Vegetation Indices (1/2)

Protocol

- Feedback received from small review committee
  - Finalizing implementing changes wrt comments

- 6 main chapters
  - Definition of Vegetation Indices
  - Requirements of Vegetation Indices
  - General considerations for satellite VI products
  - Recommended approach for global product validation
  - Recommended approach for global product intercomparison
  - Recommended content of a product validation document

- Poster presentation of draft protocol @LPVE

Vegetation Indices (1/2)

1. Definition of vegetation indices

- Vegetation indices are optical measures of vegetation canopy ‘greenness’, a direct measure of photosynthetic potential resulting from the composite property of total leaf chlorophyll, leaf area, canopy cover, and structure.

- They are also widely used as proxies in estimating canopy state variables (leaf area index, fraction of absorbed photosynthetically-active radiation, chlorophyll content, vegetation fraction) and canopy biophysical processes (photosynthesis, transpiration, net primary production).

- Definition of the most used VIs are given (NDVI, EVI)

Vegetation Indices (1/2)

2. Requirements of VI

- General requirements for VIs were formulated at the CEOS LPV VI workshop (2016):
  - The uncertainty estimate of VIs should be expressed in the VI units.
  - Evaluation of VIs should include characterization of VI value changes with respect to changes in actual vegetation conditions (biophysical and/or physiological).
  - The long-term stability of VI time series datasets is a prime goal.

- Example requirements from operational services are listed.

- Further requirements of the VIs can differ from their application. Therefore, it is advised to formulate a priori a set of key requirements for the specific application, translate these into research questions and organize the validation along these questions.

Vegetation Indices (1/2)

3. General considerations for satellite VI products

In this chapter we treat the following aspects related to validation and product inter-comparison:

- VI product algorithm and compositing method
- Temporal and spatial resolution
- Spectral considerations
- Uncertainties related to VI products
  - Sensor calibration
  - Atmospheric correction
  - Pixel quality assurance
  - Compositing
  - Scaling uncertainty

Vegetation Indices (1/2)

4. Recommended approach for Global Product Validation

- This chapter describes the recommended approach for the VI product validation with independent in-situ data.
- The time series validation approach was agreed as a standard VI validation methodology. Here, validation focuses on validating the quality of VI time series data as **how well VI products capture seasonal evolution of vegetation**.
- Datasets used for the validation of VI products can be divided into two categories: network-based and opportunistic *in situ* data:
    - *In situ observation networks*
        - AERONET-based Surface Reflectance Dataset
        - FLUXNET
        - Phenological Eyes Network (PEN) Field Spectrometer Time Series Data
        - Fiducial reference measurement for vegetation (FRM4VEG)
        - HYPERNETS (from 2022)
        - RadCalNet
        - Time-lapse camera networks (e.g. PhenoCam, PEN, and others)
        - US-NPN Observational crowdsourced data
    - *Opportunistic in situ data (as methods)*
        - NEON Airborne Observation Platform Hyperspectral Data
        - Opportunistic unmanned aerial vehicle (UAV) data at Long-Term Agroecosystem Research (LTAR) Network Data
        - Ground and drone observational reflectance data
- The chapter ends with a discussion of the capacity and limitations for global VI product validation.

Vegetation Indices (1/2)

5. Recommended approach for Global Product Intercomparison

- This chapter treats all aspects of intercomparing a global VI data set with other existing VI datasets.
- It discusses
  - The recommended inter-comparison methods
  - The sampling strategy at the spatial, temporal and angular level
  - How to deal with spectral differences
  - The inter-comparison approach
  - The intercomparison metrics
- Focus of product inter-comparison is to characterize the differences and their spatial and temporal distribution.
  - ✓ Overall similarity, magnitude of differences and their spatial and temporal patterns
  - ✓ Suggested measures
    - ✓ Product completeness
    - ✓ Spatial consistency
    - ✓ Statistical consistency
    - ✓ Temporal consistency
  - ✓ Statistical metrics discussed included:
    - ✓ RMSD (split into its systematic and unsystematic components)
    - ✓ Mean Bias Error, Mean Absolute Error
    - ✓ Precision or repeatability
- A discussion on the capacity and limitations for global product intercomparison is also given.

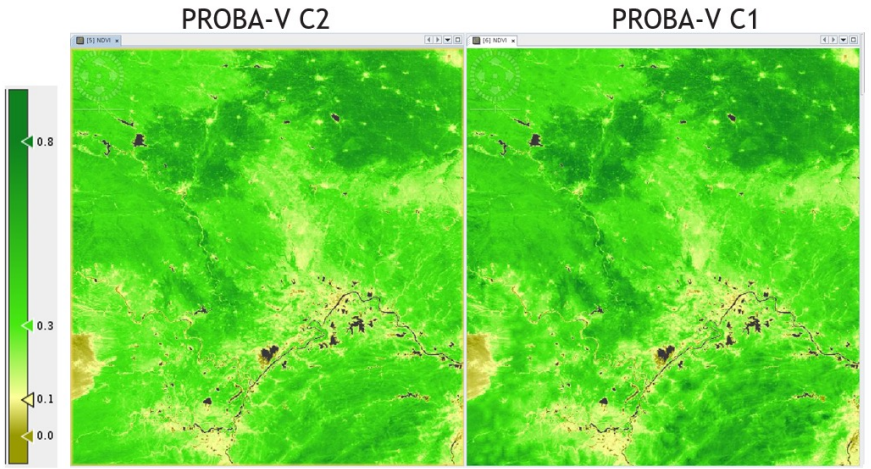
Vegetation Indices (1/2)

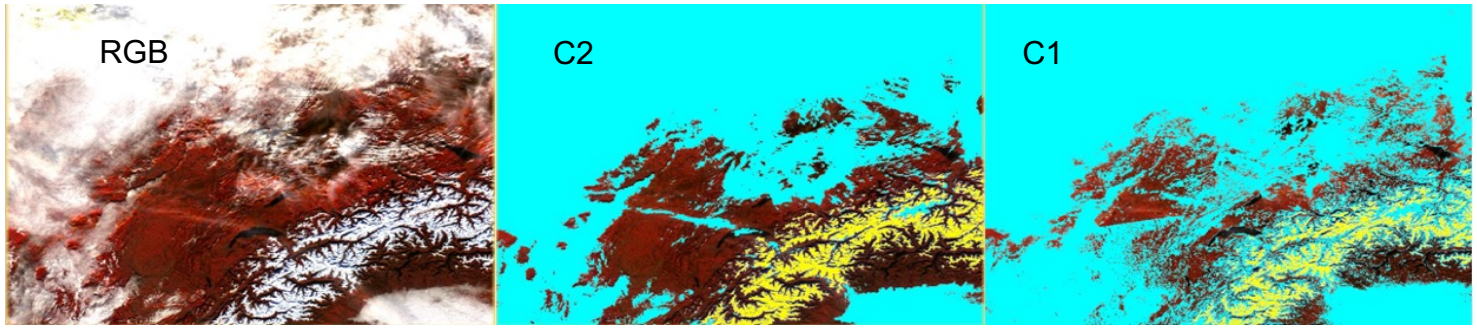
6. Recommended content of a Product Validation Document

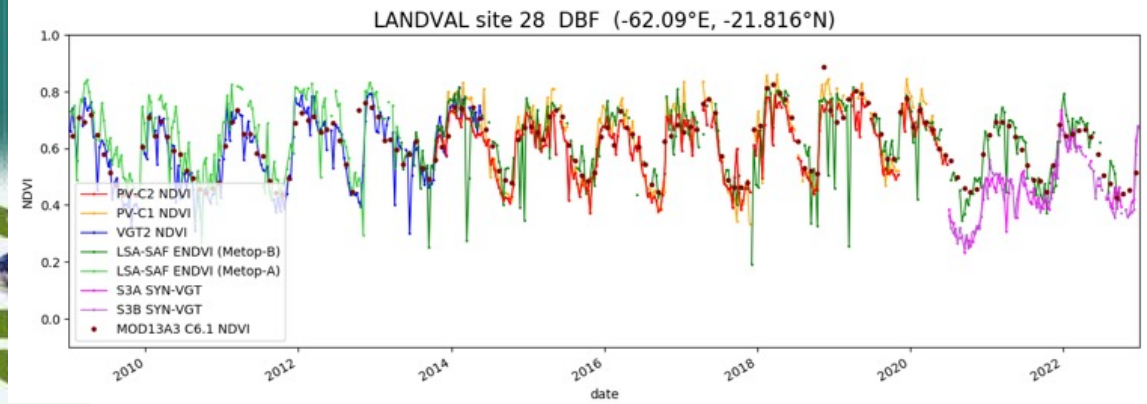
- CEOS recommends that the validation document of a VI product include:
  1) Product QA information
  2) Uncertainty information obtained via validation (NIST-traceability)
  3) Product inter-comparison results

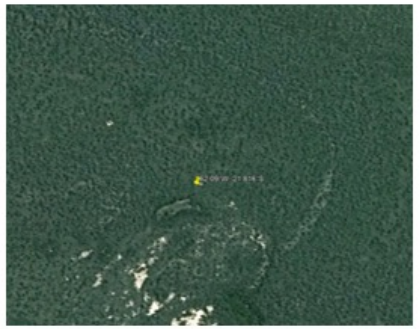
Vegetation Indices (1/2)

- **New data sets**
  - Proba-V C2 NDVI released. Validation report
    - Main differences:
      - Improved pixel classification (cloud, snow/ice, cloud shadow)
      - Improved A/C
      - Update of absolute radiometric calibration
    - Main results









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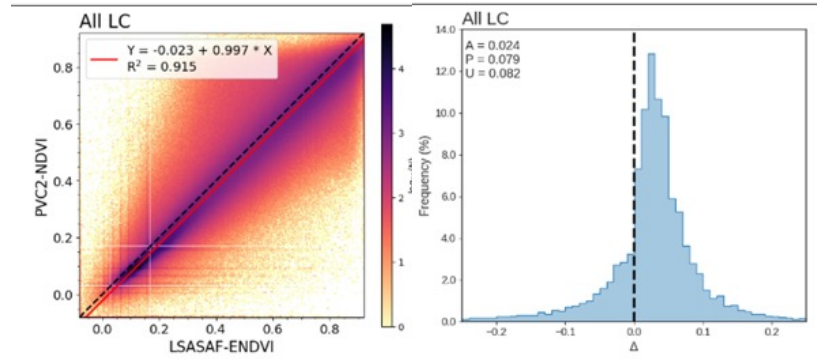

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