



NASA

Report on Cal/Val Activities

K. Thome

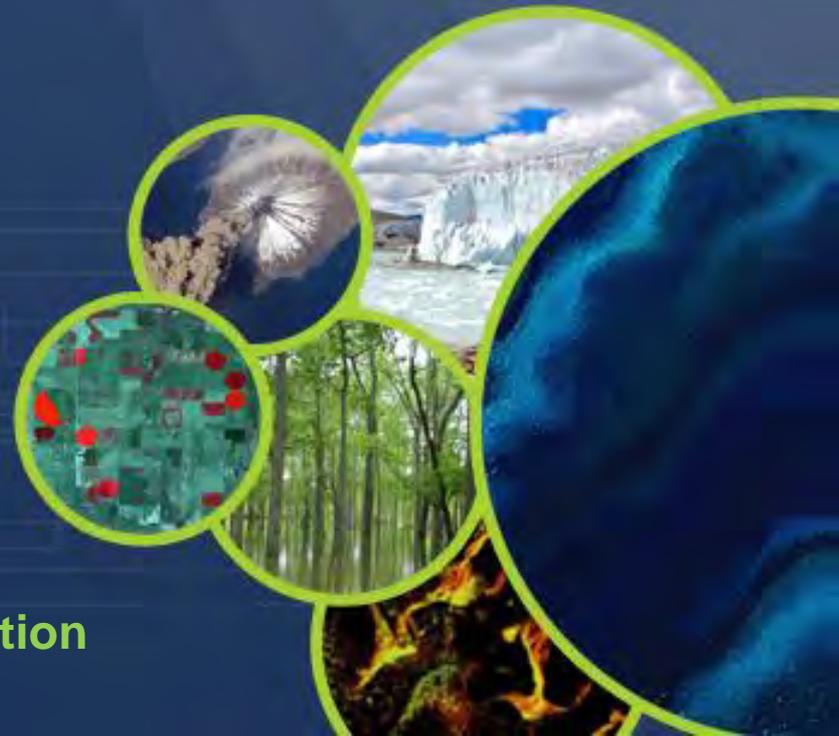
NASA/GSFC

Agency Report XIII

WGCV Plenary # 40

March 14 -18, 2016

Working Group on Calibration and Validation





Regular update – Agency overview discussion

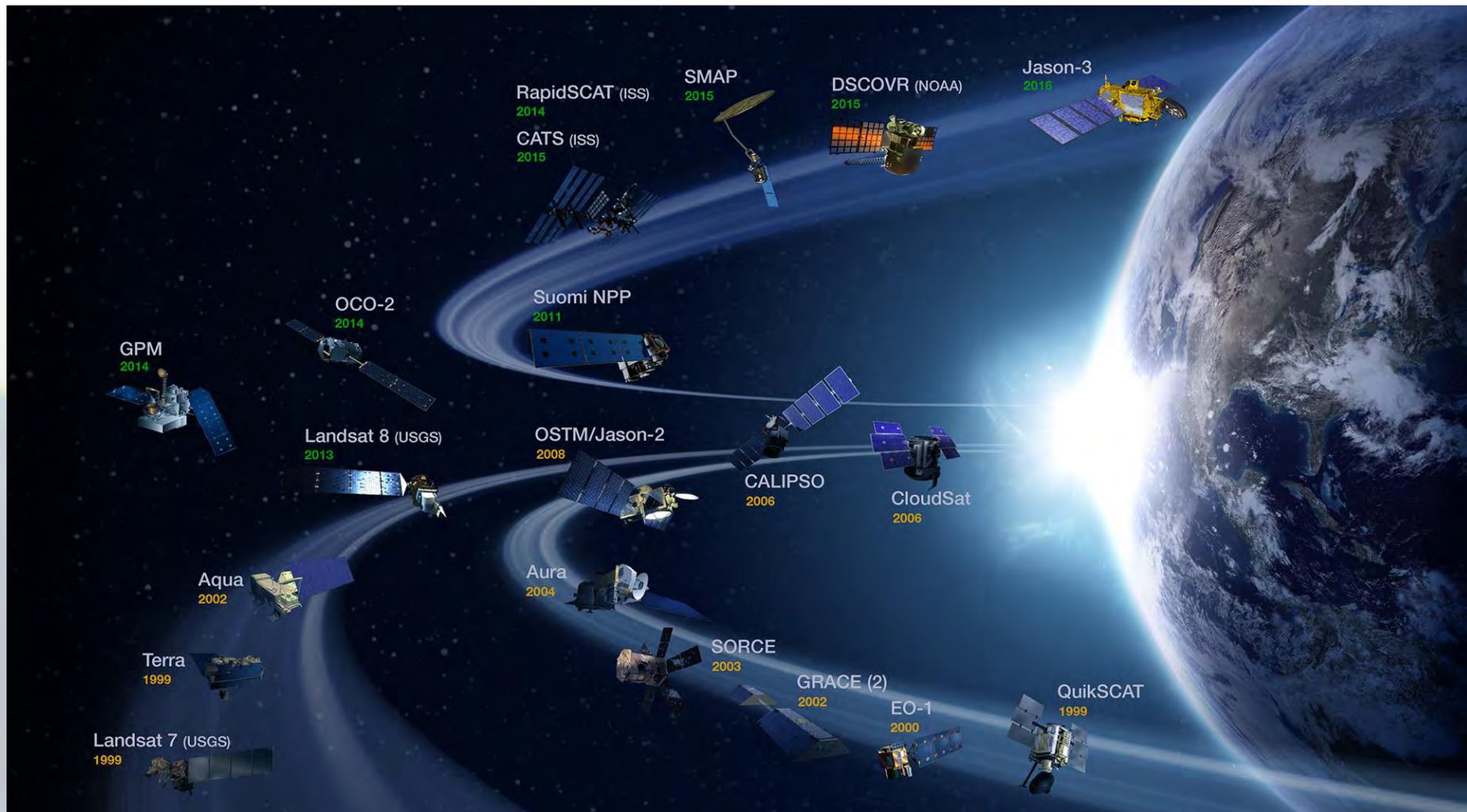
- Second decadal survey is now underway by the National Research Council
- Sustainable Land Imaging Program (w/USGS; NASA funds flight hardware)
- Continued development and launch of: SAGE-III/ISS, ECOSTRESS/ISS, GEDI/ISS, CYGNSS, TEMPO, GRACE-FO, ICESat-2, SWOT, NISAR, PACE
 - OCO-3 completion and flight to ISS in late 2017
 - CLARREO Pathfinder on ISS – official start in Spring 2016 with launch in 2020



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Regular update – Agency Missions at a Glance

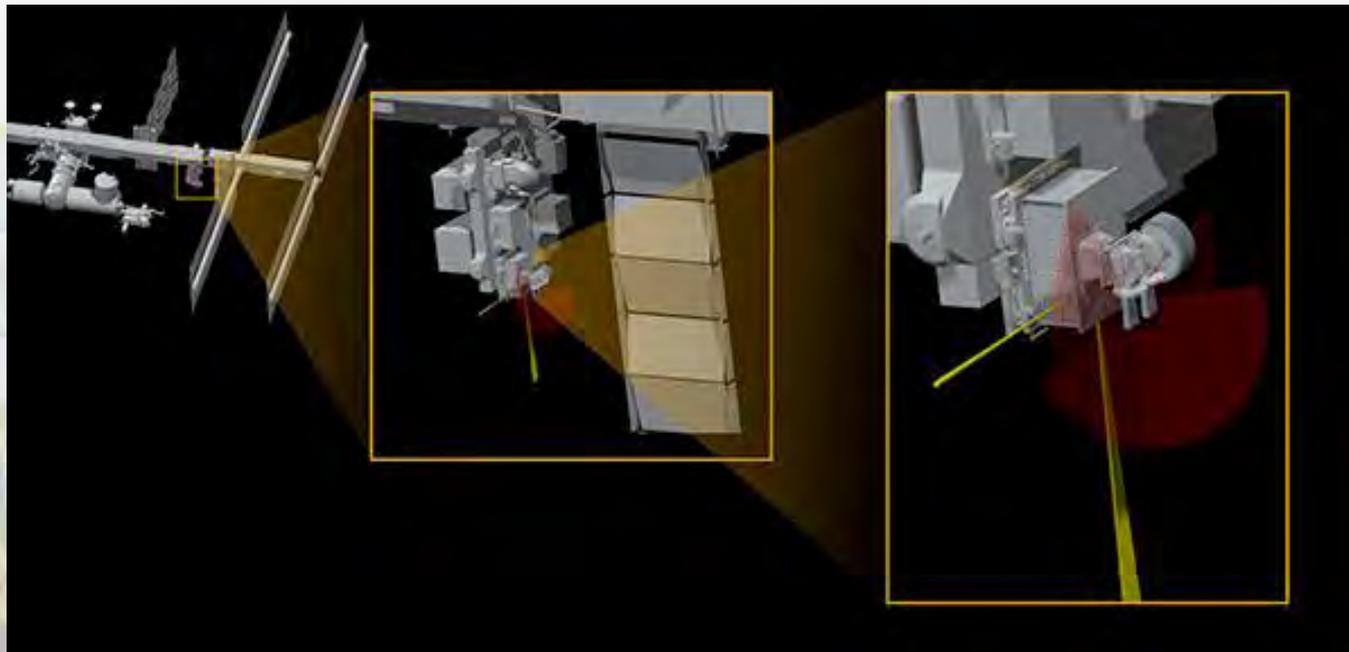




Regular update – Agency Missions at a Glance

CLARREO Pathfinder

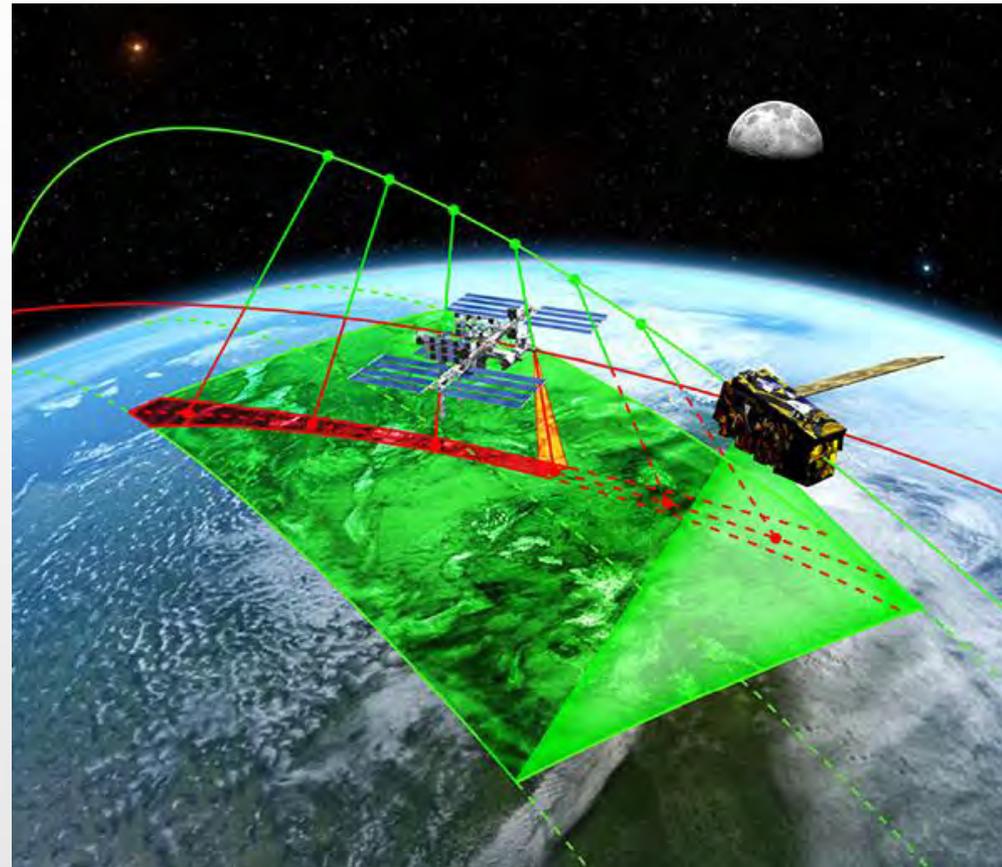
- Hosted on International Space Station (ISS) in 2020 time frame
- Slotted on the ExPRESS logistics carrier (ELC-1)
- Studies underway to determine if funds can support flight of two instruments, a Reflected Solar (RS) and an Infrared (IR) spectrometer





Regular update – Agency Missions at a Glance CLARREO Pathfinder

- Pathfinder goals include proving the high-accuracy harmonisation techniques
- Include lunar views to evaluate lunar irradiance
- Understand the protocols needed to transfer pre-launch characterization to demonstrated on-orbit accuracy





Regular update – Agency Cal/Val discussion

Sentinel 2/Landsat 8 cross-calibration

- Significant international joint agency effort
- Work included prelaunch evaluation of integrating spheres used for MSI and OLI (NASA, ESA) and Analysis of MSI diffuser witness samples (NASA, U. Arizona, ESA)
- Post-S2 launch has concentrated on
 - OLI-MSI Radiometric Comparisons
 - Vicarious calibration using automated U. Arizona RadCaTS system
 - Comparison of MSI & OLI TOA reflectance over PICS sites (USGS, SDSU, NASA)
 - OLI-MSI Geometric/Spatial Comparisons (USGS)
 - Geometric Accuracy Assessment
 - Image Registration Accuracy
 - Band Registration Accuracy
- Acknowledge the efforts of
 - Brian Markham (NASA Goddard Space Flight Center)
 - Jim Storey (SGT/USGS) and Ron Morfitt (USGS)
 - Jeff Czapla-Myers (Univ. of Arizona) and Dennis Helder (SDSU)
 - Martin Claverie (UMD)
 - Funding from NASA LCLUC, LcSPO, and USGS



Regular update – Agency Cal/Val discussion

Sentinel 2/Landsat 8 cross-calibration

- Radiometric results based pre-launch gains and do not reflect the on-orbit reflectance based calibration using the diffuser
- Initial radiometric results for the Sentinel-2a MSI data are encouraging
 - Initial data appear to be at or near requirements
 - MSI gain updates appear to show better agreement with OLI
- Geometric and spatial performance of Sentinel-2 MSI data are within specification
 - Absolute geolocation of MSI L1C products may differ from Landsat-8 L1T products by up to $\sim 37\text{m}$ (2σ), due to errors in the Landsat GLS2000 reference
 - Updates to the Landsat GLS2000 will resolve this by 2017
- Landsat CVT will continue to monitor and update analyses when appropriate

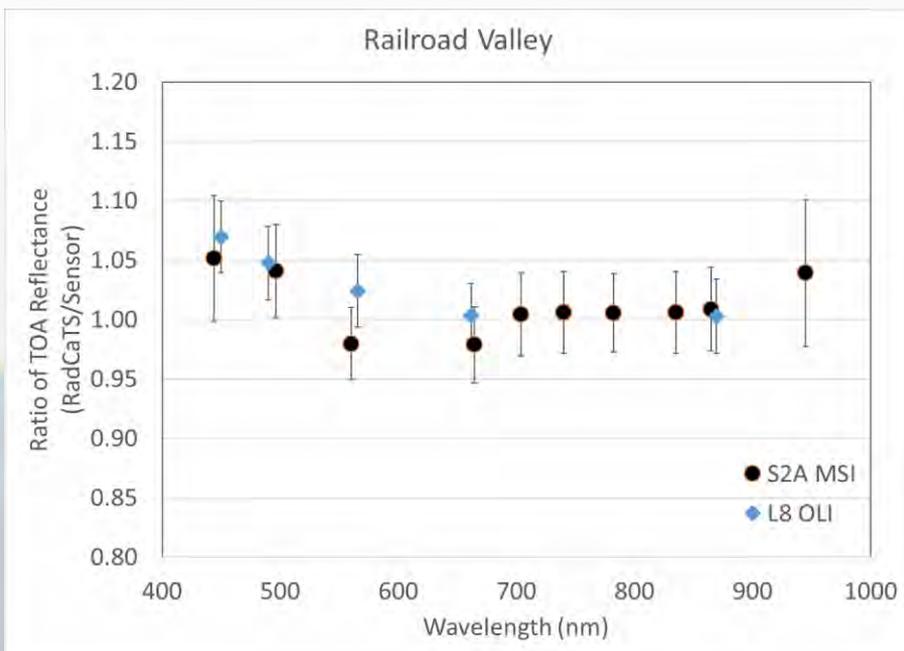


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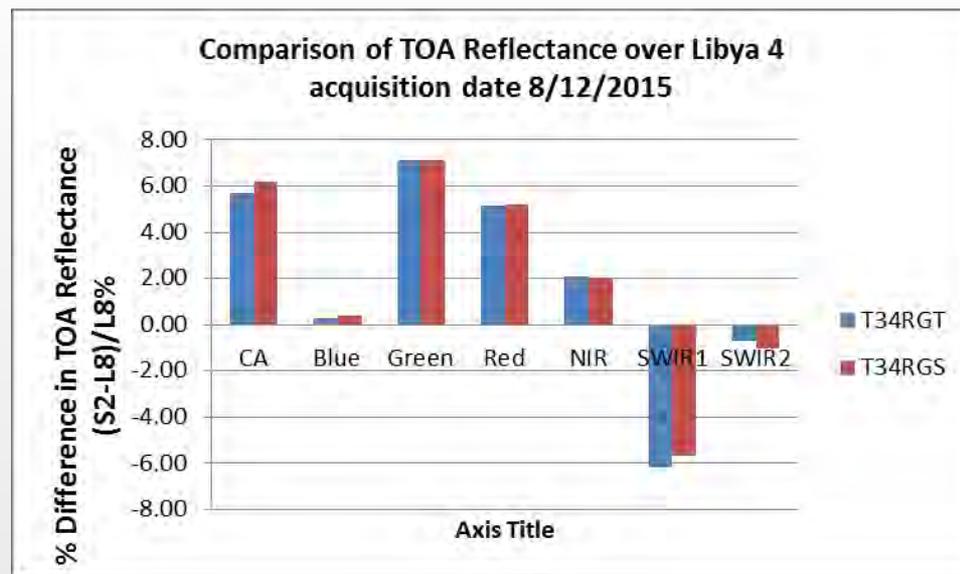


Regular update – Agency Cal/Val discussion Sentinel 2/Landsat 8

OLI/MSI TOA Reflectance Compared to U. Az RadCaTS Observations



OLI/MSI Difference in TOA Reflectance (Libya 4 PICS)



- OLI: Mar 2013 – Nov 2015, 14 dates
- MSI: Aug–Oct 2015, 4 dates (pre-operational gains)

USGS results. (SDSU results over same scene consistent to within 1% except red band)



Regular update – Agency Cal/Val discussion

Sentinel 2/Landsat 8 cross-calibration

- NASA is investing in synergistic use of international data sources to improve land monitoring
- Multi-Source Land Imaging Science (MuSLI) Team
 - Solicited through Land Cover / Land Use Change (LCLCU) research program
 - 3-year activity to prototype land products from fusion of international systems, with focus on Sentinel-1,2 and Landsat
 - Coordinated with ESA Scientific Exploitation of Operational Mission Program
- Harmonized Landsat / Sentinel-2 (HLS) Reflectance Products
 - Goal is seamless, near-daily 30m surface reflectance record from Landsat-8 and Sentinel-2a,b
 - Common atmospheric correction, spectral & BRDF adjustment, resampling to common grid & frame (“data cube” concept)
 - Collaboration among NASA GSFC, ARC, and UMD
 - Implemented on NASA Earth Exchange (NEX) – initially as a series of test sites



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Regular update – Agency Cal/Val discussion

NASA Multi-Source Land Imaging Projects

International Collaborators

Project Title

PI

Project Title	PI	International Collaborators
Multisource Imaging of Seasonal Dynamics in Land Surface Phenology	Friedl/Boston U	Eklundh / Lund
Integrating Landsat 7, 8 and Sentinel 2 Data in Improving Crop Type Identification and Area Estimation	Hansen/U. Maryland	Defourny / Louvain
Towards Near Daily Monitoring of Inundated Areas Over North America Through Multi-Source Fusion of Optical and Radar Data	Lang / U. Maryland	Creed / Western
Prototyping a Landsat-8/Sentinel-2 Global Burned Area Product	Roy / SDSU	Chuvieco / Alcalá; Tansey / Leicester
Operational Algorithms and Products for Near Real Time Maps of Rice Extent and Rice Crop Growth Stage Using Multi-Source Remote Sensing	Salas / Applied Geosystems	Hoekman / Wageningen; Le Toan / CESBIO
Multi-Source Imaging of Infrastructure and Urban Growth Using Landsat, Sentinel and SRTM	Small / Columbia U	Esch / DLR
Multi-Source Imaging of Time-Serial Tree and Water Cover at Continental to Global Scales	Townshend / U. Maryland	Schmullius / Jena

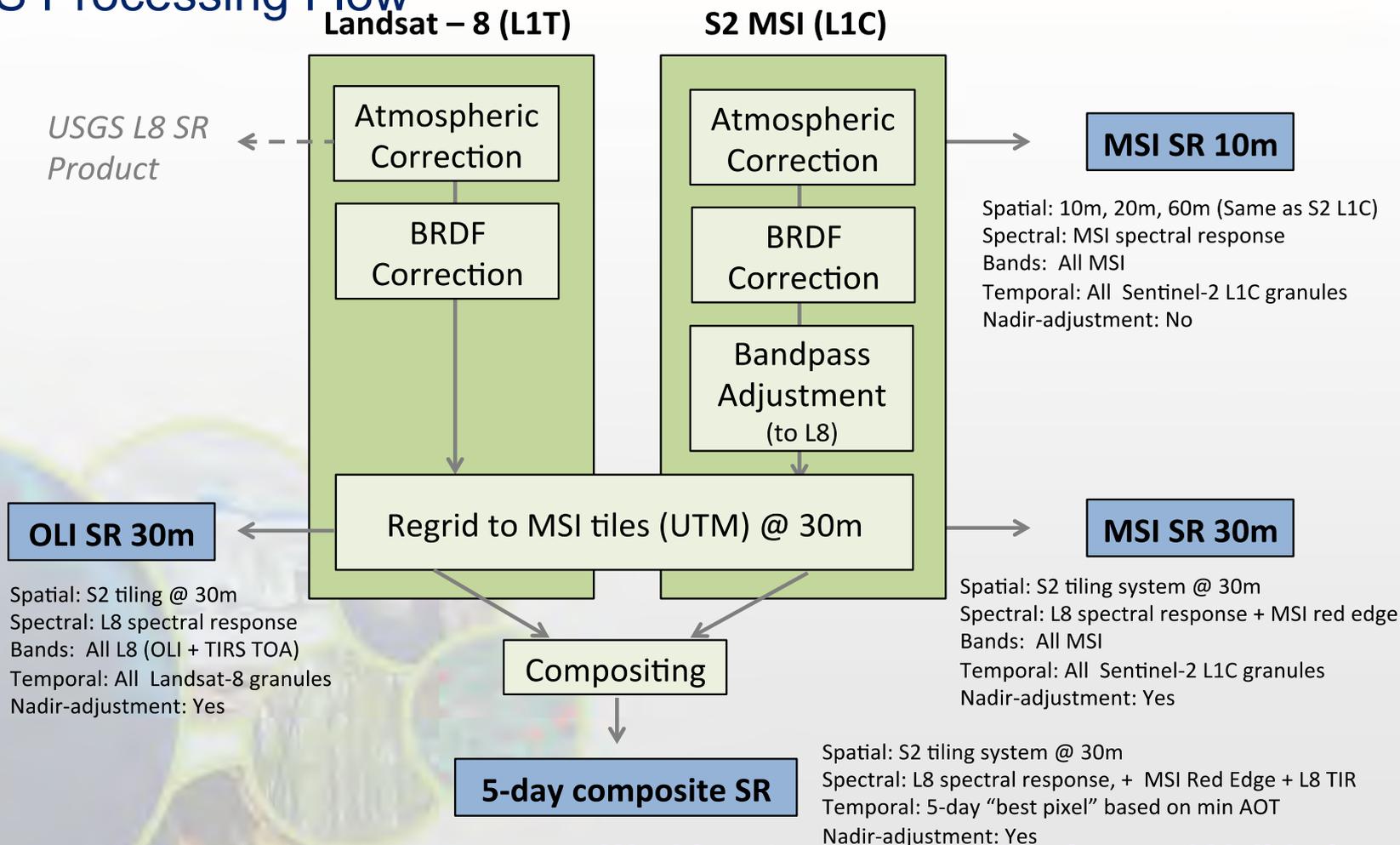


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Regular update – Agency Cal/Val discussion

HLS Processing Flow

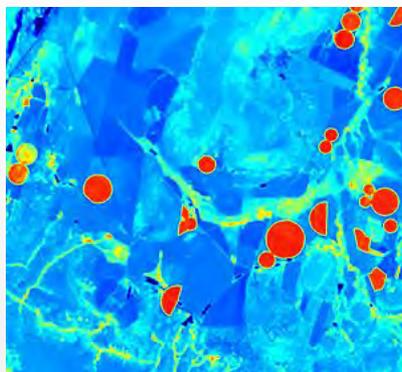




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Initial HLS NDVI Time Series (Lydenburg, South Africa)

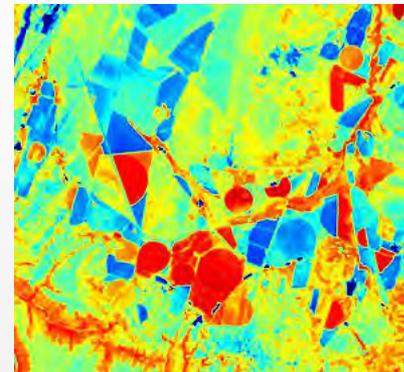
11 Oct



cloudy

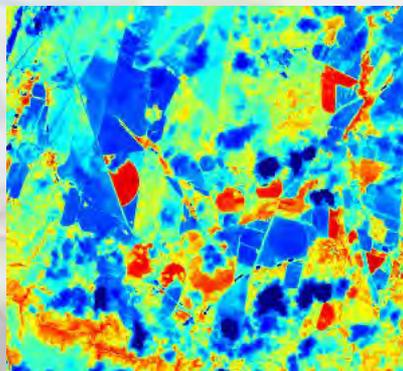


30 Dec

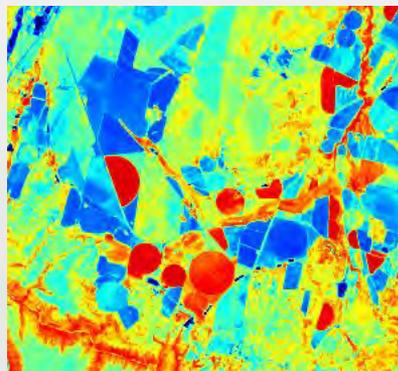


L8
OLI

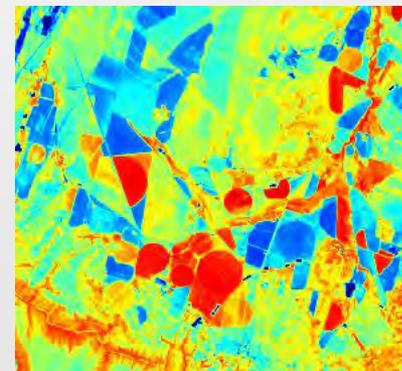
16 Dec



19 Dec



29 Dec



S2a
MSI



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Regular update – Agency Cal/Val discussion
Carbon monitoring



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NASA Carbon Monitoring System

Initiated following a 2010 Congressional Direction, the NASA CMS project is forward-looking and designed to make significant contributions in characterizing, quantifying, understanding, and predicting the evolution of global carbon sources and sinks through improved monitoring of carbon stocks and fluxes.





Carbon Cycle & Ecosystems Office

Libby Larson
Peter Griffith





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Climate change in the Arctic and Boreal region is unfolding faster than anywhere else on Earth, resulting in reduced Arctic sea ice, thawing of permafrost soils, decomposition of long- frozen organic matter, widespread changes to lakes, rivers, coastlines, and alterations of ecosystem structure and function. NASA's Terrestrial Ecology Program is conducting a major field campaign, the Arctic-Boreal Vulnerability Experiment (ABOVE), in Alaska and western Canada, for 8 to 10 years, starting in 2015. ABOVE seeks a better understanding of the vulnerability and resilience of ecosystems and society to this changing environment.

[... learn more](#)

Announcements

- ▶ Arctic Matters Day >>
Thursday, January 14, 2016
9 a.m - 4 p.m.
Washington, DC.
- ▶ Registration for the Second ABOVE Science

Tweets

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NASA_ABOVE @NASA_ABOVE 15 Jan
Call for abstracts 2nd Pan-Eurasian
Experiment (PEEX) Science
Conference, 18-20 May 2016, Beijing
peexconference.csp.escience.cn/dct/pag



Recommendations- For Cross-cutting tasks and Sub-group projects



- None

