Land Report Back

Chris Justice
Land Discipline Chair

Topics

- New Team Functions
- Some Recent MODLAND Highlights
- Discussion - User Feedback and Outreach
- Breakout Sessions
  - Vegetation Indices
  - MODIS for Modelers
  - Land CDR's
- Summary Next Steps for Land

Overview

- **New MODIS Land Team**
  - **Multiple Functions**
    - Continued Monitoring and Characterization of instrument performance
    - Continued Product Generation, Product Maintenance and Validation
    - Contributing to ESE Science Goals - utilizing MODIS land products in ESE science and applications
    - Developing and Tesingt New / Improved Land Algorithms
      - **Plant Water Content**
      - **Evaporation**
      - **Surface Reflectance**
      - **Continuous Fields of Biophysical Parameters**

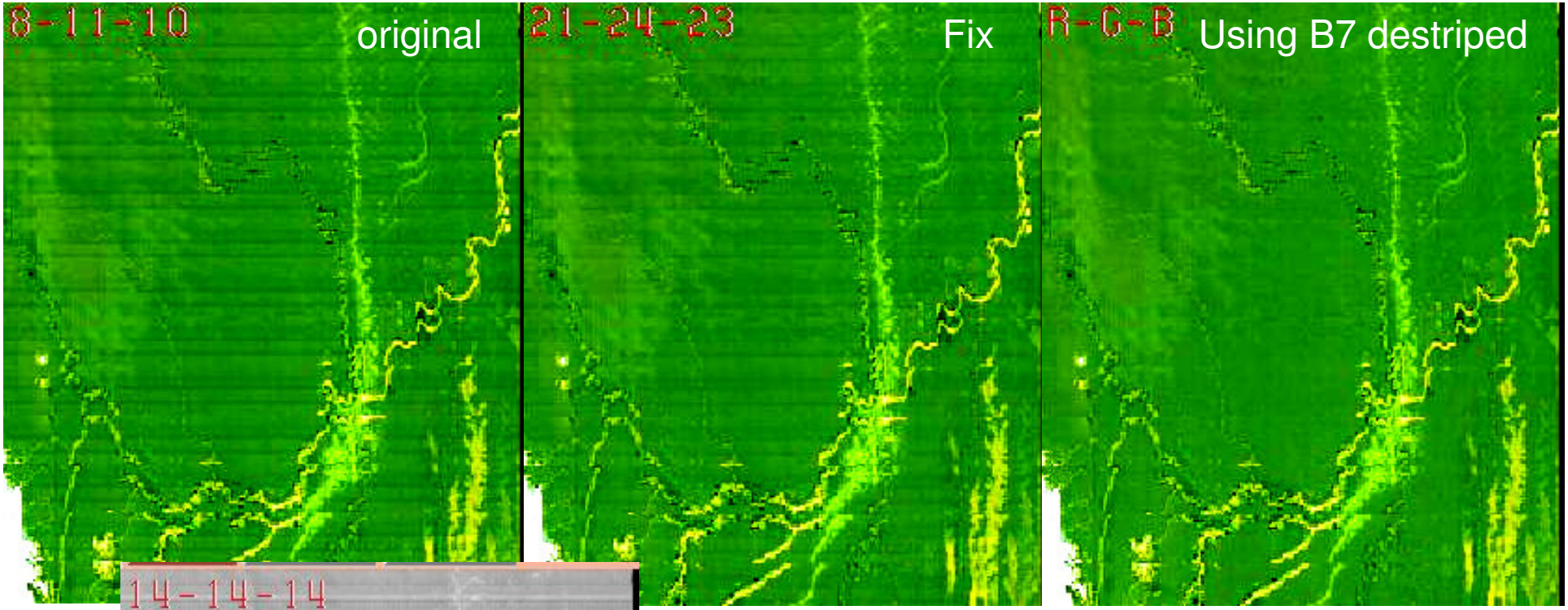
- **Actively contributing to emerging ESE Land focus – moderate resolution component**
  - **Stewardship of a suite of maturing Land Products**
    - » Continued and timely data production
    - » Product Refinement / Reprocessing
    - » Developing / Applying Quality Assessment (QA) procedures
    - » Establishing and Applying Validation Protocols (Stage 2)
  - **Outreach to and feedback from the community of data users**
    - » Science and Applications Users
  - **Guiding land data system development**
    - » Enhancing MODAPS
    - » Enhancing MODIS Rapid Response
    - » Supporting REASON project

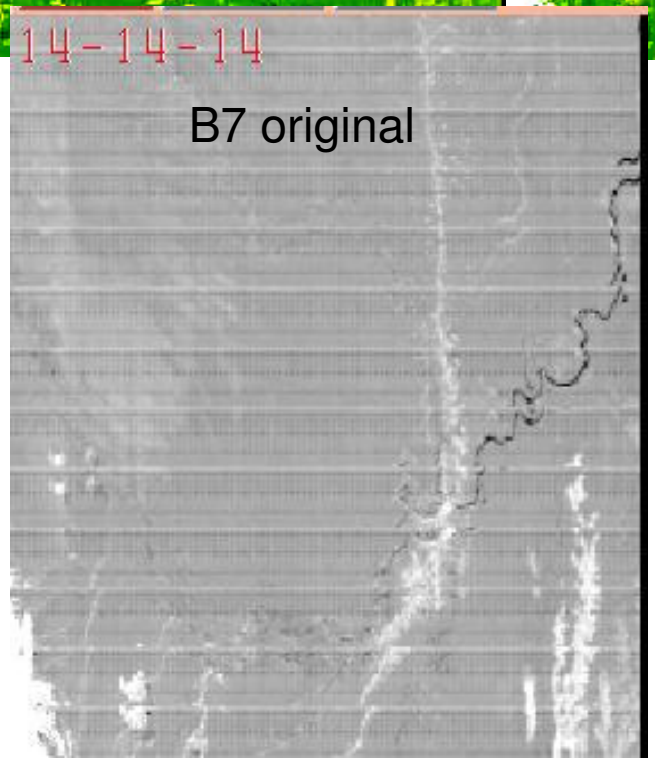
- **Transitioning MODIS capabilities and lessons to Operational Domain**
  - » MODIS to NPP VIIRS
  - » MODIS integrated in decision support
- **Defining and Prototyping CDR's**
  - » REASON Land Long Term Data Record – AVHRR>VIIRS
- **Contributing to the international observation coordination efforts**
  - » GTOS GOFC/GOLD - Data Access and Use
  - » CEOS Land Product Validation (LPV)
  - » IGOL, GEOSS – future observation coordination

Instrument: issues being tracked

- Reflective bands calibration accuracy and stability (comparison Aqua-Terra on desert sites shows agreement 1-2%) – Green
- Noise appearing in the Terra longwave bands (being tracked) – Orange
- Striping in SWIR (esp. Band7), several methods are being evaluated (eliminating noisy detector, atmosphere de-striping, Xtalk correction – MCST) – Red
- Polarization correction to be used for aerosol inversion over Land at 412nm (characterization has been provided by MCST) – Yellow

- Modland Security Code



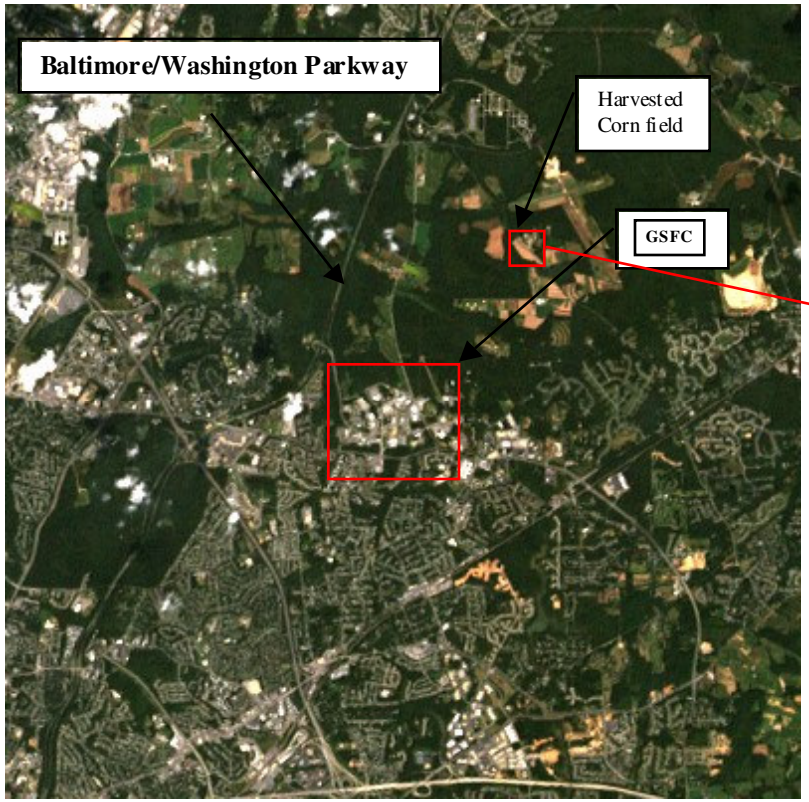


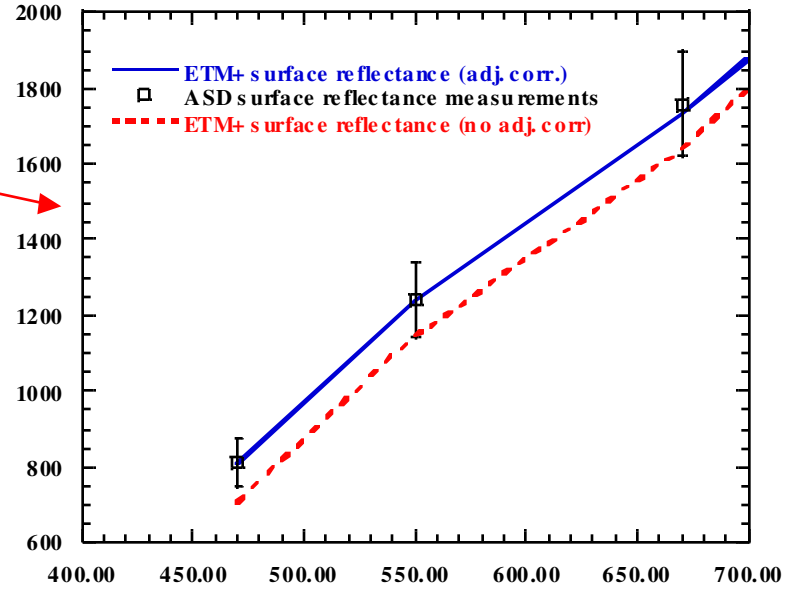
Band 7 used for Atmospheric Correction

The improvement by the “fix” is still showing stripes (but reduced),

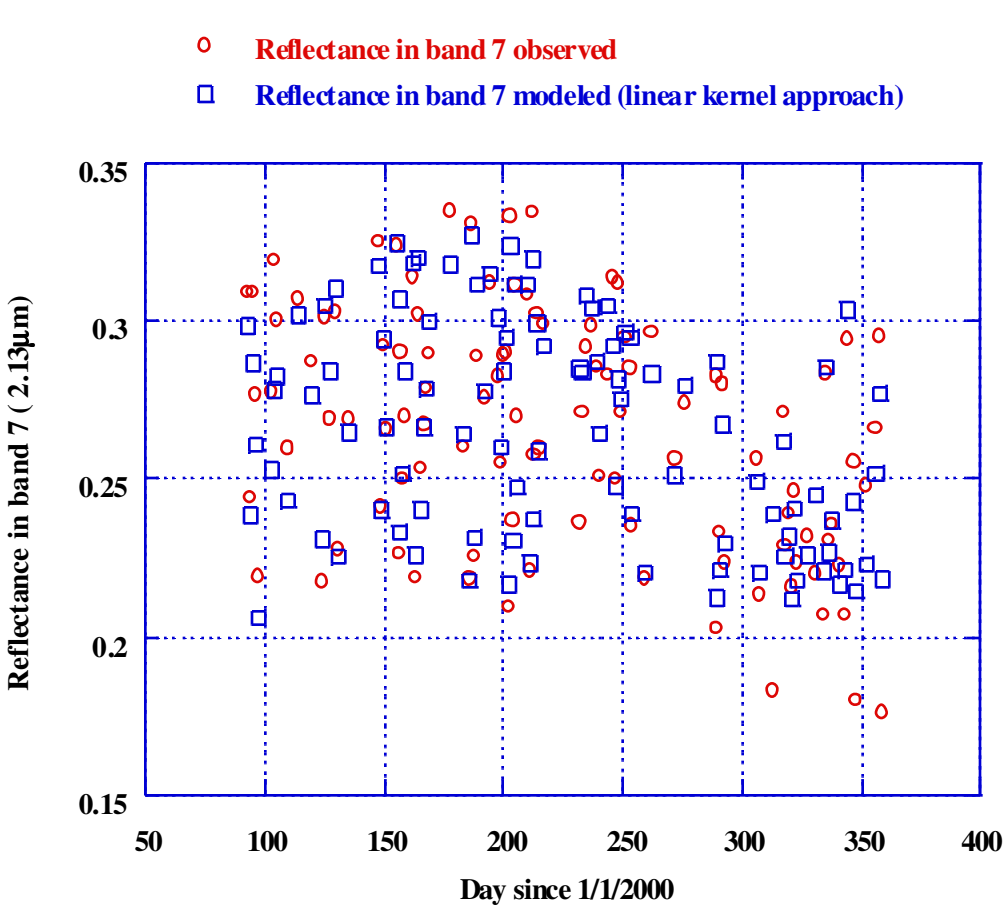
The version using the Level 1B de-stripped provided by atmosphere does not show any stripe.

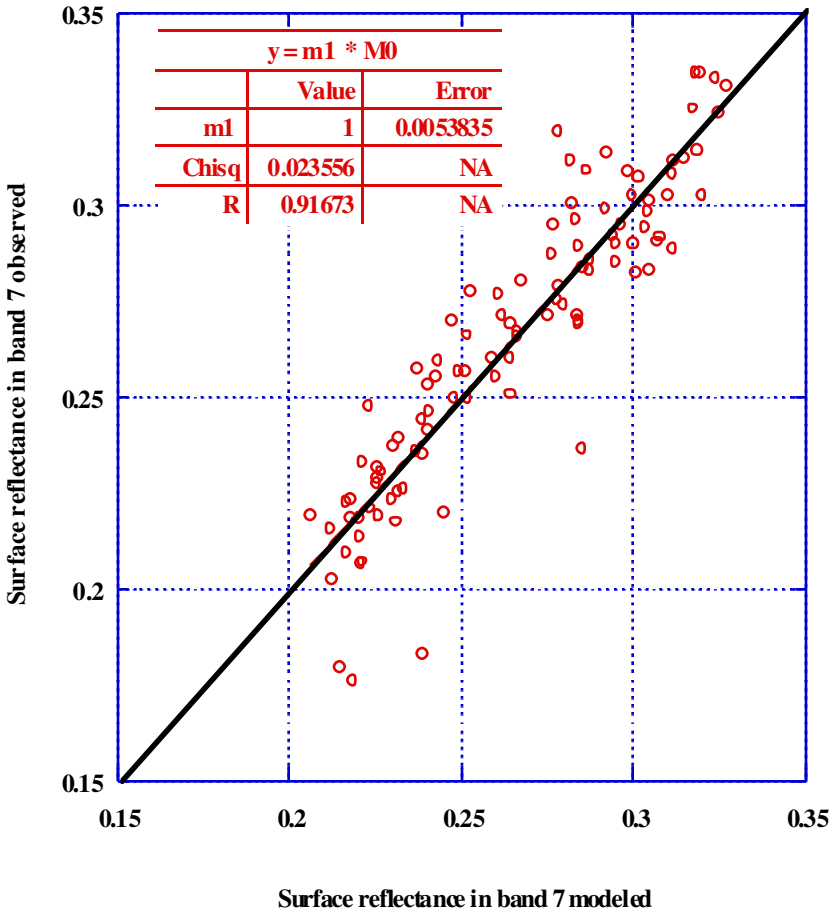
C5 - Improvements to Surface Reflectance Adjacency effect correction (validation)



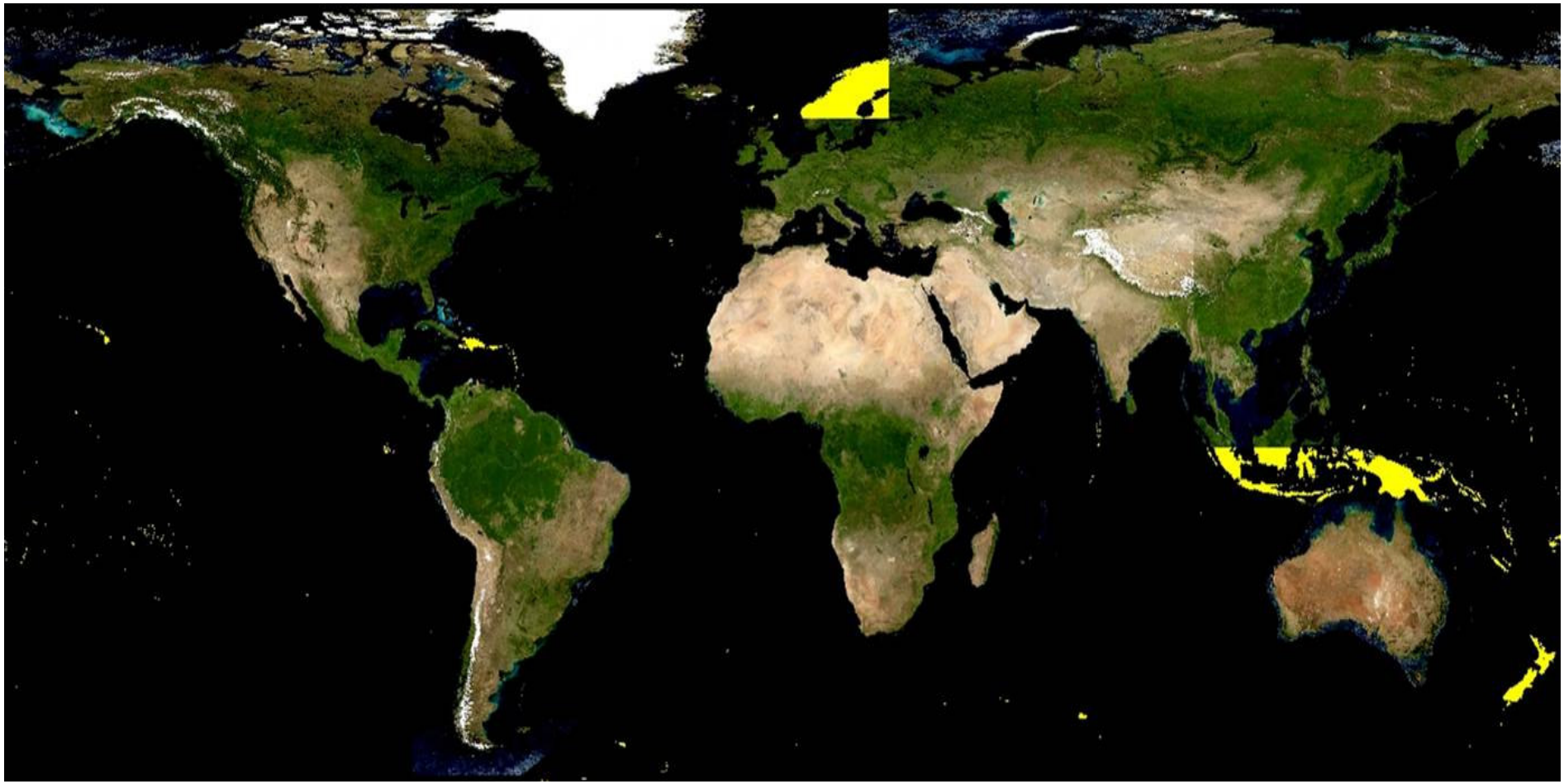


C5 - BRDF atmosphere coupling correction application to the Sevilleta site (New Mexico)



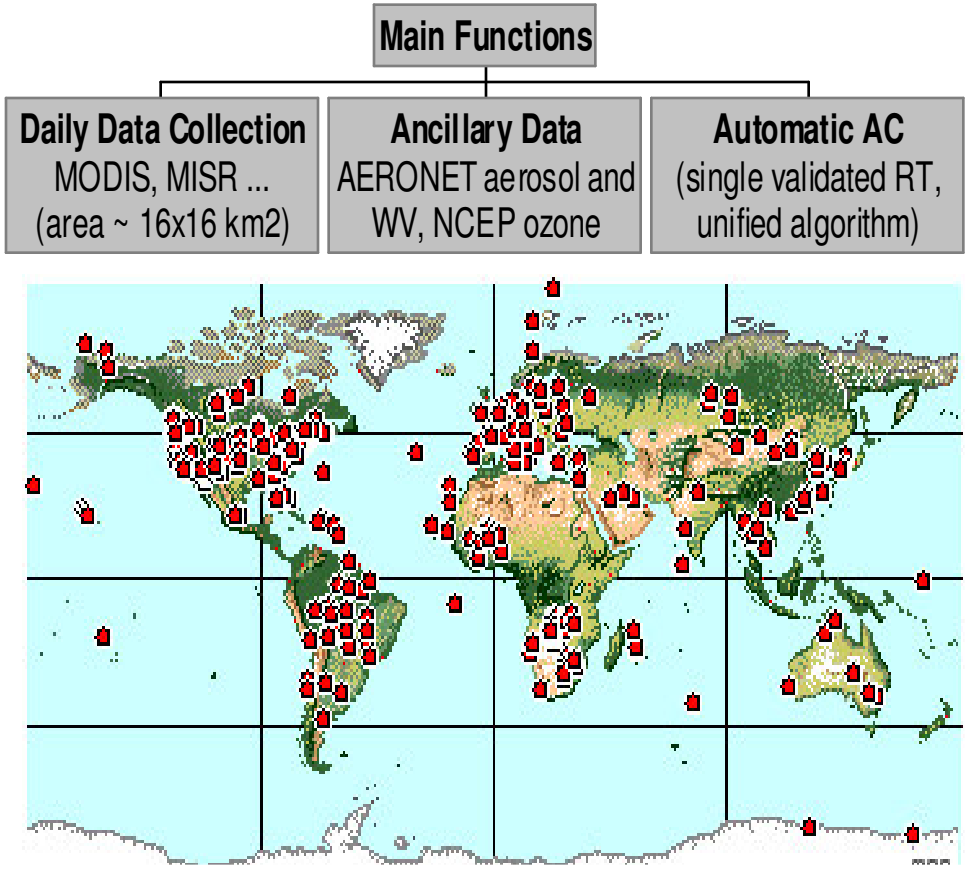


Global 500m Surface Reflectance cloud free composite status



A-SRVN - AERONET-based Surface Reflectance Validation Network

A. Lyapustin and Y. Wang,
GEST UMBC/NASA GSFC



PRODUCTS

BRDF

1. Point-wise in Observation Angles
2. Best-fit MRPV (MISR)
3. Best-fit Kernel (MODIS)

Albedo

1. Spectral
2. Shortwave Broadband (SB)
3. Spectral and SB Fluxes, PAR

Spectral Regression (for AOT retrieval)

1. 2.1 μm → blue & red

EXPECTED BENEFITS

1. Validation of surface albedo/BRDF at sensor's spatial & spectral resolution.
2. Development of global surface climatology for aerosol retrievals.
3. Way to MODIS – MISR data fusion.

Calibration Analysis

4. Vicarious calibration.
5. Cross-calibration of different sensors.
6. Detection of calibration trend based on a time series of surface reflectance.

MODIS Vegetation Index Products

- **Two indices**
  - NDVI (Continuity)
  - EVI (Enhanced)

$$EVI = G\frac{\rho_{NIR} - \rho_{red}}{\rho_{NIR} + C_1\rho_{red} - C_2\rho_{blue} + L}$$

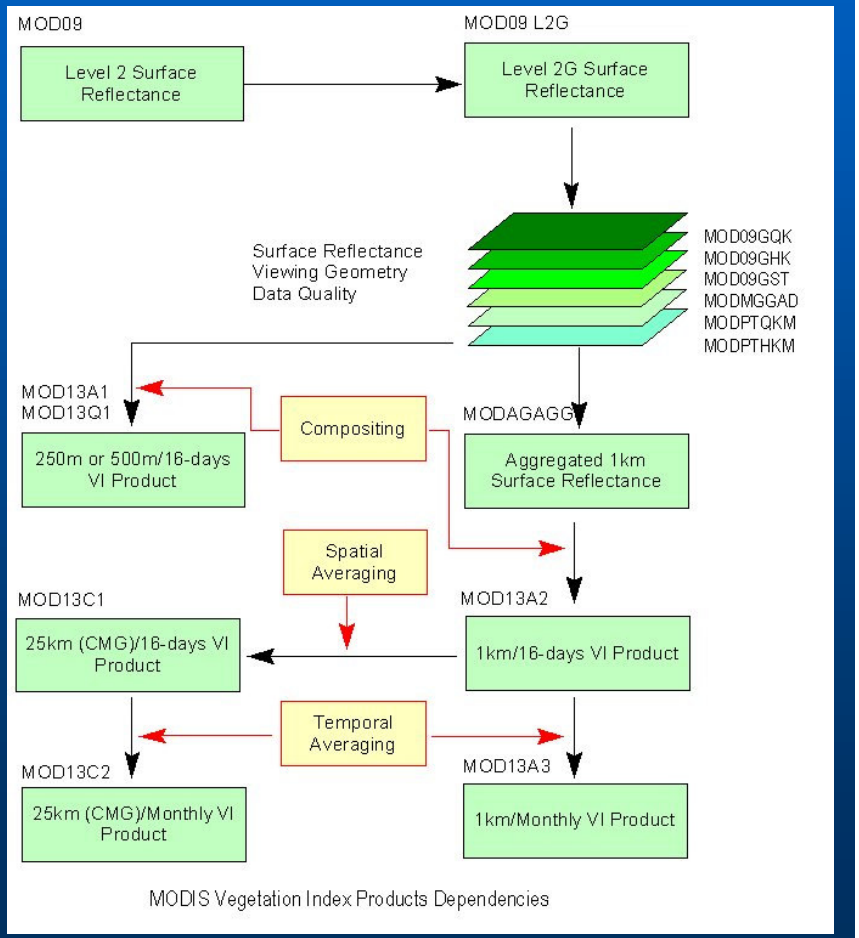
  - G, C1, C2, and L are coefficients

Each product includes

- NDVI, EVI, NDVI QA, EVI QA, Red, NIR, Blue, MIR, Sensor Zenith, Sun Zenith, Relative Azimuth
- Produced in L3 Tile units, that are ~1200 x 1200 km
- SIN grid projection (ISIN previous collections) except for the CMG products which are in the geographic projection

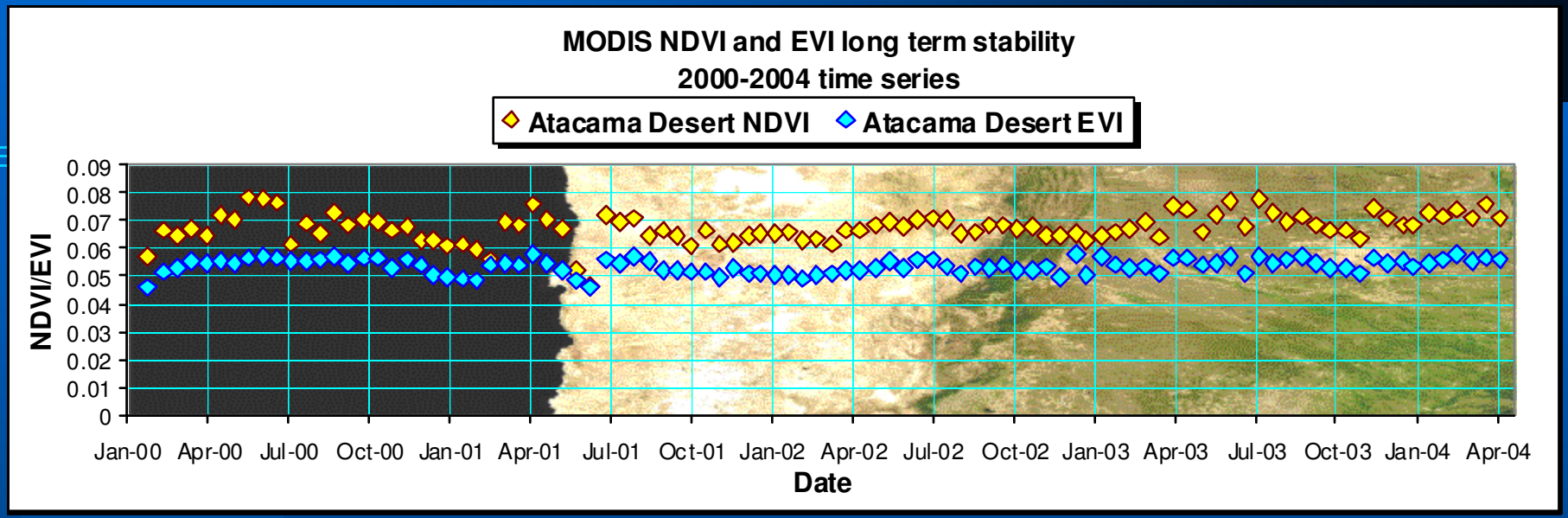
The Products are

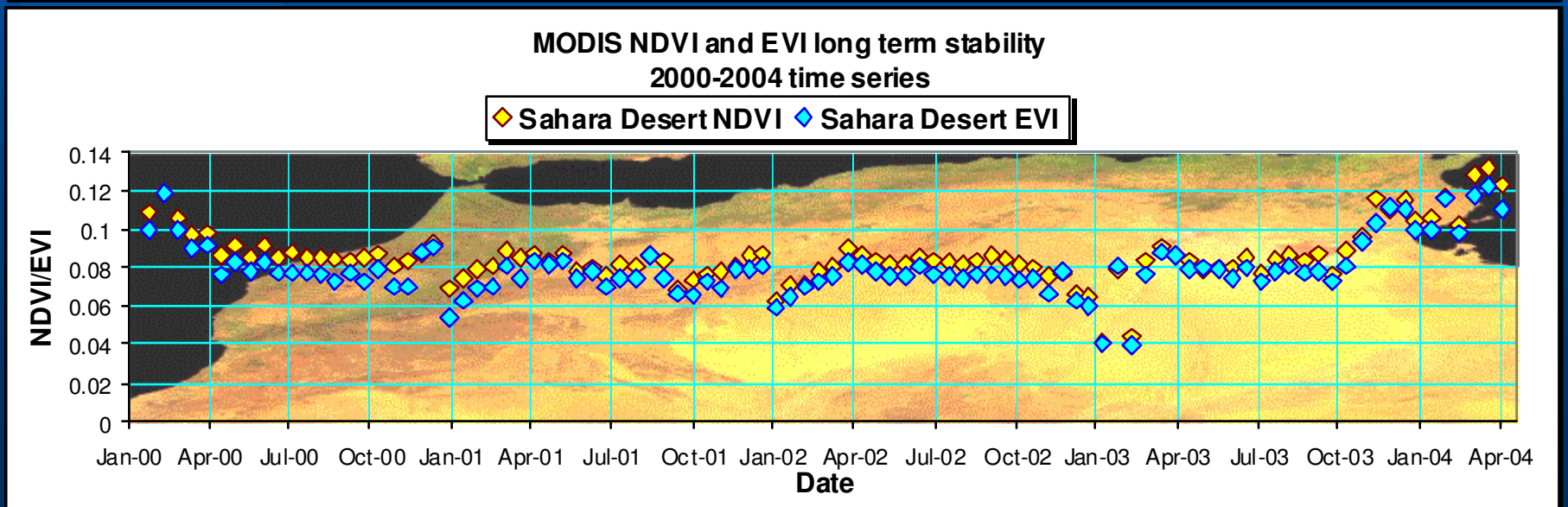
- MOD13Q1: 16-day 250m VI
- MOD13A1: 16-day 500m VI
- MOD13A2: 16-day 1 km VI
- MOD13A3: Monthly 1 km VI
- MOD13C1: 16-day 25 km VI (coarse resolution (CMG).
- MOD13C2: Monthly 25km VI (coarse resolution (CMG).



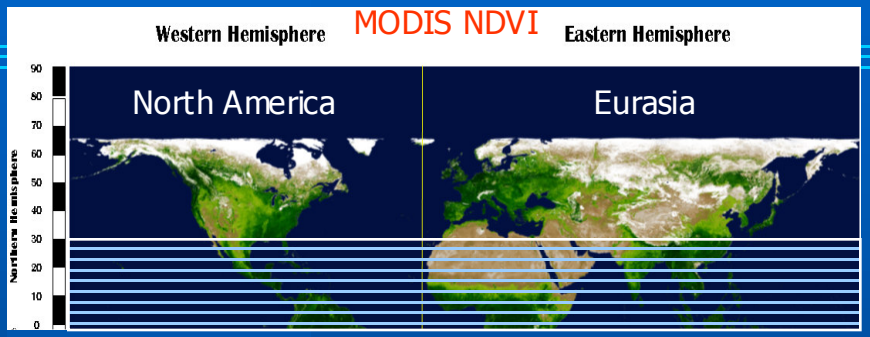
MODIS Vegetation Index Products Dependencies

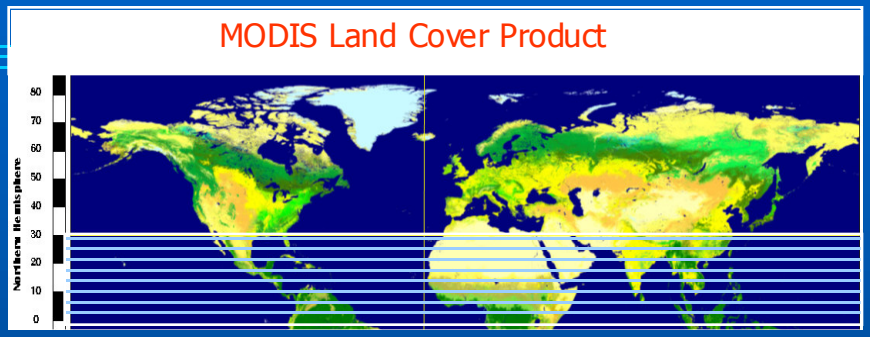
MODIS sensor (VIs) long term stability

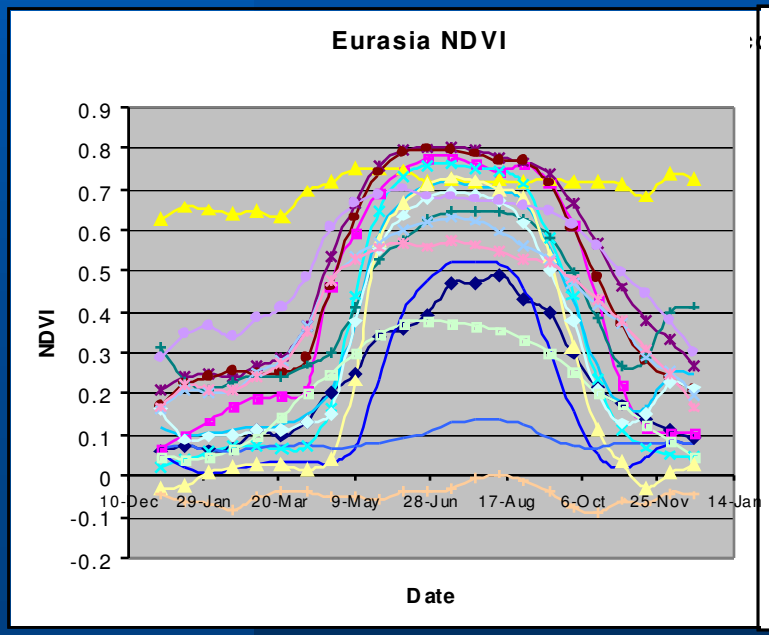


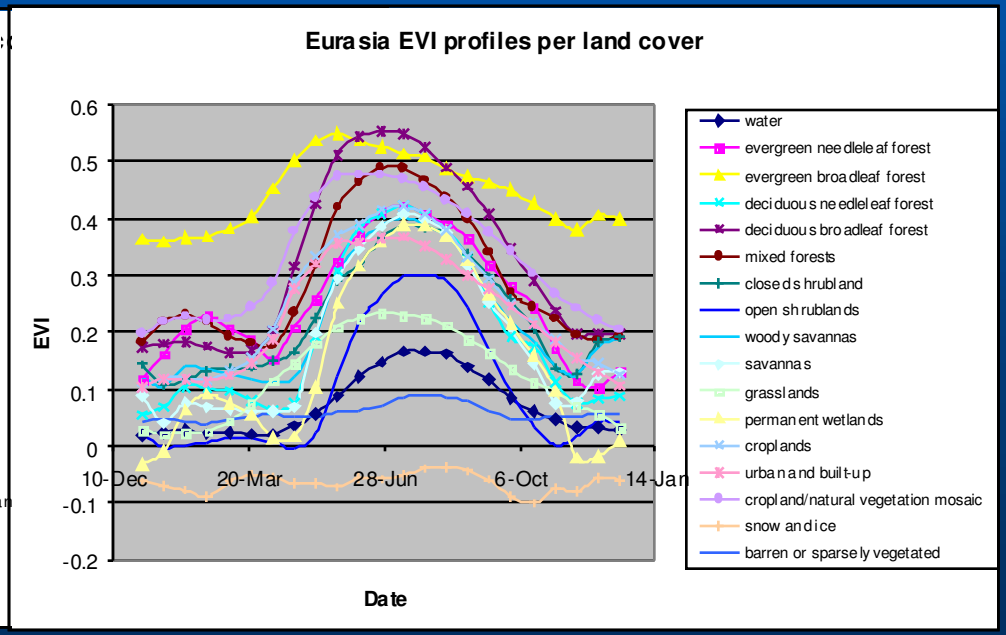


North America and Eurasia Vegetation Phenology Analysis (Feb. 2000-to-Dec. 2003)



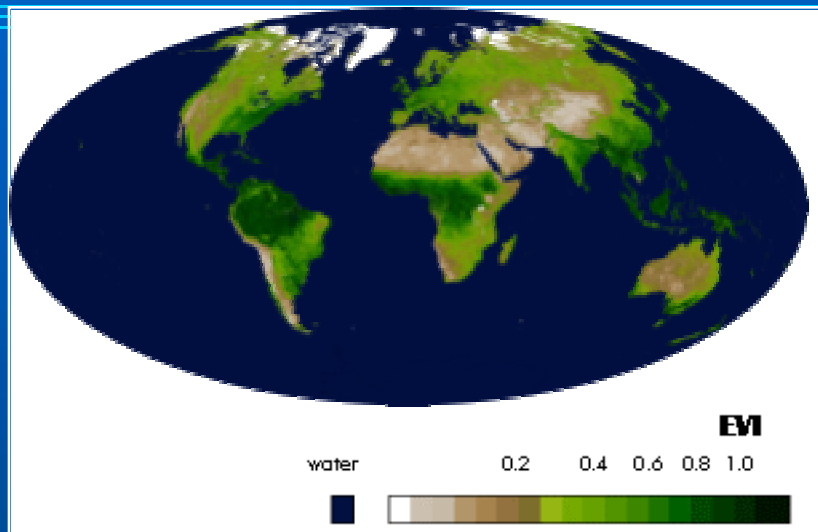


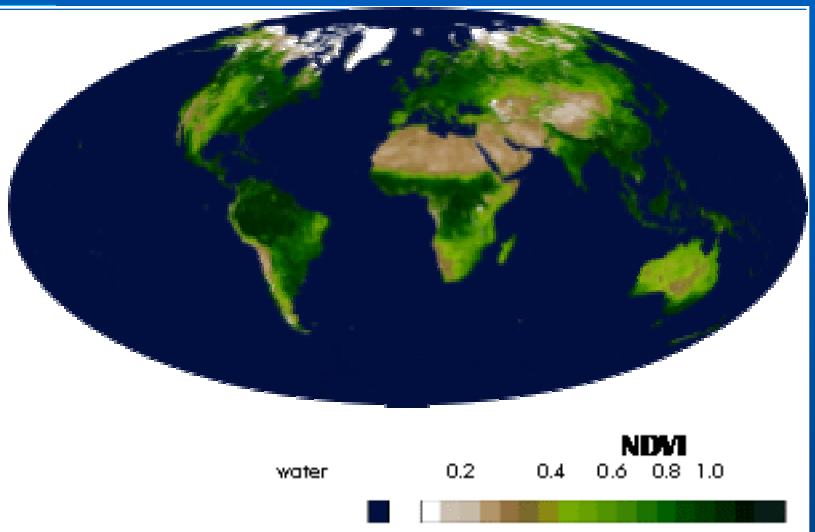


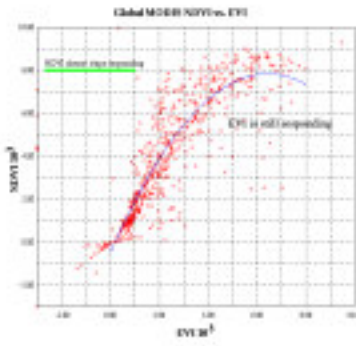


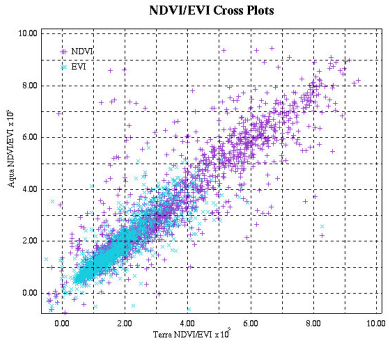
Eurasia MODIS Vegetation Index animation. Feb. 2000-Jan. 2004 NDVI time series

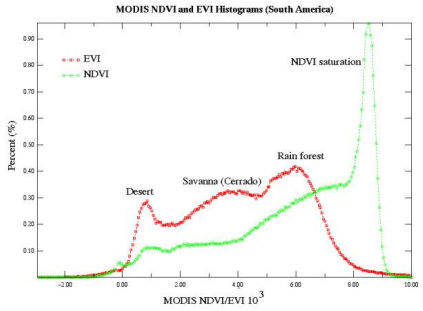
NDVI vs. EVI - comparisons

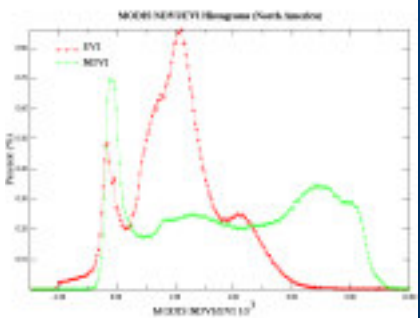






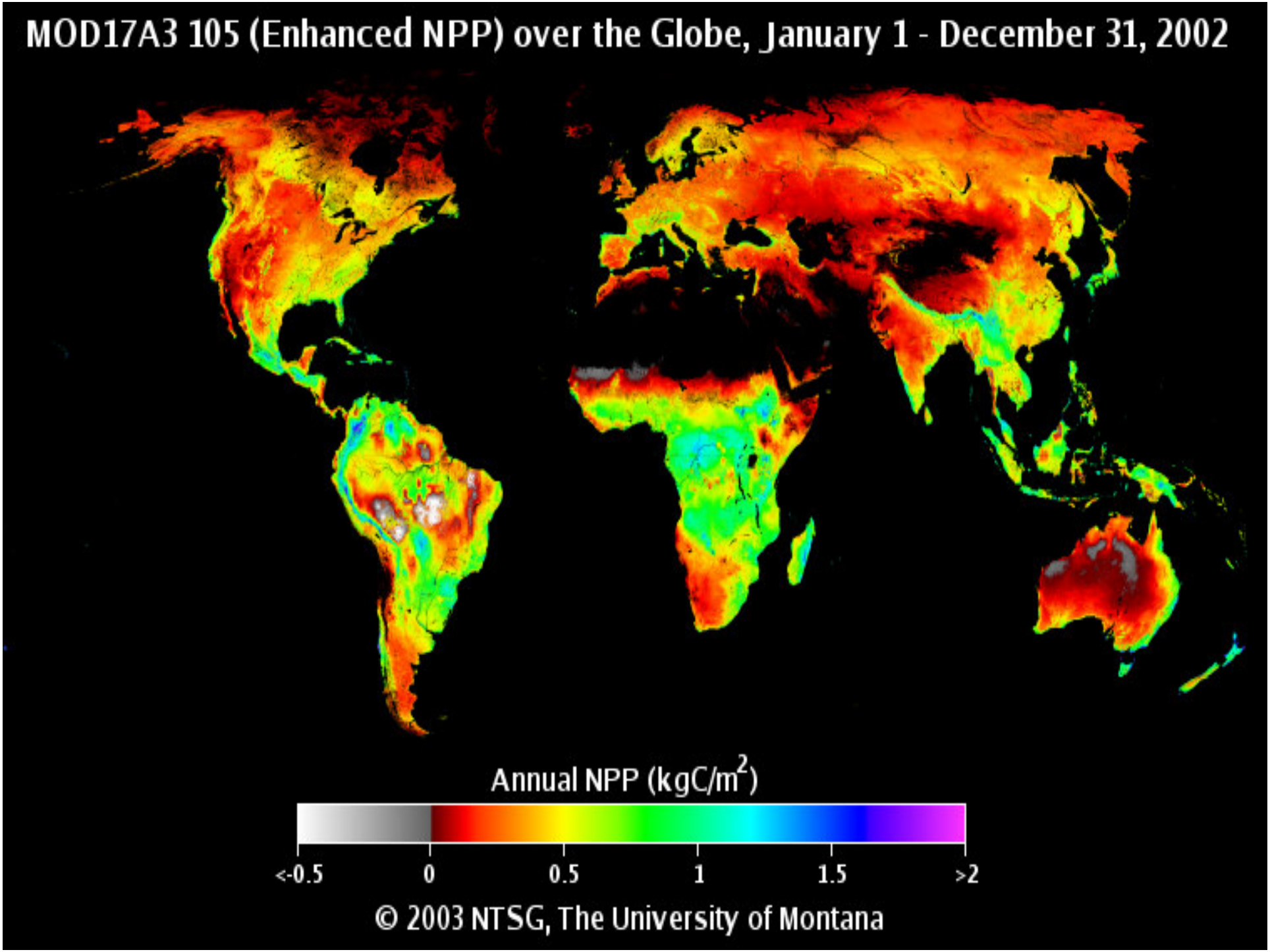






EVI/DVI Breakout Report Back

- Need to continue broader community evaluation of EVI and NDVI – small working group forming to start to build community consensus
- Two indices offer different information – and have different science issues - need to guide users as to their use
- Recommended to continue providing both indices
- NPP VIIRS is carrying both indices

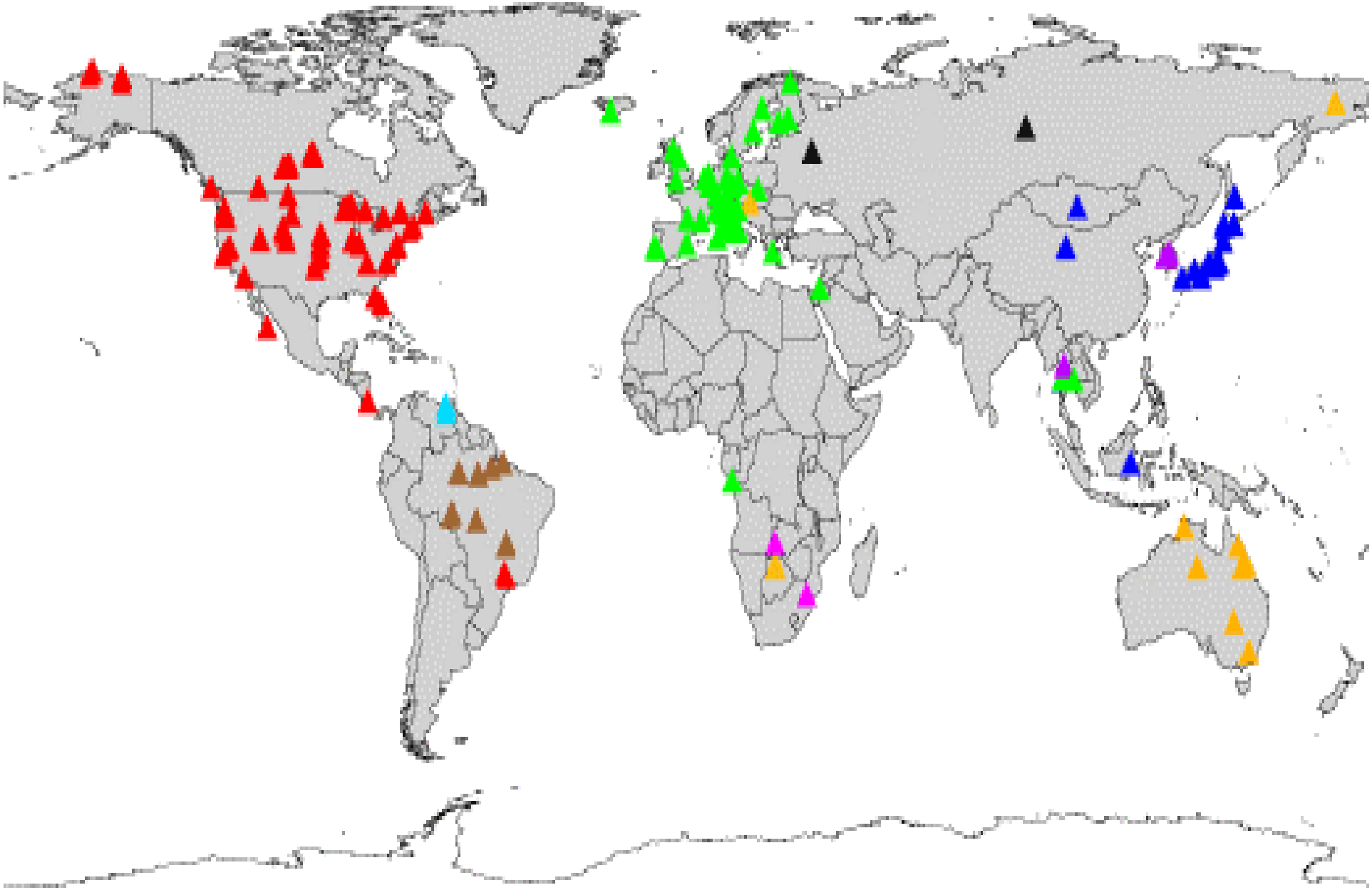

MOD17A3 105 (Enhanced NPP) over the Globe, January 1 - December 31, 2002
Annual NPP (kgC/m2)
<-0.5
0
0.5
1
1.5
>2
© 2003 NTSG, The University of Montana

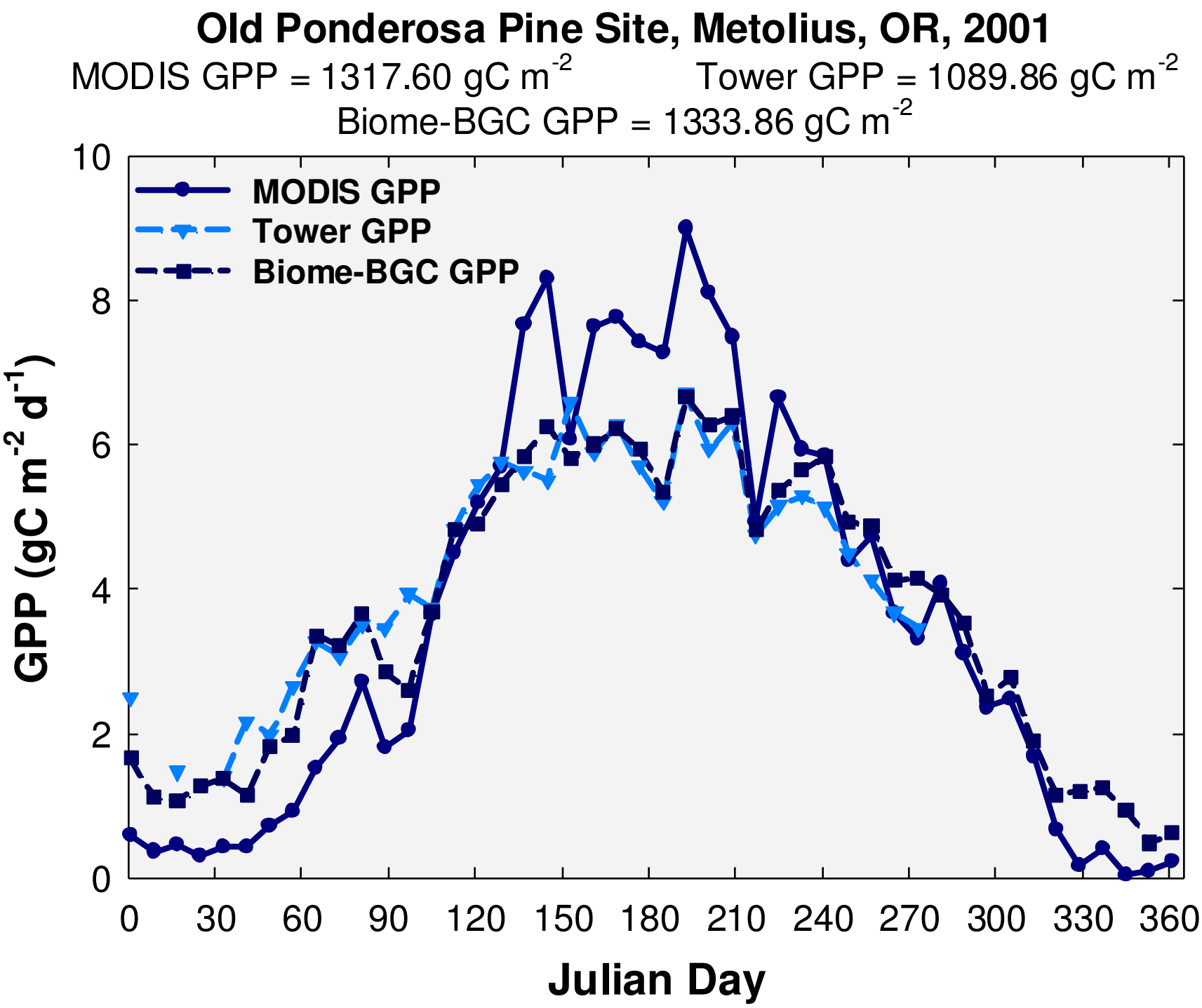
3 Sources of variability of MODIS GPP/NPP

1. Radiometric – MODIS FPAR and LAI
2. Meteorological – DAO IPAR and Temps
3. Ecological – algorithm representation of plant physiology

Each require a different mode of validation

Fluxnet 2003




Old Ponderosa Pine Site, Metolius, OR, 2001
MODIS GPP = 1317.60 gC m-2
Tower GPP = 1089.86 gC m-2
Biome-BGC GPP = 1333.86 gC m-2
MODIS GPP
Tower GPP
Biome-BGC GPP
GPP (gC m-2 d-1)
Julian Day
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2
4
6
8
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210
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270
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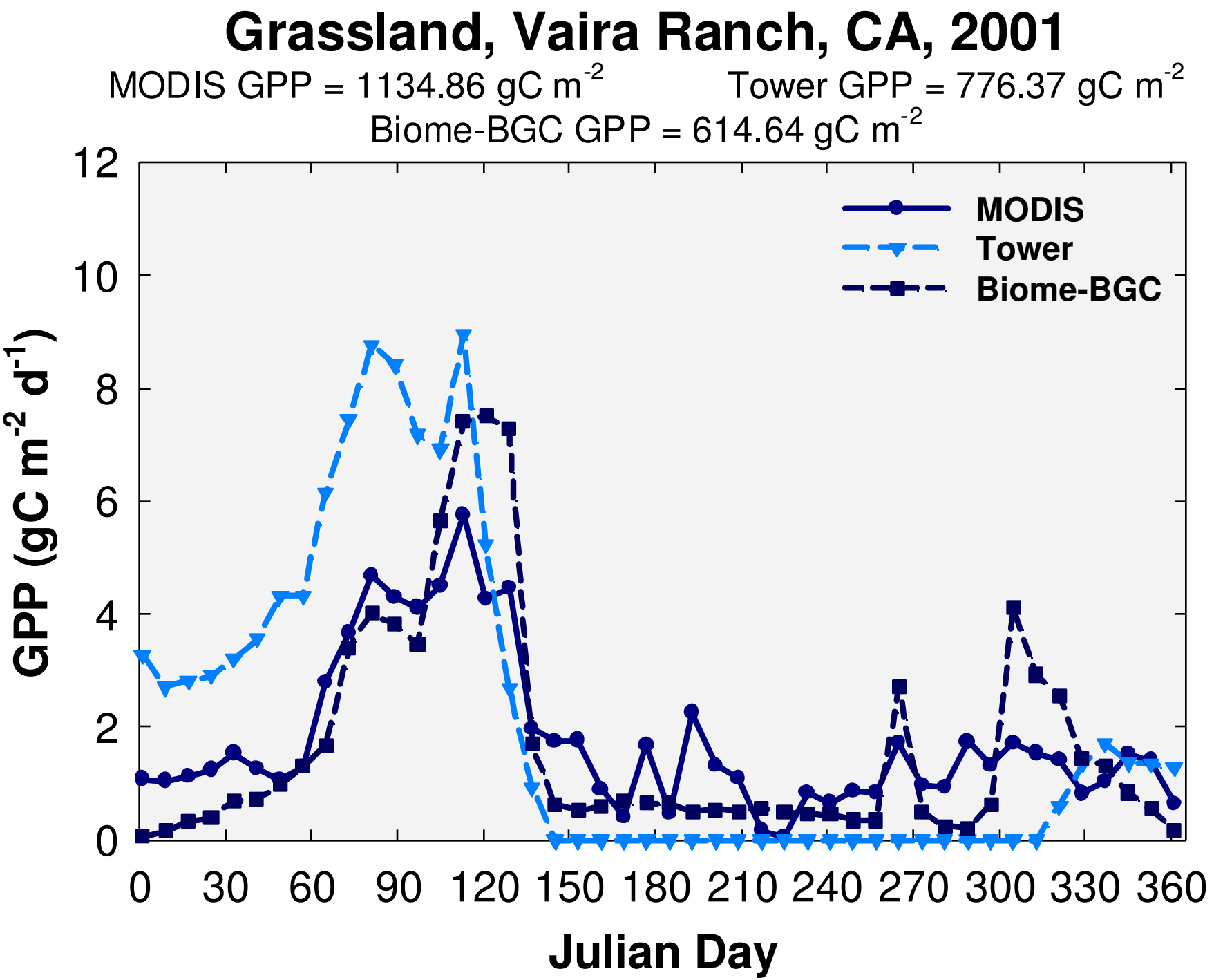
330
360


Grassland, Vaira Ranch, CA, 2001
MODIS GPP = 1134.86 gC m-2
Tower GPP = 776.37 gC m-2
Biome-BGC GPP = 614.64 gC m-2
MODIS
Tower
Biome-BGC
GPP (gC m-2 d-1)
Julian Day
0
2
4
6
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10
12
0
30
60
90
120
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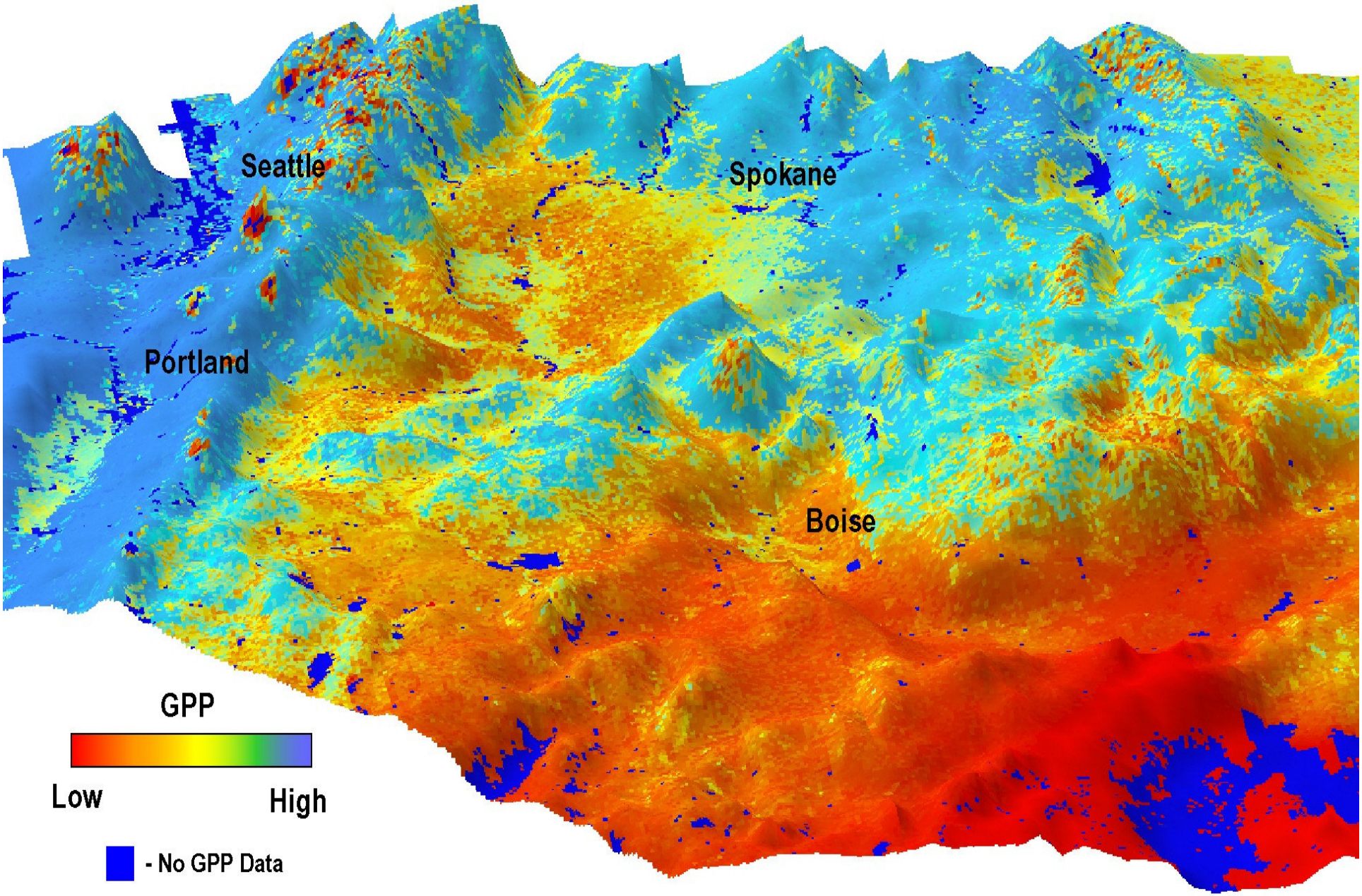
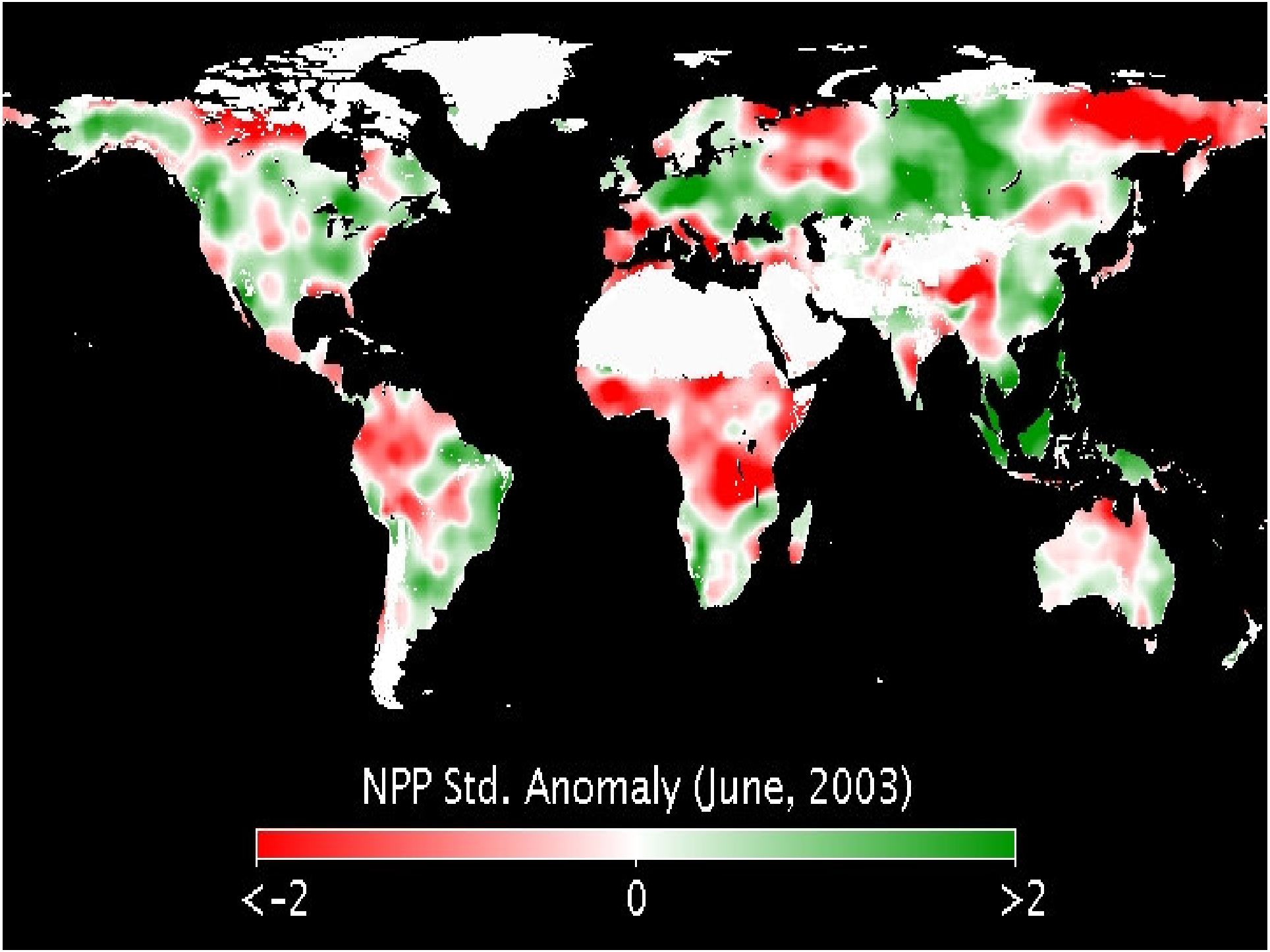
180
210
240
270
300
330
360

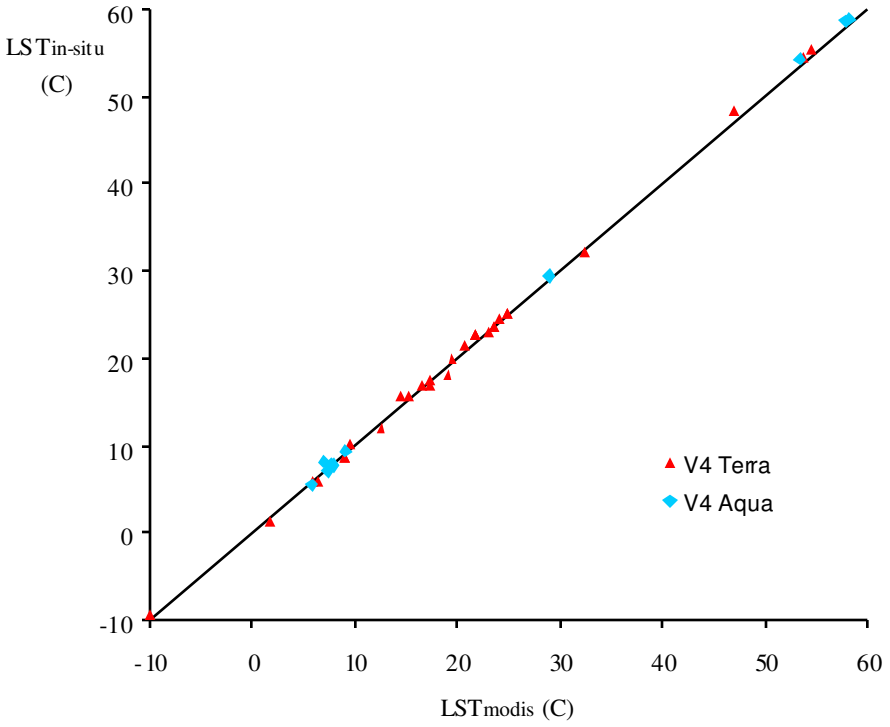
MODIS Vegetation Productivity - June 2002




NPP Std. Anomaly (June, 2003)
<-2
0
>2

Validation of the MODIS LST Products

V4 Terra and Aqua MODIS LSTs have been validated, most within 1K, with in-situ data in about 30 clear-sky cases in wide ranges of atmospheric and surface conditions in 2000-2003.



Railroad Valley, NV

Walker Lake, NV

Bridgeport grassland, CA

Snowcover, Bridgeport, CA

Rice field in Chico, CA

Soybean field, MS

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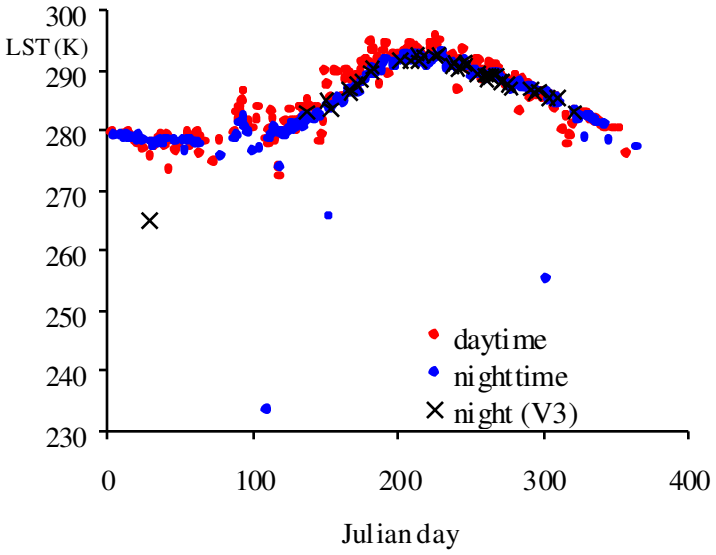
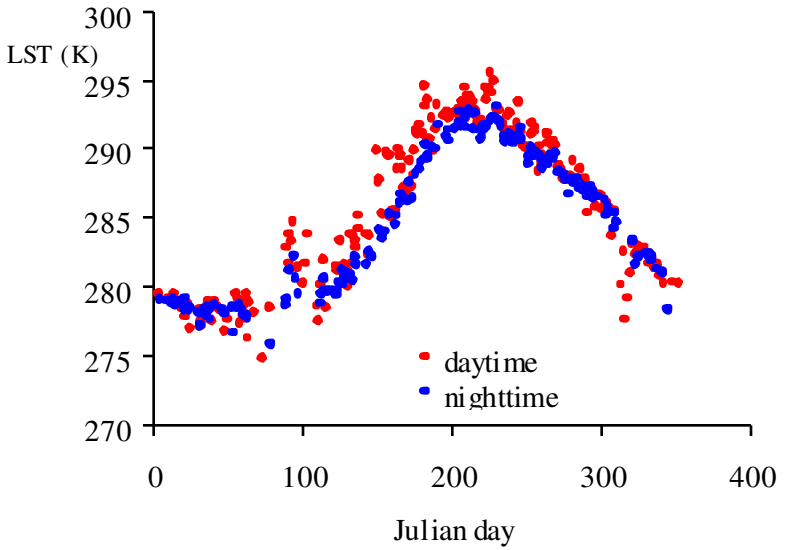
Cloud-screen scheme to remove cloud-contaminated LSTs in MODIS LST Products with landcover-dependent constraints on temporal variations in clear-sky LSTs





LSTs near the center of Lake Tahoe in the year 2002 MOD11A1 data sets before (left) and after (right) applying the cloud-screen scheme.

The cloud-screen scheme has been tested at the MODIS LST SCF and will be implemented in the V5 LST processing.

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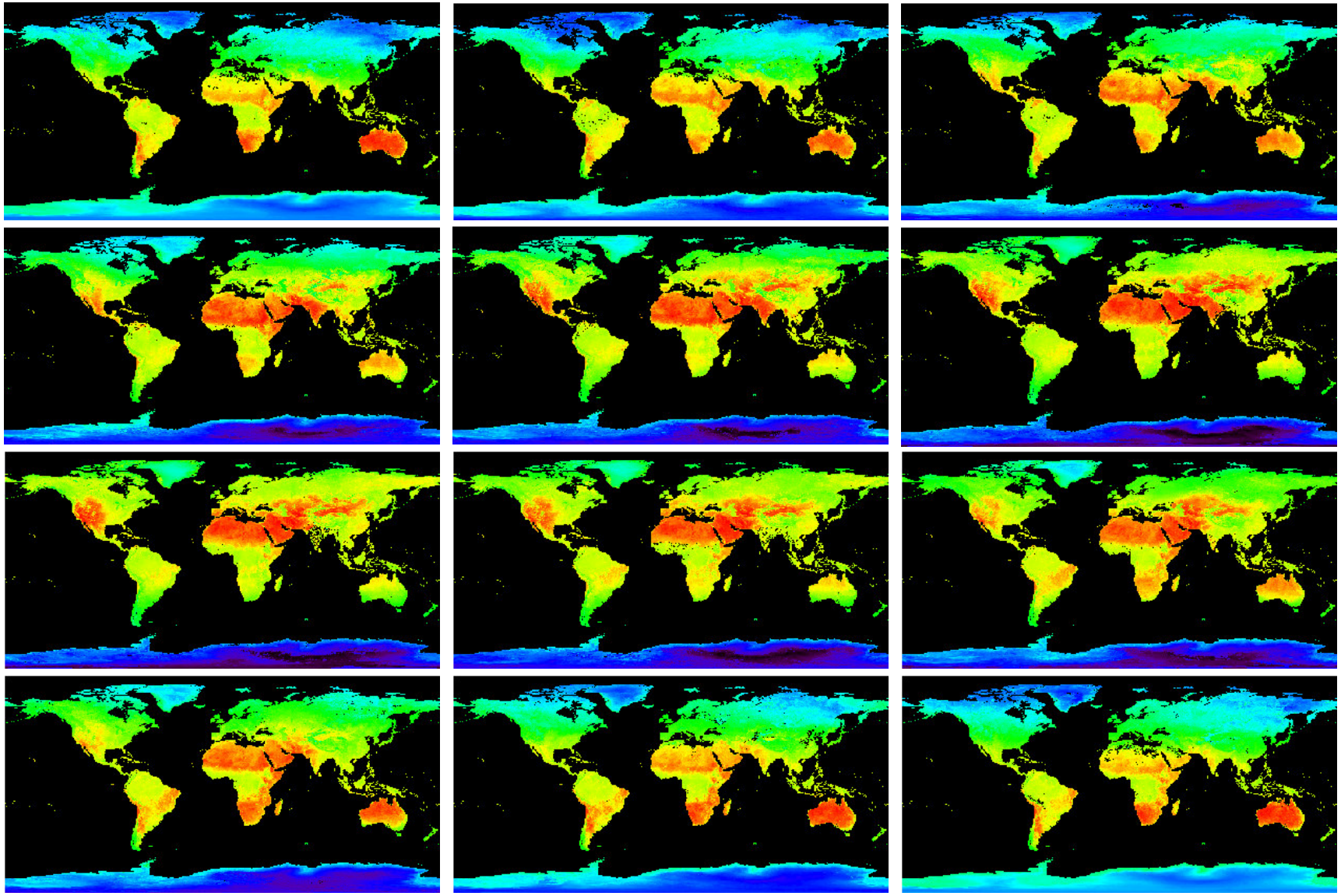
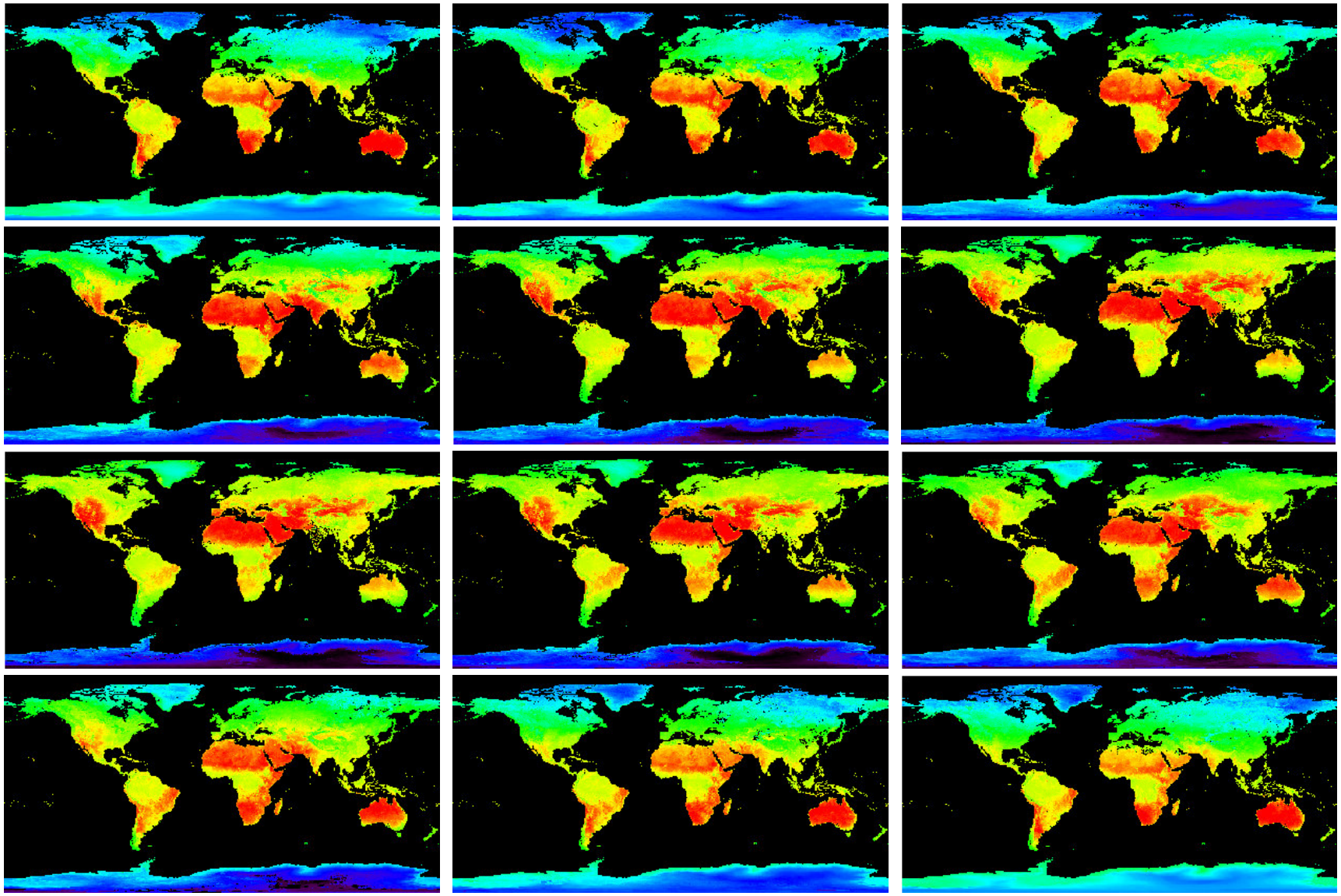
Monthly daytime LSTs from Terra MODIS data in 2003



Monthly daytime LSTs from Aqua MODIS data in 2003



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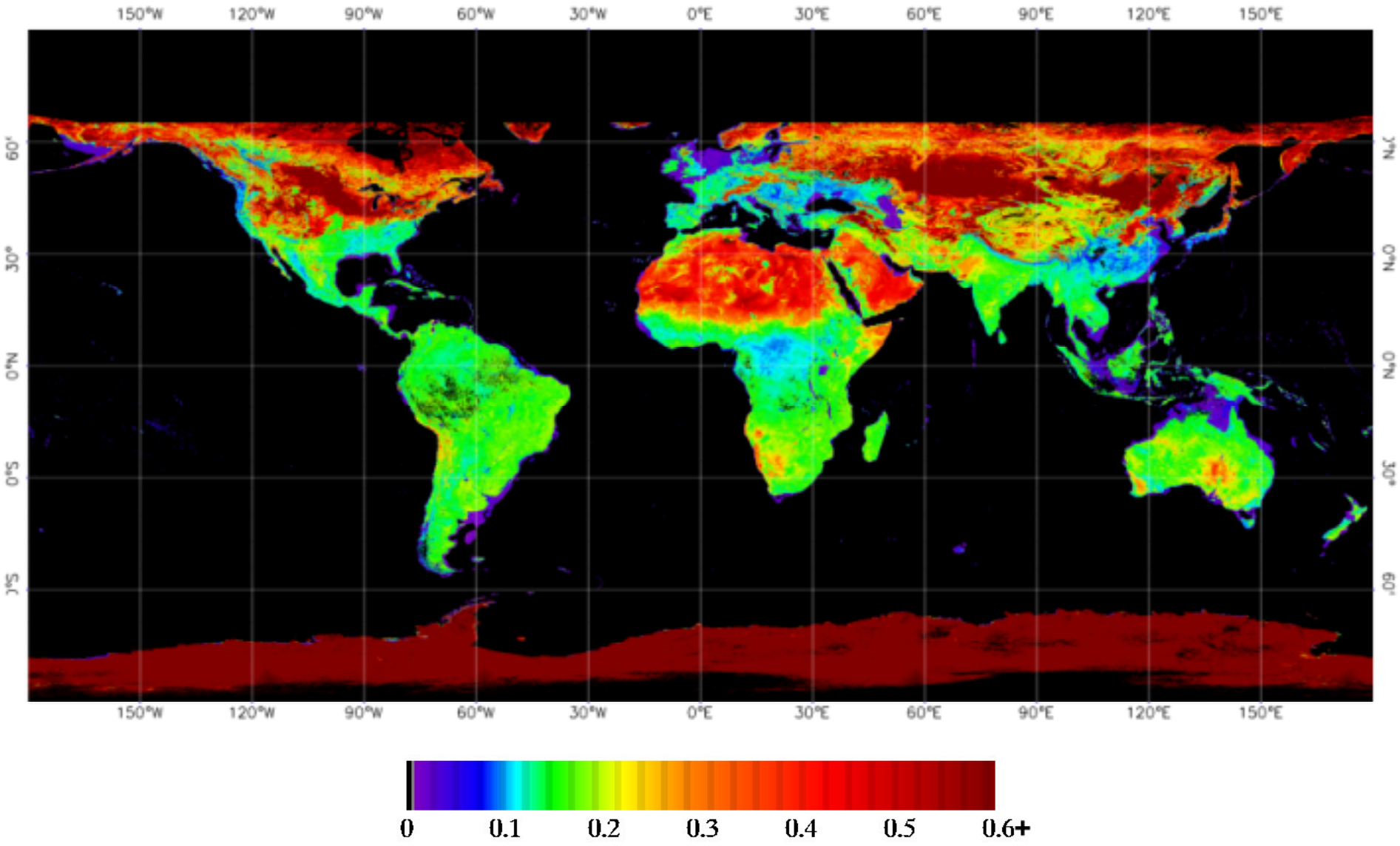
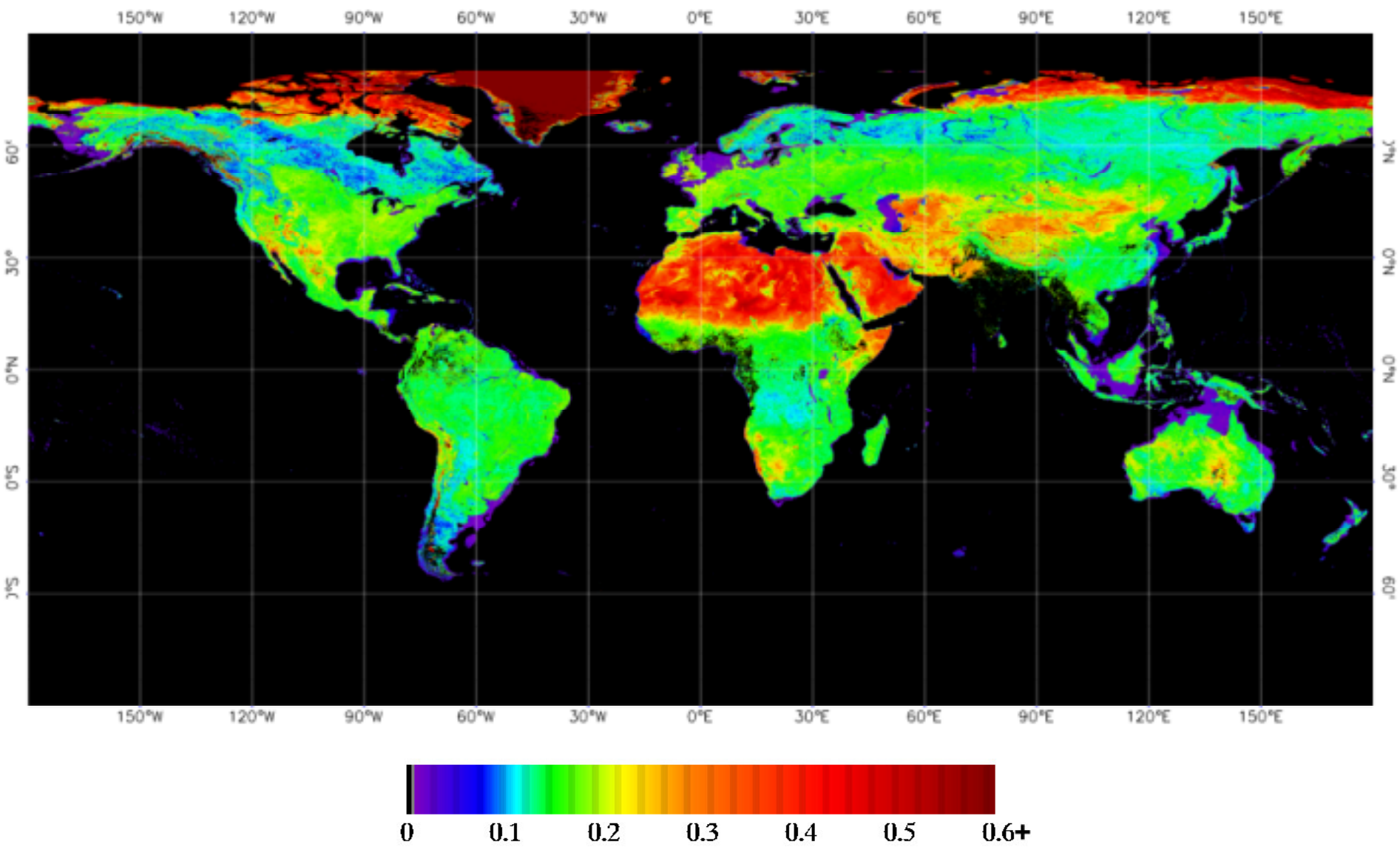
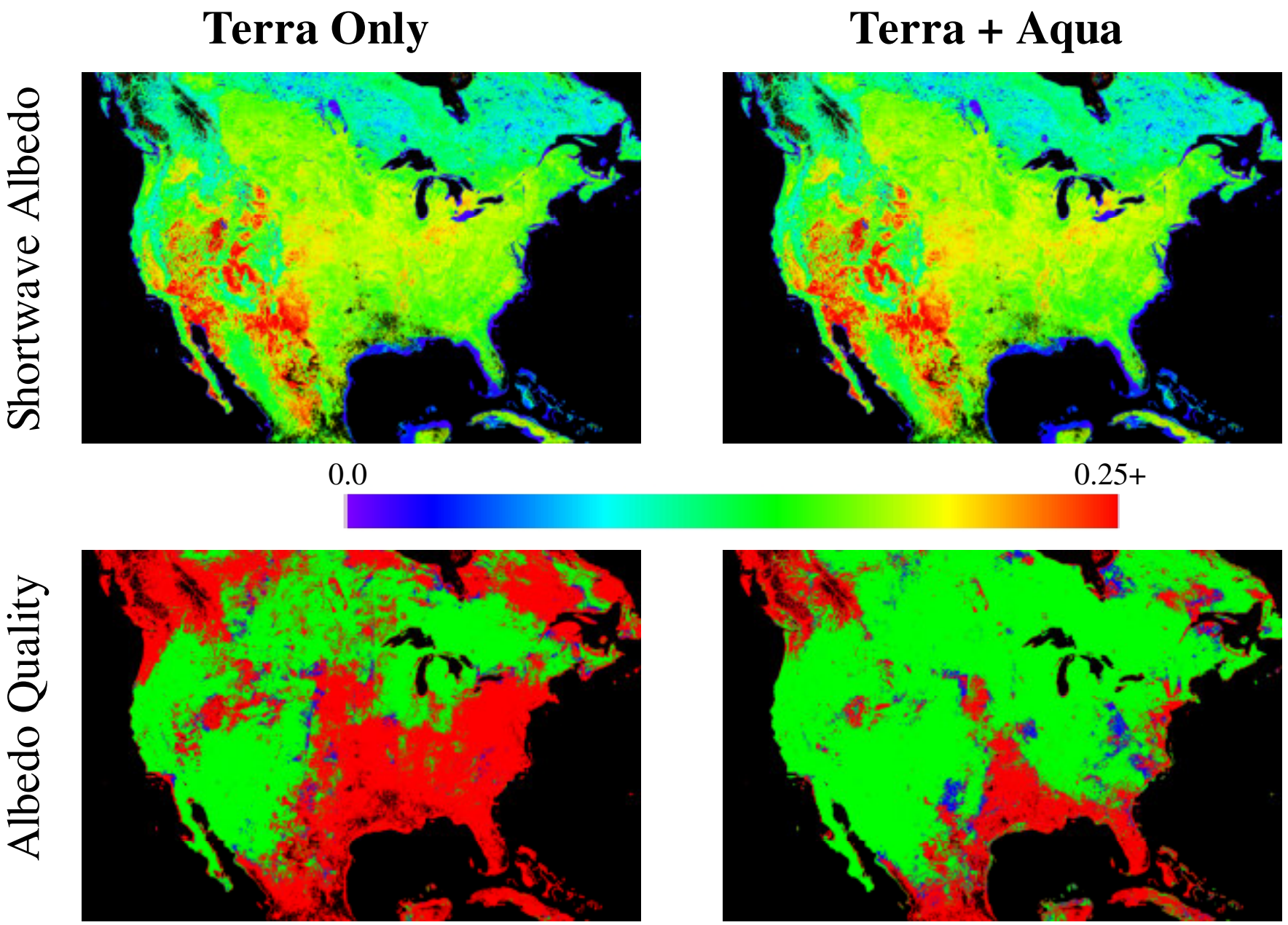
Shortwave White-Sky Albedo of January, 2001



Shortwave White-Sky Albedo of June, 2001

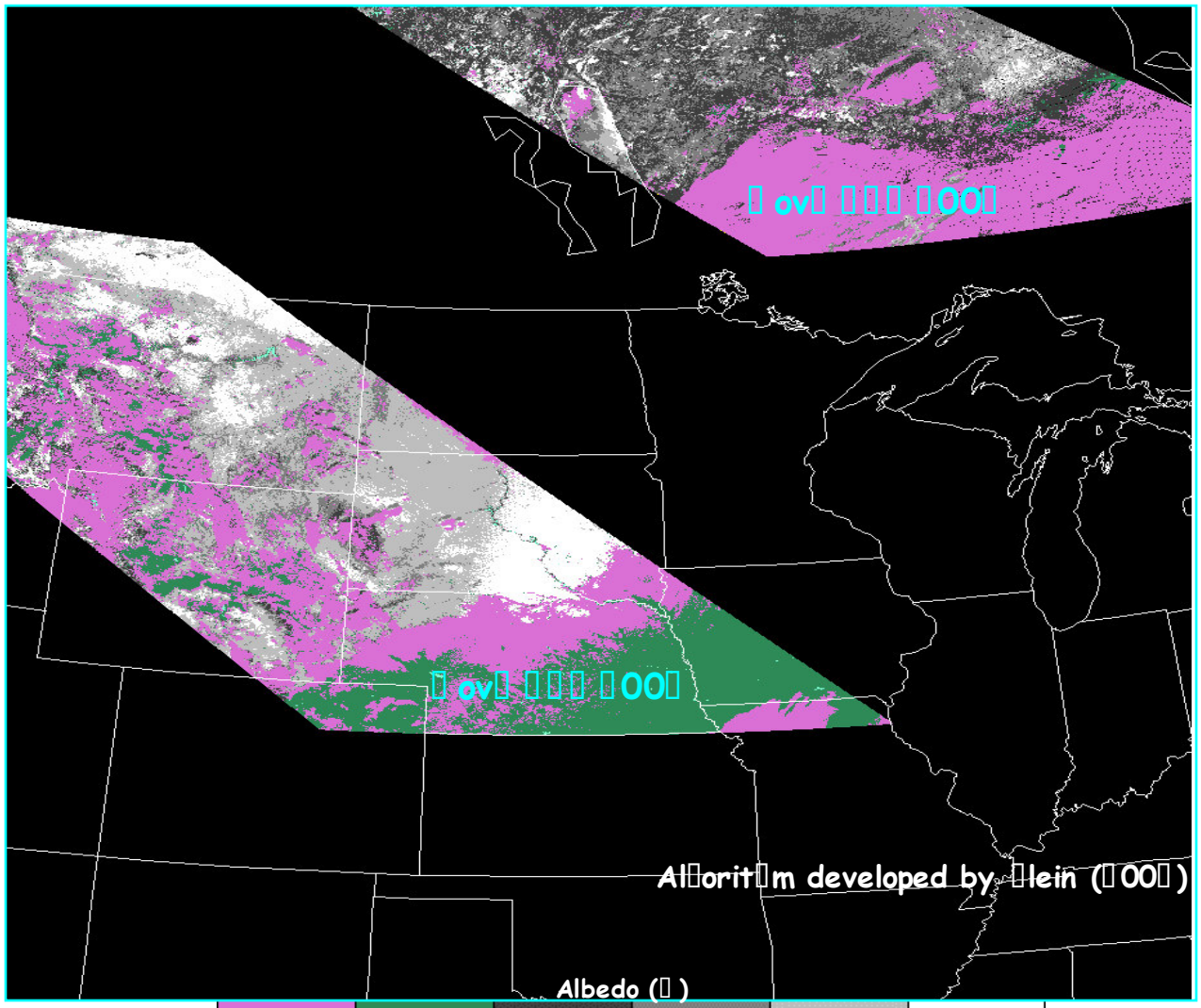




(green: highest quality; blue: moderate quality; red: poorest quality back-up algorithm; black: fill values and deep oceans)

Daily snow albedo product (MOD10A1) (beta version)
500-m resolution

Snow albedo swaths - North America



□ ort□ and □ out□ □olar □ ea □ce □ ur□ace □ emperature (□□□) □-day composite prototype maps at □□-□m resolution

□ ort□ □olar □ iew

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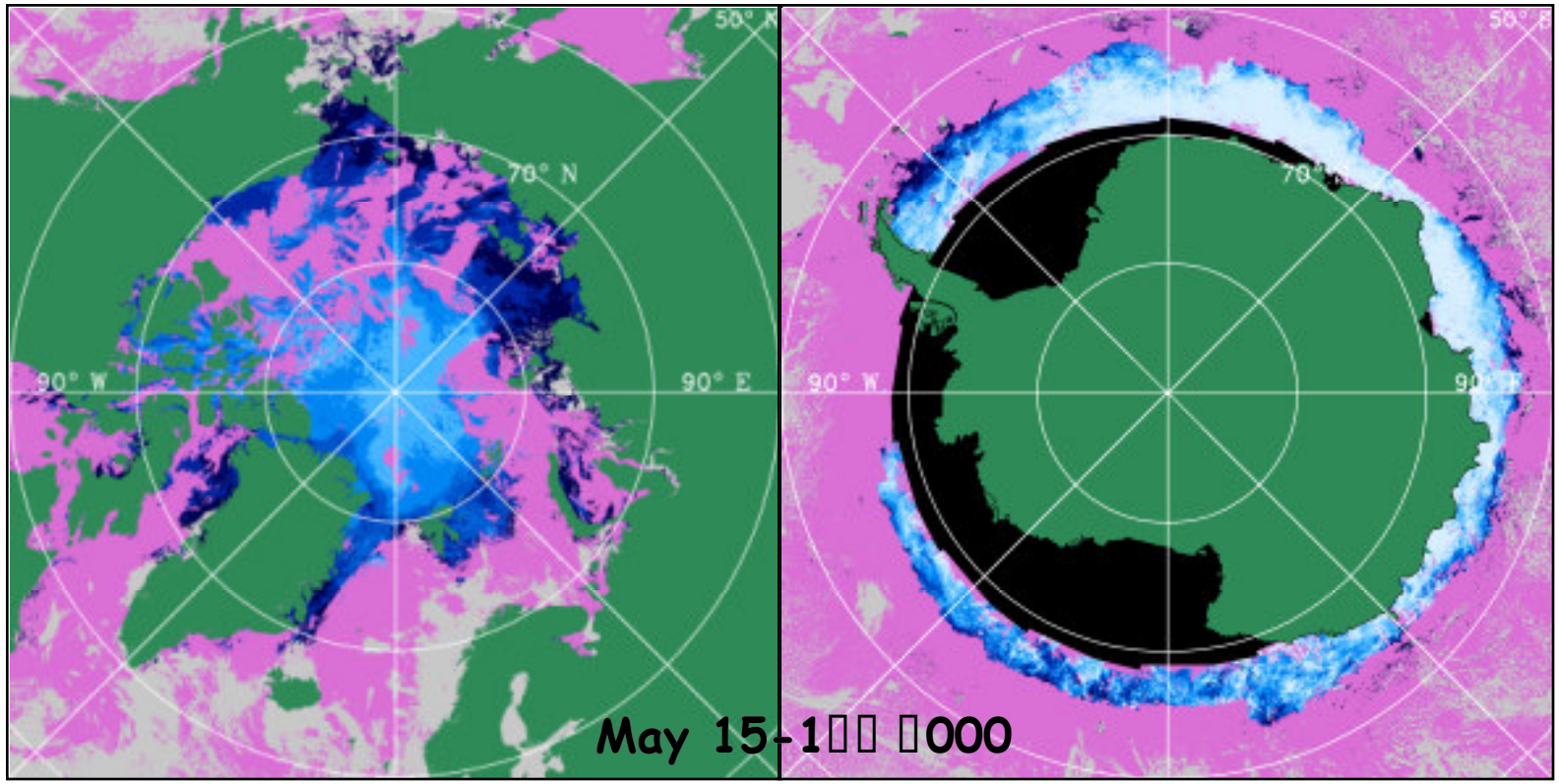
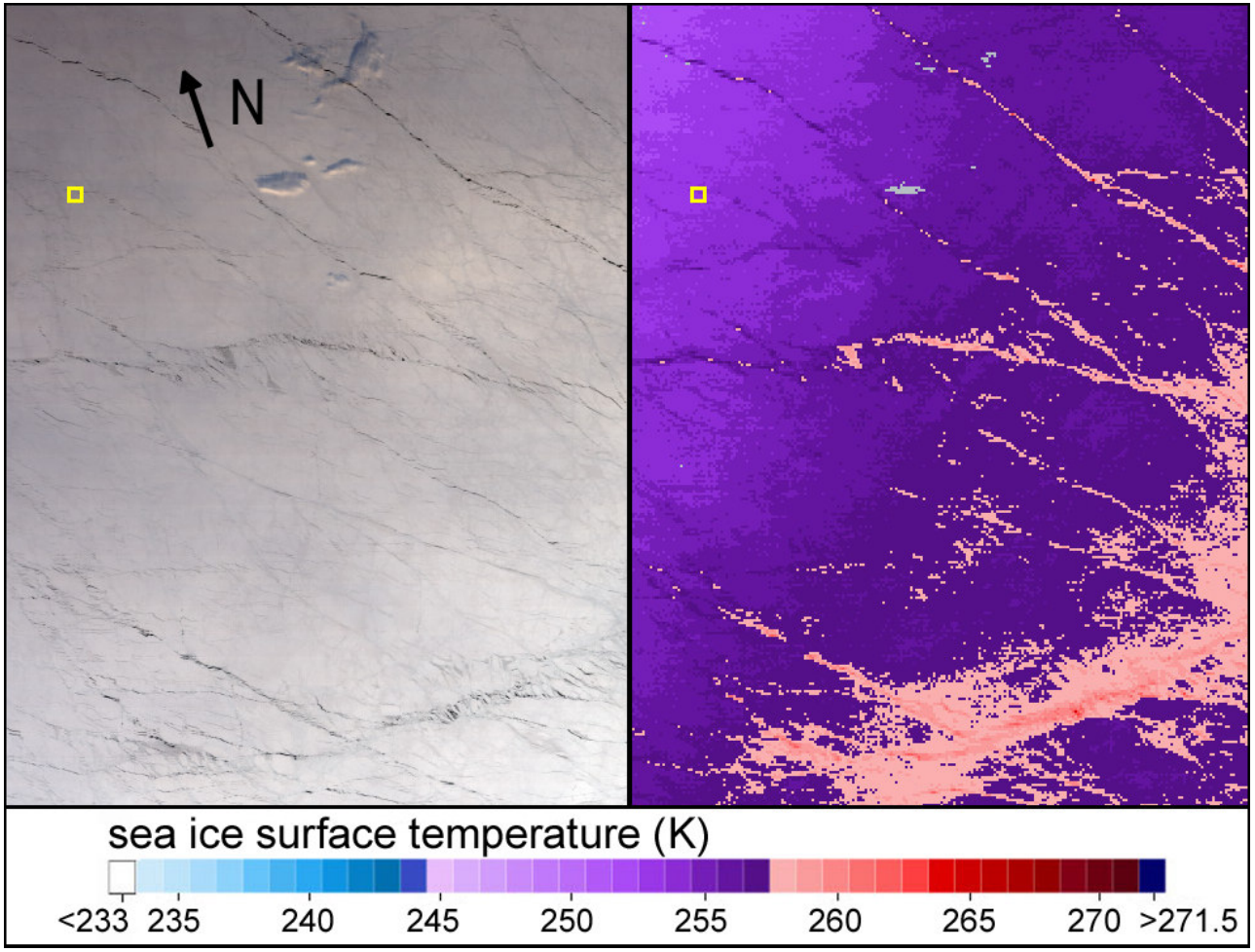


□ea ice sur□ace temperature at 1-□m resolution

Accuracy is 1□□□ durin□ t□e □cold season□ under clear s□ies

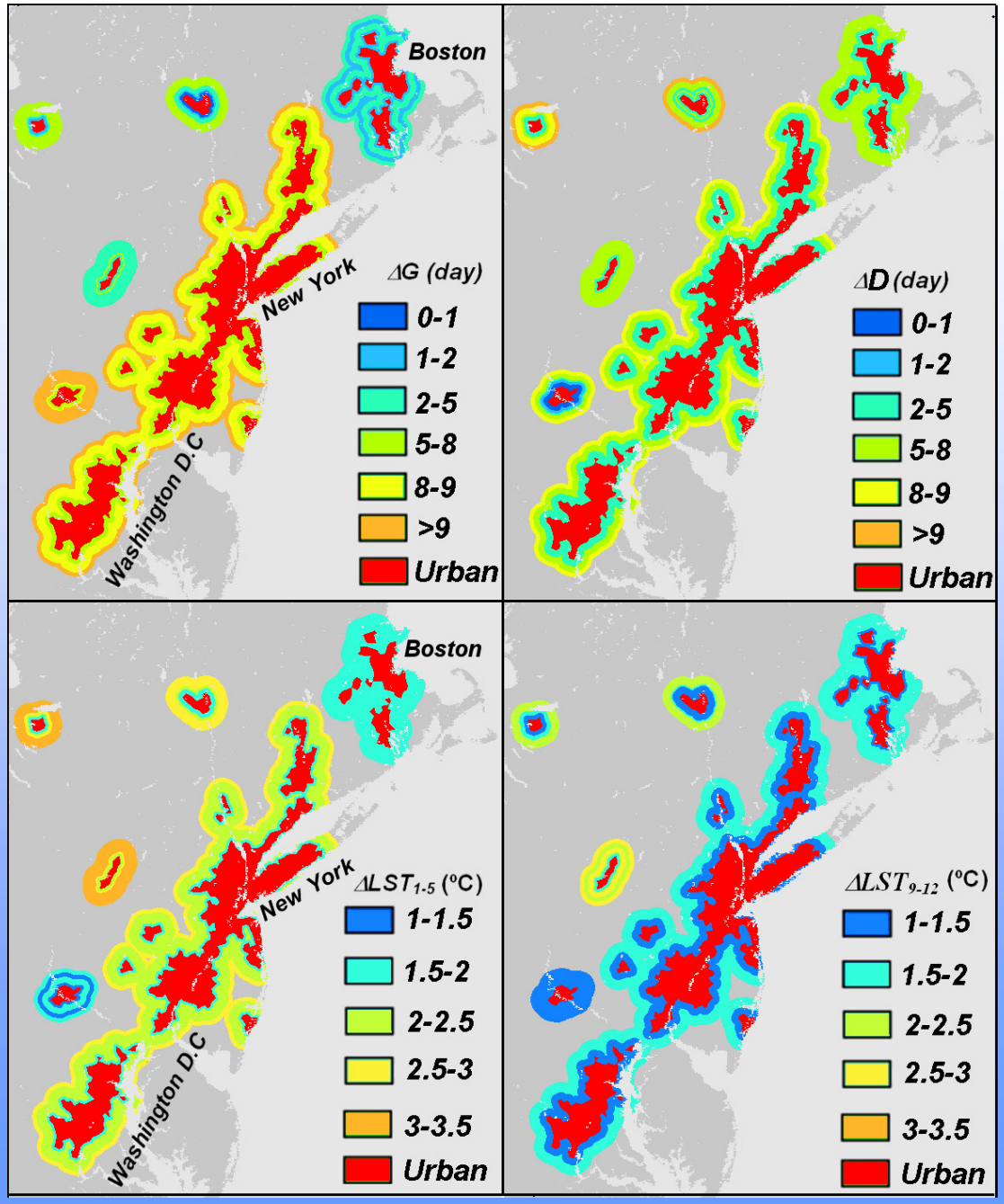


□e□t - □rue-color □erra MOD□□ ima□e usin□ bands 1 (0□□□-0□□□ μm)□ □ (0□5□5-0□5□5 μm) and □ (0□□5□-0□□□□ μm) derived □rom □erra MOD□□ □evel 1□ data□ Marc□ □□ □00□ (□□□□5 □□□)□ in t□e Arctic Ocean nort□ o□ Alas□a□ □i□□t □ □erra MOD□□ □□□ map product o□ t□e same area at t□e same date and time□

Ecological Footprint of Urban Climates

- Urban Heat Islands
  - Well defined phenomenon
  - Established phenological signature
  - Model for future global change scenario

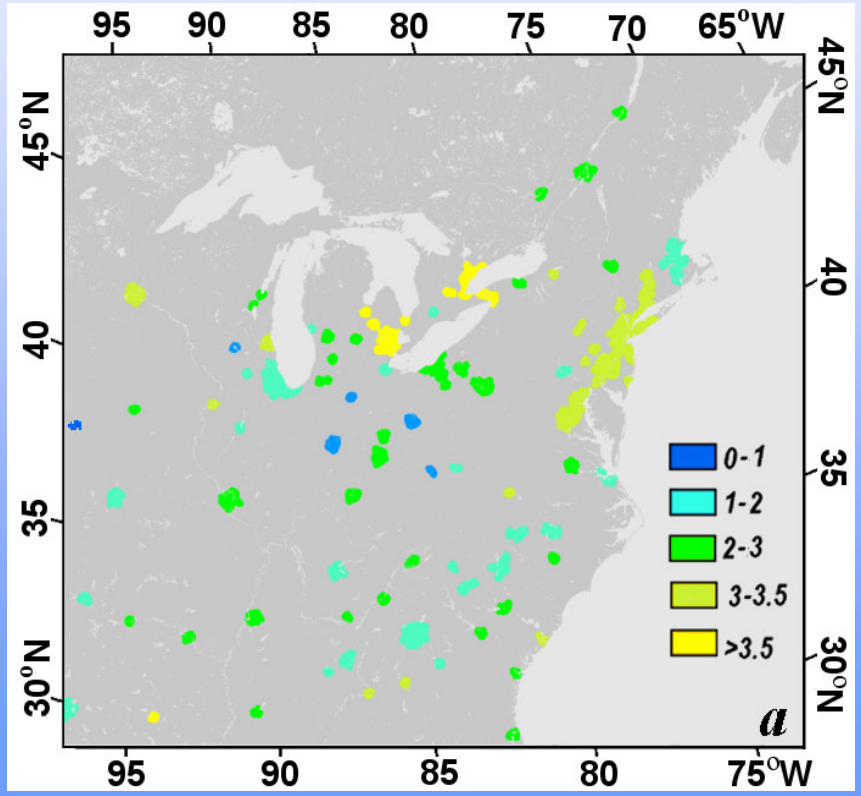
- Urban Footprint
  - Onset of greenup & dormancy
  - Surrounding natural vegetation
- Contrast urban vs surrounding natural vegetation
- Footprint ~ 2.4 times area of urban land cover



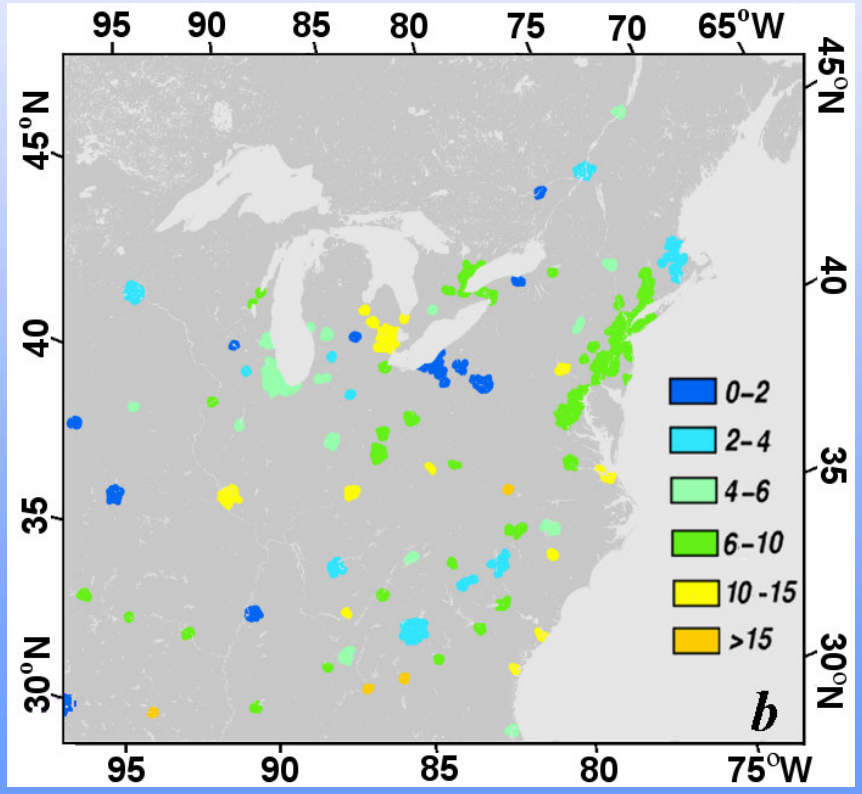
(Credit: Xiaoyang Zhang)

Footprint of Urban Climate on Phenology

Springtime MODIS LST



Change in Timing of Greenup



MODIS Burned Area
being tested and validated (**Australia Example**)

- Dry season

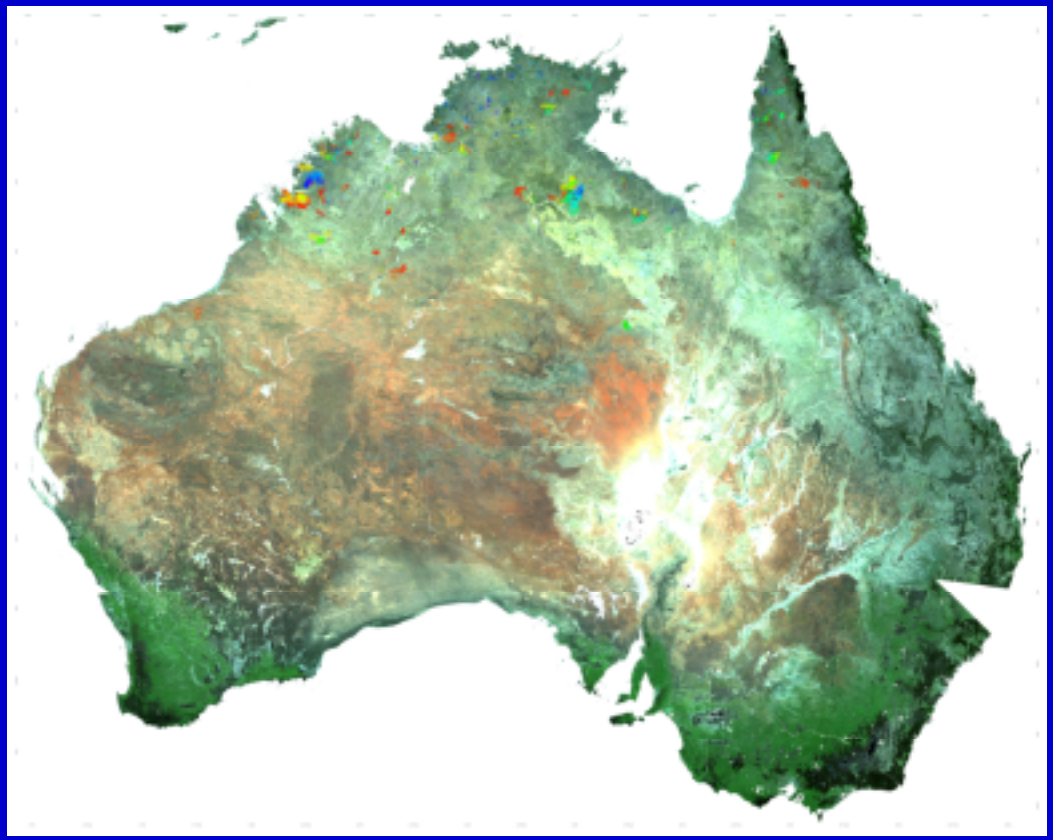
  Apr.-Nov., Northern Australia

- Input time series

  224 days (Apr. 1 – Nov. 10, 2003)

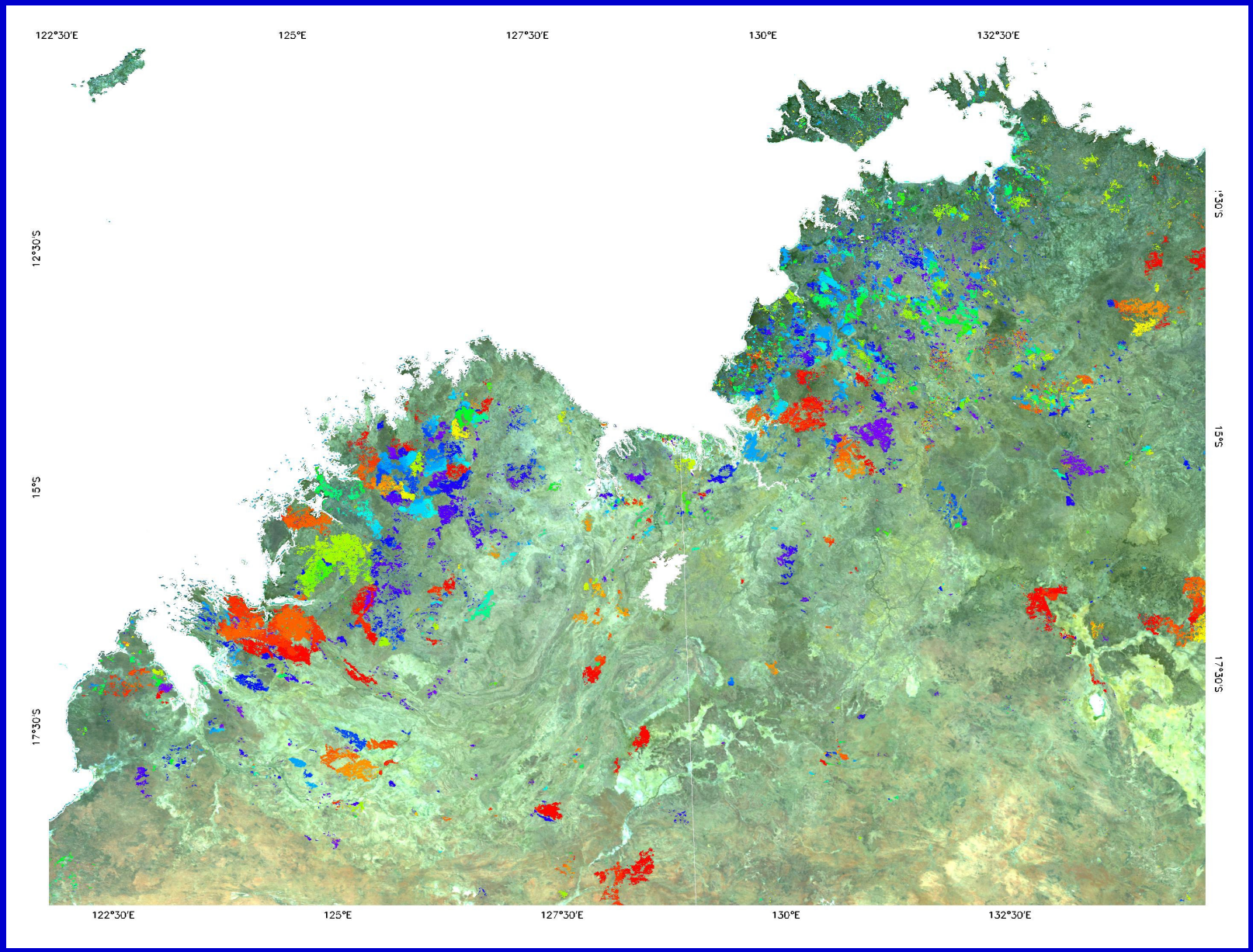
- Burned area mapped with Terra only, Aqua only and Terra+Aqua data

  May 1 – Oct. 31, 2003

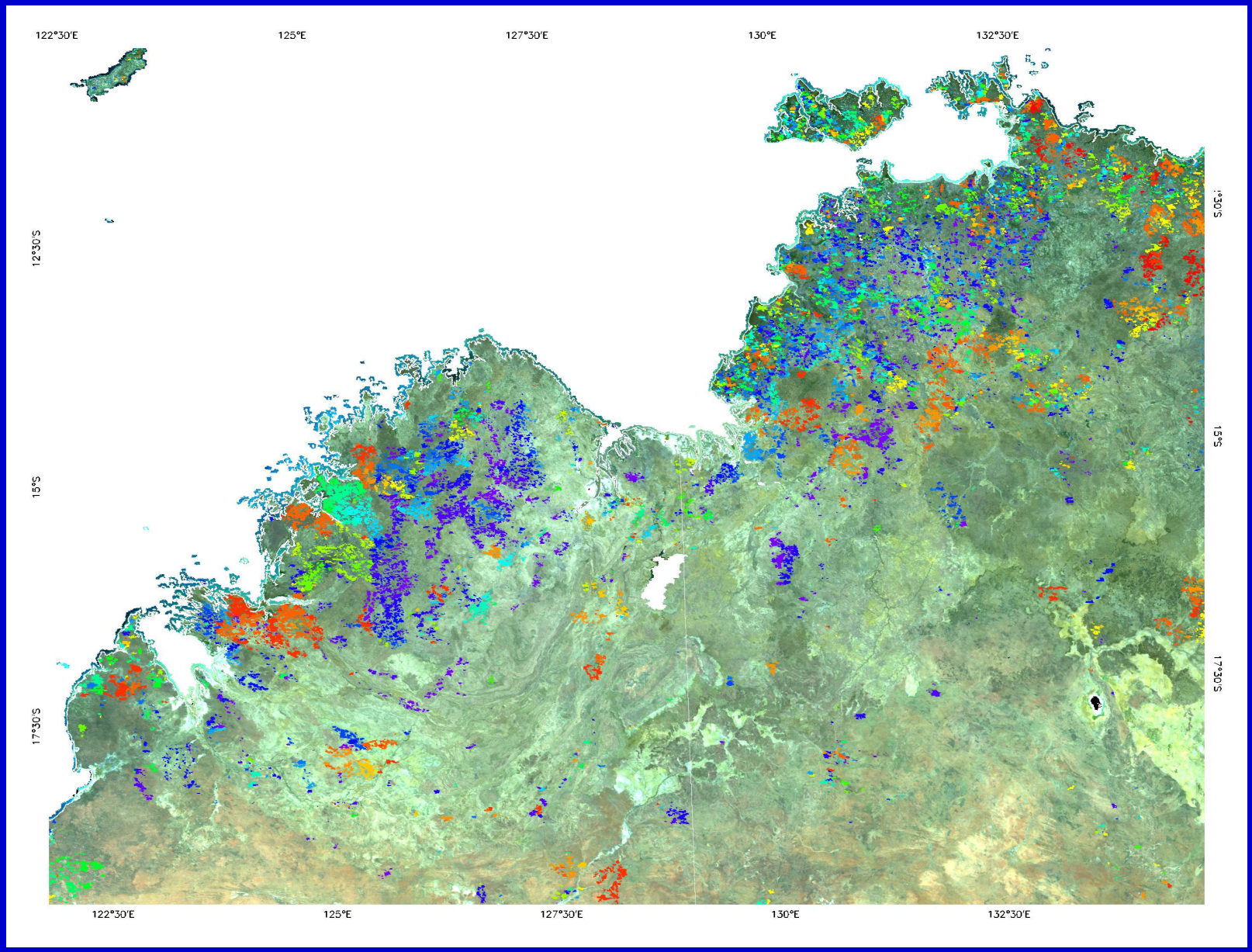


□urned area □Au□□□□□Oct□□□□□□□□□

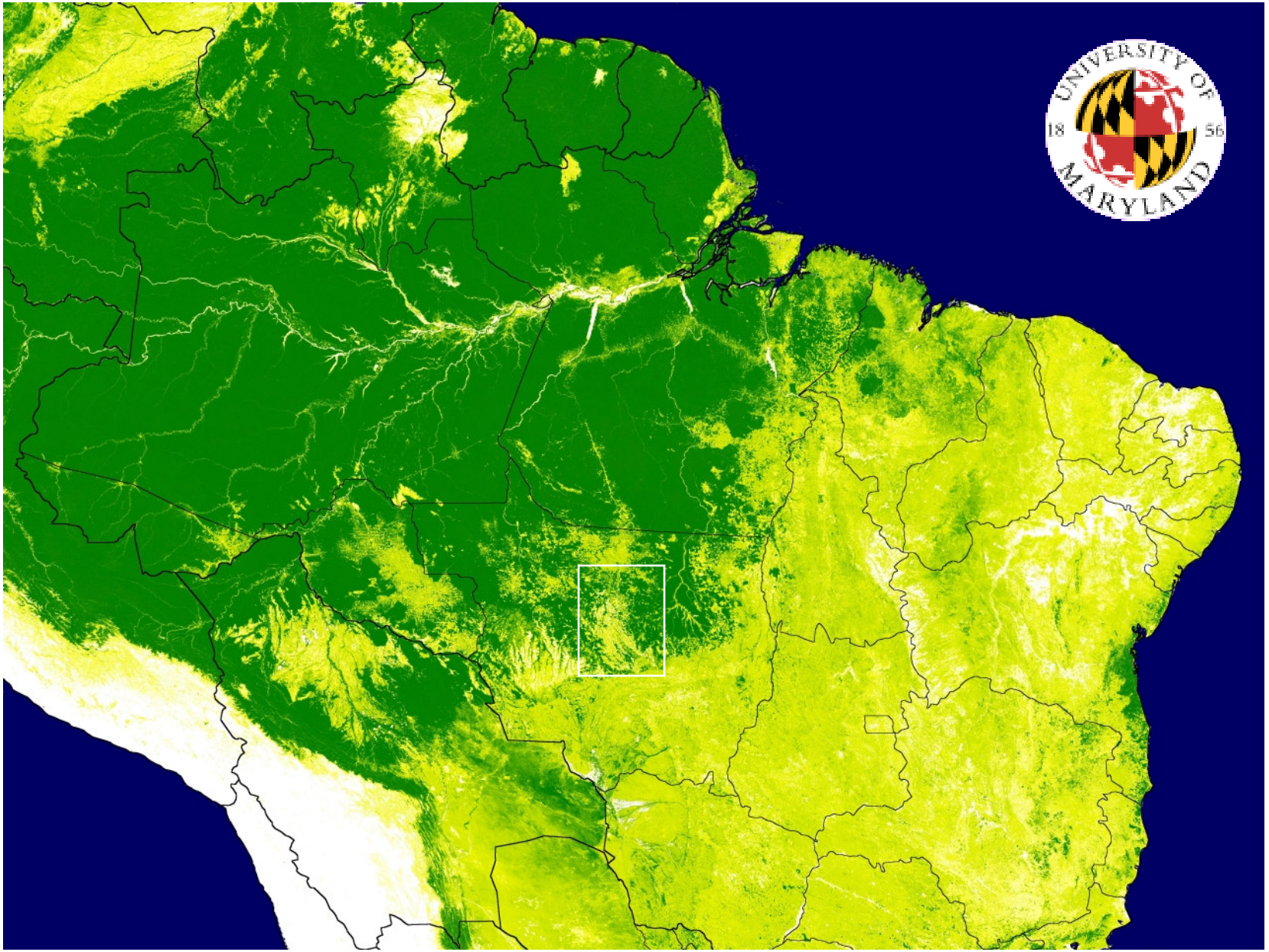
Burned area with Terra and Aqua data in N. Australia May-Oct 2000



Active fire detection from Terra and Aqua data in Northern Australia May–Oct 2004



Amazon Basin Percent Tree Cover from 500m MODIS data



Tree cover

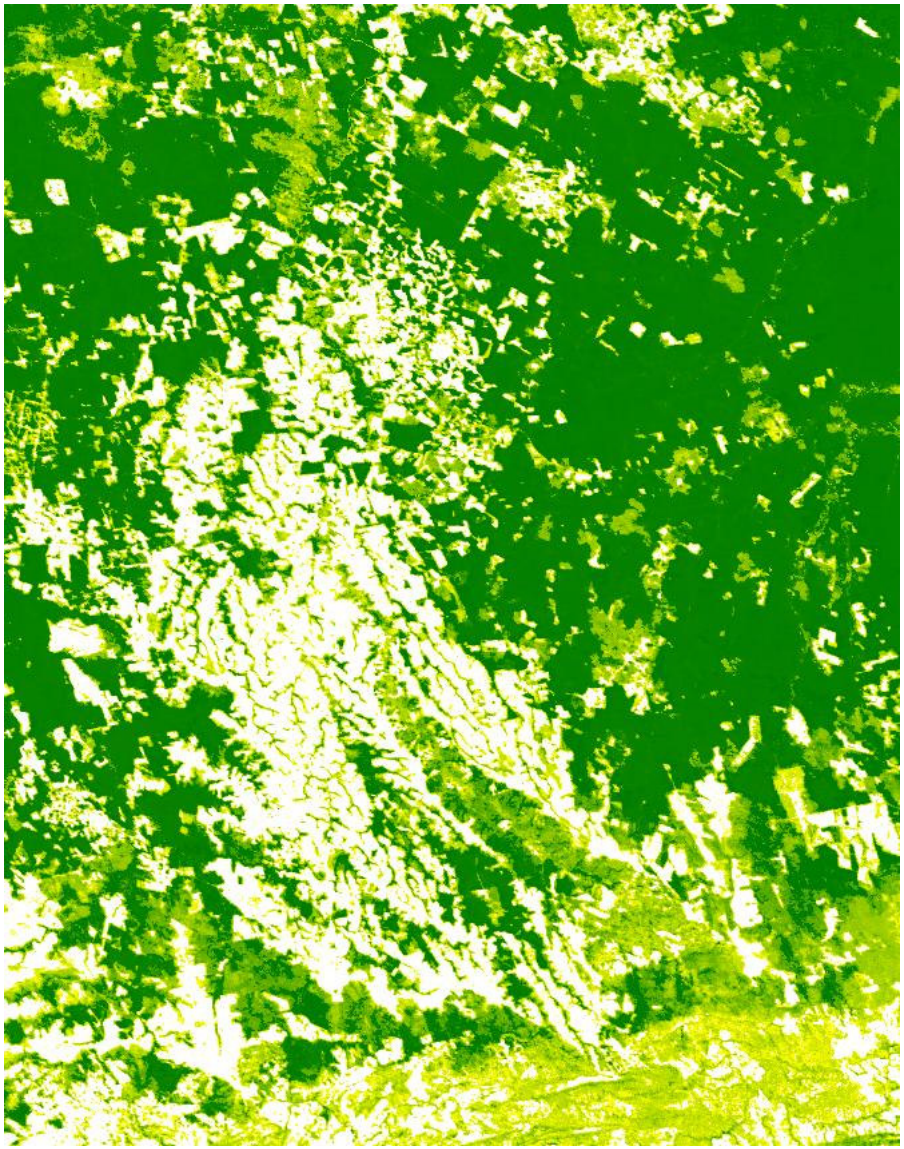
0%

100%

600 km

2000

Declining MODIS Tree Cover: Central Mato Grosso



2000

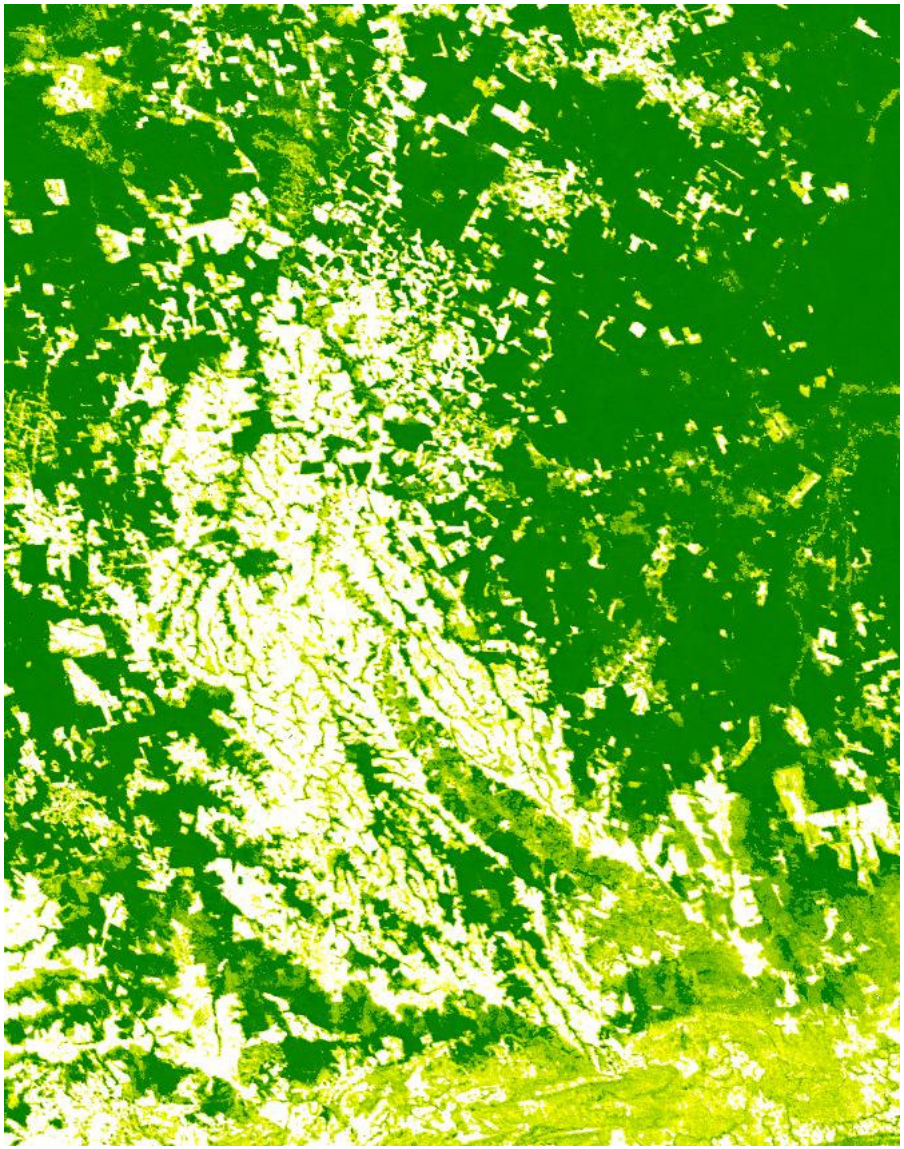
Tree cover

0%

100%

150 km

Declining MODIS Tree Cover: Central Mato Grosso



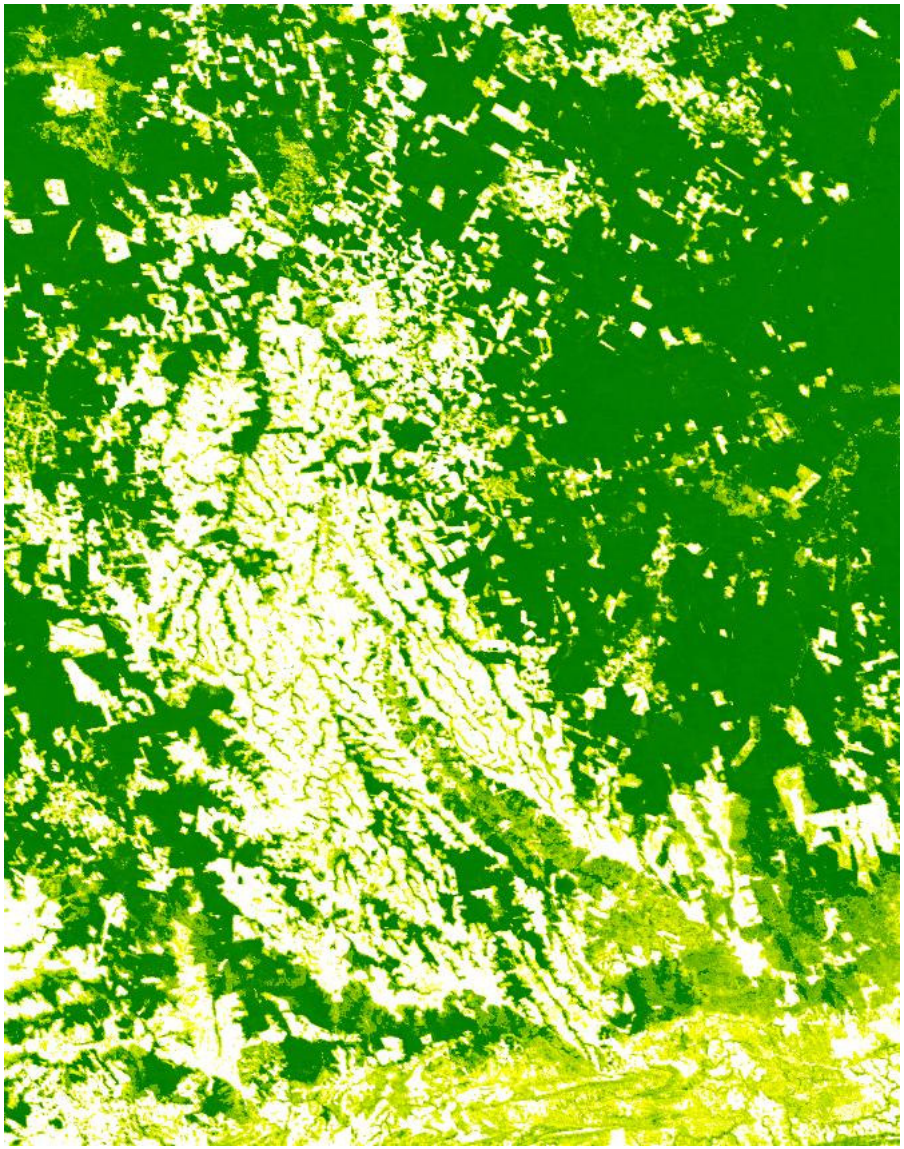
2001

Tree cover

0%

100%

150 km



2002

Tree cover

0%

100%

```
ERROR: stackunderflow
OFFENDING COMMAND: ~

STACK:
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