Committee on Earth Observation Satellites

**Working Group on Calibration and Validation**
**Land Product Validation subgroup**

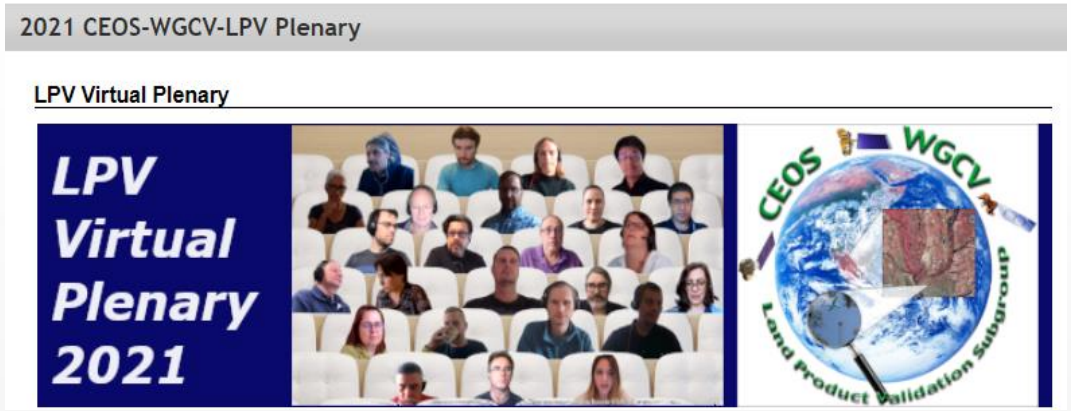
# CEOS WGCV LPV subgroup report

Fernando Camacho (EOLAB), Chair

Michael Cosh (USDA), Vice-chair

CEOS WGCV-49 Meeting, Virtual – 29/06/2021

# Meeting Objectives




**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.

# Agenda

**Presentations at https://lpvs.gsfc.nasa.gov/LPV_Meetings/LPV_plenary2021.html**

| 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 1st 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 Gascoin (CESBIO) |
| | | |
| 18:00-18:30 | Wrap-up discussion | |
| 18:30 | End of the meeting | |

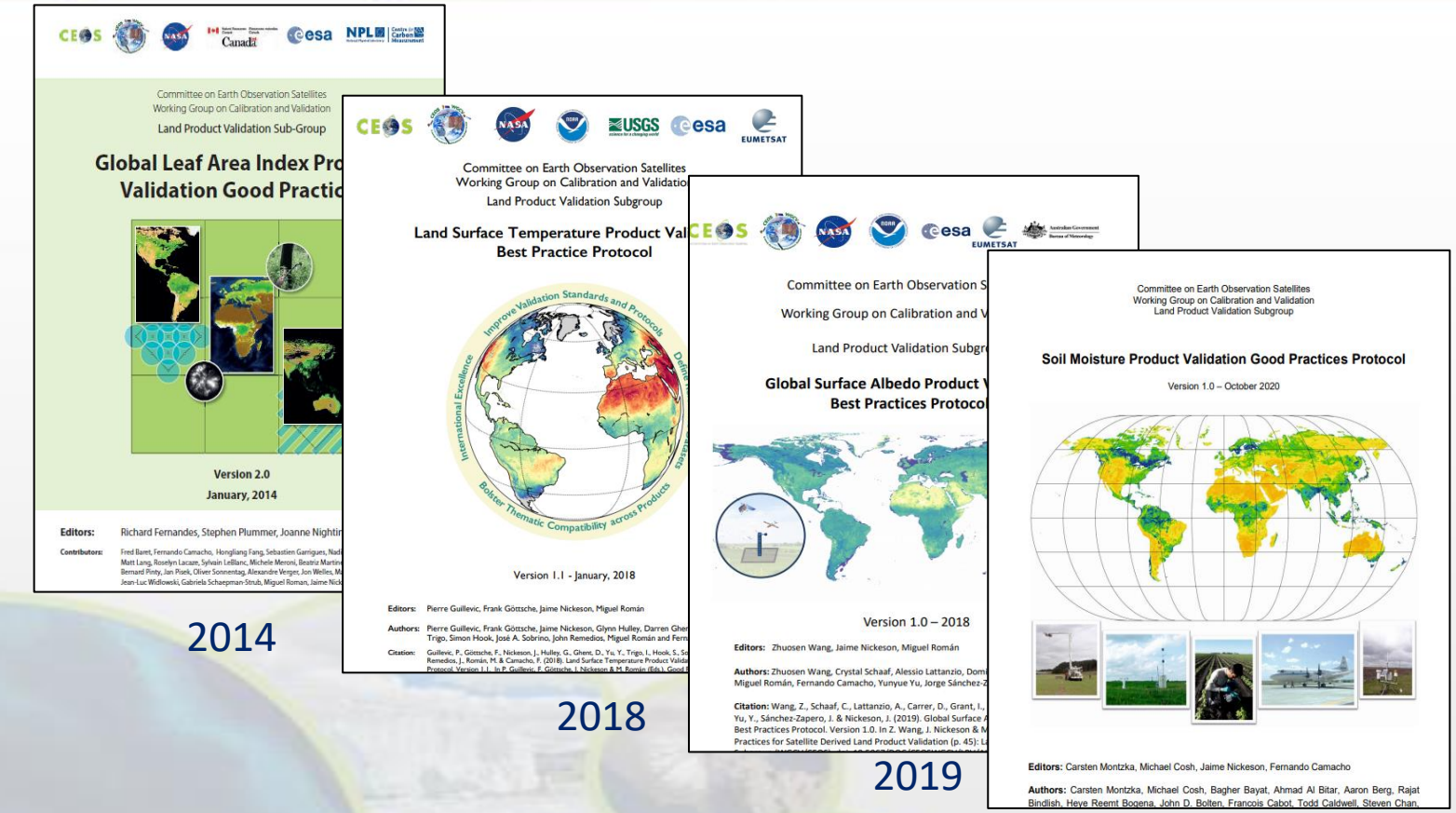
# LPV Strategy

**LPV Strategy (2019-2022) agreed in Milan 2019 :** https://lpvs.gsfc.nasa.gov/LPV_Meetings/LPV_plenary2019.html


- 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

# Validation Good Practices Protocols

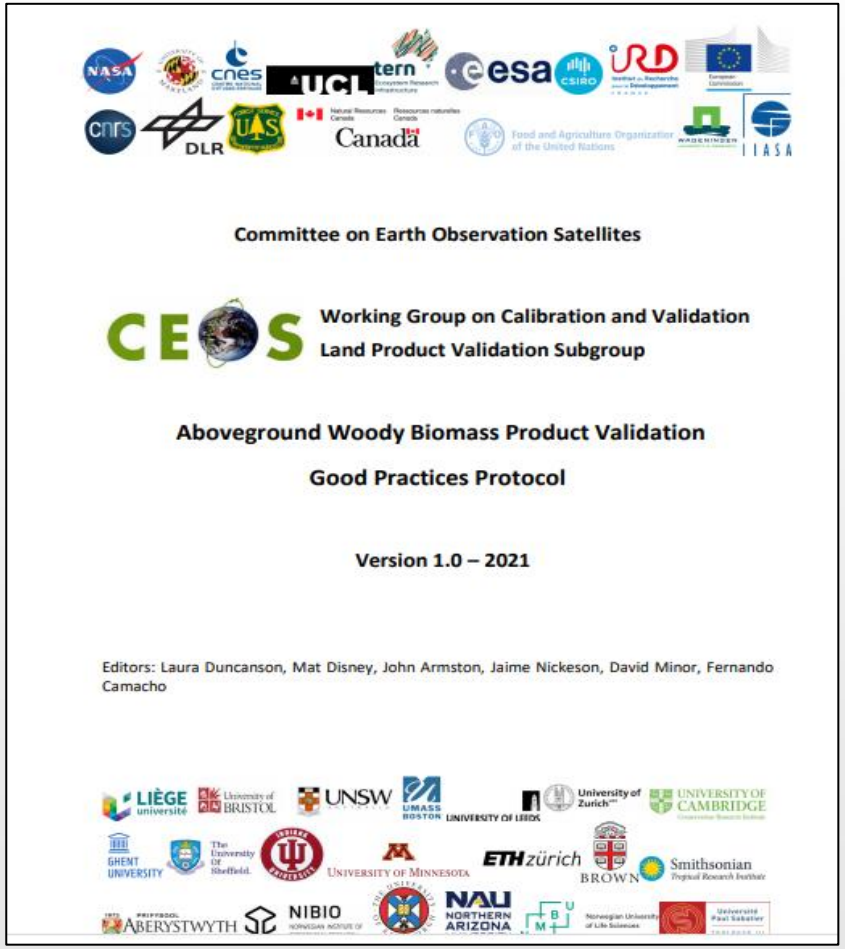



2014

2018

2019

2020



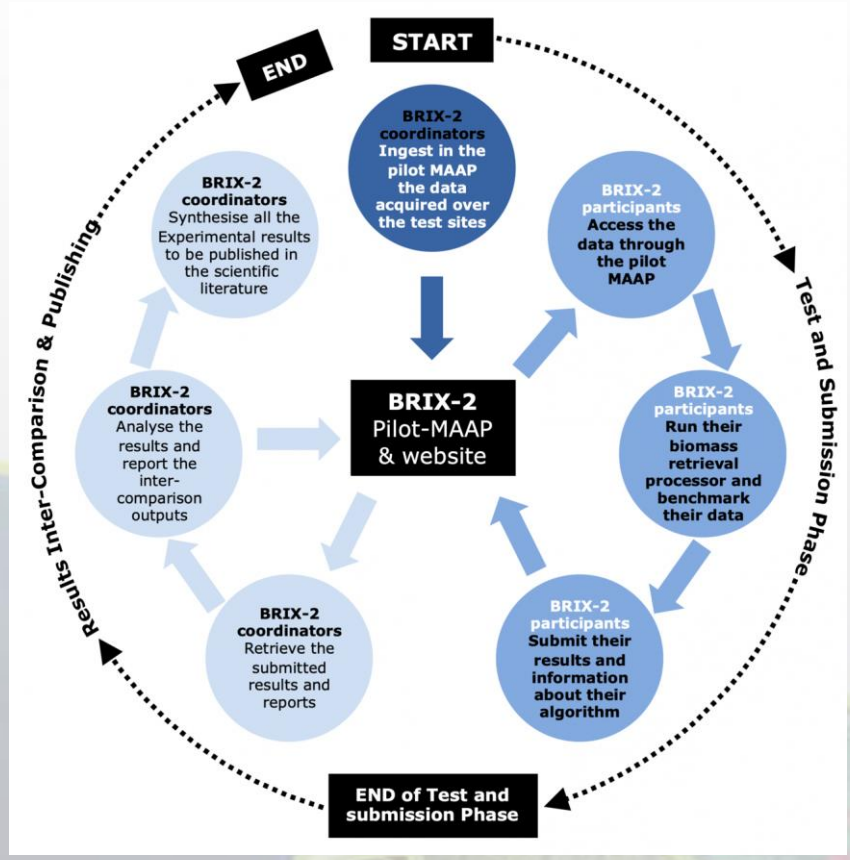

2021

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

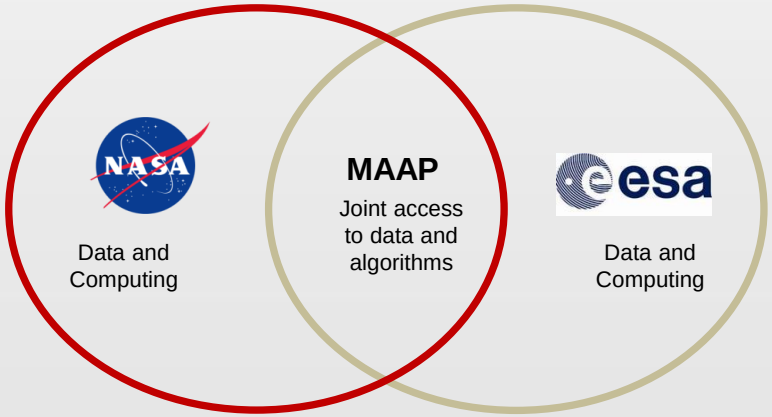
**Global Surface Reflectance Validation Good Practices need to be addressed**

# Promoting Validation and Intercomparison exercises

# BRIX-2 Activity (CEOS CV- 20-02)

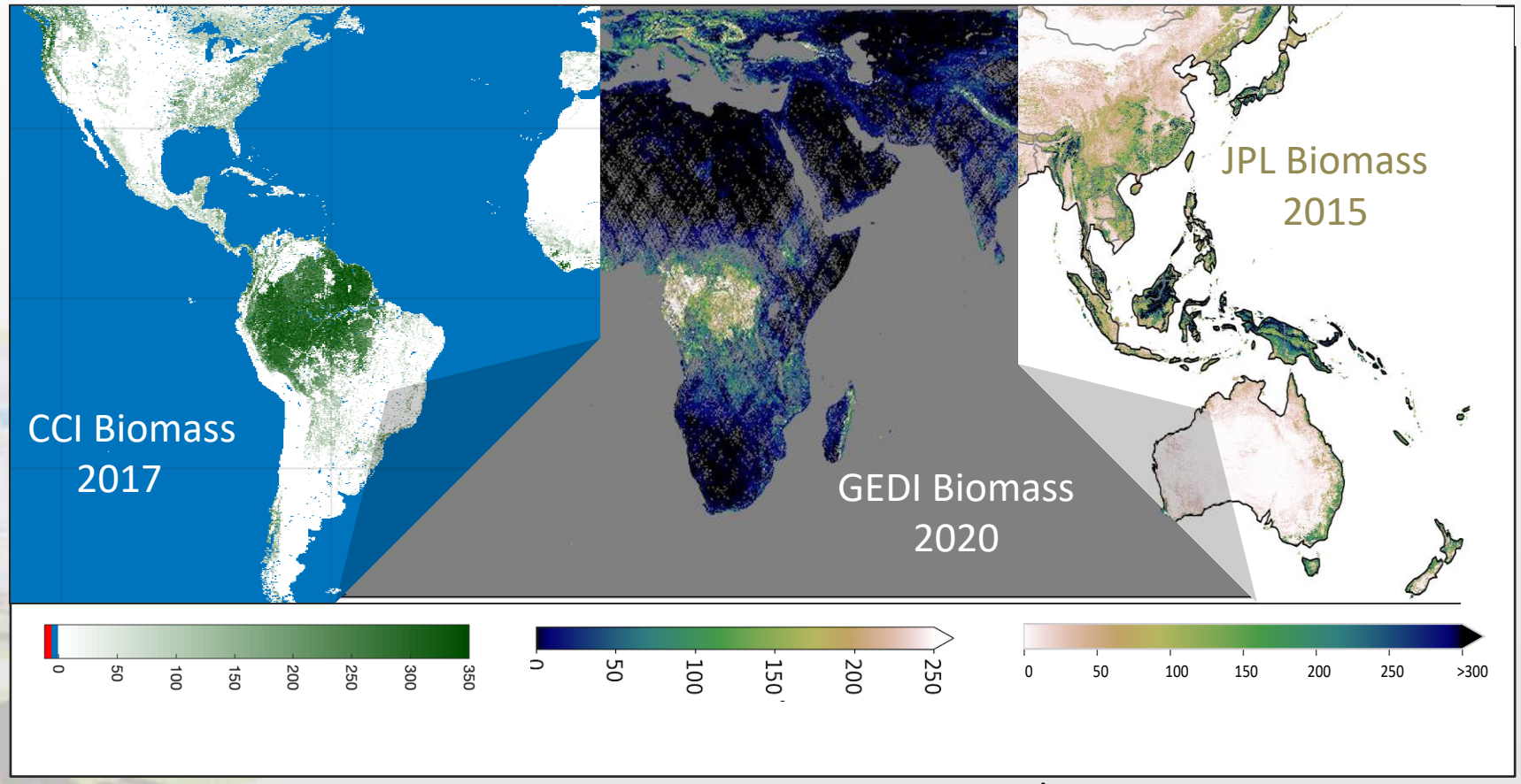



- Launch April 28-29 2021
- **Compares biomass algorithms** over tropical forests in Gabon (AfriSAR sites)
- Uses recommendations from the LPV biomass protocol
- **Focused on lidar and SAR data** (particularly for GEDI, ICESat-2, L-band and P-band SAR)
- Airborne lidar biomass maps and high-quality field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



# Biomass Product Harmonization Activity for the UNFCCC GST

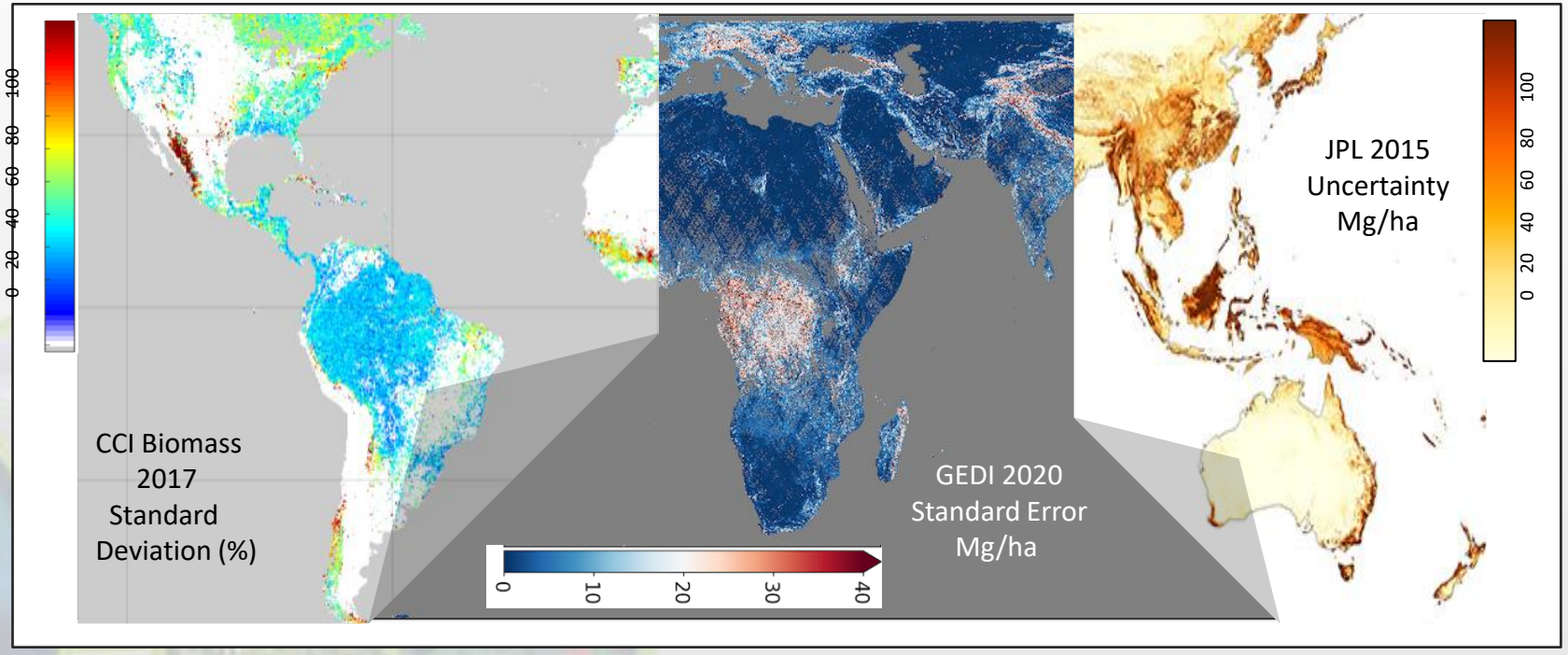
- **Open Science activity** proposed to use ESA-NASA Multi Mission Algorithm and Analysis Platform (MAAP) for inter-comparison and harmonization of biomass products for the UNFCCC GST.
- Organized by CEOS AFOLU




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 (CEOS CV-20-01)

## Surface Reflectance Intercomparison for Vegetation

**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/

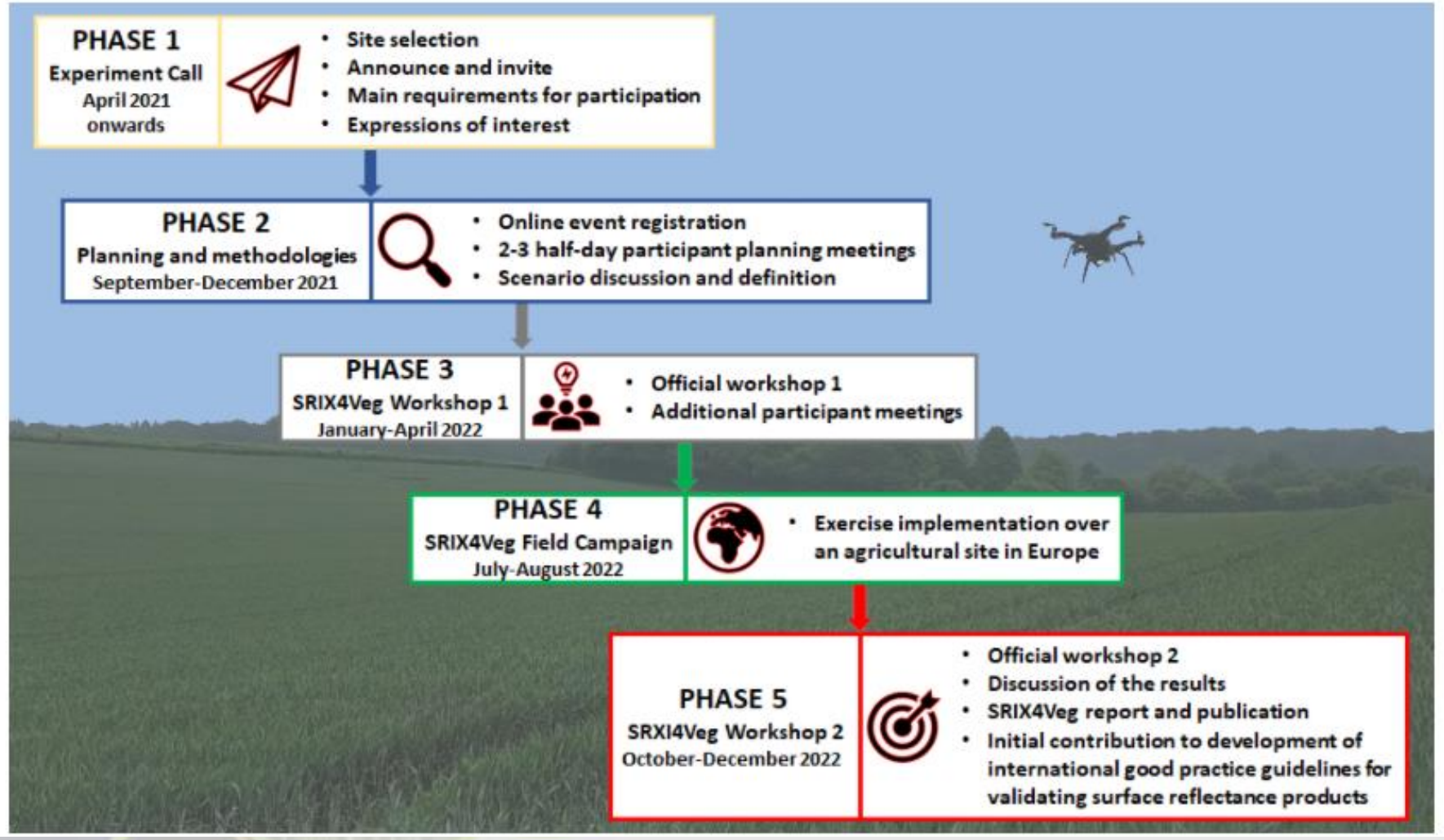
**Requirements for participation:**
UAV-mounted hyperspectral imagers capable of measuring 400 – 1000 nm contiguously;
<= 10 nm spectral resolution.

**REGISTRATION now OPEN!**

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

# SRIX4Veg (CEOS CV-20-01)

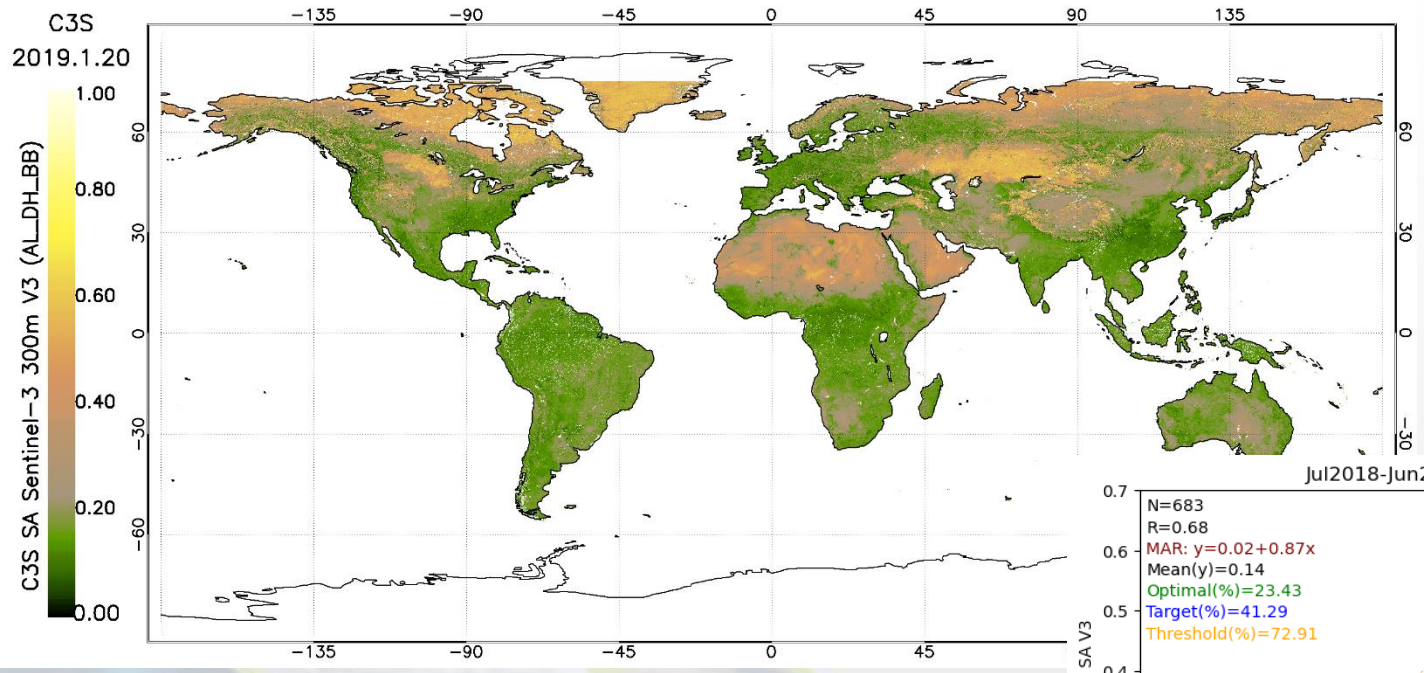
## Surface Reflectance Intercomparison for Vegetation



# Validation and Intercomparison

# Surface Albedo

## C3S Sentinel-3 Albedo



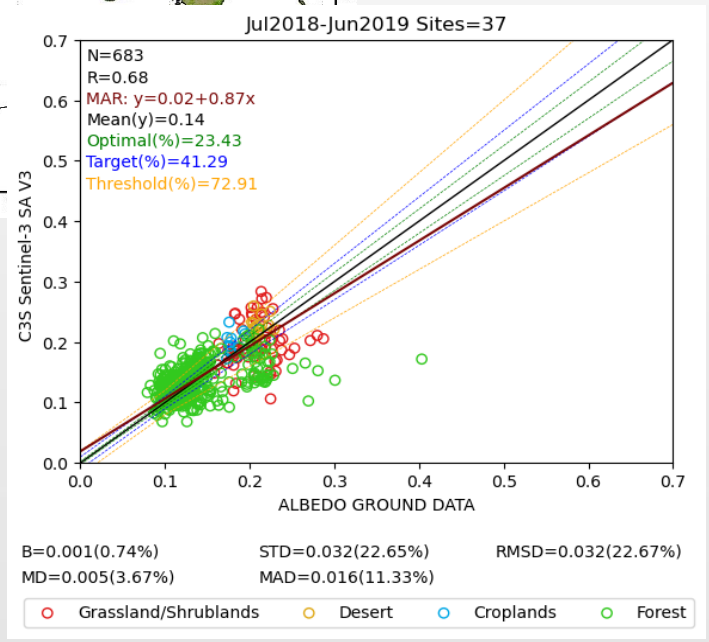

Ground data from CEOS LPV Supersites (TERN, NEON, ICOS, BSRN)

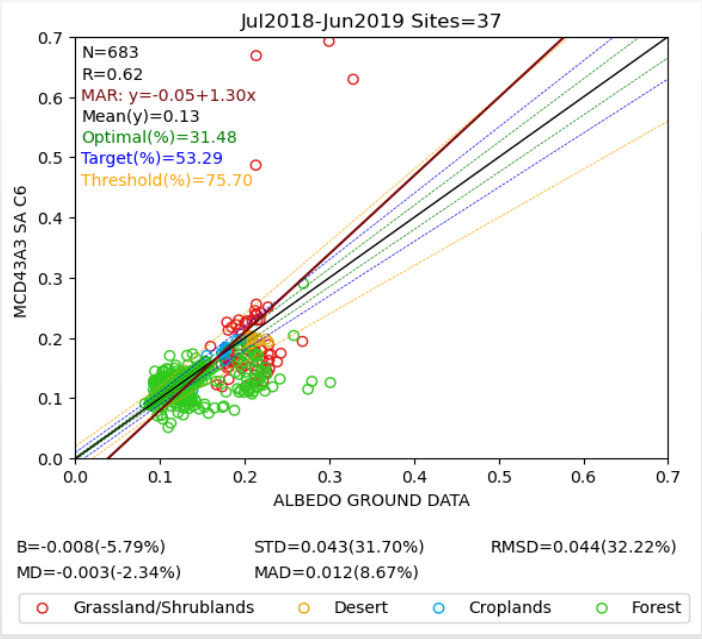
VITO & EOLAB in cooperation with CGLS

Understimation of S3 snow albedo

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

## NASA MCD43A3 SA C6

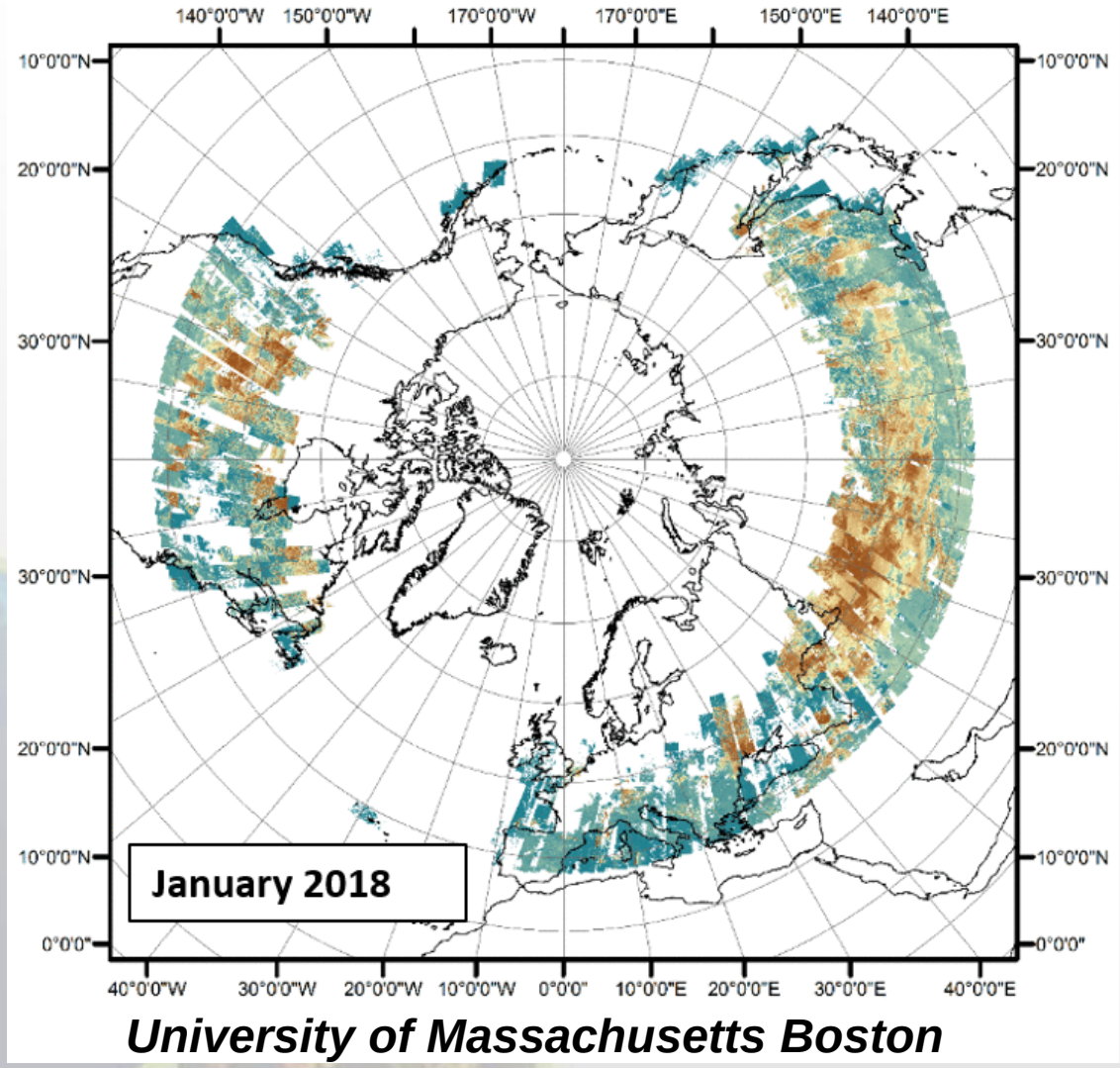


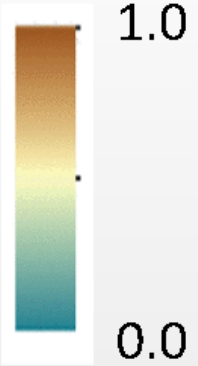



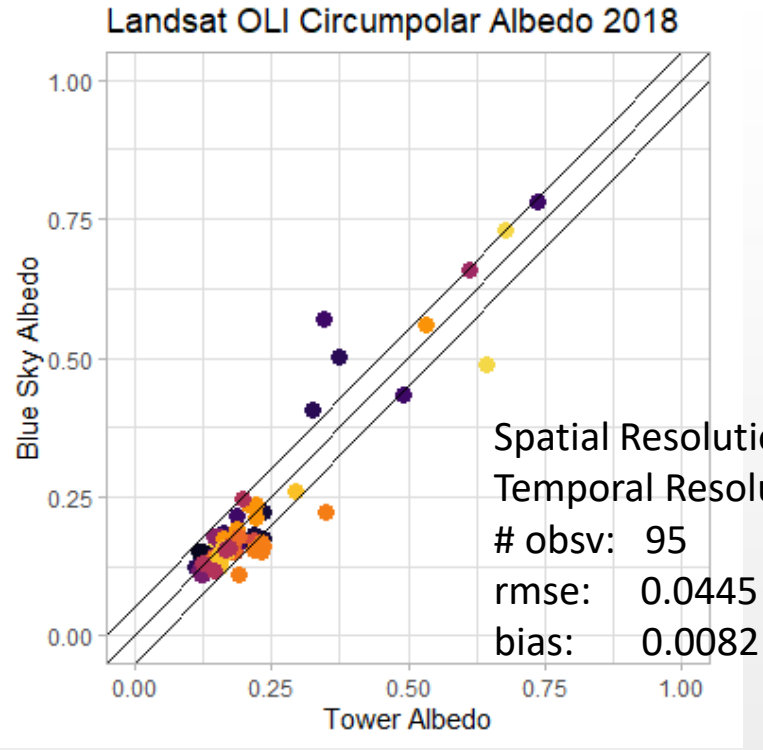
# Validation and Intercomparison

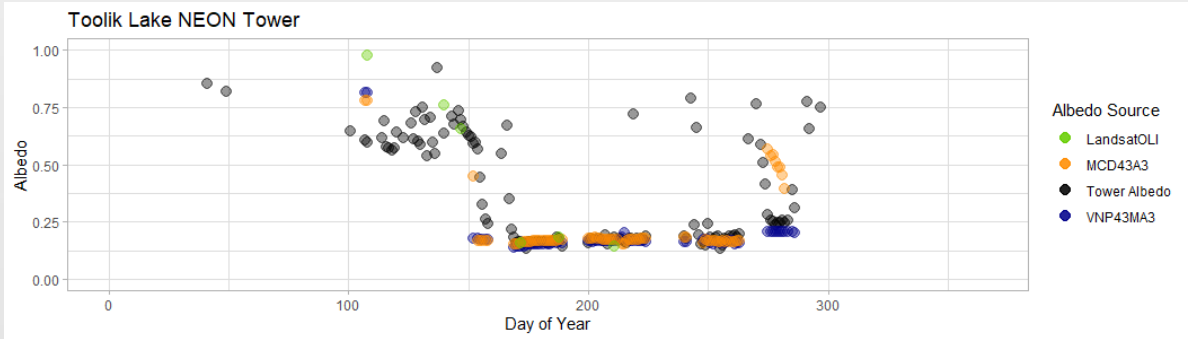
## Surface Albedo

### Landsat Albedo



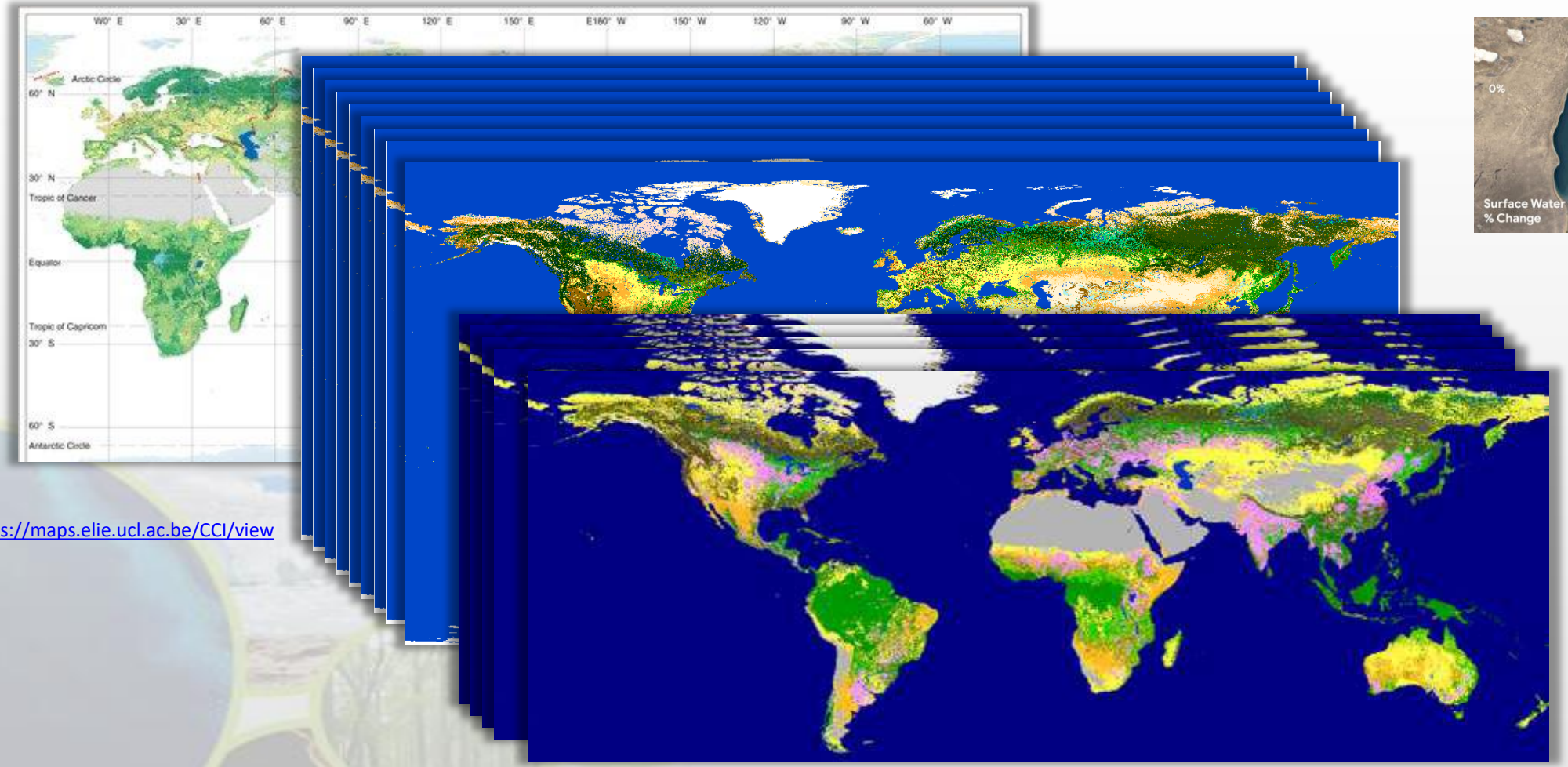

*University of Massachusetts Boston*

# Validation and Intercomparison

# Land Cover

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

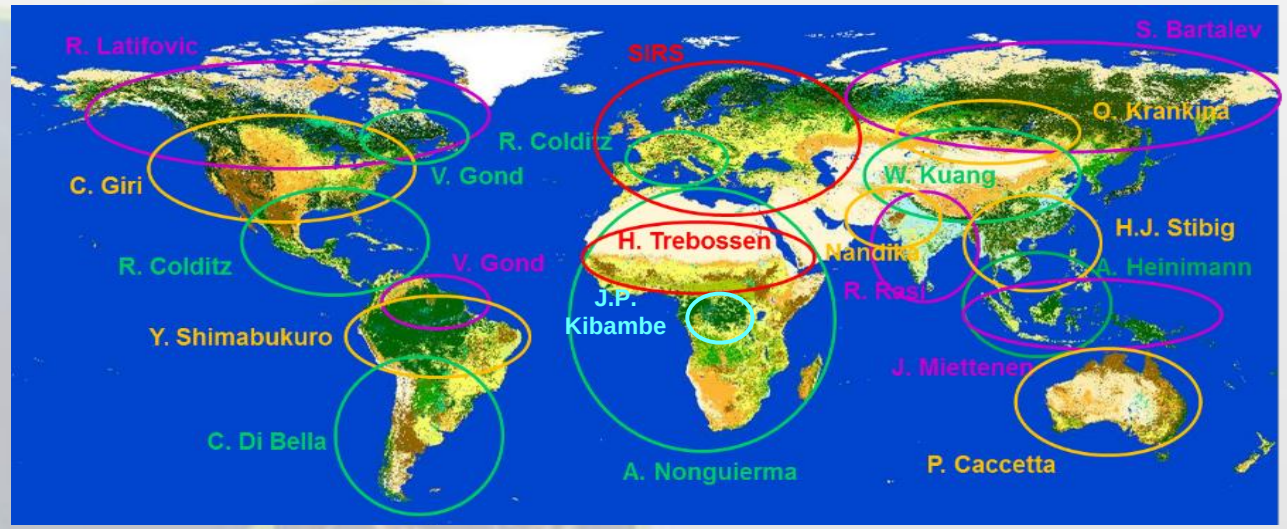
# Validation and Intercomparison

## Land Cover

# ESA CCI (1992-2015) Land Cover

**2600 Primary Sampling Units (PSU)**

stratified random sampling

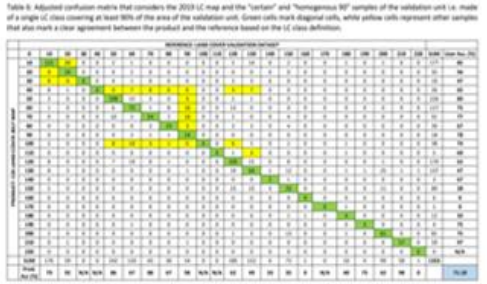



# Moving from Stage 3 to Stage 4

## 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)



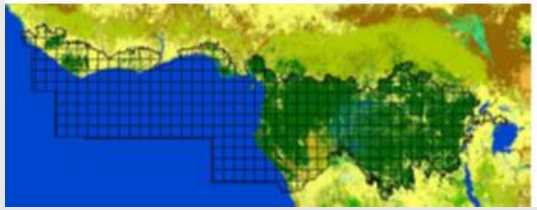
Red points = LC change samples 2018-2019

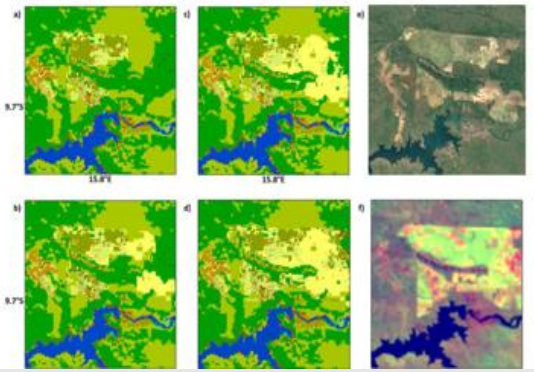
**22 LC Classes**

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

-> Two many LC classes for LC change

-> Complemented through systematic confidence-building procedure and IC





# Validation and Intercomparison

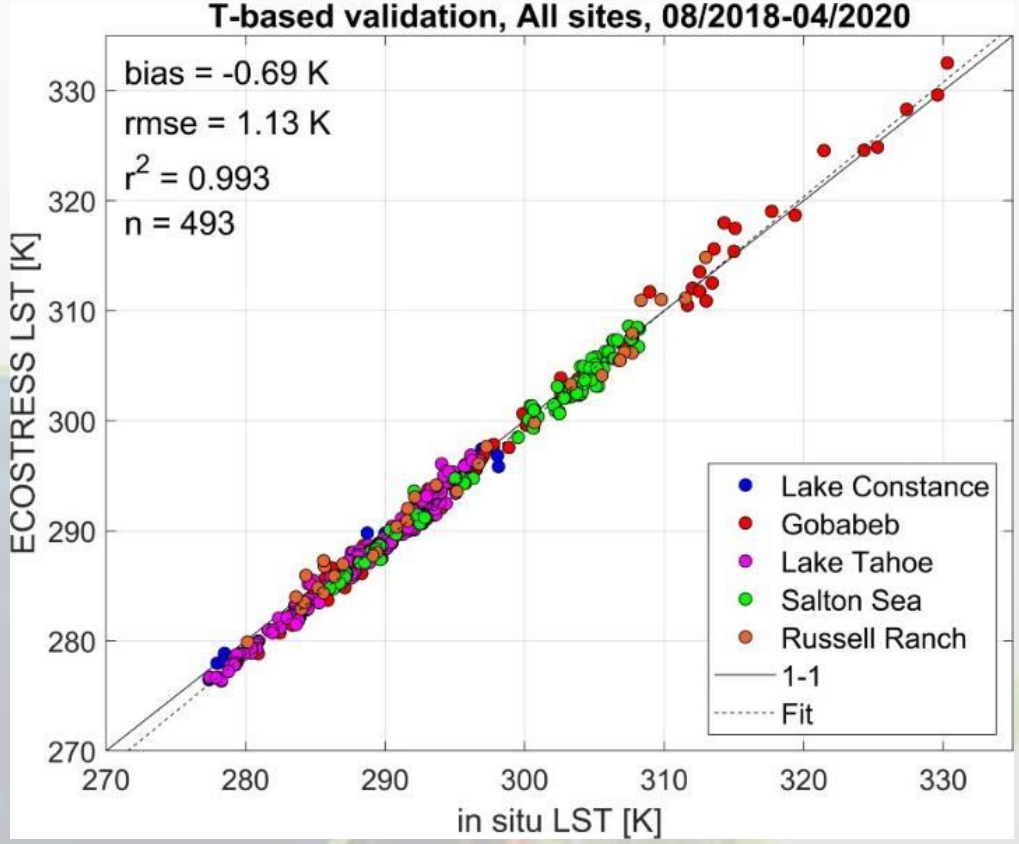
# LST

## ECOSTRESS

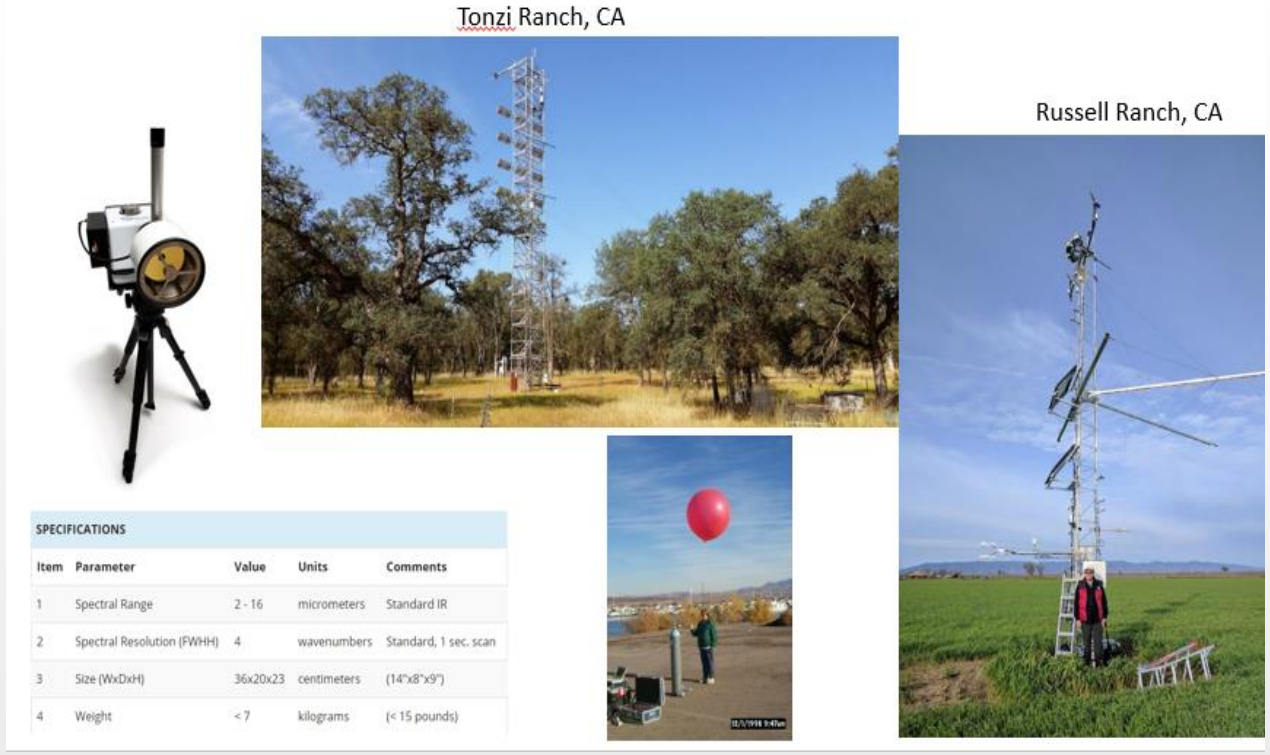
Stage-1 validation of Level-2 LST&E products completed.

LST accuracy: 1.07 K

Emissivity accuracy: 2.14%




## Landsat 9 validation planned activities



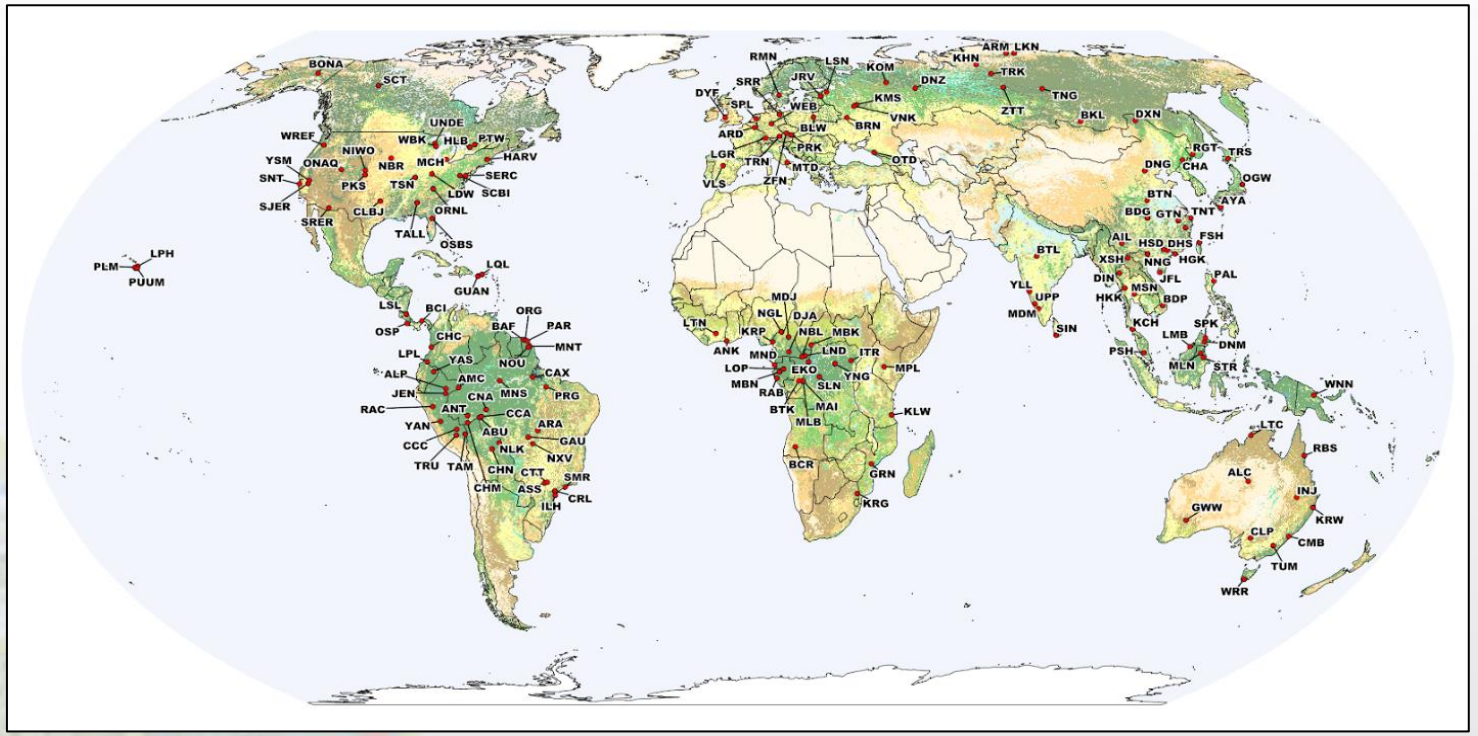

Summer 21

- 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

# GEO-TREES (CARB-21-03)

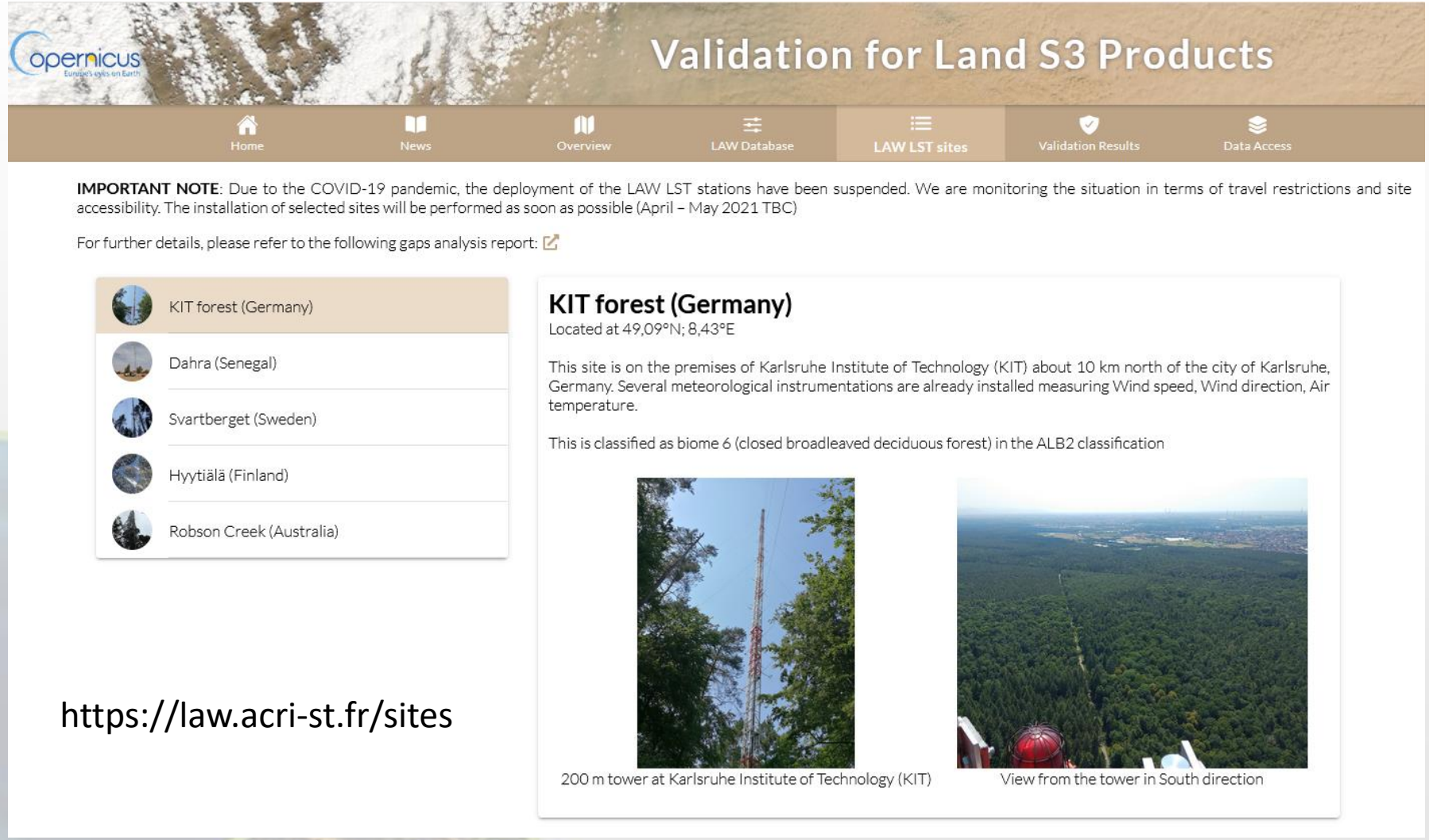
## Forest Biomass Reference System for Tree-by-Tree Inventory Data (GEO-TREES). Supporting coordinated collection of new high-quality reference measurements for validation of biomass products.



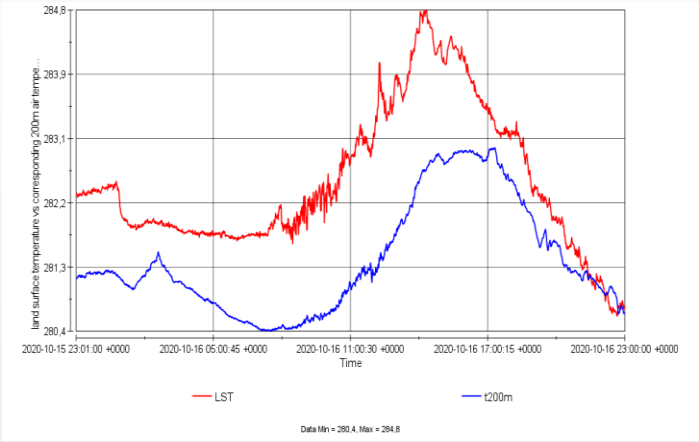

- WGCV LPV
- LSI-VC Forests
- CEOS GFOI Lead
- SIT Chair

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).

# Copernicus LAW
## Nertwork for validation of LST, AOD, WV

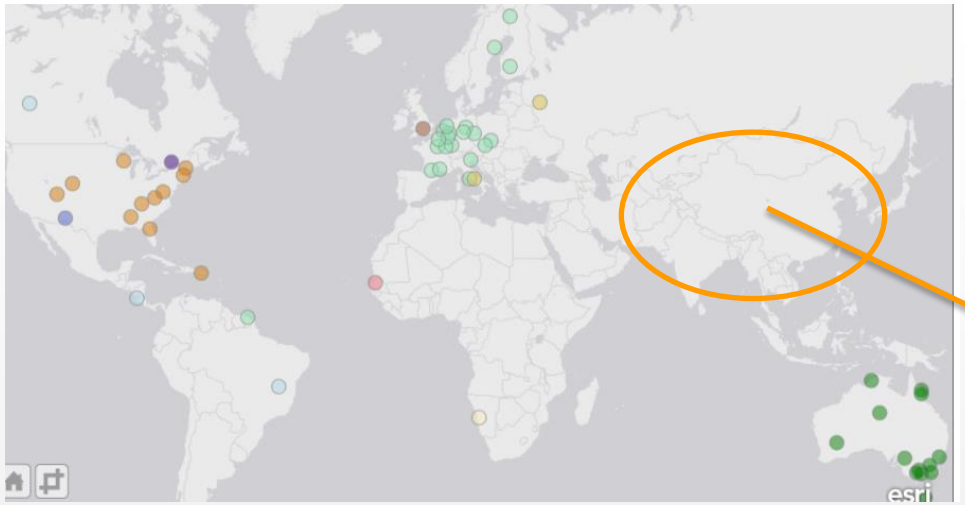



https://law.acri-st.fr/sites




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

# GAOFEN validation network (China)




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

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


# Summary of Actions

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

**Good Practices Protocols**
4 : VIs, Land Cover, Phenology, LAI/FAPAR

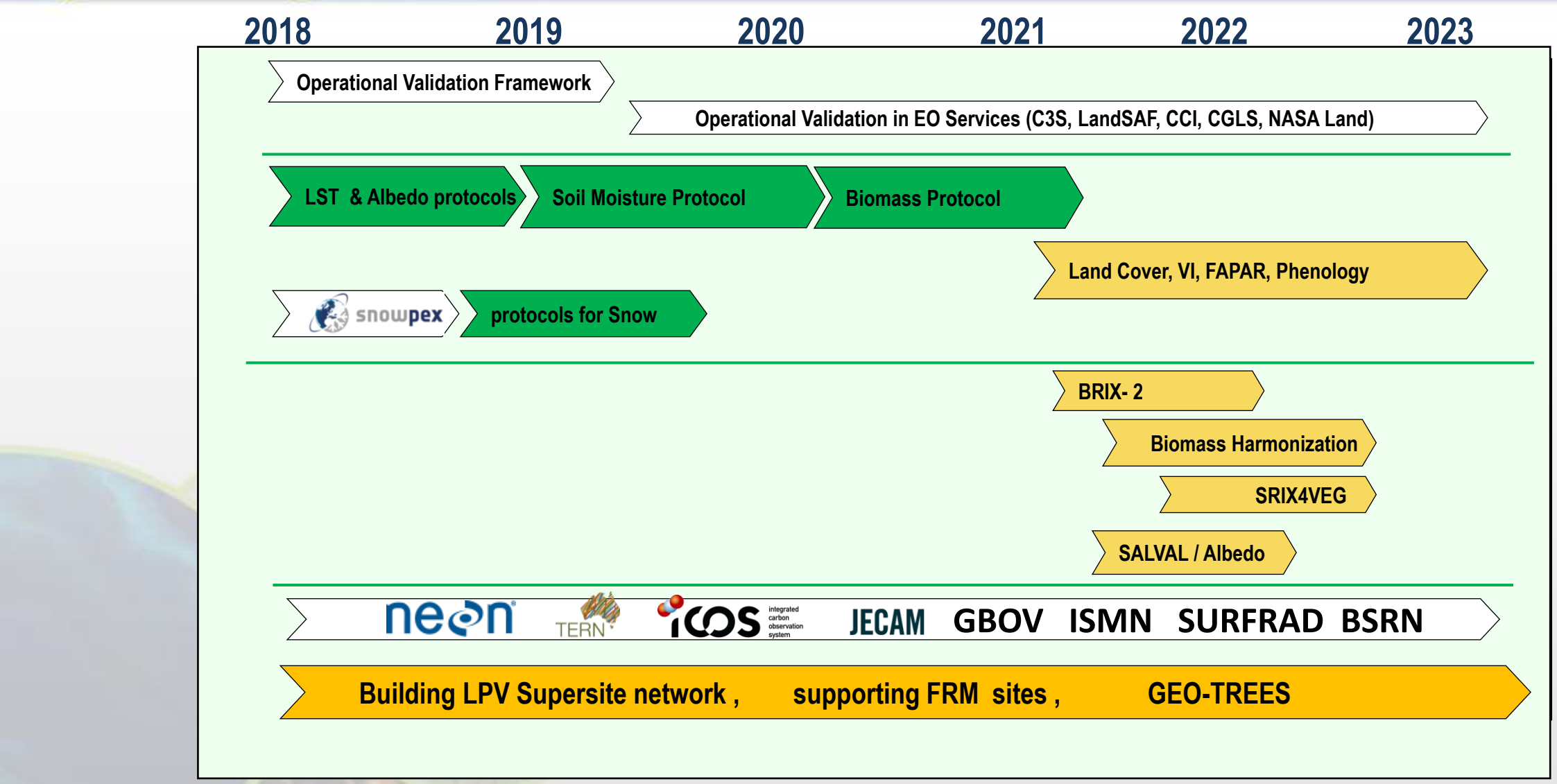
**Validation and Intercomparison**
4: BRIX-2, SRIX4Veg, Biomass Harmonization, Albedo

**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/