



2021 CEOS-WGCV-LPV Plenary

LPV Virtual Plenary



**26 – 27 May 2021**

**About 50 participants**

The main objective is to review the **CEOS LPV action plan and shape the way forward**

Specific objectives are:

- ✓ Hear reports from CEOS agencies and operational services on product validation,
- ✓ Hear activity reports from CEOS LPV focus areas,
- ✓ Discuss the status of good practices validation protocol,
- ✓ Report on current validation and intercomparison activities,
- ✓ Hear updates on fiducial reference data collection and ground networks,
- ✓ Exchange information and promote synergies among key actors in the land product validation community.



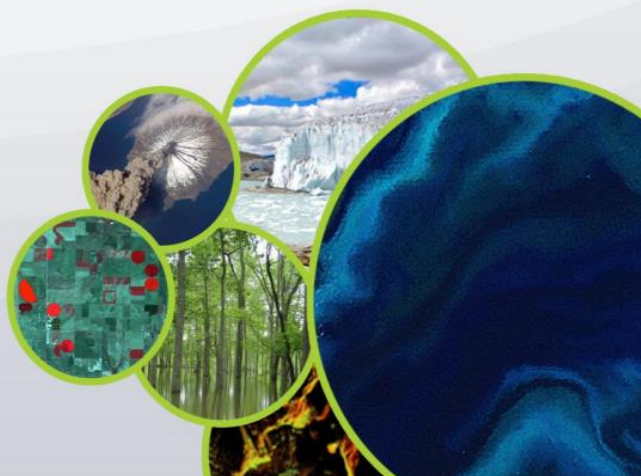
Time (UTC)	Talk	Presenter
Introduction		
15:00- 15:10	Welcome, introduction & meeting objectives	Fernando Camacho (EOLAB) / Michael Cosh (USDA)
CEOS Agencies reports		(Chair: F. Camacho)
15:10- 15:20	CEOS Working Group on Calibration and Validation	Philippe Goryl (ESA)
15:20-15:35	ESA land product validation strategy	Valentina Boccia (ESA)
15:35-15:45	ESA FRM4Veg: SRIX4Veg and proposition for an optical cal/val permanent site	Valentina Boccia (ESA)
15:45-16:00	NASA NISAR mission and cal/val plan	Bruce Chapman (NASA JPL)
16:00-16:15	Q&A	
Operational product validation		(Chair: M. Cosh)
16:15-16:30	EUMETSAT SAF on Land Surface Analysis (LSA SAF)	Isabel Trigo (IPMA)
16:30-16:45	EC Copernicus Global Land Service	Roselyne Lacaze (HYGEOS)
16:45-17:00	MODIS / VIIRS Land Surface Reflectance validation	Eric Vermote (NASA)
17:00-17:15	Q&A	
17:15-17:30	Coffee Break	
Ground networks and In-situ measurements		(Chair: J. Nickeson)
17:30-17:45	US National Ecological Observatory Network (NEON)	Tristan Goulden (Batelle)
17:45-18:00	ICOS Ecosystem observations	Dario Papale (U. Tuscia)
18:00-18:15	The Copernicus (Global Land) Ground-Based Observations for Validation (GBOV) service	Christophe Lerebourg (ACRI)
18:15-18:30	Q&A	
18:30	End of 1 <sup>st</sup> day	

Time (UTC)	Talk	Presenter
Introduction		
15:00- 15:05	Welcome and introduction	F. Camacho (EOLAB) / M. Cosh (USDA)
Future Operational Validation Needs		
15:05- 15:20	Copernicus Calibration Validation Solution (CCVS H2020) / Q&A	Joanne Nightingale (NPL)
LPV Focus Areas reports		Chair F. Camacho
15:20-15:35	Above Ground Biomass / Q&A	Laura Duncanson (U. Maryland), John Armston (U. Maryland), Mat Disney (UC London)
15:35-15:50	Surface Radiation / Q&A	Zhuosen Wang (NASA), Dominique Carrer (Meteo France)
15:50-16:05	Biophysical variables (LAI, FAPAR) / Q&A	Hongliang Fang (CAS), Marie Weiss (INRA), Sylvain Leblanc (NRCan)
LPV Focus Areas reports		Chair J. Nickeson
16:05-16:20	Vegetation Indices / Q&A	Tomoaki Miura (U. Hawai'i) Else Swinnen (VITO)
16:20-16:35	Land Surface Phenology / Q&A	Victor Rodriguez-Galiano (U. Sevilla) Joshua Grey (NCSU)
16:35-16:50	Land Cover / Q&A	Sophie Bontemps (UCL) Alexandra Tyukavina (U. Maryland)
Coffee Break		
LPV Focus Areas reports		Chair M. Cosh
17:00-17:15	LST and Emissivity / Q&A	Frank Göttsche (KIT) Glynn Hulley (NASA JPL)
17:15-17:30	Fires & Burn Areas / Q&A	Gareth Roberts (U. Southampton) Louis Giglio (U. Maryland)
17:30-17:45	Soil Moisture / Q&A	Carsten Montzka (FZ-Jülich) John Bolten (NASA)
17:45-18:00	Snow Cover/ Q&A	Chris Crawford (USGS) Simon Gascoïn (CESBIO)
18:00-18:30	Wrap-up discussion	
18:30	End of the meeting	

LPV Strategy (2019-2022) agreed in Milan 2019 : [https://lpvs.gsfc.nasa.gov/LPV\\_Meetings/LPV\\_plenary2019.html](https://lpvs.gsfc.nasa.gov/LPV_Meetings/LPV_plenary2019.html)



Committee on Earth Observation Satellites



CEOS WGCV Land Product Validation

Action Plan 2019-2022

Outcome of the LPV plenary meeting in Milan, 15<sup>th</sup> May.  
Prepared by F. Camacho, June 2019



Development of Good Practices Validation Protocols

Promoting validation and intercomparison exercises

Improving ground references: data, sites, uncertainties

Improving LPV communication



## Development of Good Practices Validation Protocols





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

### Global Leaf Area Index Product Validation Good Practices Protocol

**Version 2.0**  
January, 2014

Editors: Richard Fernandes, Stephen Plummer, Joanne Nightingale

Contributors: Fred Bamt, Fernando Camacho, Hongfang Fang, Sebastien Garrigues, Nadine Matt, Lang, Roslyn Lacaze, Sylvain LeBlond, Michele Meroni, Beatriz Martinez, Bernard Pinty, Jan Pink, Oliver Sonnentag, Alexandre Verges, Jon Welles, Mikael Widowski, Gabriela Schaepman-Staub, Miguel Roman, Jaime Nickeson

2014

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

### Land Surface Temperature Product Validation Best Practice Protocol

**Version 1.1 - January, 2018**

Editors: Pierre Galleovic, Frank Götzsche, Jaime Nickeson, Miguel Román

Authors: Pierre Galleovic, Frank Götzsche, Jaime Nickeson, Lynn Hulley, Darren Ghera, Trigo, Simon Hook, José A. Sobrino, John Remedios, Miguel Román and Fernando Camacho

Citation: Galleovic, P., Götzsche, F., Nickeson, J., Hulley, G., Ghera, D., Yu, Y., Trigo, I., Hook, S., Remedios, J., Sobrino, J. A. & Camacho, J. (2018). Land Surface Temperature Product Validation Best Practice Protocol, Version 1.1. In P. Galleovic, F. Götzsche, J. Nickeson & M. Román (Eds.), *Good Practices for Satellite Derived Land Product Validation* (p. 45). CEOS Land Product Validation Subgroup.

2018

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

### Global Surface Albedo Product Validation Best Practices Protocol

**Version 1.0 - 2018**

Editors: Zhuosen Wang, Jaime Nickeson, Miguel Román

Authors: Zhuosen Wang, Crystal Schaff, Alessio Lattanzio, Domingo Miguel Román, Fernando Camacho, Yumyue Yu, Jorge Sánchez-Zapero

Citation: Wang, Z., Schaff, C., Lattanzio, A., Carrer, D., Grant, I., Yu, Y., Sánchez-Zapero, J. & Nickeson, J. (2019). Global Surface Albedo Product Validation Best Practices Protocol, Version 1.0. In Z. Wang, J. Nickeson & M. Román (Eds.), *Good Practices for Satellite Derived Land Product Validation* (p. 45). CEOS Land Product Validation Subgroup.

2019

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

### Soil Moisture Product Validation Good Practices Protocol

Version 1.0 - October 2020

Editors: Carsten Montzka, Michael Cosh, Jaime Nickeson, Fernando Camacho

Authors: Carsten Montzka, Michael Cosh, Bagher Bayat, Ahmad Al Bitar, Aaron Berg, Rajat Bindlish, Heve Reemt Bogaena, John D. Bolten, Francois Cabot, Todd Caldwell, Steven Chan

2020

Committee on Earth Observation Satellites

## Working Group on Calibration and Validation

### Land Product Validation Subgroup

### Aboveground Woody Biomass Product Validation Good Practices Protocol

**Version 1.0 - 2021**

Editors: Laura Duncanson, Mat Disney, John Armston, Jaime Nickeson, David Minor, Fernando Camacho

2021

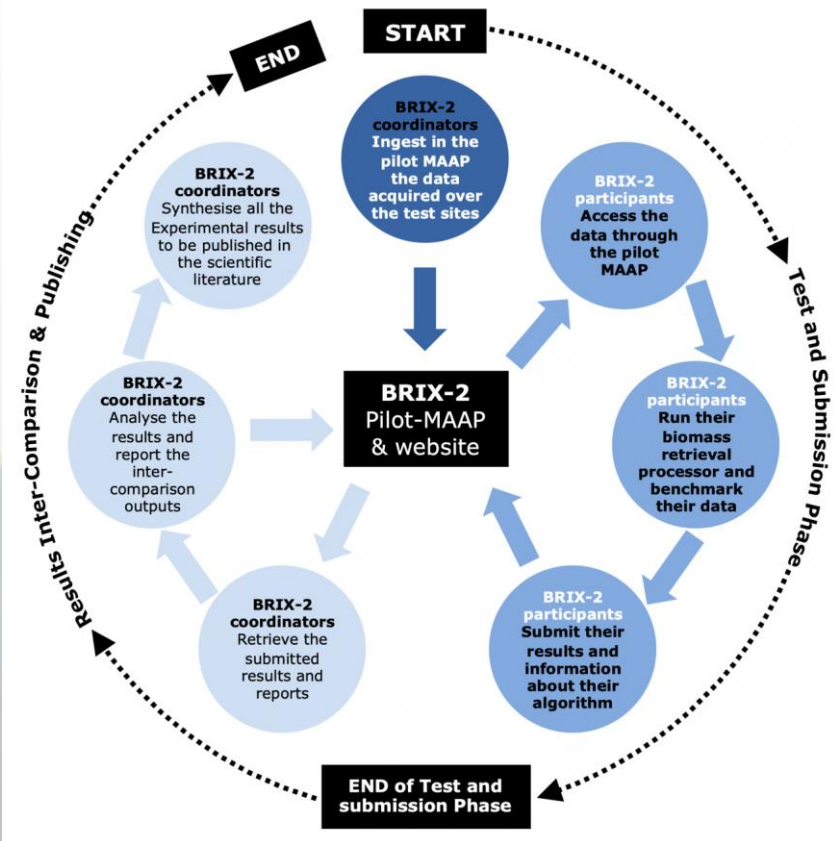
Good Practices Protocols for Land Cover, VIs, Phenology and FAPAR in progress

Global Surface Reflectance Validation Good Practices need to be addressed

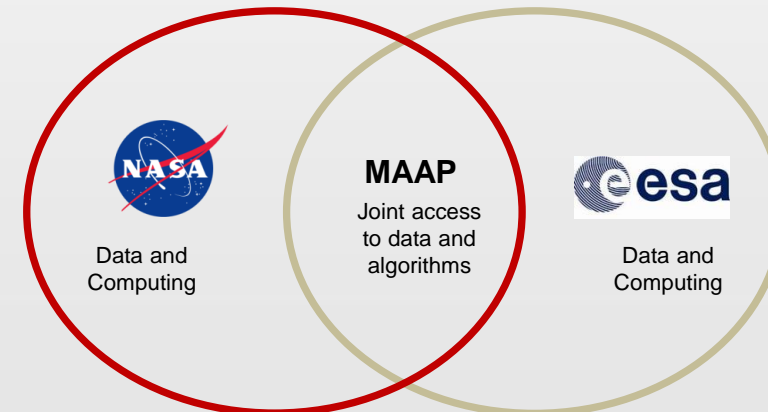


## Promoting Validation and Intercomparison exercises





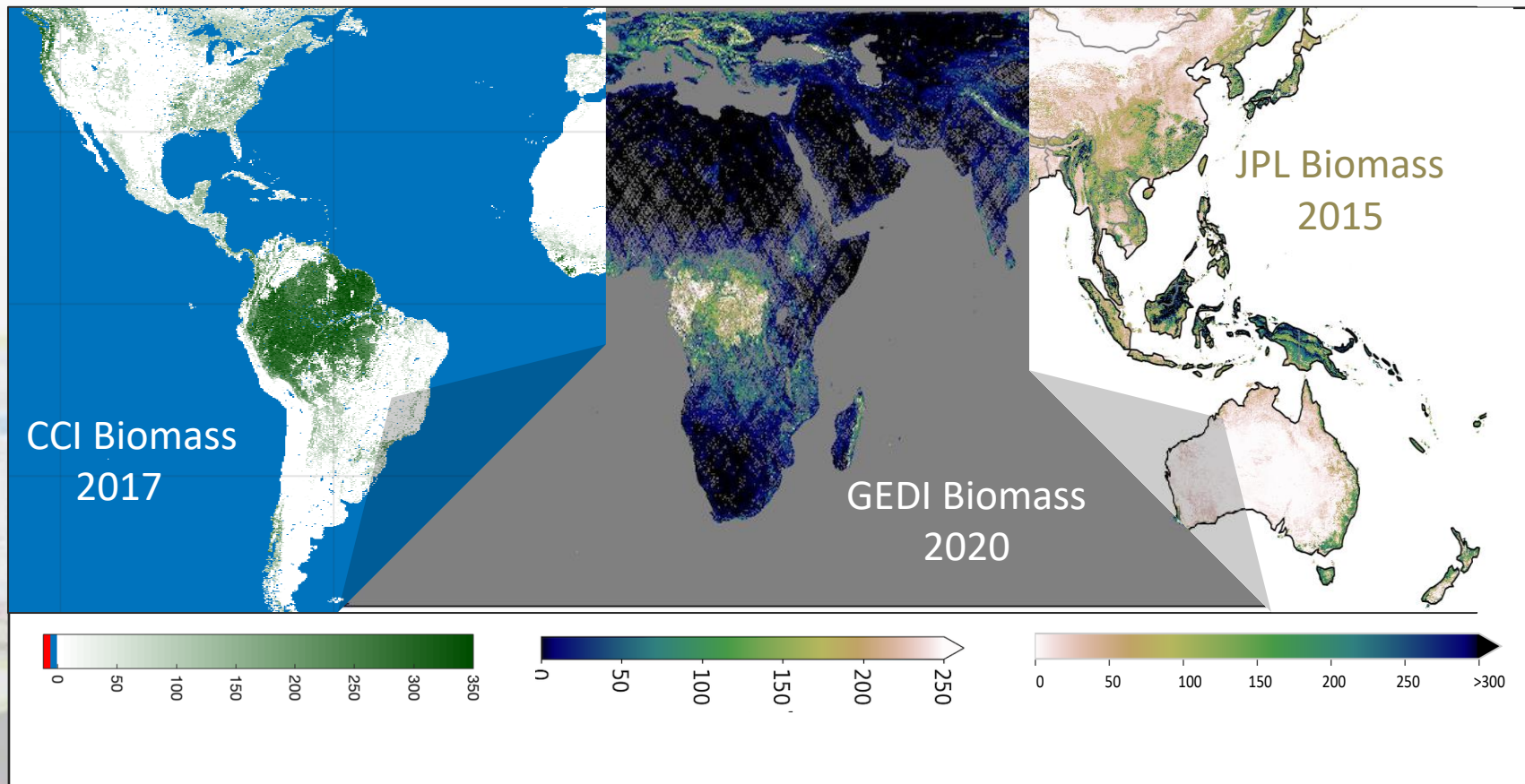
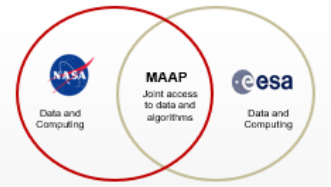
- Launch April 28-29 2021
- **Compares biomass algorithms** over tropical forests in Gabon (AfriSAR sites)
- Uses recommendations from the LPV biomass protocol
- **Focused on lidar and SAR data** (particularly for GEDI, ICESat-2, L-band and P-band SAR)
- Airborne lidar biomass maps and high-quality field plots used as reference data
- All algorithms will be made open





# Biomass Product Harmonization Activity for the UNFCCC GST

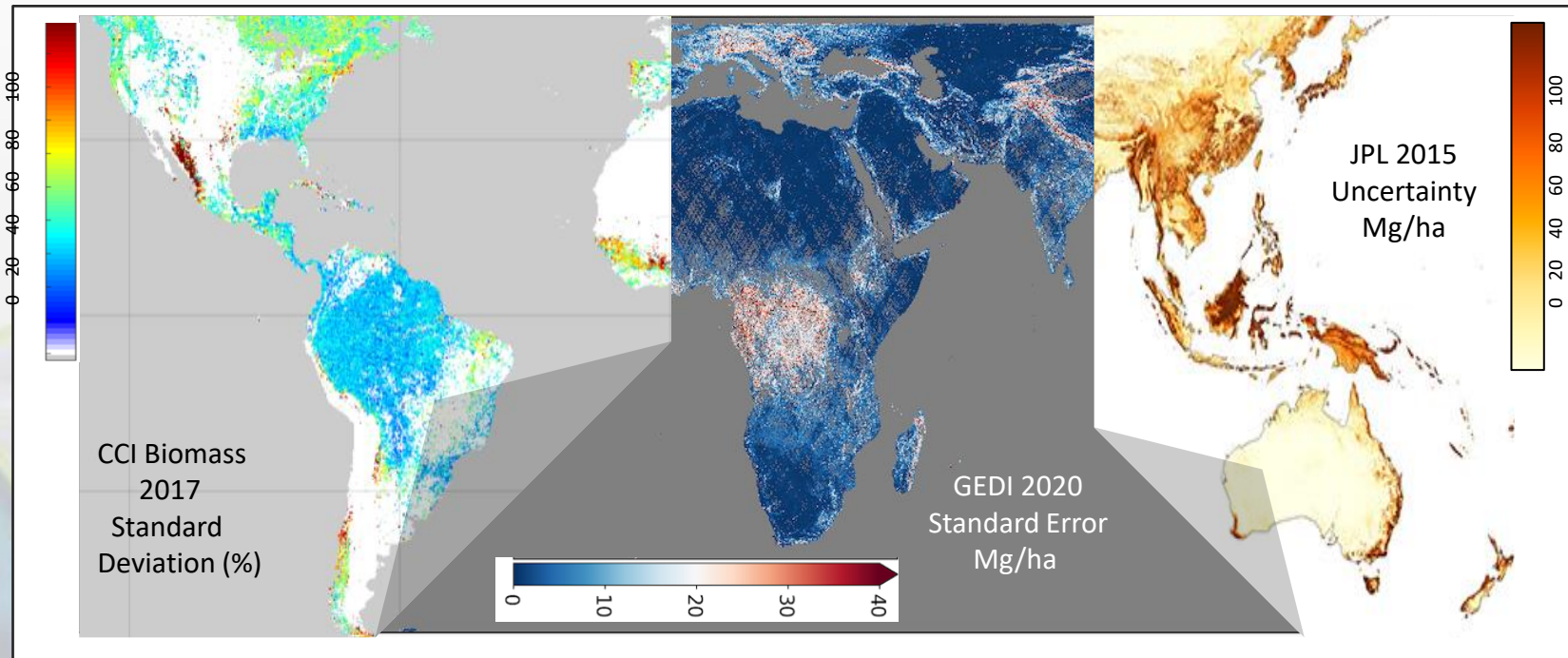
- **Open Science activity** proposed to use ESA-NASA Multi Mission Algorithm and Analysis Platform (MAAP) for inter-comparison and harmonization of biomass products for the UNFCCC GST.
- Organized by CEOS AFOLU



Aboveground Biomass Density (Mg/ha)

# Biomass Product Harmonization Activity for the UNFCCC GST

- Products will be assessed **following the WGCV LPV biomass protocol** using **available reference data** in pilot USGS SilvaCarbon countries
- Uncertainties are calculated differently between products and are scale-dependent. Harmonizing uncertainties will be challenging.



**The first goal is to have a pilot harmonization framework (and product) by COP-26  
(Nov 2021)**

SRIX4Veg represents a joint effort to ensure consensus on surface reflectance validation protocols using drones.

It has been endorsed by CEOS and is conducted in the framework of the ESA FRM4Veg project.



### Objectives:

- Testing user-based differences in surface reflectance UAV-based measurements (including instrument and operator biases as well as measurement collection procedures);
- Helping design field measurement protocols and validation methodology that are clear and can be easily applied by all users;
- Ensuring international buy-in and consensus on the field measurement protocols and global SR validation methodology developed.

<https://frm4veg.org/srix4veg/>

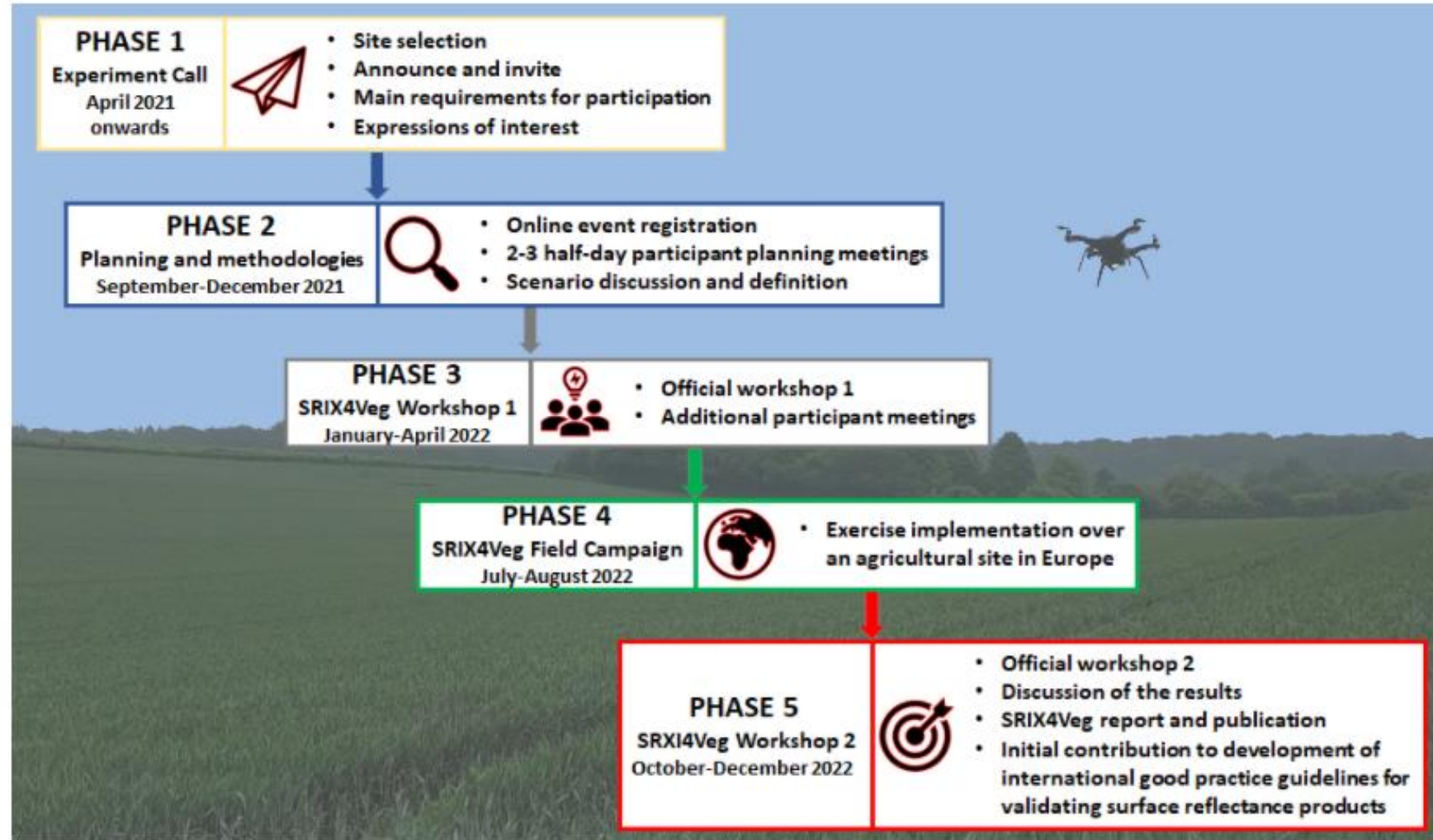


### Requirements for participation:

UAV-mounted hyperspectral imagers capable of measuring 400 – 1000 nm contiguously;  
<= 10 nm spectral resolution.

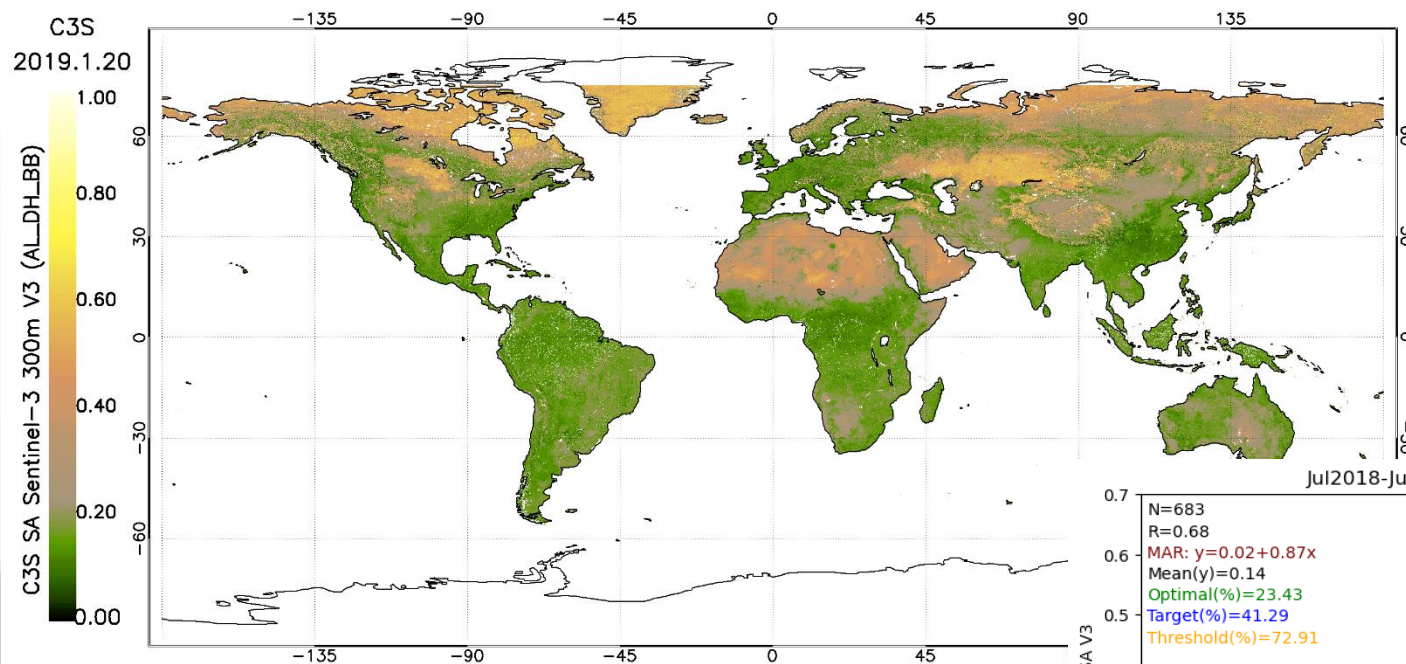
**REGISTRATION  
now OPEN!**

- GFZ ( EnMAP)
- NRC Canada
- EC-JRC
- UValencia (FLEX)
- UMilano (FLEX)
- USGS-EROS
- Finnish Geospatial Research
- Chinese Academy of Science
- HYPERNETS





## C3S Sentinel-3 Albedo

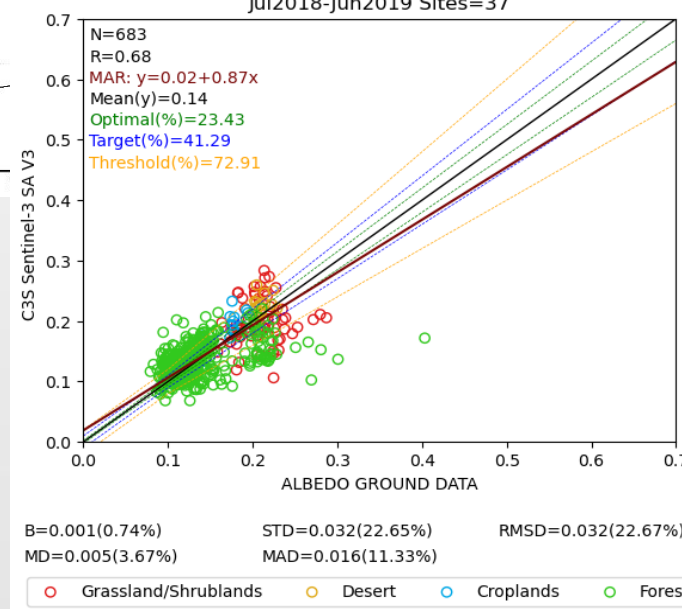


Ground data from CEOS LPV Supersites  
(TERN, NEON, ICOS, BSRN)

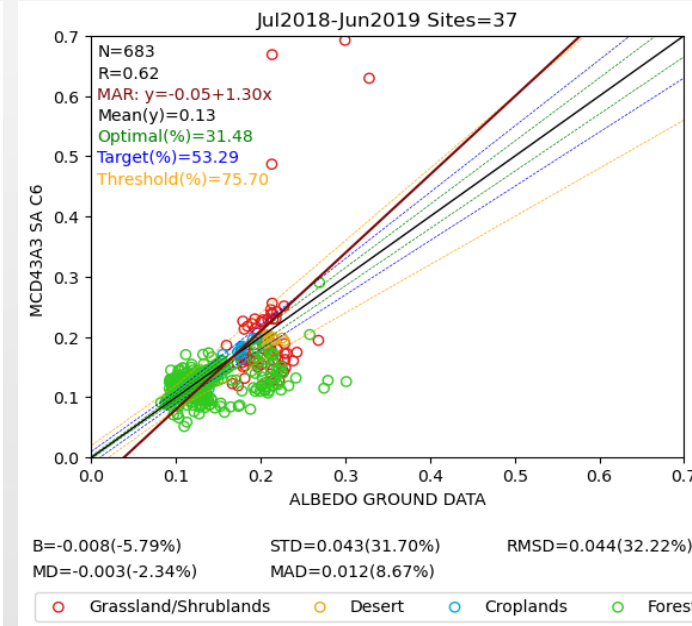
VITO & EOLAB in cooperation with CGLS

Underestimation of S3 snow albedo

Problems in IDPIX (OLCI preprocessing):  
misidentification of snow pixels as cloud

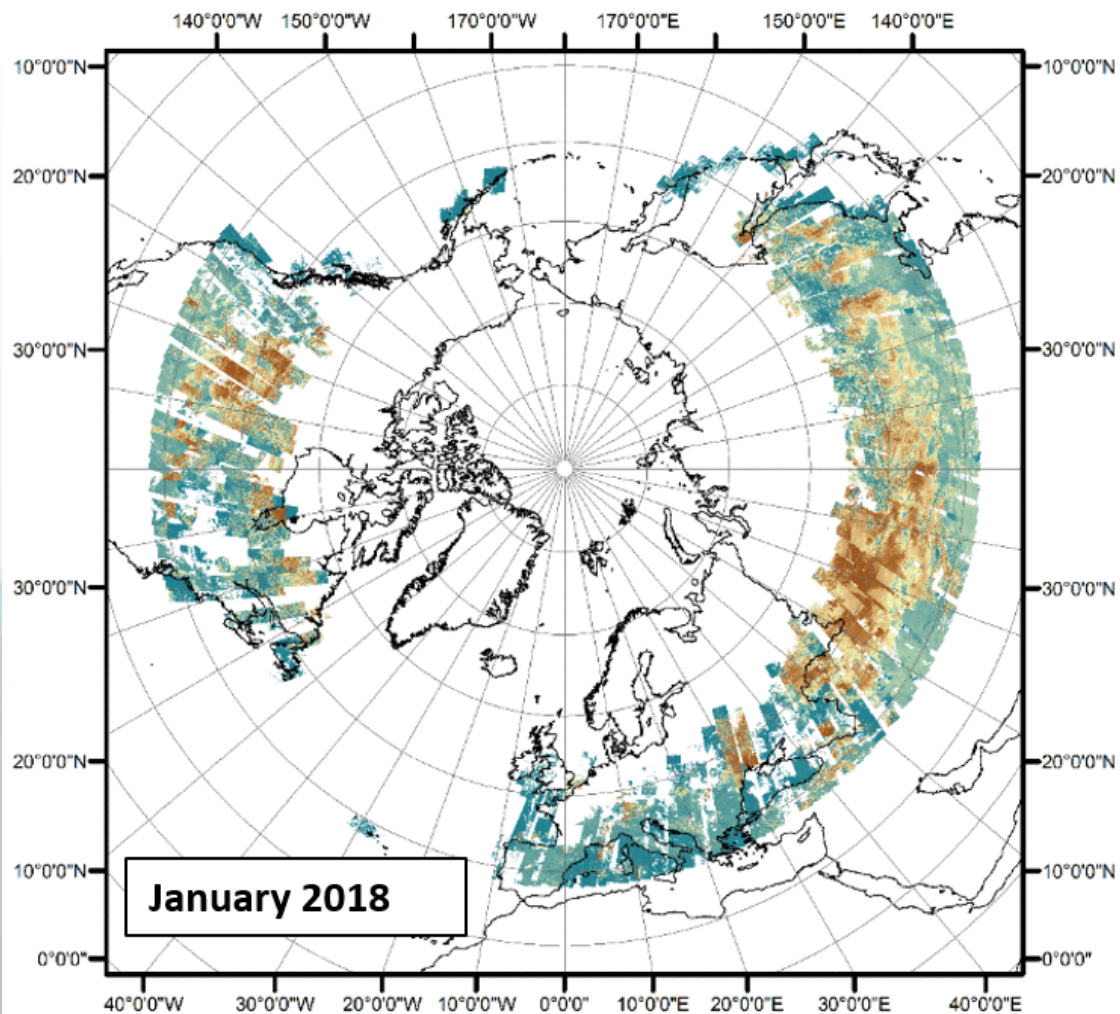


## NASA MCD43A3 SA C6



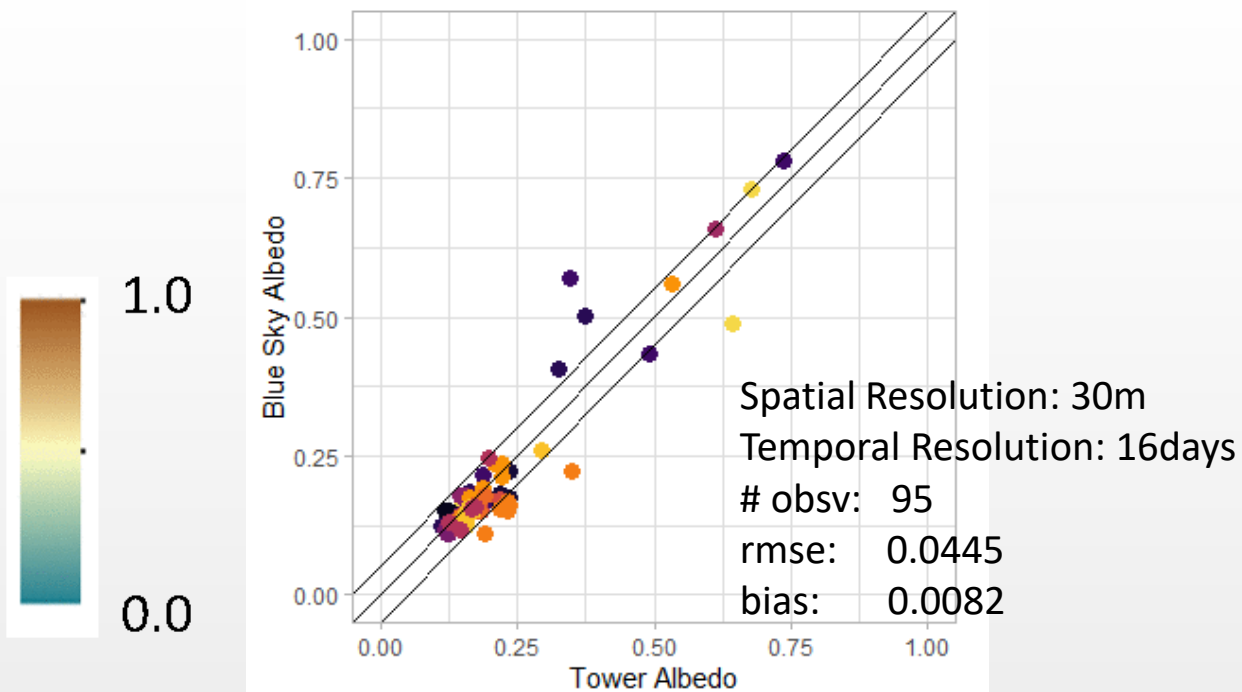


## Landsat Albedo

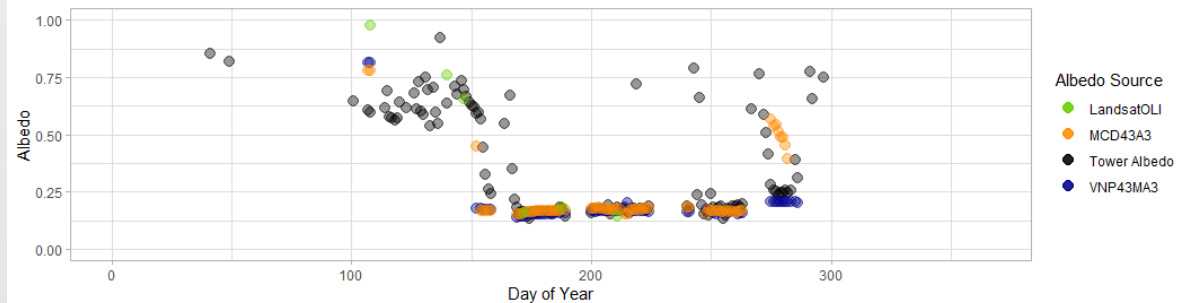


University of Massachusetts Boston

## Landsat OLI Circumpolar Albedo 2018



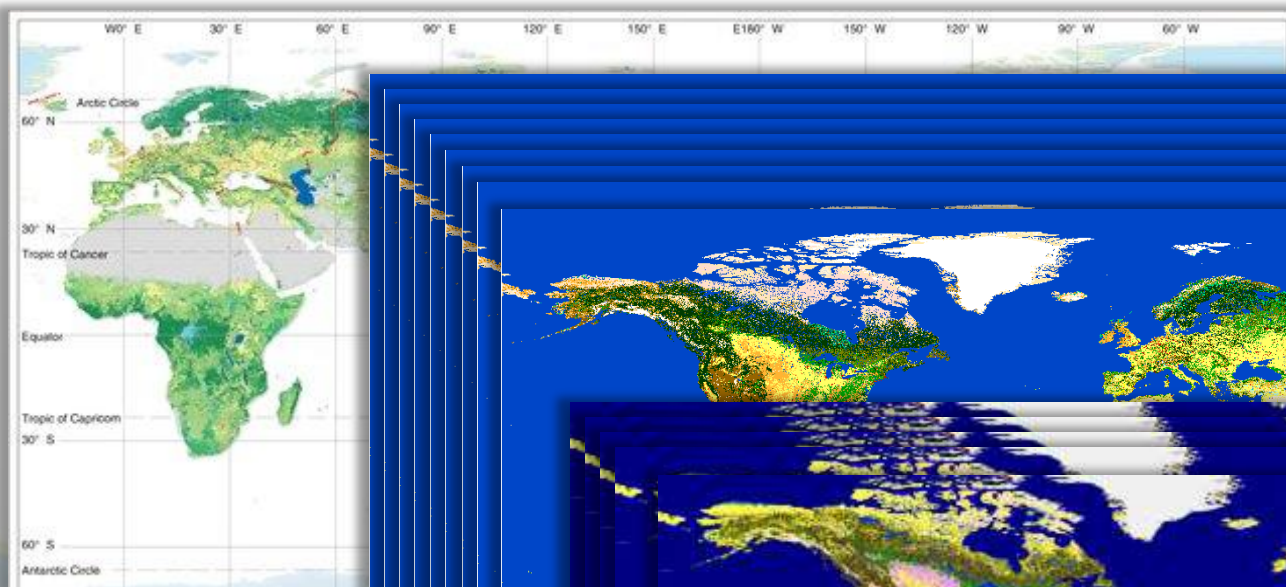
## Toolik Lake NEON Tower



# Validation and Intercomparison Land Cover



[http://www.globallandcover.com/home\\_en.html](http://www.globallandcover.com/home_en.html)



<https://global-surface-water.appspot.com/>



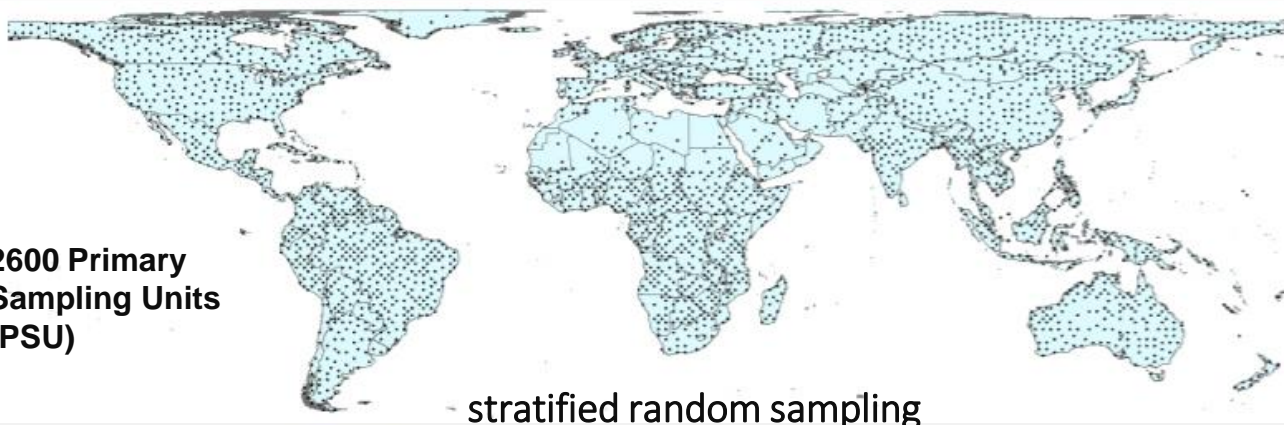
<https://maps.elie.ucl.ac.be/CCI/viewer/>



<https://glad.umd.edu/projects/global-forest-watch>

<https://land.copernicus.eu/global/products/lc>

## ESA CCI (1992-2015) Land Cover



## Moving from Stage 3 to Stage 4

### Statistical validation

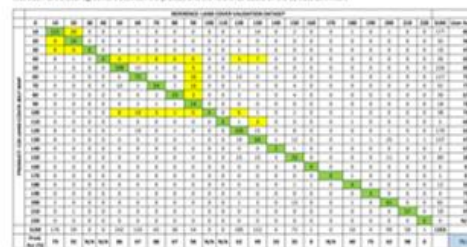
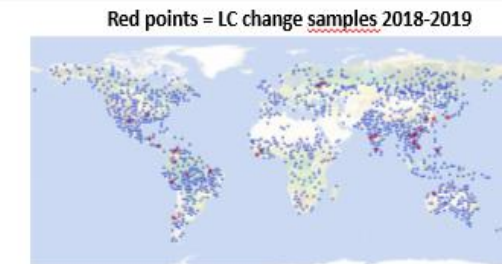
DB updated to reflect annual changes

2016-2017 (0,3% of the SSU)

2017-2018 (1,1% of the SSU)

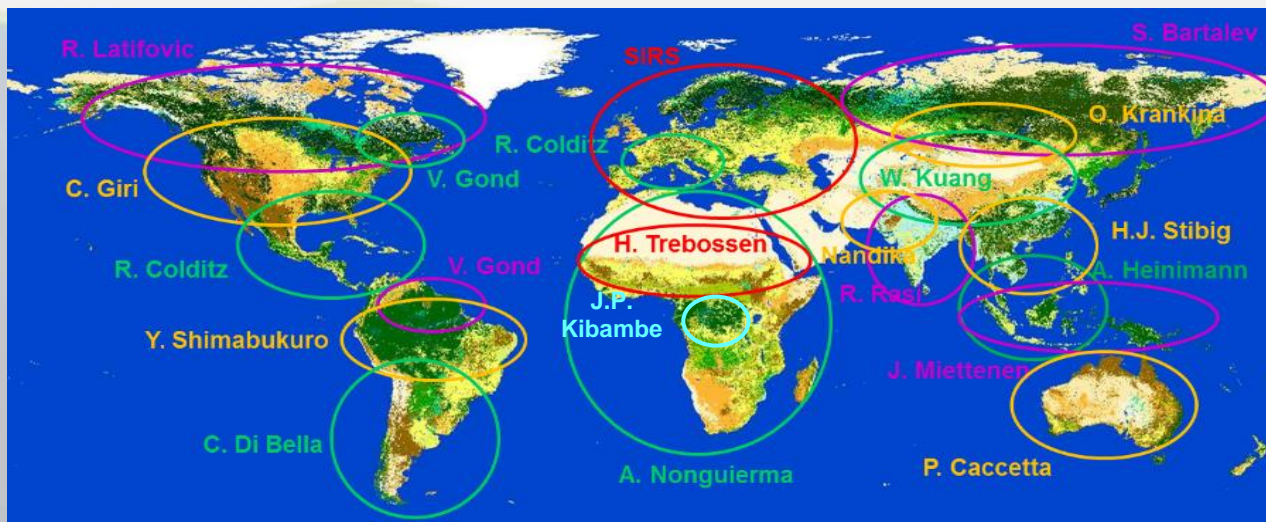
2018-2019 (1,2% of the SSU)

Table 9: Adjusted confusion matrix that considers the 2019 LC map and the "carbon" and "homogeneous 50" samples of the validation unit (i.e. made of a single LC class covering at least 80% of the area of the validation unit). Green cells mark diagonal cells, while yellow cells represent other samples that also mark a clear agreement between the product and the reference based on the LC class definition.

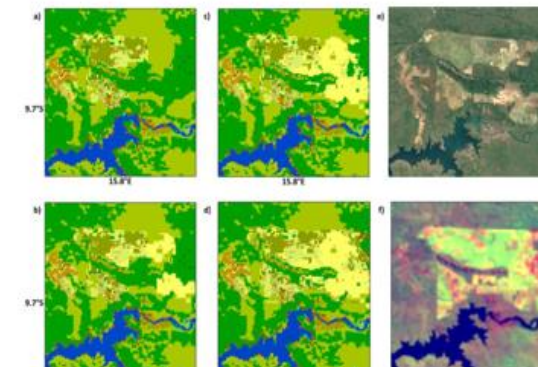
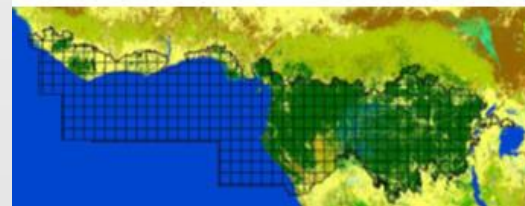



### 22 LC Classes

2016 – OA = 71.1%    2018 – OA = 70.8%  
2017 – OA = 71.1%    2019 – OA = 70.6%



-> Too many LC classes for LC change  
-> Complemented through systematic confidence-building procedure and IC







# Validation and Intercomparison LST

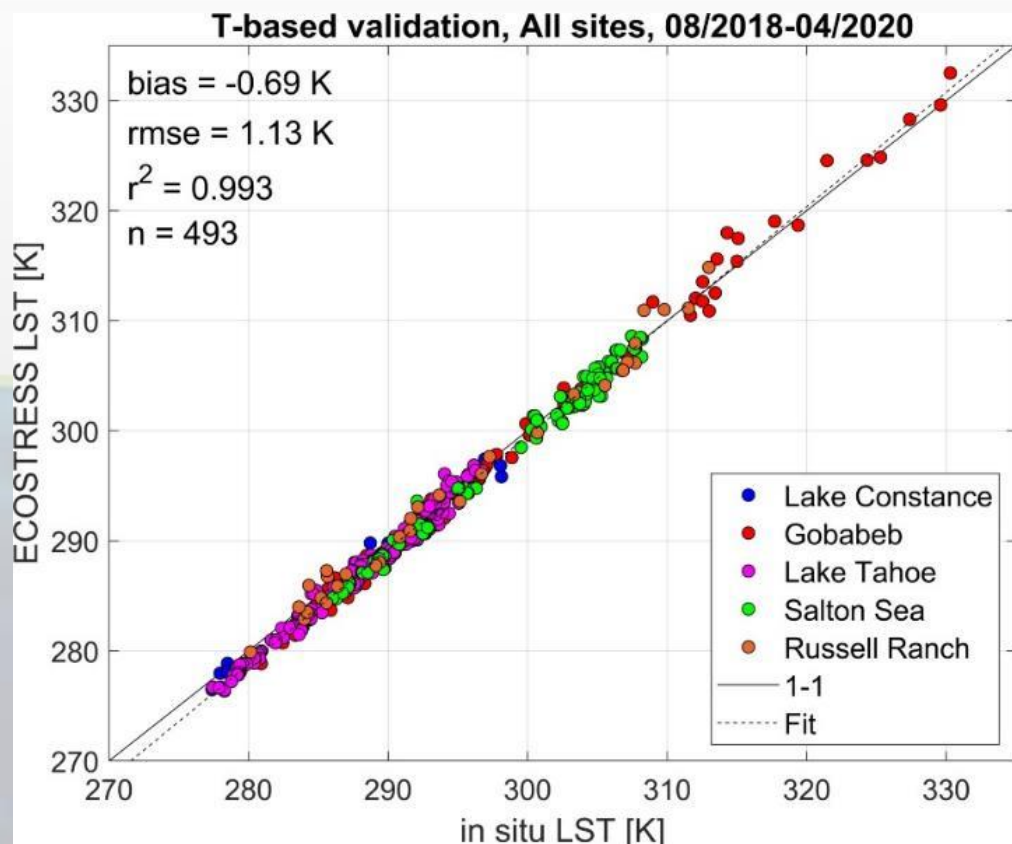


## ECOSTRESS

Stage-1 validation of Level-2 LST&E products completed.

LST accuracy: 1.07 K

Emissivity accuracy: 2.14%



## Landsat 9 validation planned activities

Tonzi Ranch, CA



Russell Ranch, CA



SPECIFICATIONS				
Item	Parameter	Value	Units	Comments
1	Spectral Range	2 - 16	micrometers	Standard IR
2	Spectral Resolution (FWHH)	4	wavenumbers	Standard, 1 sec. scan
3	Size (WxDxH)	36x20x23	centimeters	(14"x8"x9")
4	Weight	< 7	kilograms	(< 15 pounds)



### Summer 21

- conduct a validation 'round-robin' at JPL
- Additional field campaigns (Lake Tahoe, Railroad valley, Tonzi ranch, Russell Ranch)
- Define protocol for Landsat9 validation



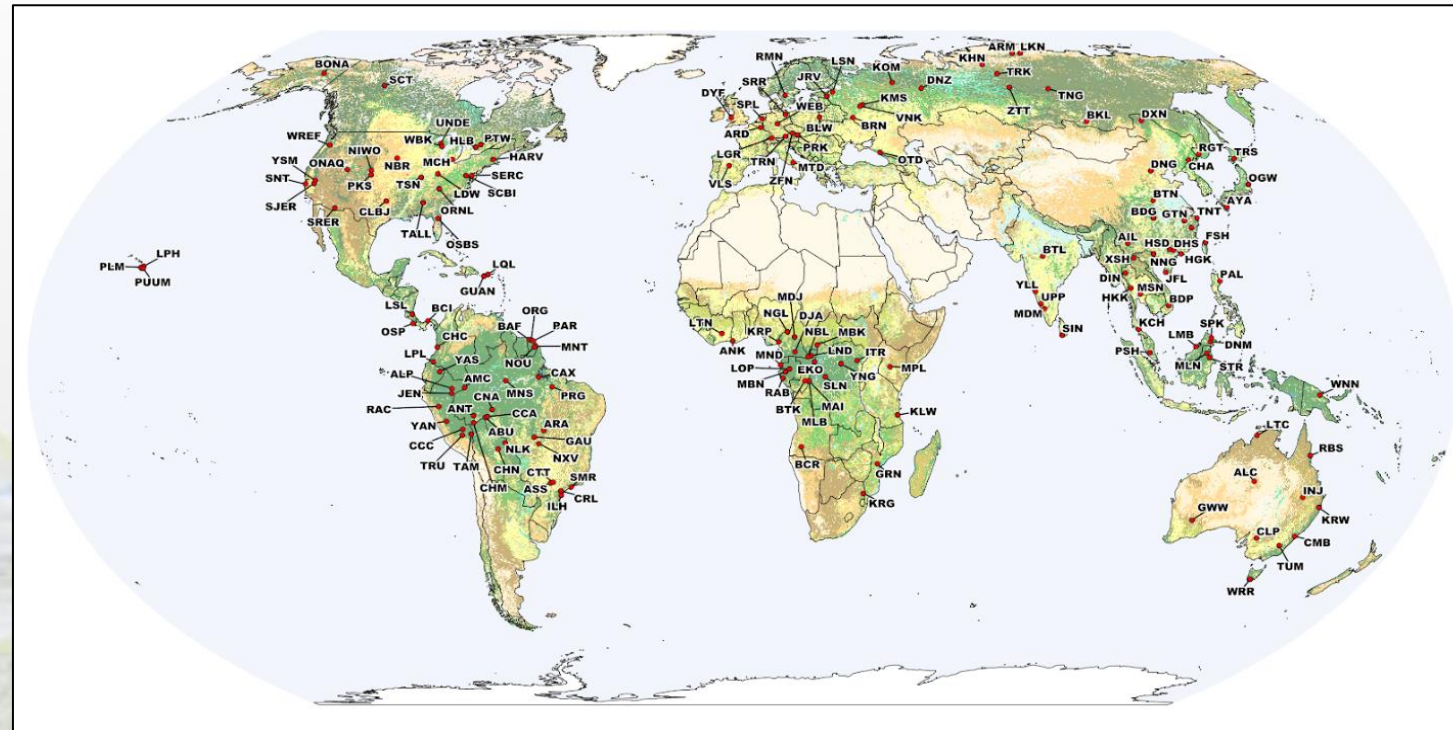
## Ground Reference Data





**Forest Biomass Reference System for Tree-by-Tree Inventory Data (GEO-TREES).  
Supporting coordinated collection of new high-quality reference measurements for  
validation of biomass products.**

- WGCV LPV
- LSI-VC Forests
- CEOS GFOI Lead
- SIT Chair



We encourage CEOS agencies to coordinate on data collection for biomass validation following recommendations from the biomass protocol (open high-quality field, TLS, and airborne lidar).



Validation for Land S3 Products

Home News Overview LAW Database LAW LST sites Validation Results Data Access

**IMPORTANT NOTE:** Due to the COVID-19 pandemic, the deployment of the LAW LST stations have been suspended. We are monitoring the situation in terms of travel restrictions and site accessibility. The installation of selected sites will be performed as soon as possible (April – May 2021 TBC)

For further details, please refer to the following gaps analysis report: [\[link\]](#)

KIT forest (Germany)

Dahra (Senegal)

Svartberget (Sweden)

Hyytiälä (Finland)

Robson Creek (Australia)

### KIT forest (Germany)

Located at 49,09°N; 8,43°E

This site is on the premises of Karlsruhe Institute of Technology (KIT) about 10 km north of the city of Karlsruhe, Germany. Several meteorological instrumentations are already installed measuring Wind speed, Wind direction, Air temperature.

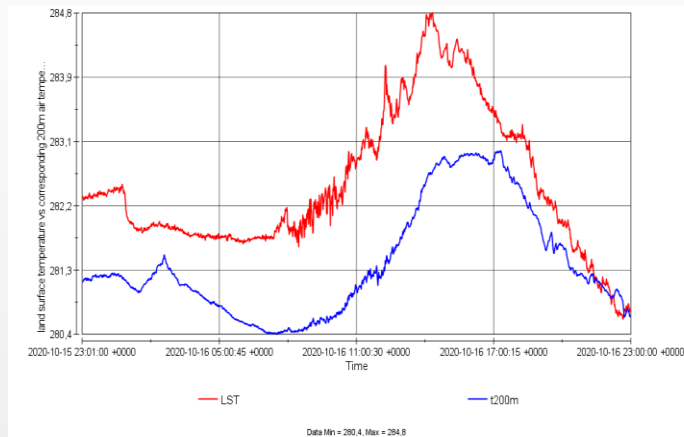
This is classified as biome 6 (closed broadleaved deciduous forest) in the ALB2 classification



200 m tower at Karlsruhe Institute of Technology (KIT)



View from the tower in South direction



Raw data logger files (csv)  
converted to netCDF  
(ESA GlobTemperature)

<https://law.acri-st.fr/sites>



- 42 sites enlisted, all land surface ECVs
- National standards (protocols) enacted
- Measurement initiated
- PI: Xingfa Gu <[guxingfa@radi.ac.cn](mailto:guxingfa@radi.ac.cn)>

Existing Gaps in Africa Asia and South America for in-situ data





**13 Actions were closed; ACTIONS in progress**

## **Good Practices Protocols**

4 : VIs, Land Cover, Phenology, LAI/FAPAR

## **Validation and Intercomparison**

4: BRIX-2, SRIX4Veg, Biomass Harmonization, Albedo

## **Ground References**

5: LPV Supersites, GEO-TREE, Links with ICOS and GAOFEN

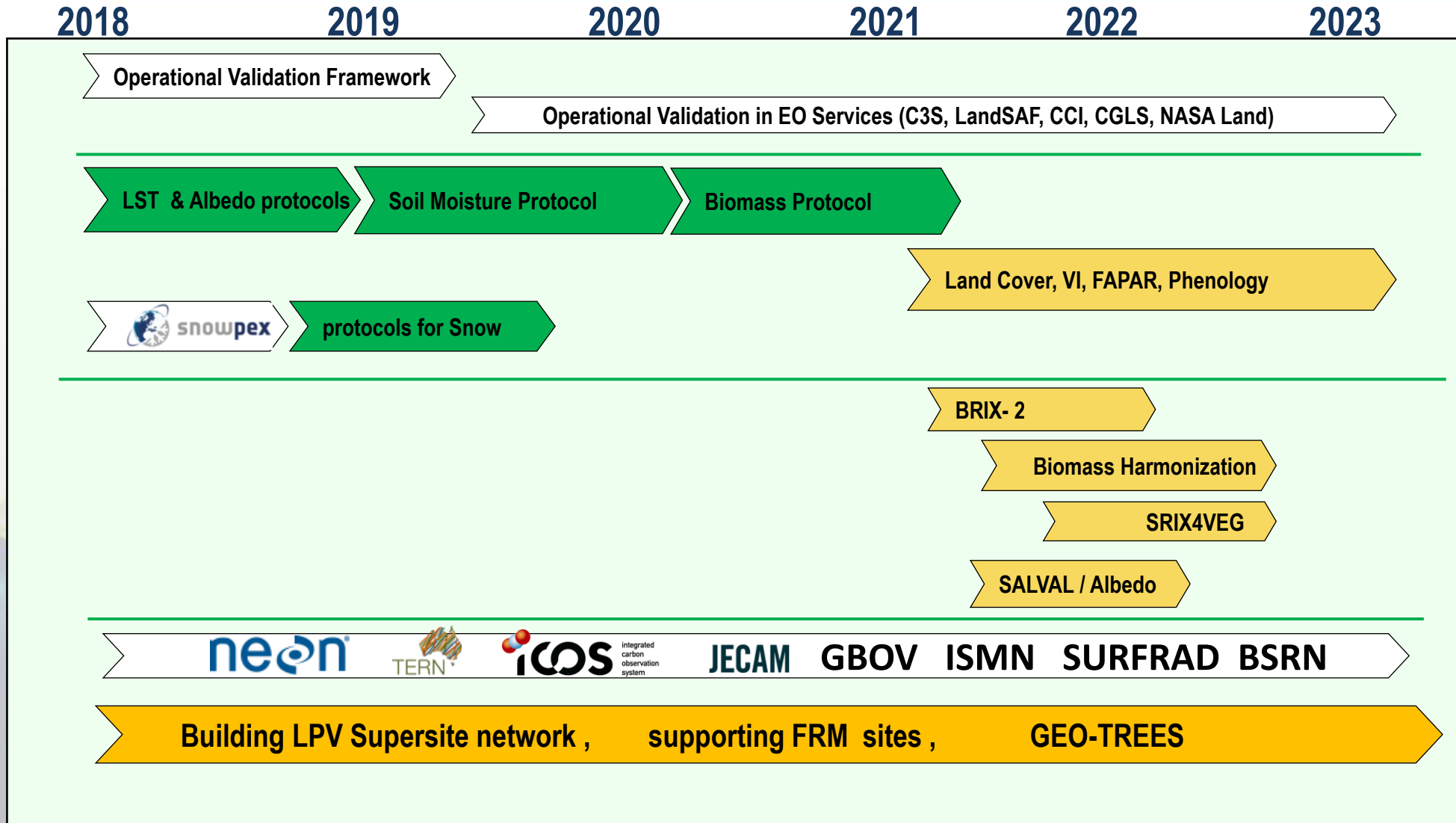
## **Tools**

2: SALVAL, support ESA in LAI/FAPAR data sharing platform

## **Communication**

LPV Land Cover IGARSS session, LPV VI workshop

# CEOS LPV 5-year roadmap





**Thank you for your attention**



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