Land Product Validation (LPV) Sub-group Meeting

Fernando Camacho – (EOLab/U. Valencia) – Chair
Michael Cosh – (USDA) – Vice Chair

Subgroup meeting
5 Jan 2021

NEXT LPV TELECON 02 Mar 2021

Attendance

Participants

Fernando Camacho
Michael Cosh
Jaime Nickeson
Zhuosen Wang
Gareth Roberts
John Bolten
Carsten Montzka
Tomoaki Miura
Hongliang Fang
Louis Giglio
Joshua Gray
Sylvain Leblanc
Frank Göttsche
Simon Gascoin
Victor Rodríguez-Galiano
Else Swinnen
Sophie Bontemps
Glynn Hulley
Chris Crawford
Dominique Carrer

Not attending

Mat Disney
John Armston
Laura Duncanson
Pontus Olofsson
Marie Weiss
Thomas Nagler

Proposed agenda items

- Welcome
- ESA – Land Product Validation Strategy Workshop
- LPV Work Plan
- LSA SAF New Products
- Focus Area review and update status
- Focus Area Reporting

ESA Workshop on Land Validation

30 Nov – 1st Dec 2020 , Virtual

- The objective of the workshop will be to define and shape the ESA long term strategy on Land Product Validation, focused on Optical Sensor and on **Surface Reflectance** and **biophysical products** (FAPAR, LAI....).
- The ESA strategy is based on the FRM concept as gold standard for validation of satellite-based products with reinforced focus on metrology
- Presentations were mainly on Land validation in a metrological context (*FRM4Veg*), Land Validation in Operational Context (*CEOS LPV, GBOV, S3-MPC*) and Recent Advance in Land Cal/Val activities (*RadCAlNet, HyperNet, UAVs&LiDAR*)
- Presentations available at **https://earth.esa.int/eogateway/events/esa-workshop-on-land-validation-strategy/programme**
  - OLIVE to be upgraded by ESA, possibility to include the albedo (SALVAL) tool. This needs to be discussed.
  - CEOS LPV LAI protocol need to be updated to incorporate new technologies (UAV, LiDAR).
  - Review the Burned Area validation stage (ESA CCI validation goes to stage 3, reference database available).
- The conclusions of the workshop will be published in a paper (to be submitted to Remote Sensing Special Issue on Recent Advances in Land Product Validation)

LPV Work Plan 2019 - 2022

Deadline before 2021

Group	Lead / PoC	ID	Action	Start	Deadline	Status
Chair	F.Camacho	19-LPV-01	Revise hierarchy table including FRM concept	2019	Q3/2019	closed
Chair	F.Camacho	19-LPV-03	Investigate suitability of ICOS delivered data for validation	2019	Q1/2020	started
Chair	F.Camacho	AGRI-13	Stablish mechanism to collaborate with GEOGLAM related to Essential Agriculture Va	2019	Q4/2019	closed
Chair	F.Camacho	19-LPV-04	Promote a new WGCV SR task (LPV-IVOS) in the context of FRM4VEG	2019	Q3/2019	closed
Biomass	L.Duncanson	CARB-16	Cal/val and production of biomass products from CEOS missions	2017	Q4/2019	closed
Biomass	L.Duncanson	CARB-16-2018	Biomass validation paper	2018	Q2/2019	closed
Biomass	L.Duncanson	CARB-16-2018	CEOS WGCV biomass protocol	2018	Q3/2019	delayed Q1/2021
Biomass	L.Duncanson	CARB-16-2018	Establishment of ground-based carbon super-sites	2018	Q4/2019	delayed Q1/2021
Albedo	Ian Grant / FA leads	19-LPV-09	Developing protocols for surface downwelling radiation product validation	2019	Q4/2020	started
Albedo	F.Camacho / FA lea	19-LPV-10	Paper on albedo validation and intercomparison (SALVAL tool)	2019	Q1/2020	started
Biophysical	H. Fang	19-LPV-13	Biophysical Workshop at IGARSS	2019	Q3/2019	closed
Biophysical	M. Weiss	19-LPV-14	Datasharing platform under FAIR principles for ground references	2019	Q2/2020	
LST	FA leads	19-LPV-20	Ecostress stage 1 validation		Q4/2020	closed
VI	Swinnen	19-LPV-24	paper on VI product intercomparison	2019	Q3/2020	
VI	Miura	19-LPV-25	paper on vi VIIRS validation	2019	Q2/2020	

Closed, In progress , Delayed

LPV Work Plan 2019 - 2022

Deadline after 2021

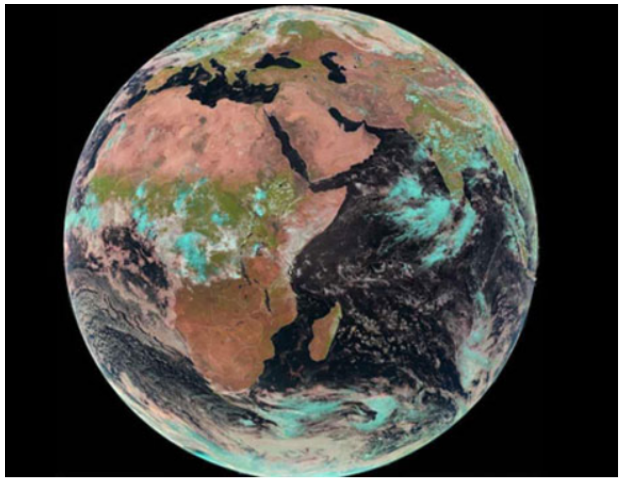
Group	Lead / PoC	ID	Action	Deadline	Status
Chair /Radiation	F.Camacho	CV-20-01	SRIX-4Veg	Q4/2022	starts Q2/2021
Chair/ Biop	F.Camacho/ Fang	20-LPV-01	Update DIRECT 2.0 to 2.1	Q4/2021	started
Chair / Secretariat	F.Camacho	19-LPV-05	Promote special sessions on land product validation at AGU and EGU	Q4/2021	delayed (COVID
Biomass	L.Duncanson	CV-20-02	BRIX-II	Q1/2022	starts Q1/2021
Land Cover	Sophie Bontemps	19-LPV-11	Land Cover product validation protocol	TBD	started
Land Cover	FA leads	19-LPV-12	Workshop on LC product validation	Q3/2021	IGARSS
Biophysical	M. Weiss / FA leads	19-LPV-15	Update the LAI protocol, complement it with Fapar	Q4/2021	
Active Fire /BA	FA leads	19-LPV-16	Finalize the BA protocol	Q4/2022	
Active Fire /BA	FA leads	19-LPV-17	Develop validation protocol for Active Fire / FRP	Q2/2021	started
Soil Moisture	FA leads	19-LPV-18	Soil Moisture Validation Protocol	Q2/2021	closed
Phenology	FA leads	19-LPV-21	Phenology Validation Protocol	Q4/2021	
VI	FA leads	19-LPV-22	VI validation protocol	Q4/2021	started
VI	FA leads	19-LPV-23	3rd Workshop VI	Q2/2021	

Closed, In progress , Delayed

Action Plan to be updated during the next LPV Plenary (May 21)

EUMETSAT LSA SAF new products

Indian Ocean Data Coverage (IODC)



LSA SAF

New set of land products based on MSG-IODC:

- MLST, DLST (LST)
- MDSSF, MDSLF (Solar fluxes)
- METREF (Evapotranspiration)
- MDAL, MTAL (Surface Albedo)
- Daily, 10-daily VEGA (FVC, FAPAR, LAI)

Those products are currently generated in NRT and were also processed back to Aug 2017 to provide the users with the full time series. All products are available at landsaf.ipma.pt

Focus Area Review/Update Status

Status of updates by focus area.

Some only need a review, changes are not required, just assure all is current!

Most focus area pages are in need of review/update.

Good news is that most Product lists are now up to date.

Focus Area	Home Page	Product table	Collaboration Page	References	Listserv names	Letters to Community
Land Cover		Jan 2021			Oct 2019	
Biophysical LAI/Fpar	Sept 2020	Dec 2020	Sept 2020	Sept 2020	Oct 2019	Sept 2019
Surface Rad/Albedo	Dec 2019	Feb 2020	Dec 2019	Dec 2019	Dec 2019	May 2020
LST/Emissivity	April 2019	April 2019	April 2019	April 2019	April 2019	
Fire/Burn Area	April 2019	Dec 2020	Mar 2020		Mar 2020	
Soil Moisture	April 2019	working on it	Feb 2019	Sept 2019	Sept 2019	Dec 2020
Phenology	April 2019	July 2020		April 2020		
Snow Cover	April 2019	Dec 2020			Oct 2019	
Vegetation Index	Sept 2019	Dec 2020	Sept 2019	May 2019	May 2019	
Biomass	April 2019	Mar 2020	April 2019	April 2019	Oct 2019	Sept 2020

Focus Area Reports

- Vegetation Indices
- Snow
- Biomass
- Land Cover
- Biophysical (LAI/FAPAR)
- Fire/Burn Area
- LST&E
- Surface radiation
- Phenology
- Soil Moisture

Vegetation Indices

- Copernicus LMS released a BRDF-normalized NDVI 300m product based on Sentinel-3 (in demonstration mode). This is an NRT data set starting on July 2020. Backprocessing is foreseen till January 2019. Validation is starting this month (by VITO) on a test data set of 1 year (June 2018 – July 2019).
- Copernicus LMS will release next week a BRDF-normalized NDVI 1 km product based on SPOT-VGT and PROBA-V, spanning the period 1999 – 06/2020. A paper is in preparation.
- Upon these releases, the CEOS LPV VI-products website will be reviewed again.
- Validation of the Sentinel-2 based NDVI @10m covering Europe is ongoing.
- JPSS VI products have been released (regional at 1km and global at 4 km). Upon the release of this newer VI product suite, JPSS VI EDR is no longer in production.

Snow (1/2)

- New Snow Focus Area Co-lead, Simon Gascoin

- Information on current regional to global scale snow product availability (all countries) that includes snow cover, snow depth, and snow water equivalent has been updated and will soon be available on the website

- New focus area leads are planning to promote LPV-Snow Focus Area through outreach and communication, and work to continue increasing CEOS presence in international snow activities/initiatives – goal is to promote new interest and community involvement in reviewing and contributing to the Snow Focus web content where relevant and appropriate

Snow 2/2

EEA Copernicus High Resolution Snow Extent Services:

- Sentinel-2 (20m, near real time; Europe) snow products were released in 2020
- Wet snow extent from S1 for HR FSC snow layer: development and implementation of service started (prototype planned by Q3/Q4 2021).

Third Satellite Snow Product Validation and Intercomparison Exercise (SnowPEx) planning and coordination underway;

- Building on ISSPI-1/2 from 2015-2020
- Incorparate new satellites & sensors
- Improved snow algorithms and products
- Will continue work on snow extent trends
- ISSPI-3 planned for Q3 2021 in Alpbach, Austria pending COVID-19 status and maybe move to virtual format

Above Ground Biomass

- CEOS biomass protocol in final revision before endorsement in March at CEOS Plenary this Spring
- Linking biomass focus area activities to the AFOLU (Agriculture, Forestry & other land use) CEOS effort in support of the UNFCCC Global Stock Take
- GEDI biomass products are expected to be released in next few months (likely Feb or March)

Land Cover (1/2)

- Global LC products validation
  - Copernicus Climate Change Service
    Annual update for 300-m global land cover map (2019), in addition to the time series spanning 1992-2018
  - Copernicus Global Land Service – Version 3.0
    Annual updates for 100-m global land cover maps (2015-2019)

  Both products validated according to CEOS Stage 4

3	Uncertainties in the product and its associated structure are well quantified over a significant (typically > 30) set of locations and time periods representing global conditions by comparison with reference in situ or other suitable reference data. Validation procedures follow community-agreed-upon good practices. Spatial and temporal consistency of the product, and its consistency with similar products, has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature.
4	Validation results for stage 3 are systematically updated when new product versions are released or as the interannual time series expands. When appropriate for the product, uncertainties in the product are quantified using fiducial reference measurements over a global network of sites and time periods (if available).

- Website update in progress (reference and products)

Land Cover

Special session @IGARSS 2021 (Brussels, July 2021)

CEOS Land Product Validation: Sampling-based estimation of area and accuracy for Land Cover products

- P. Olofsson (Boston Univ.): 'Good practices for estimating area and assessing accuracy of land cover and land cover change products'
- E. Bullock (Boston Univ.): 'Assessment framework for tropical forest disturbance'
- R. d'Andrimont (JRC): 'LUCAS Copernicus 2018: Earth Observation relevant in-situ data on land cover throughout the European Union'
- C. Lamarche (UCLouvain): 'Protocol design for classification algorithms benchmarking and validation for global land cover maps in the Copernicus Climate Change Service and ESA CCI Land Cover High and Medium Resolution '
- J. phillipson (Univ. Lancaster): 'Uncertainty quantification in classification problems

Abstract submission deadline: 25th January

Fire Disturbance (1/2)

Burned area product : Copernicus Climate Change Initiative (CCI)

- Sentinel-3 OLCI burned area (released November 2020)
  - 300m and 0.25° datasets
  - Daily temporal resolution
  - 2017 to present
  - Preliminary validation against globally distributed Landsat scenes

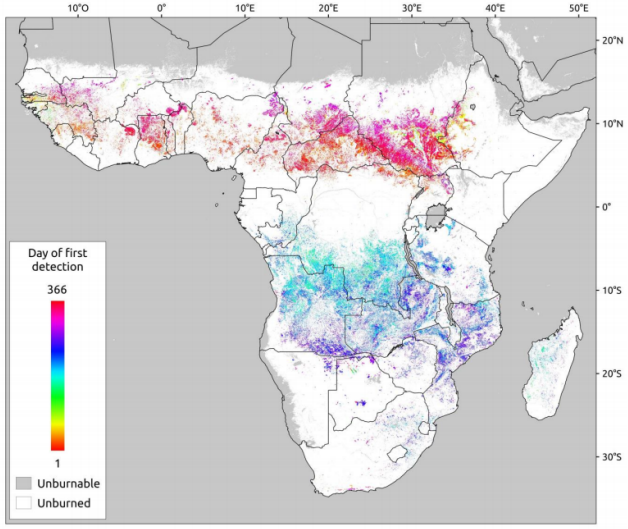
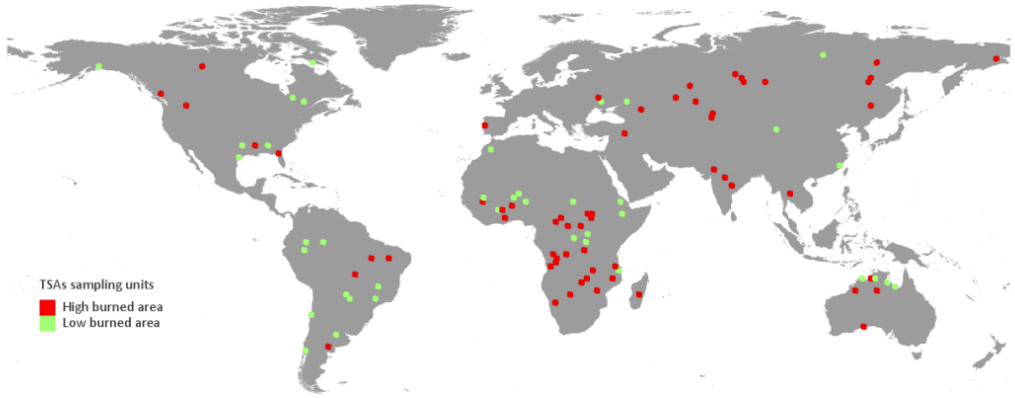


Figure 1: Day of detection for Area 5 (Sub-Saharan Africa) for the year 2018, derived from the pixel product.

http://datastore.copernicus-climate.eu/documents/satellite-fire-burned-area/D3.3.15-v1.0_PUGS_CDR-ICDR_BA_SENTINEL3_v1.0_PRODUCTS_v1.0.1.pdf

Remote Sensing Special Issue

- **"Remotely Sensed Estimates of Fire Radiative Energy"**
  - Uncertainty analysis
  - Product validation
  - Inter-sensor comparisons of FRP/FRE approximation
- Deadline – February 2022



http://datastore.copernicus-climate.eu/documents/satellite-fire-burned-area/D2.2.15-v1.0_PQAD_CDR-ICDR_BA_SENTINEL3_v1.0_PRODUCTS_v1.2.pdf

Fire Disturbance (2/2)

Recent Publications

Active fire :

- Li, F., Zhang, X., Kondragunta, S., Schmidt, C.C. and Holmes, C.D., 2020. A preliminary evaluation of GOES-16 active fire product using Landsat-8 and VIIRS active fire data, and ground-based prescribed fire records. *Remote Sensing of Environment*, *237*, p.111600.
- Xu, W., Wooster, M.J., He, J. and Zhang, T., 2020. First study of Sentinel-3 SLSTR active fire detection and FRP retrieval: Night-time algorithm enhancements and global intercomparison to MODIS and VIIRS AF products. *Remote Sensing of Environment*, *248*, p.111947.

Burned Area :

- Campagnolo, M.L., Libonati, R., Rodrigues, J.A. and Pereira, J.M.C., 2021. A comprehensive characterization of MODIS daily burned area mapping accuracy across fire sizes in tropical savannas. *Remote Sensing of Environment*, *252*, p.112115.
- Franquesa, M., Vanderhoof, M. K., Stavrakoudis, D., Gitas, I. Z., Roteta, E., Padilla, M., and Chuvieco, E., 2020. Development of a standard database of reference sites for validating global burned area products. *Earth System Science Data*, 12, 3229–3246.
- Pessôa, A.C.M., Anderson, L.O., Carvalho, N.S., Campanharo, W.A., Junior, C.H.L.S., Rosan, T.M., Reis, J.B.C., Pereira, F.R.S., Assis, M., Jacon, A.D., Ometto, J.P., Shimabukuro, Y.E., Silva, C.V.J., Pontes-Lopes, A., Morello, T.F., and Aragão, L.E.O.C., 2020. Intercomparison of Burned Area Products and Its Implication for Carbon Emission Estimations in the Amazon. *Remote Sensing*, 12, 3864.
- Valencia, G. M., Anaya, J. A., Velásquez, E. A., Ramo, R., and Caro-Lopera, F. J., 2020. About Validation-Comparison of Burned Area Products. *Remote Sensing*, 12, 3972.

Biophysical

- Updated biophysical focus area web pages.
  - MODSI, MISR links updated
  - GLOBMAP, data link in English underway
- New GCOM-C LAI/FAPAR products available (V2.0, 250 m, Jun 2020) https://suzaku.eorc.jaxa.jp/GCOM_C/data/product_std.html
- Meetings
  - IGARSS'21, Jul 11-16, 2021 (Paper submission deadline Jan 25, 2021).
  - ISPRS, Nice, France, Jul 4-10, 2021.
  - RAQRS 6th, Univ. of Valencia, Spain. Sep 20-24, 2021.
  - EO for agriculture under pressure conclusions (5-9th October)
- Articles

  Amin, E., Verrelst, J., Rivera-Caicedo, J.P., Pipia, L., Ruiz-Verdú, A., & Moreno, J. (2020). Prototyping Sentinel-2 green LAI and brown LAI products for cropland monitoring. *Remote Sensing of Environment*, 112168, https://doi.org/10.1016/j.rse.2020.112168

LST&E (1/4)

COVID-19 and conferences

- AGU Fall meeting**, 7-11 Dec 2020: Virtual**
  - **Temperature Session: Taking the Temperature of the Earth**

- ECOSTRESS science and applications team meeting, **Dec 1, 2020, virtual**

https://ecostress.jpl.nasa.gov/events/ecostress-science-and-applications-team-meeting-1

- IGARSS Conference 2021: **Jul 11 - 16, Brussels, Belgium**

- EUMETSAT Conference 2021: **Sep 20-24, Bucharest, Romania**

- 6th Recent Advances on Quantitative Remote Sensing (RAQRS) Conference: **Sep 20-24, 2021, Valencia (Torrent), Spain**

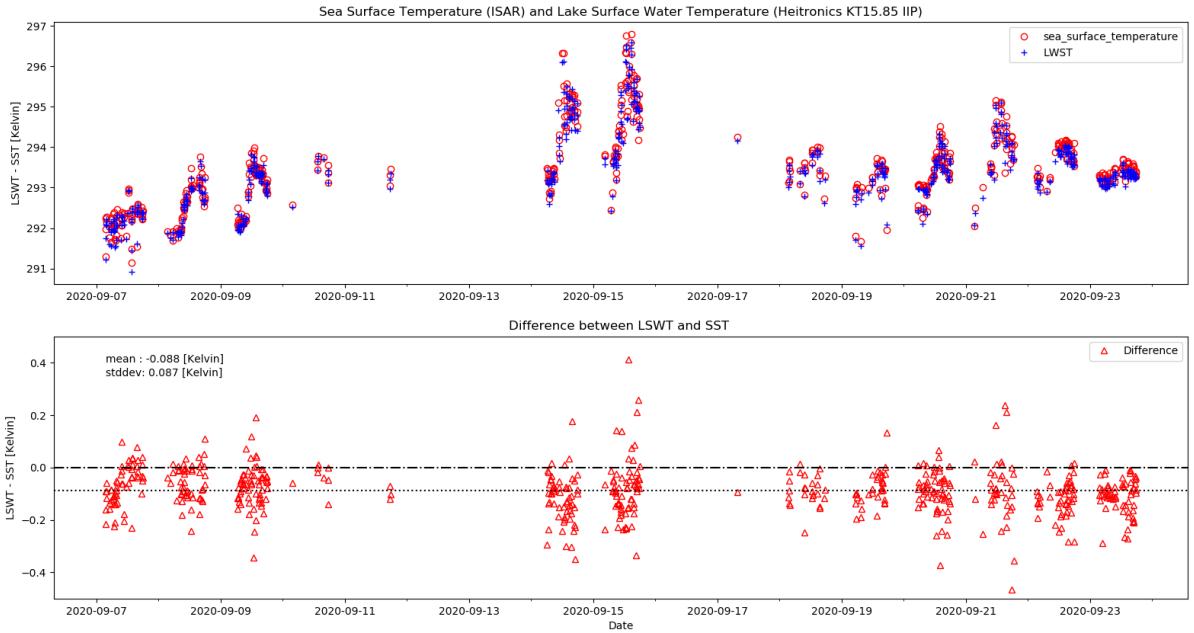
LST&E (2/4)

Lake Constance inter-comparison

EUMETSAT

Heitronics KT15.85 and ISAR onboard *BSB Friedrichshafen.*

<u>Difference in-situ ST KT15.85 – ISAR:</u>
Bias = -0.09 K
Stddev = 0.09 K



LST&E (3/4)

Landsat LST validation activities

- Conduct a validation ‘round-robin’ at JPL:
  - Thermal radiometers from JPL, ASU, RIT
  - JPL blackbodies, chambers, and water baths
- Conduct additional measurements during Landsat under-flights at field sites:
  - March-May 2021
  - Railroad valley, Algodones dunes
  - Lake Tahoe, Salton sea, Tonzi ranch, Russell Ranch
- Establish protocols for Landsat 9 checkout and validation

LST&E (4/4)

Recent LST&E publications

- J. Ma et al. (2020), A global long-term (1981–2000) land surface temperature product for NOAA AVHRR. Earth System Science Data, doi: 10.5194/essd-12-3247-2020

- Langsdale, et al. (2020), Inter-Comparison of Field- and Laboratory-Derived Surface Emissivities of Natural and Manmade Materials in Support of Land Surface Temperature (LST) Remote Sensing. Remote Sensing, doi: 10.3390/rs12244127

  → Emissivity differences for field and laboratory methods

- Hulley et al. (2020), Validation and quality assessment of the ECOSTRESS level-2 land surface temperature and emissivity product, Rem. Sens. Environ, in review.

- Loveless et al. (2020), The Combined ASTER MODIS Emissivity Over Land (CAMEL) Version 2 Climatology, Remote Sens. 2021, 13, 111, https://doi.org/10.3390/rs13010111.

Surface Radiation

Past meetings

- 25 November 2020 - Workshop on Artificial Intelligence / Machine Learning Methods and Cloud Computing - SAF/EUMETSAT workshop

- 3-4 December 2020 - Workshop Albedo & climate change mitigation – This workshop is organized by CIRAD and the CLAND Convergence Institute, with the support of the Global Research Alliance on Agricultural Greenhouse Gases and the 4 per Thousand Initiative. Presentations available online: http://albedocc.lsce.ipsl.fr/index.php/presentations and https://youtu.be/-6cEvogumw8?t=1274

Code Development

Development of open source code for surface albedo retrieval.

New BSRN albedo working group

A vote with the BSRN community indicated a clear interest in the establishment of an albedo working group.

Articles

- Carre et al., *Surface albedo retrieval from 40-years of Earth observations through the EUMETSAT/LSA SAF and EU/C3S programmes: the versatile algorithm of Pyalus* (Submitted to Remote Sensing)

Land Surface Phenology (1/3)

New review papers published:

- Caparros-Santiago, V.; Rodriguez-Galiano, V. & Dash J. Land surface pehnology as indicator of global terrestrial ecosystem dynamics: a systematic review. ISPRS Journal of Photogrammetery and Remte Sensing"

ISPRS Journal of Photogrammetry and Remote Sensing 171 (2021) 330–347

Contents lists available at ScienceDirect

ISPRS Journal of Photogrammetry and Remote Sensing

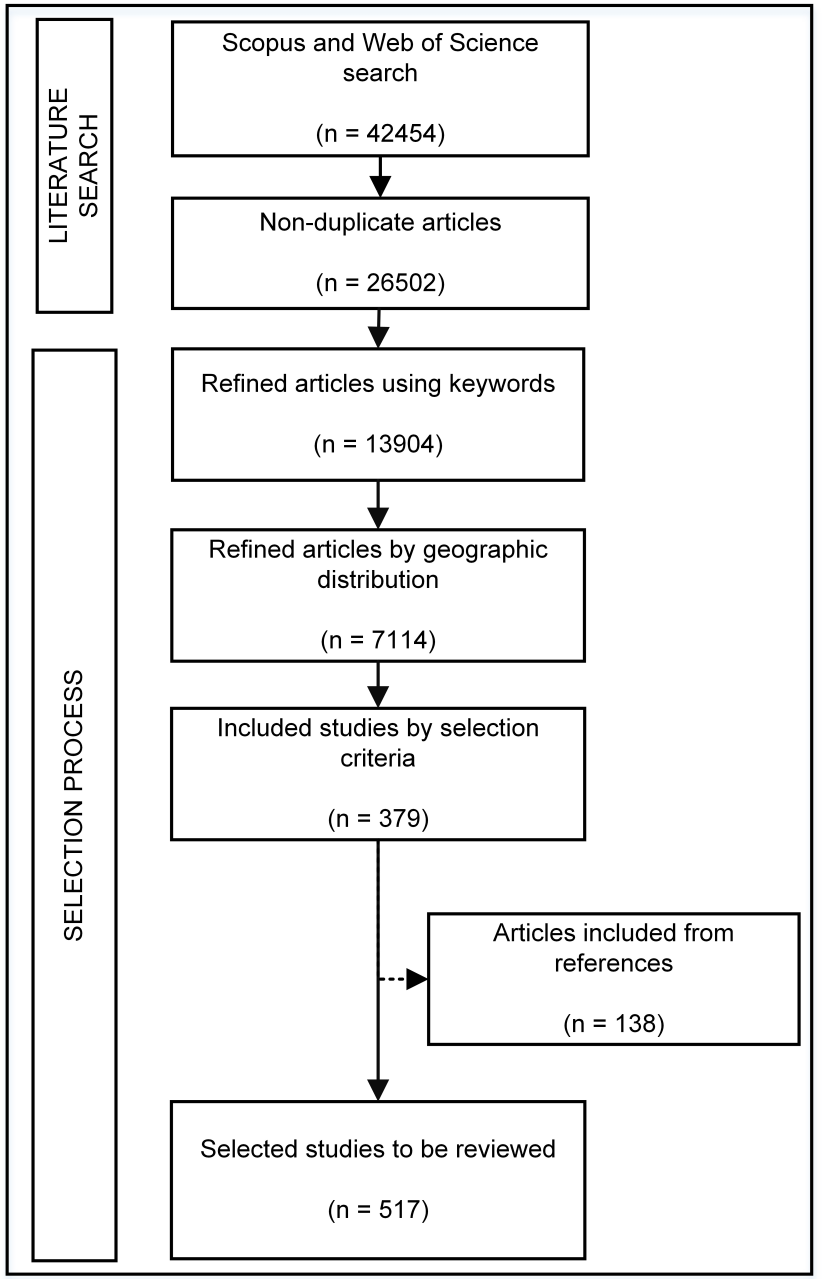
journal homepage: www.elsevier.com/locate/isprsjprs

Review Article

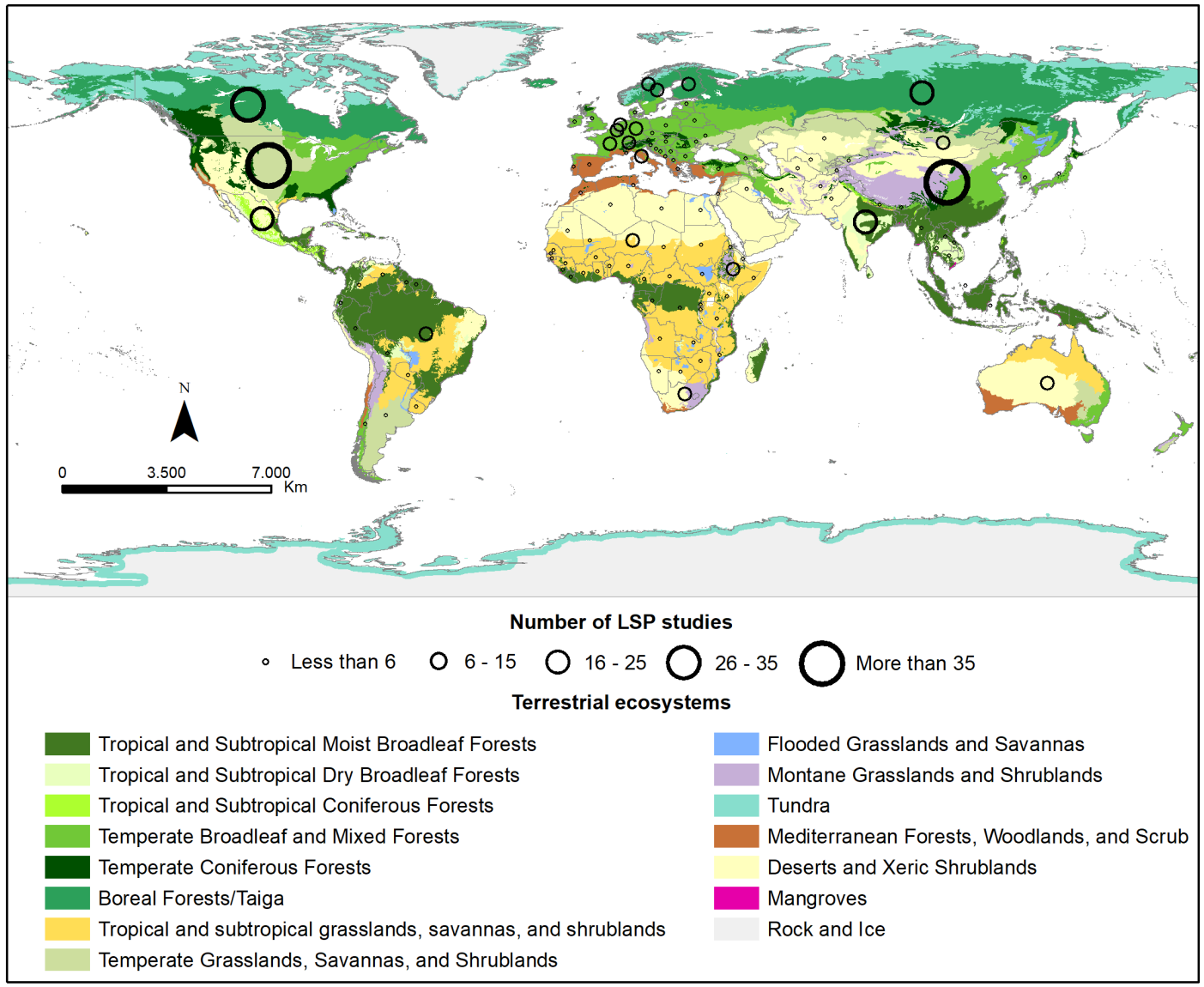
Land surface phenology as indicator of global terrestrial ecosystem dynamics: A systematic review

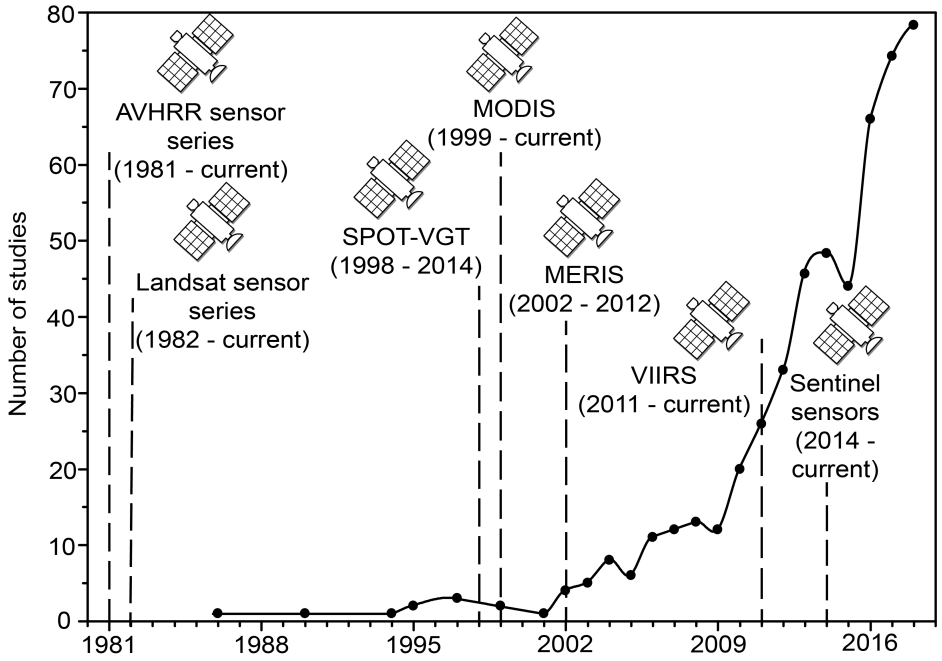
Jose A. Caparros-Santiago [a], Victor Rodriguez-Galiano [a,*], Jadunandan Dash [b]

[a] Departamento de Geografía Física y Análisis Geográfico Regional, Universidad de Sevilla, Seville 41004, Spain
[b] School of Geography and Environmental Science, University of Southampton, Southampton SO17 1BJ, United Kingdom

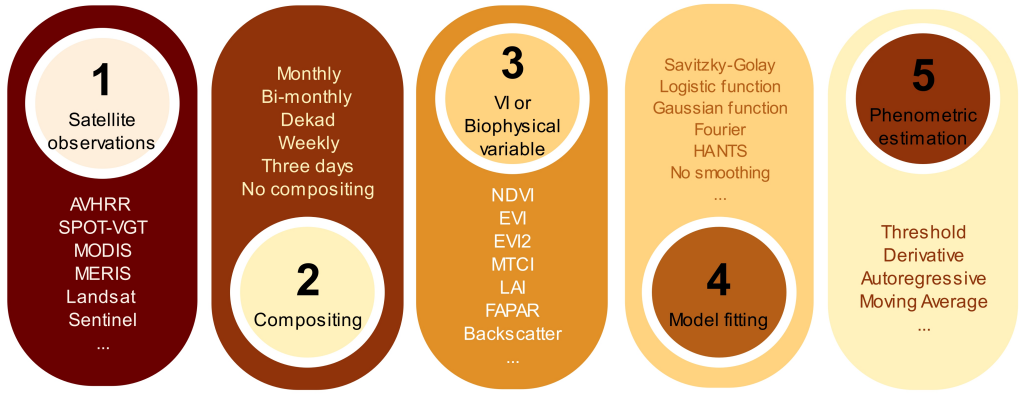


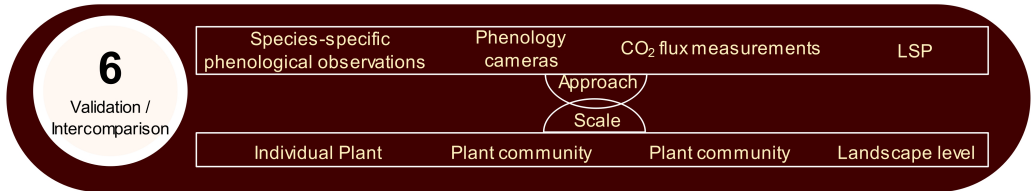
Land Surface Phenology (2/3)

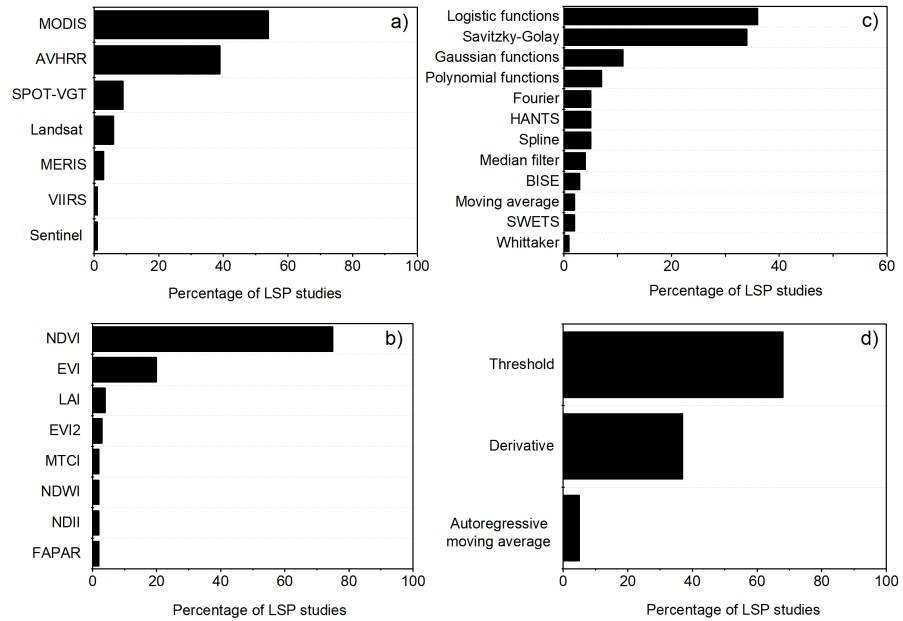




Land Surface Phenology (3/3)







References	Study area	Study period	Satellite data	SOS	EOS
Julien and Sobrino (2009)	Global	1982-2003	AVHRR	-0.38	0.45
Julien and Sobrino (2009)	Eurasia	1982-1999	AVHRR	-0.293	0.156
Julien and Sobrino (2009)	North America	1982-1999	AVHRR	-0.121	0.363
Zhou et al. (2001)	Eurasia	1982-1999	AVHRR	-0.36	0.6
Zhou et al. (2001)	North America	1982-1999	AVHRR	-0.42	0.2
Jeong et al. (2011)	Northern Hemisphere	1982-1999	AVHRR	-0.29	0.238
Jeong et al. (2011)	Northern Hemisphere	2000-2008	AVHRR	-0.022	0.255
Zeng et al. (2011)	Eurasia (≥60º N)	2000-2010	MODIS	-0.27	0.35
Zeng et al. (2011)	North America (≥60º N)	2000-2010	MODIS	-1.15	0.22
Zhang et al. (2014)	North American tundra	1982-1999	AVHRR	-0.25	0
Zhang et al. (2014)	North American tundra	2000-2010	MODIS	-0.68	-0.03
Park et al. (2016)	> 45º N	1982-2014	AVHRR	-0.161	0.067
Jeganathan et al. (2014)	> 45º N	1982-2006	AVHRR	-0.58	0.64
Stöckli and Vidale (2004)	Europe	1982-2001	AVHRR	-0.54	0.42
Zhu et al. (2012)	North America	1982-2006	AVHRR	-0.132	0.551
Piao et al. (2006)	China	1982-1999	AVHRR	-0.79	0.37
Cong et al. (2013)	China	1982-2010	AVHRR	-0.13	-

Soil Moisture

News:

- High resolution (1km) Soil Moisture was integrated within the USDA NASS's Crop Condition and Soil Moisture Analytics (Crop-CASMA) system and the USDA FAS Crop Assessment tool. Led by Rajat Bindlish (NASA GSFC).

Workshops:

- 6th Satellite Soil Moisture Validation and Application Workshop, postponed to autumn 2021, Perugia, Italy (now planned to be in person and virtual). Details TBD.
- SMOS for Climate symposium, postponed to 9-11th March 2021 at the Eden project, UK, was recently canceled
- 7th Satellite Soil Moisture Validation and Application Workshop, Fall 2022, New Orleans, USA