CEOS/WGCV/LPV Update

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## CEOS-LPV Structure and Agency Programs

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<thead>
<tr>
<th>Group</th>
<th>First Name</th>
<th>Surname</th>
<th>Country</th>
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NOAA Contributions to LPV

- LPV focus area leads funded by NOAA – Vegetation Indices, Land Surface Temperature
- Creates operational NDVI, Fire, Snow products
- NOAA PIs on the VIIRS Land Science team are developing and validating VIIRS Environmental Data Records (EDRs)

EUMETSAT Contributions to LPV

- CEOS leadership – vice-chair of WG Climate
- Albedo focus area lead supported by EUMETSAT
- Sustained, Coordinated Processing of Environmental Satellite Data for Climate Monitoring – SCOPE-CM – retrieval of satellite albedo from geostationary satellites from various agencies
Image classification errors can greatly bias mapped areas of land change—also, "pixel-counting" in maps is inconsistent with IPCC criteria reporting of land change.

CEOS-LPV is providing guidance to implement protocols for unbiased estimation of area and accuracy.

NASA and other agencies support development and implementation of estimation protocols.
Rigorous design-based validation of global burned area products, in which reference data are selected via a probability sampling design, is effective in reducing the standard errors of accuracy and area estimators compared to simple random sampling.
Multi Angle Imaging BRDF Unmanned aerial system

https://viirsland.gsfc.nasa.gov/Campaigns.html
SuperSwift Platform with:
(1) Soil moisture radiometer,
(2) Volcano payload,
(3) MALIBU
MALIBU Campaign Status

- Ortho-rectified imagery @ BSRN Table Mountain (Nov 30, 16.)
- FAA approvals went through without a hitch – from flight request, to approval, to deployment in < 2 weeks!

![Time Series plot from:](https://www.esrl.noaa.gov/gmd/grad/meetings/BSRN_talks/P2_3_Crystal_Schaaf_BSRN_validation_2016_v0.8.pdf)
### 3.2 Progress on the implementation of the CEOS Strategy for Carbon Observations from Space

<table>
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<tr>
<th>CARB-19: Land product validation listing and framework</th>
<th>Q4 2017</th>
<th><strong>Summarize current list of validated land data products relevant to Carbon Strategy.</strong></th>
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<td>Document validation framework and protocols</td>
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<td>Provide guidance for online platform for intercomparison of terrestrial carbon products.</td>
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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*).
CARB-19: Land product validation listing (Example #3)

CEOS-LPV Validation Reports – Land Surface Temperature & Emissivity Focus Area

Provides List of Products with
- Meta-data
- Contacts
- Links to Validation Reports
- Links to Data Centers
### 3.2 Progress on the implementation of the CEOS Strategy for Carbon Observations from Space

| CARB-19: Land product validation listing and framework | Q4 2017 | **Summarize current list of validated land data products relevant to Carbon Strategy.**<br>Document validation framework and protocols<br>Provide guidance for online platform for intercomparison of terrestrial carbon products. | WGCV |
• 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)
Protocol Status: LST validation protocol document is complete and undergoing peer-review. The protocol will present recommendations on internationally accepted validation good practices.

Overarching Goal: To ensure thematic compatibility across products, reference datasets, and methods. CEOS agency deliverables include:

- Support product development, validation, and interconsistency efforts (ROSES, MEaSUREs), maintain the On Line Interactive Validation Exercise (OLIVE) platform to assess global satellite products (LAI, Albedo, LST).
- Maintain observational networks in the US (BSRN/SURFRAD, USCRN) used for routine validation of LST.
- Develop and maintain the online Land Product Characterization System (https://landsat.usgs.gov/lpcs) to facilitate the characterization and validation of multi-satellite products using in-situ data.
- Provide users with multi-mission LST data (GlobTemperature). Engage with the user community through the International LST and Emissivity Working Group (http://ilste-wg.org)
CV-12 WGCV action: Evaluation of validation supersites and new validation approaches

Evaluation of well-characterized supersites with data continuity prospects for validation purposes that allow for testing of products, algorithms, and validation strategies through radiative transfer modeling.

LPV Supersite Definition

- A Supersite should be fully characterized (3D canopy structure, plus key land variables) to allow a RT model parameterization, whereas a core site refers typically to the same variable.
- A Supersite should be useful for the validation of several land products ( > 3 ).

Candidates Networks:
- TERN Australian Super Sites
- ICOS Ecosystem network
- NEON
- Sites proposed by LPV members
National Ecological Observatory Network (NEON)

- Continental-scale ecological observation facility sponsored by the National Science Foundation to gather and synthesize data on the impacts of climate change, land use change and invasive species on natural resources and biodiversity.
- Strategically locates sites across the U.S. to capture variability in ecological and climatological conditions (terrestrial and aquatic stations).
- Coordinates local measurements in the field with high-resolution airborne remote sensing.
- Provide resources for the ecological community to integrate observations and datasets independently, such as collection and processing protocols.
- NEON network includes core and relocatable terrestrial sites across the U.S. (including Alaska, Hawaii and Puerto Rico). Core sites (20) are fixed, collect data for a minimum of 30 years and are designed to represent and capture wildland conditions. Relocatable sites (27) move through time to capture environmental gradients not captured at core sites.
- Open access to sites data is provided through the NEON data portal (http://data.neonscience.org/home).

Contact:
- Shelley Petroy
The networks referred previously have been investigated to select the candidate sites. Two major criteria were first applied:

- **Availability of data**: the station is active.
- **Spatial representativeness**: to guarantee the highest level of homogeneity and to minimize issues associated with spatial representativeness in the point-to-pixel comparison.

- Using high resolution satellite images (available via Google Earth™), to identify those matching the requirement of homogeneity in the area surrounding the measurement tower
- Only visually homogeneous sites at 3x3 km and 1x1 km are considered.

### Overall, 61 Supersites selected out of:

- TERN: 18 nodes in 10 Supersites
- ICOS: 71 sites
- NEON: 47 sites
- LPV: 13 sites
Vegetation Index Focus Area

• May 2016: Proposed at CEOS WGCV LPV meeting
• Sep 2016: Officially established
• Nov 2016: Held a VI & LSP workshop (Fort Collins, CO)
  1) Initiate the development of validation protocols for Vegetation Indices and Land Surface Phenology products.
  2) Develop a strategy to advance the validation stage of one or more operational Land Surface Phenology Products and one or more Vegetation Index Products
    • To learn the current validation status of VI products
    • To exchange validation methodologies used for VI products
    • To discuss and develop a list of action items and a strategic plan
LPV Vegetation Index & Land Surface Phenology Workshop

Participants touring NEON site caught on the PhenoCam!
Three components of VI validation needed to define and characterize VI uncertainties and to satisfy the user needs:

1) Uncertainty of VIs in their units (e.g., NDVI)
2) VI sensitivity to vegetation biophysical/physiological conditions
3) Long-term stability of VI time series data

Potential data sources for VI validation were identified:

- NEON airborne hyperspectral data
- AERONET-based surface reflectance data
- Ground-/drone-observational reflectance data
- FLUXNET data

*Each participant volunteered to look into one or more of these datasets and to begin evaluating their VI products of interest*
Vegetation Index Focus Area

• Mar 2017:
  • Else Swinnen (VITO) appointed as co-lead
  • Invitation to participate in the VI focus area was sent (127 potential participants)

• July 2017: the VI focus area website launched and completed (https://lpvs.gsfc.nasa.gov/NDVI/VI_home.html)
  • Updated VI product list
  • Updated VI validation references
Building International Structures

It is our aim to build international structures for the validation of this extensively utilized remote sensing variable. Global Vegetation Index products are routinely used in crop monitoring and forecasting by the UN’s FAO and the USDA’s FFS to predict yield and predict shortages. They also serve as key measurements in productivity, phenology, climate, hydrology, biochemical and biodiversity studies. Thus, a coordinated effort on the validation of global VI measurements is warranted, and the LPV VI focus area aims to lead such an effort.

Links to In Situ Networks for VI Validation

- The World Meteorological Organization
- The FLUXNET Project
- The National Ecological Observatory Network (NEON)
- The PhenoCams Network

Vegetation Index Home | Vegetation Index References | Vegetation Index Products
Vegetation Index Focus Area

• Action Items:
  • Preliminary validation exercises using the identified validation data sources
  • Selection of a globally representative set of sites for inter-comparison
  • Inter-comparison exercise
  • Reconvening in a year or 1.5 years
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lpvs.gsfc.nasa.gov