

CEOS WGCV Land Product Validation (LPV) Sub-Group: Current and Potential Roles in Future Decadal Survey Missions

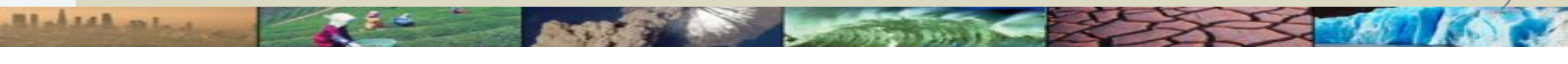
**Miguel O. Román¹ *for* Joanne Nightingale^{1,2},
Jaime Nickeson^{1,2} & Gabriela Schaepman-Strub³**

(¹NASA GSFC, ²Sigma Space Corp, ³University of Zurich)

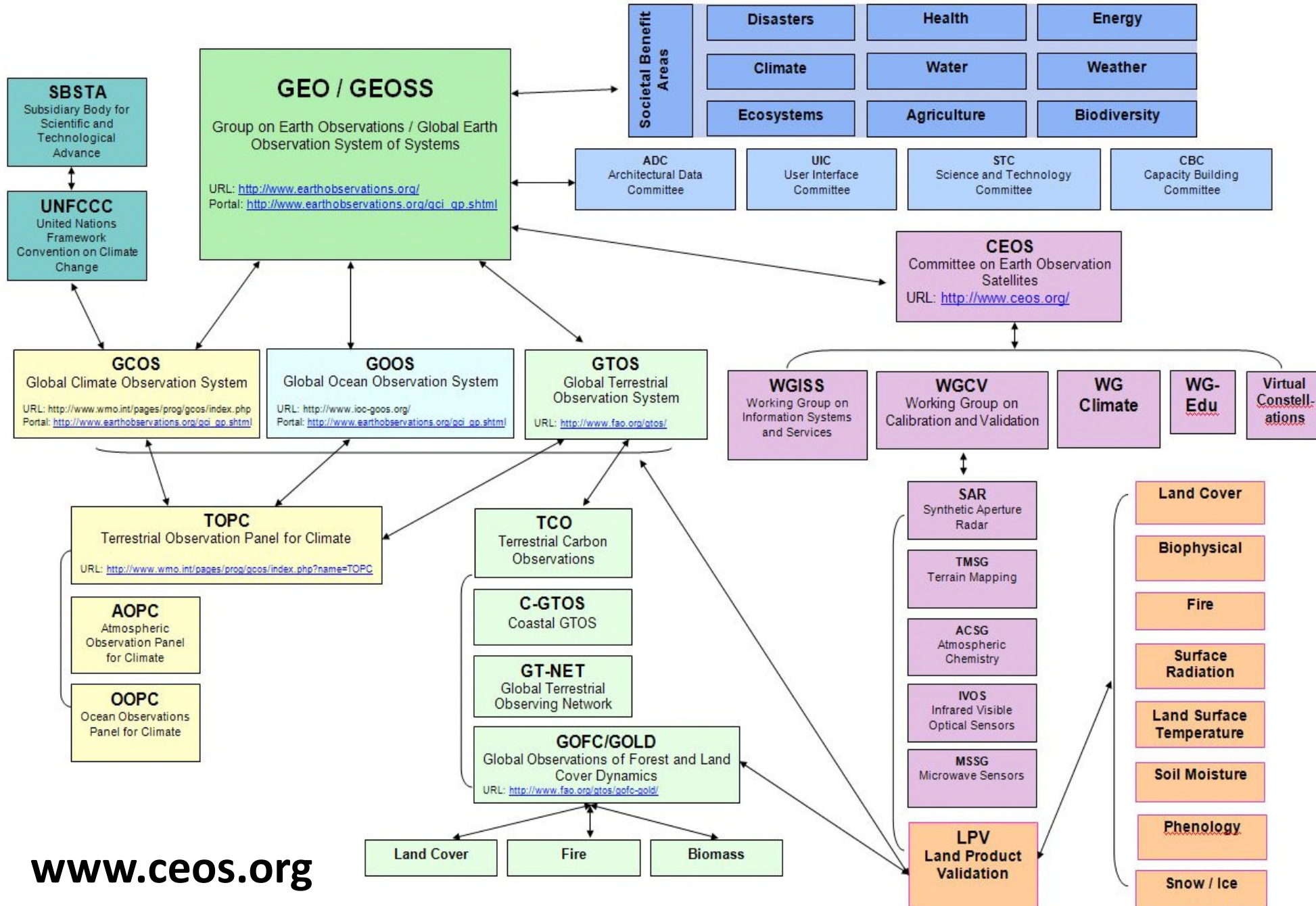
~ With input from LPV Focus Group Leads

Outline

- Re-cap: Objectives and Goals
- LPV Structure Updates
- LPV activities relevant to HyspIRI
- Cal/Val Plans for VIIRS Land Science Products



Linkages between International Programs concerned with Terrestrial Earth Observation



www.ceos.org

LPV Objective & Goals

To foster and coordinate **quantitative validation** of higher level global land products derived from remotely sensed data, in a traceable way, and to relay results so they are relevant to users.

- To increase the **quality and efficiency** of global satellite product validation by developing and promoting international **standards and protocols** for:
 - Field sampling
 - Scaling techniques
 - Accuracy reporting
 - Data / information exchange
- To provide feedback to international structures (GEOSS) for:
 - Requirements on product accuracy and quality assurance (QA4EO)
 - Terrestrial ECV measurement standards
 - Definitions for future missions

LPV Sub-group Structure

8 Land Product Focus Groups – 2 international co-leads

Chair: Joanne Nightingale 2010 - 2013
(NASA GSFC)

Vice-Chair: Gabriela Schaepman-Strub
(University of Zurich)

Support: Jaime Nickeson
(NASA GSFC)

Focus Groups

* ECV

Focus Group	North America	Europe / Other	Listserv
Land Cover*	Mark Friedl (Boston University)	Martin Herold (Wageningen University, NL)	137
Fire* (Active/Burned Area)	Luigi Boschetti (University of Maryland)	Kevin Tansey (University of Leicester, UK)	73
Biophysical - LAI*	Richard Fernandes (NR Canada)	Stephen Plummer (Harwell, UK)	80
Biophysical - $fAPAR$ *	Fred Huemmrich (NASA GSFC)	Nadine Gobron (JRC, IT)	80
Surface Radiation (Reflectance, BRDF, Albedo*)	Crystal Schaaf (Boston University)	Gabriela Schaepman (University of Zurich, SW)	41
Land Surface Temperature*	Simon Hook (NASA JPL)	Jose Sobrino (University of Valencia, SP)	65
Soil Moisture*	Tom Jackson (USDA)	Wolfgang Wagner (Vienna Uni of Technology, AT)	48
Land Surface Phenology	Jeff Morisette (USGS)	Jadu Dash (University of Southampton, UK)	76
Snow/Ice*	Dorothy Hall (NASA GSFC)	Jouni Pulliainen (Finish Instit of Meteorology, FI)	13+

LPV Webpage: <http://lpvs.gsfc.nasa.gov/>

[+ NASA Homepage](#)

CEOS Working Group on Calibration and Validation

Home About Documents Contact Links

Land Product Validation

Focus Areas

- Biophysical
- Fire/Burn Area
- Land C...
- Phenology
- Snow Cover
- Soil Mo...

Announcing...

QA4EO Workshop on Providing Harmonised Quality Information in EO Data by 2015, 18-20 October 2011. [Download announcement.](#)

[iLEAPS 3rd Science Conference](#), 18-23 September 2011, Garmisch-Partenkirchen, Germany. Abstracts due 15 April.

[CEOS WGCV 33rd plenary meeting](#), Moscow, Russia. 17-20 May 2011.

The LPV Soil Moisture Focus Group will hold a joint meeting May 5, 2011 in Oxnard, CA.

[ISRSSE 3d](#), including special session on ground networks. 10-15 April 2011, Sydney, Australia.

Data access

[LPV Core Sites](#)
[Cal/Val Portal](#)

Subscribe!

LPV subgroup focus area mailing lists.
Choose a group:
Select Focus Area
Subscribe me!

[How to use these mailing lists](#)

Link to current
CEOS Calendar

- Background
- Products
- Meetings
- Case Studies
- Inter-comparisons

The subgroup on Land Product Validation (LPV) Group on Calibration and Validation (WGCV), working groups within the Committee on Earth CEOS structure). A diagram and list of international related to CEOS and Earth observation are provided. This group arose out of the recognized need for product validation were essential for wide acceptance products used for global monitoring of Earth product data collection, the potential benefits from international and obvious.

For more information about the evolution and About link on the navigation bar. The guidelines (updated Oct 2009) are:

Stage 1 Validation	Product accuracy is assessed for time periods by comparison with in situ or other suitable reference data.
Stage 2 Validation	Product accuracy is estimated over periods by comparison with reference data. Spatial and temporal consistency has been evaluated over globally representative locations. Results are published in the peer-reviewed literature.
	Uncertainties in the product and its comparison with reference in situ or other suitable reference data. Uncertainties are characterized in a statistically robust way over multiple locations and time periods.

Meetings related to Soil Moisture

Upcoming Meetings

- [EUMETSAT/ESA Scatterometer Science Conference](#)
Centralstation
Darmstadt, Bundesland Germany
4/11/2011 - 4/13/2011

The conference will address Level 1 (backscatter) and Level 2 (soil moisture) validation and calibration activities for the METOP Advanced scatterometer and prepare for future scatterometer missions that hold a large potential for long-term soil moisture monitoring. Also, soil moisture applications will be covered.

- [SMAP Cal/Val Workshop #2](#)
Embassy Suites Hotel
Oxnard, CA USA
5/3/2011 - 5/5/2011

As a result of the preliminary Cal/Val plan and previous workshop involving the science community, activities were initiated to support the objectives of Cal/Val. These included field campaigns to provide specific data sets for the algorithm teams, developing tower and aircraft-based simulators, and developing and implementing methods for integrating the diverse in situ resources available for validation. As part of this workshop, results to date will be reviewed and additional requirements identified. These activities include additional field campaigns.

- [Joint GEWEX International Soil Moisture Working Group \(ISMWG\) and CEOS Soil Moisture Validation \(SMV\) Meeting](#)
Embassy Suites Hotel
Oxnard, CA USA
5/5/2011 - 5/5/2011

The ISMWG and the newly formed CEOS Soil Moisture Validation (SMV) Focus Group will hold a joint meeting to address mutual areas of interest and to formulate plans to establish and document validation protocols and data sharing. This one day meeting will be held in conjunction with the SMAP Cal/Val Workshop to be held in the US in the Spring of 2011.

Institution: NASA - JPL
[Link to validation information](#)

Spatial Scale: 1-1 km
Temporal Scale: Day, Mon, Qtr, and Annual

eMODIS, derived from MODIS
Contact: [Calli Jenkerson](#)
Institution: USGS-EOS

Spatial Coverage: CONUS
Temporal Coverage: 2000+
Spatial Scale: 250m/500m/1K
Temporal Scale: 7, 14 day

LAJ, derived from MODIS
Contact: [Ranga Myneni](#)
Institution: Boston University
[Link to validation information](#)

Spatial Coverage: Global
Temporal Coverage: 2000+
Spatial Scale: 1 km
Temporal Scale: 8-day

LPV Activities relevant to HysplRI

HyspIRI Products

LPV Focus Group / Product	VSWIR L 2/ 3	VSWIR L4	VSWIR Global	TIR L4	SWIR / TIR
LAND COVER					
Fractional land cover / veg. cover		Existing Val Methods	Existing Val Methods		
Disturbance, PFT, hazard susceptibility		Research Required			
SURFACE RADIATION					
Surface Reflectance	Existing Val Methods				
Surface Albedo	Existing Val Methods				
BIOPHYSICAL					
Gross / Net Primary Production		Existing Val Methods	Existing Val Methods		
fPAR		Existing Val Methods	Existing Val Methods		
LAI		Existing Val Methods	Existing Val Methods		
Water content, LUE, Pigments		Research Required			
FIRE					
Detection of Fire events				Existing Val Methods	Existing Val Methods
Fire fuel loads		Research Required			
LAND SURFACE TEMPERATURE					
LST				Existing Val Methods	Existing Val Methods
Emissivity				Existing Val Methods	Existing Val Methods
Evapotranspiration				Research Required	

Existing Val Methods

Research Required



ALBEDO

Albedo and reflectance anisotropy

- Official recognition of the need for long-term in-situ radiation measurements for spectral and broadband BRDF/albedo.
- Stresses importance of BSRN, Fluxnet, AERONET.
- Provides guidelines for data collection protocols and standardization across the flux networks.



Surface Radiation Focus Group



WORLD METEOROLOGICAL
ORGANIZATION

INTERGOVERNMENTAL
OCEANOGRAPHIC COMMISSION

IMPLEMENTATION PLAN FOR THE GLOBAL OBSERVING SYSTEM FOR CLIMATE IN SUPPORT OF THE UNFCCC

(2010 UPDATE)

6.1.3. Monitoring at Terrestrial Reference Sites

Many, if not most, of the terrestrial ECVs (such as FAPAR, LAI, biomass, and albedo) are too heterogeneous spatially to make global *in situ* measurements practical. They are typically measured at a limited number of research sites or retrieved from space measurements over large areas. There are three key requirements for *in situ* measurements at reference sites in the context of long-term global climate measurements: (a) To ensure that a representative set of biomes are properly and consistently documented over long periods of time (decades or more). This will allow the details of natural vegetation changes and carbon stocks, including fluxes, to be carefully monitored at key locations; (b) to measure key meteorological ECVs to support interpretation of changes recorded at such sites; and (c) to optimize the joint use of these terrestrial reference sites with:

- a set of sites delivering essential ground data for the validation of satellite-derived products that provide extensive geographical coverage for these variables (see Action T29 dealing specifically with calibration/validation of FAPAR and LAI).
- key ecosystem sites (see Action T4).

It may be efficient to establish these reference sites by building on existing networks, such as the Flux and Energy Exchange Network (FLUXNET) and the Long-Term Ecological Research Network (LTER), and to seek overlap between those networks.

Action T3⁹³ [IP-04 T3, T29]⁹⁴

Action: Development of a subset of current LTER and FLUXNET sites into a global terrestrial reference network for monitoring sites with sustained funding perspective, and collocated measurements of meteorological ECVs; seek linkage with Actions T4 and T29 as appropriate.

Who: Parties' national services and research agencies, FLUXNET organizations, the US National Ecological Observatory Network (NEON) and the European Integrated Carbon Observation System (ICOS), in association with CEOS WGCV, CGMS-GSICS, and GTOS (Terrestrial Carbon Observations Panel (TCO) and TOPC).

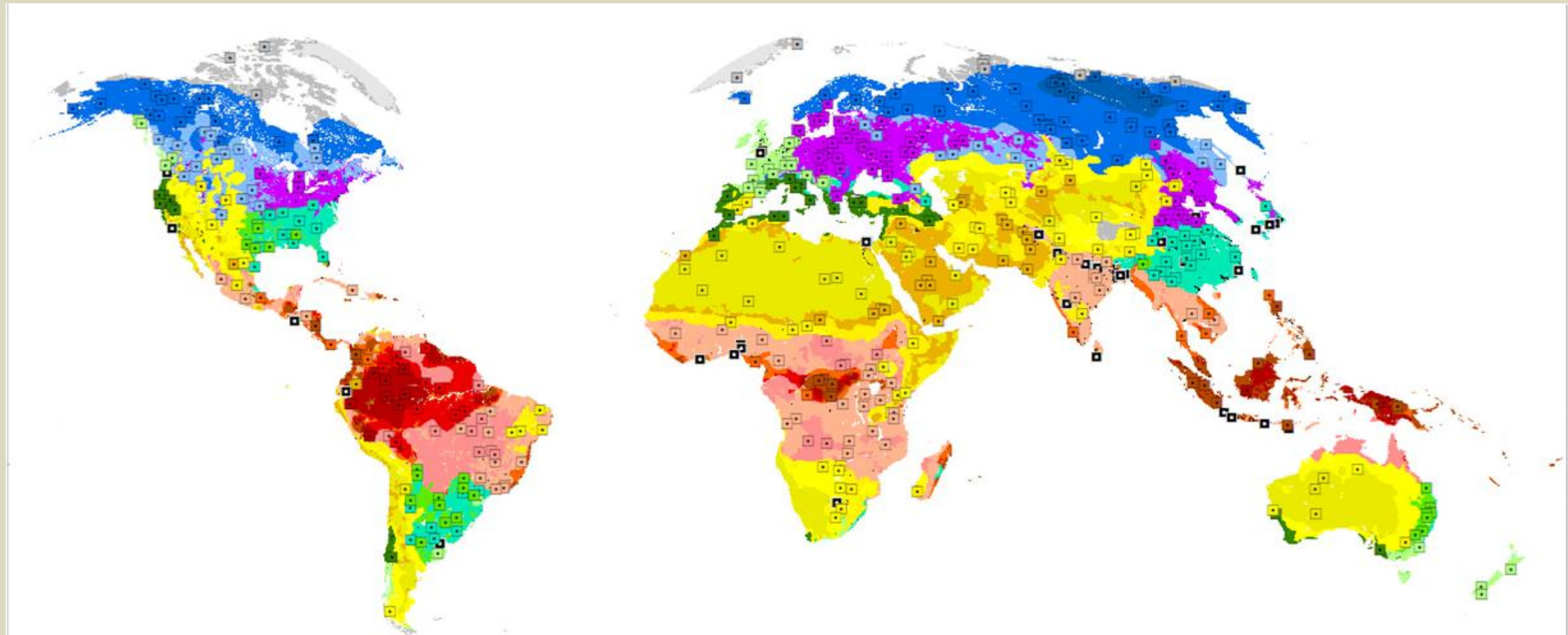
Time-frame: Implementation started by 2011, completed by 2014.

Performance Indicator: Plan for the development and application of standardised protocols for the measurements of fluxes and state variables.

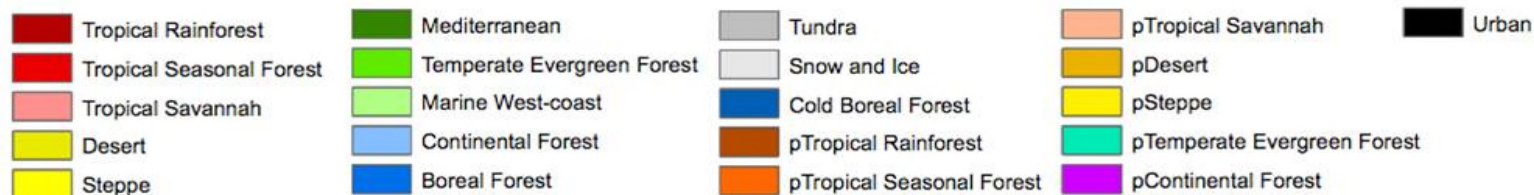
Annual Cost Implications: 30-100M US\$ (40% in non-Annex-I Parties).

Land Cover Focus Group

- Implementation of a global sample design and database for land cover validation independent of specific products
- Design provides a global stratified sample of LC validation sites based on climate/vegetation biomes & population data, sample sites are 5km x 5km
- “Ground truth” derived from very high resolution imagery with the assistance of local experts



Global Validation Sites: Stratification & Geographic Sampling

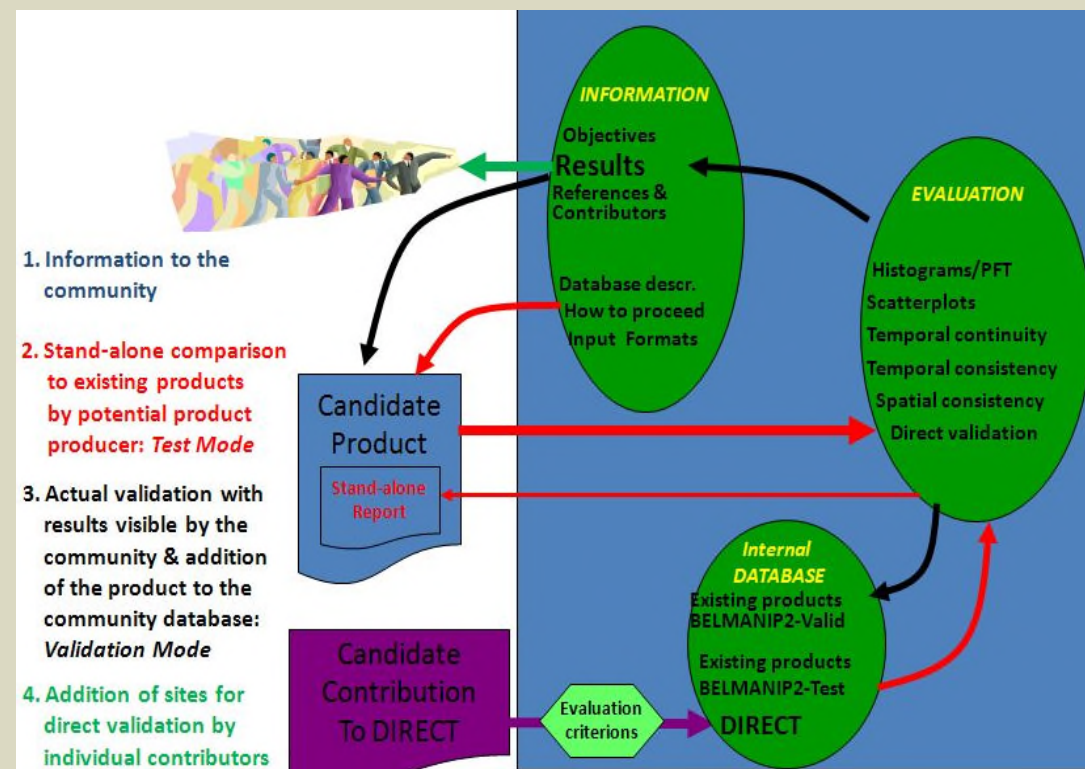


Biophysical Focus Group



- OLIVE (**O**nLine **I**nteractive **V**alidation **E**xercise) (Baret *et al.*)
- Web-interface tool for independent validation of biophysical land products (LAI, fAPAR and Albedo)
- Will provide existing in situ data and high resolution scaled reference maps for validation, new validation datasets may be submitted

- Technical specifications document undergone review by ESA and key LPV members
- Operational mid-2011
- User workshop scheduled for early 2012

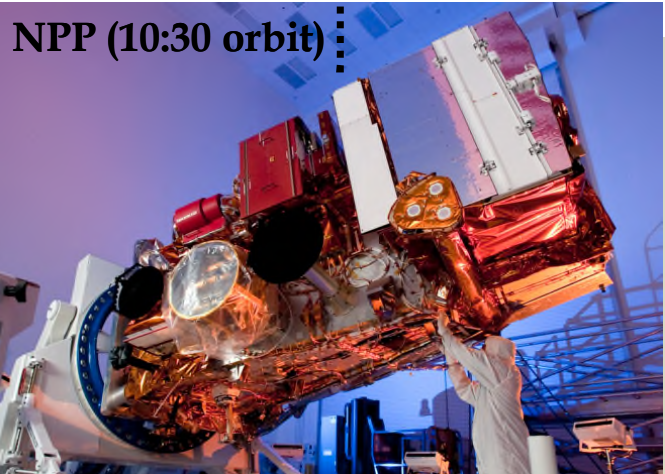
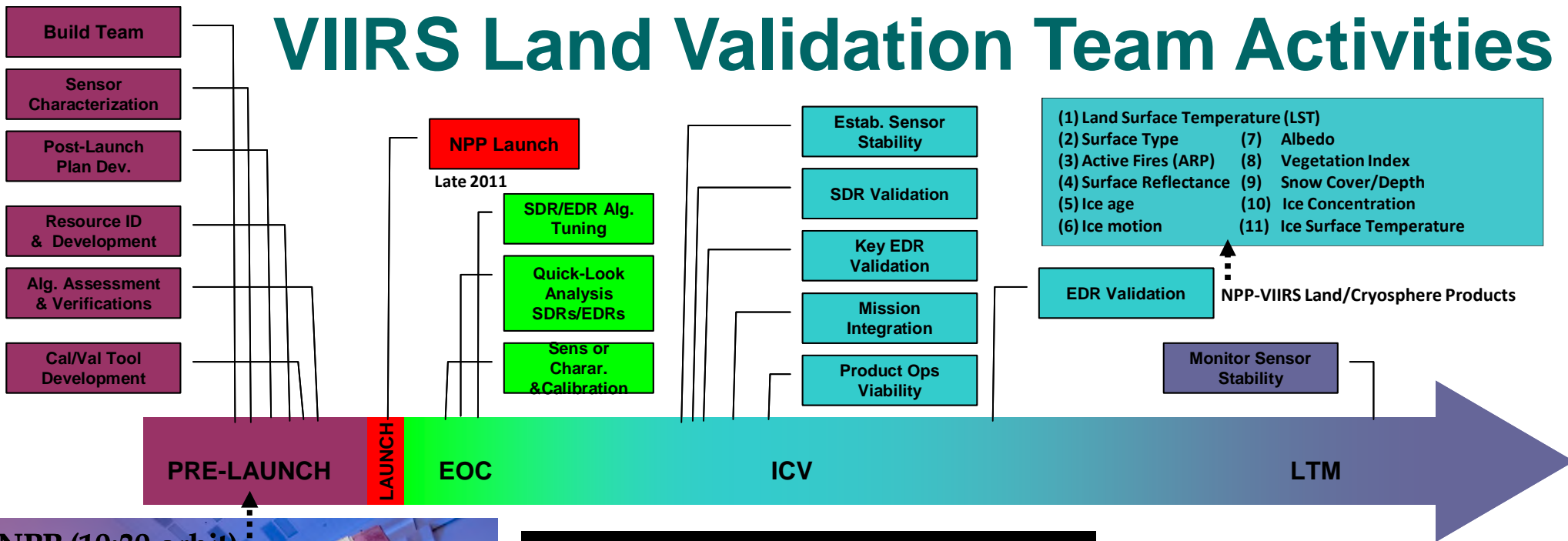


LPV and Data Quality

- LPV starting involvement with WGCV –WGISS and ESIP Federation Information Quality Cluster (GSFC)
- IQ cluster
 - Quality of remote sensing data, terminology, standardization, IQ framework, IQ4EO white paper preparation
- Standards for “ALL remote sensing products”:
 - Metadata
 - QA flags
- Assessment of “fitness for purpose” and ways of defining this within product meta-data
- LST community via **HyspIRI** product planning and Barrax field campaign work are willing to be the first “test case”

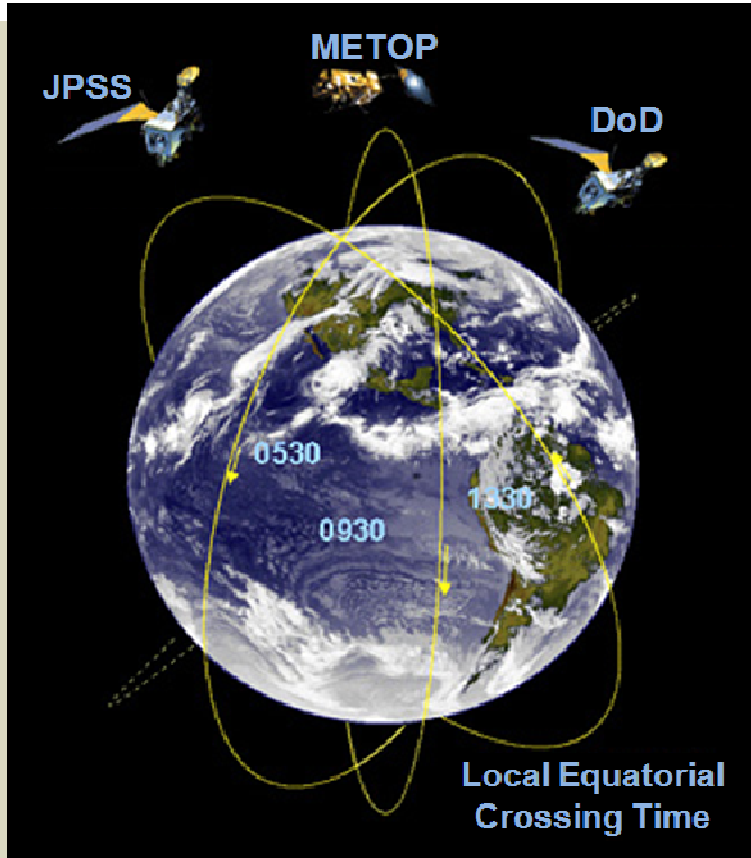
Cal/Val Plans for VIIRS Land Science Products

VIIRS Land Validation Team Activities



JPSS-DPA Objectives:

- To validate the VIIRS Land EDRs, IPs, and ARPs to meet operational performance requirements.



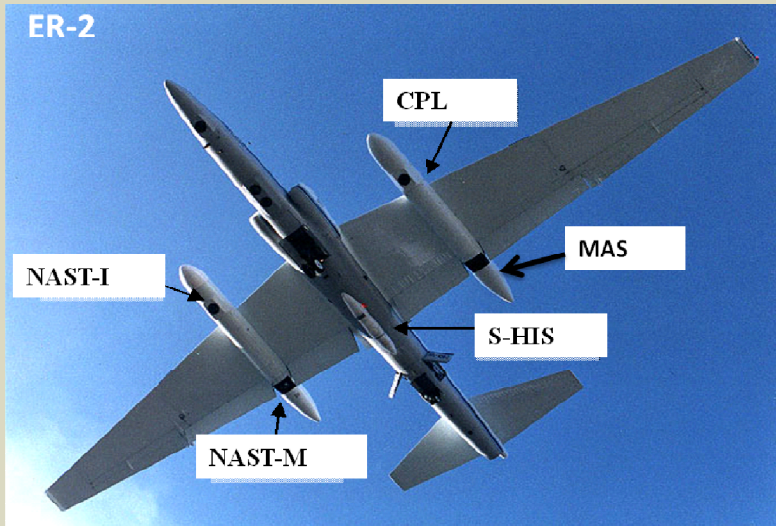
NASA's Role:

- To continue the scientific data record started in the EOS era.
- To coordinate algorithm development, QA, and validation activities for "Science-quality" products.
- Reprocessing will also be required to produce consistent, integrated, EOS/NPP/JPSS long term data records.



Aircraft Campaigns in Support of VIIRS Cal/Val Efforts

From Sensor Data Records...



- Airborne simulators support prototyping and testing of Level 1 VIIRS Sensor Data Records (SDRs).

- Provide verification of sensor calibration and stability during ICV and LTM.

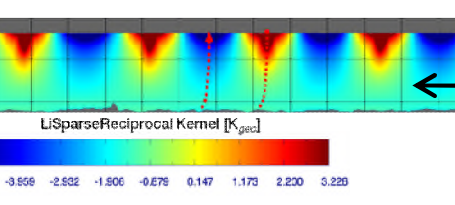
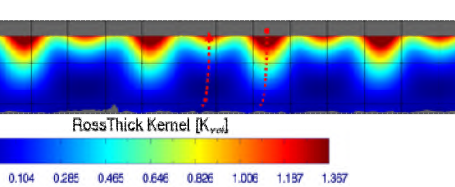
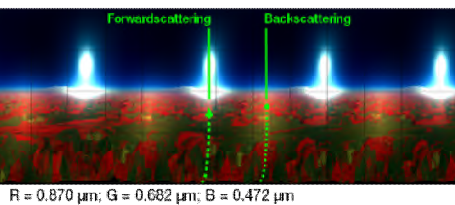
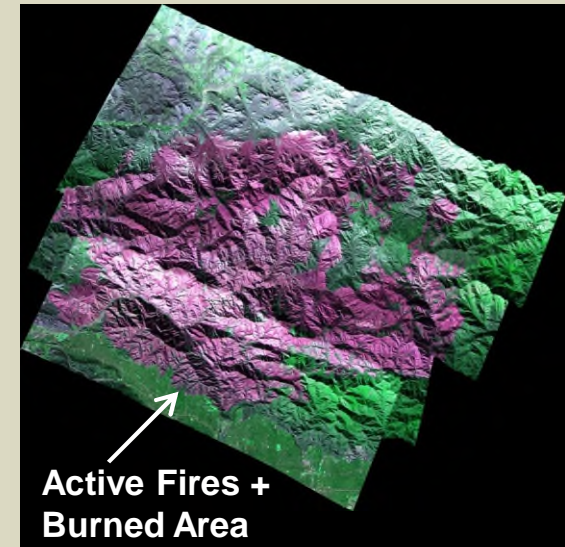
... to Global Land Products

(AMS/Ikhana)

IFOV:	2.5 mrad
FOV:	85.9°
GIFOV:	50 m

Simulated Bands:

- ETM+ B1-B4
- MODIS B27
- VIIRS M15-M16



(CAR/P3-B)

Simulated Bands:

- ETM+ B1-B4
- MODIS B1,B2,B3,B5
- VIIRS I2, M3, M5, M7-8

IFOV:	17.5 mrad
FOV:	190.0°
GIFOV:	4.0-500 m

Surface Reflectance, VI, BRDF, and Albedo
(see poster display)

- Development and testing of standard products (L2+); Provides critical in-situ data for multi-sensor validation and intercomparison studies.

ER-2 Coverage from Dryden, CA



