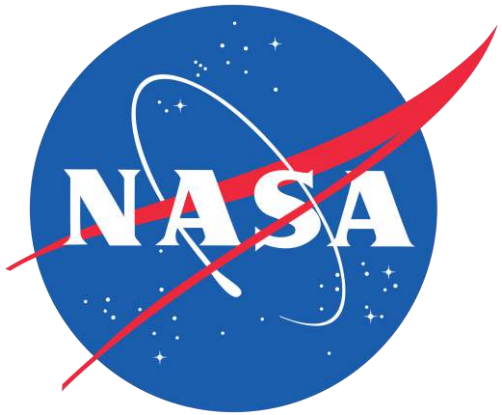
MODIS/VIIRS Land Discipline Team Activities

Miguel Román MODIS/VIIRS Measurement Team Lead

Copernicus Global Land User Conference

10/23/2018



Things to cover today (Per Michel's request)

- Governance structure of MODIS
- Products
- Decision and management of the developments / role of different entities / scientific support
- Decision and management of the evolution
- Validation approach
- Management of the continuity / historical / archiving system
- Dissemination Platform philosophy
- Communication / Product Promotion approach (?)
- User Survey / number and type of user/applications/downstream business
- Potential synergies with Sentinel 3

Coarse Resolution EOS Land Products

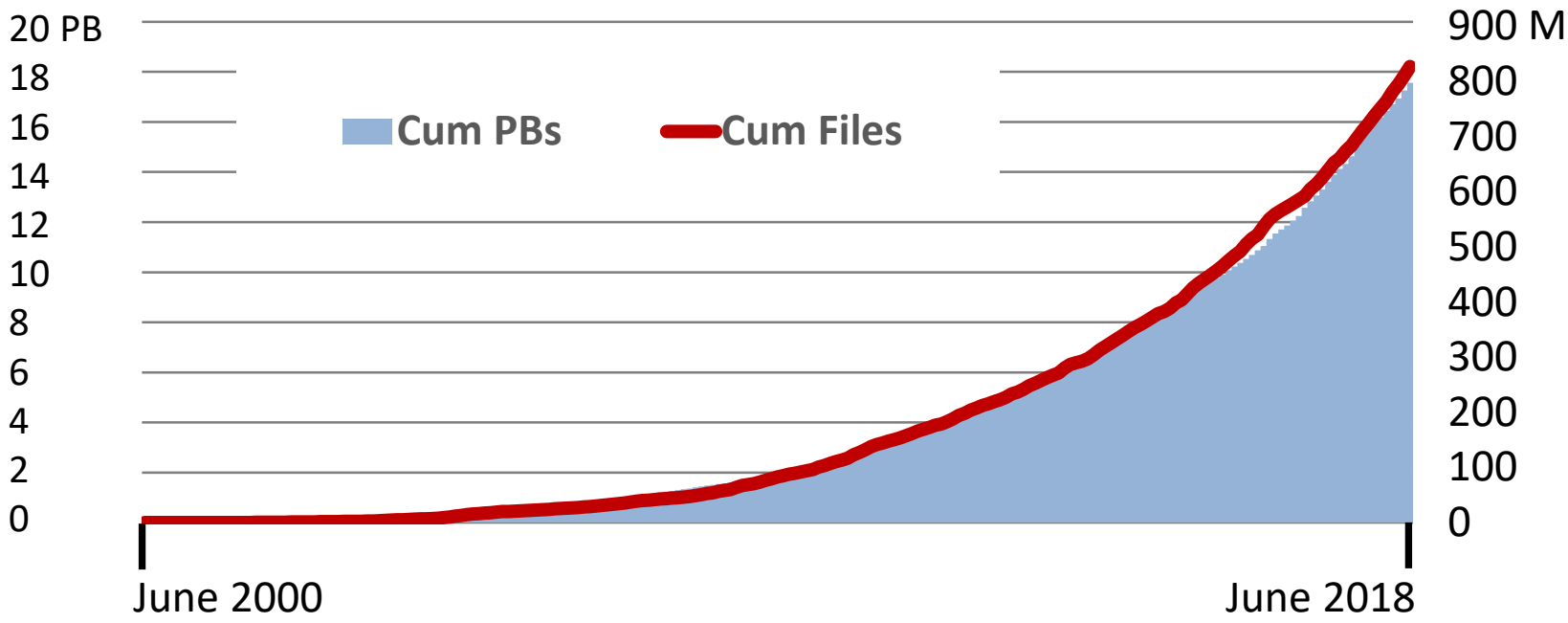
- **Heritage of EOS MODIS Land**
  - Science quality AM and PM observations
  - Peer reviewed science quality products – for the Science/Applications community
    - ATBD process
  - Systematic Improvement Reprocessing (5+ reprocessings)
  - Explicit QA (QA metadata)
    - Land Data Operational Product Evaluation (LDOPE) known issues, golden tiles, integration and test
  - Land Product Validation (accuracy assessment)
    - Land Validation Strategy > subsequently adopted by CEOS LPV
    - Significant initial investment in Validation – reduced in recent years
  - Basis for Long Term Data Record (18 years and counting)
  - Multiple ways to get the data easily inc. via Google EE, AWS
- **The 'Gold Standard' for Global Land Products**
  - Unprecedented uptake and impact of land products for both science and applications

MODIS Land Team - 2001 Post Launch

Science Team Members / Science Data Support Team / DAAC Reps

MODIS / VIIRS Land Team 2008

LP DAAC MODIS Land Data Distribution - Trend

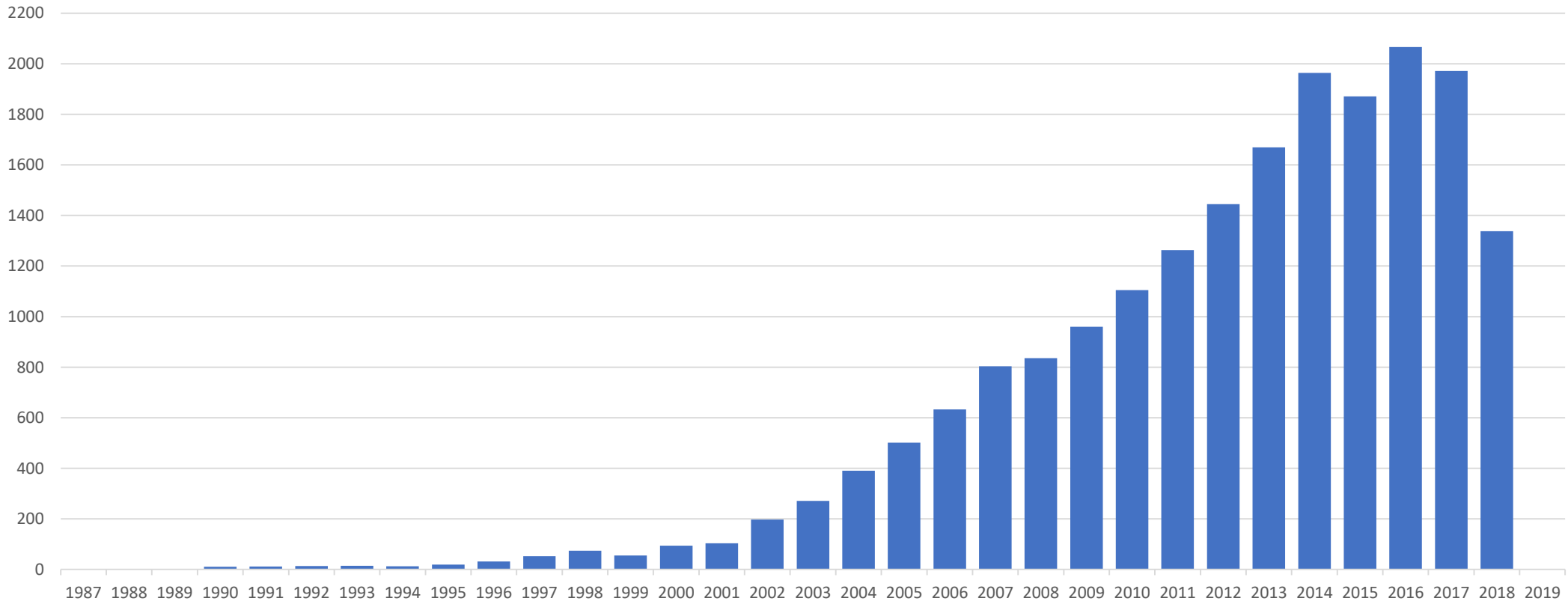


- Midpoint of volume distributed (8.78 PB) occurred in February 2015.
- Midpoint of files distributed (409,914,492) occurred in April 2015.
- In 2019 (assuming trends hold), cumulative volume distribution will exceed 20 petabytes and cumulative file distribution will exceed one billion.

MODIS Total Publication Statistics

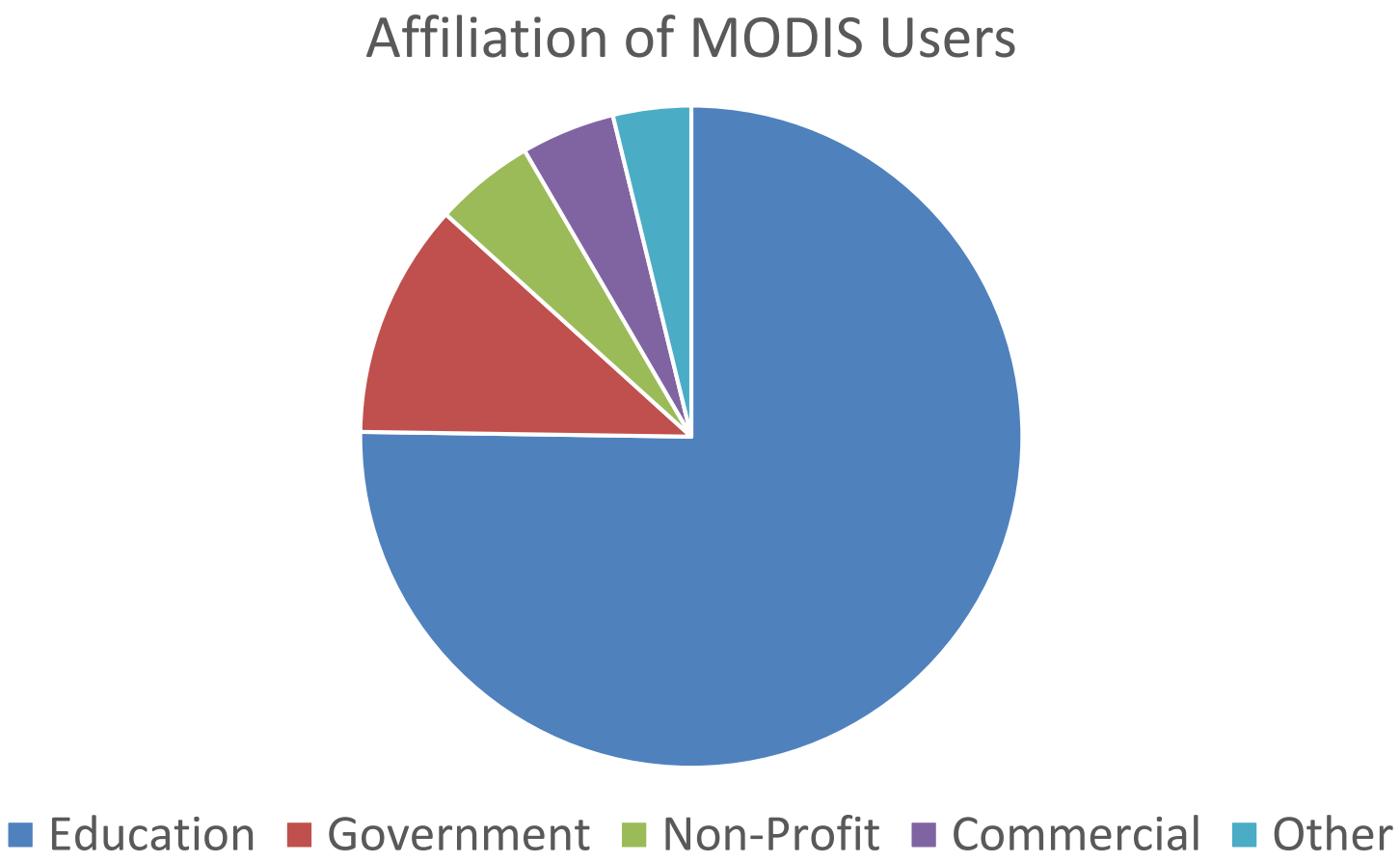
courtesy Dr. Salomonson

MODIS ALL PUBLICATIONS
TOTAL: 19,722 as of 10/03/2018



LP DAAC MODIS Land Data Distribution – 1 Year Detail

- For period July 1, 2017 – June 30, 2018



LP DAAC MODIS Land Data Distribution – 1 Year Detail

- For period July 1, 2017 – June 30, 2018
  - Eight products had > 1,000 unique users:

Product	Shortname	Version	Users
MODIS/Terra Vegetation Indices 16-Day L3 Global 250m SIN Grid	MOD13Q1	6	3,290
MODIS/Terra+Aqua Land Cover Type Yearly L3 Global 500m SIN Grid	MCD12Q1	51	2,161
MODIS/Terra Land Surface Temperature/Emissivity Daily L3 Global 1km SIN Grid	MOD11A1	6	1,660
MODIS/Terra Surface Reflectance 8-Day L3 Global 500m SIN Grid	MOD09A1	6	1,542
MODIS/Terra Land Surface Temperature/Emissivity 8-Day L3 Global 1km SIN Grid	MOD11A2	6	1,419
MODIS/Terra Net Evapotranspiration 8-Day L4 Global 500m SIN Grid	MOD16A2	6	1,172
MODIS/Terra Vegetation Indices 16-Day L3 Global 250m SIN Grid	MOD13Q1	5	1,093
MODIS/Terra Surface Reflectance Daily L2G Global 250m SIN Grid	MOD09GQ	6	1,028

USGS

NASA

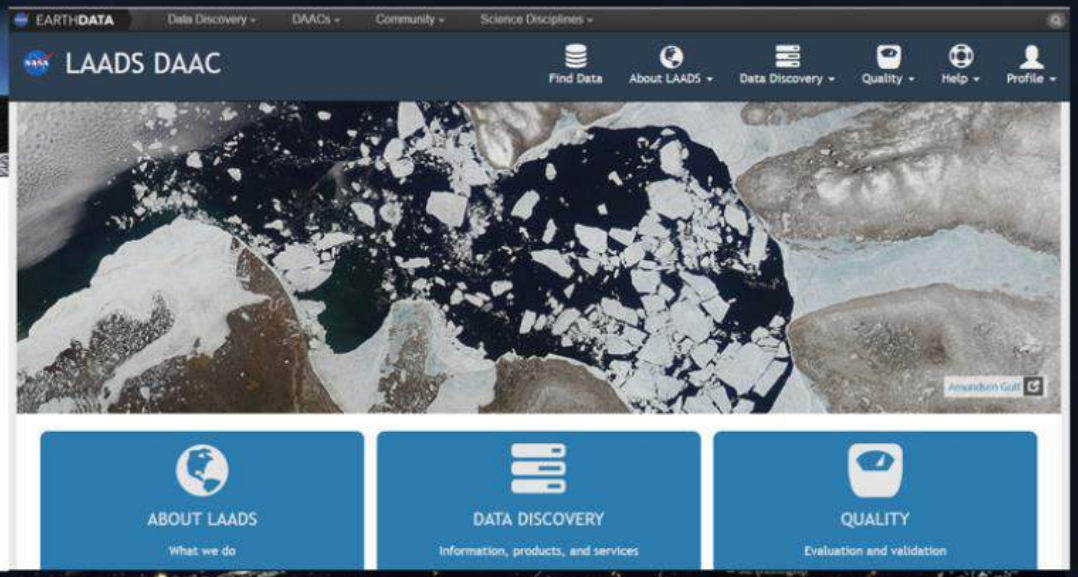
Science and Exploration Directorate

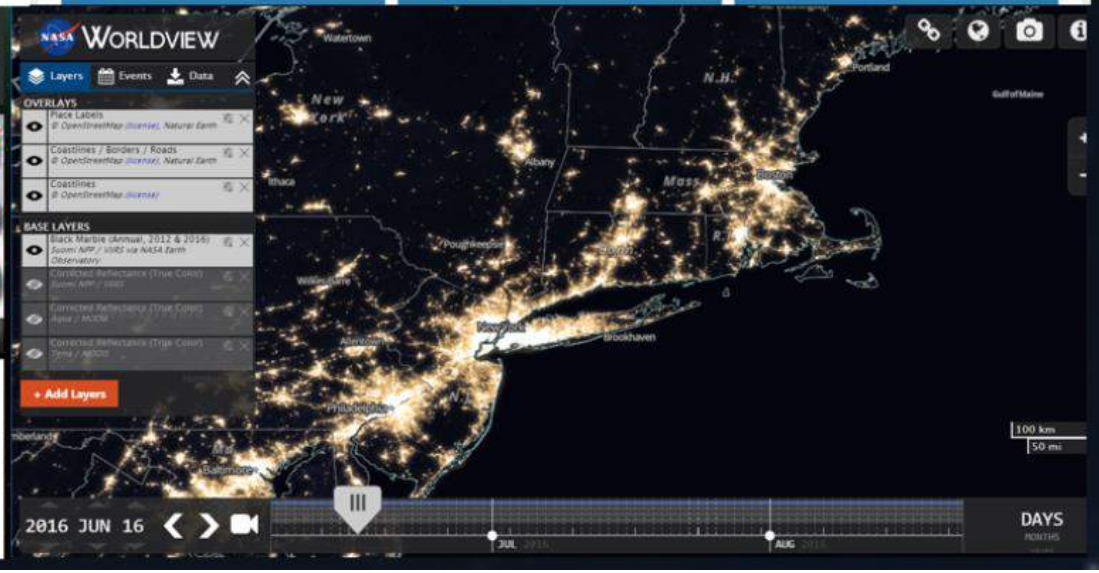
Terrestrial Information Systems Laboratory

Apply operationally proven data systems components to support earth observing missions (Terra/Aqua/Suomi-NPP)	→ Data Acquisition, Processing, Archive, Distribution, Search/Access
Work closely with science teams to support product generation, quality assessment and validation.	→ Algorithm Development/Integration, Calibration and Validation
Develop value-added products and services to facilitate utilization of NASA earth data and information.	→ Customized science products, near real-time products for applications and outreach
Carry out research in the development and application of new technology and standards.	→ Scalable systems for processing and archiving, Data interoperability, Service interoperability
Geolocation, Land Surface Reflectance, BRDF/Albedo, NASA Black Marble	→ Fundamental Land Science Products

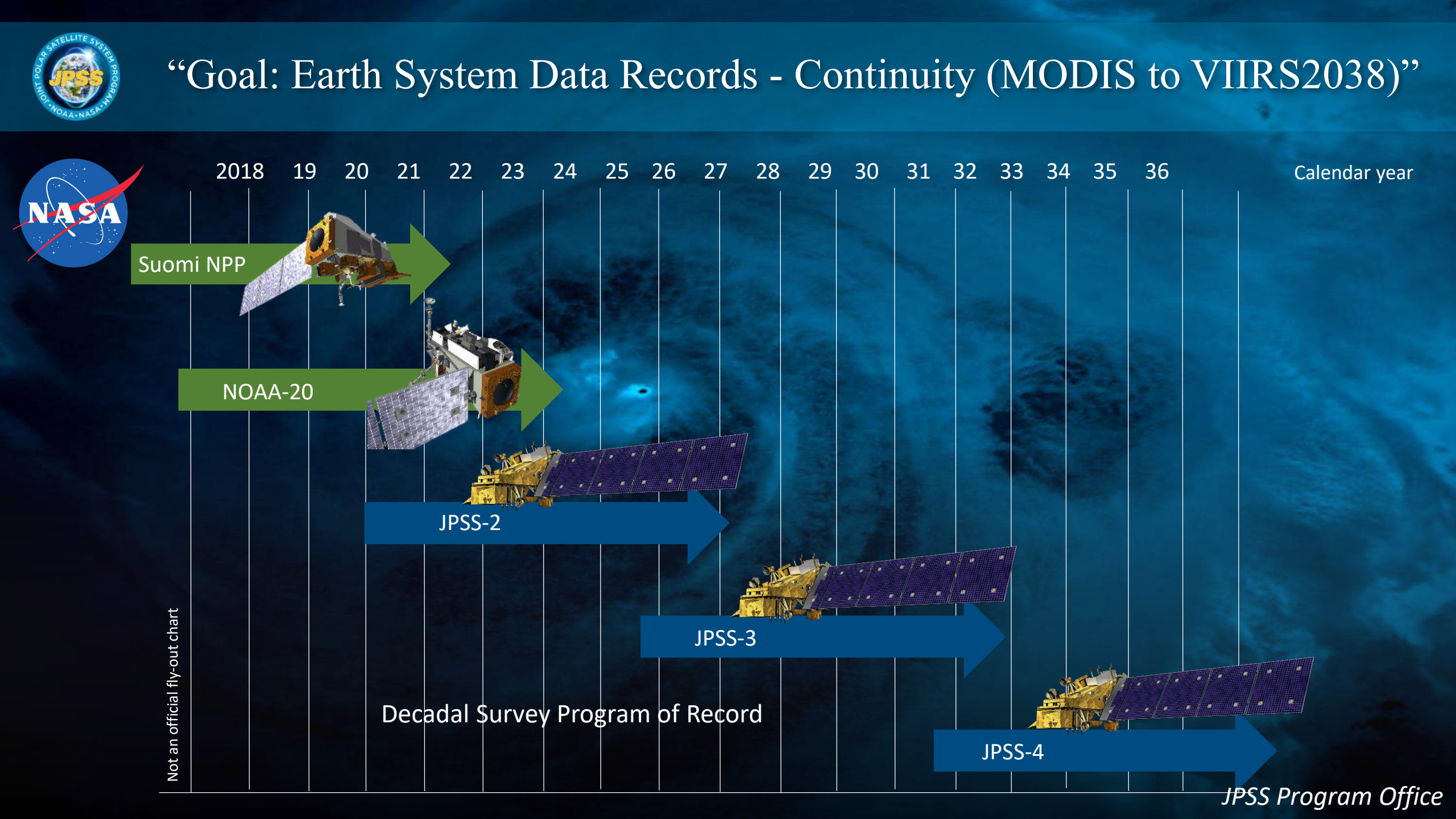
Science and Exploration Directorate

Terrestrial Information Systems Laboratory





“Goal: Earth System Data Records - Continuity (MODIS to VIIRS2038)”



JPSS Program Office

MODIS > VIIRS

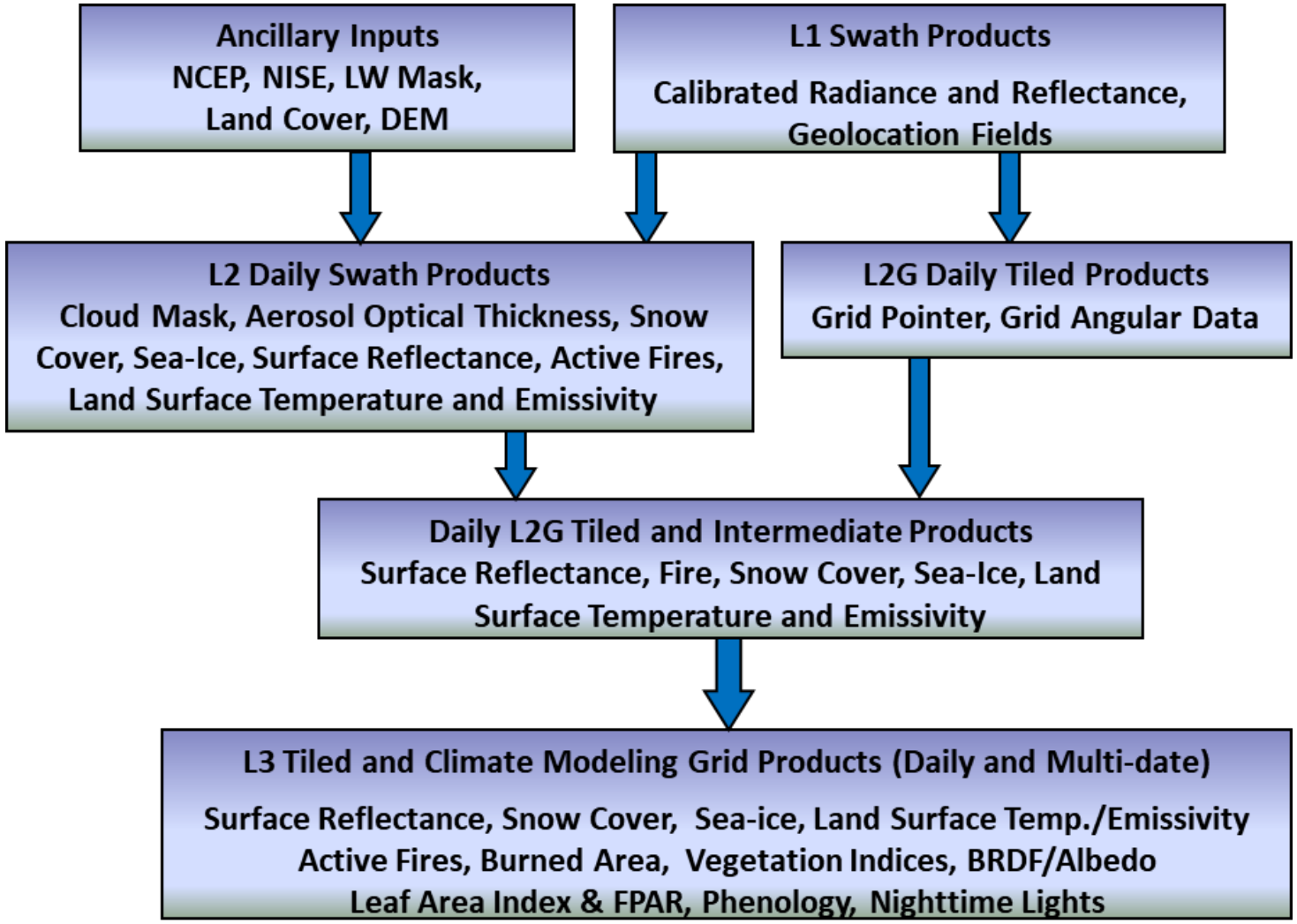
- VIIRS instrument adopted many of the qualities of MODIS
  - IPO benefited from MODIS experience - But not all science needs were accommodated
- NOAA VIIRS data products were developed largely around the MODIS heritage algorithms (w. MODIS P.I. participation)
- Not an exact match in algorithms/products due to a number of factors
  - Operational mandate (NWS, DOD), No formal science requirements
  - Difficult process for accepting algorithm changes w. high contractor costs
  - Limitations and complexity of the IDPS Processing System
  - No routine reprocessing for consistent data records
- NASA Land PI's funded to evaluate NOAA SNPP-VIIRS products for science use
- NASA generated its own MODIS/VIIR Land Continuity Products to meet the needs of the science/applications users – production slower than anticipated
- NOAA moved processing from IDPS to NDE and is now including reprocessing
- Current divergence in the S-NPP VIIRS NASA and NOAA Level 1 products
- JPSS-1/NOAA 20 continuing the NOAA Land Products (JPSS-2 and beyond)

V1.0 Suomi-NPP VIIRS Land Product Status

EOS Products	Algorithms Delivered to Land SIPS	Product Integration and Testing	ATBD Delivery	Delivery of User's Guide	Products Delivered to assigned DAAC
Surface Reflectance	✓	✓	✓	✓	✓
LAI/FPAR	✓	✓	✓	✓	✓
Snow Products	✓	✓	✓	✓	✓
MAIAC	Qtr 4, 2018	Qtr 4, 2018	Qtr 3, 2018	Qtr 1, 2019	V2.0 - Qtr 1, 2019
BRDF/Albedo	✓	✓	✓	✓	✓
Burned Area	Qtr 3, 2018	Qtr 4, 2018	✓	Qtr 4, 2018	Qtr 1, 2019
Active Fires	✓	✓	✓	✓	✓
Vegetation Index	✓	✓	✓	✓	✓
LST&E	✓	✓	✓	✓	Qtr 4, 2018
Ice Surface Temp	✓	✓	✓	✓	✓
Sea Ice Cover	✓	✓	✓	✓	✓
Phenology	✓	Underway	✓	✓	Qtr 4, 2018
Black Marble	✓	Underway	✓	✓	Qtr 1, 2019

Details in Reports at the Land Break out session:
https://modis.gsfc.nasa.gov/sci_team/meetings/201810/

NASA VIIRS Land Product Interdependencies



Status of MODIS Surface Reflectance – Vermote

MODIS SR Product suite

Collection 6: (Released in 2015)

Bands 1 through 7

250m, 500m, 0.05 deg.

Daily, 8 days

Status and Updates:

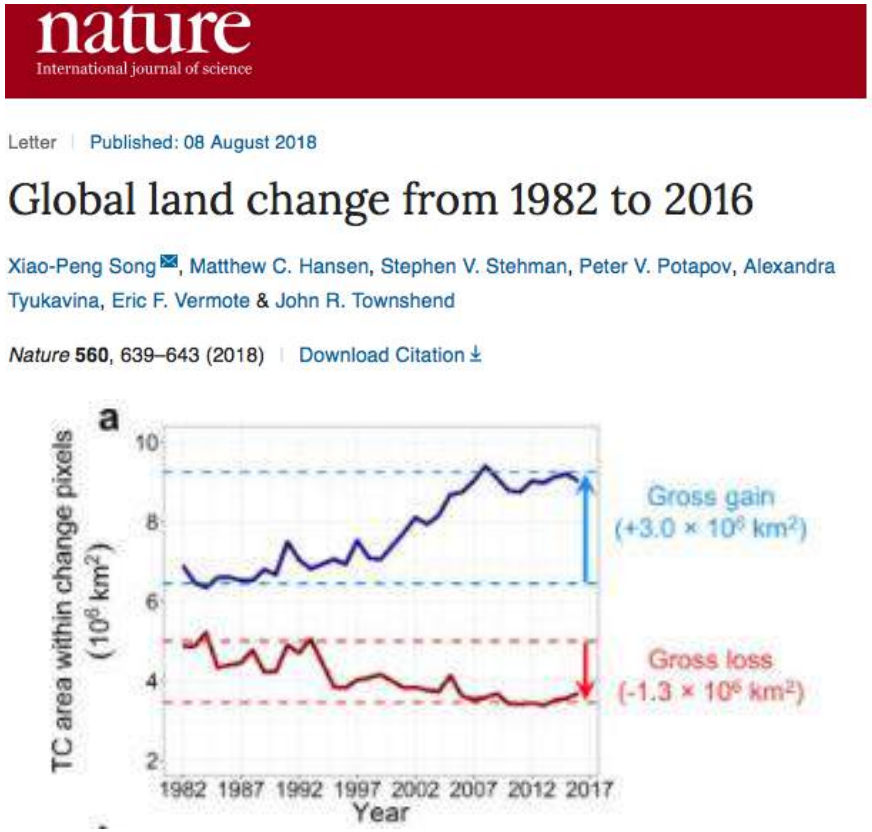
- MODIS SR Collection 6 (LaSRC: Land Surface Reflectance Code) is the basis for a variety of SR product (VIIRS, AVHRR, Landsat, Sentinel 2) assuring consistency and traceability in the SR products from multiple satellites/instruments.
- Validation stage IV (AERONET) and cross-comparison with MODIS is on-going.

Known Issues:

- None

Recent Publications:

- Doxani, G., Vermote, E., Roger, J.C., Gascon, F., Adriaensen, S., Frantz, D., Hagolle, O., Hollstein, A., Kirches, G., Li, F. and Louis, J., 2018. Atmospheric correction inter-comparison exercise. Remote Sensing, 10(2), p.352.
- Skakun, S., Franch, B., Vermote, E., Roger, J.C., Becker-Reshef, I., Justice, C. and Kussul, N., 2017. Early season large-area winter crop mapping using MODIS NDVI data, growing degree days information and a Gaussian mixture model. Remote Sensing of Environment, 195, pp.244-258.
- Breon F.M., Vermote E.F., Murphy E., Franch B., (2015) Measuring the directional variations of land surface reflectances from MODIS, IEEE transactions on Geoscience and Remote Sensing, 53 (8), 4638-4649.

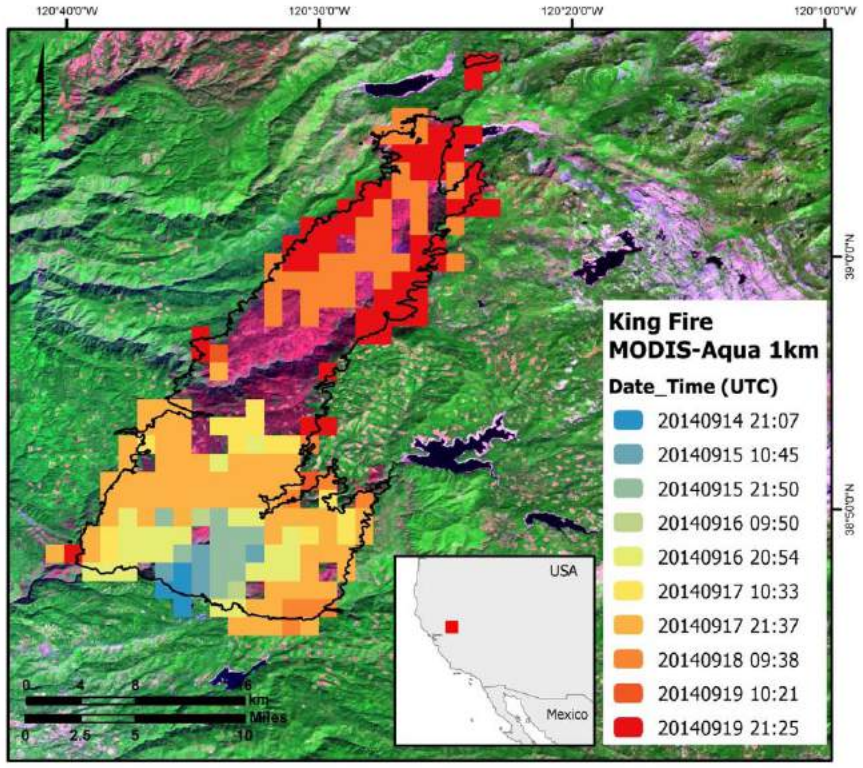


"Contrary to popular opinion, tree cover increased by 2.24 million square kilometers (more than 850,000 square miles), an increase of about 7 percent during the time period."

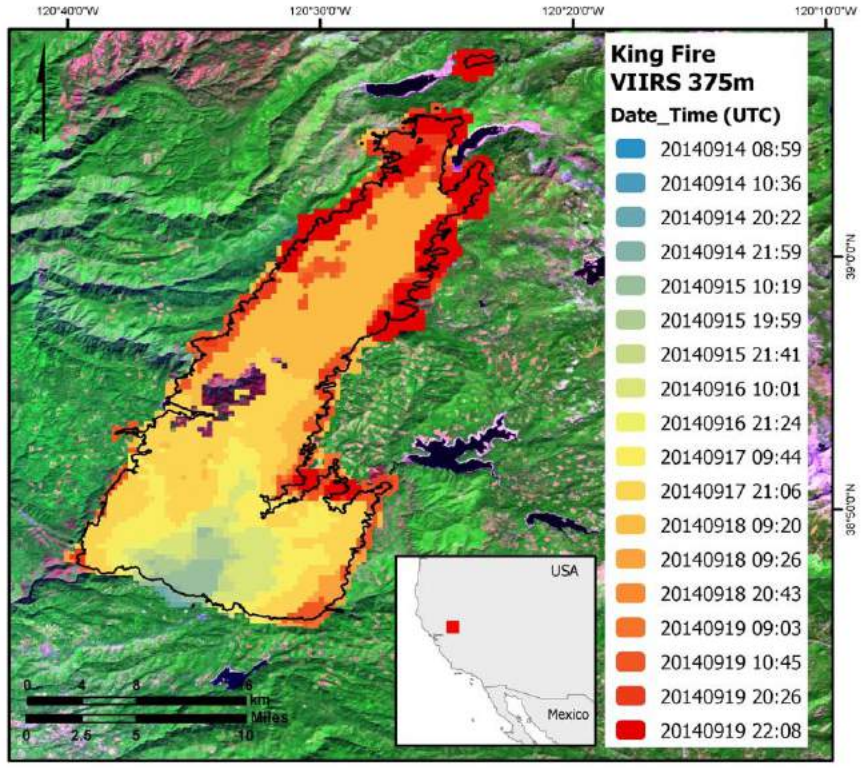
S-NPP/VIIRS Active Fire Product Suite: Bridging EOS and JPSS

Louis Giglio[1], Wilfrid Schroeder[2], Joanne Hall[1]
[1]University of Maryland, [2]NOAA NESDIS

Aqua/MODIS 1km



S-NPP/VIIRS 375m



1-km Aqua MODIS (left) and near-coincident 375-m S-NPP VIIRS (right) mapping of fire progression during the 2014 King Fire event in California. Colored polygons describe the active fire pixel footprints of MODIS and VIIRS. The black polygon outlines the fire-affected area mapped using the background Landsat-8/OLI image acquired on 5 October 2014

Status of MODIS Burned Area - Giglio

MODIS Burned Area Product

Collection 6: (released 2017)

- MCD64A1: Monthly L3 500 m SIN Grid
- MCD64CMH: Monthly CMG (released 2018)

Status and Updates:

- Stage-2 validation complete.
- Stage-3 validation in preparation.

Known Issues:

- Edge fix for 26 tiles (patch 6.0.8).

Recent Publications:

- Giglio, L., Boschetti, L., Roy, D. P., Humber, M. L., and Justice, C. O., 2018, The Collection 6 MODIS burned area mapping algorithm and product. *Remote Sensing of Environment*, 217:72–85.
- Humber, M. L., Boschetti, L., Giglio, L., and Justice, C. O., 2018, Spatial and temporal intercomparison of four global burned area products, *International Journal of Digital Earth*.
- Andela et al., 2017, A human-driven decline in global burned area. *Science*, 356:1356-1362.

RESEARCH ARTICLES | ECOLOGY

A human-driven decline in global burned area

N. Andela[1,2,*], D. C. Morton[1], L. Giglio[3], Y. Chen[2], G. R. van der Werf[4], P. S. Kasibhatla[5], R. S. DeFries[6], G. J. Collatz[1], S. Han…

+ See all authors and affiliations

Science 30 Jun 2017:
Vol. 356, Issue 6345, pp. 1356-1362
DOI: 10.1126/science.aal4108

Article | Figures & Data | Info & Metrics | eLetters | PDF

Burn less, baby, burn less

Humans have, and always have had, a major impact on wildfire activity, which is expected to increase in our warming world. Andela *et al.* use satellite data to show that, unexpectedly, global burned area declined by ~25% over the past 18 years, despite the influence of climate. The decrease has been largest in savannas and grasslands because of agricultural expansion and intensification. The decline of burned area has consequences for predictions of future changes to the atmosphere, vegetation, and the terrestrial carbon sink.

Science, this issue p. **1356**

Status of Terra/Aqua MODIS BRDF, Albedo and NBAR - Schaaf

MODIS BRDF Albedo NBAR Products

Collection V006:

- MCD43A: 500 m SIN grid
- MCD43A1: BRDF/Albedo Model Parameters
- MCD43A2: BRDF/Albedo Quality
- MCD43A3: Albedo
- MCD43A4: NBAR
- MCD43C: 0.05 degree CMG
- MCD43C1: CMG BRDF/Albedo Model Parameters
- MCD43C2: CMG BRDF/Albedo Model Snow-Free Parameters
- MCD43C3: CMG Albedo
- MCD43C4: CMG NBAR
- MCD43D: 30 Arc-Second CMG (1 – 40)
- MCD43GF: CMG Gap-Filled Snow-Free

Status and Updates:

- New daily retrievals are being used extensively for phenology studies.
- Snow free Gap Filled V006 products (MCD43GF) are under production →

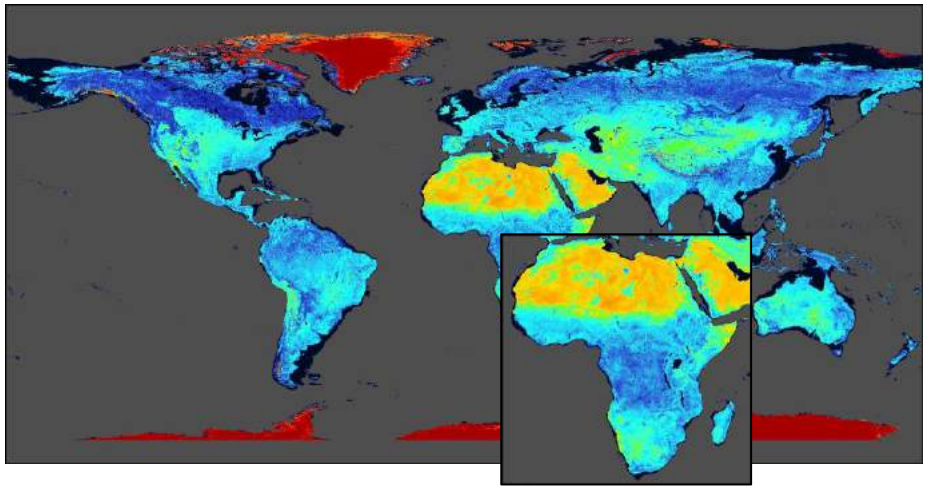
Known Issues:

- None

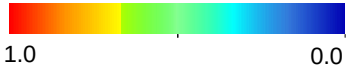
Recent Publications:

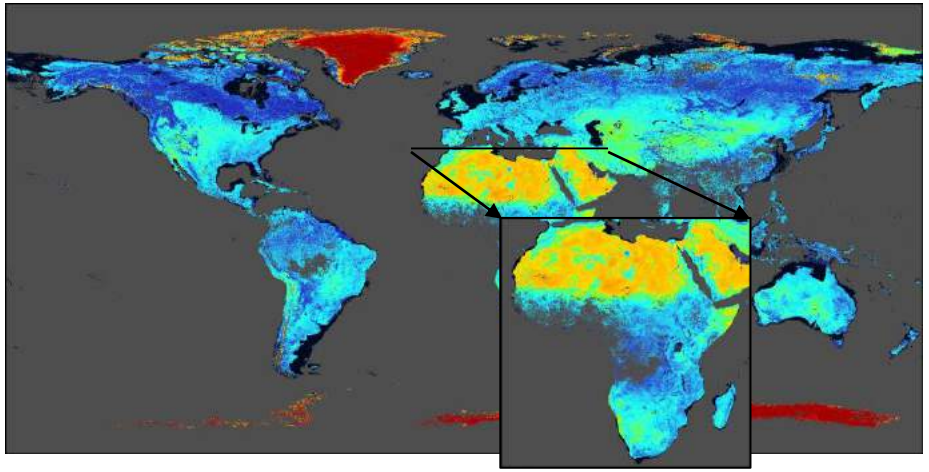
- Wang, Z., Schaaf, C. B., Sun, Q., Shuai, Y., & Román, M. O. (2018). Capturing Rapid Land Surface Dynamics with Collection V006 MODIS BRDF/NBAR/Albedo (MCD43) Products. Remote Sensing of Environment, 207(February), 50–64. https://doi.org/10.1016/j.rse.2018.02.001

- Sun, Q., Wang, Z., Li, Z., Erb, A., & Schaaf, C. B. (2017). Evaluation of the Global MODIS 30 Arc-Second Spatially and Temporally Complete Snow-Free Land Surface Albedo and Reflectance Anisotropy Dataset. International Journal of Applied Earth Observation and Geoinformation, 58, 36–49. https://doi.org/10.1016/j.jag.2017.01.011



MCD43GF: DOY250, 2010
Shortwave Broadband WSA



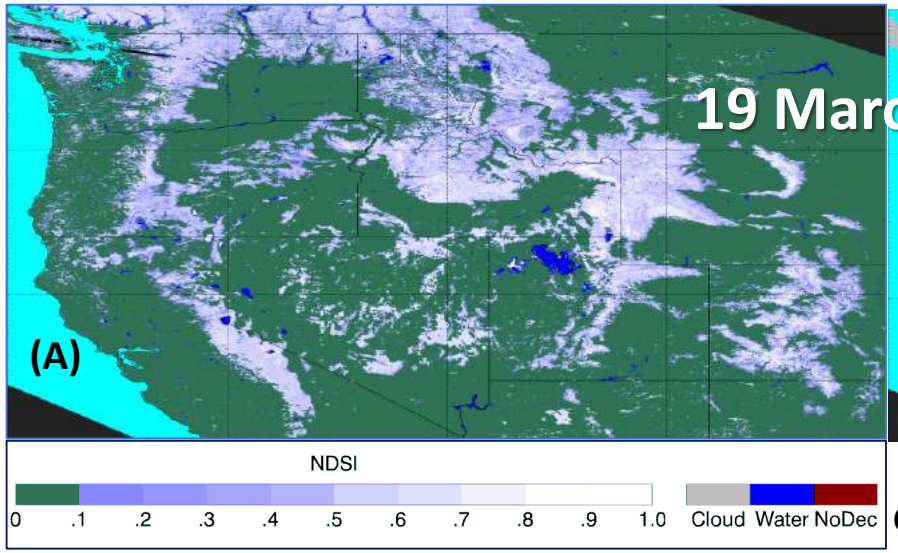


MCD43D61: DOY250, 2010
Shortwave Broadband WSA

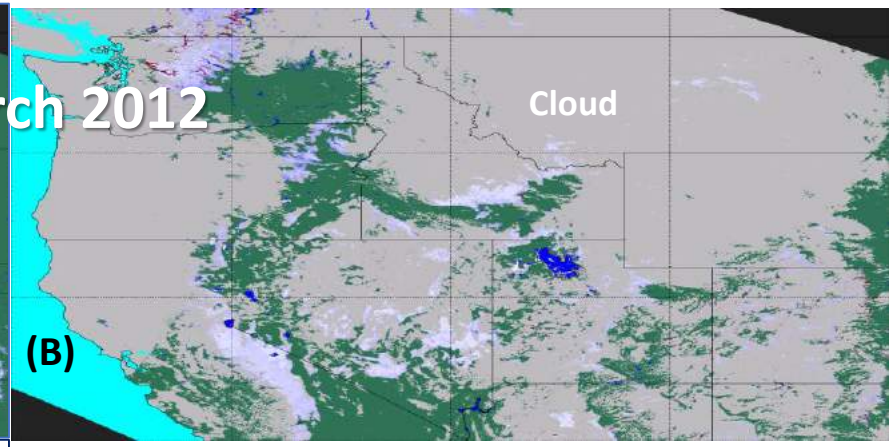
Generating continuous time series of daily snow cover with the MODIS Cloud-Gap-Filled (CGF) Product

Dorothy Hall[1] and George Riggs[2]
[1]ESSIC / University of Maryland, [2]SSAI

Cloud-Gap Filled Daily Snow Map

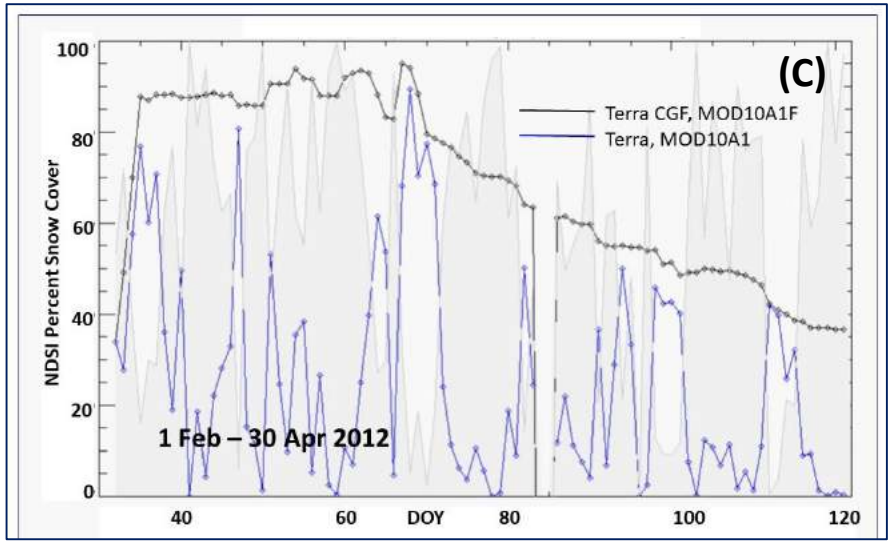


Daily Snow Map with Cloud



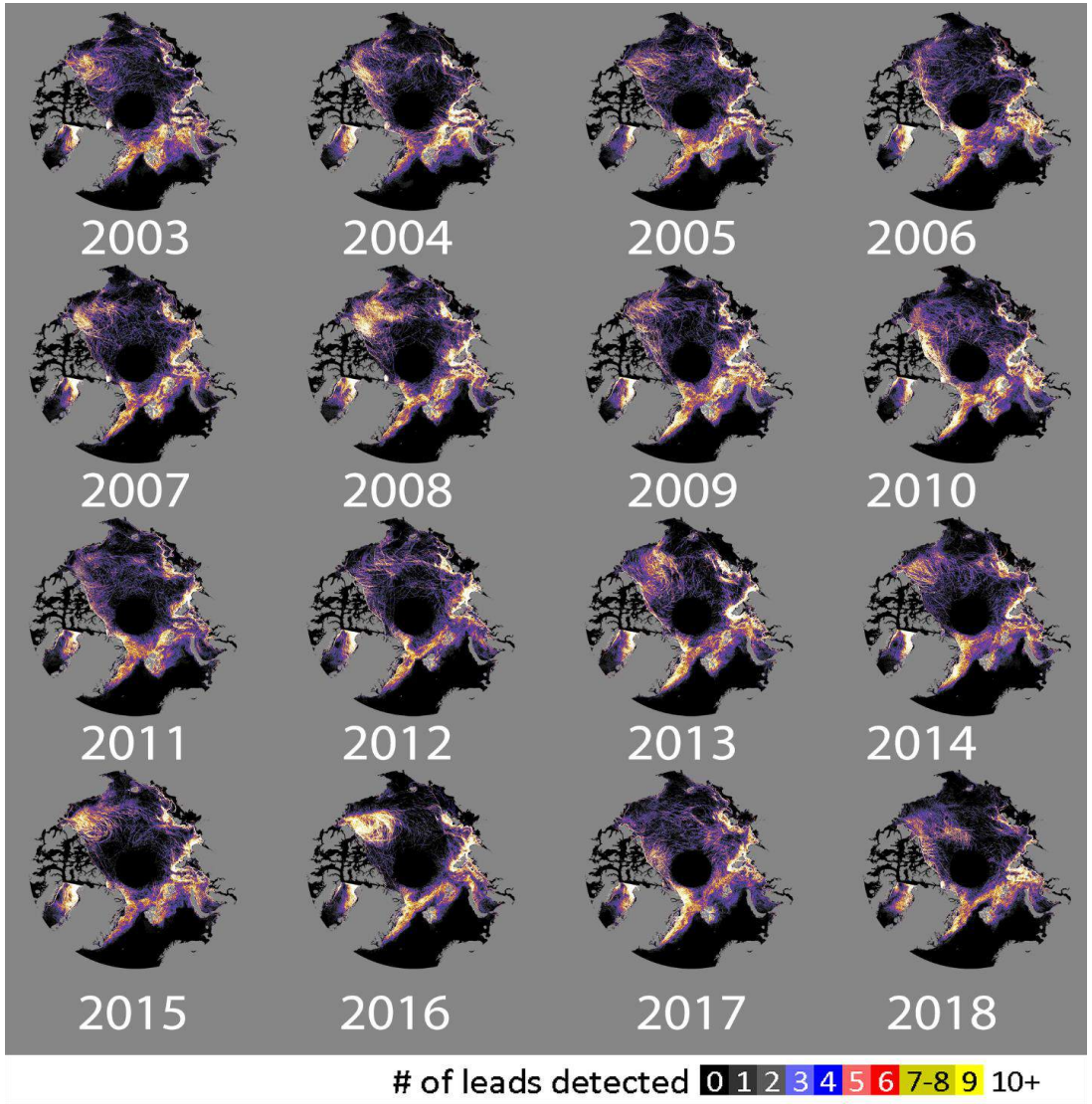
The cloud-gap filled (CGF) MODIS product provides a consistent and continuous cloud free snow cover map (A) compared to the daily snow cover product (B) that has clouds which cause gaps in a time series of snow observations. The CGF maps are able to capture snow buildup and depletion (C), for example in Wind River Range, Wyoming, 1 Feb to 30 April 2012 (C).

Comparison of Terra CGF and the standard Terra snow maps



Arctic Sea Ice Lead Properties from MODIS/VIIRS

Sea ice leads play a critical role in the exchange of mass and energy between the ocean and atmosphere in the polar regions, particularly in the Arctic. We are developing a methodology to detect and characterize sea ice leads applied to MODIS and VIIRS data to identify lead characteristics, including width, orientation, and spatial distribution, which can aid in navigation and is essential to investigate any correlations with observed chances in the Arctic Sea Ice.



Leads frequency map by year. Legend is at bottom of the figure.

Season is January - April

Status of MODIS Long Term VI Time Series - Didan

MODIS VI Suite (in its 19th year)

Collection 5: (Suspended in 2018)
Collection 6: (Released in 2015)
Collection 7: (In prep)

Status and Updates:

- *Improved QA compositing scheme*
- *Multiple and ongoing algorithm adjustments to deal with changes in upstream products and/or issues*
- *Ongoing opportunistic validation (using NEON data)*

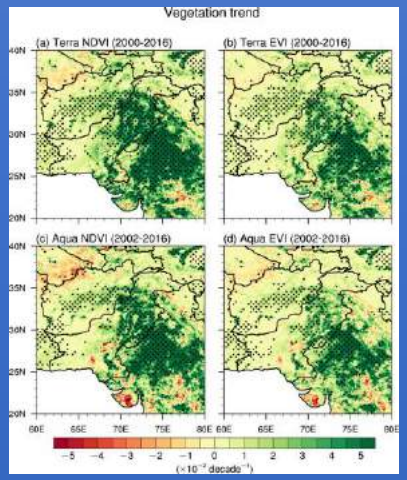
Known Issues:

- The 2010 (C6) decision to use pre-composited 8-day surface reflectance inputs is causing spatial consistency issues that will be addressed in C6.1/C7

Recent Publications:

- Jarchow, C. J., Didan, K., Barreto-Muñoz, A., et al. (2018). Application and Comparison of the MODIS-Derived Enhanced Vegetation Index to VIIRS, Landsat 5 TM and Landsat 8 OLI Platforms: A Case Study in the Arid Colorado River Delta, Mexico. *Sensors*, *18*(5), 1546.
- EL-Vilaly, M. A. S., Didan, K, et al. (2018). Characterizing Drought Effects on Vegetation Productivity in the Four Corners Region of the US Southwest. *Sustainability*, *10*(5), 1643.
- El-Vilaly MA, Didan K, et al. Vegetation productivity responses to drought on tribal lands in the four corners region of the Southwest USA. Frontiers of Earth Science. 2017 May:1-5. DOI 10.1007/s11707-017-0646-z
- Peng D, Zhang X, Wu C, Huang W, et al. Intercomparison and evaluation of spring phenology products using National Phenology Network and AmeriFlux observations in the contiguous United States. Agricultural and forest meteorology. 2017 Aug 15;242:33-46.

MODIS NDVI/EVI product suite continues to lead and drive science and applications with more than 12,000 publications mentioning and/or using the MODIS NDVI/EVI time series, with multiple high end journal articles appearing annually.



Jin, Q., & Wang, C. (**2018**). The greening of Northwest Indian subcontinent and reduction of dust abundance resulting from Indian summer monsoon revival. *Scientific reports*, *8*(1), 4573.

Status of MODIS LAI/FPAR - Myneni

MODIS LAI/FPAR Product

Collection 6: (Released in 2015)

- MOD15A2H: MODIS/Terra 8-Day L4 500 m SIN Grid
- MYD15A2H: MODIS/Aqua 8-Day L4 500 m SIN Grid
- MCD15A2H: MODIS/Terra+Aqua 8-Day L4 500 m SIN Grid
- MCD15A3H: MODIS/Terra+Aqua 4-Day L4 500 m SIN Grid

Status and Updates:

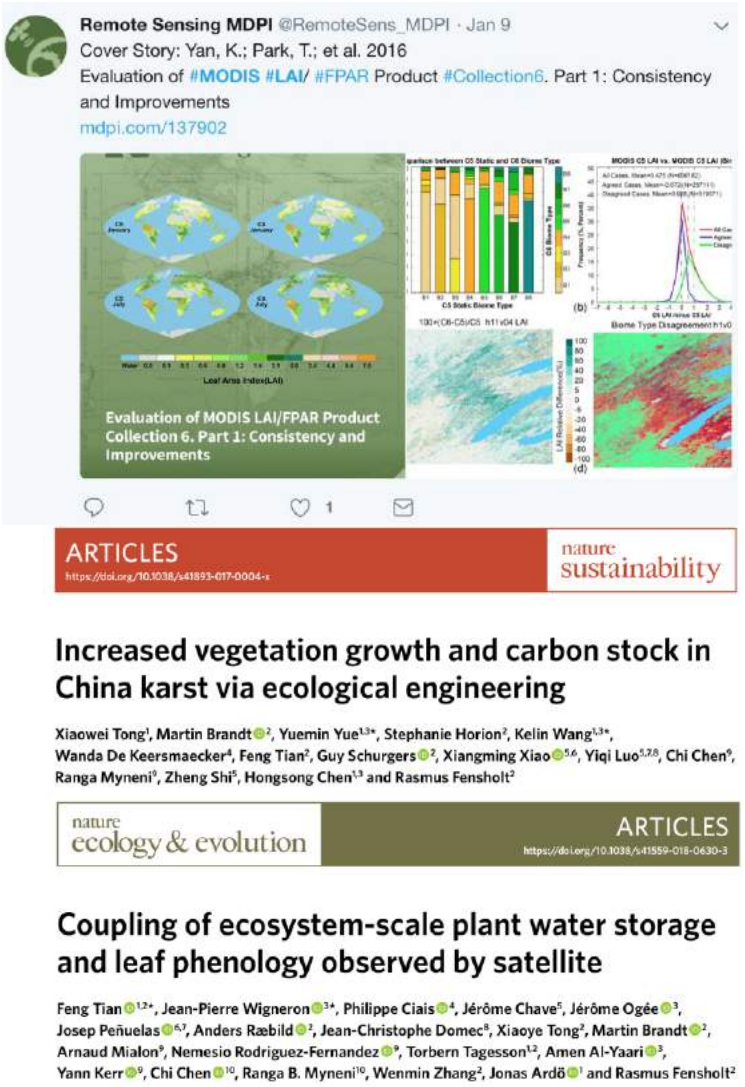
- *L2G–lite 500 meter surface reflectance used* as input, instead of reflectance at 1km resolution MODAGAGG .
- New *multi-year land cover product at 500m* resolution, in place of the 1km resolution static land cover product.

Known Issues:

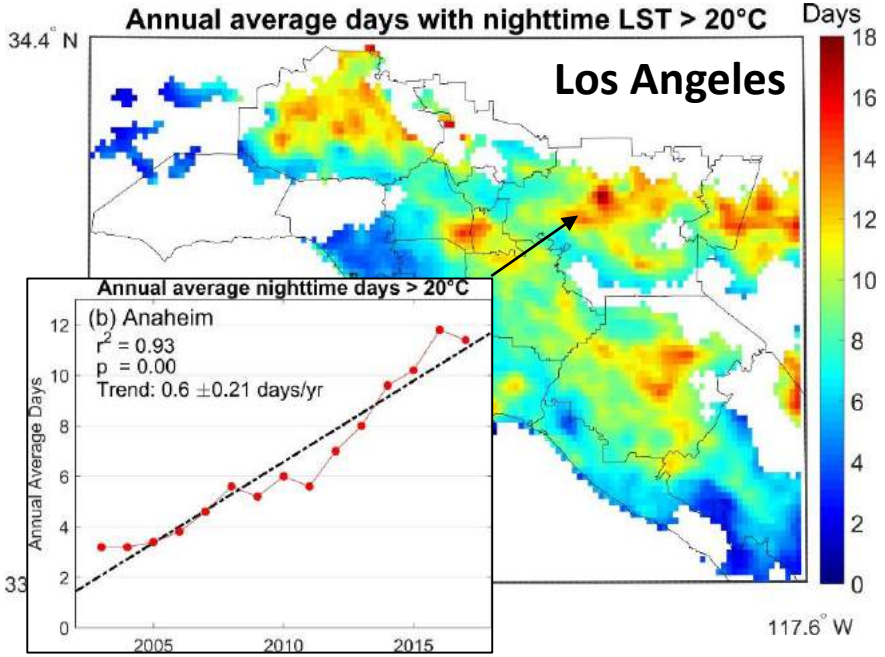
- N/A.

Recent Publications:

- Chen et al., (under review). China and India lead in greening of the world through land-use management. ***Nature Sustainability***.
- Xu et al., 2018. An integrated method for validating long-term leaf area index products using global networks of site-based measurements. ***Remote Sens. Environ***., doi:10.1016/j.rse.2018.02.049
- Chen et al., 2017. Prototyping of LAI and FPAR Retrievals from MODIS Multi-Angle Implementation of Atmospheric Correction (MAIAC) Data. ***Remote Sensing***, doi:10.3390/rs9040370



MODIS LST Detects Rising Temperatures and Heat Wave Trends in Urban Environments



Hulley et al. 2018, RSE

New MOD21 LST product can pinpoint current and future communities that are most vulnerable to the detrimental effects of heat waves and extreme heat in urban areas. Heat vulnerability maps derived from this data can advise local governments on effective climate adaption and mitigation strategies.

LETTER

doi:10.1038/nature13462

Strong contributions of local background climate to urban heat islands

Lei Zhao[1,2], Xuhui Lee[1,2], Ronald B. Smith[3] & Keith Oleson[4]

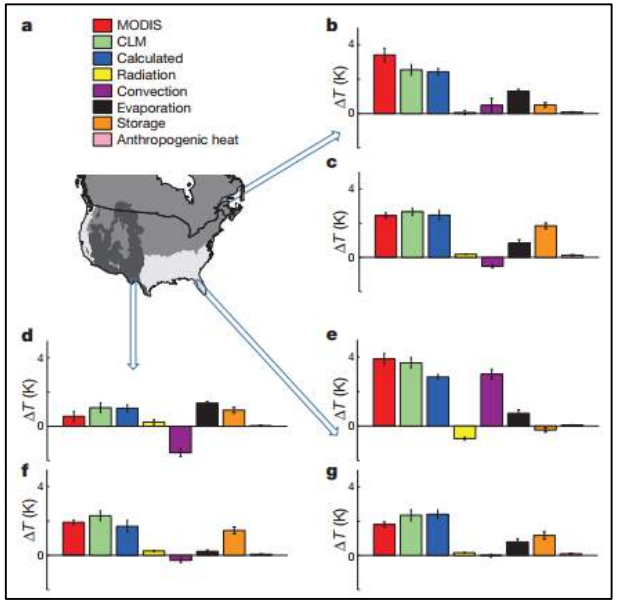
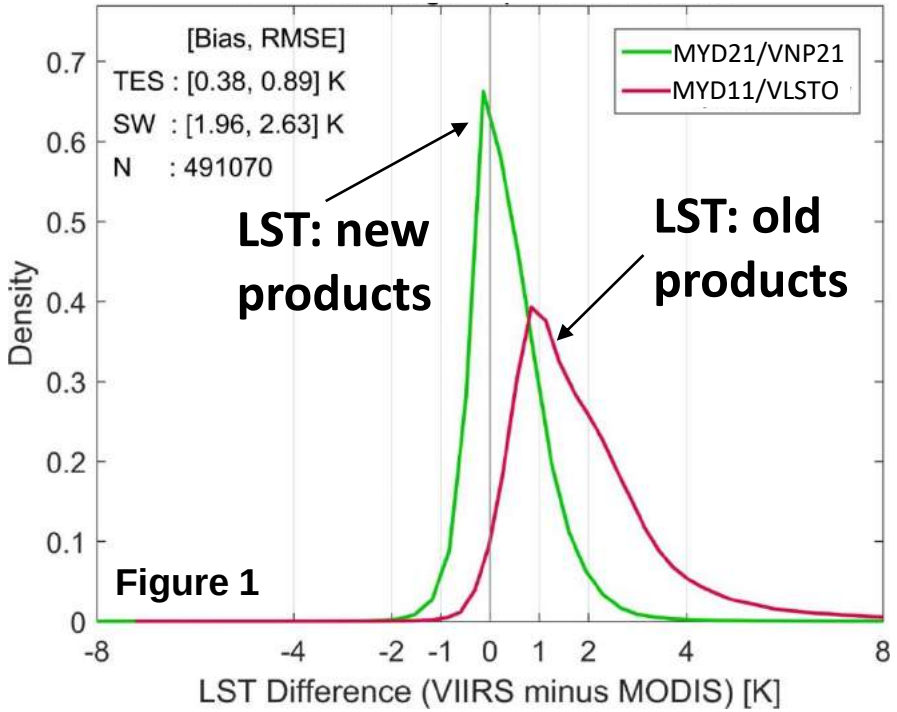
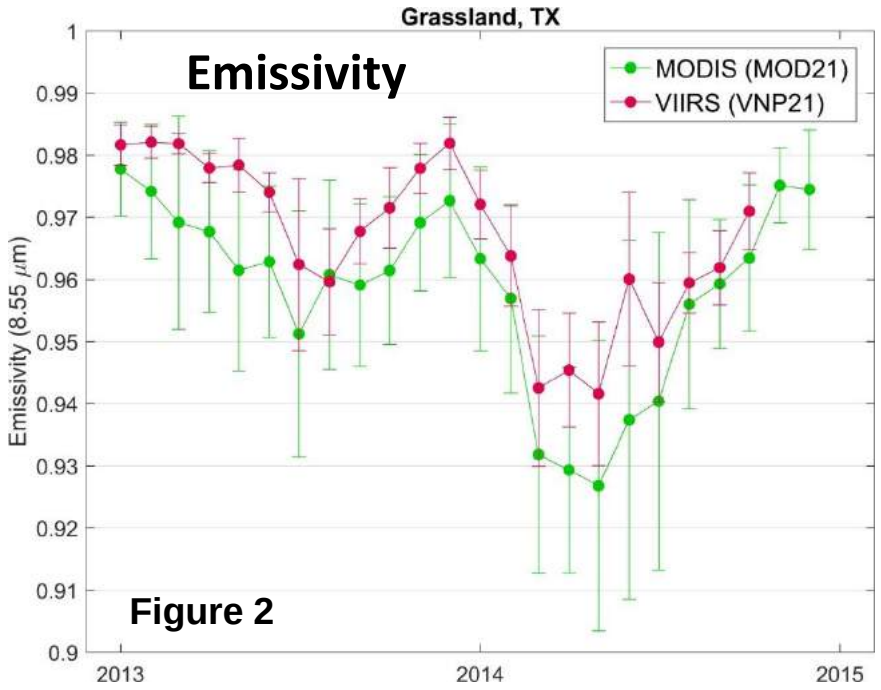


Figure 2 | Attribution of UHI intensity in three Köppen–Geiger climate zones. **a**, Map of climate zones: white, mild temperate/mesothermal climate; grey, continental /microthermal climate; dark grey, dry climate. **b**, **d**, **e**, Daytime values of MODIS and modelled ΔT and its component contributions in each of the three zones (see arrows). **c**, **f**, **g**, Night-time values in each of the three zones (see arrows). Green bars denote model-predicted ΔT and blue bars denote UHI intensity calculated as the sum of the component contributions. Error bars, 1 s.e. for each climate zone.

MODIS/VIIRS LST&E Continuity

2013-2015 VIIRS/MODIS Matchups, CONUS





- Land Surface Temperature and Emissivity (LST&E) are key variables used in a wide range of studies including climate variability, land cover use/change, and the energy balance between land and atmosphere.
- New NASA LST&E products for MODIS (MxD21) and VIIRS (VNP21) being produced in 2017 use a consistent algorithm (TES) that physically retrieves both LST and emissivity and addresses discrepancies between the current suite of MODIS and VIIRS LST split-window based products (MYD11, VLSTO).
- Continuity between the new MYD21/VNP21 LST data records was demonstrated at the <±1 K level (**Figure 1**) that are invariant on atmospheric conditions and land cover type (Hulley et al. 2017). Retrieved emissivities at 8.55 micron also showed close agreement in both emissivity magnitude and temporal variation (**Figure 2**).

NASA Black Marble Product Status

ATBD Review and User's Guide:

- The Black Marble product suite (VNP46) algorithm theoretical basis document (ATBD) was recently published in peer reviewed literature: https://doi.org/10.1016/j.rse.2018.03.017.
- ATBD and User's Guide documents, following NASA Science Team guidelines, have been posted in the Black Marble product landing page (URL below).

Science PGE Status:

- Science team and Land SIPS have completed testing of the assorted Level 2/2G products. Testing has been completed on the VIIRS DNB BRDF retrieval used as input to the daily nighttime light products.
- We anticipate that the Black Marble products will be transitioned into LAADS DAAC in late 2018 and LANCE-NRT soon after.

https://viirsland.gsfc.nasa.gov/Products/NASA/BlackMarble.html

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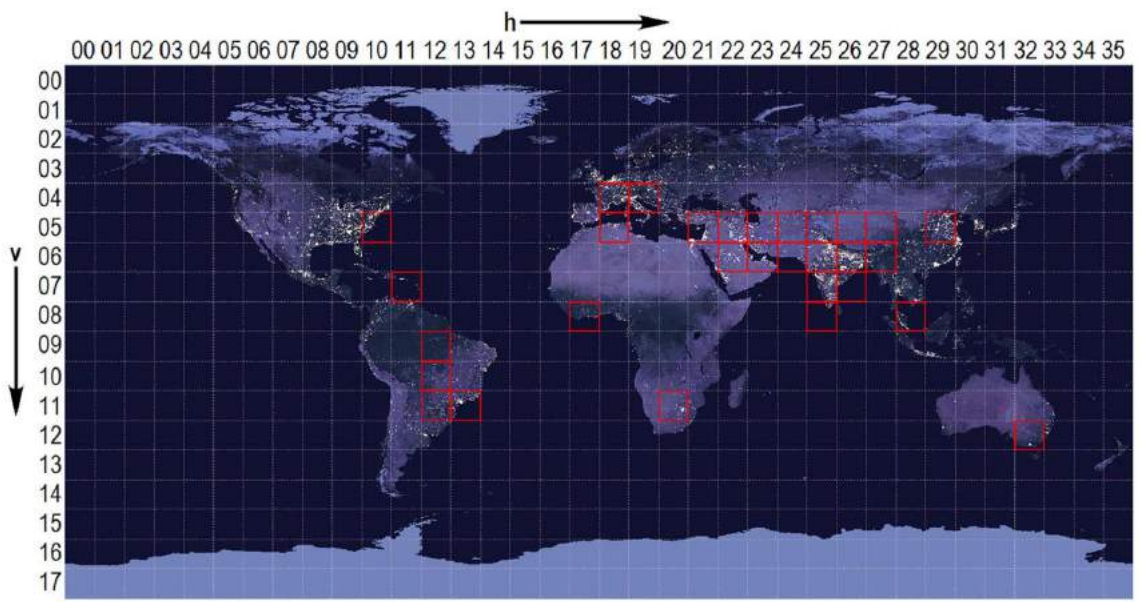
journal homepage: www.elsevier.com/locate/rse

NASA's Black Marble nighttime lights product suite

Miguel O. Román[a,*], Zhuosen Wang[b,a], Qingsong Sun[c,a], Virginia Kalb[a], Steven D. Miller[d], Andrew Molthan[f,e], Lori Schultz[e,f], Jordan Bell[e,f], Eleanor C. Stokes[g], Bhartendu Pandey[g],

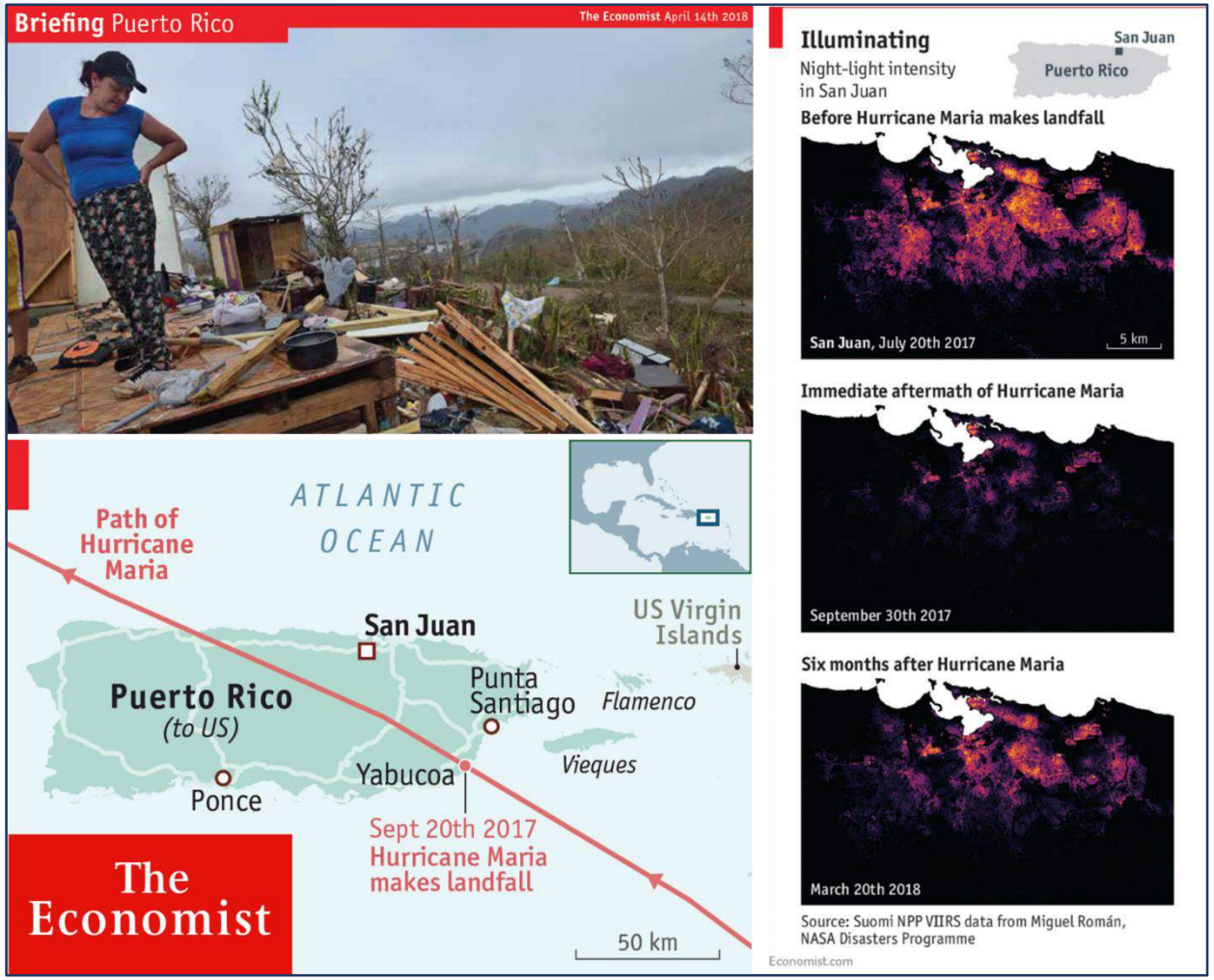


Suomi-NPP VIIRS geographic Lat/Lon grid system. 30 sample tiles (5-year time series) were used to conduct extensive benchmark tests on the Black Marble product.

Recent Highlights

The April 2018 issue of The Economist featured data and images from NASA's Black Marble Science Team in an article about the recovery of Puerto Rico's energy sector six months after Hurricane Maria devastated the island.

https://bit.ly/2IXJmfs



Progress on the Implementation of the CEOS Strategy for Carbon Observations from Space: CEOS/WGCV/LPV Subgroup Supplement

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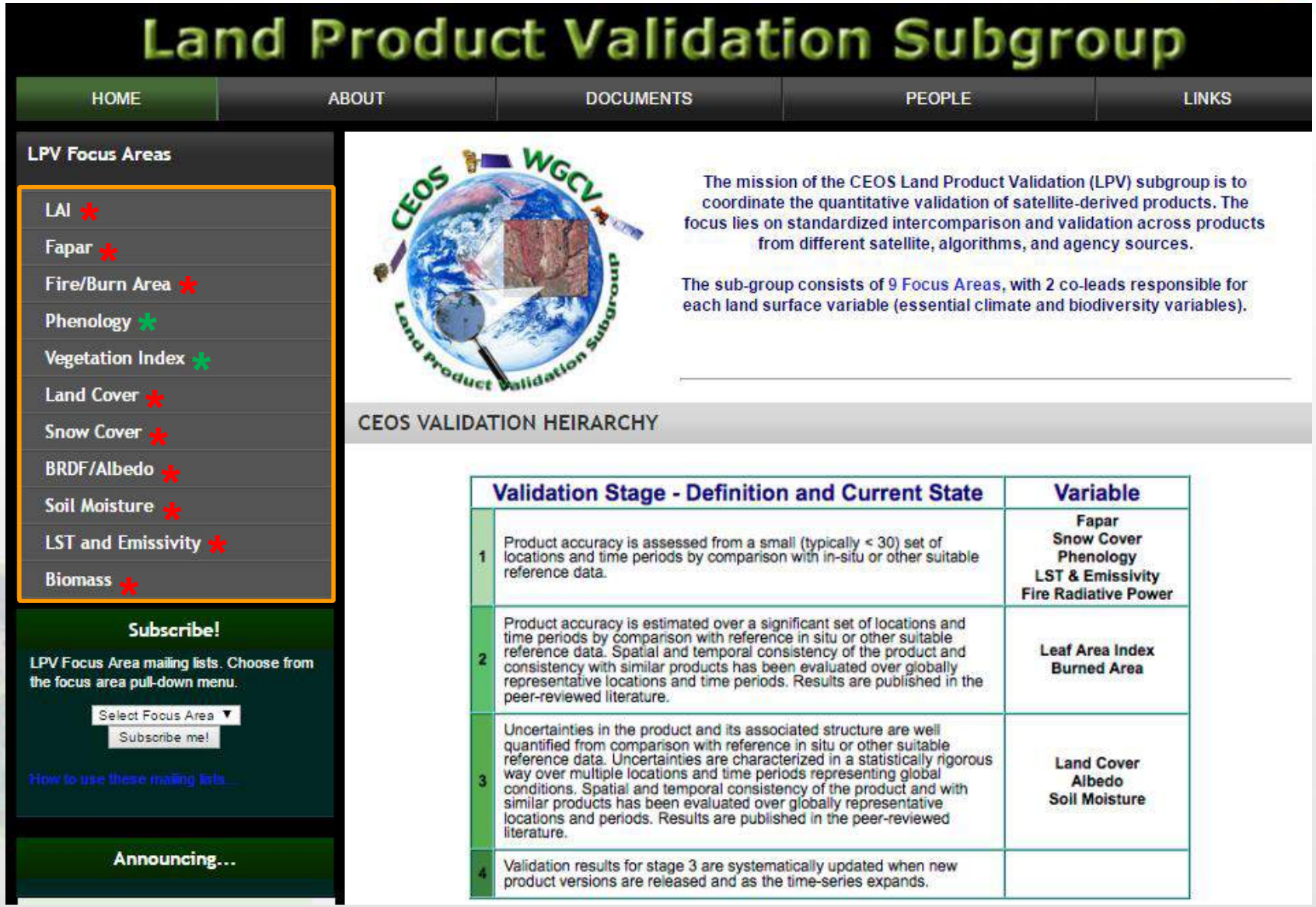
CARB-19: Land product validation listing

- CEOS/WGCV/LPV has completed listing of 11 carbon-focused variables, totaling 138 land products from 11 CEOS Agencies.

https://lpvs.gsfc.nasa.gov/

- 9 product categories are listed as GCOS Essential Climate Variables (ECVs*)
- 2 product categories are listed as GEOBON Essential Biodiversity Variables (EBVs*).



Land Product Validation Subgroup

HOME | ABOUT | DOCUMENTS | PEOPLE | LINKS

LPV Focus Areas

- LAI *
- Fapar *
- Fire/Burn Area *
- Phenology *
- Vegetation Index *
- Land Cover *
- Snow Cover *
- BRDF/Albedo *
- Soil Moisture *
- LST and Emissivity *
- Biomass *

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LPV Focus Area mailing lists. Choose from the focus area pull-down menu.

Select Focus Area ▼

Subscribe me!

How to use these mailing lists...

Announcing...

The mission of the CEOS Land Product Validation (LPV) subgroup is to coordinate the quantitative validation of satellite-derived products. The focus lies on standardized intercomparison and validation across products from different satellite, algorithms, and agency sources.

The sub-group consists of 9 Focus Areas, with 2 co-leads responsible for each land surface variable (essential climate and biodiversity variables).

CEOS VALIDATION HEIRARCHY

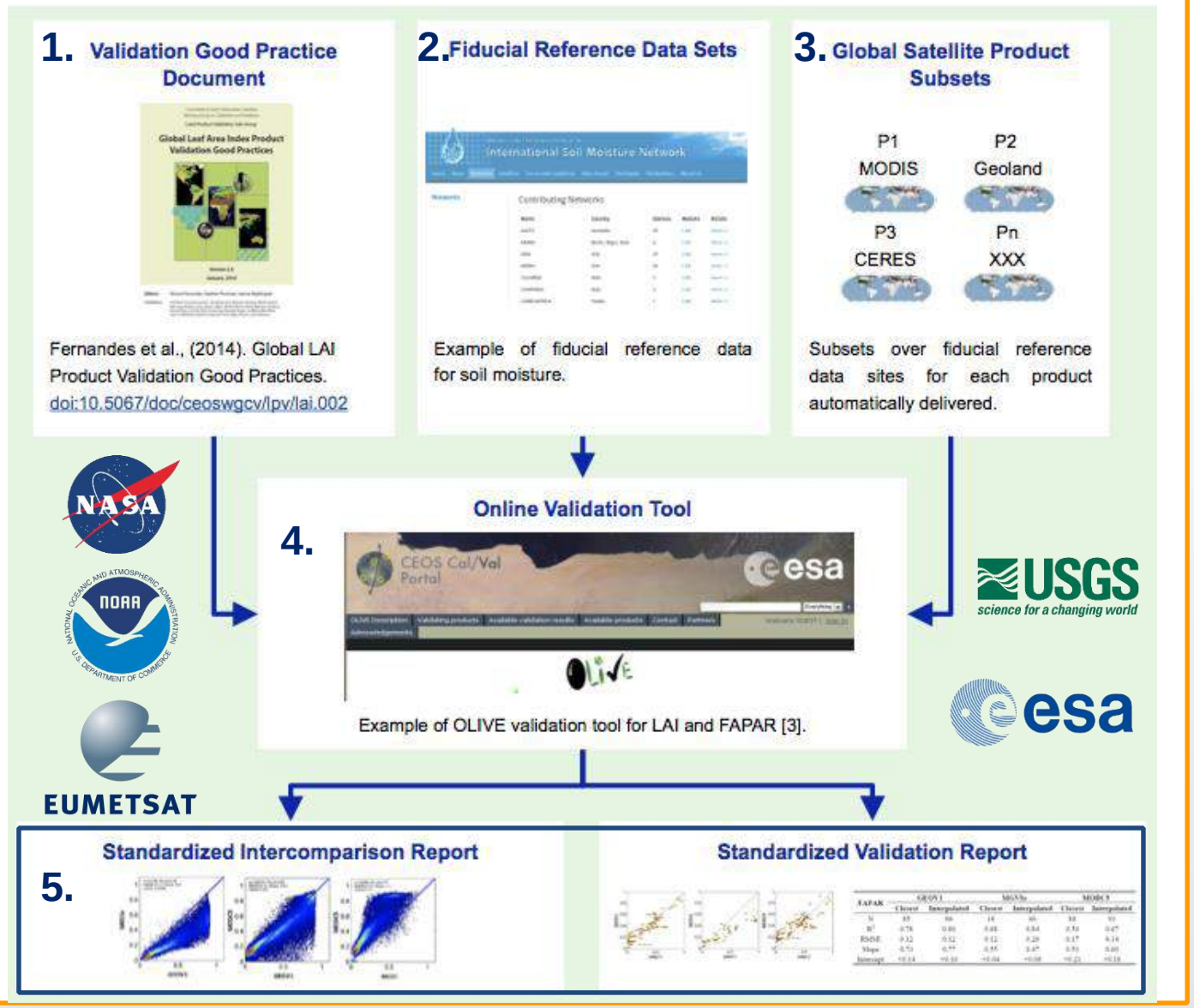
	Validation Stage - Definition and Current State	Variable
1	Product accuracy is assessed from a small (typically < 30) set of locations and time periods by comparison with in-situ or other suitable reference data.	Fapar Snow Cover Phenology LST & Emissivity Fire Radiative Power
2	Product accuracy is estimated 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.	Leaf Area Index Burned Area
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.	Land Cover Albedo Soil Moisture
4	Validation results for stage 3 are systematically updated when new product versions are released and as the time-series expands.	

CARB-19: CEOS Land Validation Framework

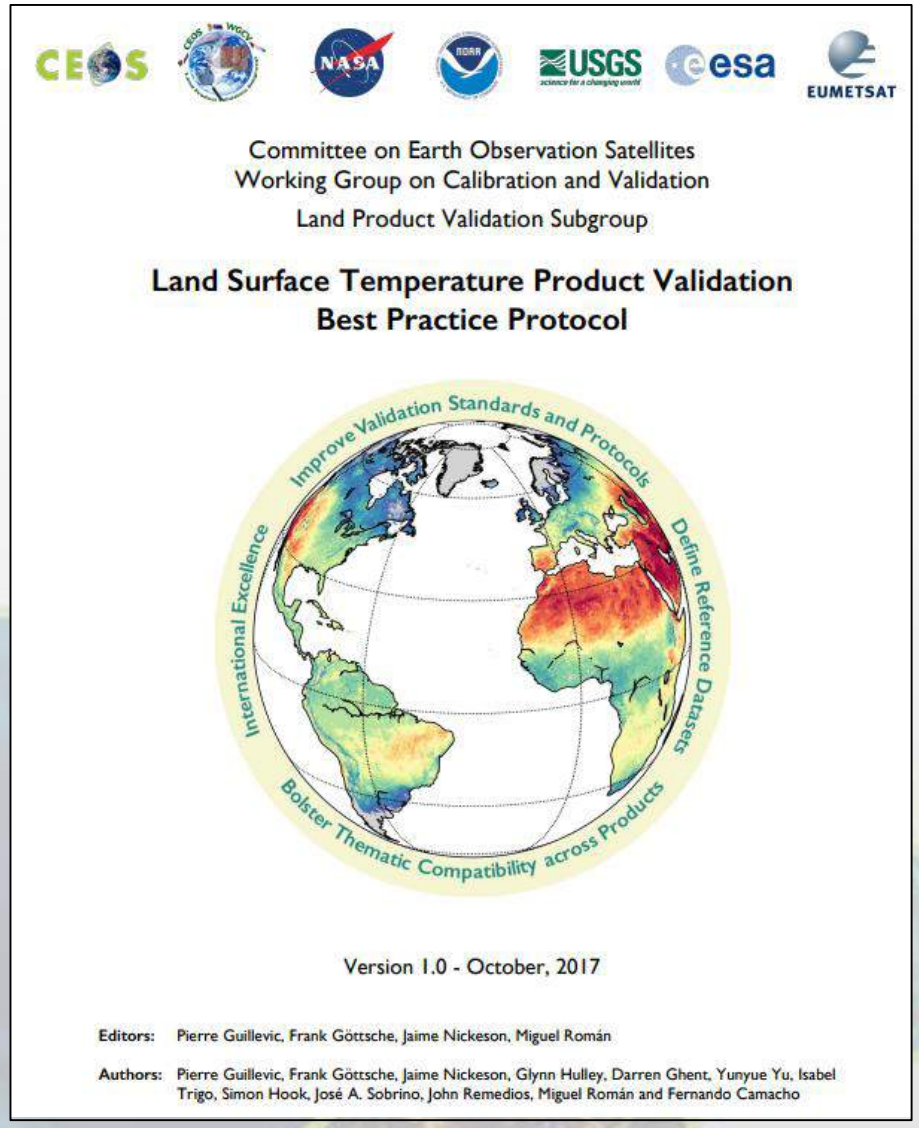
- CEOS LPV has established a framework with the aim of independent validation and consistent uncertainty reporting across products as main output.
- Multiple agencies are coordinating five actionable tasks:

1. **[NASA]** Developing best practice validation protocols, where validation methods are sent through rigorous peer-review (Q4-2018).
2. **[NOAA/ESA/EUMETSAT]** Ensuring access to processed fiducial reference data (ongoing).
3. **[USGS/NOAA]** Supporting automated subsets of global satellite products (LPCS; Q2-2017.)
4. **[NASA]** Implementing data analysis tools (Q2-2018).
5. **[NASA/ESA]** Delivering standardized intercomparison and validation reports (Q4-2018)

Schaepman-Strub et al., (2017) submitted



CARB-19: Land Surface Temperature Product validation protocol endorsed at CEOS-LPV Plenary



Committee on Earth Observation Satellites
Working Group on Calibration and Validation
Land Product Validation Subgroup

Land Surface Temperature Product Validation Best Practice Protocol

Version 1.0 - October, 2017

Editors: Pierre Guillevic, Frank Göttsche, Jaime Nickeson, Miguel Román

Authors: Pierre Guillevic, Frank Göttsche, Jaime Nickeson, Glynn Hulley, Darren Ghent, Yunyue Yu, Isabel Trigo, Simon Hook, José A. Sobrino, John Remedios, Miguel Román and Fernando Camacho

Authors: Guillevic, P., Göttsche, F., Nickeson, J., Hulley, G., Ghent, D., Yu, Y., Trigo, I., Hook, S., Sobrino, J.A., Remedios, J., Román, M. & Camacho, F.

https://doi.org/10.5067/doc/ceoswgcv/lpv/lst.001

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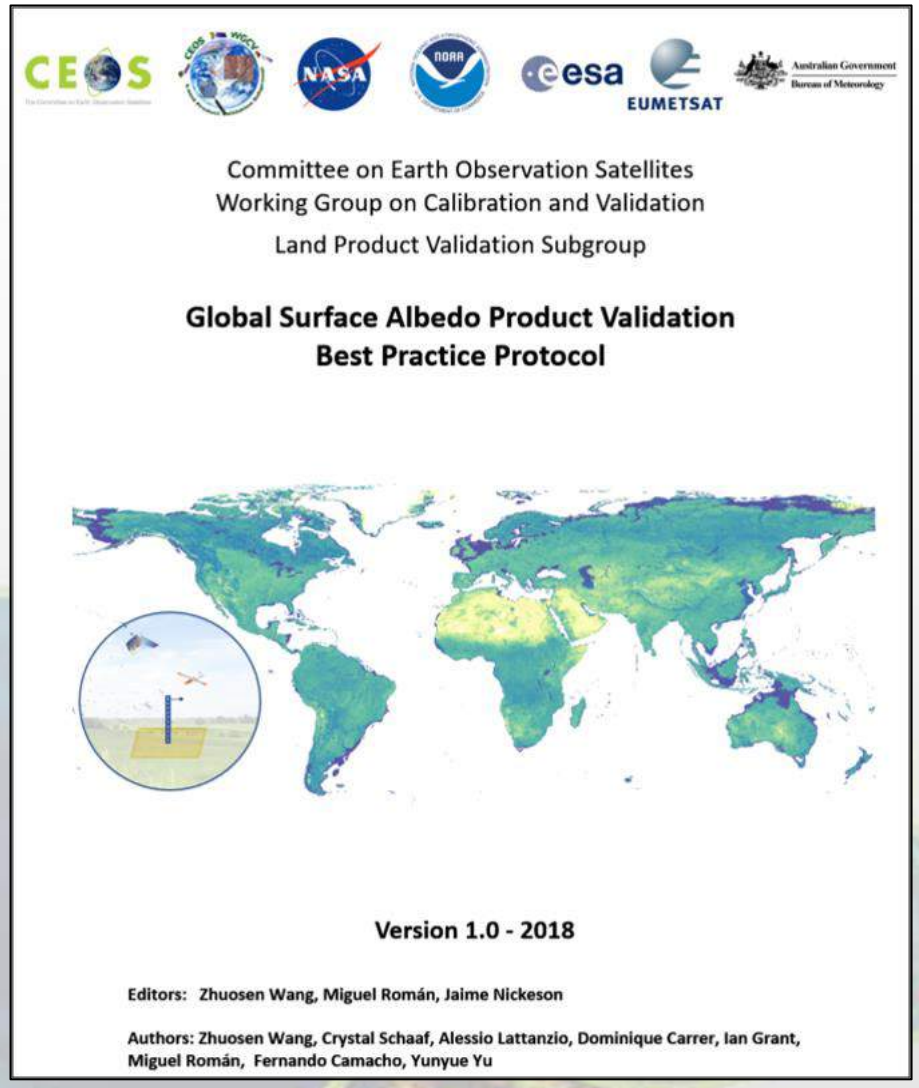


Authors: Z. Wang, C. Schaaf, A. Lattanzio, D. Carrer, I. Grant, M. Román, F. Camacho, Y. Yu.

CARB-19: CEOS LPV Super Sites endorsed at CEOS-WGCV-43

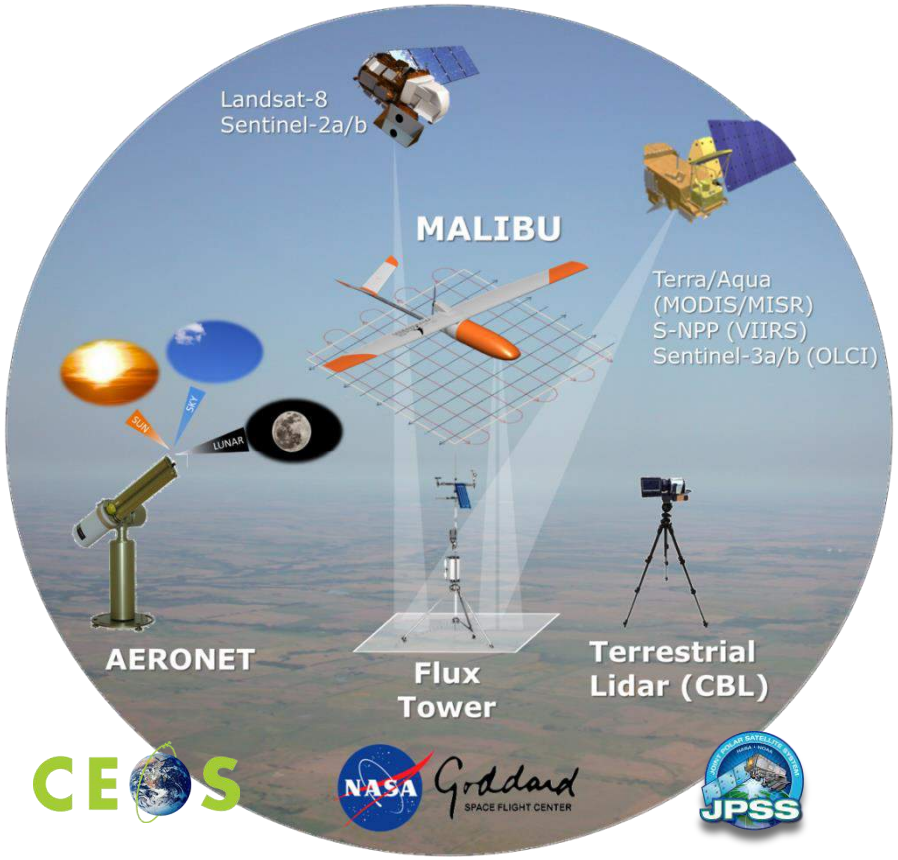
CEOS-LPV Super Site page added to LPV web site:

- **Definition**: Well-characterized (canopy structure and bio-geophysical variables) site following well-established protocols useful for the validation of satellite land products and for radiative transfer modeling approaches. Active long term operations (funding and infrastructure support).
- **Interactive map** of sites, color coded by network (10 networks included). Click on site renders a pop-up window with site name, land cover type, and a link to site network page.

  Page includes a link to spreadsheet of **site details**.

  Link to selection **report**: **https://goo.gl/Mw7RMz**).
- **Objective site selection process helps inform CEOS Agency field experiments (e.g., ESAFiducial Reference Measurement framework:** https://earth.esa.int/web/sppa/activities/frm).

MALIBU Multi AngLe Imaging Brdf Unmanned aerial system



https://viirsland.gsfc.nasa.gov/Campaigns.html

Summary:

Joint GSFC 618/619 effort to develop multi-angular reference datasets for the assessment of BOA reflectance-based products (e.g., BRDF, albedo, NBAR, VI, PRI, LAI/FPAR, snow cover, and phenology metrics).

MALIBU Superswift Deployment at Table Mountain, CO

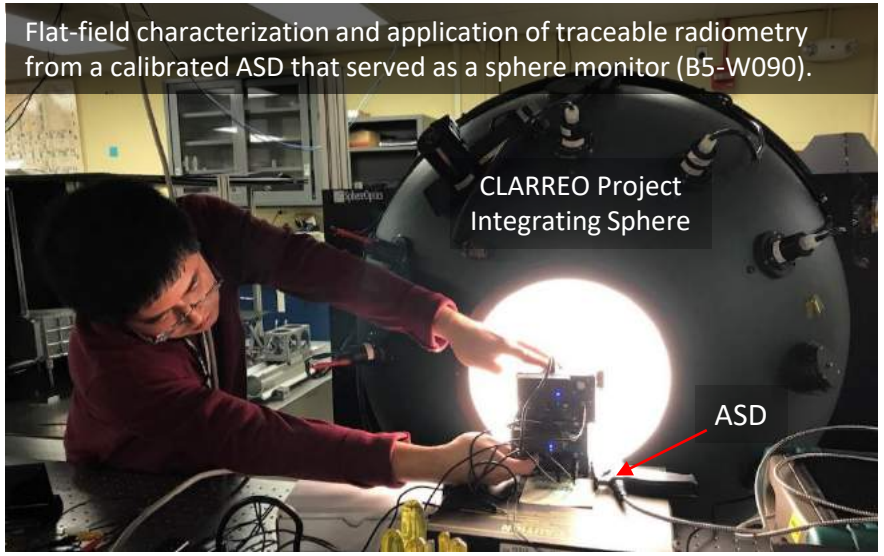
Benefits:

A cost effective ($300 × Flight Hour), exempted (FAA-S.333 & TCAN) platform, that follows CEOS-WGCV good practice protocols.

MALIBU's '*abilitys*' (Key Performance Characteristics)

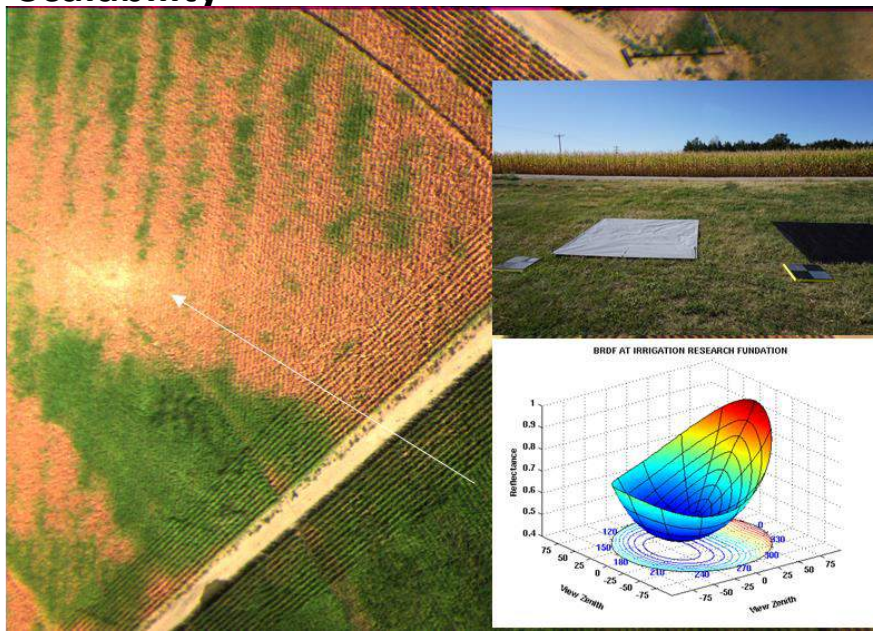
CEOS Working Group on Calibration and Validation

Traceability

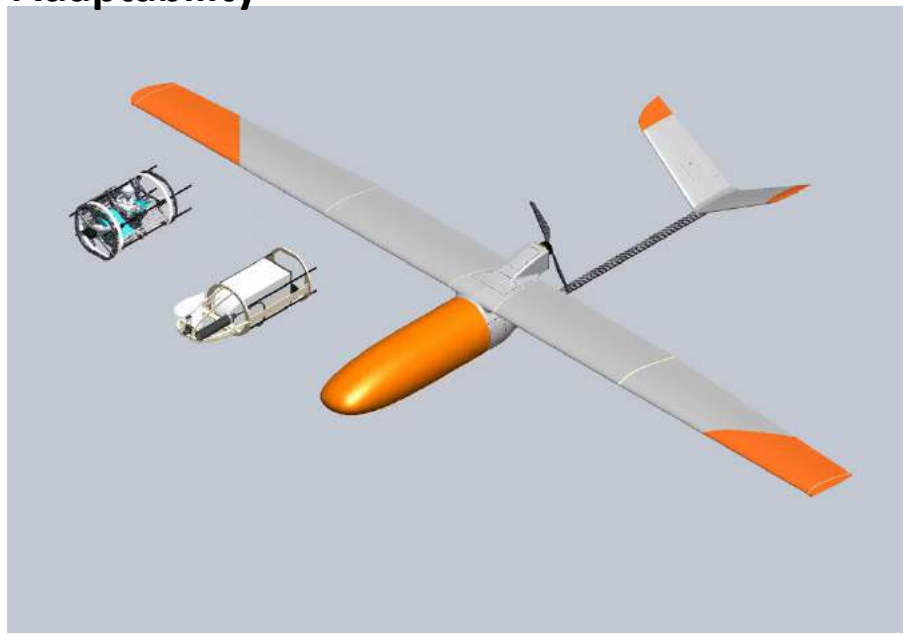


Mobility

Scalability



Adaptability



Land Team Foci for current Performance Cycle

- **MODIS + VIIRS product maintenance > Senior Review**
- **Securing Data Continuity MODIS> VIIRS> NOAA 20 >**
  - **Towards Long-term Land Data Records**
- **Missions > Measurements Redux**
  - **Greater focus on multi-instrument products and science**
  - **New instruments added to the Land processing**
  - **International instruments (e.g. Sentinel 3 a/b AM orbit)**
- **Experimental Products (Evaluation/Test) > Standard Products**
  - **Sustained Production (at the end of funding cycle)**
  - **Need for QA Metadata and QA Process**
- **Product Validation on limited budgets (leverage CEOS LPV)**
- **Evolving the Land SIPS for multi-instrument data**
  - **IT Infrastructure**
  - **Increased Science Stewardship for Orphaned Products**
- **New approach to ATBDs and Documentation**

Developing a Long-Term Strategy for NASA Land Products