

Land Report Back

Chris Justice

UMd Geography



MODIS Land Team 2001 Post Launch



Science Team Members / Science Data Support Team / DAAC Reps

MODIS / VIIRS Land Team 2008

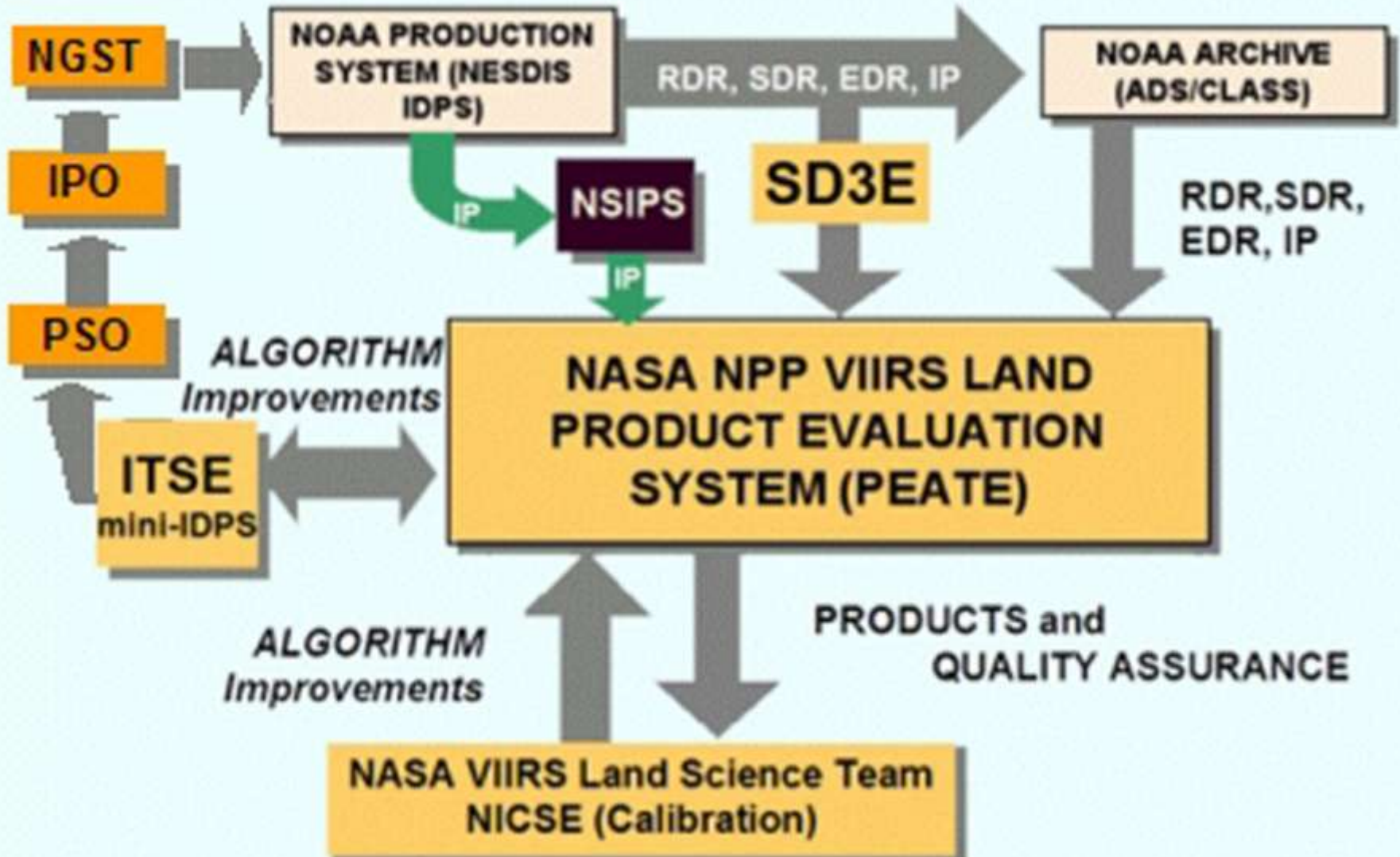


NPP VIIRS Issues

- Current Focus Land EDR evaluation and NASA ESDR Generation
- VIIRS EDR's (daily level 2) that can hopefully meet some of our science needs
 - Surface Reflectance IP (C5 MODIS)
 - TOC EVI
 - LST
 - Snow Cover
 - Ice Extent
 - Sea Ice Concentration (but IP needs archiving) – Ice Age
 - Land Surface Type (NWS)
- VIIRS ESDR's that are now in development
 - LST
 - Albedo
 - Composited NDVI and EVI
 - Fire (w. IPO)
 - Sea Ice C
 - LAI
 - Land Cover and Phneology
- Currently no plans for VIIRS VCF
- Land PEATE Budget Post Launch (staffing)
- Land Assessment of VIIRS EDR Adequacy to HQ (within 6 months)
- EDR validation planning/prototyping underway – some IPO support in process
- Need to Test the data flows in terms of algorithm improvements



Product Evaluation Flow



Recommendations for VIIRS FU2

(Land Priorities)

- **Improved VNIR IFA to address the optical crosstalk problem**
- Improved optical design in SWMWIR and LWIR address dewar window ghosting features
- **Improved VNIR Read Out Integrated Circuit (ROIC) to address static electrical crosstalk problem**
- Perform end-to-end testing of the solar diffuser/monitor/screen on-board calibration system relative to earth view
- Eliminate the noise in the gain switch regions of the VIIRS dual gain bands
- Maintain calibration and characterization of all GSE between successive VIIRS flight units
- **Improved saturation handling for single bands (i.e. aggregation) – Fire**
- Employ tunable lasers (e.g. NIST SIRCUS) in measurements of system level spectral response of VIIRS bands
- Report sub-scene statistics of the impact of crosstalk and near field response particularly in regions of scientific interest such as coastlines and cloud edges (i.e. currently full scene statistics are reported)
- Employ NIST Optical Technology Division personnel in VIIRS instrument and calibration technical meetings.
- **Improved testing of near field and far field stray light VIIRS response**
- Implement testing in t/v of band to band registration between cold and warm focal planes

Additional Land Issues for FU2

- Fire needs
 - Eliminate M13 Crosstalk
 - M13 – ‘squarer’ PSF for fire characterization pre-aggregation
 - Full/Extended range calibration for M13
 - Full resolution download for M15 or flag aggregated pixels which include saturated pixels
 - Higher saturation than current spec for M13 and M15
 - keep FU1 current test performance or better on FU2 (M15 at least same as MODIS Band 31)

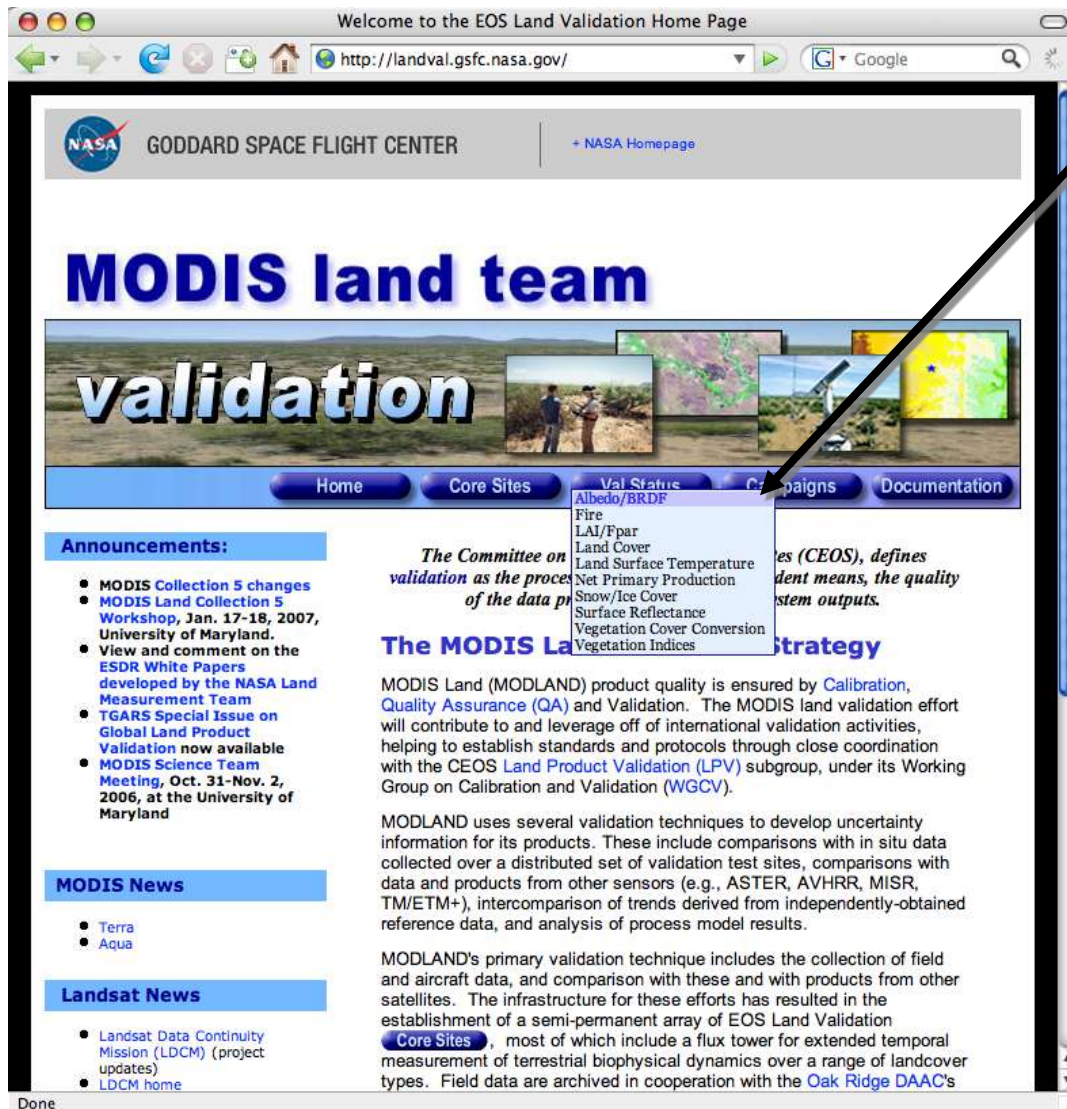
Outstanding MODIS Issues

- 250m Land Water Mask still needed (preferably dynamic)
- ATBD Process for Standard Products
 - Step 1. Develop and Test Algorithm at SCF > w. larger volume test runs at MODAPS as needed > QA / Val > Community Feedback
 - Step 2. ATBD generation > ATBD Review > HQ decision
 - Step 3. MODAPS Operational Integration and Test
 - Step 4. MODAPS production
 - Ustin, Lyapustin currently middle of Step 2
 - Liang completed Step1.

New MODIS Issues

- C5 Reprocessing Completed
 - Major kudos to the MODAPS Team !
- Need to update our Websites
 - C5 User Guides
 - C5 Validation status (all Stage 2 Validation ??)
 - MODIS Home Page needs updating

Update land product accuracy statements



Welcome to the EOS Land Validation Home Page
http://landval.gsfc.nasa.gov/

NASA GODDARD SPACE FLIGHT CENTER + NASA Homepage

MODIS land team validation

Home Core Sites Val Status Campaigns Documentation

Announcements:

- MODIS Collection 5 changes
- MODIS Land Collection 5 Workshop, Jan. 17-18, 2007, University of Maryland.
- View and comment on the ESDR White Papers developed by the NASA Land Measurement Team
- TGARS Special Issue on Global Land Product Validation now available
- MODIS Science Team Meeting, Oct. 31-Nov. 2, 2006, at the University of Maryland

MODIS News

- Terra
- Aqua

Landsat News

- Landsat Data Continuity Mission (LDCM) (project updates)
- LDCM home

The Committee on validation as the process of the data product (CEOS), defines validation means, the quality of the system outputs.

The MODIS Land Product Validation Strategy

MODIS Land (MODLAND) product quality is ensured by Calibration, Quality Assurance (QA) and Validation. The MODIS land validation effort will contribute to and leverage off of international validation activities, helping to establish standards and protocols through close coordination with the CEOS Land Product Validation (LPV) subgroup, under its Working Group on Calibration and Validation (WGCV).

MODLAND uses several validation techniques to develop uncertainty information for its products. These include comparisons with in situ data collected over a distributed set of validation test sites, comparisons with data and products from other sensors (e.g., ASTER, AVHRR, MISR, TM/ETM+), intercomparison of trends derived from independently-obtained reference data, and analysis of process model results.

MODLAND's primary validation technique includes the collection of field and aircraft data, and comparison with these and with products from other satellites. The infrastructure for these efforts has resulted in the establishment of a semi-permanent array of EOS Land Validation **Core Sites**, most of which include a flux tower for extended temporal measurement of terrestrial biophysical dynamics over a range of landcover types. Field data are archived in cooperation with the **Oak Ridge DAAC's**

Product "pick-list"



Albedo/BRDF
Fire
LAI/Ppar
Land Cover
Land Surface Temperature
Net Primary Production
Snow/Ice Cover
Surface Reflectance
Vegetation Cover Conversion
Vegetation Indices

ice albedo product using
gion on the Tibetan Plateau

Ma, Zhan Sun, and Wenhua Jiang
2004

ctroradiometer (MODIS) global land
: studies. We evaluate the accuracy
any 2001 to July 2003) of ground
in (32.30 deg N, 84.06 deg E, 4420
nsists of semidesert or desert soil.
field measurements shows that the
accuracy requirement of 0.02. There is
id the ground-measured albedo, with
f 0.036.

as observed from AWS and derived

daily albedos
ground
MODIS

New MODIS Issues

- As a result of Last Recomplete
 - VCC is a discontinued product
 - VI and LAI will have no Version C6
 - Issues of C5 / C6 dependencies yet to be resolved
- C5 community product intercomparisons underway

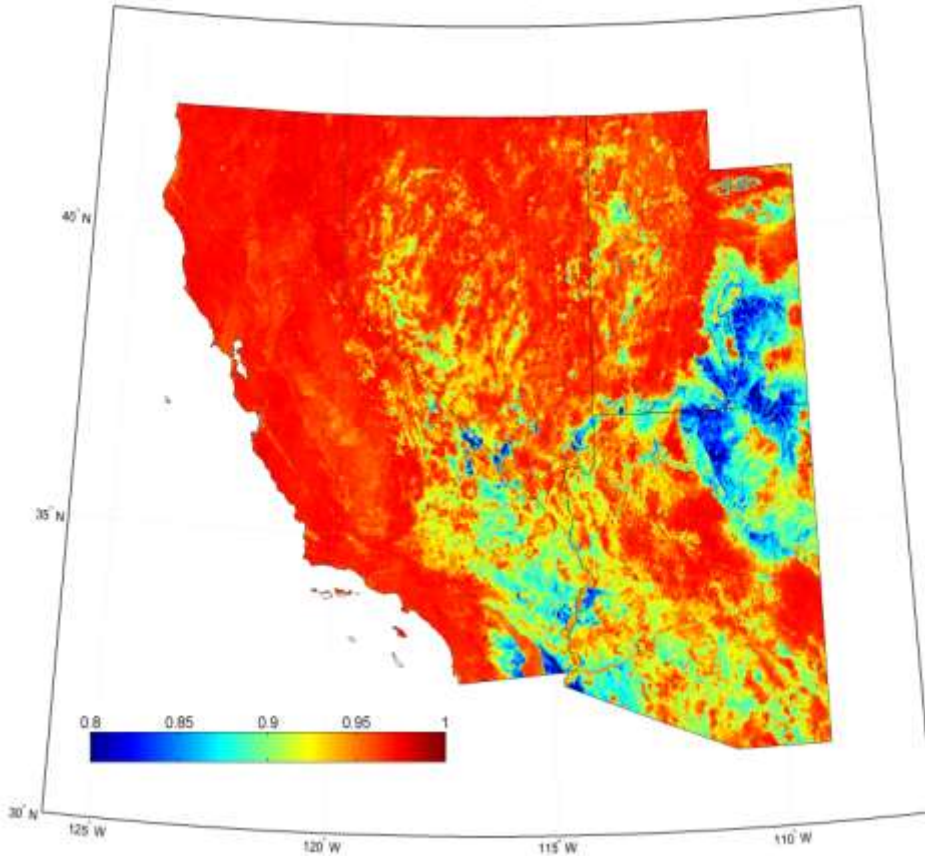
MODIS, AIRS, ASTER LST&E Climate Product Characteristics

Potential Sources of Bias

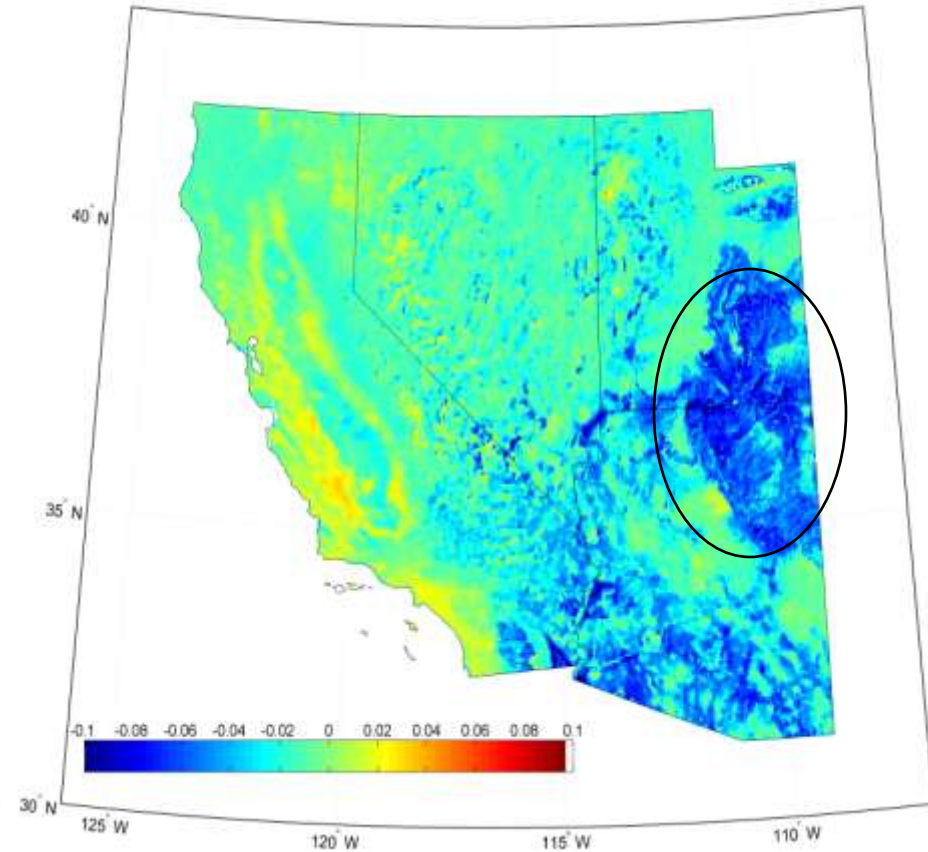
	Terra/Aqua MODIS	Aqua AIRS	Terra ASTER
Cloud Contamination	Cloud Detection	Cloud Clearing	Cloud Detection
Algorithm	Day/Night Land Cover Class	Multi-spectral	Calibration Curve
Temporal Sampling	Clear only; 10:30 AM, PM 1:30 AM, PM Twice daily	Partly Cloudy; 1:30 AM, PM Twice daily	Clear only 10:30 AM, PM every 16 days
Spatial Sampling and Resolution	1 km Clear Only (1 km → 5 km)	45 km CC (15 km → 45 km)	90 m Clear only
Scan angle	55	45	8.55

ASTER minus MODIS (MYD11C3 V5) Mean Summer Emissivity Difference

ASTER Mean Summer Emissivity - 8.3 μm - 2000-2008



ASTER minus MODIS (v5) Mean Summer Emissivity - 8.3 μm
2003, 2004, 2007, 5 km resolution



- MODIS (v5) uses Day/Night combined with Split-Window Land Cover type
- **Up to 10% emissivity difference in arid/semi-arid areas!! (~7 K)**

MODIS LST Sub group – summary of actions

Action 1 in response to the user request for C4 LST products

- make minor changes to the V4 PGE16 code for using the C5 inputs, run tests and make decision within one month.
- if the modified V4 code can generate LST products similar to old C4 LST products, use the code to process MODIS data since 01/01/07 parallel to the current C5 forward processing.
- to remove cloud-contaminated LSTs from the daily CMG LST products similar to the post-processing for the C4 LST products in the past.
- keep both the C4 and C5 MODIS LST products in the archive.

Action 2 to fix the high emissivity problem of the C5 LST products in arid regions

- make small adjustments to the day/night algorithm in the current V5 PGE16 code and run tests within six months.
- if the updated V5 code can make significant improvements, make another C5 reprocessing and forward processing with the new V5 code.

MODIS LST C5 Issue and Solution

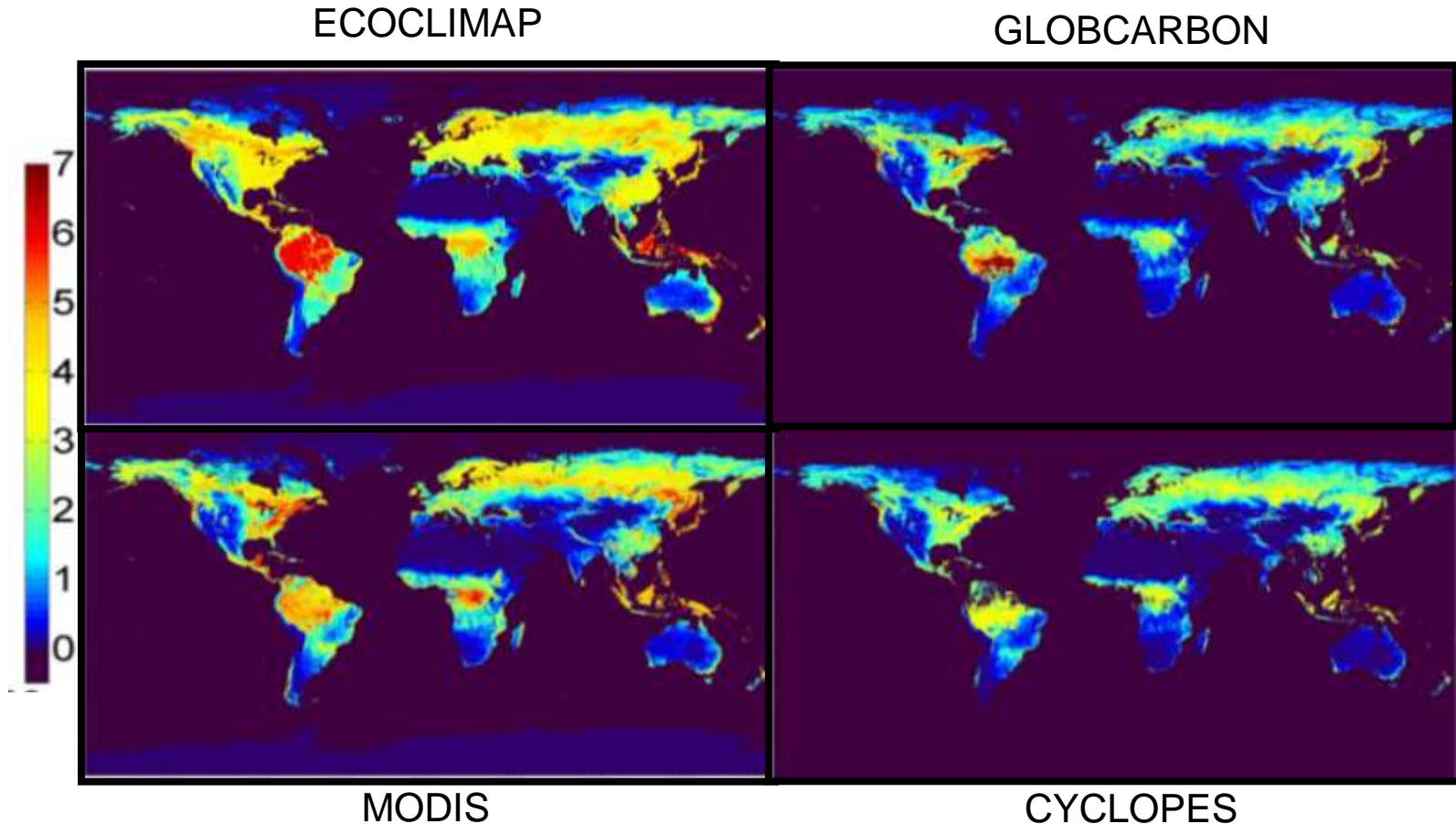
- LST Issue C4 vs C5
 - Retrieved LST and Emissivity in C5 may be largely incorrect over arid/semi-arid area. C4 retrieval may be more closer to the truth value in these area.
 - C4 retrievals are cloud contaminated.
- Solution
 - Distribute both C4 and C5 LST.
 - Document and post the difference between C4 and C5 LST for public information (via SCF, LDOPE, LP DAAC web sites)
- LST Data Availability and Reprocessing
 - C4 and C5 available for 2000 – 2006
 - For period 2007 and forward
 - C5 available
 - C4.1 will be made by reprocessing LST using C4 LST algorithm with C5 inputs (L1B, water vapor and atmospheric profile) after testing and validation.
 - Run C4.1 LST Test using 3-month data (June – Aug 2006) over North America.



A QUALITY ASSURANCE
FRAMEWORK FOR
EARTH OBSERVATION

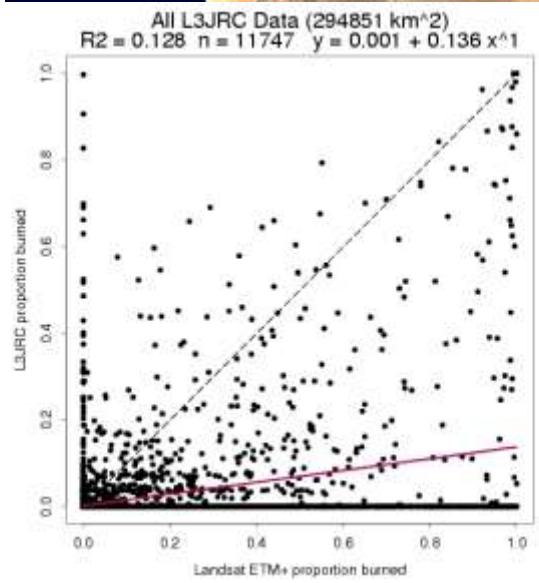
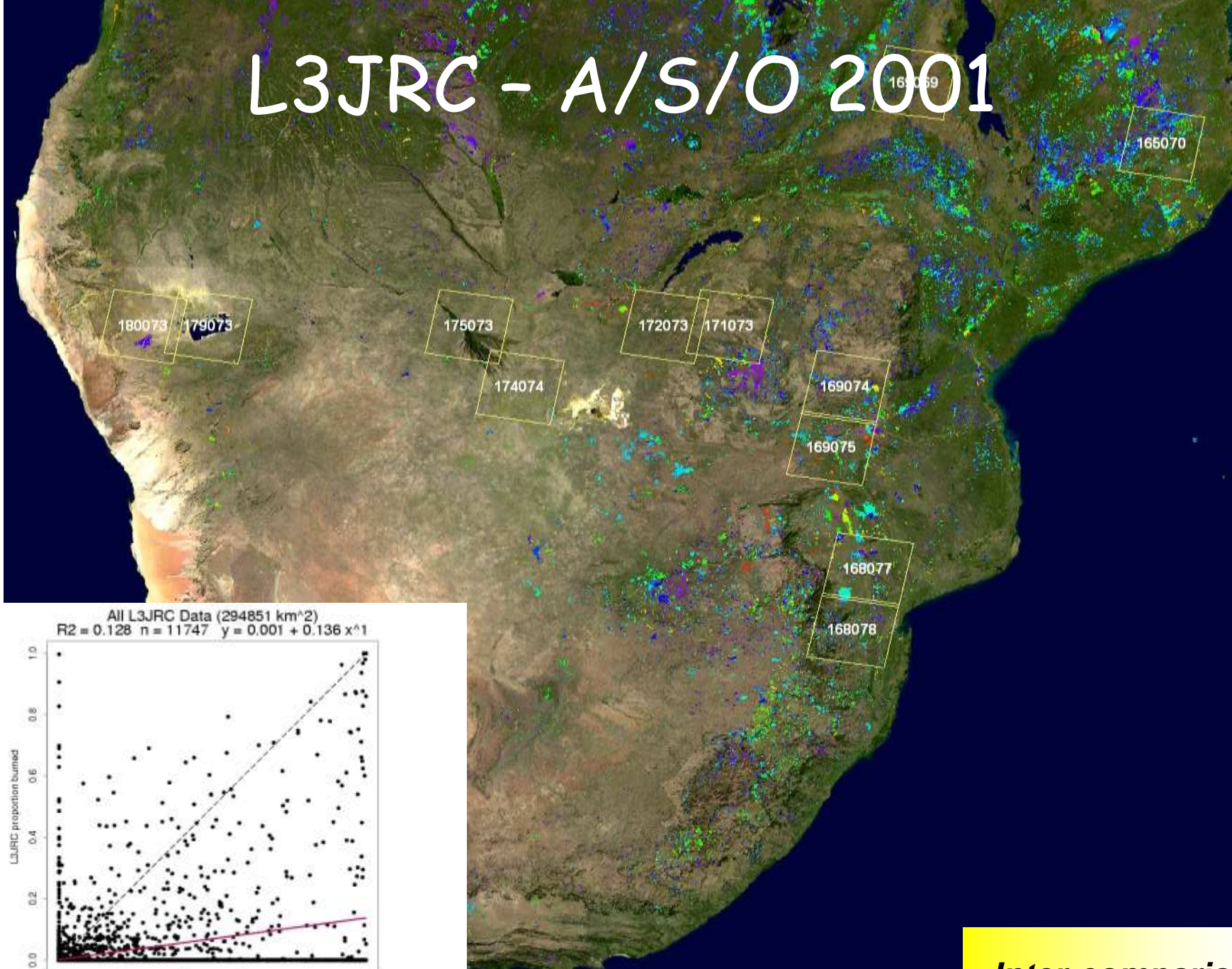
- **Data Quality,**
- **Data Policy *and***
- **Communication & Education.**

Example Inter-comparisons: Leaf Area Index



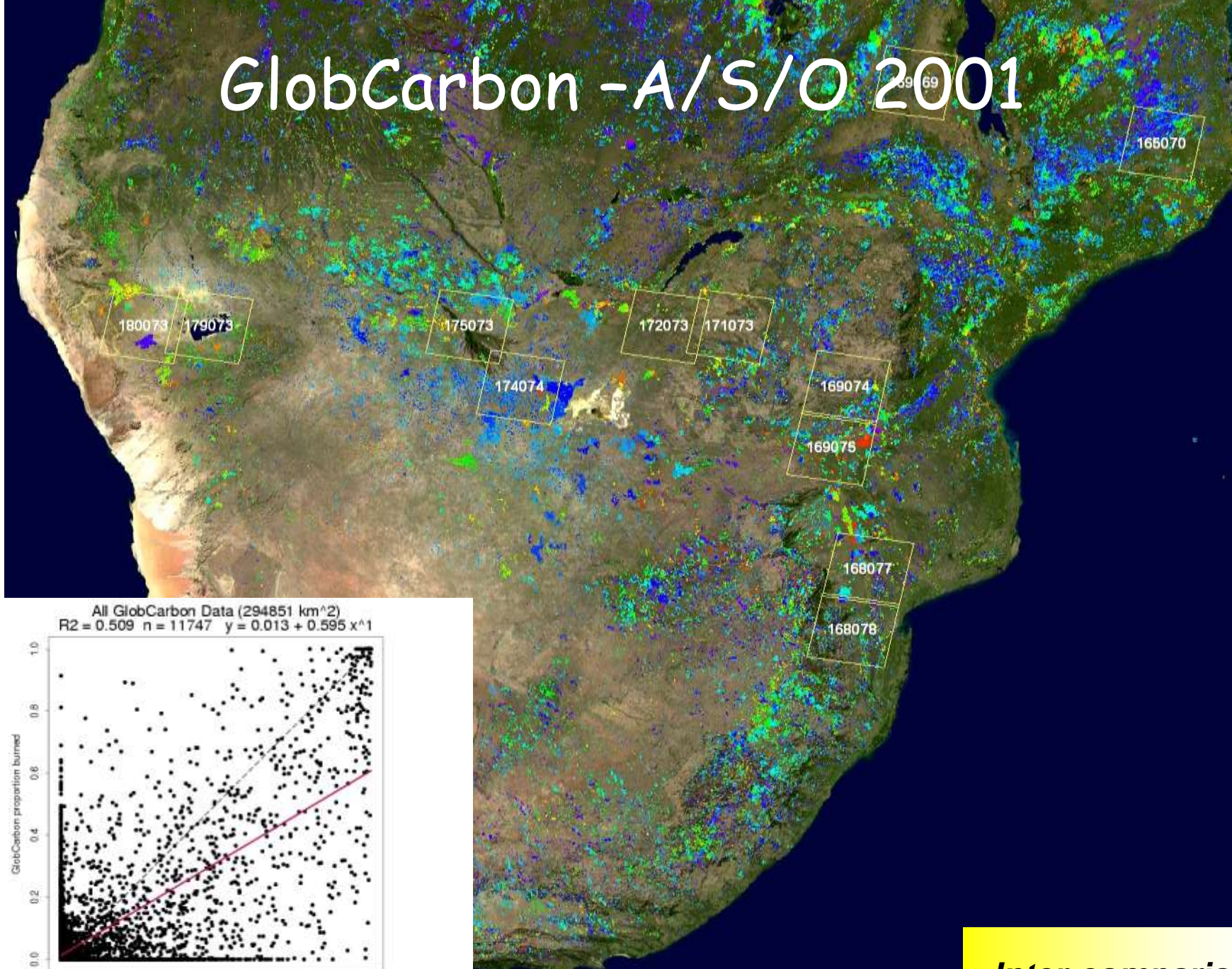
Garrigues, et al., (in press). Validation and Intercomparison of Global Leaf Area Index Products Derived From Remote Sensing Data, *JGR*.

L3JRC - A/S/O 2001

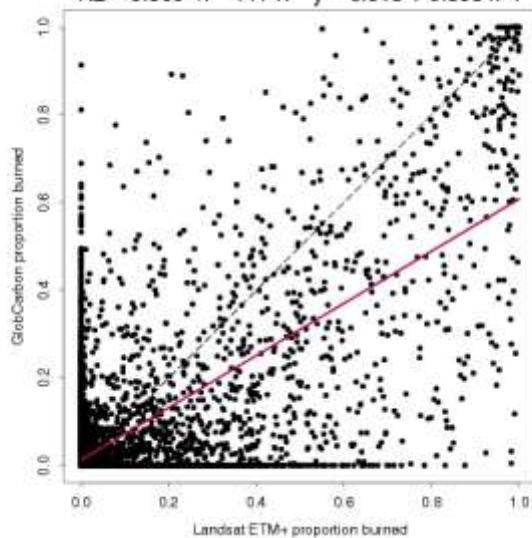


Inter-comparison

GlobCarbon - A/S/O 2001

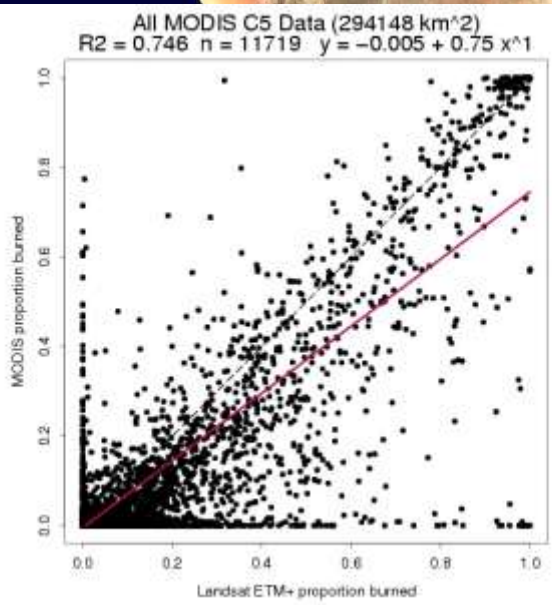
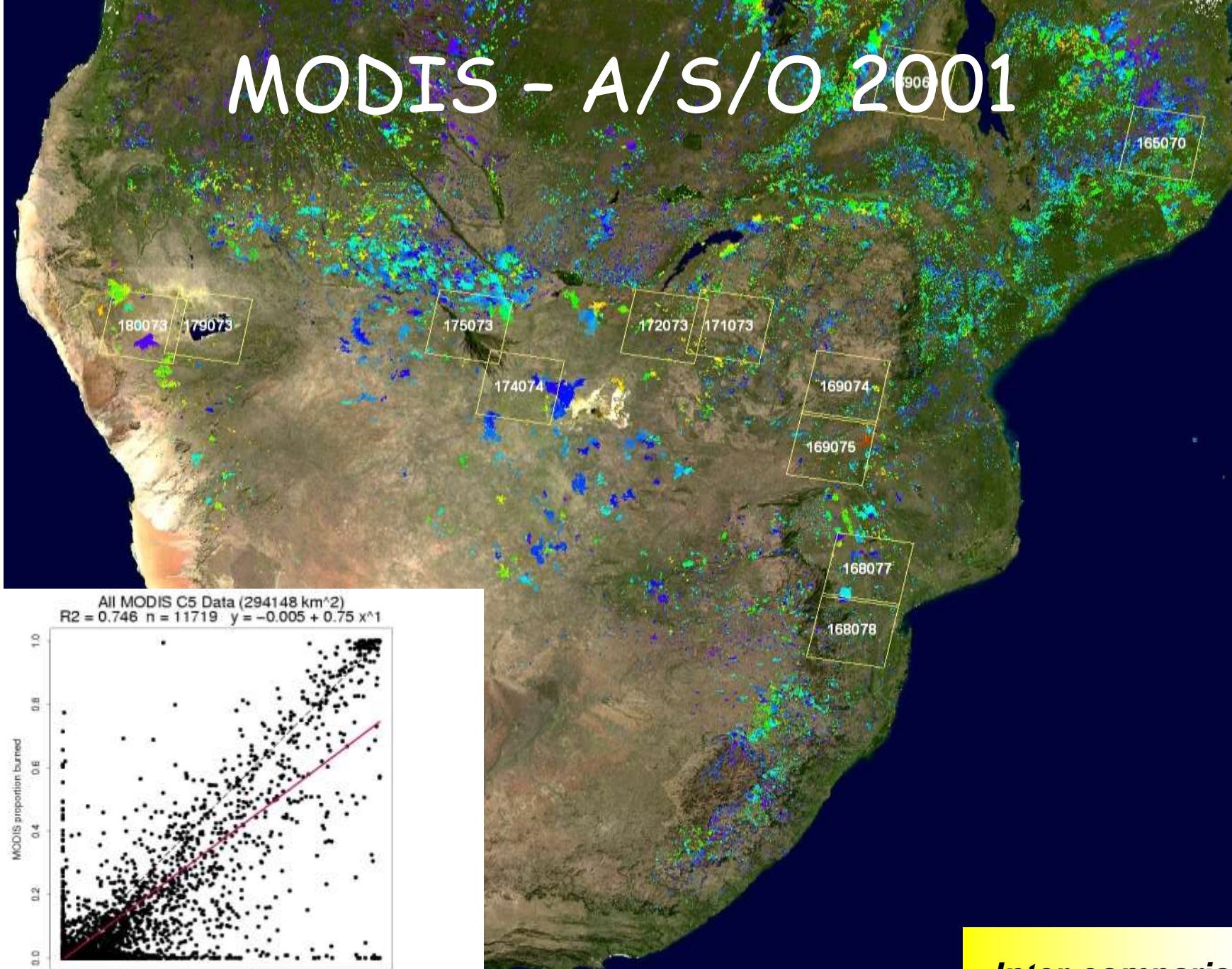


All GlobCarbon Data (294851 km²)
R² = 0.509 n = 11747 y = 0.013 + 0.595 x¹



Inter-comparison

MODIS - A/S/O 2001



Inter-comparison



Land C6 Straw-man Time-line



- May 2008 List of L1 C6 changes defined
- June 2008 List of Land C6 changes defined and a straw-man C6 plan developed
- ???? 2008 Period for community comment/review on proposals
- ???? 2008 Science tests of C5 Atmos. and Land products with C6 L1 software
- ???? 2009 Delivery of Land C6 algorithms
- ???? 2009 Science testing of Land C6 algorithms
- ???? 2009 Start C6 L1 production with current C5 Atmos and Land algorithms
- ???? 2009 Start of Land C6 reprocessing; @ 16.5X reprocessing would finish by ???? 2010



C6 Planning

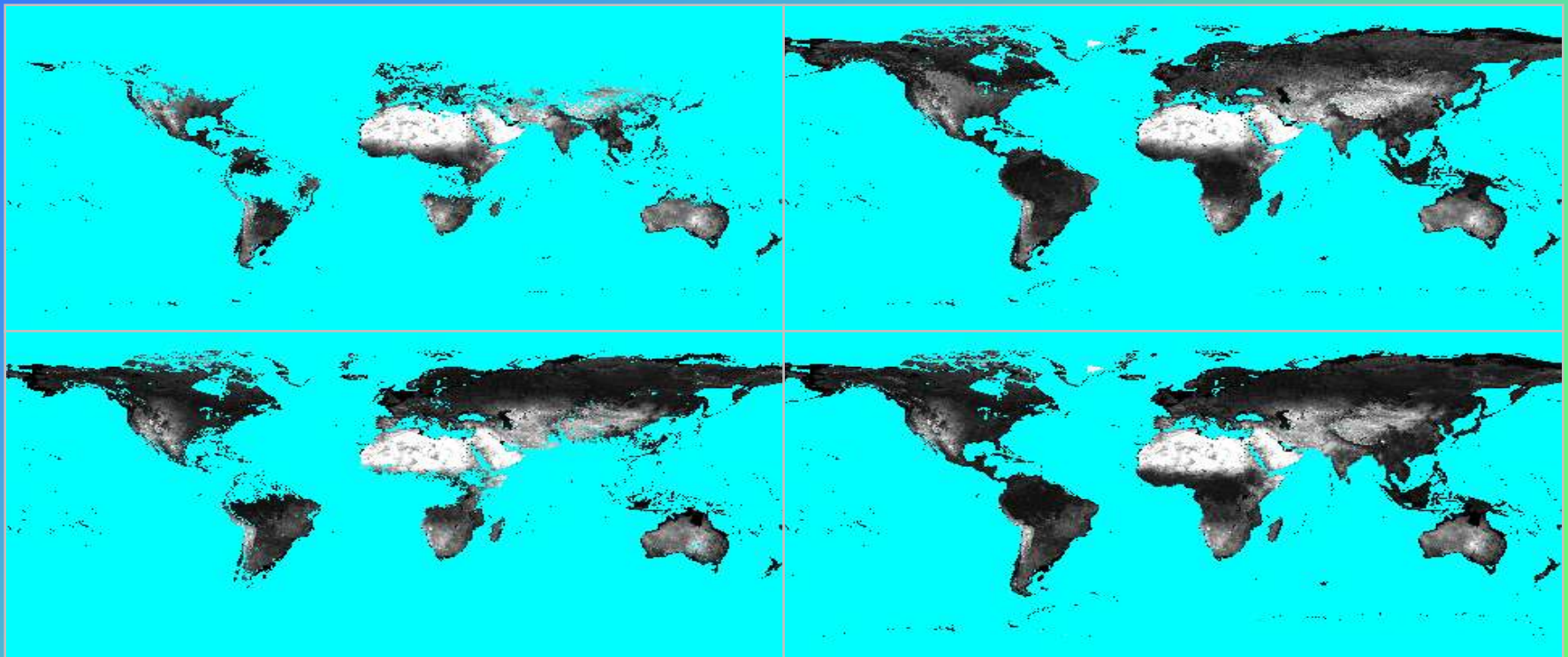


- Need time for community to evaluate C5
- For some products C5 will be the last reprocessing – VI, LAI
- Agreed on greater community outreach on C6 – including availability of C6 test data sets
-

MODIS and VIIRS

Albedo and Reflectance Anisotropy (BRDF)

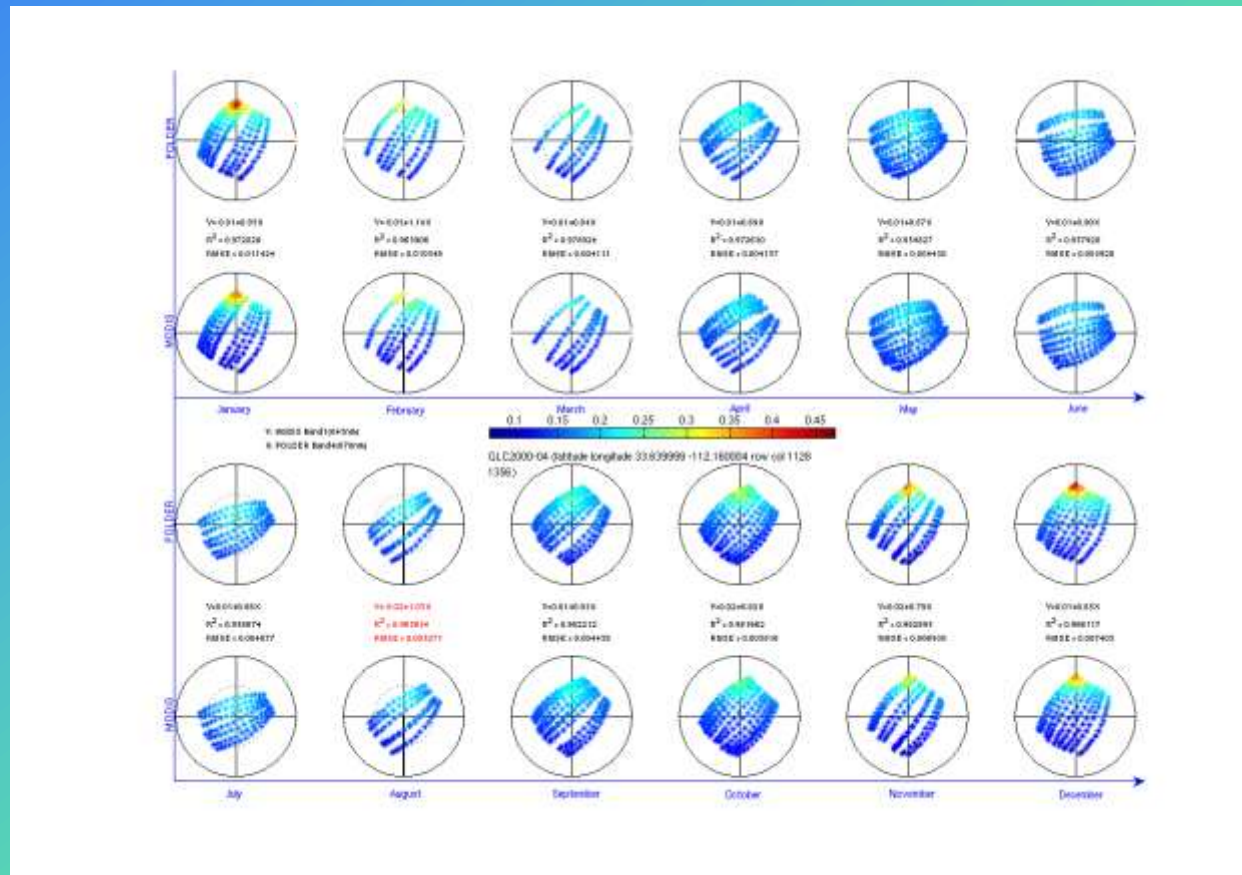
- Gap-filled Global 30arc sec BRDF Product (continued collaboration with the Atmosphere Team)



5-year composite maps of the MODIS BRDF at Band1 using high quality full inversions only (Left) before gap-filling and (Right) after gap-filling in January (Top) and July (Bottom). Histogram stretch: 0-388.

MODIS and VIIRS Albedo and Reflectance Anisotropy (BRDF)

- Validation with POLDER-3/PARASOL
 - Selection of sites for a variety of land covers Nov 2005-Oct 2006.

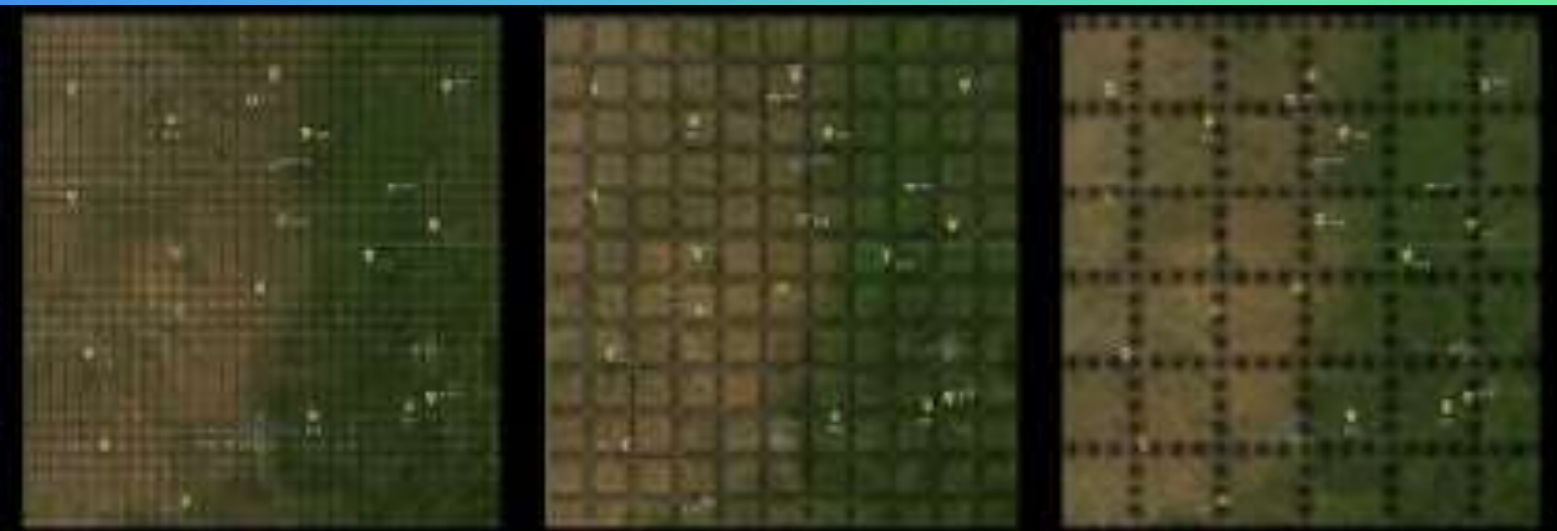
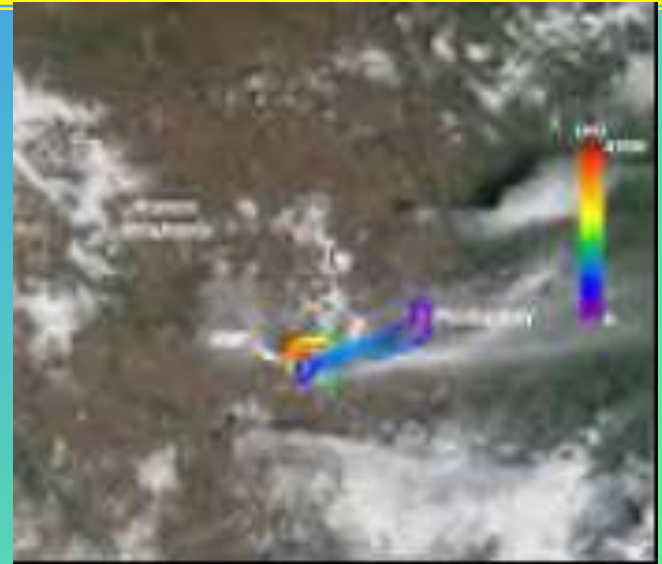


MODIS and VIIRS

Albedo and Reflectance Anisotropy (BRDF)

- CLASIC field campaign over the ARM Southern Great Plains site
- Tower data
- Cloud Absorption Radiometer

J-31 CAR Flight Track Map

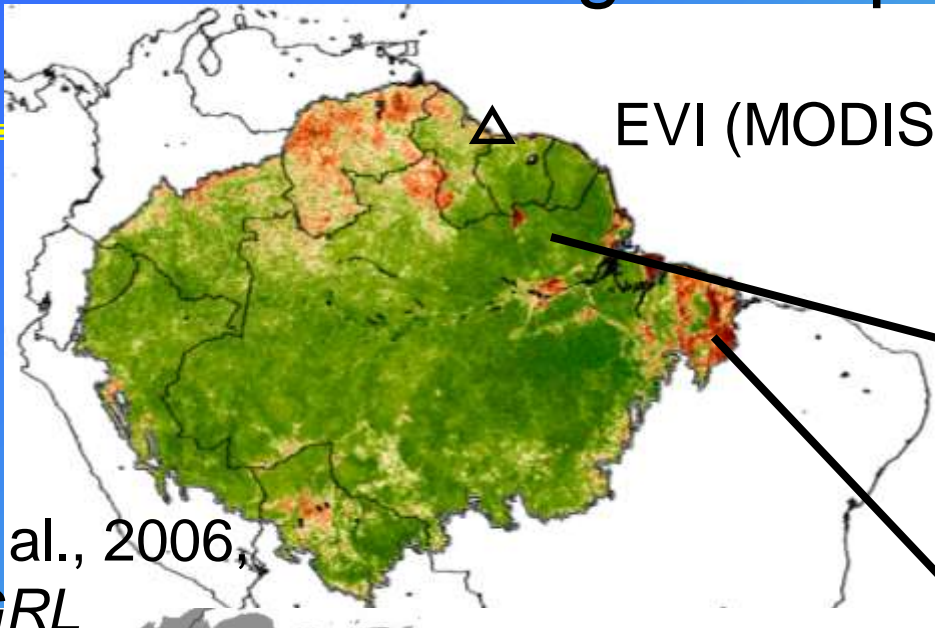
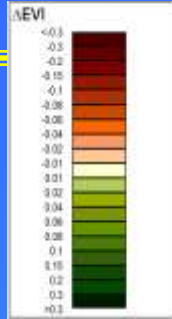


250-500m

1km

0.05degree

Amazon forests green-up in the dry season

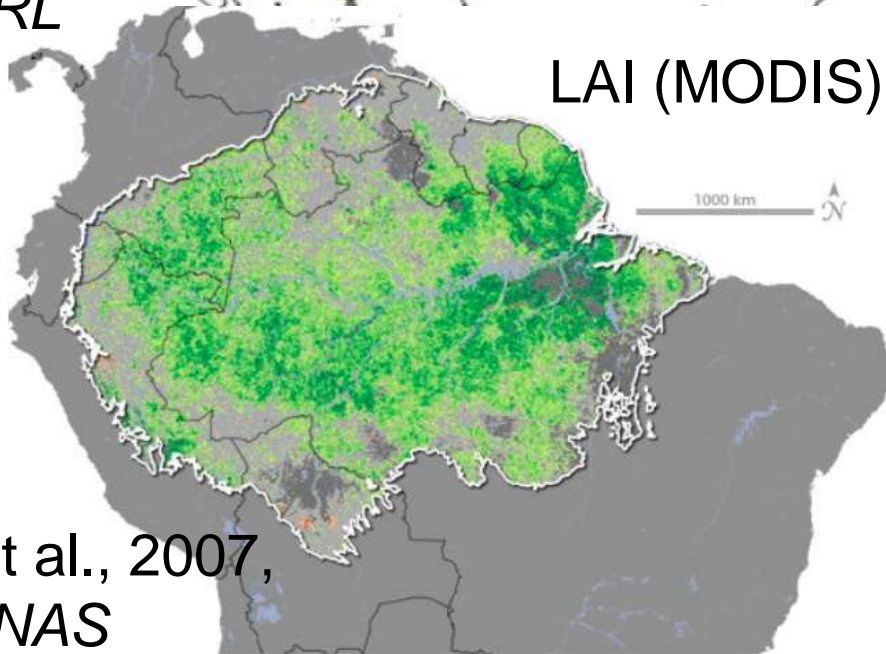


EVI (MODIS)



Rainforest greens up

Huete et al., 2006,
GRL

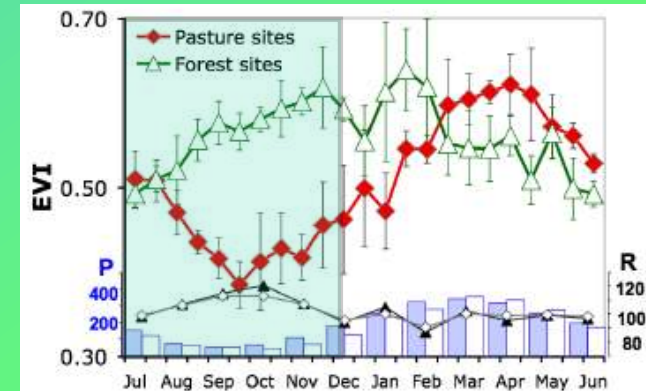


LAI (MODIS)

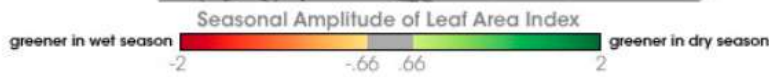


Converted land dries out

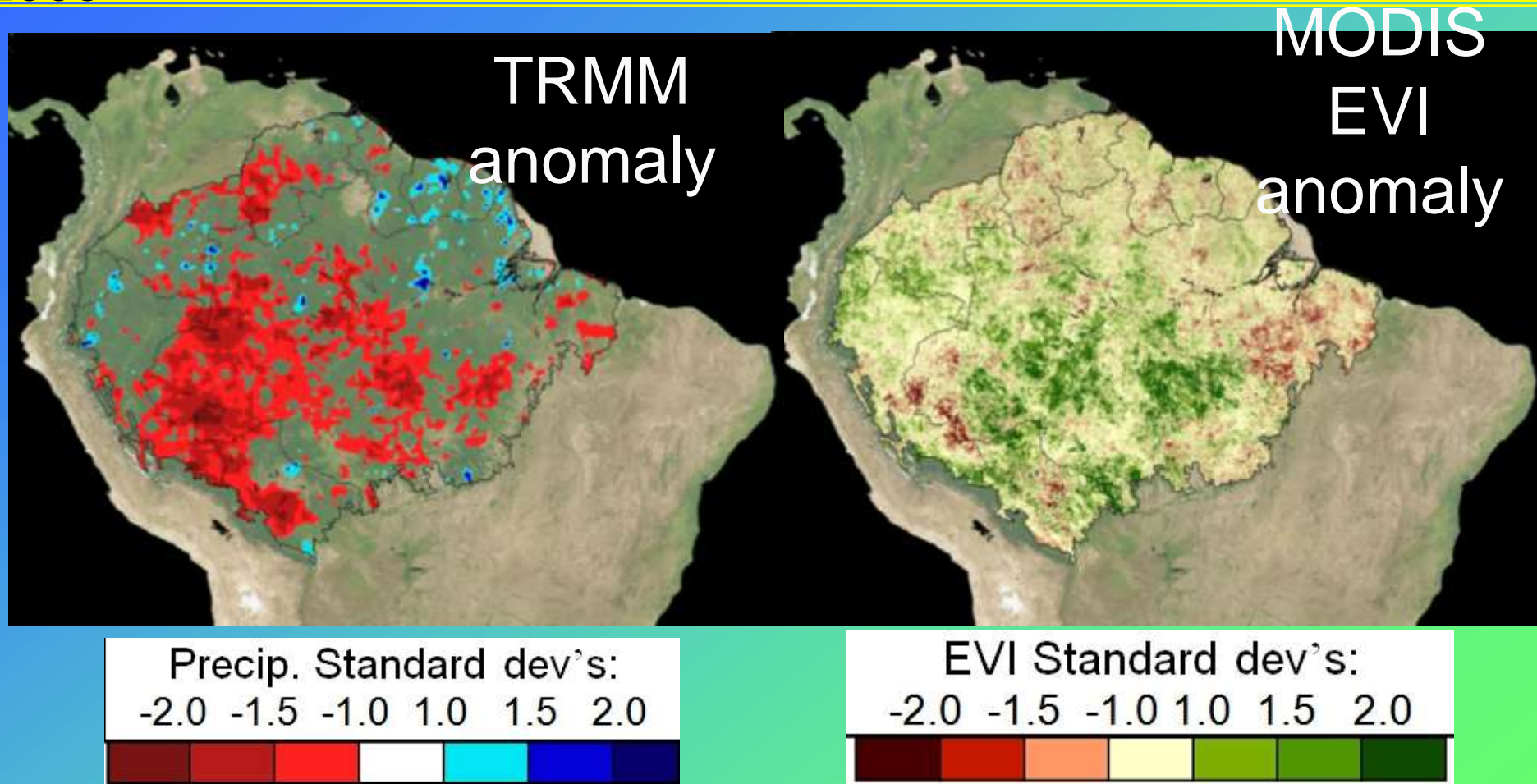
Myneni et al., 2007,
PNAS



dry 'sunny' season rainy season

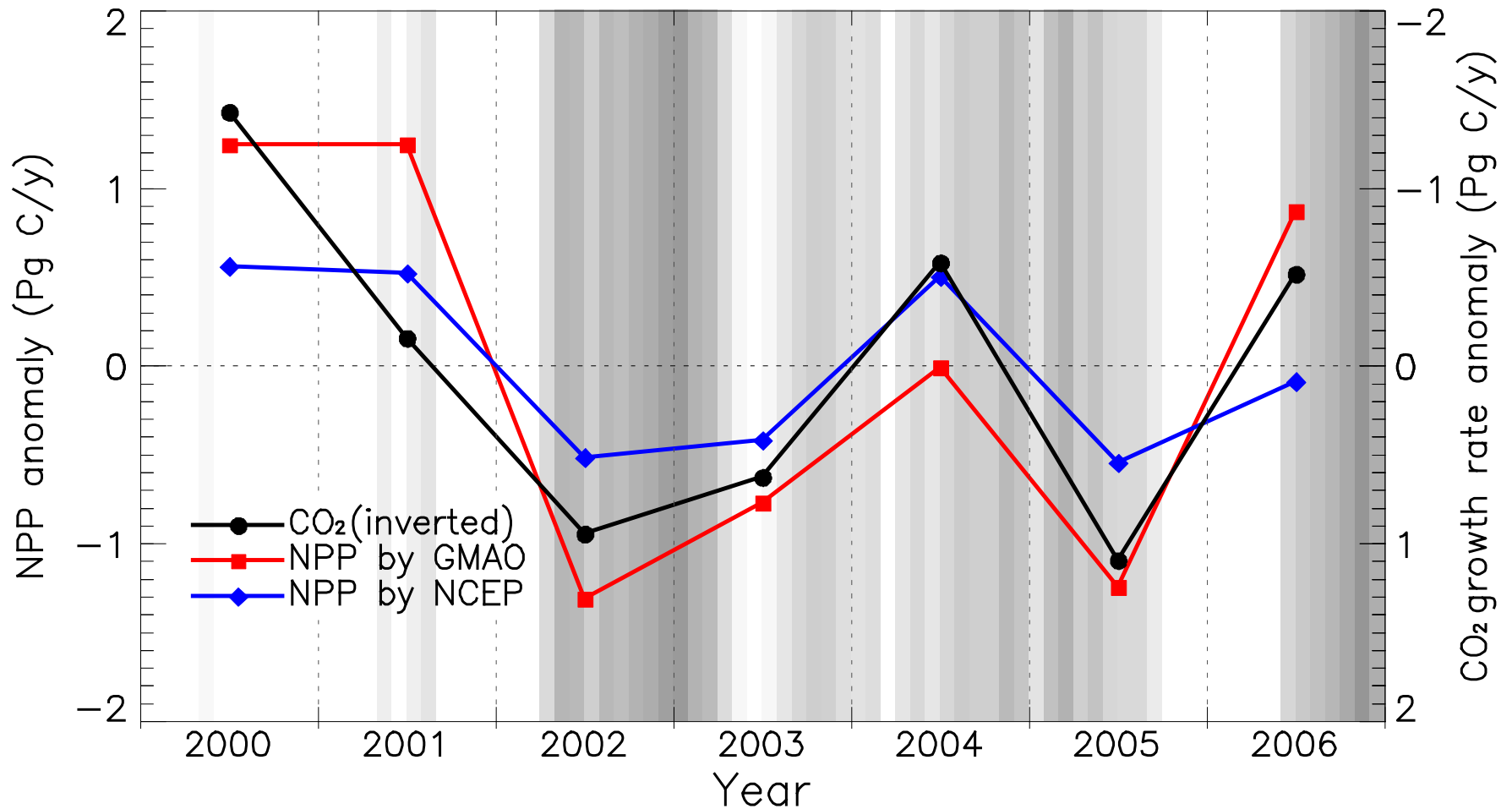


Amazon rainforest more productive and highly resilient to short term climatic anomalies such as the intense drought in 2005



- Rainforest was resilient to short term climatic anomalies and

Global MODIS NPP vs. inverted CO₂ interannual growth rates



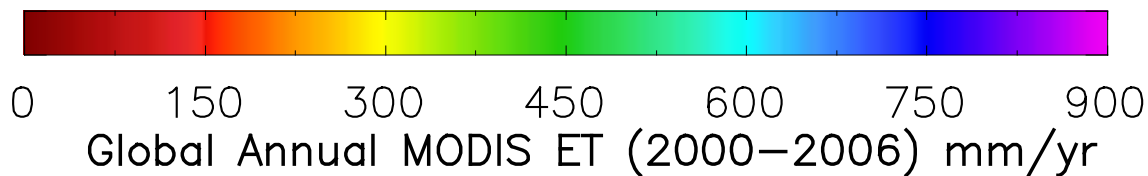
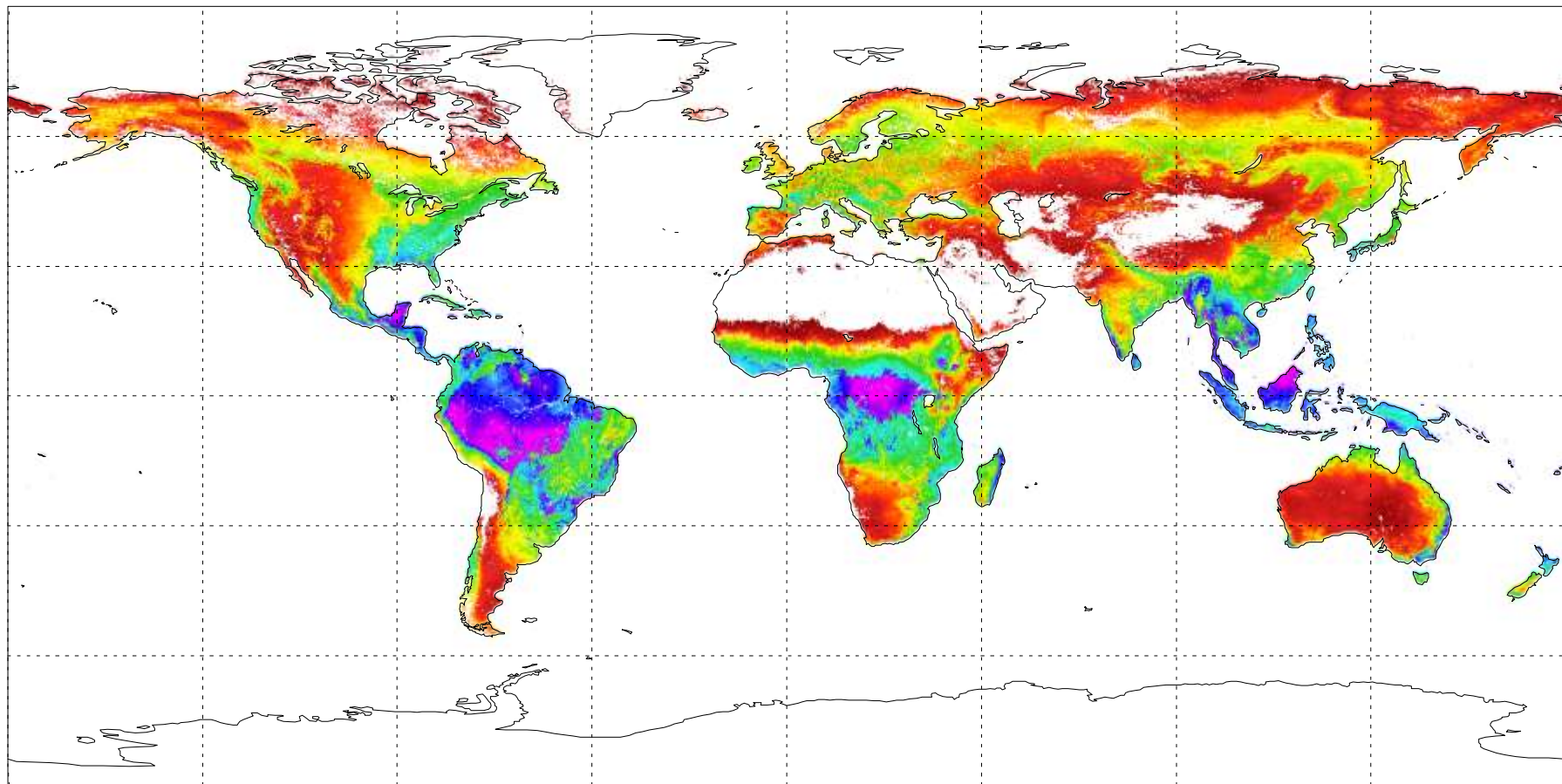
Correlation between MODIS NPP and inverted CO₂ annual growth rate anomalies

NPP by GMAO 0.872 2000~2006 $p < 0.006$

NPP by NCEP 0.866 2000~2006 $p < 0.006$

University of Montana

A new data set: MODIS Evapotranspiration



University of Montana



Measurement Portal



Vegetation Parameters



Land Cover / Land Use Change



Surface Radiation Budget



Land Hydrosphere

09_095

Sensors

Spatial Resolution Greater Than 1km

- AATSR – IRS-2
- ATSR – IRS-1
- AVHRR – NOAA POES
- AVHRR/3 – MetOp
- GOES Imager – GOES
- POLDER 1-2 – ADEOS 1-2
- SEVIRI – Meteosat Second Generation
- Vegetation – SPOT 4-5
- VIIRS – TBMM

Spatial Resolution 10m - 1km

Spatial Resolution Less Than 10m

Microwave Sensors

Planned Sensors

Current News

- May - 2008 [New Proposed Satellite Mission – Kyoto](#)
- Apr - 2008 [Imagery for Everyone](#)
- Mar - 2008 [CIMETSAT and JRC agree to cooperate on monitoring climate change](#)
- Mar - 2008 [First Global L.C. Map at 300m](#)
- Mar - 2008 [Arctic Ice Returns, Thin and Tentative](#)

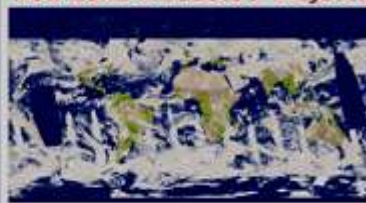
[Full Archive](#) [Submit Article](#)

Upcoming Meeting Schedule

- Sep 1 : Sep 4, 2009 [GOSS-# User Conference](#)
- Nov 10 : Nov 14, 2008 [LCLUC Science Team Meeting - Thailand](#)
- Nov 3 : Nov 7, 2008 [ALOS-R Workshop](#)
- May 27 : May 30, 2008 [GOSS in the Americas](#)
- May 13 : May 15, 2008 [VIIRS-MODIS Science Team Meeting](#)

[Full Schedule](#) [Submit Meeting](#)

New Land Products / Projects



LTDR is a NASA-funded REASON project to produce a consistent long-term data set from AVHRR and MODIS instruments for climate studies. [Read more...](#)

[Advertise New Products or Projects](#)

International Coordination

The international community has established several organizations to coordinate efforts and requirements for current and future missions:

- [Group on Earth Observations \(GEO\)](#)
 - [Global Agricultural Monitoring System](#)
- [Committee on Earth Observation Satellites \(CEOS\)](#)
 - [Working Group on Calibration / Validation](#)
 - [Working Group on Information Systems and Services \(WIGSS\)](#)
 - [Land Product Validation \(LPV\) Subgroup](#)
- [International Global Observations for Land \(IGOL\)](#)
- [Global Terrestrial Observing System \(GTOS\)](#)
 - [Global Observation of Forest and Land Cover Dynamics \(GOFGLD\)](#)
 - [Land Cover Implementation Team](#)
 - [Fire Implementation Team](#)
 - [Land/Vegetation Direct Readout](#)
 - [Climate Observations](#)
 - [Terrestrial Carbon](#)

Mission to Measurements

The NASA Earth science research program's Carbon Cycle and Ecosystems Focus Area and Water and Energy Cycle Focus Area are establishing a Land Measurements Team to address their observation needs for science-quality time series data records.

The new measurement team is intended to shift the emphasis away from individual mission-oriented data sets to measurements to meet the needs of the focus areas that utilize observations from different missions and instruments.

NASA ESDRs

[Click To View White Papers](#)

The NASA Land Measurements Team addresses the observation needs for science-quality time series data records, to be called "Earth System Data Records" (ESDRs). These ESDRs will meet the needs of both the research and applied science communities of NASA. The ESDR white papers are intended as a basis for measurement team discussion.

Quick Data Search

Select Product:

Refine by Spatial Scale: ≤ 500m > 500m
 Refine by Temporal Scale: ≤ Monthly > Monthly

Land Measurements Portal

Information on:

- Land Product Suites
 - ESDR's / CDR's
 - LTDR's
 - EDR's
- Products
 - DAAC's
 - SCF's
 - PI web sites
 - Validation status
 - Sensors
 - Intn'l Data Sets
- Intn'l Coordination
- Upcoming meetings