CEOS LPV, Phenology

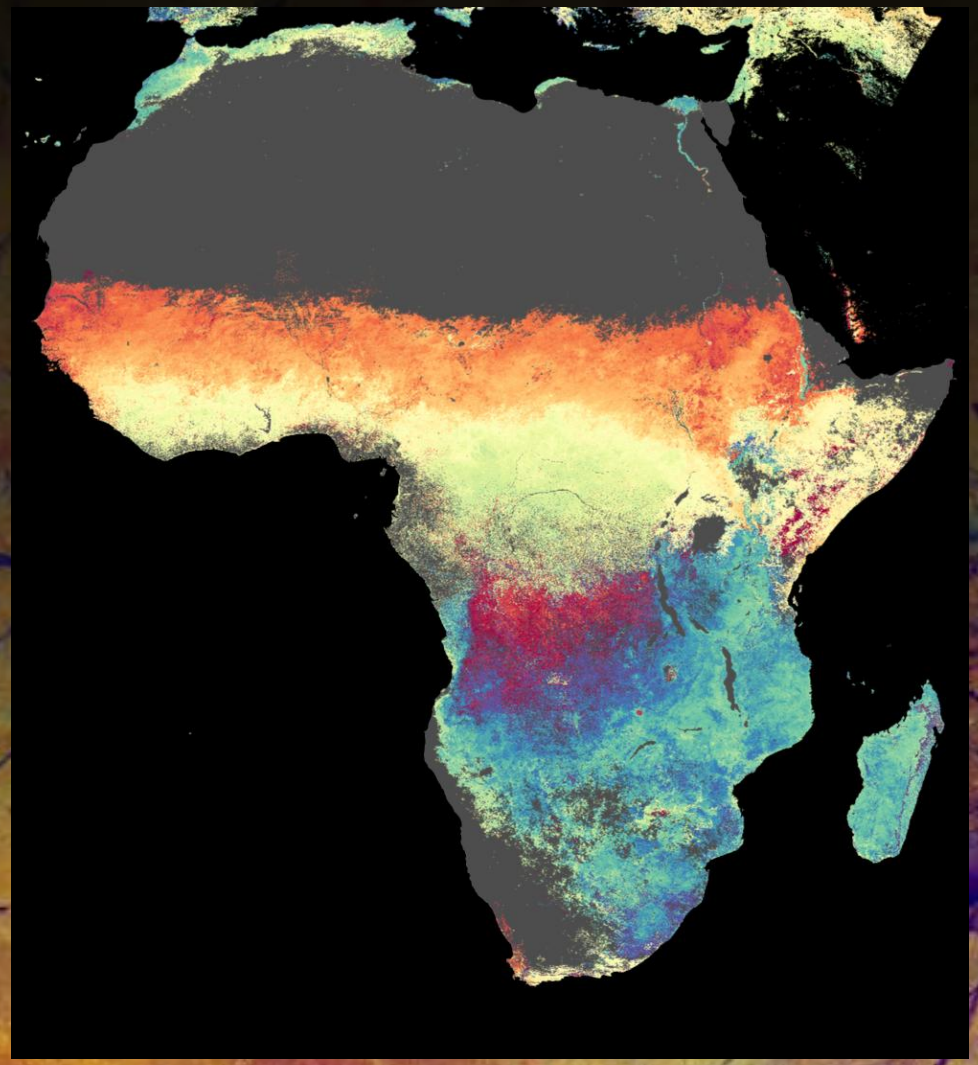
LPS, Milan 2019

Josh Gray & Jadu Dash

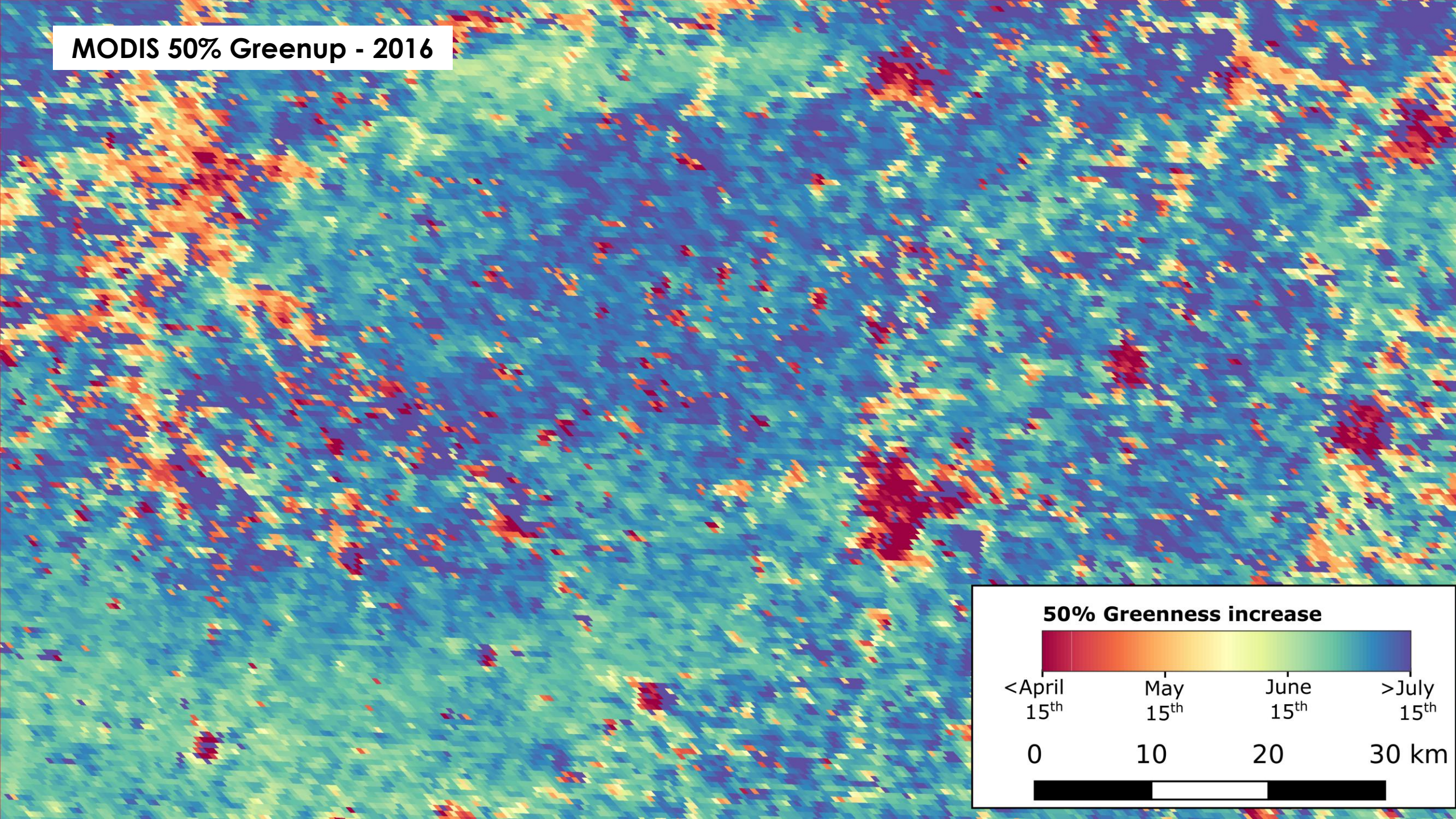
Summary of Past Activities

- Coordinate between satellite and ground measurement groups to ensure quality of LSP and fit for purpose (100 members, equal representation from both)
- Organize workshop and provide a forum for the two community to interact (2 workshops)
- Promote satellite product validation (Newsletter)

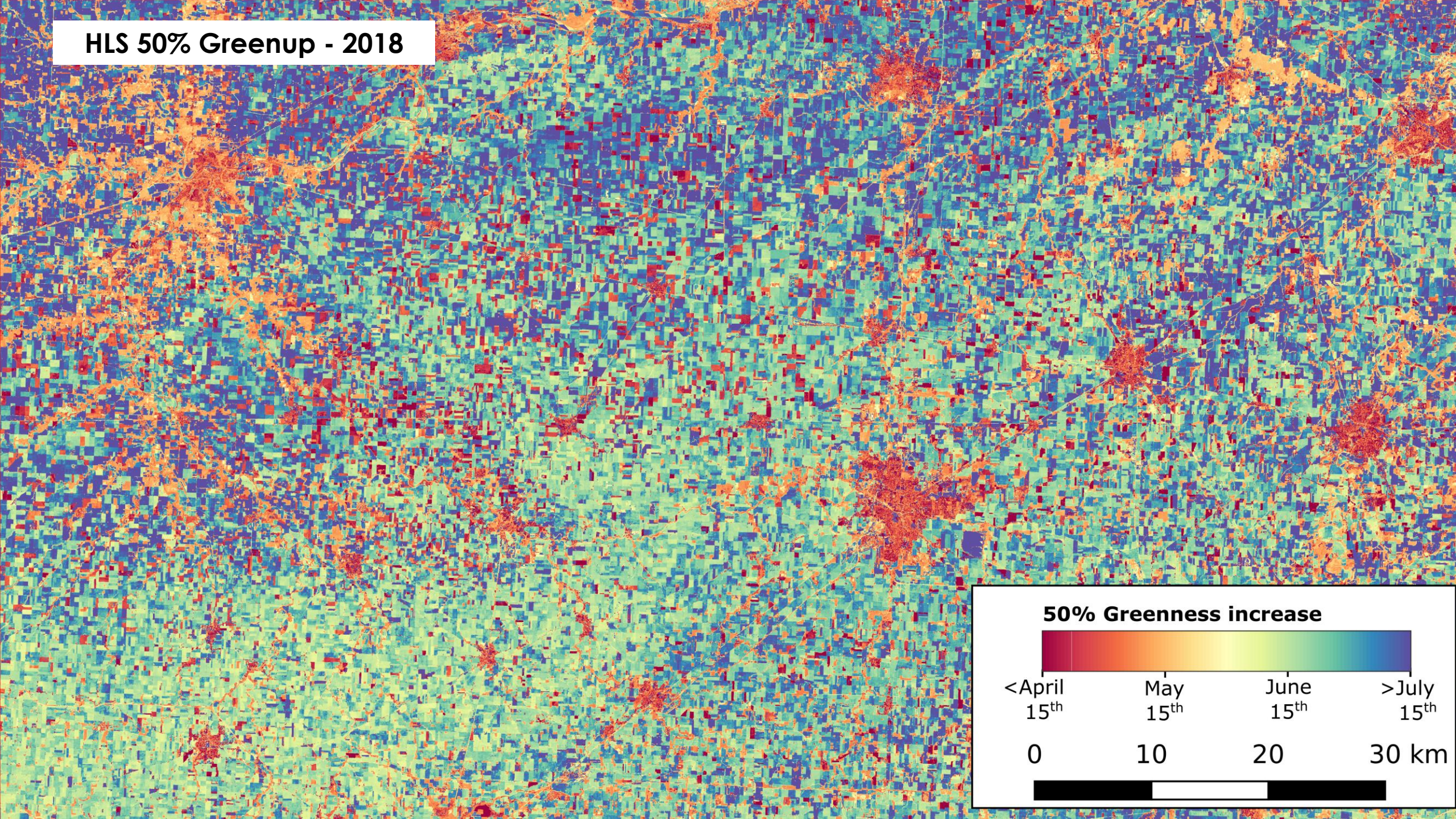
Current LSP Products



- **MODIS:**
  - MCD12Q2 v6
  - AUSCOVER (Australia only)
  - eMODIS (CONUS only)
- **VIIRS:**
  - Land Surface Phenology
- **MODIS/AVHRR:**
  - VIP
- **Landsat/Sentinel-2:**
  - HLS-LSP (forthcoming; NA only)

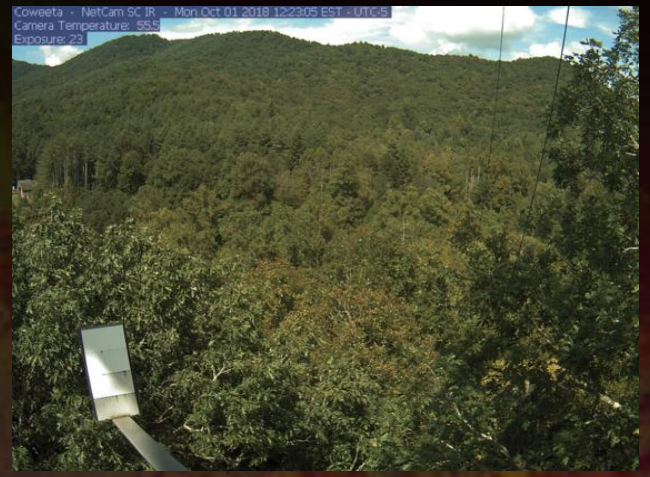

MODIS 50% Greenup - 2016
50% Greenness increase
<April 15th
May 15th
June 15th
>July 15th
0
10
20
30 km

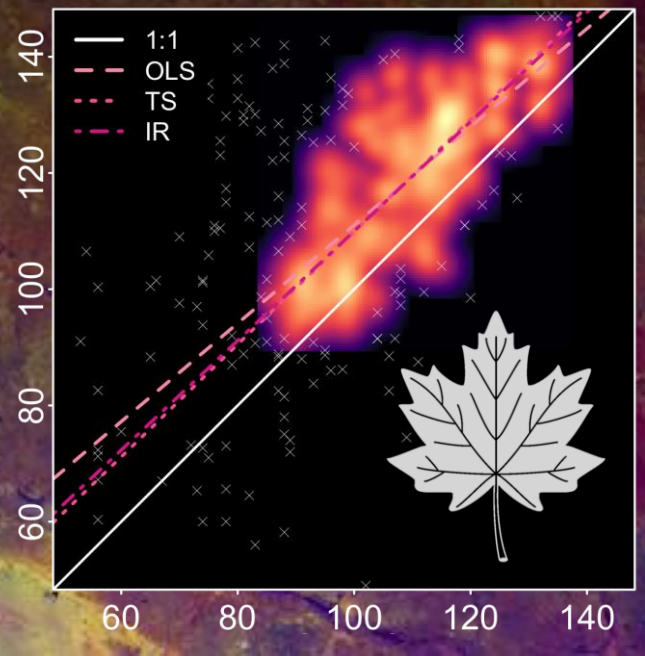
HLS 50% Greenup - 2018



Independent Datasets

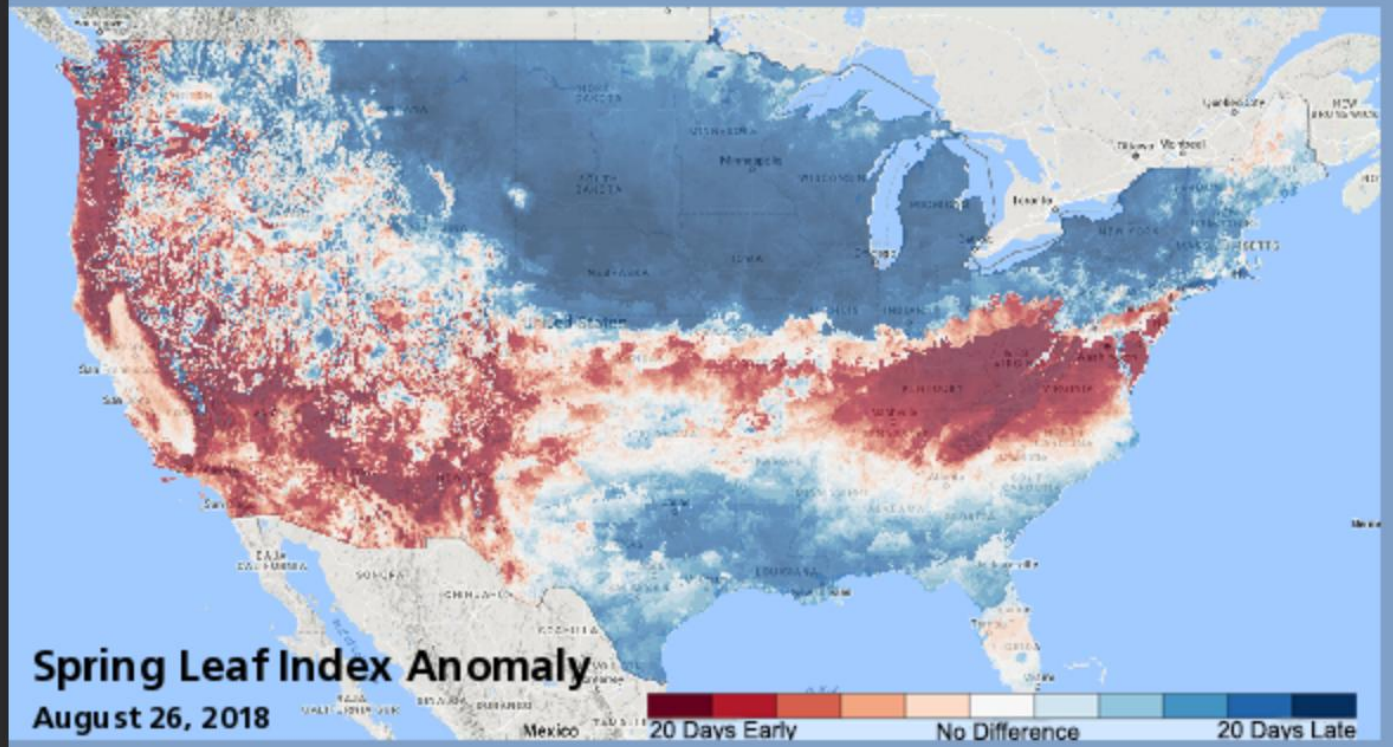
- PhenoCam
- Japanese PhenoEyes
- Citizen Science Obs.
  - US-NPN
  - PEP725
- NEON
- Lund SPECNET/NORDSPEC
- Disparate site-specific (e.g. John O'Keefe, Aimee Bailey)





USA npn National Phenology Network 10 Year Anniversary

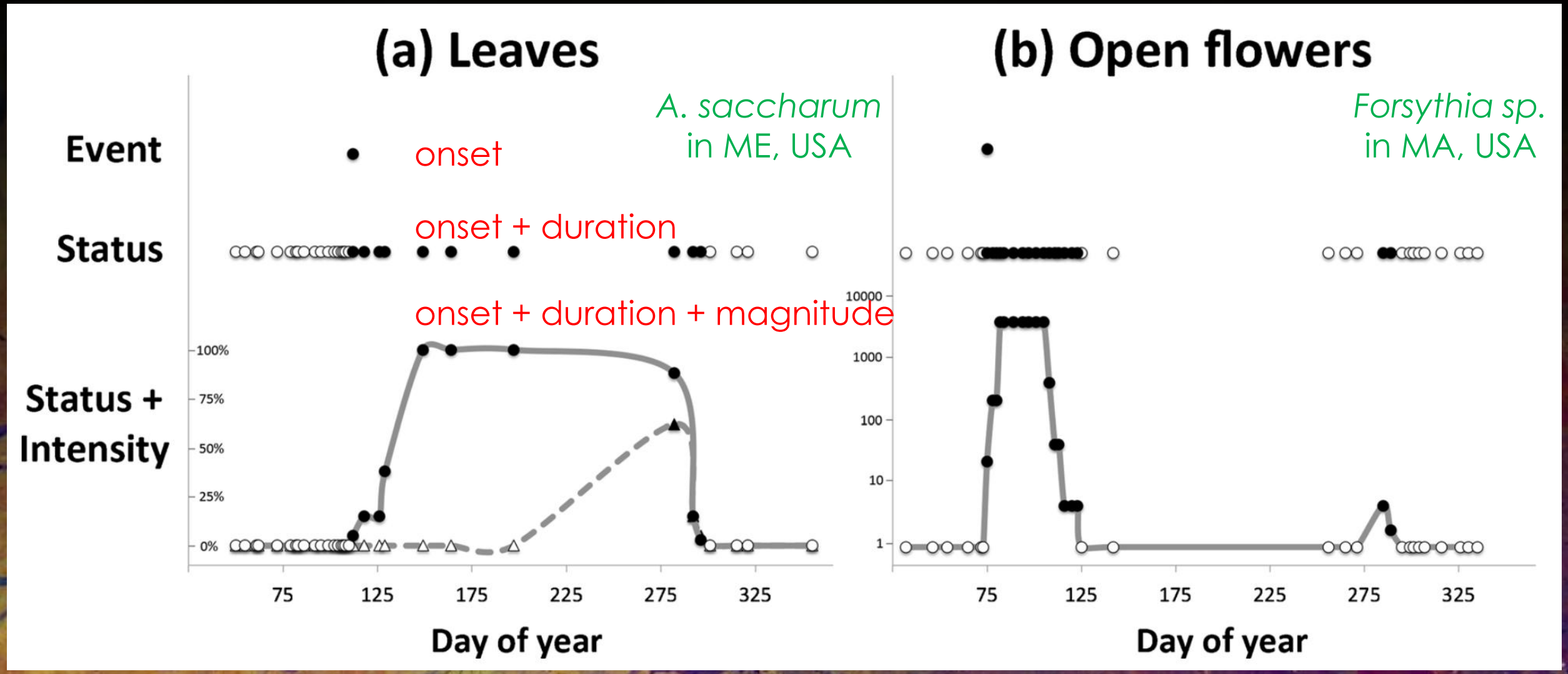
Taking the Pulse of Our Planet



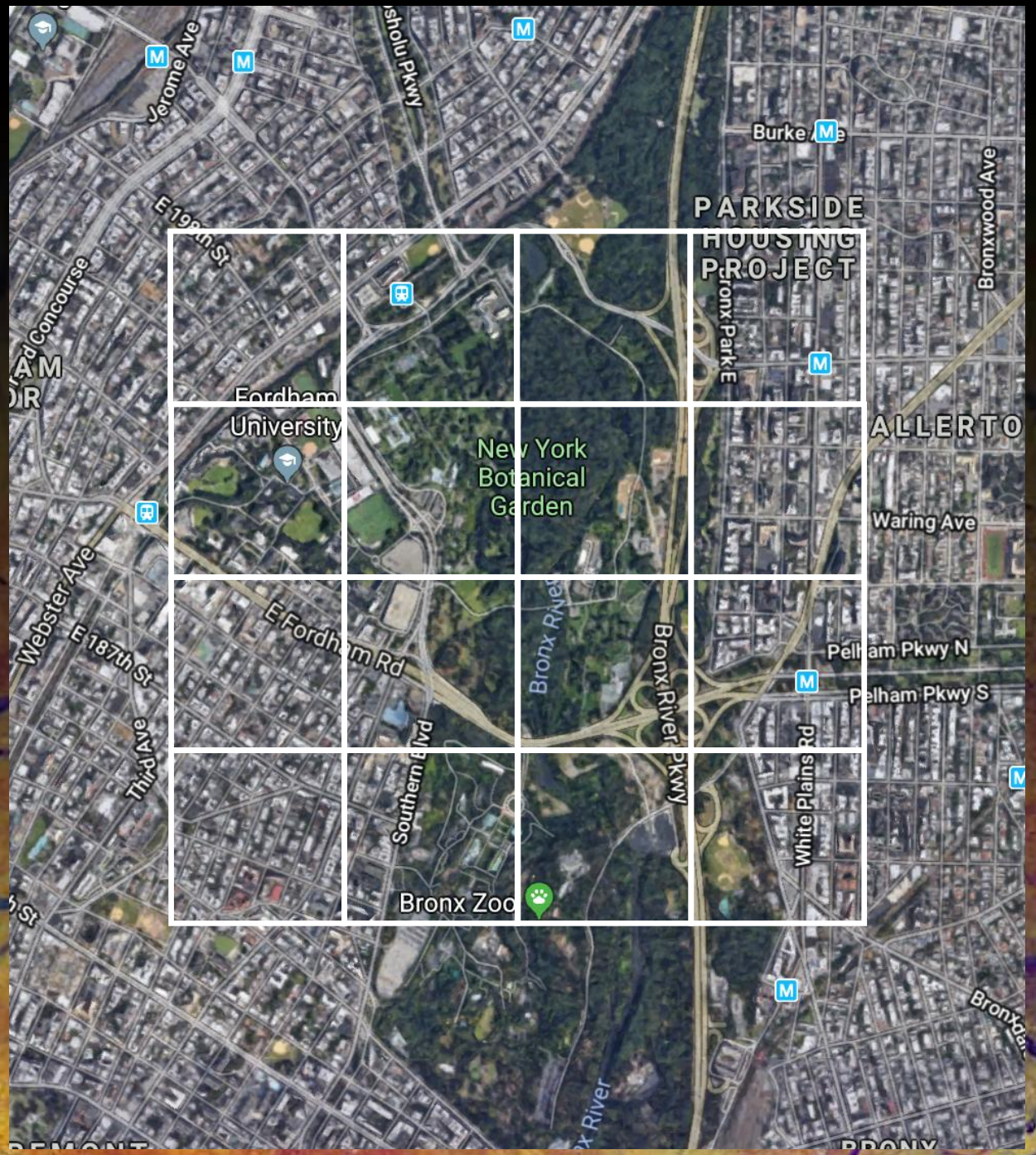
Status of Spring

This year, spring leaf-out was 1-3 weeks late in the SE, northern Great Plains, MW, and NE and 1-3 weeks early across the central Great Plains and mid-Atlantic. The west is a patchwork of early and late arrival.

SEE THE MAPS



From Denny et al. 2014, Int J Biometeorol


Jerome Ave
Burke Ave
PARKSIDE
HOUSING
PROJECT
Bronxwood Ave
Bronx Park E
Fordham
University
New York
Botanical
Garden
Waring Ave
Webster Ave
E 187th St
E Fordham Rd
Bronx River
Pelham Pkwy N
Pelham Pkwy S
Third Ave
Southern Blvd
White Plains Rd
Bronx Zoo


CAMPUS CIRCLE
90
Ocala Rd
Florida State
University
W Pensacola St
W Pensacola St

Remote Sensing of Environment 226 (2019) 74–92

Contents lists available at ScienceDirect

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse

Long-term continuity in land surface phenology measurements: A comparative assessment of the MODIS land cover dynamics and VIIRS land surface phenology products

Minkyu Moon[a,*], Xiaoyang Zhang[b,c], Geoffrey M. Henebry[d,e], Lingling Liu[b,c], Josh M. Gray[f], Eli K. Melaas[a], Mark A. Friedl[a]

Agricultural and Forest Meteorology 256–257 (2018) 137–149

Contents lists available at ScienceDirect

Agricultural and Forest Meteorology

journal homepage: www.elsevier.com/locate/agrformet

Evaluation of land surface phenology from VIIRS data using time series of PhenoCam imagery

Xiaoyang Zhang[a,b,*], Senthilnath Jayavelu[a], Lingling Liu[b], Mark A. Friedl[a], Geoffrey M. Henebry[a,d], Yan Liu[e], Crystal B. Schaaf[e], Andrew D. Richardson[f,g,h], Joshua Gray[i]

AGU PUBLICATIONS

JGR

Journal of Geophysical Research: Biogeosciences

RESEARCH ARTICLE

10.1002/2017JG003811

Key Points:

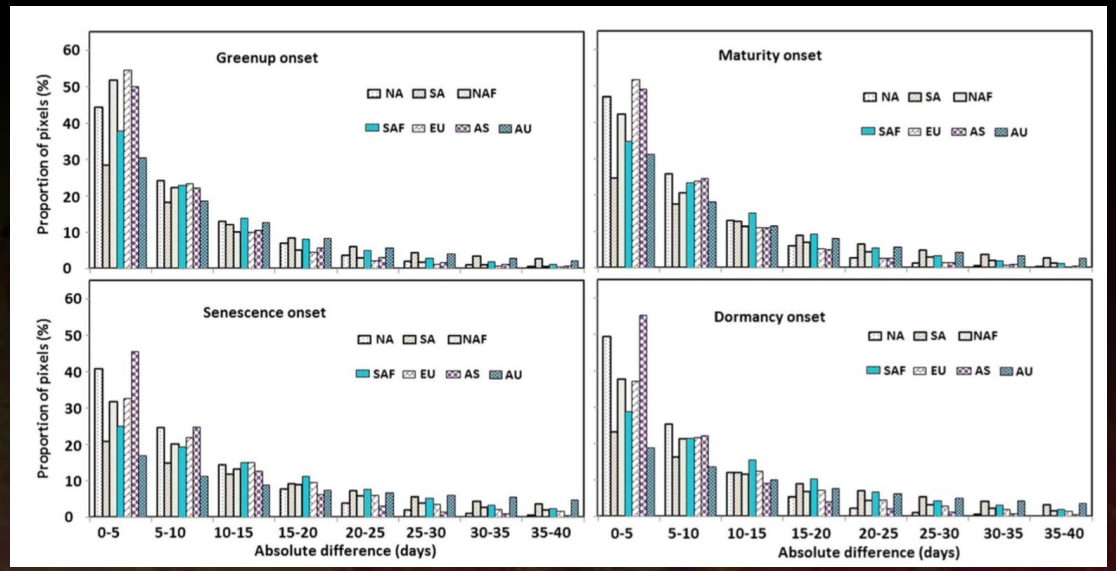
- EVI2 time series from VIIRS and MODIS were similar with unsystematic discrepancies, but VIIRS EVI2 was systematically higher than AVHRR EVI2

Comparisons of global land surface seasonality and phenology derived from AVHRR, MODIS, and VIIRS data

Xiaoyang Zhang[1,2], Lingling Liu[1], and Dong Yan[1]

[1]Geospatial Sciences Center of Excellence, South Dakota State University, Brookings, South Dakota, USA, [2]Department of Geography, South Dakota State University, Brookings, South Dakota, USA

Zhang, et al 2017



Zhang, et al 2018

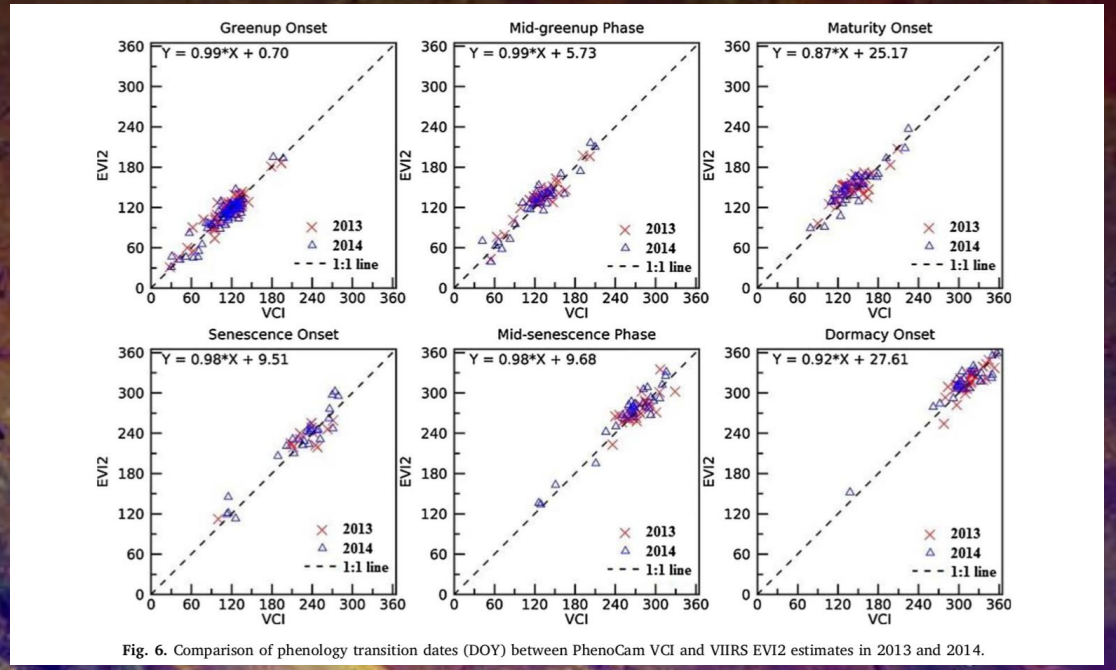
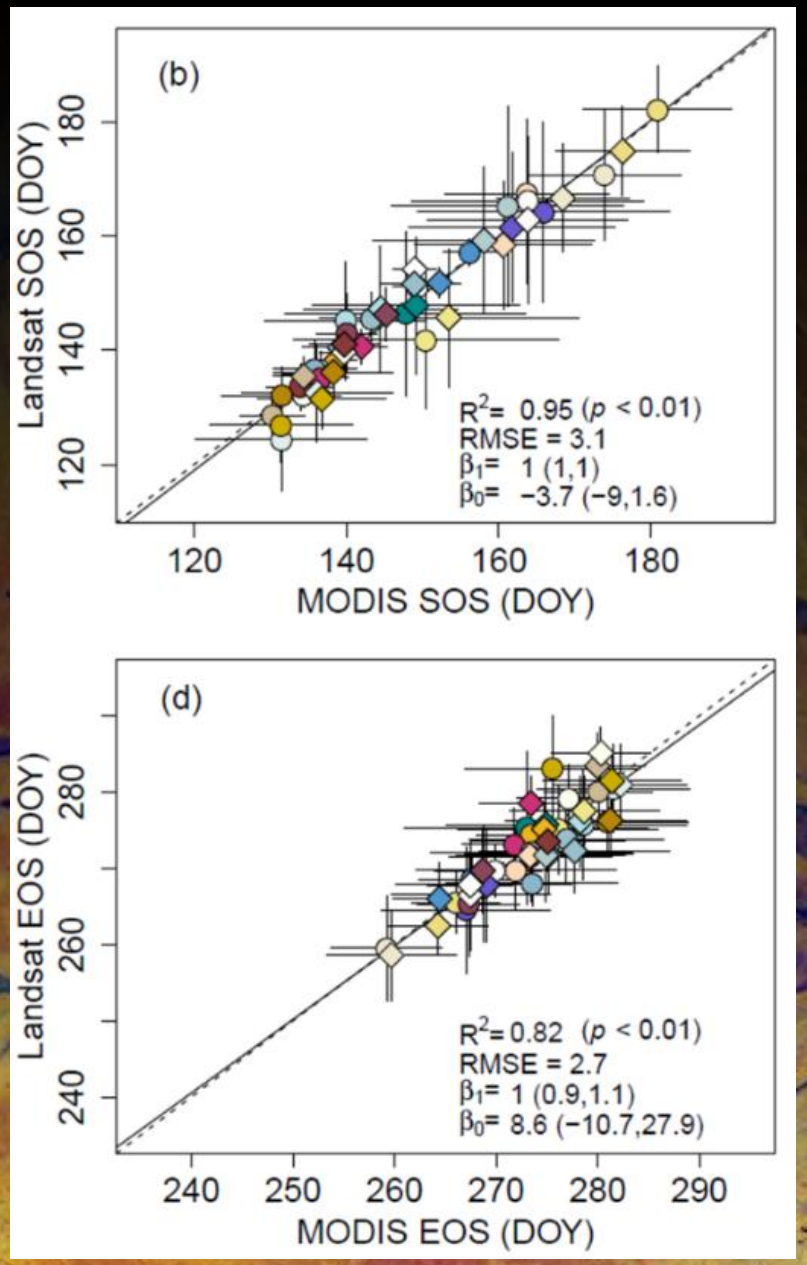
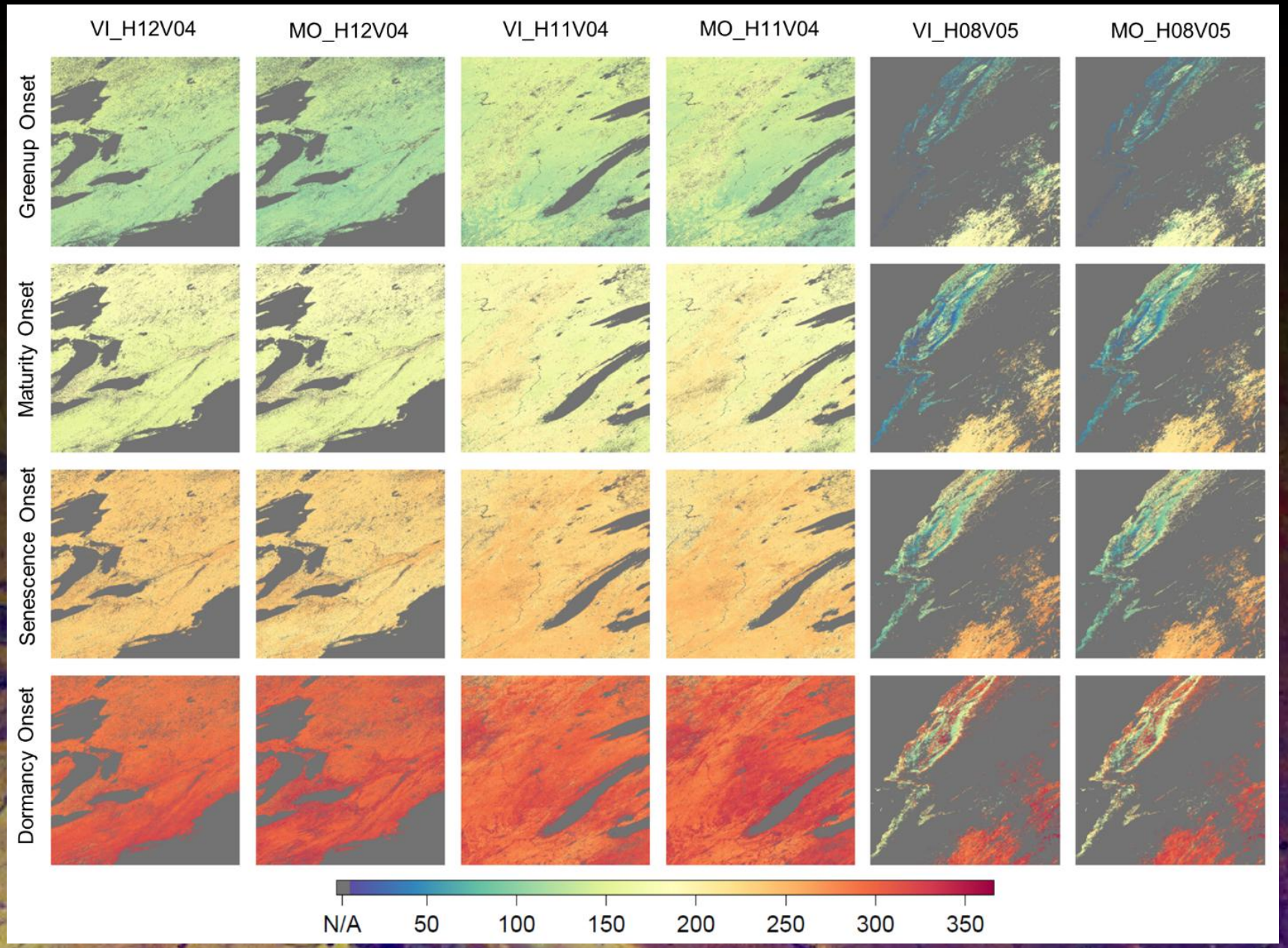


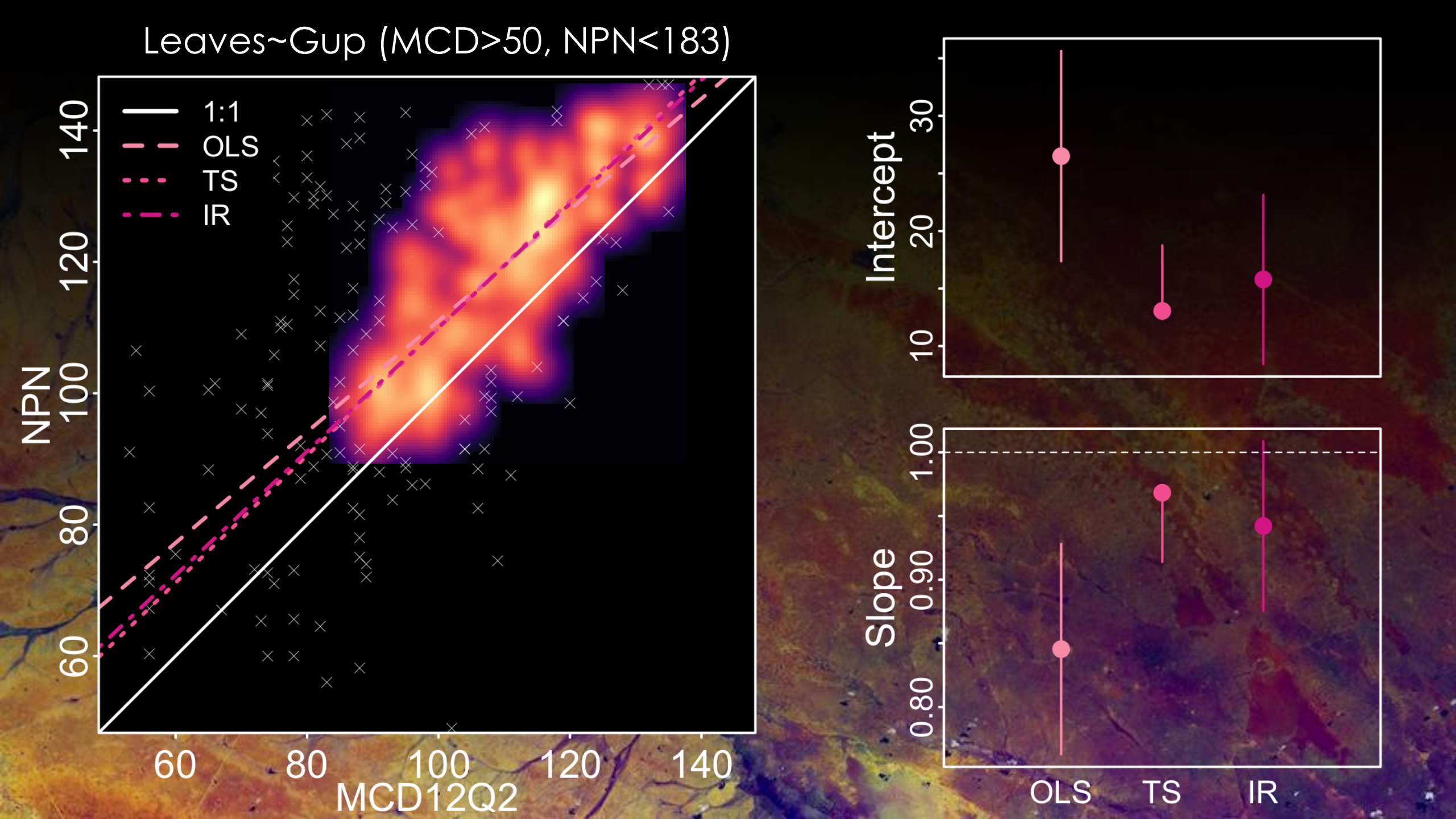
Fig. 6. Comparison of phenology transition dates (DOY) between PhenoCam VCI and VIIRS EVI2 estimates in 2013 and 2014.

Melaas, et al 2016

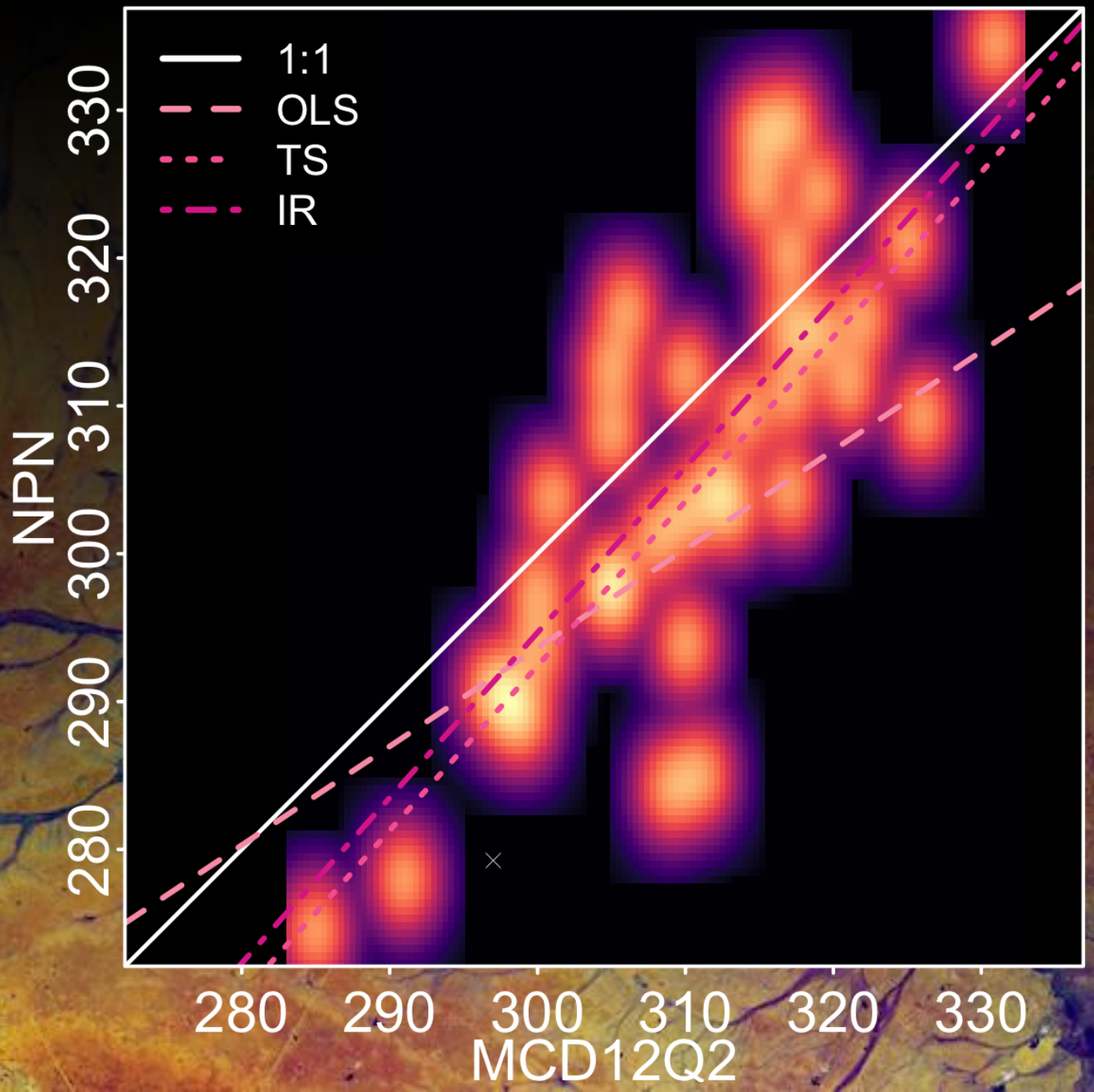


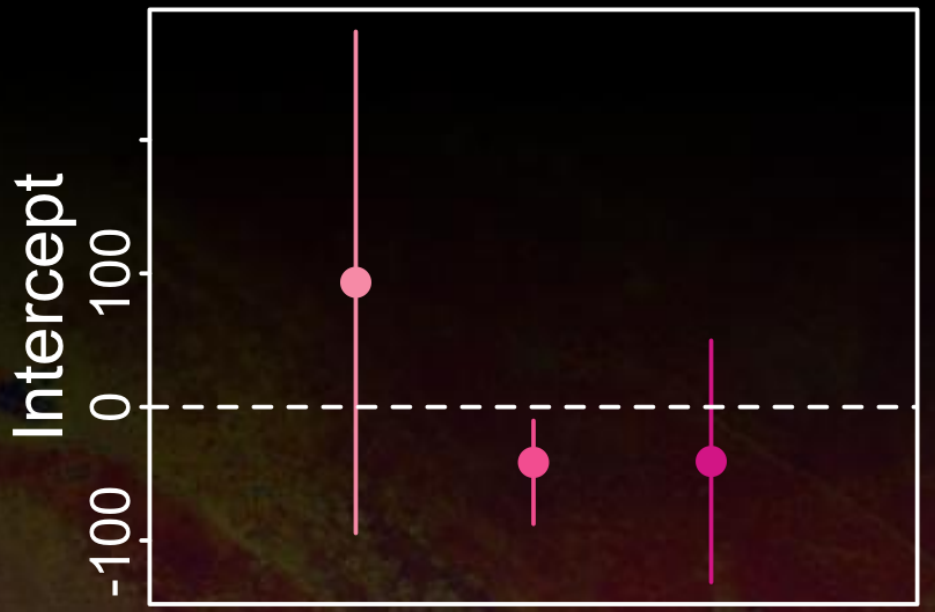
Moon, et al 2018

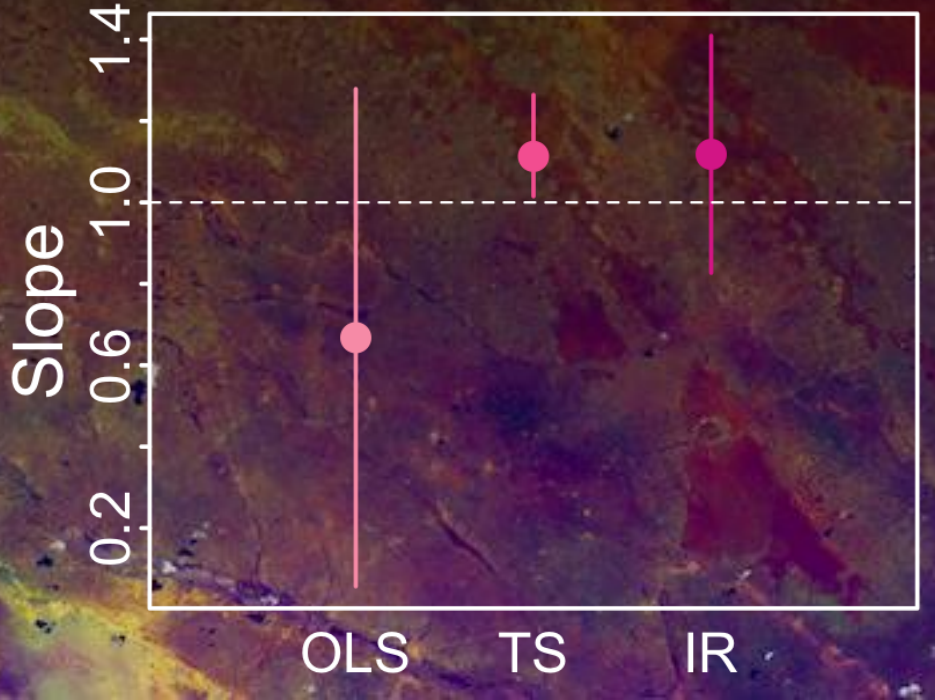



Leaves~Gup (MCD>50, NPN<183)
1:1
OLS
TS
IR
NPN
60
80
100
120
140
MCD12Q2
Intercept
10
20
30
Slope
0.80
0.90
1.00
OLS
TS
IR

All leaves fallen~Dor (NPN>200; omit 10%)







Phenology Validation Stage

Validation Stage - Definition and Current State		Variable
0	No validation. Product accuracy has not been assessed. Product considered beta.	
1	Product accuracy is assessed from a small (typically < 30) set of locations and time periods by comparison with in-situ or other suitable reference data.	**Snow** **Fire Radiative Power**
2	Product accuracy is estimated over a significant set of locations and time periods by comparison with reference in situ or other suitable reference data. Spatial and temporal consistency of the product and consistency with similar products has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature.	**fAPAR** **Phenology** **Burned Area** **Land Cover** **LAI**
3	Uncertainties in the product and its associated structure are well quantified from comparison with reference in situ or other suitable reference data. Uncertainties are characterized in a statistically rigorous way over multiple locations and time periods representing global conditions. Spatial and temporal consistency of the product and with similar products has been evaluated over globally representative locations and periods. Results are published in the peer-reviewed literature.	**Vegetation Indicies** **Albedo** **Soil Moisture** **LST & EmissiSvity** **Phenology**
4	Validation results for stage 3 are systematically updated when new product versions are released and as the time-series expands.	**Active Fire**

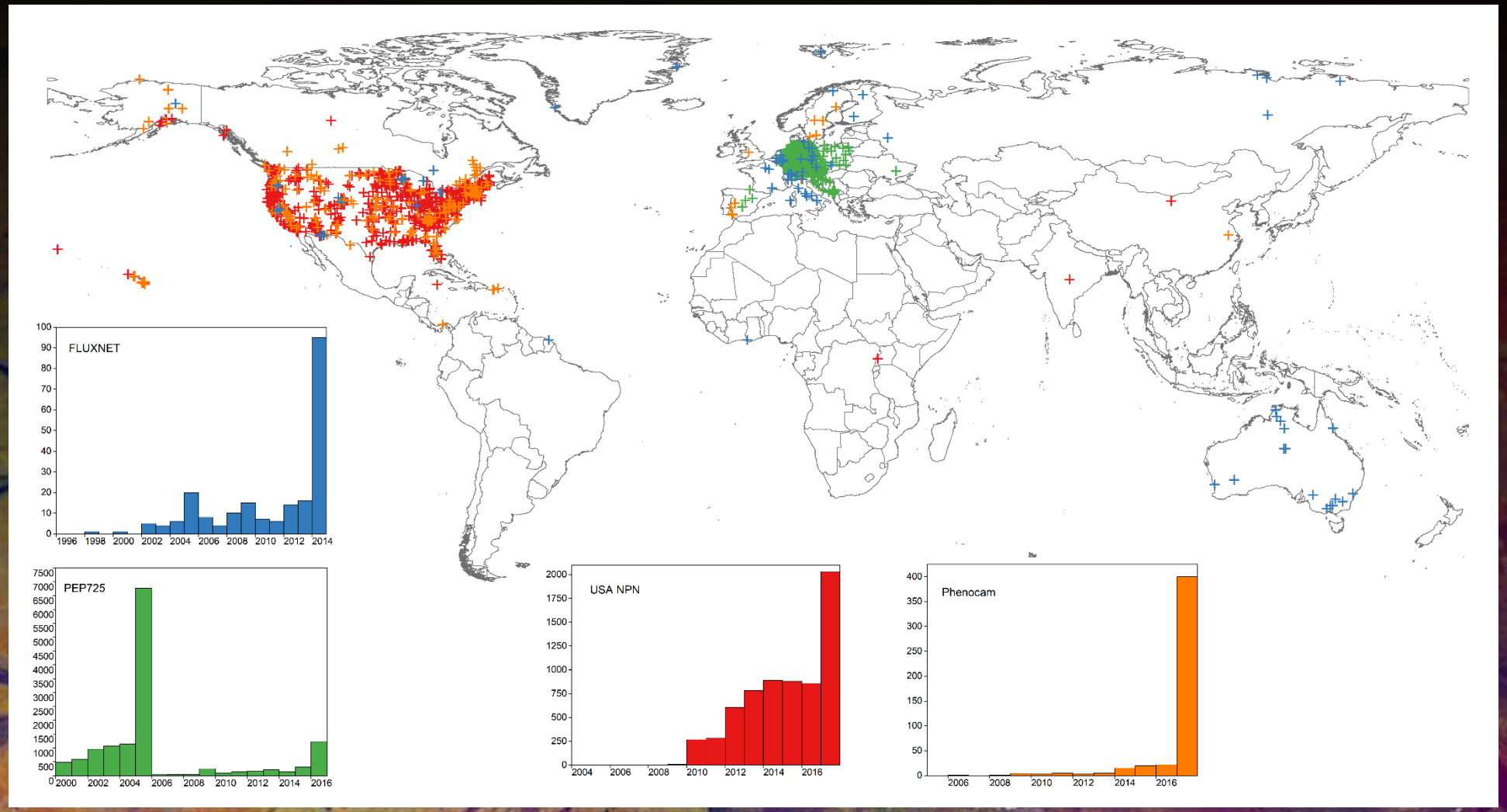
Phenology Validation Stage

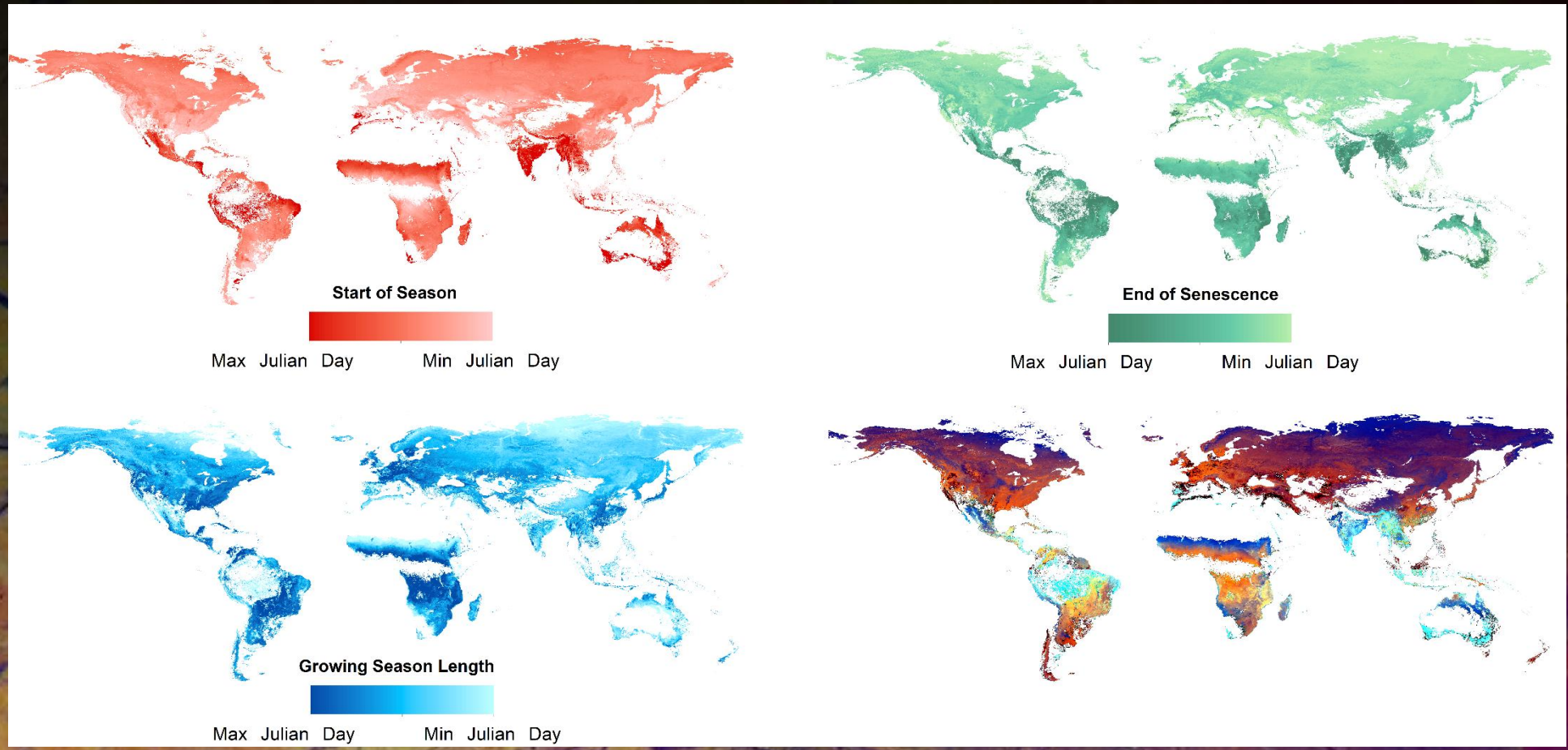
- **Type A sites:** detailed spatial and temporal ground observations incorporating multiple *resolution scaling* opportunities
- **Type B sites:** PhenoCams and citizen science observations

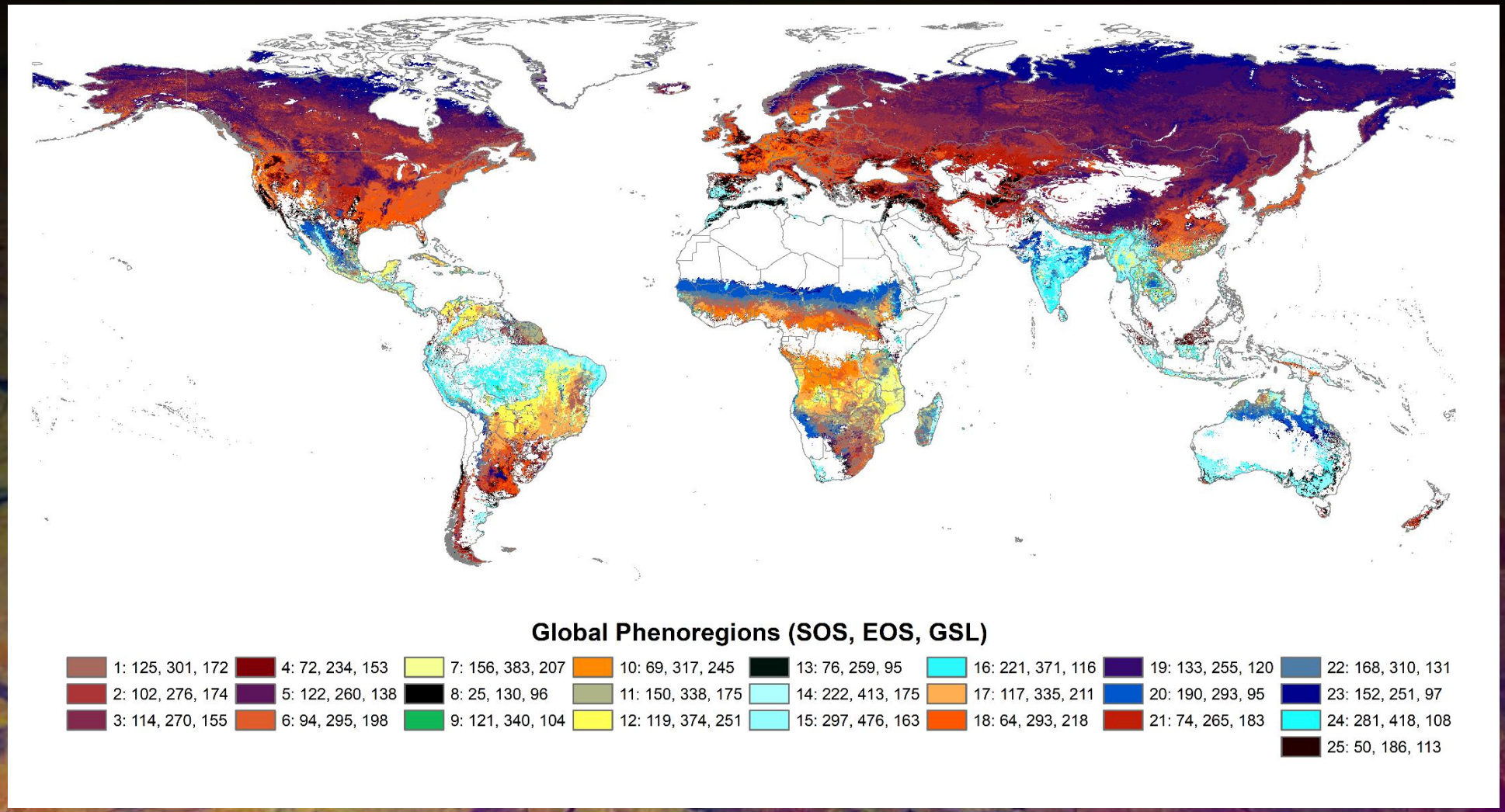
Future Activities: Next 2 Years

- Ongoing assessment/papers/site establishment
  - Characterize site representativeness
- Communication: Newsletter (next 3 months)
- Best practices documentation
  - Review of methods
  - 3rd international workshop
- Coordination
  - GEOBON-EBV integration/adoption
  - other LPV groups e.g. VI, biophysical etc.

GEO GROUP ON EARTH OBSERVATIONS


FLUXNET
PEP725
USA NPN
Phenocam


Start of Season
Max Julian Day
Min Julian Day
End of Senescence
Max Julian Day
Min Julian Day
Growing Season Length
Max Julian Day
Min Julian Day


Global Phenoregions (SOS, EOS, GSL)
1: 125, 301, 172
2: 102, 276, 174
3: 114, 270, 155
4: 72, 234, 153
5: 122, 260, 138
6: 94, 295, 198
7: 156, 383, 207
8: 25, 130, 96
9: 121, 340, 104
10: 69, 317, 245
11: 150, 338, 175
12: 119, 374, 251
13: 76, 259, 95
14: 222, 413, 175
15: 297, 476, 163
16: 221, 371, 116
17: 117, 335, 211
18: 64, 293, 218
19: 133, 255, 120
20: 190, 293, 95
21: 74, 265, 183
22: 168, 310, 131
23: 152, 251, 97
24: 281, 418, 108
25: 50, 186, 113

Challenges

“Validation” vs “Assessment” Need for Type A sites