GLOBAL VEGETATION WORKSHOP

Univ. Montana

8-10 August 2006

MEETING SUMMARY

Steven W. Running

NTSG Univ Montana

31 October 2006

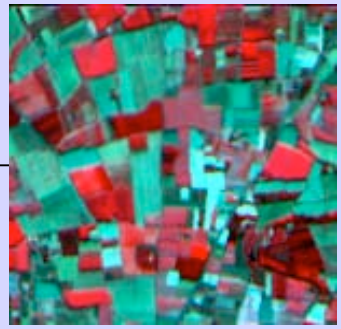
The CEOS Leaf Area Index Inter-comparison as a prototype activity

S_bastien Garrigues, University of Maryland,at NASA's GSFC,MD,USA
Roselyne Lacaze, Medias-France, Toulouse, France
Jeff Morisette, NASA' GSFC, Greenbelt, MD,USA
Fred Baret, INRA, Avignon, France
Marie Weiss, Noveltis, Toulouse, France
Richard Fernandes, CCRS, Canada
Jaime Nickeson, SSAI, Greenbelt,MD,USA
Stephen Plummer, IGBP-ESA, , Italy
Wenze Yang, Boston University, USA
Ranga Myneni, Boston University, USA

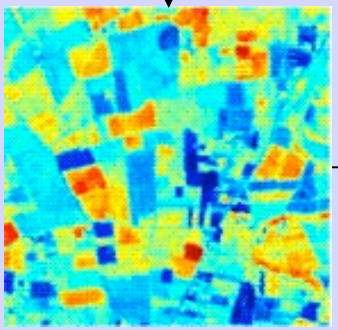
Direct Validation Approach

LAI Field data

Transfer function

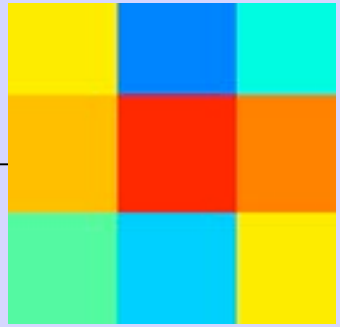


High resolution imagery



High resolution LAI map

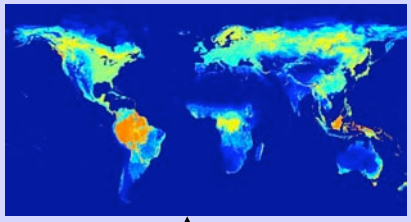
Aggregate & Relate



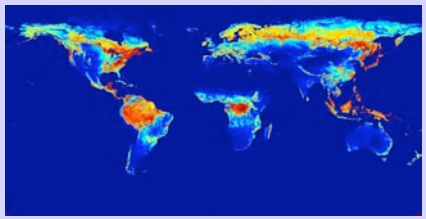
Moderate resolution LAI

Accuracy Assessment

LAI inter-comparison approach



Projection & resampling



Extraction over BELMANIP sites

Inter-comparison metrics:
- Map of difference
- Global histogram
- Transect
- Product/product scatter plot
- Temporal profile

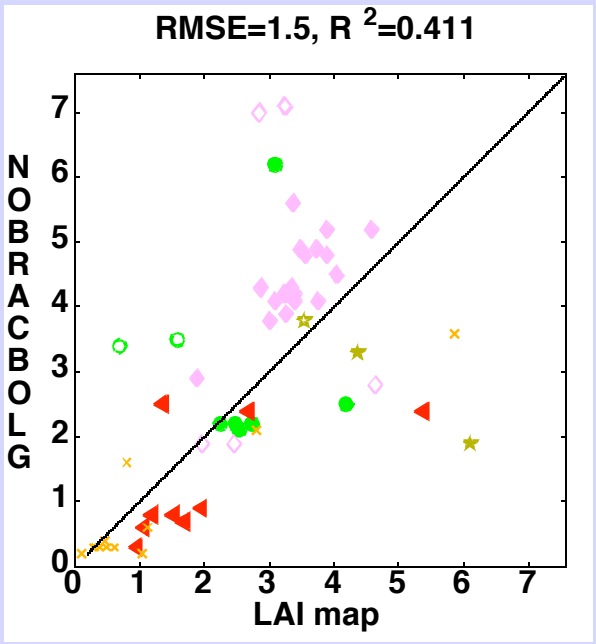
Product maker

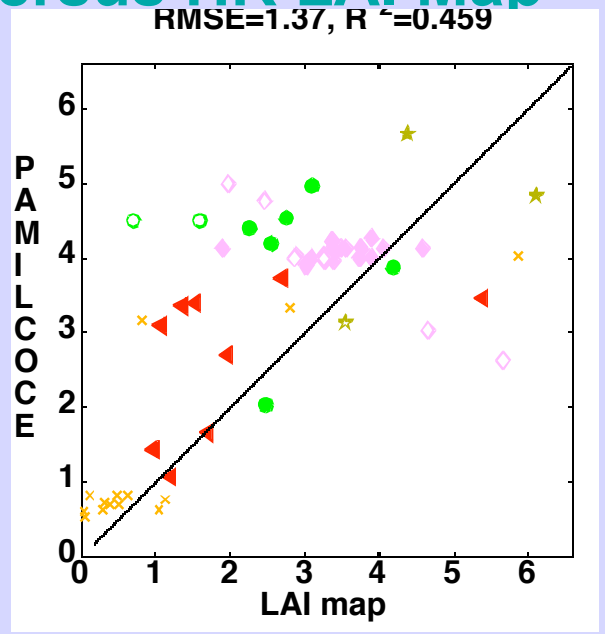
Coordinator: (NASA's GSFC)

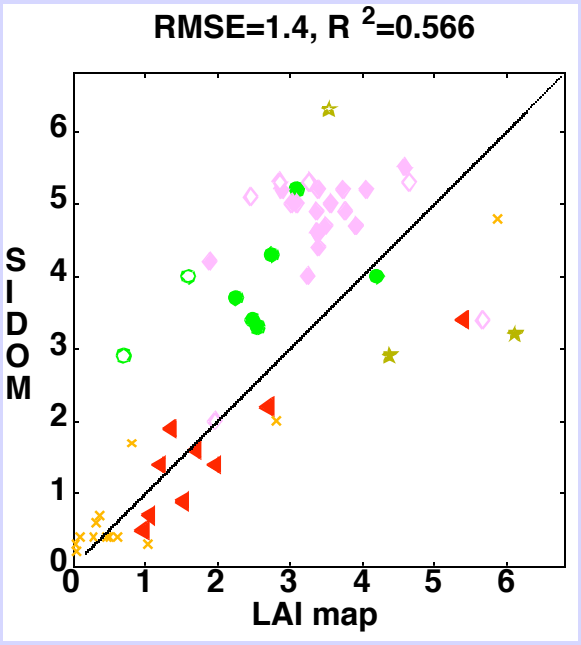
Method & Expertise

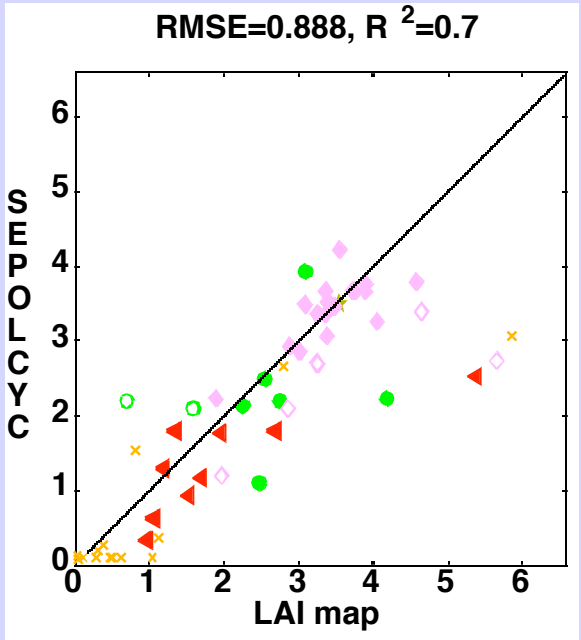
Direct validation: Product versus HR LAI Map

- Decid. Broad. For.
- Ever. Needle. Forest
- Ever. Broad. Forest
- Crops
- Grass
- Mixed Forest
- same year
- different year



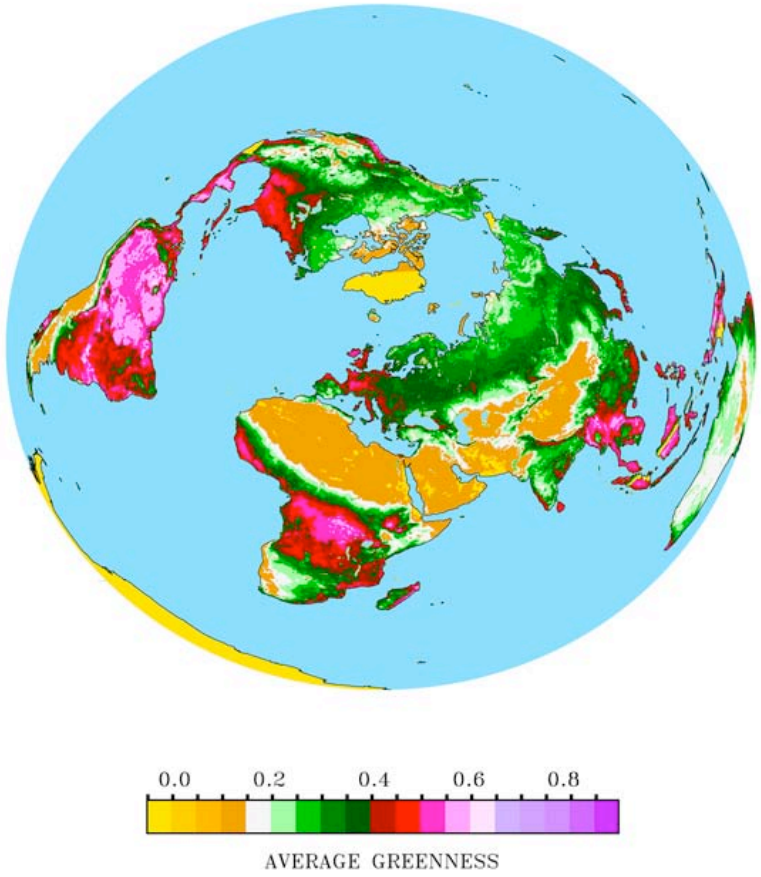






Ecological Forecasting

by integrating surface, satellite, and climate data with ecosystem models



Ramakrishna Nemani

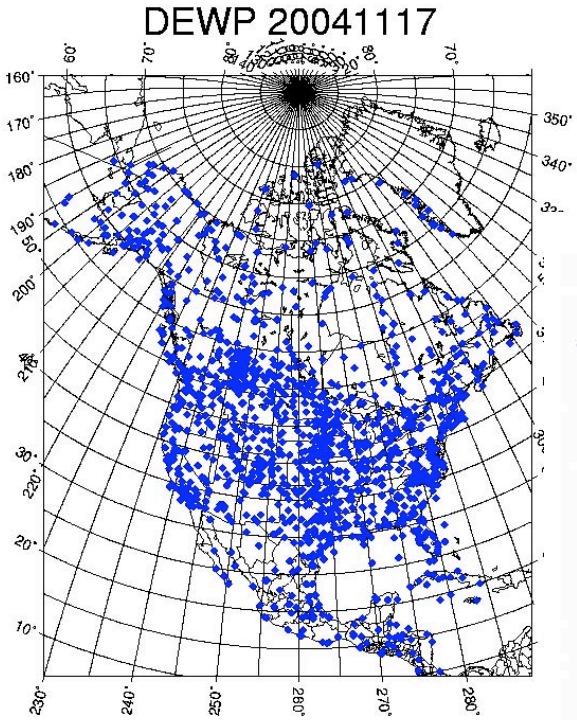
Ames Research Center
Moffett Field, CA

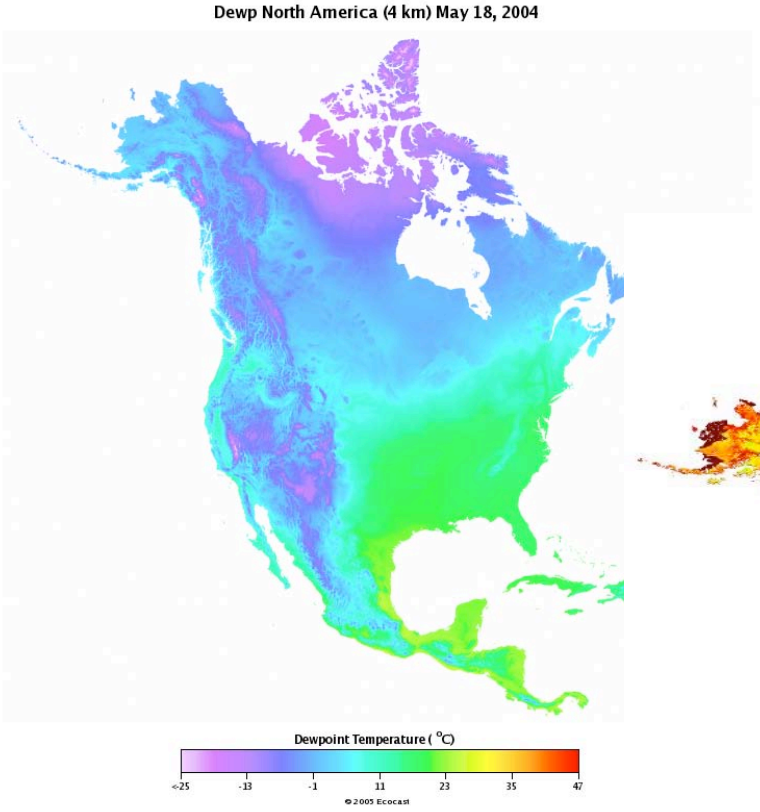
With contributions from:

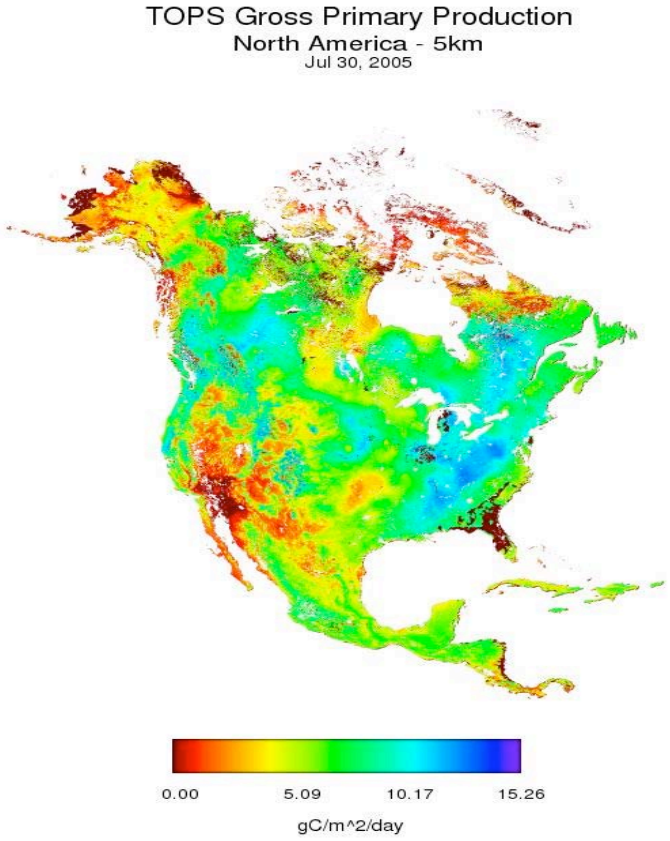
Kazuhito Ichii
Petr Votava
Andy Michaelis
Michael White
Hirofumi Hashimoto
Ranga Myneni
Forrest Melton
Cristina Milesi
Steve Running

Global Vegetation Workshop, Missoula, MT, August 8-10, 2006

Rapid Prototyping of TOPS products for NACP



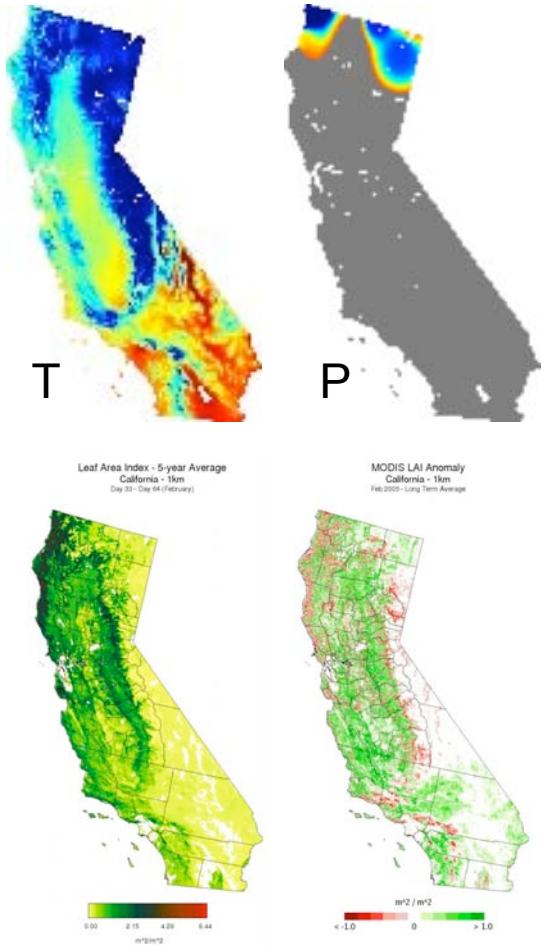


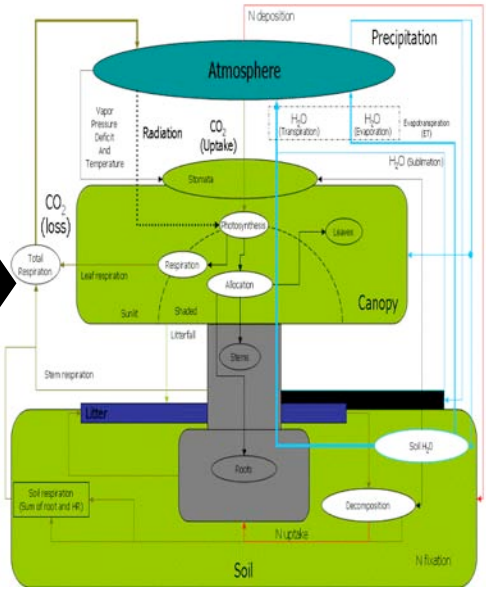


California : Ecological Daily Nowcast at 1km

[Feb/01/2006]

Climate + Satellite

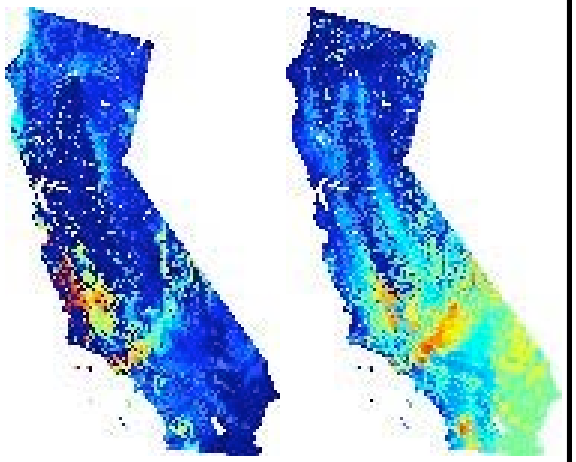




Biome-BGC

Simulation models

Carbon and water cycles



GPP (gC/m2/d)

ET (mm/d)

Outputs include plant growth, irrigation demand, streamflow
Salt water incursion, water allocation, crop coefficients

A 0.05 degree global climate/interdisciplinary long term data set from AVHRR, MODIS and VIIRS

PI & Co-I's:

- *NASA GSFC*: Ed Masuoka (PI), Nazmi Saleous, Jeff Privette, Jim Tucker & Jorge Pinzon.
- *UMD*: Eric Vermote & Steve Prince.
- South Dakota State University: David Roy

Collaborator: Chris Justice (UMD).

NASA Study Manager: Dr. Diane Wickland.

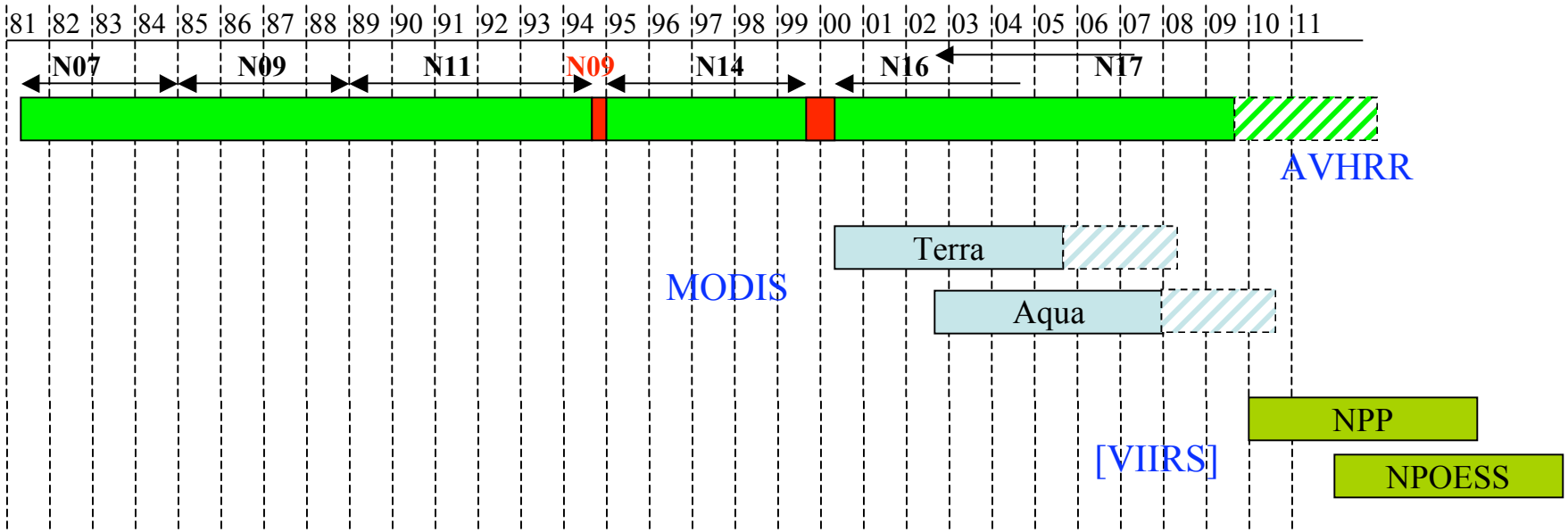
Proposed LTDR Products

AVHRR, MODIS, [VIIRS]:

- VIS/NIR surface reflectance
- MIR surface reflectance
- Vegetation Indices
- Surface temperature and emissivity
- Snow
- LAI/FPAR
- BRDF/Albedo
- Aerosols
- Burned area

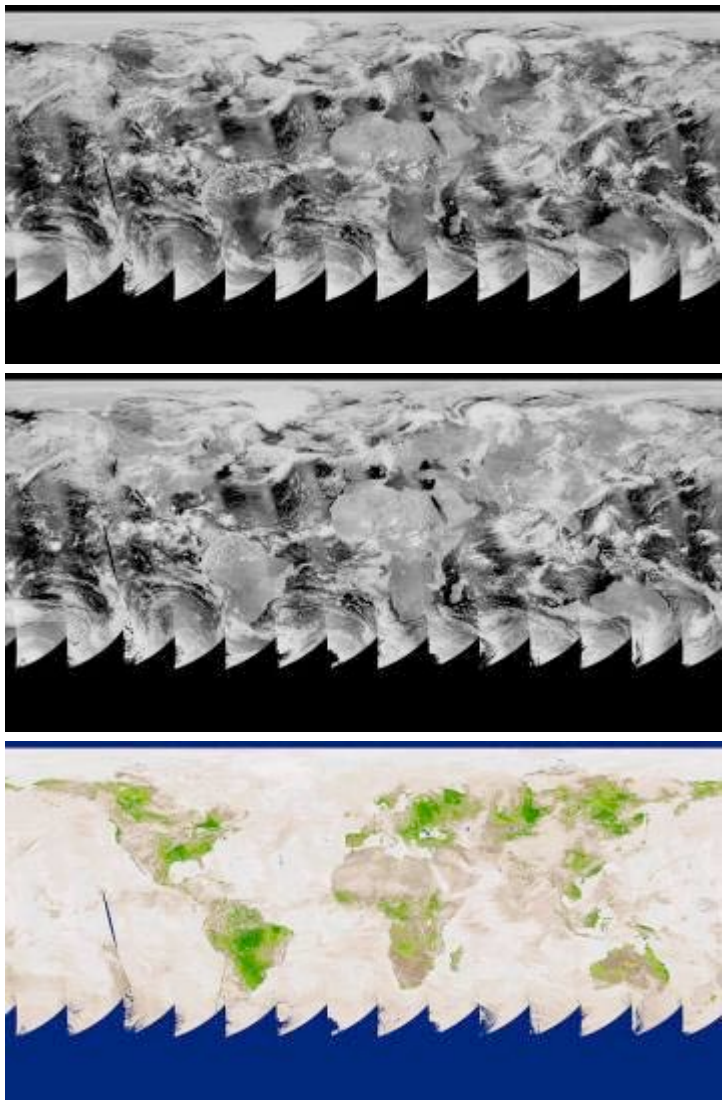
Products and formats will be modified based on feedback from the User Community Workshops.

Data Sources



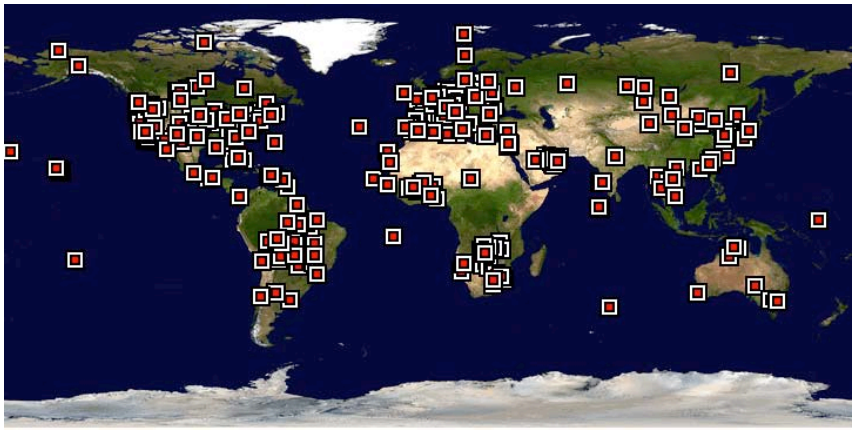
Production of the Beta Data Set

- Algorithms:
  - -Vicarious calibration (Vermote/Kaufman)
  - -Cloud screening: CLAVR
  - -Partial Atmospheric Correction:
    - -Rayleigh (NCEP)
    - -Ozone (TOMS)
    - -Water Vapor (NCEP)
- -Products:
  - -Daily NDVI (AVH13C1)
  - -Daily surface reflectance (AVH09C1)
  - -16-day composited NDVI (AVH13C3)
  - -Monthly NDVI (AVH13CM)
- -Format:
  - -Linear Lat/Lon projection
  - -Spatial resolution: 0.05 Deg
  - -HDF-EOS
- -Time Period:
  - - 1981 – 2000 completed
- -Archive and Distribution:
  - -Over 1 TB stored online.
  - -Distributed by ftp and web

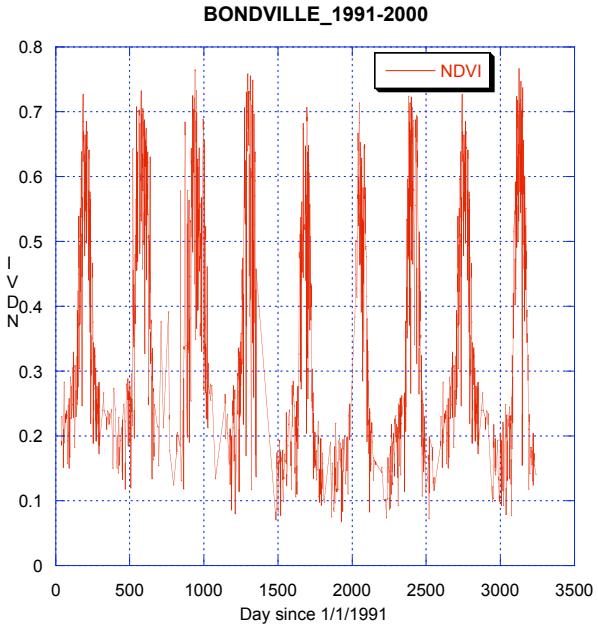


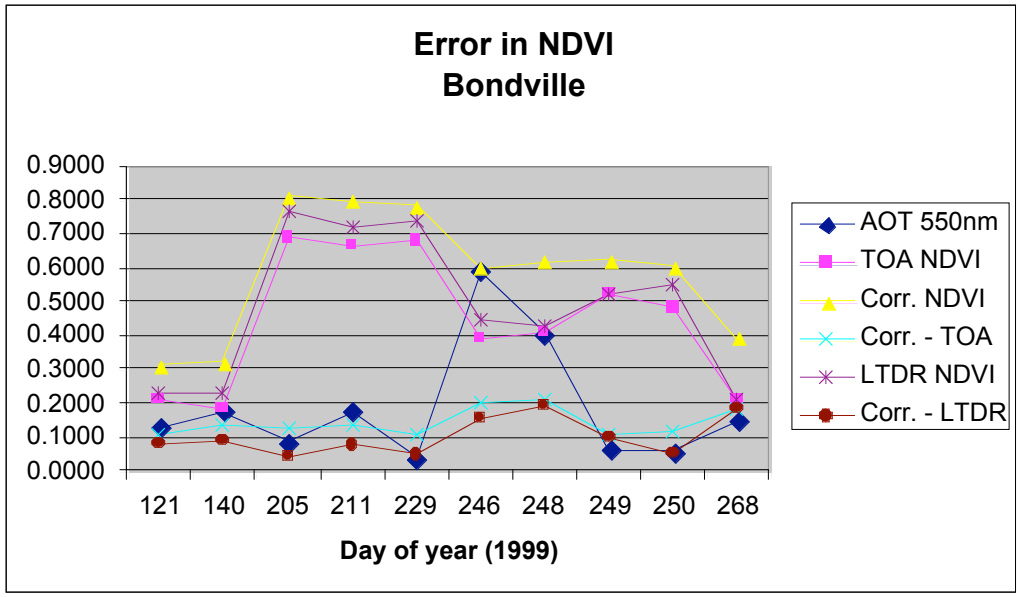
NOAA-11 - 1992193 (7/11/1992) : Ch1, Ch2 and NDVI

Data Set Evaluation

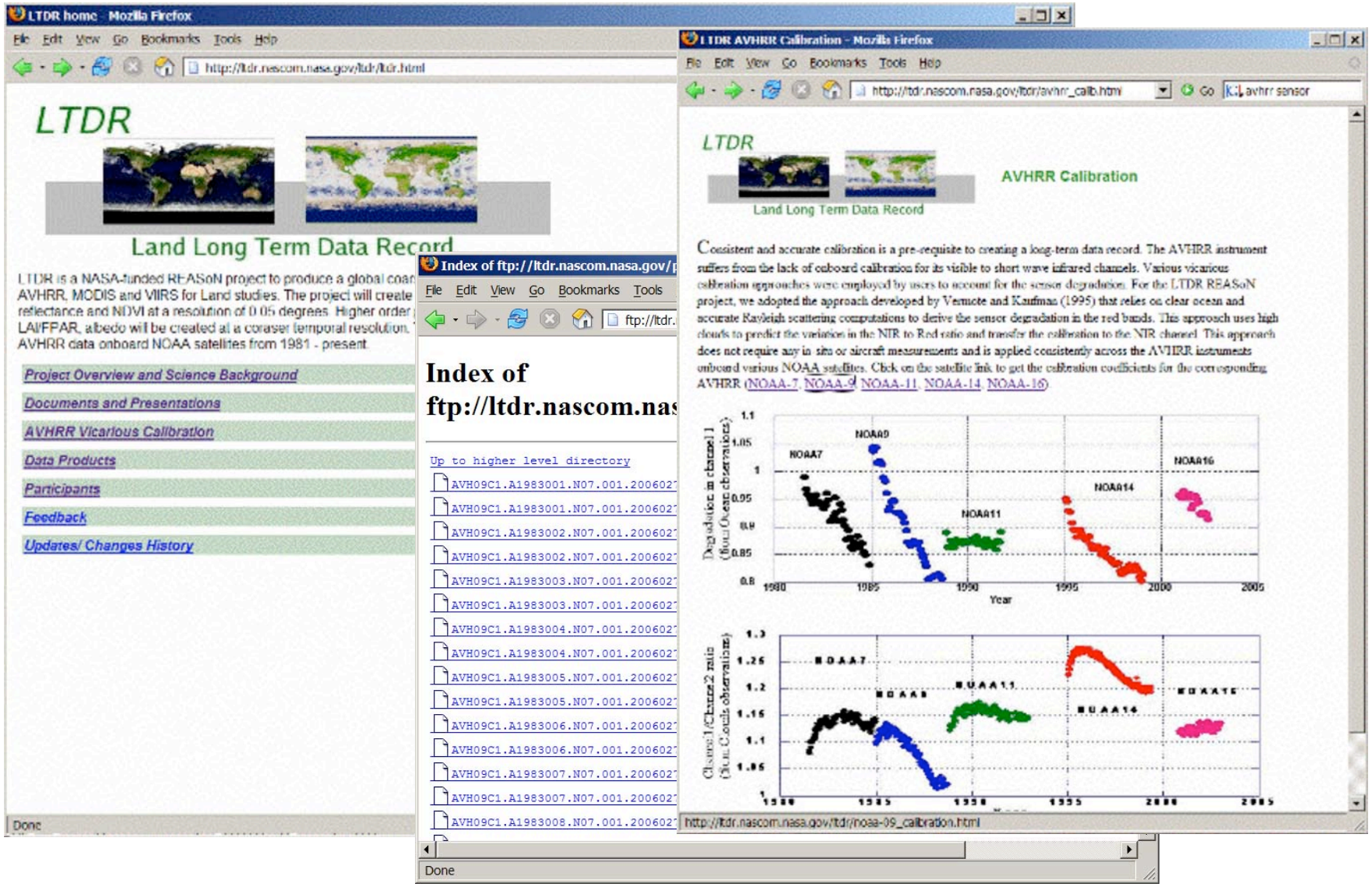


- 50x50 km cutouts centered on aeronet sites
- Surface reflectance and NDVI Time series plots posted on the QA webpage.
- Use aeronet AOT and WV measurement when available to assess errors due to lack of atmospheric correction.





LTDR Web Page

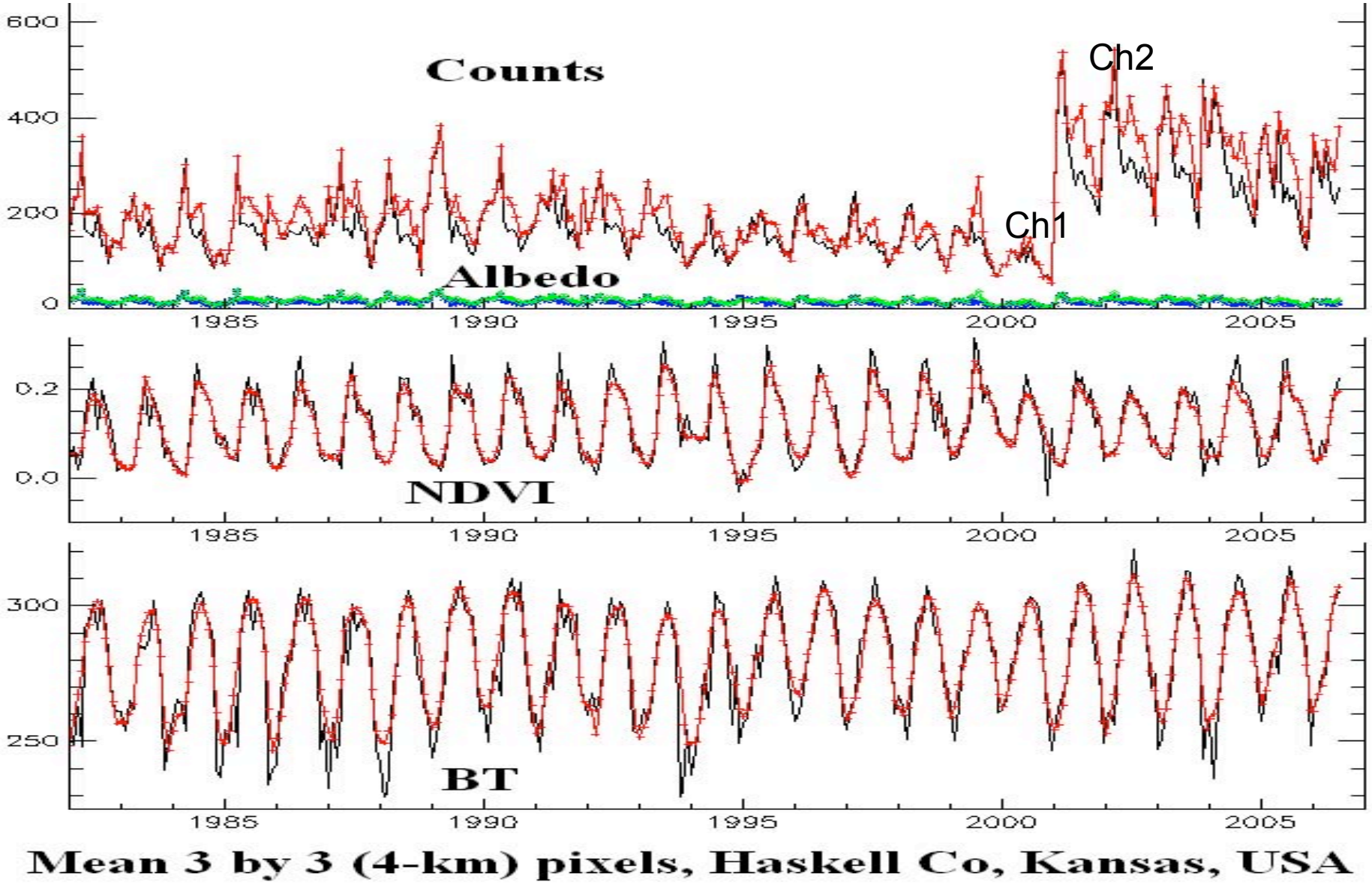


http://ltdr.nascom.nasa.gov/ltdr/ltdr.html

1. NOAA Operational Global Vegetation Index Products

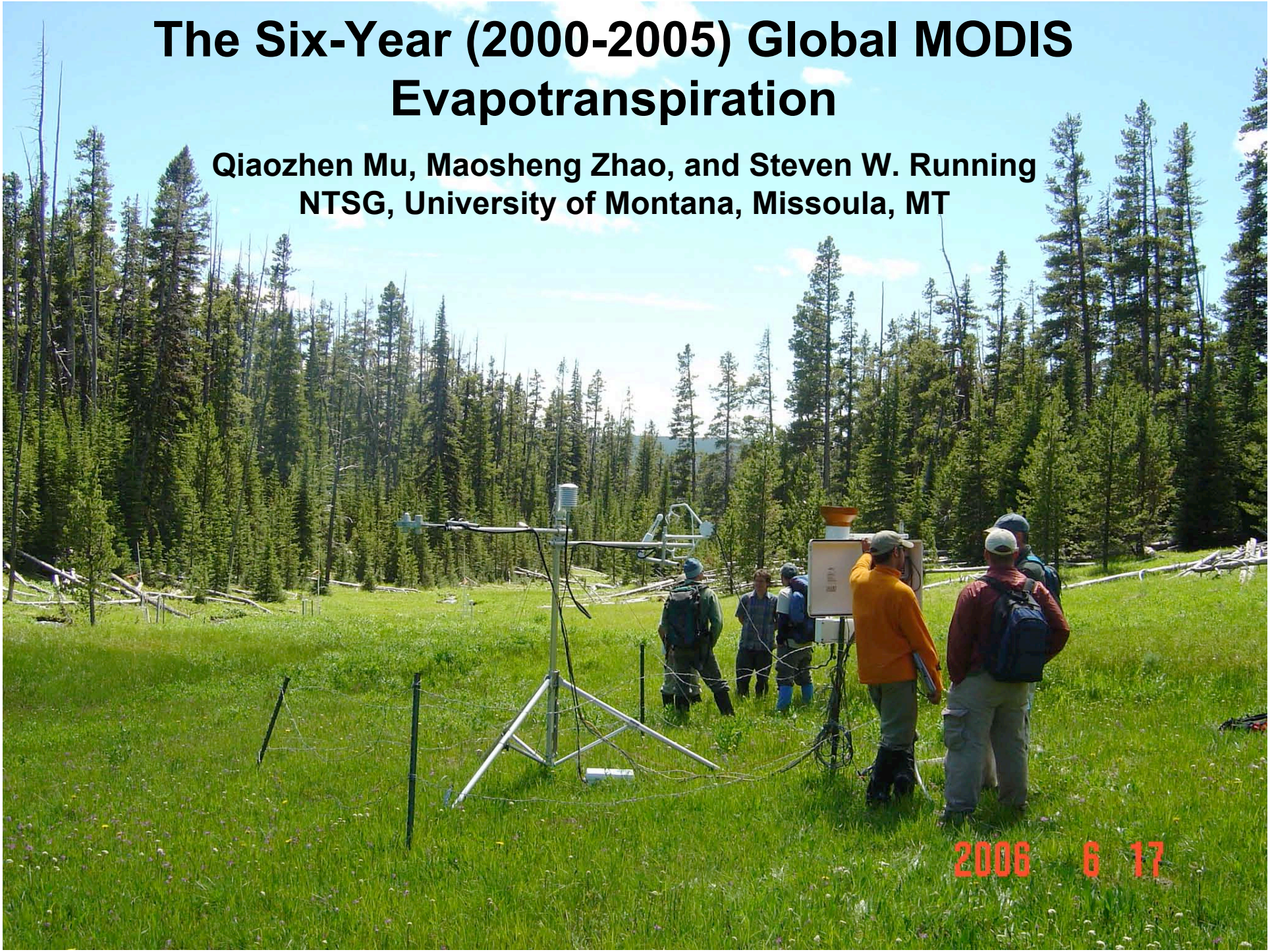
2. 26-year, 4 km, 7-day Composite Data Set

GVI-x Time Series

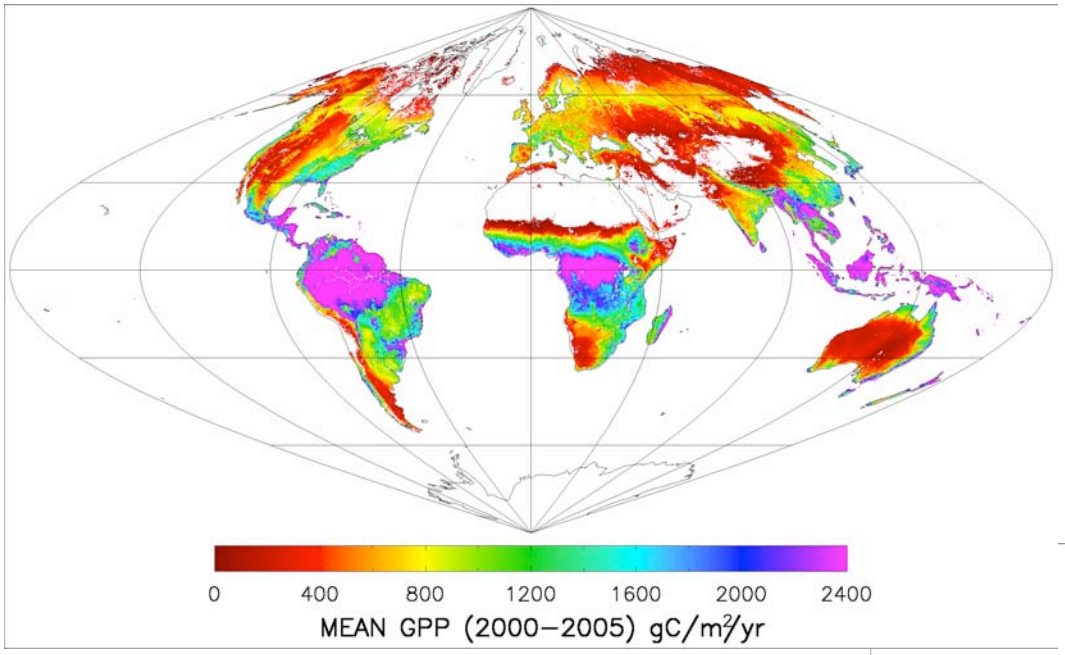


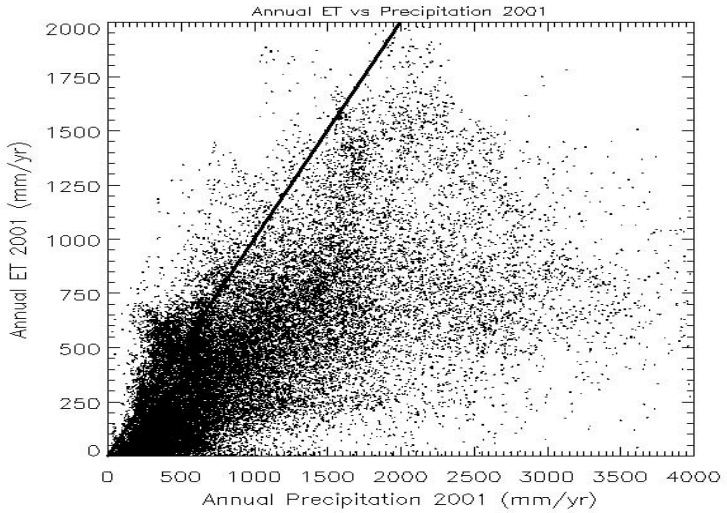
The Six-Year (2000-2005) Global MODIS Evapotranspiration

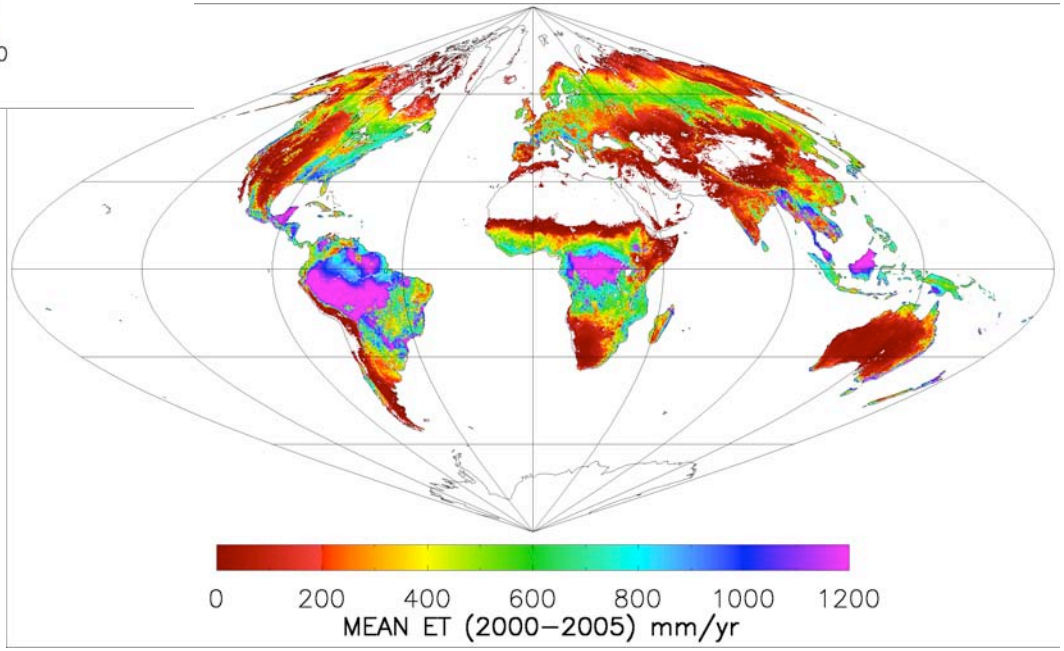
Qiaozhen Mu, Maosheng Zhao, and Steven W. Running
NTSG, University of Montana, Missoula, MT



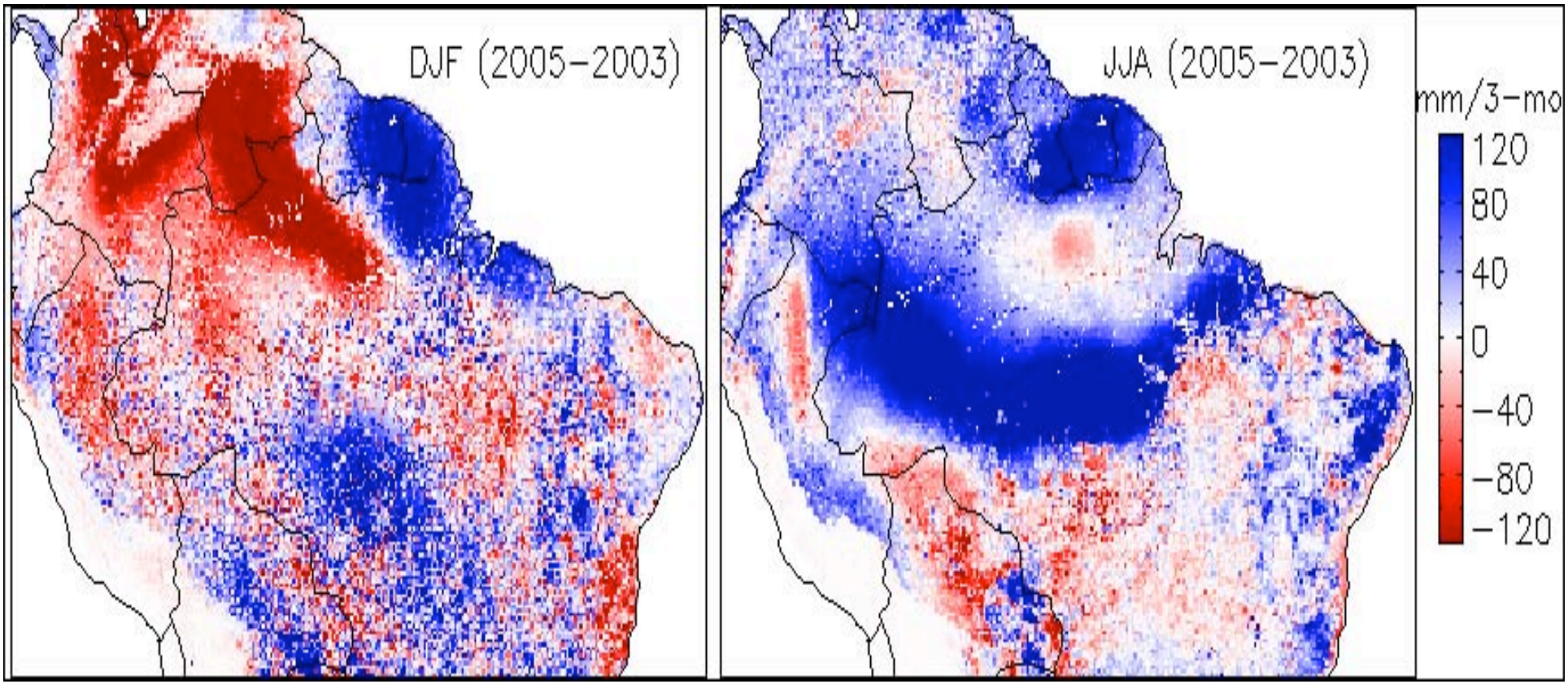
Spatial patterns of mean MODIS GPP and ET (2000-2005)





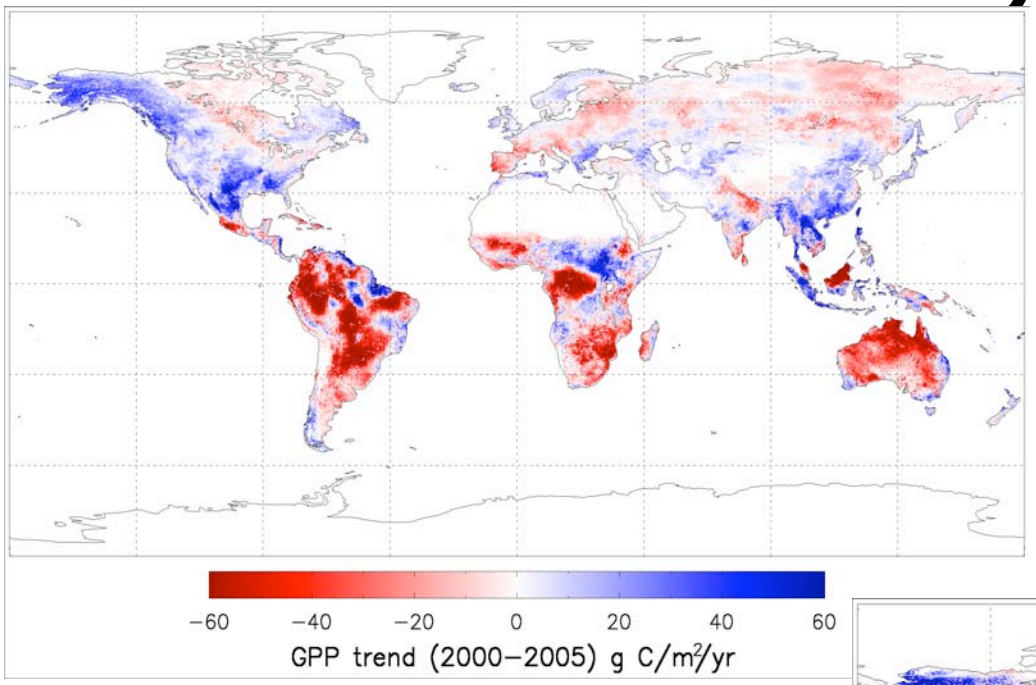


MODIS ET anomaly analysis



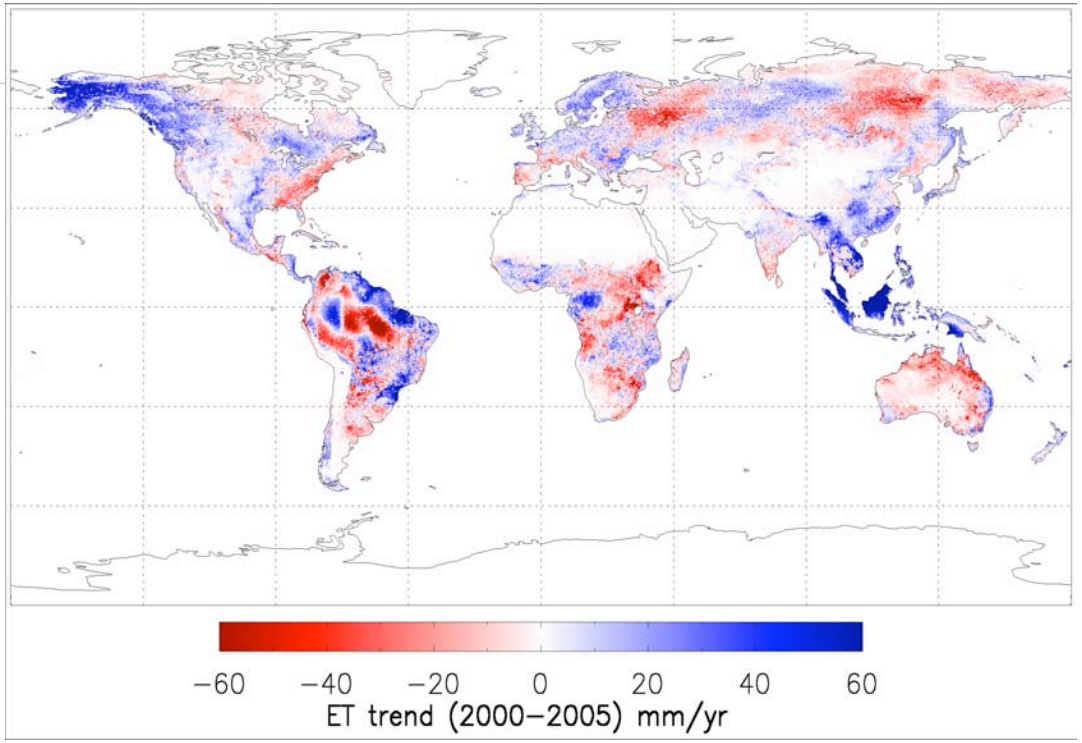
The differences between MODIS ET (2003, 2005) for the Amazon region in DJF (left) and JJA (right). The MODIS ET captures the drought during the 2005 growing season.

Global MODIS *anomaly* trends (2000-2005)



GPP

ET



Workshop General Recommendations

- **International coordination initiatives are needed for developing science quality LTDR from existing and planned international assets**
- **There is need for coordination of the planned moderate resolution missions**
  - **instrument calibration / product continuity / validation / data access**
  - **constellation planning**
  - **launch dates / redundancy /optimizing operations**
- **Mechanisms are needed for transitioning proven research observations from the global systems to the operational domain**
- **Increased attention to the integration of moderate, high – in situ observations for land science applications (WMO model?)**
- **The lines of communication between the moderate resolution community and GEOSS need to be identified and strengthened**
- **Improved communication between data producers and users**
- **Improve international data access**
- **Create a home for continuing international coordination of the biophysical variables (FAPAR, LAI, NPP)**

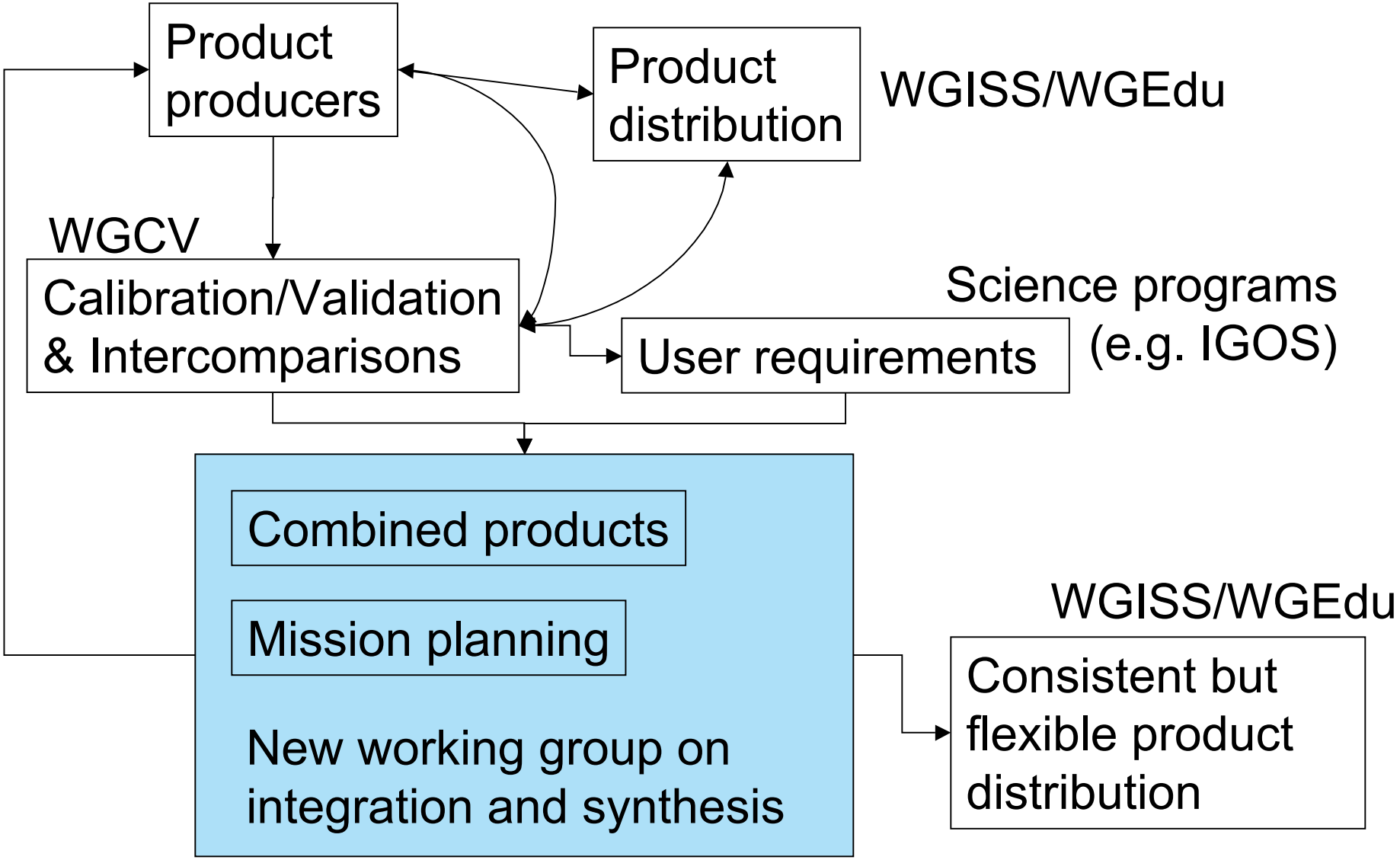
Specific Recommendations: Space and Funding Agencies

- Aeronet (international status federated network) continuity and enhancement
  - consider pathway to operational
- Expand existing terrestrial networks to include additional variables
  - Enhance existing terrestrial networks (Fluxnet, Aeronet) for product validation (AOT, surface reflectance, VI, PAR albedo, ET, LAI, NPP, Phenology)
  - Enhance the BSRN networks for validation (surface reflectance, PAR, albedo)
- Fill the Landsat data gap
- Develop capability to provide daily high resolution global coverage
  - <250-m, 5-day cloud free
- Assess International Data Policies and Interoperability
- Support new missions
  - Lidar – vegetation structure
  - L- or P-Band Radar – forest biomass
  - Moderate Resolution Multi-Angle capability (Polder type/PP) – canopy structure and radiation products
  - Geostationary systems for land studies
- Ensure explicit validation program for every funded Mission

Specific Recommendations: Science and Applications Communities

- Develop consensus validation strategies
  - Such as Land Product Validation protocol for LAI
- Demonstration of Maturing Products' Capabilities
  - Multi-sensor Products e.g. Optical/Radar Fusion
  - Hyperspectral products
  - Multi-angular products
- Propagate near real time systems into additional products
  - Enhance Direct Broadcast products, code sharing and exchange
- Enhanced data distribution systems to meet user needs
  - single access to product types (domain services)
- Continued End User Education and Outreach
  - Inform potential users of data
  - Enhance data accessibility
  - Generate discussion on potential user needs

Global Vegetation Monitoring: Way forward through CEOS



Action: Explore CEOS Working Group on Integration and Synthesis

- Products
  - Confusing number of similar products (e.g., LAI)
  - Validation and Intercomparisons can be very informative
  - Users need to
    - Know what products are available
    - Know which products are best for answering their study questions
    - Better define their needs once they know which products are available
  - Proper data fusion should build on intercomparison and user requirements.

- CEOS should initiate a pilot working group on sensor constellations (for combined products and mission planning).

Surface Radiation: Summary Recommendations

- Ensure that AERONET continues (through VIIRS)
  - *(Funding agency)*
- Improve *FLUXNET/BSRN* data protocols to match albedo validation needs.
  - Communicate needs to Fluxnet community
  - Support tower efforts to increase funding to include equipment and personnel needed for additional measurements
- Target all high resolution sensors for validation
  - Albedo in both priority & AERONET sites
  - (*Data providers*)
- Product intercomparisons
  - (*Product developers*)

Land Cover: Summary Recommendations

- Need for reliable long term data
  - Coordinated effort among agencies
- Validation needs
  - Centralized validation database
    - Coordinated plan to establish global long-term validation sites
  - Reduced cost of high resolution data
- Need for the bulk/vertical dimensions for better characterization
  - Canopy lidar
  - Radar
- Combine the spectral/radiometric capabilities of MODIS with the resolution of Landsat.
  - Geostationary satellites
- Need integrated information systems.

Vegetation Indices: Summary Recommendations

- Continue global VI time series
  - improve future products
  - retain backward compatibility
- Improve spatial and temporal resolution
  - <1km
  - weekly or less time step
- Determine what VIs and phenological parameters are describing with respect to ecology and biophysical properties
- Develop alternative indices to characterize the biophysics, photobiology, biochemistry
  - light use efficiency (e.g., PRI,)
  - Vegetation Water Indices (e.g., LSWI)

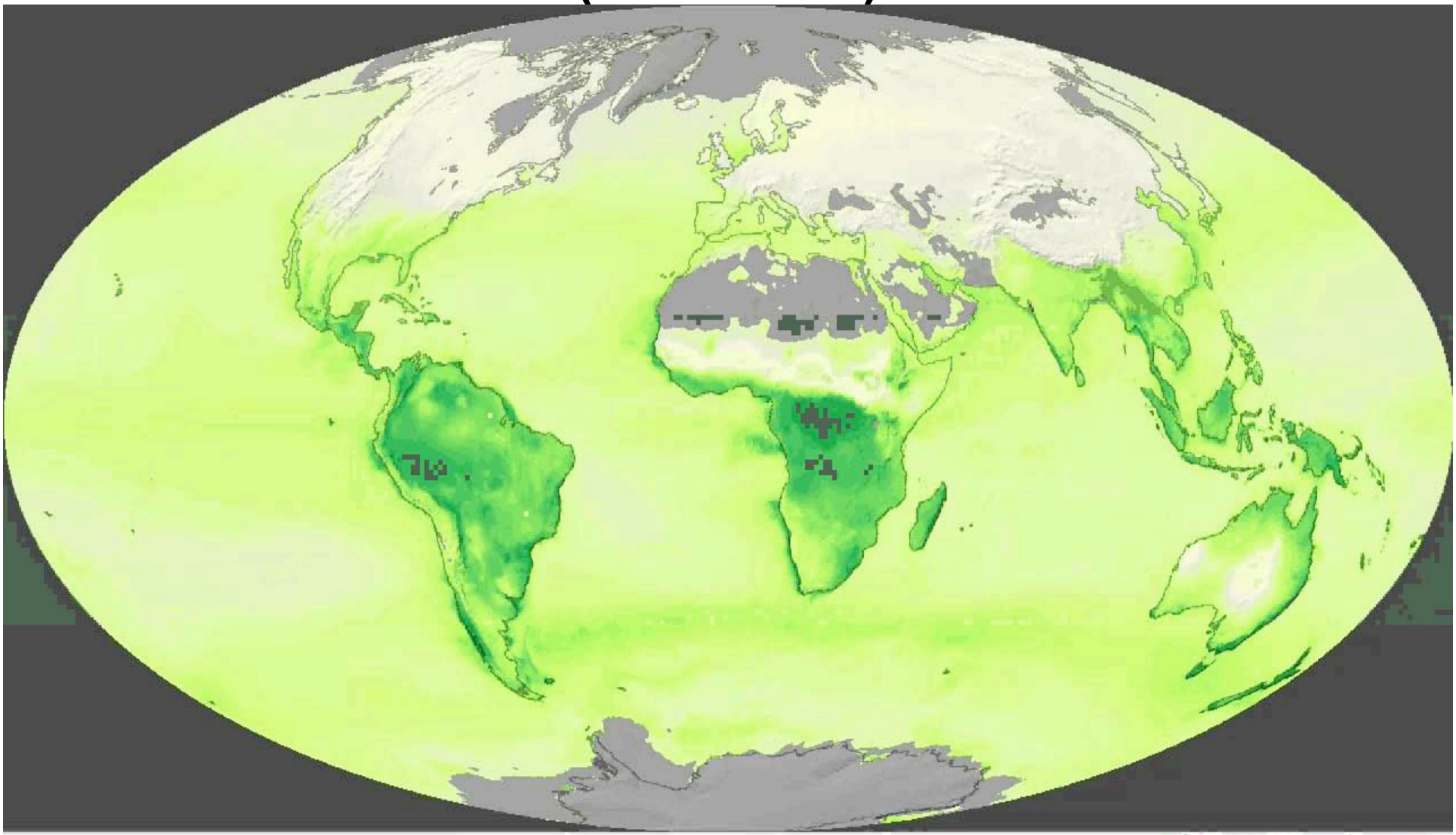
Biophysical Variables: Summary Recommendations

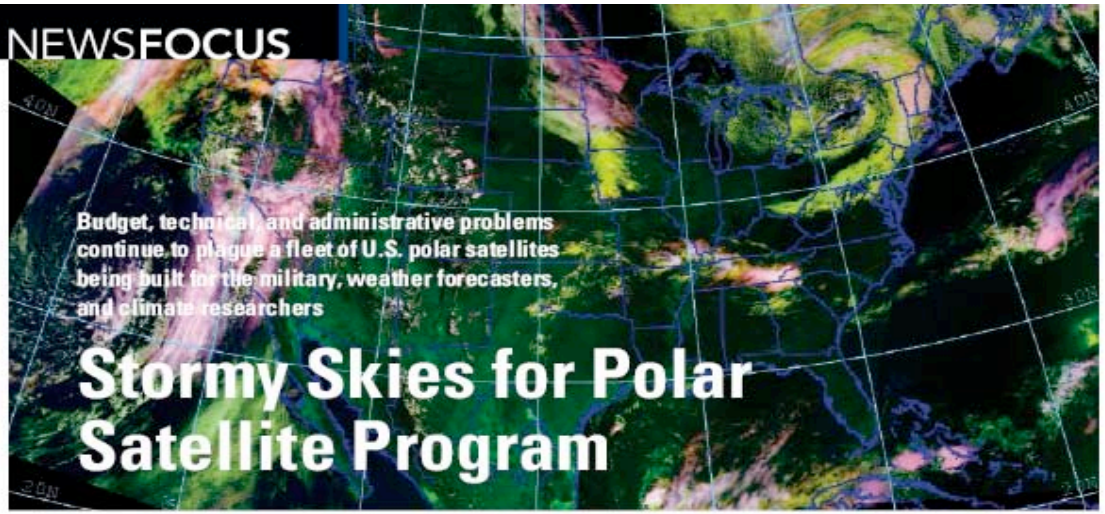
- Need continuity of global products
  - Large improvement in the spatial resolution for future missions
  - Multi-agency satellite constellation
  - Multi-agency receiving/processing systems
- Continuing validation/intercomparison essential
  - Need proper support by agencies
- Provide quantitative uncertainties
- Documentation for all products and validation activities

Fire:
Summary Recommendations

- Start an International Stage 2/3 Global Burned Area Product Validation
  - Follow CEOS LPV protocol
    - Organize GOFC Workshop for design and agreements on data access
- Start international effort on a Burned Area LTDR
  - Intercomparison of multiple products needed
  - First priority should be on burned area
- Need on assessment of future missions
  - GLOBCARBON ends in 2007
  - VIIRS has limited characterization
  - Improve sensor design enabling active fire detection
- Need a LAND Direct Broadcast coordination initiative to include Fire – code/experience sharing

MODIS Land + Ocean NPP (2000-2005)





Budget, technical, and administrative problems continue to plague a fleet of U.S. polar satellites being built for the military, weather forecasters, and climate researchers

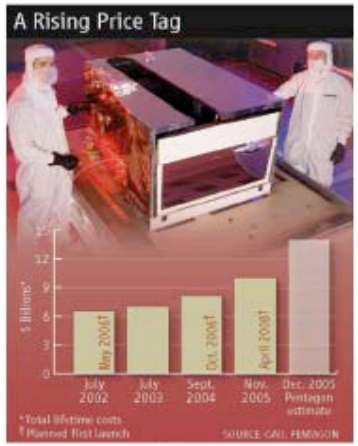
Stormy Skies for Polar Satellite Program

WITH MORE USES THAN A SWISS ARMY knife, the National Polar-Orbiting Operational Environmental Satellite System (NPOESS) was supposed to be the world's most sophisticated series of weather satellites. But somewhere in its 12-year history, the multibillion-dollar NPOESS has also become one of the country's most troubled technology projects. Next week, the Pentagon will issue binding plans on how to fix a project now behind schedule and massively over budget. The expected overhaul could shape for decades how well U.S. forces prepare for battle, civilian authorities anticipate killer storms, and scientists understand Earth's ever-changing climate.

Since the 1960s, the U.S. Department of Defense and the National Oceanic and Atmospheric Administration (NOAA) have used separate north-south orbiting satellite systems to provide daily global weather coverage and crucial multiday forecast data. In 1994, President Bill Clinton proposed to merge those systems in a $6.5 billion project that was to save an estimated $1.8 billion over its lifetime. The system would pack 14 sensors—half of them new—onto six 7-meter-long crafts, with three flying at a time until 2018. Sounders would probe the air column, sensors would look through clouds as well as watch for space weather, and the crafts' capabilities would be a quantum leap over decades-old NOAA and Pentagon polar systems. "We have made major strides to converge military and civil weather requirements," Air Force Maj. Gen. Robert Dickman told Congress in 1995.

But now, more than a decade later, technical problems on one of the sensors have rippled through the program and pushed estimated cost overruns into the billions of dollars. As currently configured, the system is as much as 3 years behind schedule and carries, by the Pentagon's latest estimate, a lifetime price tag of $14 billion (see graph). The overrun triggered an automatic top-to-bottom review, which the Secretary of Defense is set to present to lawmakers next week.

The delay could leave U.S. forces without the best data on sandstorms or ocean currents, military planners worry, not to mention a possible weakening of civilian weather coverage if there are problems with a NOAA satellite scheduled to be launched in 2007. What the Government Accountability Office (GAO) calls a "program in crisis" is really the "fleecing of America," according to Representative Bart Gordon (D–TN), ranking Democrat on the House Science Committee, who wants NOAA Administrator Conrad Lautenbacher to resign for ignoring what Gordon says were clear warning signs about NPOESS. "This is a program that is dangling by a thread," says one congressional staffer who follows the project.



Skyward. The Pentagon's estimate for the program is much higher than what NPOESS staff assume.

NPOESSing a challenge

Polar satellites are wonderfully useful because their 100-minute orbits provide coverage of nearly every point on Earth. But their attractiveness didn't forge an automatic alliance between defense and research bureaucrats operating in two different cultures. "NOAA looked at the Air Force and said, 'Huh, goose-stepping fascists.' And the Air Force looked at NOAA and said, 'Fish-kissing tree huggers,'" said former program manager John Cunningham at a 2003 briefing on the project.

Their needs were different as well: The Pentagon wanted sensors with high resolution and speedy delivery of the data, whereas NOAA sought instruments with a multitude of spectral bands for weather research. NASA agreed to join in, canceling planned follow-ons for environmental missions while adding environmental and climate sensors to the NPOESS fleet after its scientists lusted after the chance to use systems whose sequential platforms will stay aloft for 20 years rather than the usual 5-year window. "I thought [NPOESS] was the right thing to do, and in some ways, the only way to do it," says biogeochemical modeler Berrien Moore of the University of New Hampshire, Durham, who has long advised the government on behalf of the climate community.

The initial cooperation went "surprisingly well," says the Navy's Robert Winokur, then head of NOAA's satellite program. The package would include everything from an ozone detector to a device for aerosol studies (see graphic, p. 1297). The microwave imager would provide more channels for detailed moisture profiles than existing instruments. And the Visible/Infrared Imager Radiometer


THE END