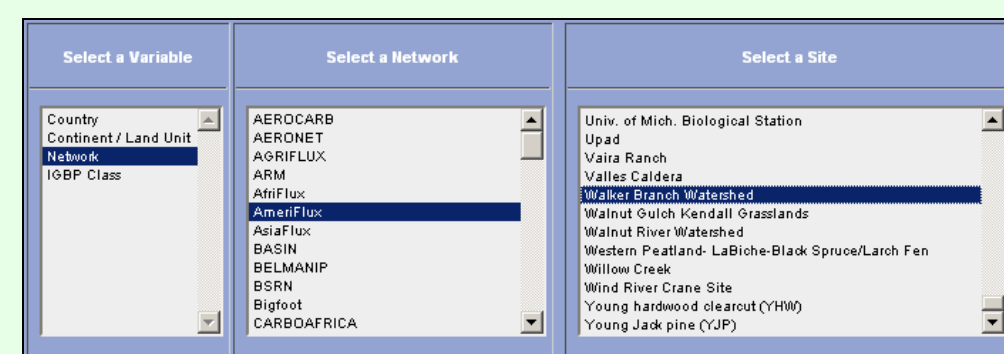
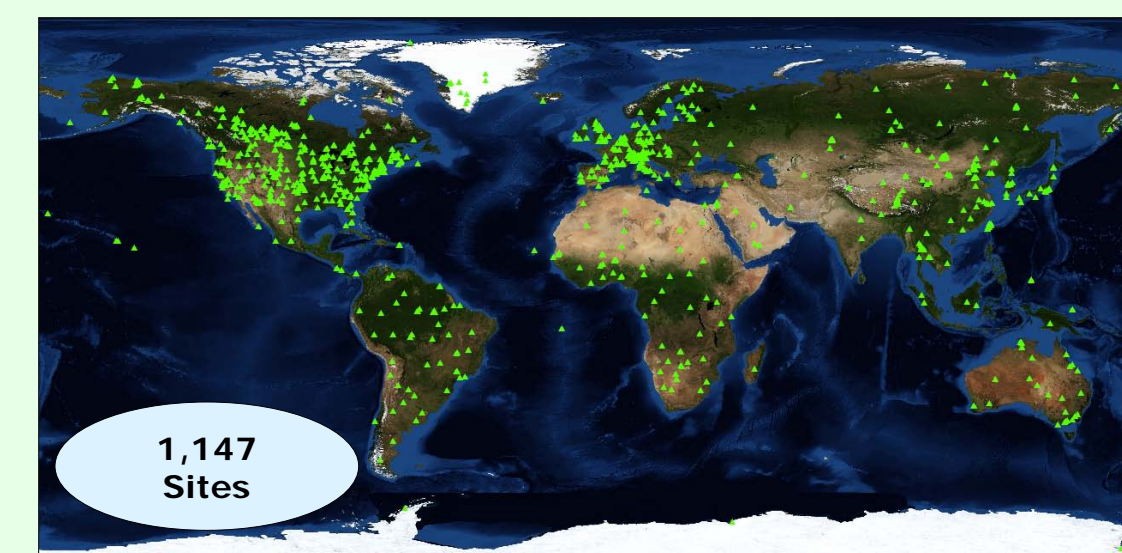
- MODIS fixed site subsets reformatted from HDF-EOS into ASCII/GeoTIFF format using LP DAAC's MODIS Reprojection Tool, Geospatial Data Abstraction Library (GDAL) tools and custom Perl code
- Subsets for the MODIS Global subsetting tool are generated directly from MODIS tiles using customized code obtained from The HDF Group (THG)
- Visualization of data is done using Perl code and Perl graphics library

ORNL DAAC MODIS Subsets provide data in a format and size that is designed for field researchers. The availability of these subsets dramatically reduces the amount of time needed to process data. For example, to obtain four years of NDVI data for a 7 x 7 km area from MODIS tiles, users would have to download approximately 10 GB of data. Extracting 7 x 7 km area from nearly 200 MODIS tiles (one tile for every 16- day period) would require time and resources. The ORNL DAAC however delivers the subset in few minutes and the size of the data delivered is less than 100 MB for a similar subset. The data are offered in tabular files and in GIS compatible format to allow users to import the data into analysis software and GIS processing packages.

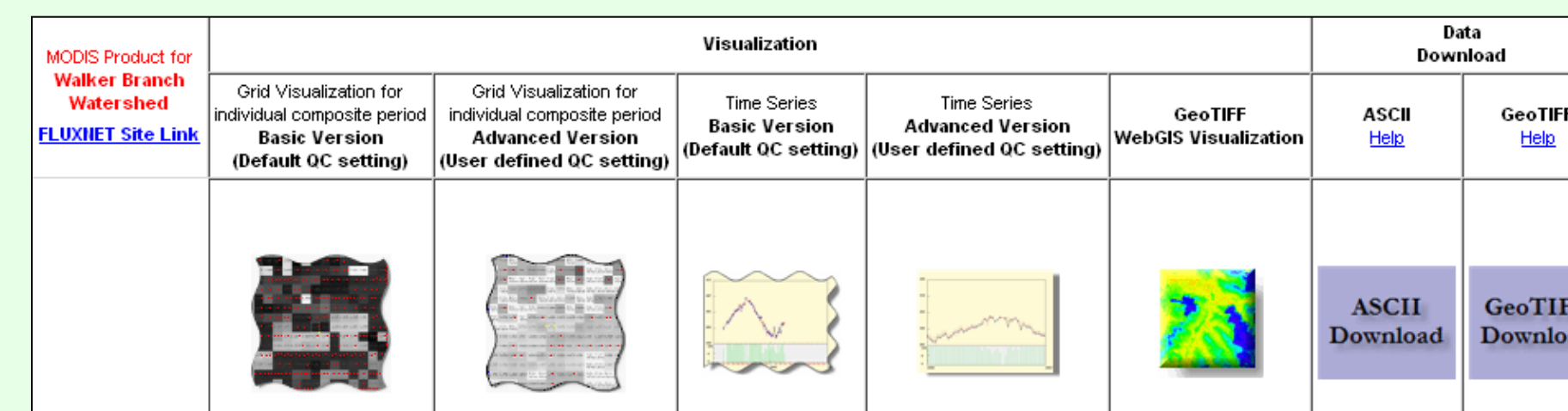
MODIS Land Product Subsets for Selected Field Sites

<http://daac.ornl.gov/modisfixedsite>

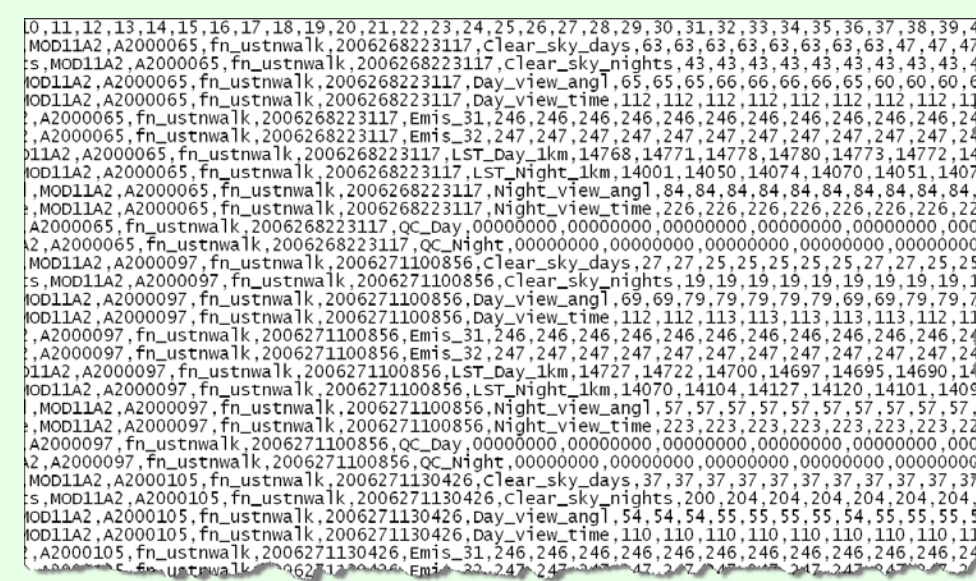
MODIS ASCII and GeoTIFF Subsets are available for over 1,000 field sites worldwide. Sites are included upon willingness to share *in situ* site data (*quid pro quo*). Subsetted data (original size: 25 x 25 km) are received from the MODIS processing stream and converted at the ORNL DAAC into ASCII (7 x 7 km) and GeoTIFF (25 x 25 km) formats.



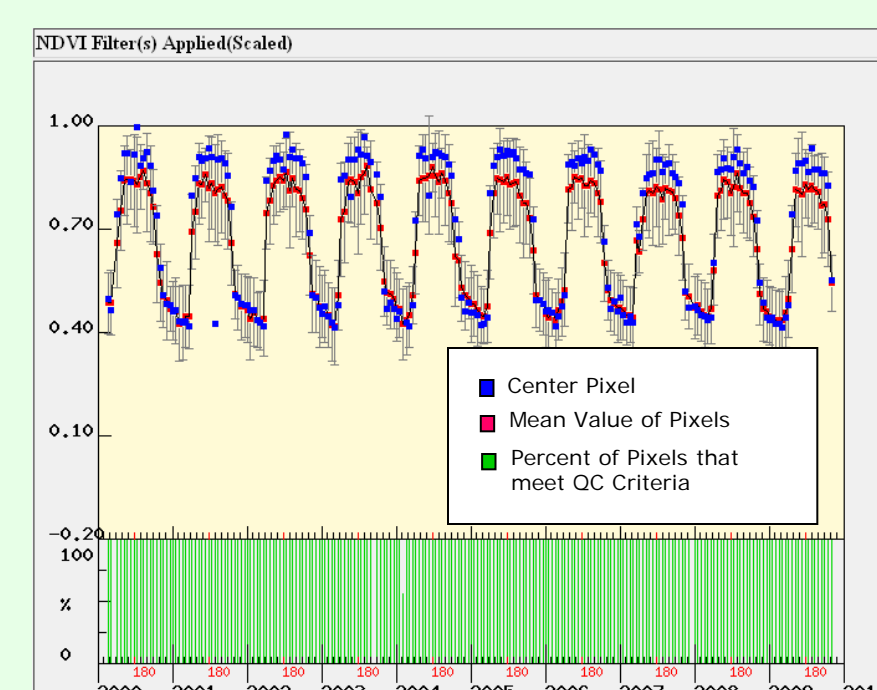
Data visualization and download options for Walker Branch Watershed- Tennessee



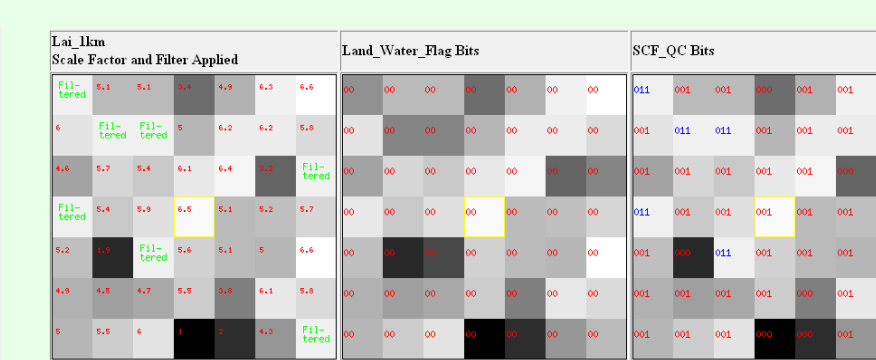
ASCII (Tabular) Subsets



ASCII Example: NDVI for Walker branch site.



Time-series graphs: NDVI Time series for Walker Branch FLUXNET site.



Composite Period Grid Plot: LAI grid for Walker Branch site for composite period June 17th 2000 to June 24th 2000

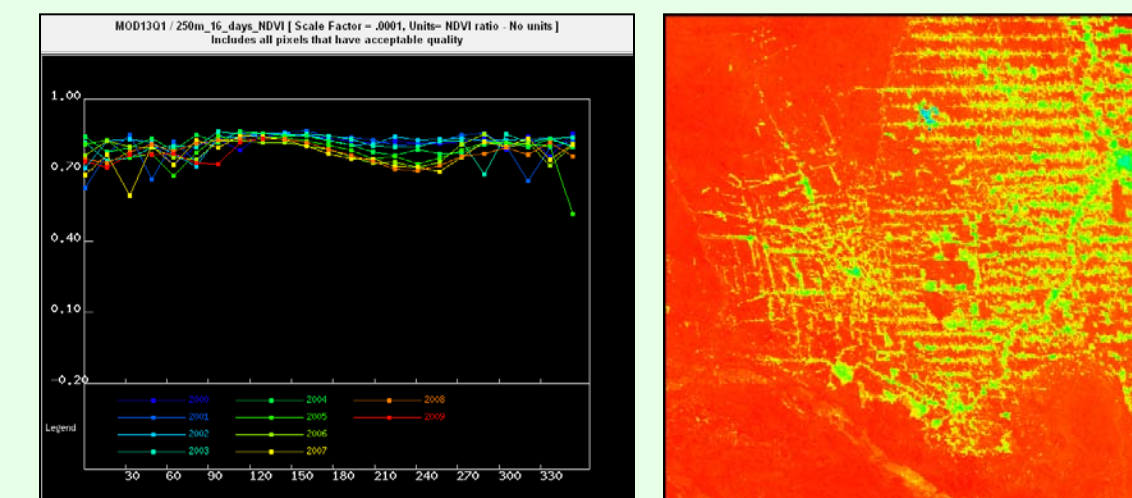
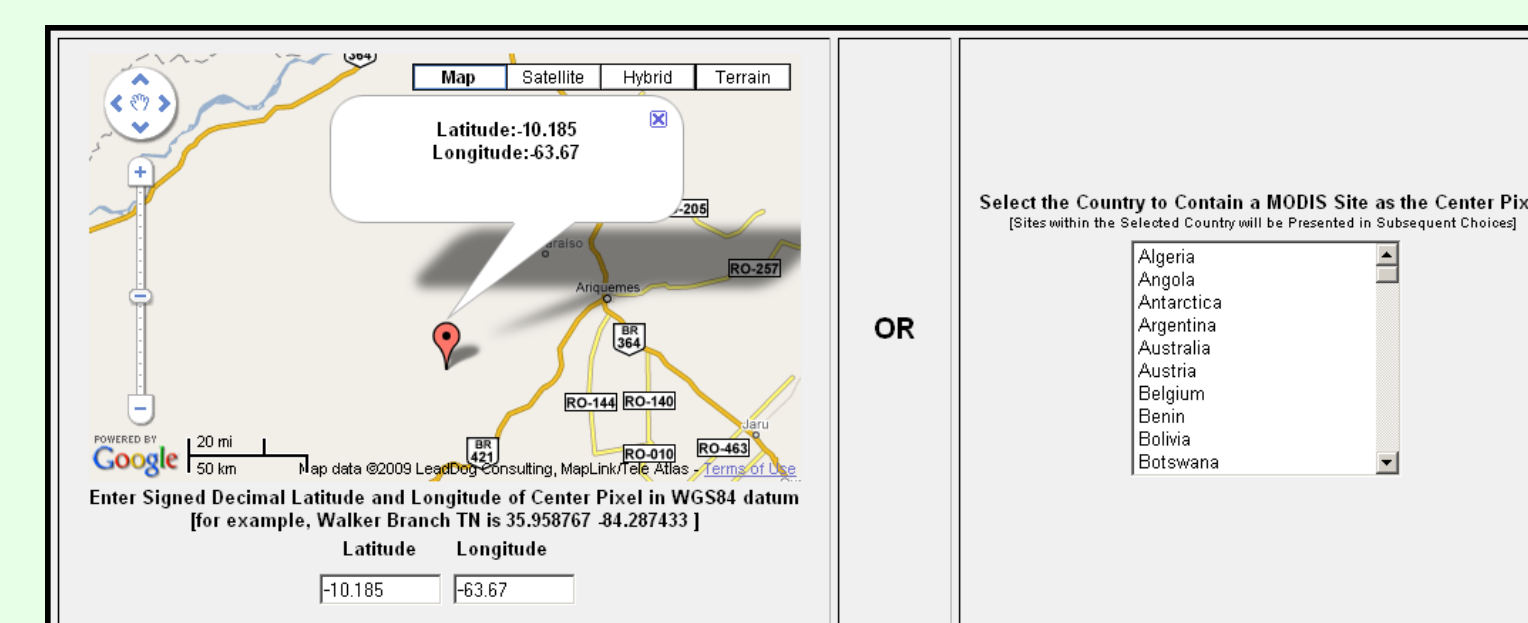
Users also have the option of choosing their own quality control criteria.

MODIS Land Product Subsets for any location

<http://daac.ornl.gov/modisglobal>

The ORNL DAAC also offers subsets of MODIS Land Products in ASCII and GeoTIFF format for user-selected areas (from one pixel up to 201 x 201 km) worldwide and for any time period during the MODIS record.

- User places an order through a Web interface
- The tool will send an email message containing a URL where the output can be accessed
- Subset generation including generation of time series data file, graphs, and statistics takes 10 to 60 minutes (depends on area, time period, and product)



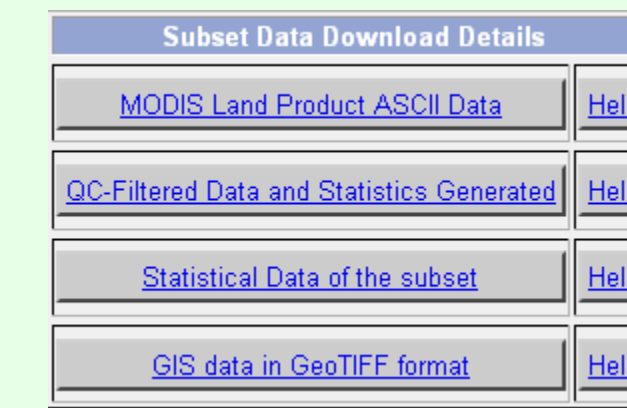
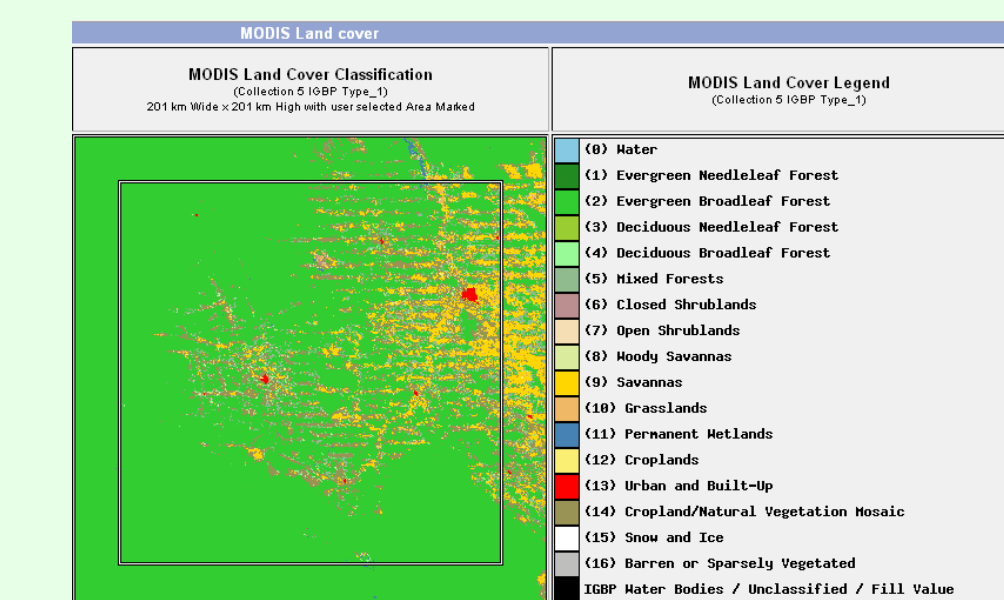
Multi year stacked NDVI Time Series Plot (MOD13Q1 2000-2009)

NDVI for Composite Period Jul 11th 2000 (MOD13Q1 2000193)

- Plots generated on the fly for a user selected time period
- Stacked time series for all years for inter-annual data comparison
- Statistics are provided for all pixels in selected area that have the same land cover class as center pixel.

Data Download

- ASCII (tabular CSV) subset file
- GeoTIFF file (In Sinusoidal projection or Geographic coordinate system)
- Statistical data of the subset

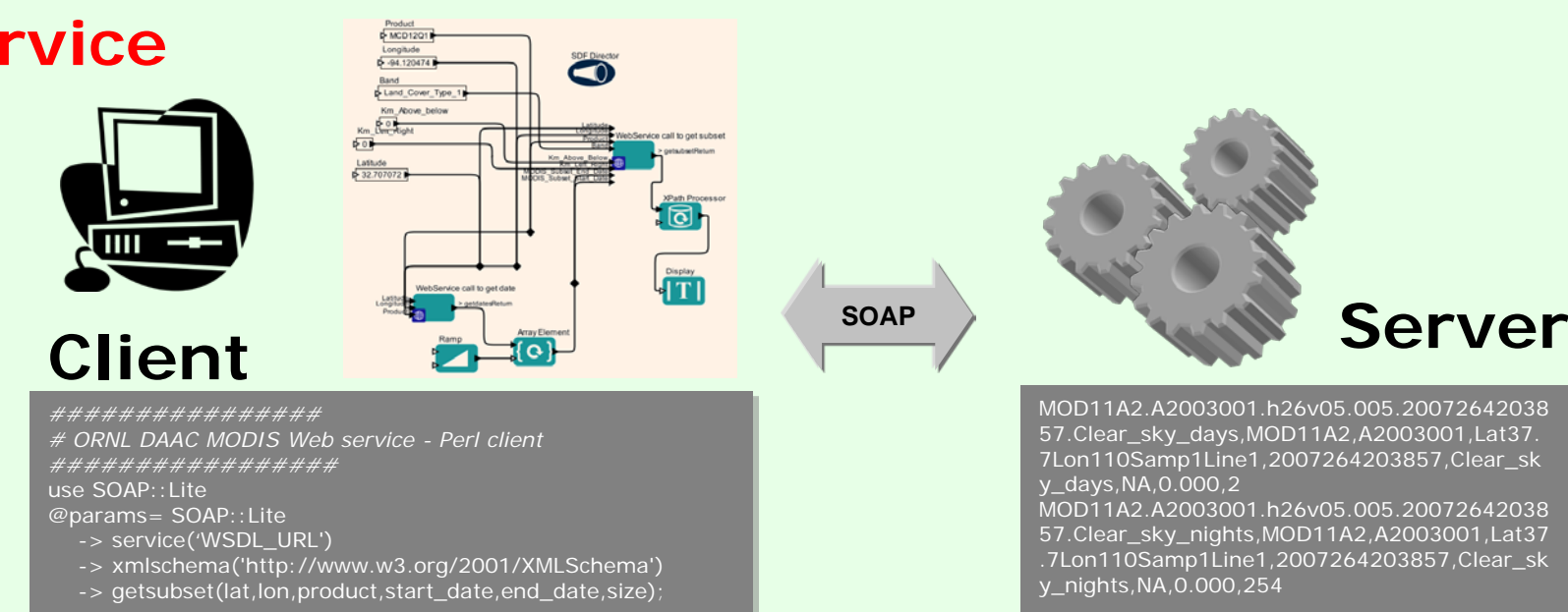


MODIS Land Product Subsets Web Service (SOAP)

<http://daac.ornl.gov/modiswebservice>

Simple Object Access Protocol (SOAP) based Web Service for programmatically accessing MODIS subsets.

- Programmatically retrieve subsets
- Real time data delivery
- Integrate with client side tools
- Connect with workflow software

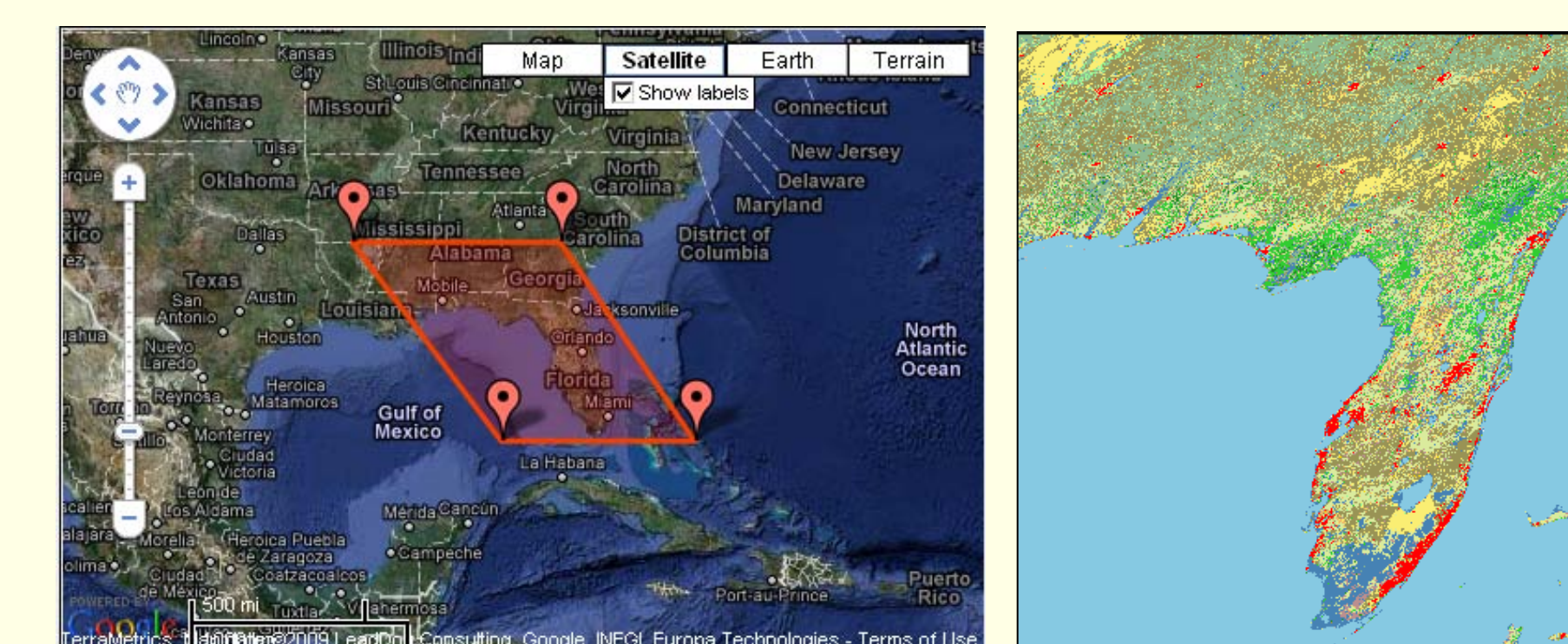


Future Developments: (Prototypes)

ORNL DAAC is in the process of testing various prototypes in its MODIS subsetting and visualization tool. These prototypes offer various enhancements to the subsetting and visualization tool and have been developed to meet specific user demands. To gauge the importance of these tool enhancements to the broader user community, we would like your feedback. We have listed the various prototypes that are currently under development. If you would like to see any of these enhancements move from prototype to production, or if you have suggestions please contact us (contact details are provided below).

Increase On-demand Subset Size to 1001 sq. km

The MODIS Land products on-demand global subsetting tool provides subsets to a maximum of 201 x 201 km. The 201 km subset size restricts the use of the subsets for some regional/state level analysis. In some cases users would have to assemble several subsets to create a regional/state level mosaic of the data. To meet some of this user demand, ORNL DAAC has developed an enhanced global on-demand subsetting tool that allows users to create subsets up to 1001 x 1001 km. The subsets will be provided in GeoTIFF and ASCII file format.

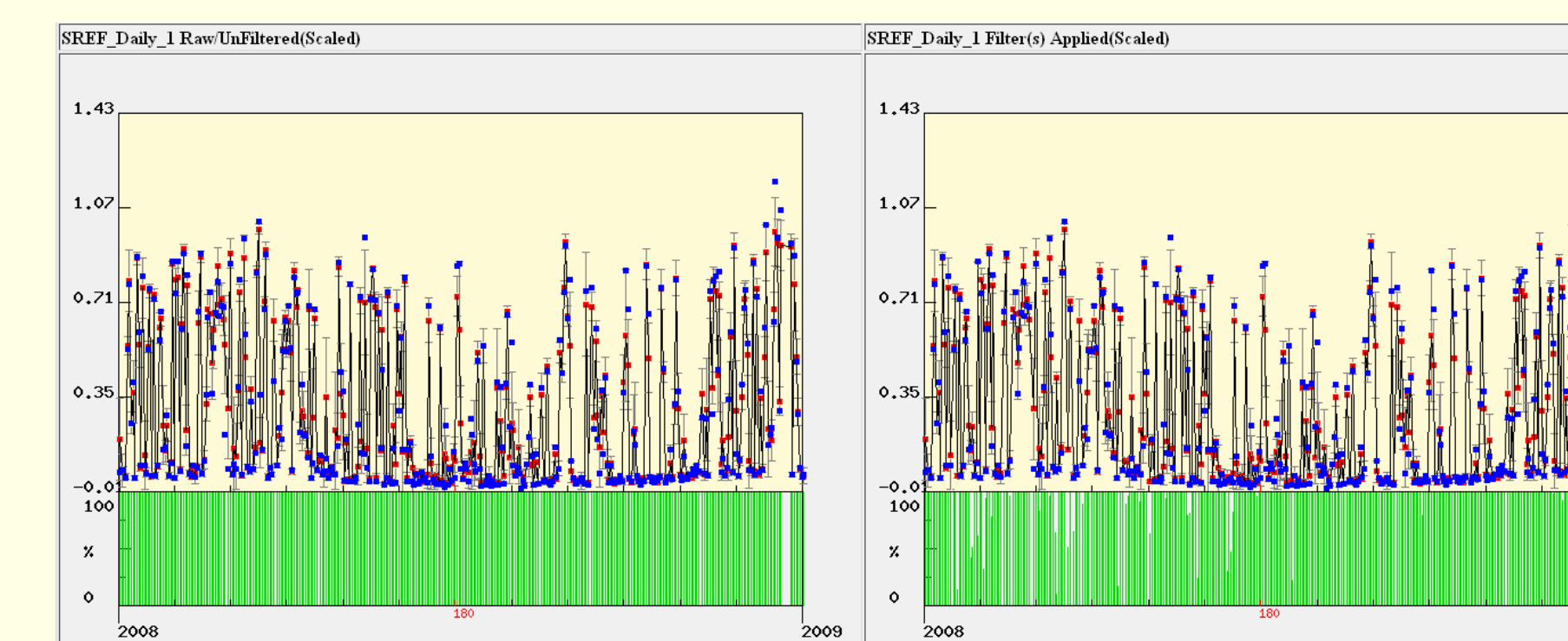


MODIS Global tool subsets – showing a 1001 x 1001 km subset over Florida. A Google maps image of the subset and the MODIS land cover image of the subset area are shown.

Please provide your comments in the sheet below

Support for MODIS Daily products

Several users have requested subsets of MODIS daily products. The MODIS daily products, such as the daily Terra MODIS surface reflectance, are particularly useful in inter-comparison and validation. The daily observations are useful in comparing the MODIS values with tower/field site measurements. ORNL DAAC has added subsets of the Terra MODIS surface reflectance product, MOD09GA for few of FLUX tower sites.



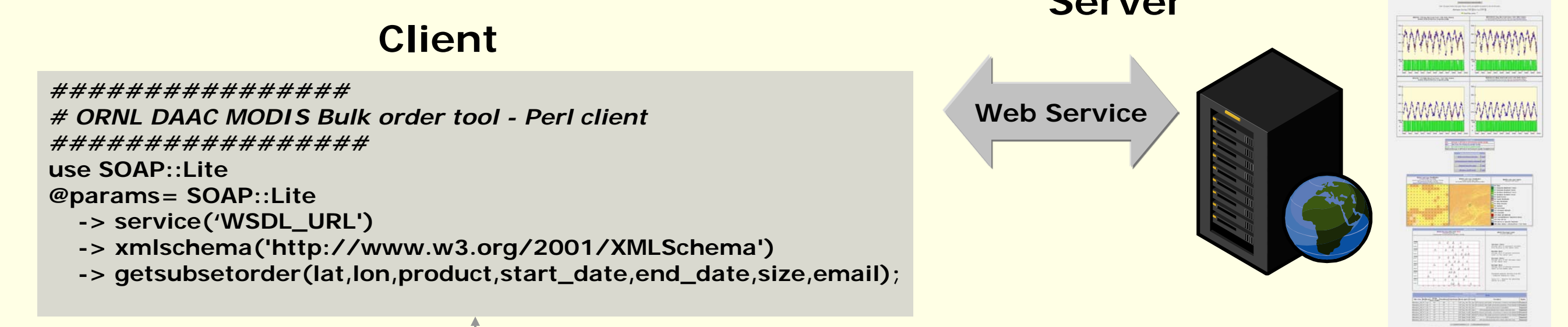
Time series of MOD09GA subsets for Walker branch FLUX tower site. Time series is shown for year 2008.

Please provide your comments in the sheet below

Bulk ordering of global tool subsets

The MODIS Global tool allows users to order subsets through a web interface. Users select their subset coordinates, product, temporal range, and spatial size of the subset through a web interface and the processed subset order is then packaged into a web page and emailed to the user. Although this mechanism of data delivery works well for most users, it doesn't meet the demands of user's who need subsets for many locations and products. ORNL DAAC has developed a web service that allows users to programmatically order MODIS Global tool subsets. The tool works using web service protocol and allows users to order global tool subsets through command line operations.

Please provide your comments in the sheet below



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