National Aeronautics and Space Administration

ARSET

Applied Remote Sensing Training

http://arset.gsfc.nasa.gov

Creating and Using Normalized Difference Vegetation Index (NDVI) from Satellite Imagery

Instructors: Cindy Schmidt and Amber McCullum

Week 3

Course Structure

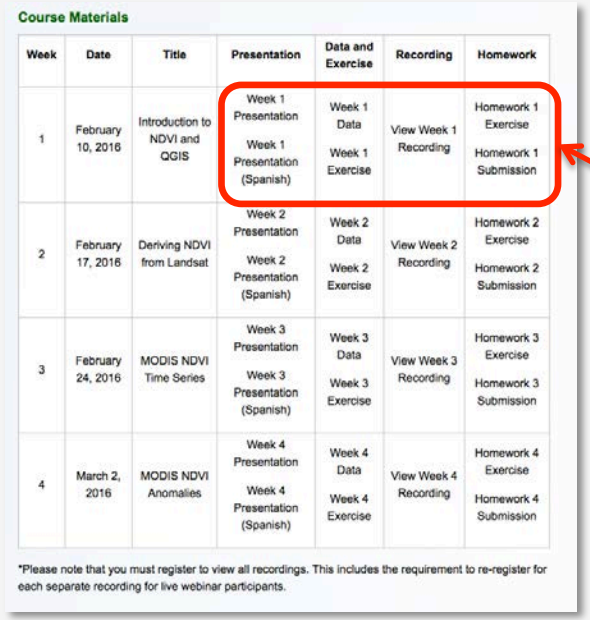
- One lecture per week – every Wednesday from February 10 to March 2 at 12:00-1:00pm EST (-05:00 UTC)
  - Lectures
  - In-class exercise
  - Q&A
  - Homework exercises
- Webinar recordings, PowerPoint presentations, in-class exercises, and homework assignments can be found after each session at:
  - http://arset.gsfc.nasa.gov/ecoforecasting/webinars/advanced-webinar-creating-and-using-normalized-difference-vegetation-index
- Q&A: Following each lecture and/or by email (cynthia.l.schmidt@nasa.gov)

Homework and Certificates

- Homework
  - Hands-on exercise each week
  - Answers must be submitted via Google Form
- Certificate of Completion:
  - Attend all 4 webinars
  - Complete all 4 homework assignments by the deadline (access from ARSET website)
    - Week 3 Deadline: Wednesday March 9th
  - You will receive certificates approximately 2 months after the completion of the course from: marines.martins@ssaihq.com

Accessing Course Materials

- http://arset.gsfc.nasa.gov/ecoforecasting/webinars/advanced-webinar-creating-and-using-normalized-difference-vegetation-index



Course Materials

Week	Date	Title	Presentation	Data and Exercise	Recording	Homework
1	February 10, 2016	Introduction to NDVI and QGIS	Week 1 Presentation Week 1 Presentation (Spanish)	Week 1 Data Week 1 Exercise	View Week 1 Recording	Homework 1 Exercise Homework 1 Submission
2	February 17, 2016	Deriving NDVI from Landsat	Week 2 Presentation Week 2 Presentation (Spanish)	Week 2 Data Week 2 Exercise	View Week 2 Recording	Homework 2 Exercise Homework 2 Submission
3	February 24, 2016	MODIS NDVI Time Series	Week 3 Presentation Week 3 Presentation (Spanish)	Week 3 Data Week 3 Exercise	View Week 3 Recording	Homework 3 Exercise Homework 3 Submission
4	March 2, 2016	MODIS NDVI Anomalies	Week 4 Presentation Week 4 Presentation (Spanish)	Week 4 Data Week 4 Exercise	View Week 4 Recording	Homework 4 Exercise Homework 4 Submission

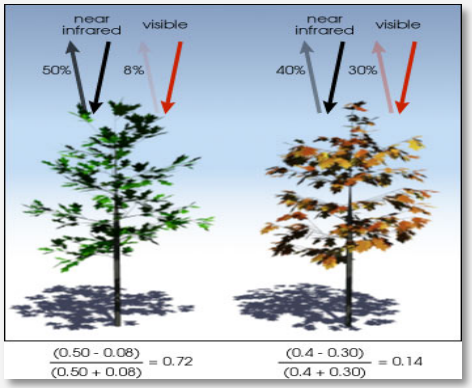
*Please note that you must register to view all recordings. This includes the requirement to re-register for each separate recording for live webinar participants.

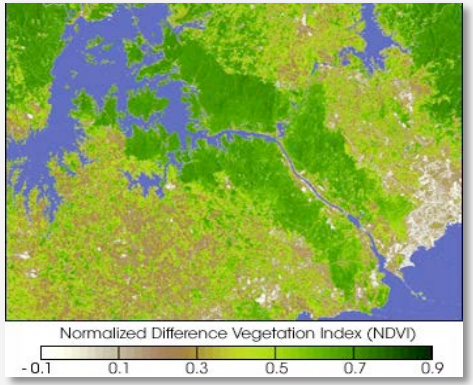
Course materials are provided here using each specified link and will be active after each week

Course Outline

Week 1

Overview of NDVI and QGIS



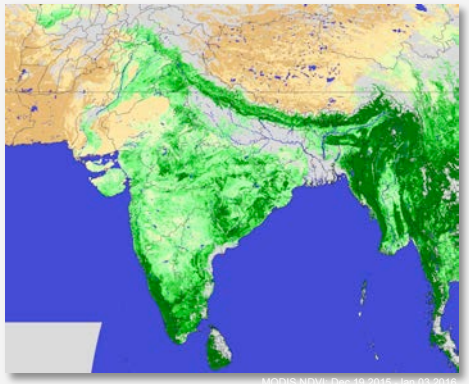


Week 2

NDVI with Landsat

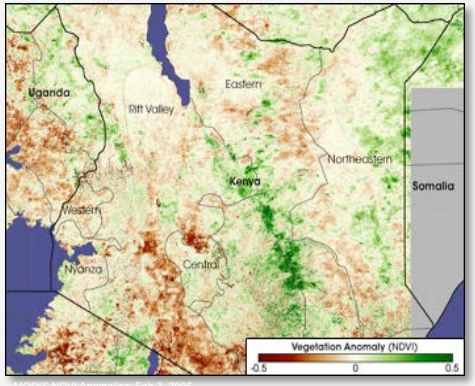
Week 3

MODIS NDVI Time Series



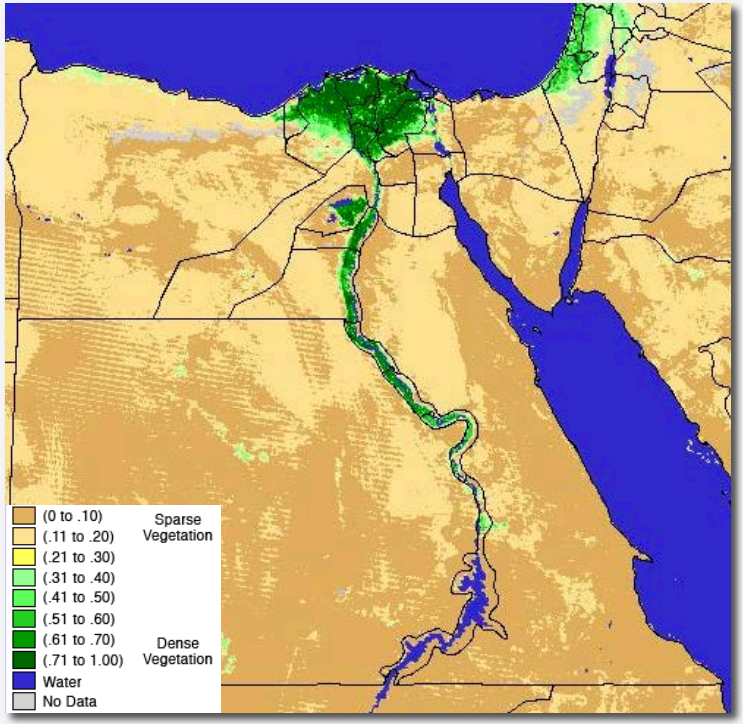
Week 4

MODIS NDVI Anomaly Mapping



Week 3 Agenda

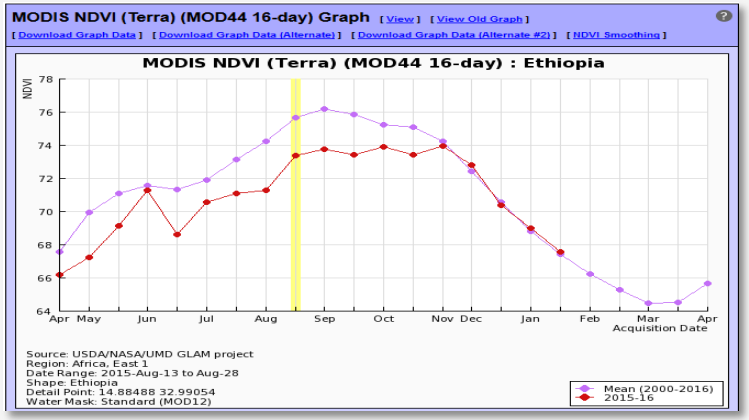
- Overview of MODIS Imagery
- Live Demos: Global Agricultural Monitoring (GLAM) Project
  - MODIS/NDVI Time Series Database
  - GIMMS MODIS system
- Q&A



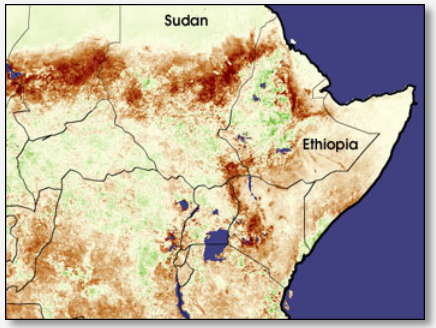
MODIS NDVI of Nile River Basin from GLAM

NDVI Time Series and Anomalies

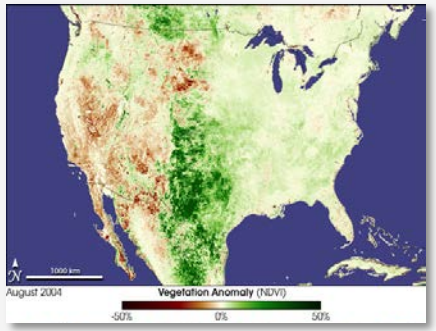
- Can be used to identify
  - Changes in vegetation health
  - Land degradation
  - Decreased/increased precipitation
  - Changes in phenology (green-up timing)



NDVI time series for 2015, Ethiopia



NDVI anomaly, August 1984, Ethiopia

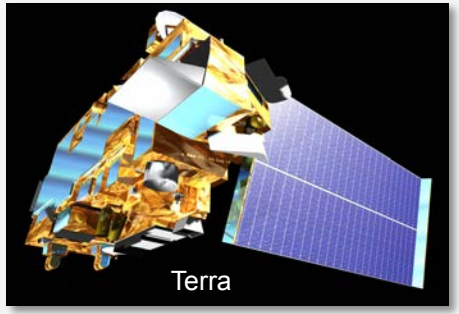


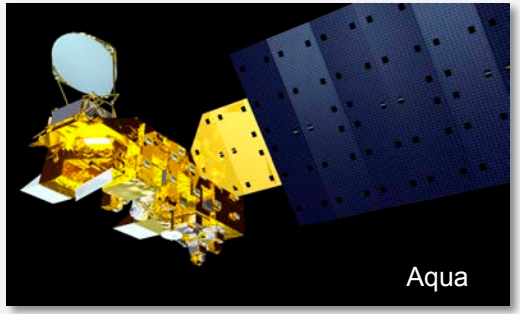
NDVI anomaly, August 2004, USA

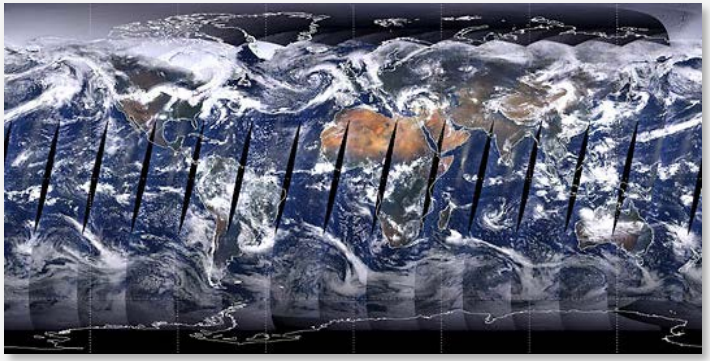
MODIS Review

MODIS Characteristics

- Spatial Resolution
  - 250m, 500m, 1km
- Temporal Resolution
  - Daily, 8-day, 16-day, monthly, quarterly, yearly
  - 2000-present
- Data Format
  - Hierarchal data format

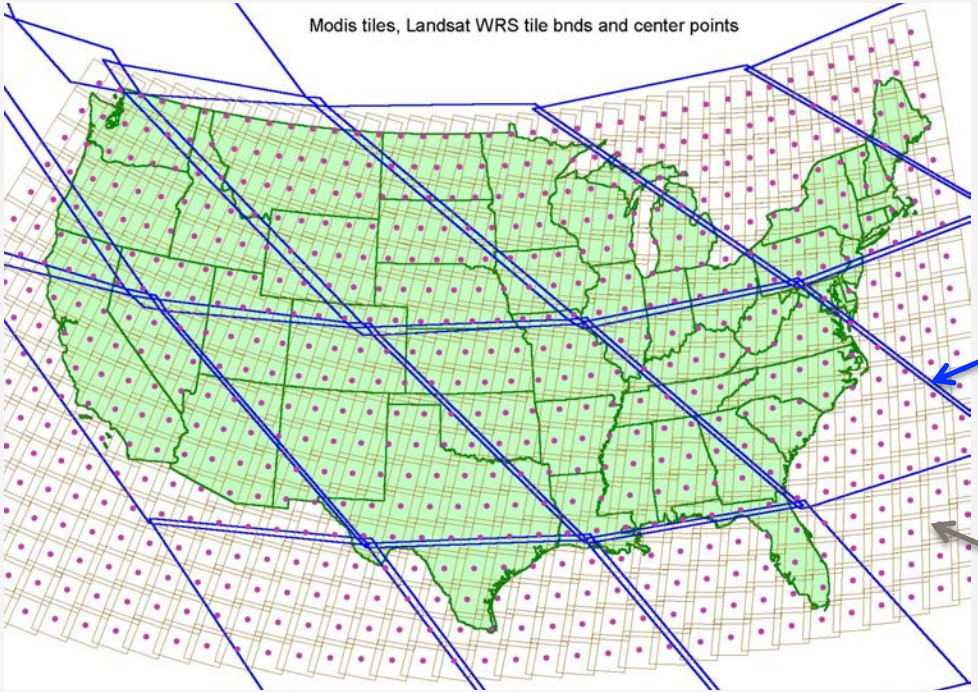






- Spectral Coverage
  - 36 bands (major bands include Red, Blue, IR, NIR, MIR)
    - Bands 1-2: 250m
    - Bands 3-7: 500m
    - Bands 8-36: 1000m
- Orbital gaps

MODIS Tiles vs. Landsat



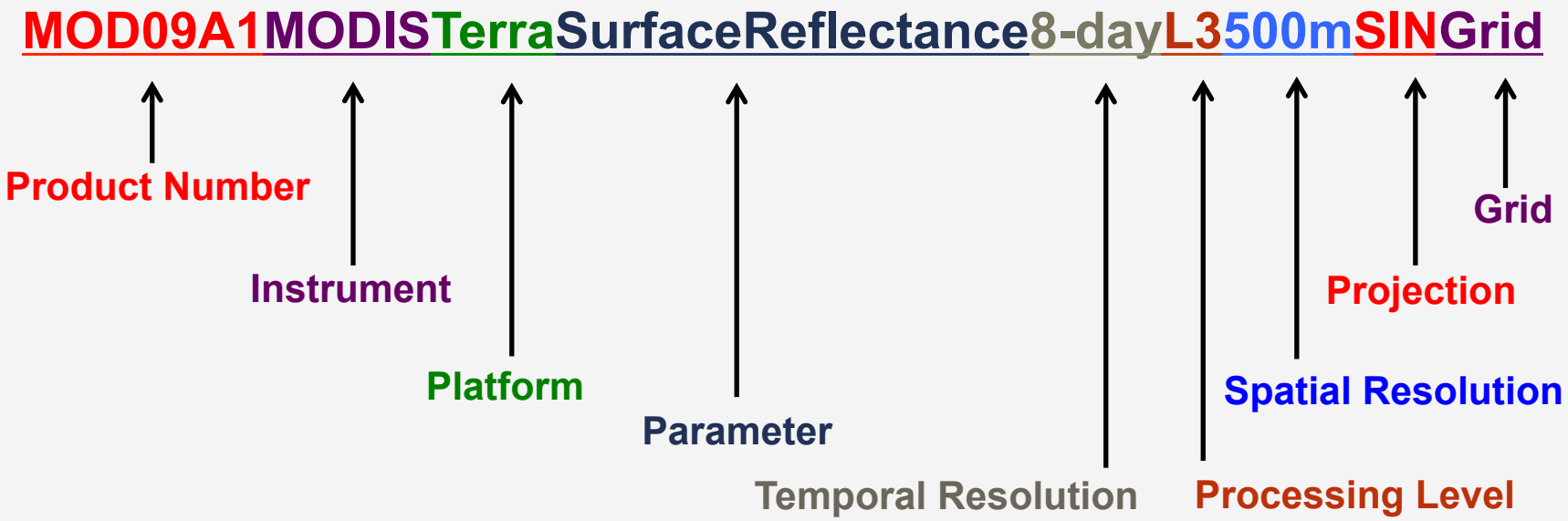
Large swaths!

MODIS tiles in blue

Landsat tiles in brown

MODIS Naming Convention

MODIS filenames follow a naming convention which gives useful information regarding the specific product. For Example:



**NOTE: MOD – Terra; MYD – Aqua; MCD - Combined

MODIS Land Products

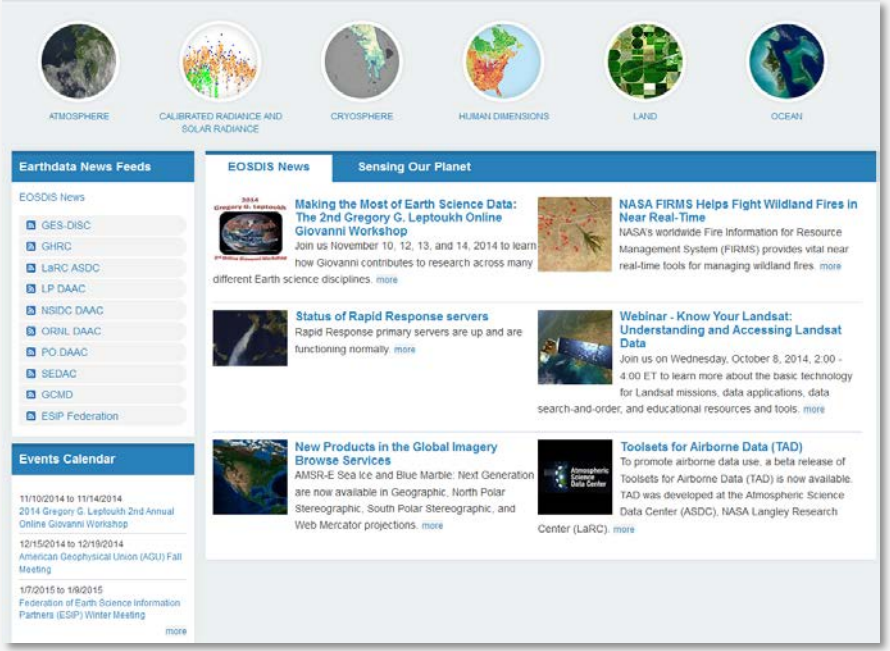
MODIS Name	Product Name Short name	Spatial Resolution (m)	Temporal
MOD 09	Surface Reflectance	500	8-day
MOD 11	Land Surface Temperature	1000	Daily, 8-day
MOD 12	Land Cover/Change	500	8-day, Yearly
MOD 13	Vegetation Indices	250-1000	16 day, monthly
MOD 14	Thermal Anomalies/Fire	1000	Daily, 8-day
MOD 15	Leaf Area Index/Fraction of Absorbed Photosynthetically Active Radiation (FPAR)	1000	4-day, 8-day
MOD 16	Evapotranspiration		
MOD 17	Primary Production	1000	8-day, yearly
MOD 43	Bidirectional reflectance distribution function (BRDF)/Albedo	500-1000	16-day
MOD 44	Vegetation Continuous Fields	250	yearly
MOD 45	Burned Area	500	monthly

All MODIS Land Products are available at processing Level 3

Where to Obtain MODIS Land Products

- Land Processes Distributed Active Archive (LP DAAC)
  https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table

- Earth Observing System Data and Information System (EOSDIS):
  http://Earthdata.nasa.gov



Where to Obtain MODIS Land Products

ECHO Reverb: http://reverb.echo.nasa.gov

Data Subsetting and Visualization: Oakridge National Lab DAAC (ORNL DAAC): http://daac.ornl.gov

GLCF: http://www.landcover.org/data/lc

GLOVIS: http://glovis.usgs.gov

Fire Information for Resource Management System (FIRMS): https://earthdata.nasa.gov/data/near-real-time-data/firms

Where to Obtain MODIS Land Products

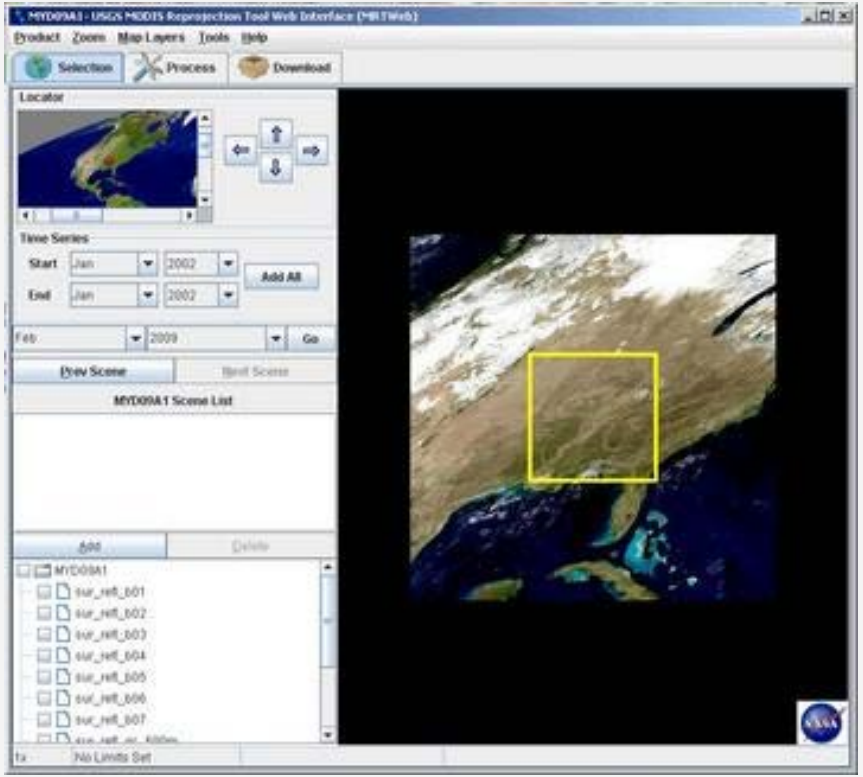
Worldview (Fires, Land Surface Temperature and Snow Cover): https://earthdata.nasa.gov/labs/worldview

Visualization, SERVIR: https://www.servirglobal.net/Global/MapsData/InteractiveMapper.aspx

MRTWeb: http://mrtweb.cr.usgs.gov

MRTWeb

- MRTWeb enables you to:
  - Visualize
  - Select
  - Mosaic
  - Subset
  - Reproject
  - Reformat



What is EVI?

- Enhanced Vegetation Index (MOD13Q1) – standard product from MODIS
  - More sensitive to changes in areas having high biomass
  - Reduces the influence of atmospheric conditions on vegetation index values
  - Corrects for canopy background signals

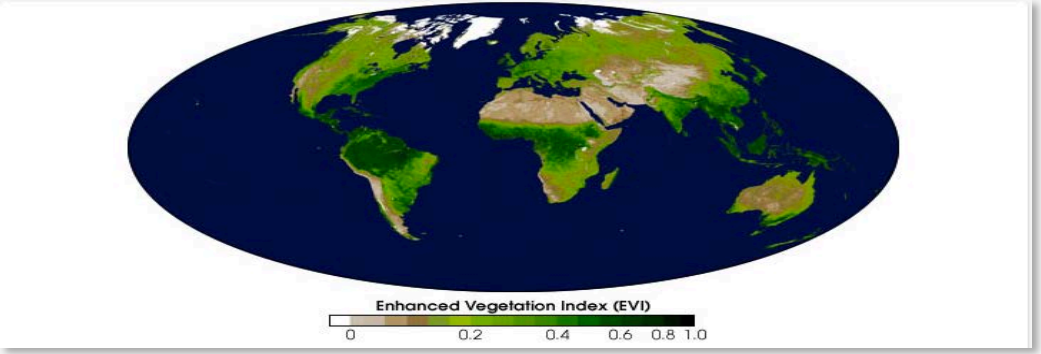


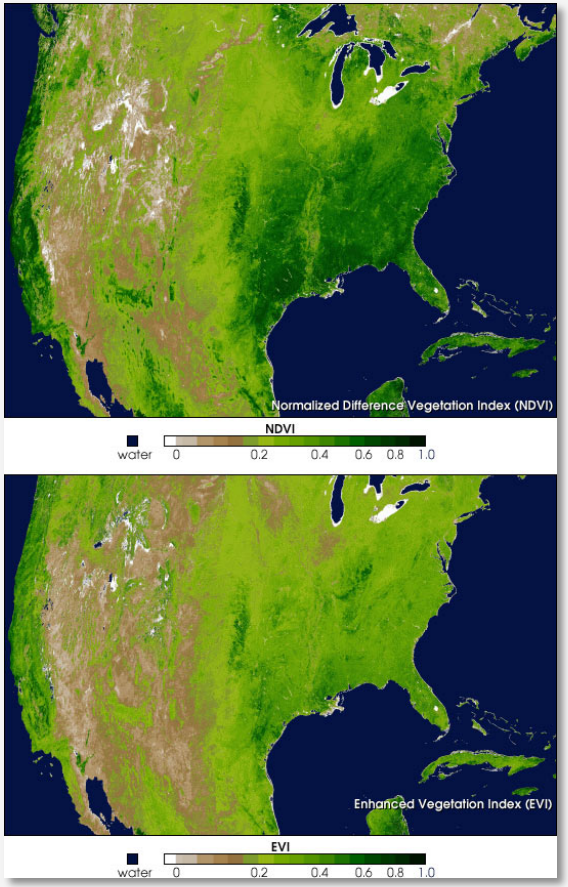
Image credit: NASA Earth Observatory

What is EVI?

- EVI is calculated as:

EVI= G * $(NIR-RED)/NIR+C1*RED-C2*BLUE+L$

  - Red and Blue bands must be atmospherically corrected
  - G is a scaling factor. G = 2.5
  - C_1, C_2 and L are coefficients to correct for atmospheric condition. For MODIS and Landsat C_1=6, C_2 = 7.5 and L = 1



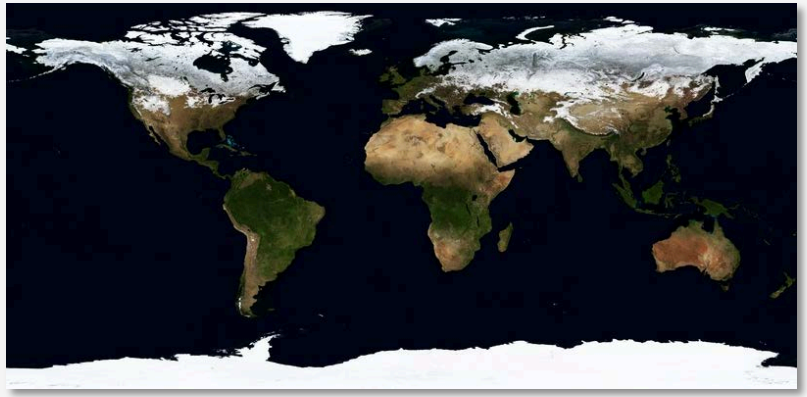
Comparison between MODIS NDVI and EVI in North America March 2000

Source: earthobservatory.nasa.gov

Live Demos: Global Agriculture Monitoring (GLAM) Project

Global Agriculture Monitoring (GLAM) Project

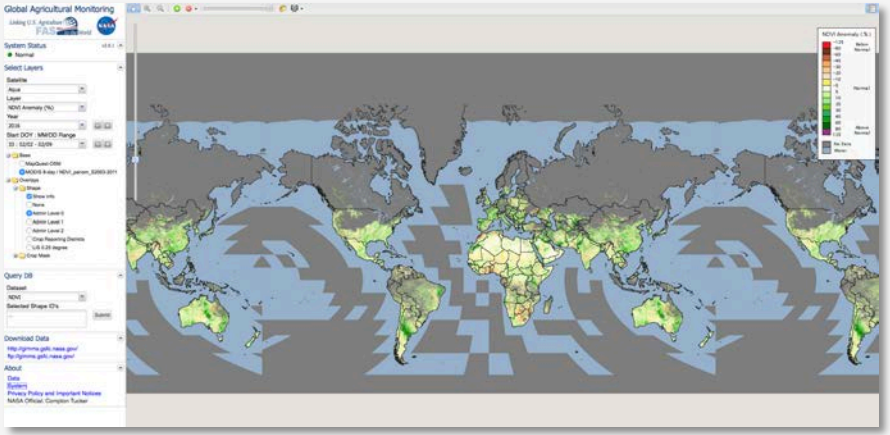
- Global 16-day 250 m NDVI time series database
- USDA and NASA collaboration
  - Integrates remote sensing into USDA monitoring system
- Web-interface
  - Plot time series graphs over crop season
  - Monitor current conditions
  - Spatially view NDVI anomalies
  - Plot histograms of current and historical NDVI data



Website:
http://pekko.geog.umd.edu/usda/test/

Global Agriculture Monitoring (GLAM) Project

- Global Inventory Modeling and Mapping Studies (GIMMS) MODIS monitoring system
- USDA and NASA collaboration
  - Integrates remote sensing into USDA monitoring system
- Web-interface
  - Global NDVI distribution datasets in online viewer
  - Download GeoTIFF imagery
  - Spatially view NDVI and NDVI anomalies



Website:
http://glam1.gsfc.nasa.gov

Contacts

- ARSET Land Management and Wildfire Contacts
  - Cynthia Schmidt: Cynthia.L.Schmidt@nasa.gov
  - Amber McCullum: AmberJean.Mccullum@nasa.gov
- General ARSET Inquiries
  - Ana Prados: aprados@umbc.edu
- ARSET Website:
  - http://arset.gsfc.nasa.gov/

National Aeronautics and
Space Administration

ARSET
Applied Remote Sensing Training
http://arset.gsfc.nasa.gov

Thank You

Next Week:

MODIS NDVI Anomalies