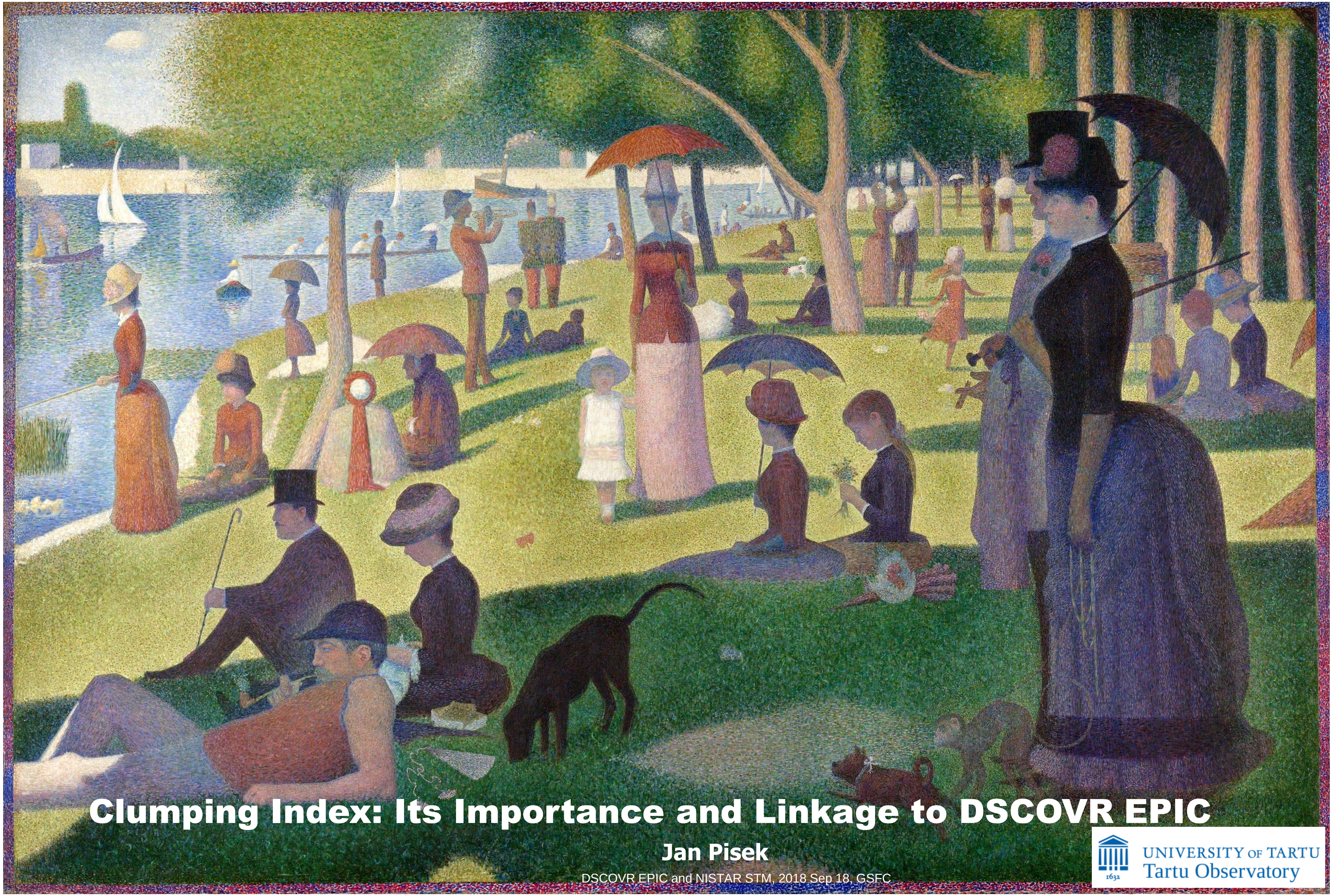


Clumping Index: Its Importance and Linkage to DSCOVR EPIC

Jan Pisek

UNIVERSITY OF TARTU
Tartu Observatory

DSCOVR EPIC and NISTAR STM, 2018 Sep 18, GSFC

11

RAdiation transfer Model Intercomparison (RAMI)

Homogeneous discrete cases in the solar domain:

This set of experiments was suggested to simulate the radiative transfer regime in the red and near infra-red spectral bands for homogeneous environmental scenes composed of a large number of non overlapping disc-shaped objects representing the leaves, located over a horizontal plane standing for the underlying soil surface. To address the needs of different RT models, we are providing both a statistical scene description, as well as, a file with the exact coordinates of every leaf in the canopy. You may or may not make use of this information depending on the needs of your particular model.

These objects were randomly distributed finite size scatterers characterized by the specified radiative properties (reflectance, transmittance), and the orientation of the normals to the scatterers followed either a uniform or a planophile distribution function. The radiative properties of the underlying soil were also specified (in this case a simple Lambertian scattering law). The particular values selected for these input variables represented classical plant canopy conditions.

The following figure exhibits a graphical representation of such a scene:

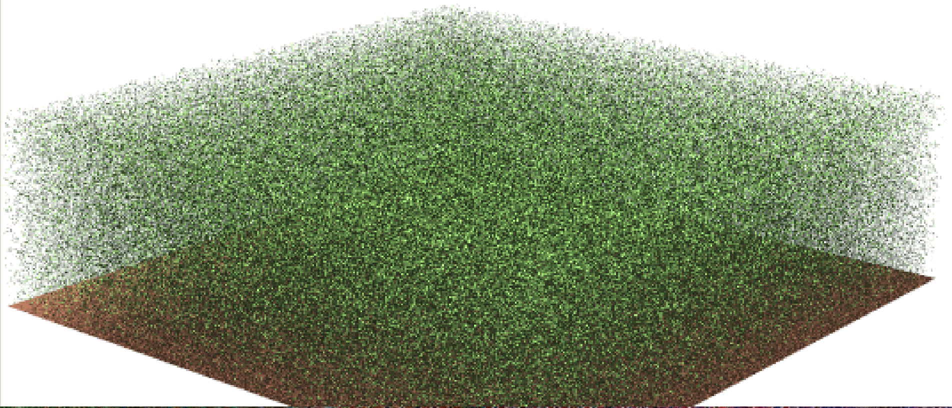
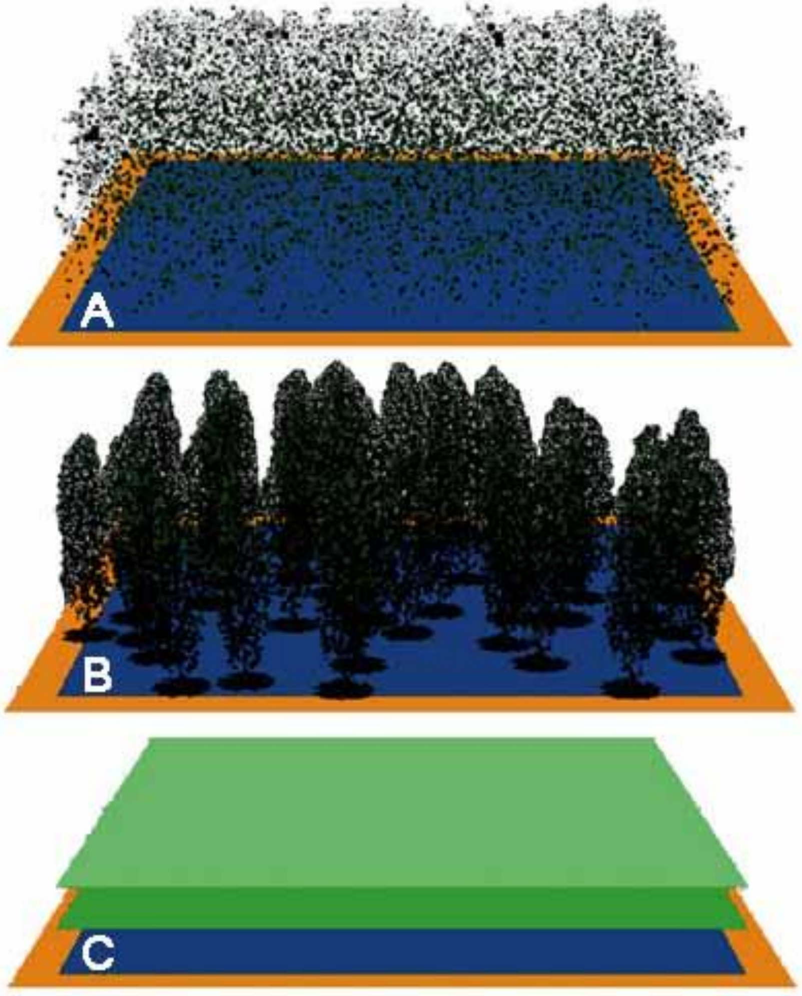


Photo: community of Beloit, Wisconsin



Ω= 1

Ω< 1

LAI=2

Affects

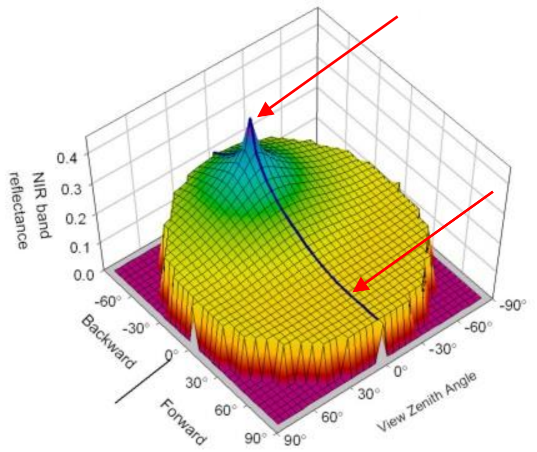
- **radiation interception and distribution within the canopy**
- **evapotranspiration**
- **plant growth**
- **carbon cycle**

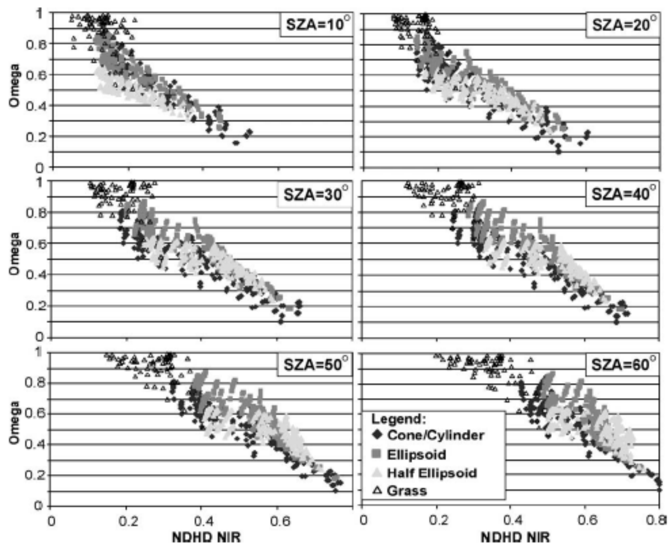
Captures the ecological importance of existing canopy architectural difference of various vegetation types

$$P(\theta) = e^{-G(\theta)L\Omega/\cos\theta}$$

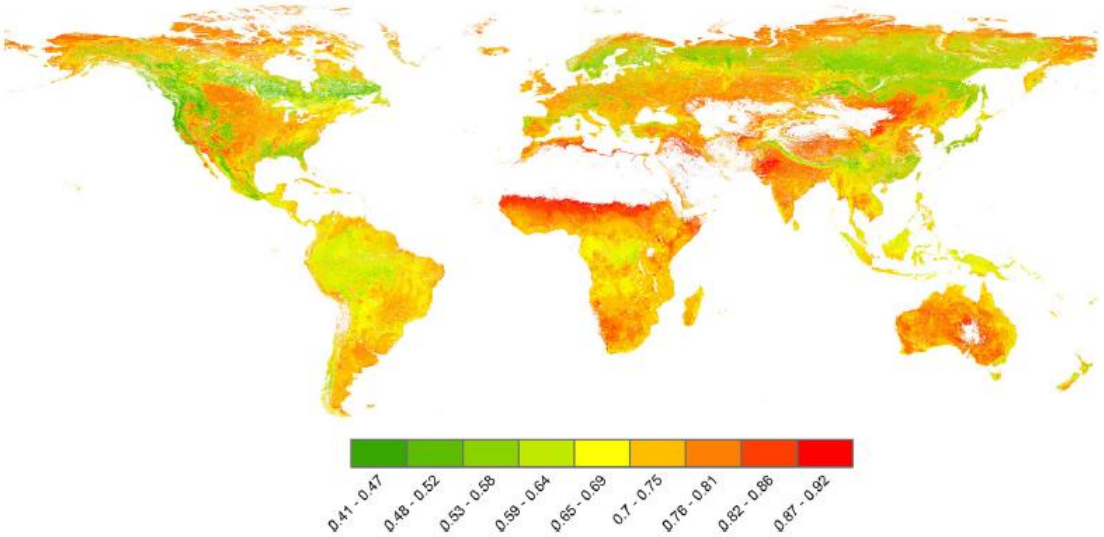
Images: Sylvain Leblanc

Estimating clumping index from remote sensing data - NDHD



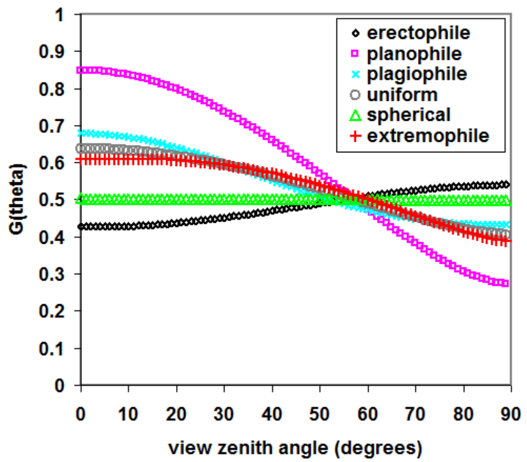


The anisotropy index (NDHD) = (HS – DS)/(HS + DS)



Chen et al., 2005, RSE; He et al., 2012, RSE

Estimating clumping index from remote sensing data - DSCOVR



sunlit leaf area index

$$SF = SLAI / LAI$$

sunlit fraction

leaf area index

optical path through the vegetation layer

Solve for τ
(Yang et al., 2017, RSE)

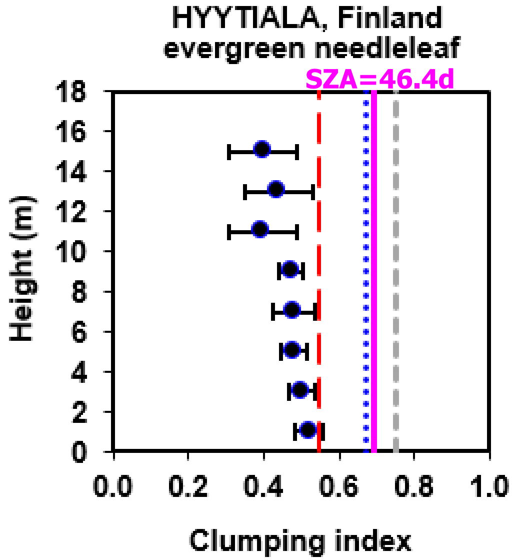
$$SF = (1 - \exp(-\tau))/\tau$$

0.5 — sun zenith angle

$$\tau = G * LAI * CI / \cos(SZA)$$

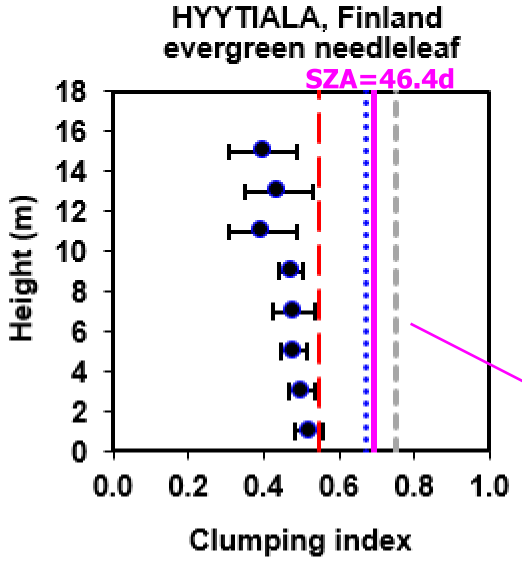
$$CI = (2 * \tau * \cos(SZA))/LAI$$

Needleleaf canopies



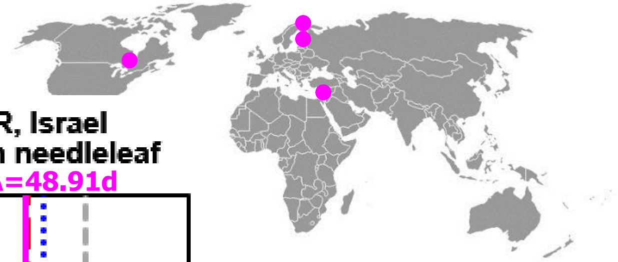
POLDER
MODIS
MISR
DSCOVR

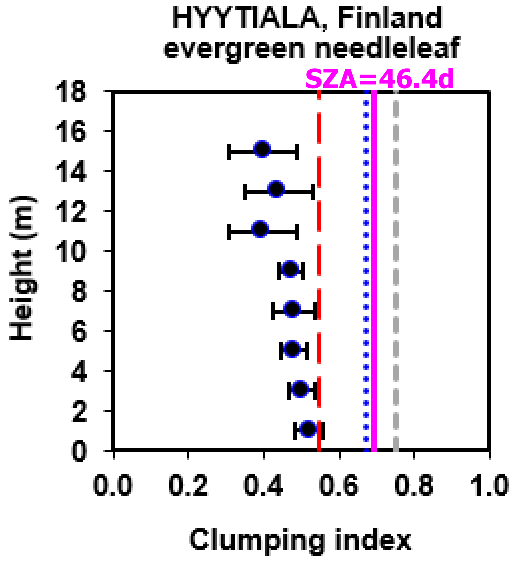
Needleleaf canopies

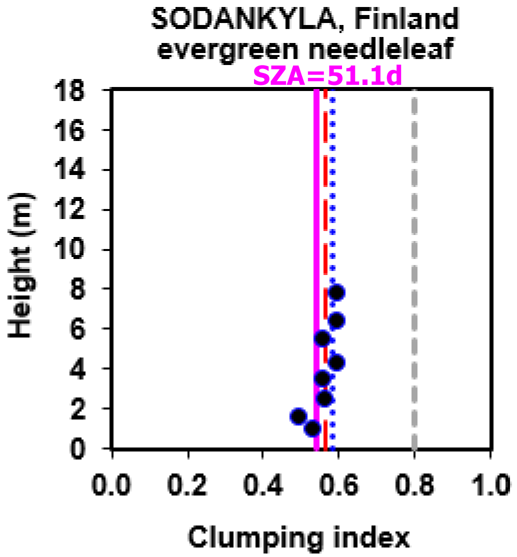


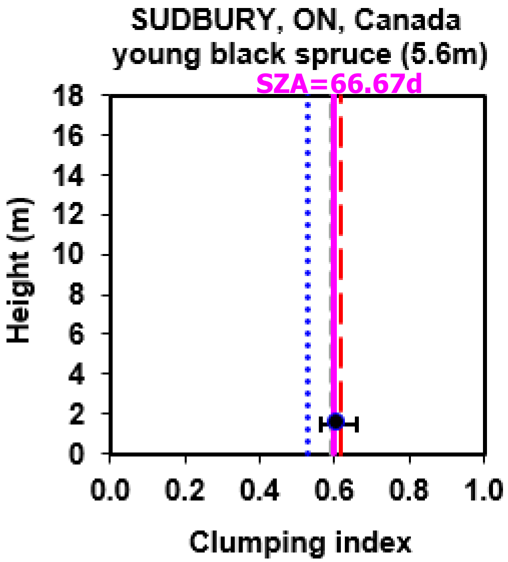
- POLDER
- MODIS
- MISR
- **DSCOVR**

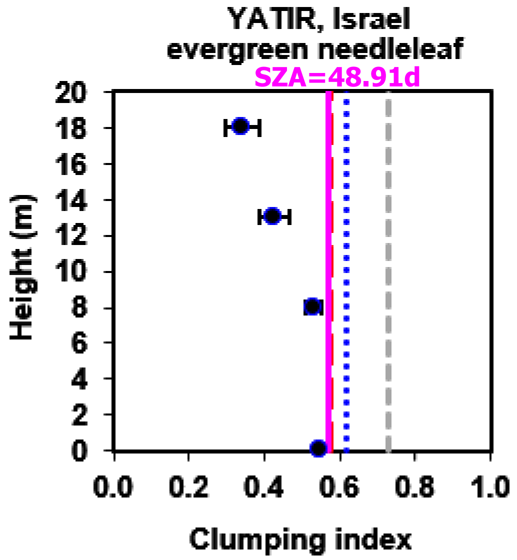
Needleleaf canopies





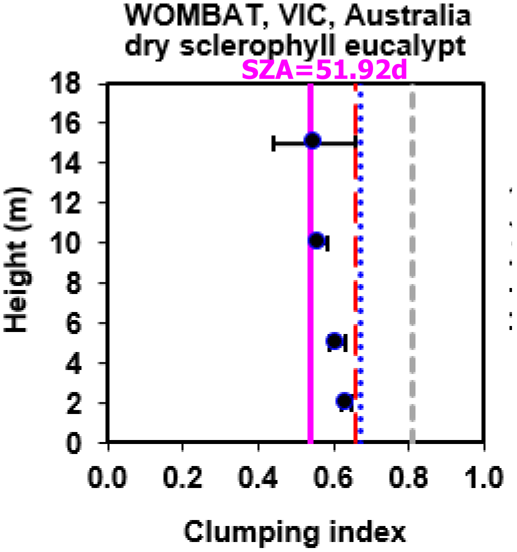






POLDER
MODIS
MISR
DSCOVR

Broadleaf canopies



POLDER
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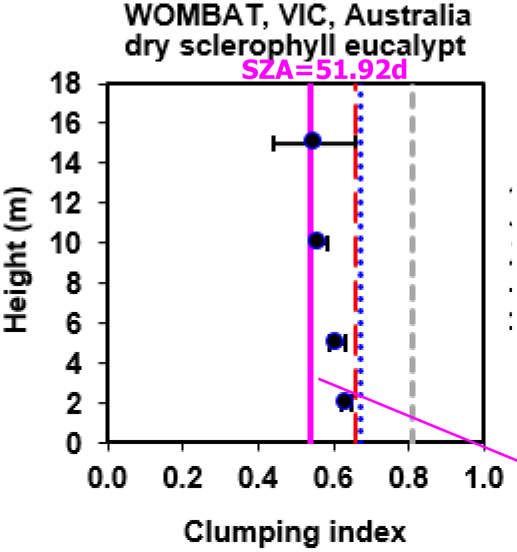
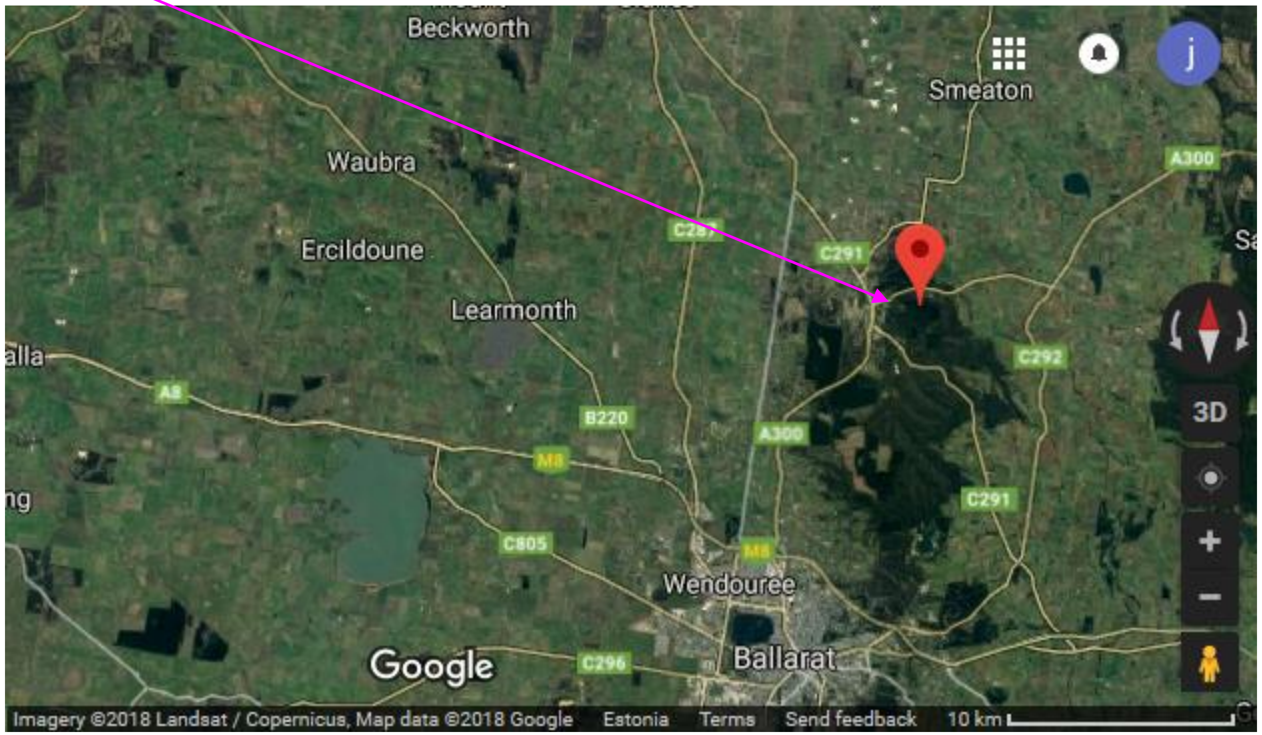
MISR
DSCOVR

Broadleaf canopies





POLDER
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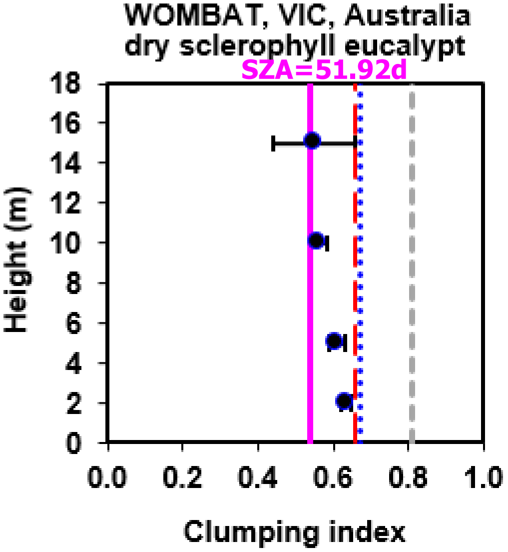
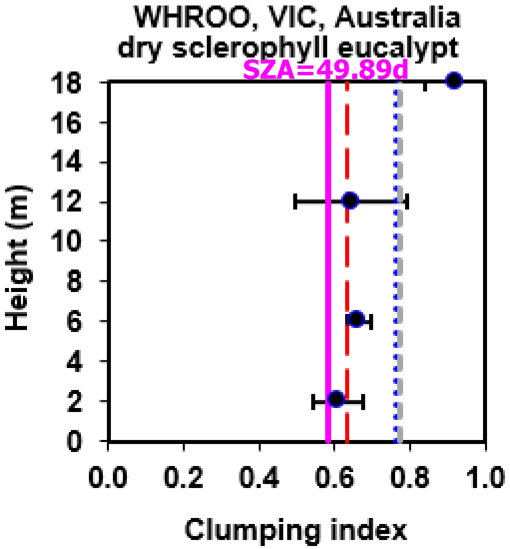
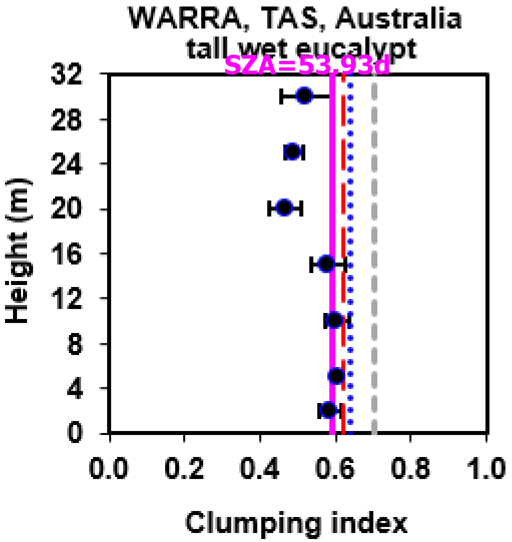
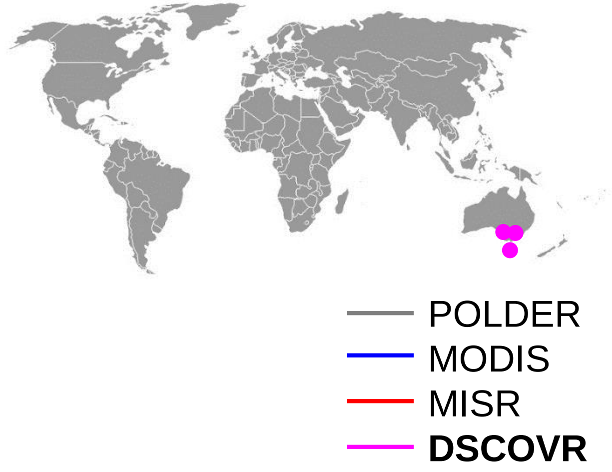
Broadleaf canopies

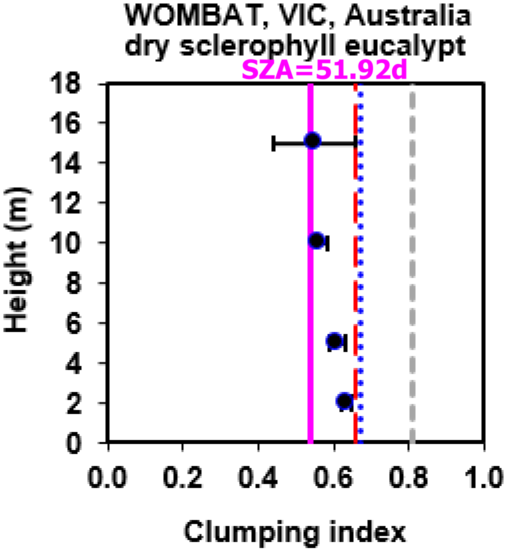


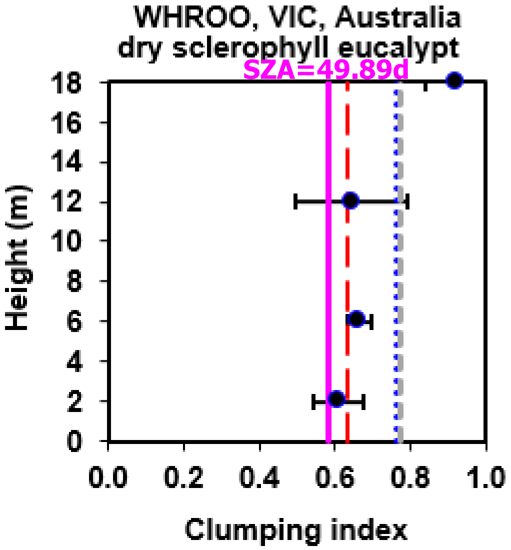


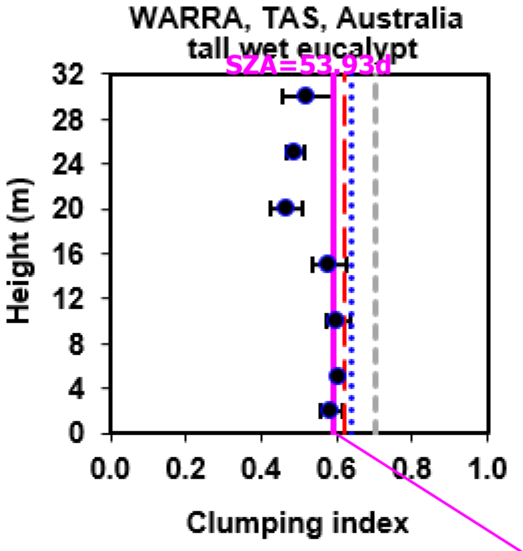




Broadleaf canopies







POLDER
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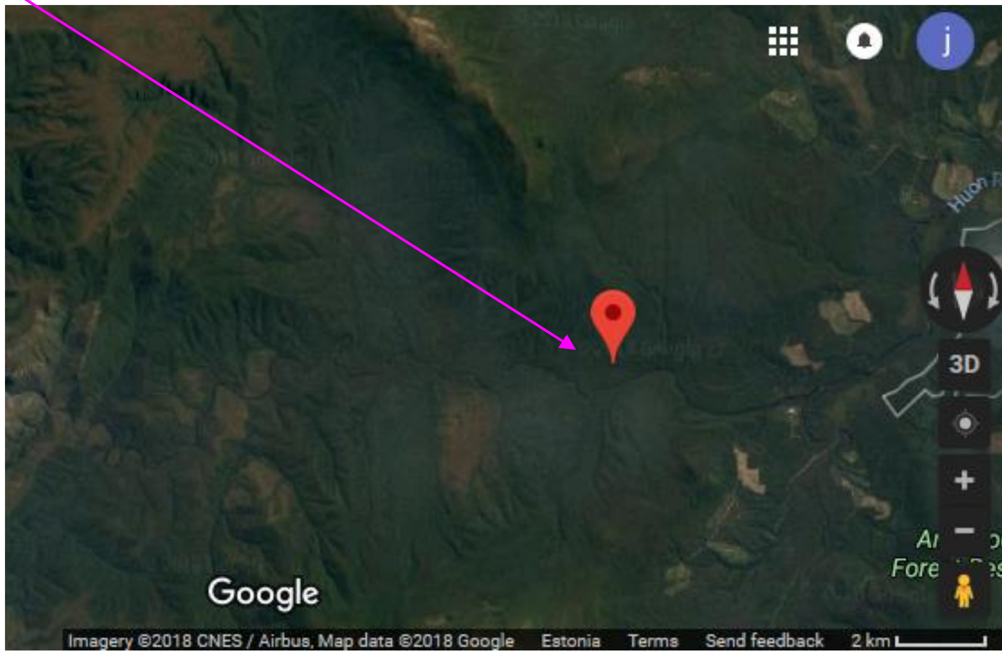
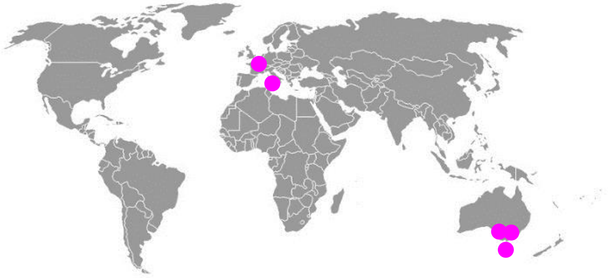
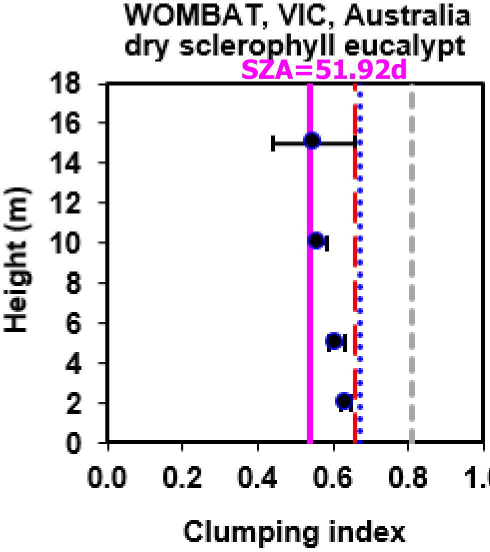
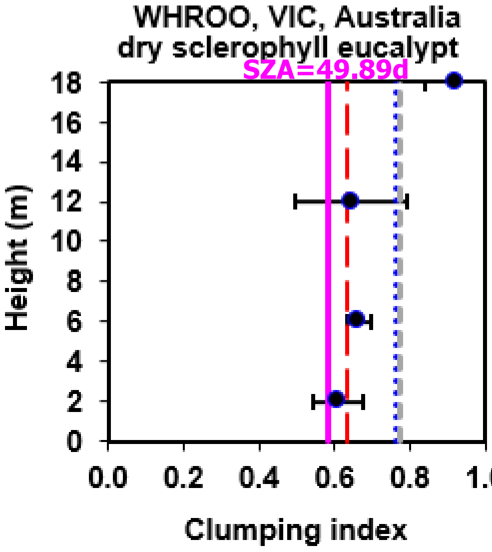


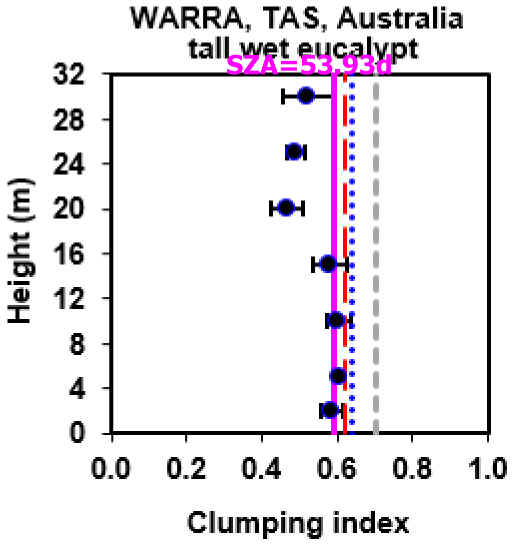
Broadleaf canopies

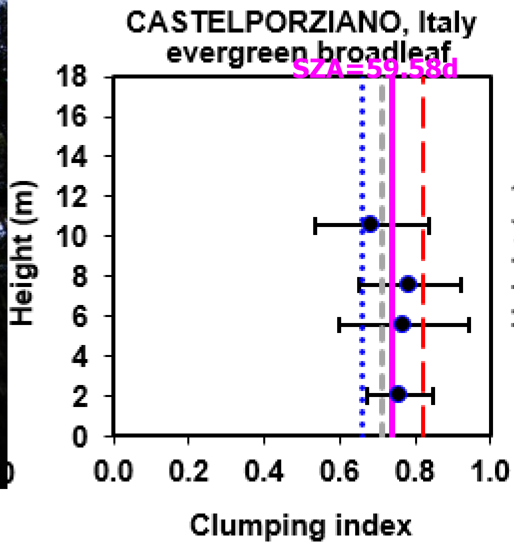


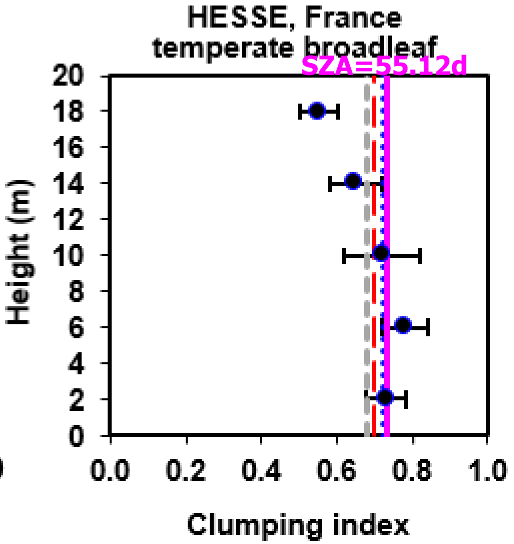
- POLDER
- MODIS
- MISR
- **DSCOVR**











National Aeronautics and Space Administration
Goddard Space Flight Center

Keywords

CEOS Working Group on Calibration and Validation

Land Product Validation Subgroup

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LPV Focus Areas

- LAI
- Fapar
- Fire/Burn Area
- Phenology
- Vegetation Index
- Land Cover
- Snow Cover
- BRDF/Albedo
- Soil Moisture
- LST and Emissivity
- Biomass

LPV Supersites

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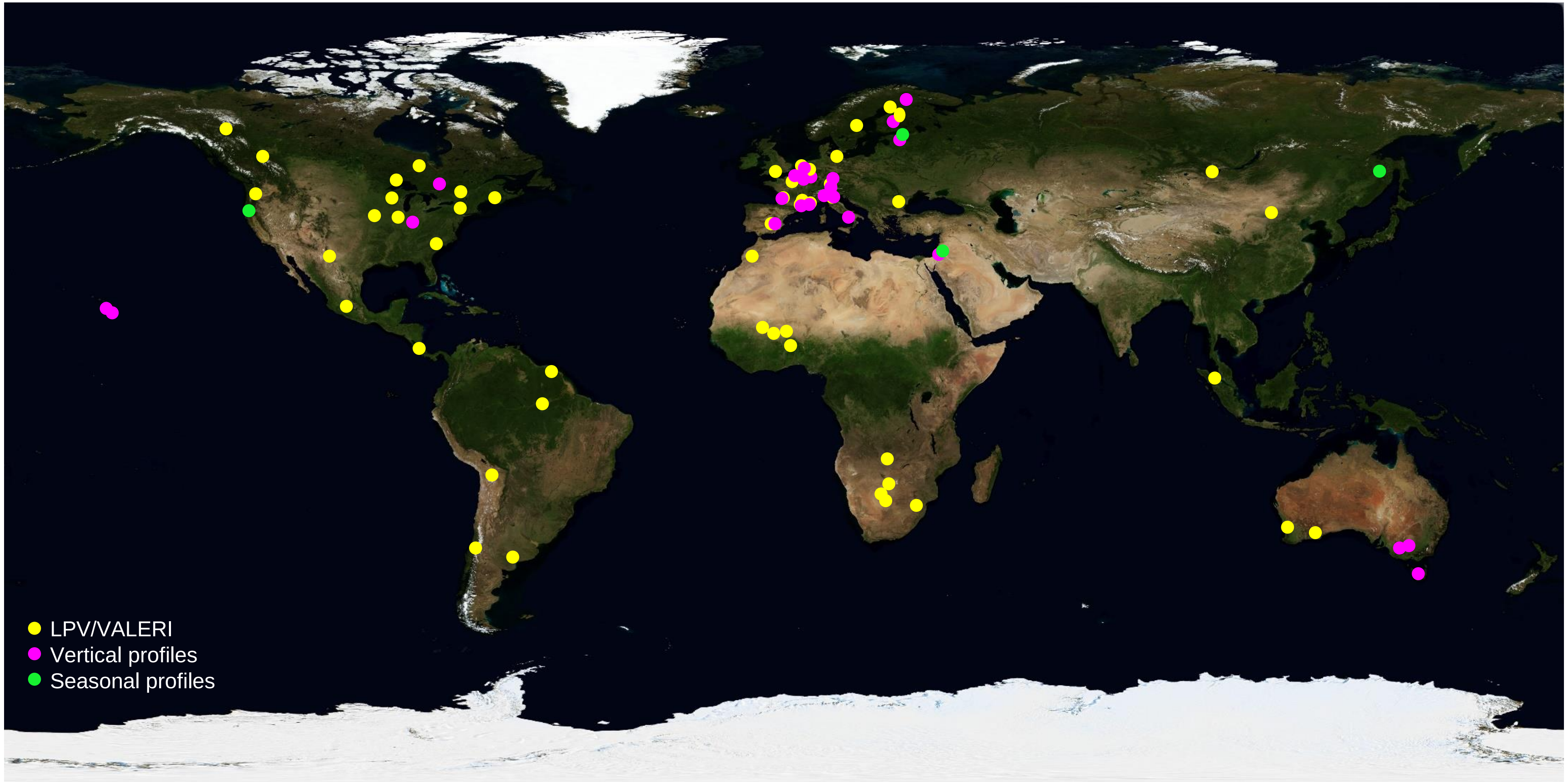
The mission of the CEOS Land Product Validation (LPV) subgroup is to coordinate the quantitative validation of satellite-derived products. The focus lies on standardized intercomparison and validation across products from different satellite, algorithms, and agency sources.

The sub-group consists of 11 Focus Areas, with 2 co-leads responsible for each land surface variable (essential climate and biodiversity variables).

CEOS VALIDATION HIERARCHY

	Validation Stage - Definition and Current State	Variable
0	No validation. Product accuracy has not been assessed. Product considered beta.	
1	Product accuracy is assessed from a small (typically < 30) set of locations and time periods by comparison with in-situ or other suitable reference data.	Snow Fire Radiative Power
2	Product accuracy is estimated over a significant set of locations and time periods by comparison with reference in situ or other suitable reference data. Spatial and temporal consistency of the product and consistency with similar products has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature.	Fapar Phenology Burned Area Land Cover LAI
3	Uncertainties in the product and its associated structure are well quantified from comparison with reference in situ or other suitable reference data. Uncertainties are characterized in a statistically rigorous way over multiple locations and time periods representing global conditions. Spatial and temporal consistency of the product and with similar products has been evaluated over globally representative locations and periods. Results are published in the peer-reviewed literature.	Vegetation Indicies Albedo Soil Moisture LST & EmissiSvity Phenology
4	Validation results for stage 3 are systematically updated when new product versions are released and as the time-series expands.	Active Fire

Reference sites



Background MODIS image provided by The Blue Marble

For the first time it is shown that it might be possible to obtain approximate p-values for any location solely from Earth Observation data.

Remote Sensing of Environment 215 (2018) 1–6

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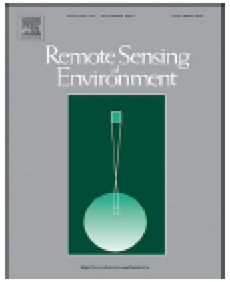
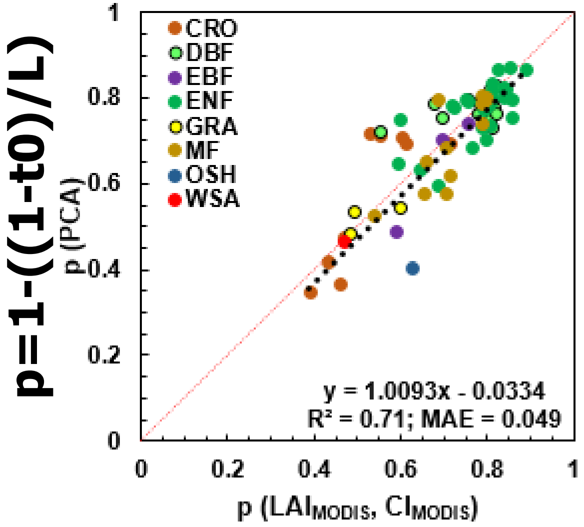


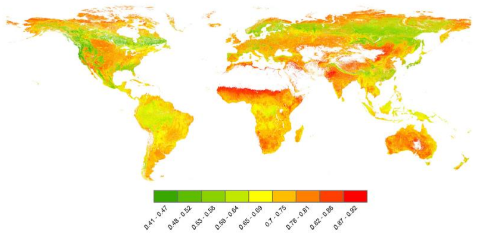
Data synergy between leaf area index and clumping index Earth Observation products using photon recollision probability theory

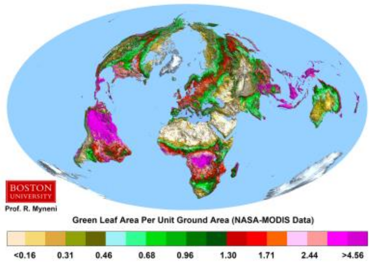
Check for updates

Jan Pisek[a,*], Henning Buddenbaum[b], Fernando Camacho[c], Joachim Hill[b], Jennifer L.R. Jensen[d], Holger Lange[e], Zhili Liu[f], Arndt Piayda[g], Yonghua Qu[h], Olivier Roupsard[i], Shawn P. Serbin[j], Svein Solberg[e], Oliver Sonnentag[k], Anne Thimonier[l], Francesco Vuolo[m]



$$p=1-((1-\exp(-0.5*\Omega*L/\cos\theta))/L)$$





Pisek et al., 2018, RSE