Land Product Validation (LPV) Sub-group Meeting

Michael Cosh – (USDA) –Chair
Fabrizio Niro – (ESA/ESRIN) – Vice Chair

Subgroup meeting
05 Apr 2022

NEXT LPV TELECON 07 Jun 2022

Attendance

Participants

Michael Cosh

Fabrizio Niro

Jaime Nickeson

Zhuosen Wang

Gareth Roberts

John Bolten

Carsten Montzka

Louis Giglio

Sylvain Leblanc

Frank Göttsche

Sasha Tyukavina

Hongliang Fang

Simon Gascoin

Marie Weiss

Glynn Hulley

Laura Duncanson

Chris Crawford

Joshua Gray

Else Swinnen

Not attending

Dominique Carrer

Victor Rodríguez-Galiano

Sophie Bontemps

Tomoaki Miura

John Armston

Mat Disney

WORKING GROUP ON CALIBRATION & VALIDATION

CEOS

Proposed agenda items

- Welcome
- LPV Chair Transition
- LPV Work Plan
- Focus Area Web Status
- Focus Area Reporting

CEOS LPV Chair transition

Thanks for your participation in the poll to approve our candidate for the vice-chair role.

- Announcing Fabrizio Niro, of ESA, as new Vice Chair of LPV. Fabrizio will Lead LPV in the 2025-2028 time frame.

- Welcome Fabrizio! Please introduce yourself.

CEOS LPV

Meetings

- WGCV 50 was held March 22-25, 2022, Virtual

- Living Planet Symposium, May 23-27, 2022
  https://lps22.esa.int/

- WGCV 51 will be this October 2-4, 2022, in Tokyo, Japan

CEOS WGCV Plenary

WGCV – 50 - Virtual

March 22
- Chair's Report
- Action Review
- WGCV Vice Chair Nomination
- Subgroup Reports (LPV, IVOS)
- SRIX 4Veg
- ISO Standards

March 23
- Subgroup Reports (MSSG, ACSG)
- ACIX / CMIX
- RadCalNet
- Greenhouse Gas Cal/Val Update

March 24
- Subgroup Reports (SAR, TMSG)

- SARCalNet
- DEMIX
- Terminology and common online dictionary
- CEOS ARD Update

March 25
- CNES CEOS Chair Priority on a Land Surface Temperature Protocol
- GSICS
- WGCV activities in the CEOS Work Plan
- TRUTHS, CLARREO, Chinese SITSAT updates
- WGCV-51

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!

Product lists are now up to date.

Focus Area	Home Page	Product table	Collaboration Page	References	Listserv	Letters to Community
Land Cover	May 2021	Jan 2021	May 2021	**Sep 2021**	Oct 2019	
Biophysical LAI/Fpar	**Nov 2021**	**Nov 2021**	**Nov 2021**	**Sep 2021**	Oct 2019	Sept 2019
Surface Rad/Albedo	Mar 2021	**Nov 2021**	Mar 2021	Dec 2019	May 2020	May 2020
LST/Emissivity	Mar 2021	**Nov 2021**	Mar 2021	April 2019	April 2019	
Fire/Burn Area	May 2021	Dec 2020	Mar 2020	**Jan 2022**	Mar 2020	
Soil Moisture	Mar 2021	Feb 2019	Mar 2021	Mar 2021	Dec 2020	Dec 2020
Phenology	Apr 2021	July 2020	Apr 2021	April 2020		
Snow Cover	**Oct 2021**	Jan 2021	**Oct 2021**	**Oct 2021**	Oct 2019	
Vegetation Index	May 2021	**Nov 2021**	May 2021	May 2021	May 2019	
Biomass	Apr 2021	**Oct 2021**	Apr 2021	Apr 2021	Sep 2020	Sept 2020

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CEOS

Focus Area Reports

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

Fire Disturbance (1/3)

Product Update

- China Meteorological Administration
- Global Fire Spot Monitoring (GFR)
- Fire detections provided by the Fengyun (FY) series of LEO satellites
    - FY-3D uses the improved Medium Resolution Spectral Imager (MERSI-2)
    - Data available from 2017 – present; daily data at 0.01°
        - http://satellite.nsmc.org.cn/portalsite/default.aspx

Meetings

- GOFC Fire Implementation Team meeting + thematic fire workshop
  - 21– 23 June 2022 in Stresa, Italy
  - Primary goal of validation session will be to reach consensus on unresolved issue(s) and solicit assistance with writing
    - FireCCI "long" validation units
    - BARD usage recommendations?

Recent Publications (Active Fire)

- Chen, J., Yao, Q., Chen, Z., Li, M., Hao, Z., Liu, C., Zheng, W., Xu, M., Chen, X., Yang, J. and Lv, Q., 2022. The FY-3D Global Active Fire product: Principle, Methodology and Validation. *Earth System Science Data Discussions*,1-32.

- Coskuner, K. A., 2022. Assessing the performance of MODIS and VIIRS active fire products in the monitoring of wildfires: a case study in Turkey. *Forest-Biogeosciences and Forestry*, 15(2), 85.

Fire Disturbance (3/3)

Recent Publications (Burned Area)

- Katagis, T. and Gitas, I.Z., 2022. Assessing the Accuracy of MODIS MCD64A1 C6 and FireCCI51 Burned Area Products in Mediterranean Ecosystems. *Remote Sensing, 14*(3), 602.

- Zhang, S., Zhao, H., Wu, Z., & Tan, L., 2022. Comparing the ability of burned area products to detect crop residue burning in China. *Remote Sensing*, 14, 693.

- Giglio, L., and Roy, D. P., 2022. Assessment of satellite orbit-drift artifacts in the long-term AVHRR FireCCILT11 global burned area data set. *Science of Remote Sensing*, 5, 100044.

LST & Emissivity (1/3)

Conferences

- International Earth Surface Working Group (IESWG) Workshop: **Apr 05-07, 2022, fully virtual, hosted by Finnish Meteorological Institute (FMI)**

- ECOSTRESS Science and Applications team meeting**, April 12-14, 2022**

- ESA Living Planet Symposium (LPS): **May 23-27, 2022, Bonn, Germany**

- Int. Radiation Symposium (IRS) 2022: **Jul 4-8, 2022, Thessaloniki, Greece**

- EUMETSAT Meteorological Satellite Conf.: **Sep 19-23, Brussels, Belgium**

- 6th Recent Advances on Quantitative Remote Sensing (RAQRS) Conf.: **Sep 19-23, 2022, Valencia (Torrent), Spain**

LST & Emissivity (2/3)

- LSA SAF (EUMETSAT): LST validation station at Gobabeb, Namibia operates nominally; however, still irregular data transmission (internet issues)

- ESA LST_cci Phase 1 has been completed; **Phase 2** started on 1st of Jan 2022 and has 'a key objective to improve the current suite of LST ECV Products, and produce new LST ECV Products.

- Copernicus LAW, Sentinel-3: five new LST validation stations are now operational.

- ECOSTRESS collection 2 (build 7) improved LST&E products in early 2022. First products released as beta (7.1) to first adopter users, followed by full release to LPDAAC.

- Landsat 8 and 9 underflight cal/val underway by TIR validation teams at dedicated sites. Landsat 9 orbit was directly below Landsat 8 for several days in November giving unique opportunity for intercalibration.

CEOS

European ECOSTRESS Hub (EEH) LST Evaluation

- Temperature and Radiance based validation and comparison with NASA L2 LST, EEH LST (two algorithms).

- Intercomparison at 9 sites over different biomes (KIT, GCU, ICOS) show in general good agreement with RMSE's less than 2 K.
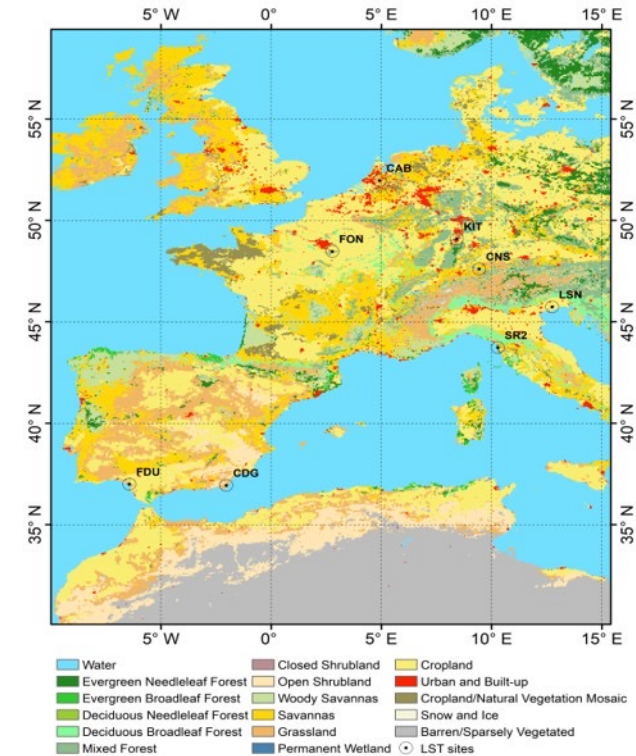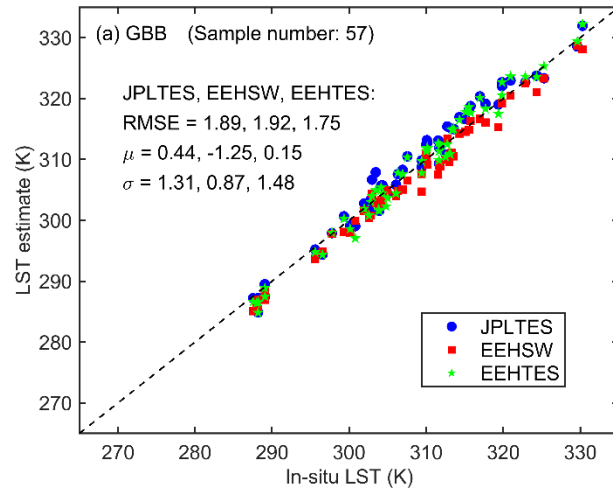
GCOS requirements specific to CC adaptation measures. Albedo best practices protocol were set-up based on GCOS requirements from modelling community.

Table 11. Initial Assessments of ECV for adaptation discussed in this chapter (GCOS 2021 status report)

Surface albedo	ECV: Surface Albedo
	Albedo could be used for monitoring extreme events such as heavy snowfall and could detect urban changes for adaptation (linked to the net surface solar radiation heat flux). However, accuracy and stability requirements are only met over vegetated areas.
	The quality of the albedo spatial measurements decreases during the fall and winter. The installation height of standard pyranometers varies from 3 m to 30 m across the Baseline Surface Radiation Network (BSRN).
	Despite accuracy problems, changes and trends in relative values can be used.

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ECV Products and Requirements for Albedo

These products and requirements reflect the Implementation Plan 2016 (**GCOS-200**). GCOS is reviewing and will update the requirements until 2022. More information on: **gcos.wmo.int**.

PRODUCT	DEFINITION	FREQUENCY	RESOLUTION	REQUIRED MEASUREMENT UNCERTAINTY	STABILITY	STANDARDS/ REFERENCES
Maps of directional hemispherical reflectance (DHR) albedo for adaptation	Albedo without diffuse irradiance component.	Daily	50m	max(5%; 0.0025)	max(1%; 0.001)	
Maps of bi-hemispherical reflectance (BHR) albedo for adaptation	Albedo with isotropic illumination only (white-sky)		50m	max(5%; 0.0025)	max(1%; 0.001)	
Maps of DHR albedo for modelling	Albedo without diffuse irradiance component.	Daily	200/500m	max(5%; 0.0025)	max(1%; 0.001)	
Maps of BHR albedo for modelling	Albedo with isotropic illumination only (white-sky)		200/500m	max(5%; 0.0025)	max(1%; 0.001)	

Do we need to update the best practices protocol documents?

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Surface Radiation (3/3)

BSRN

     1) Circling feedback to extent spectral competences measurements.
     2) Working on renewed request as a GCOS endorsed network.

Recent publications

Li, R., Wang, D., Liang, S., 2021. Comprehensive assessment of five global daily downward shortwave radiation satellite products. Sci. Remote Sens. 4, 100028. doi:10.1016/J.SRS.2021.100028

Land Surface Phenology

Protocol

- All but one of the protocol chapters now have a lead author(s)!
  - Seeking a lead for inherent error chapter
- Currently determining in-common guidance/items across chapters:
  - Questions that each chapter must answer
  - Chapter outline/template
  - Common set of sites (inheriting from CEOS super sites, but including others)
  - Shared terminology with precise definitions and the statistical methods to determine them (e.g. how to calculate bias)
- Expecting final document by end of 2022

Not Protocol

- New validation activity: Gray, Zhang, et al geostationary LSP validation with flux towers (help getting S American flux years)
- MCD12Q2~FLUXNET2015 analysis finally under review at GCB

Special Issue??

Soil Moisture

News:

- International Soil Moisture Network (ISMN) is moving to the International Centre for Water Resources and Global Change (ICWRGC) and the Federal Institute of Hydrology (BfG) in Germany, and new team members were announced

- Soil Moisture School, funded by IEEE GRSS, aims at graduate students, young professionals and earth scientists to learn how to collect and utilize soil moisture resources from in situ and satellite sensors, schedule and content is currently prepared

- Presenting aims and activities of CEOS LPV soil moisture focus area at Soil Moisture Validation and Application Workshop in Perugia

Workshops:

- ESA Living Planet Symposium, 23-27 May 2022, Bonn, Germany

- IEEE GRSS Soil Moisture School (ISMS), 6-7th July 2022, Amherst, USA (https://ieee-grss-soil-school.rsvpify.com)

- 6th Satellite Soil Moisture Validation and Application Workshop, 7-9th June 2022, Perugia, Italy

- World Congress on Soil Science, 31 July - 5 August 2022, Glasgow (https://22wcss.org)

- 7th Satellite Soil Moisture Validation and Application Workshop, Fall 2024?, New Orleans, USA?

Vegetation Indices

Protocol

- Meeting to discuss document and progress (22 March 2022).

- Deadline for first draft (end of April 2022).

- Document is now progressing well.

- List of first small group of reviewers identified.

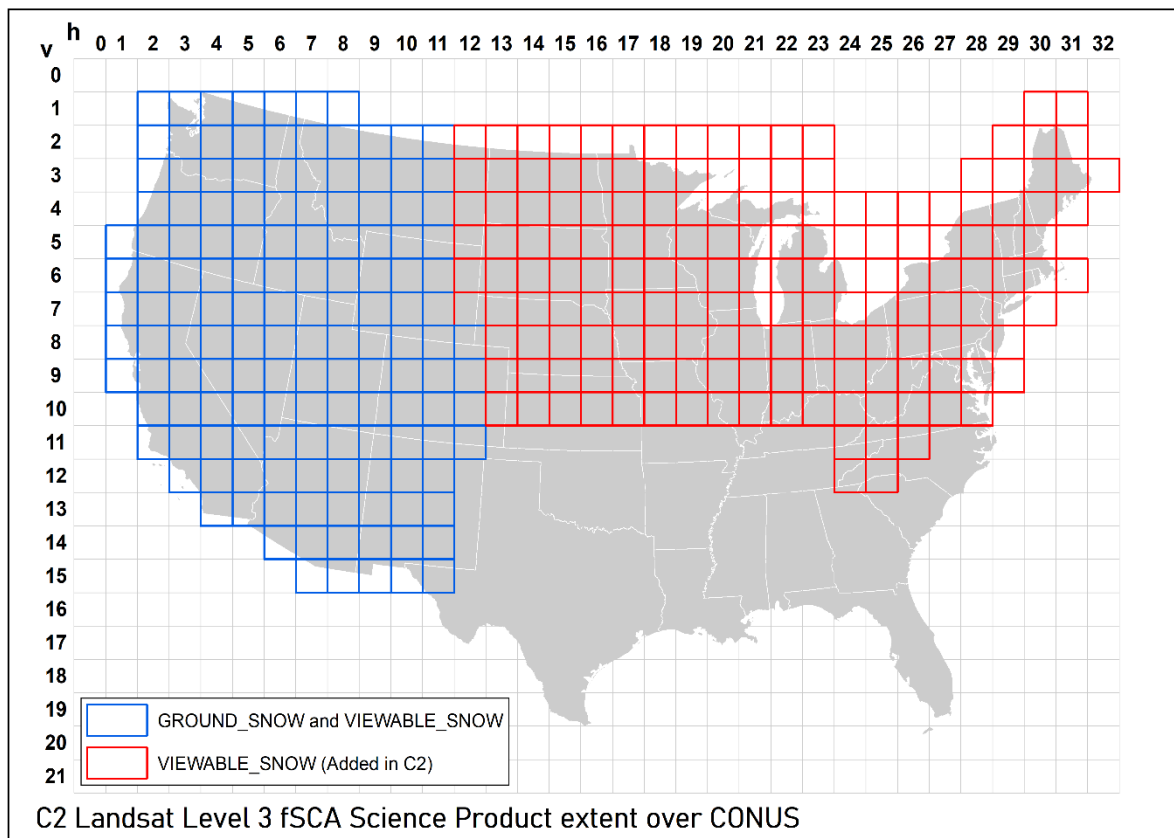- New meeting planned on 26 April 2022 to discuss first full draft

Snow – Landsat 9 and Data Availability

- USGS Collection 2 Landsat 9 Level-1 and Level-2 data products are available as of February 10, 2022

- NOTE: Landsat 9 will be re-processed – likely end of 2022

- Landsat 8 and Landsat 9 are now acquiring more global data than ever before, ~1500 image per day
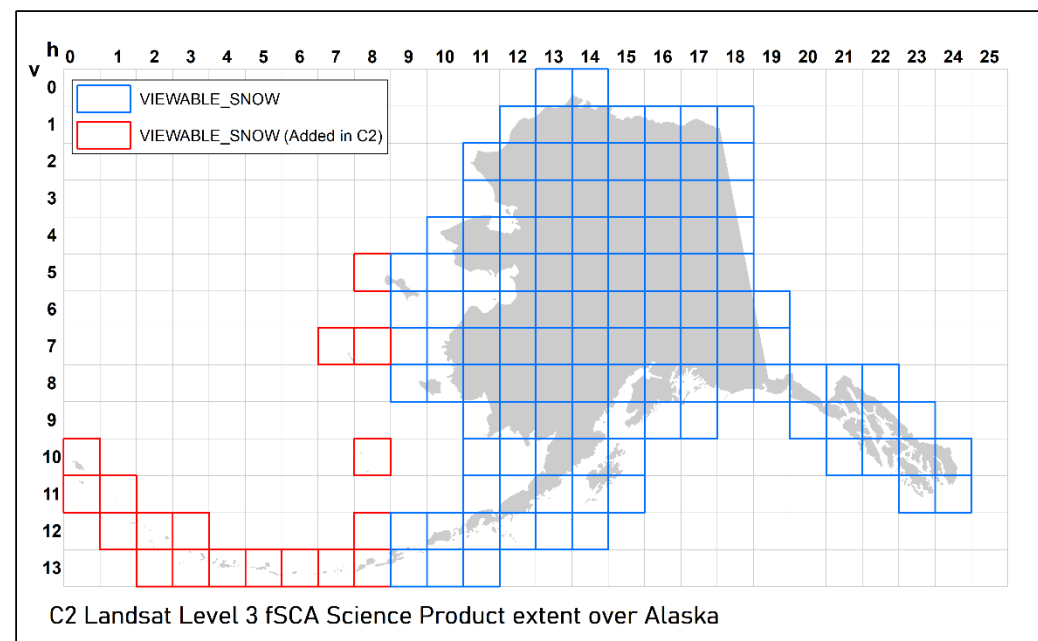
Revisit Frequency (Days)
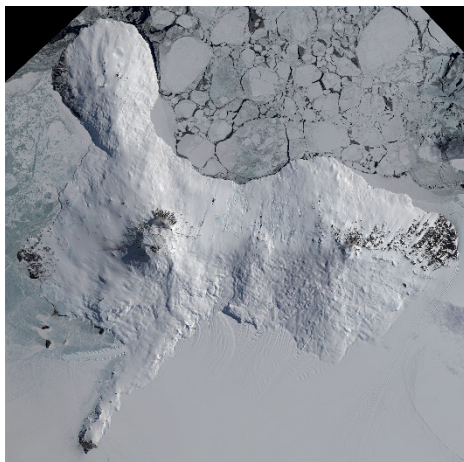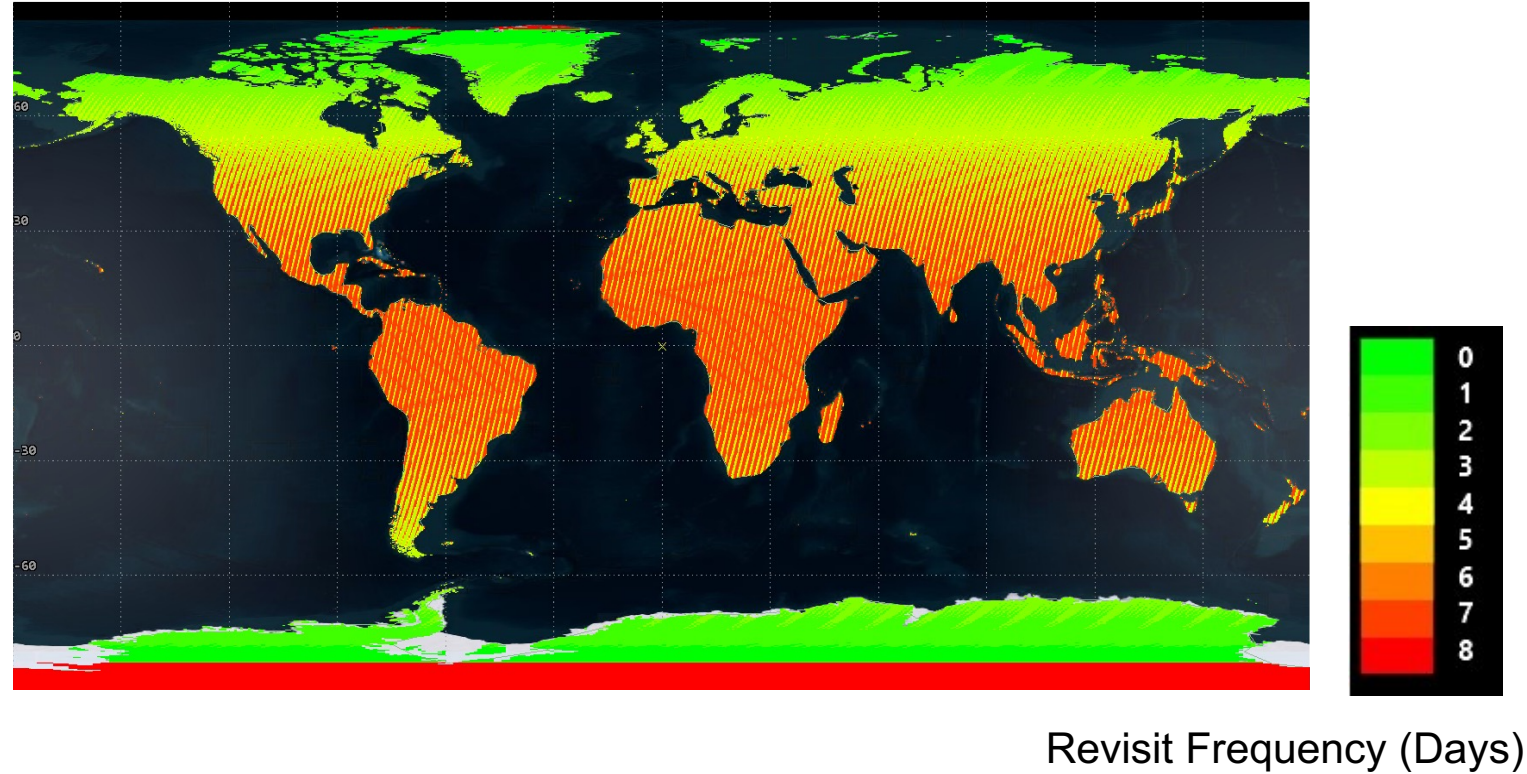
Landsat 9 OLI-2 image over Ross Island, Antarctica on November 10, 2021; source: USGS

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Snow - Landsat Collection 2 fractional Snow-Covered Area (fSCA)

C2 Landsat Level 3 fSCA Science Product extent over CONUS

Legend: GROUND_SNOW and VIEWABLE_SNOW; VIEWABLE_SNOW (Added in C2)

C2 Landsat Level 3 fSCA Science Product extent over Alaska

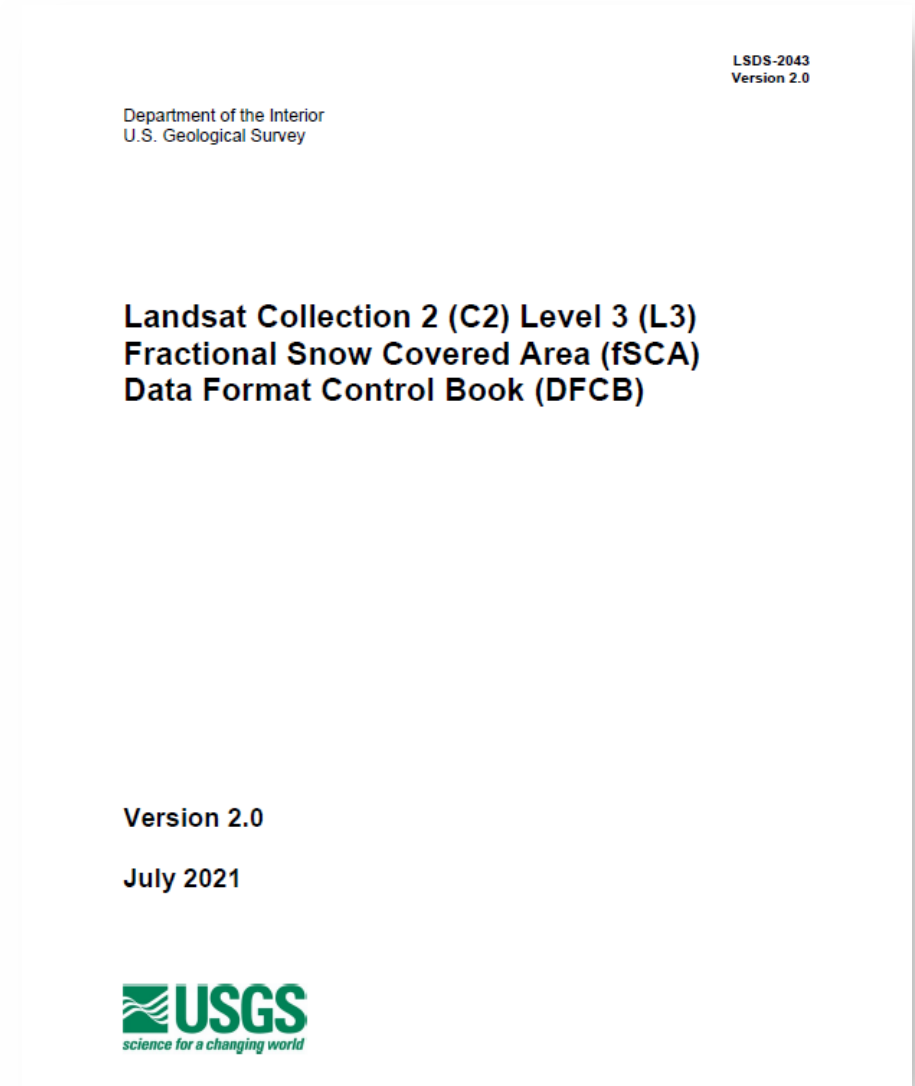Legend: VIEWABLE_SNOW; VIEWABLE_SNOW (Added in C2)

- Includes Landsat 4-8 (1982-present); Landsat 9 will be added down the road
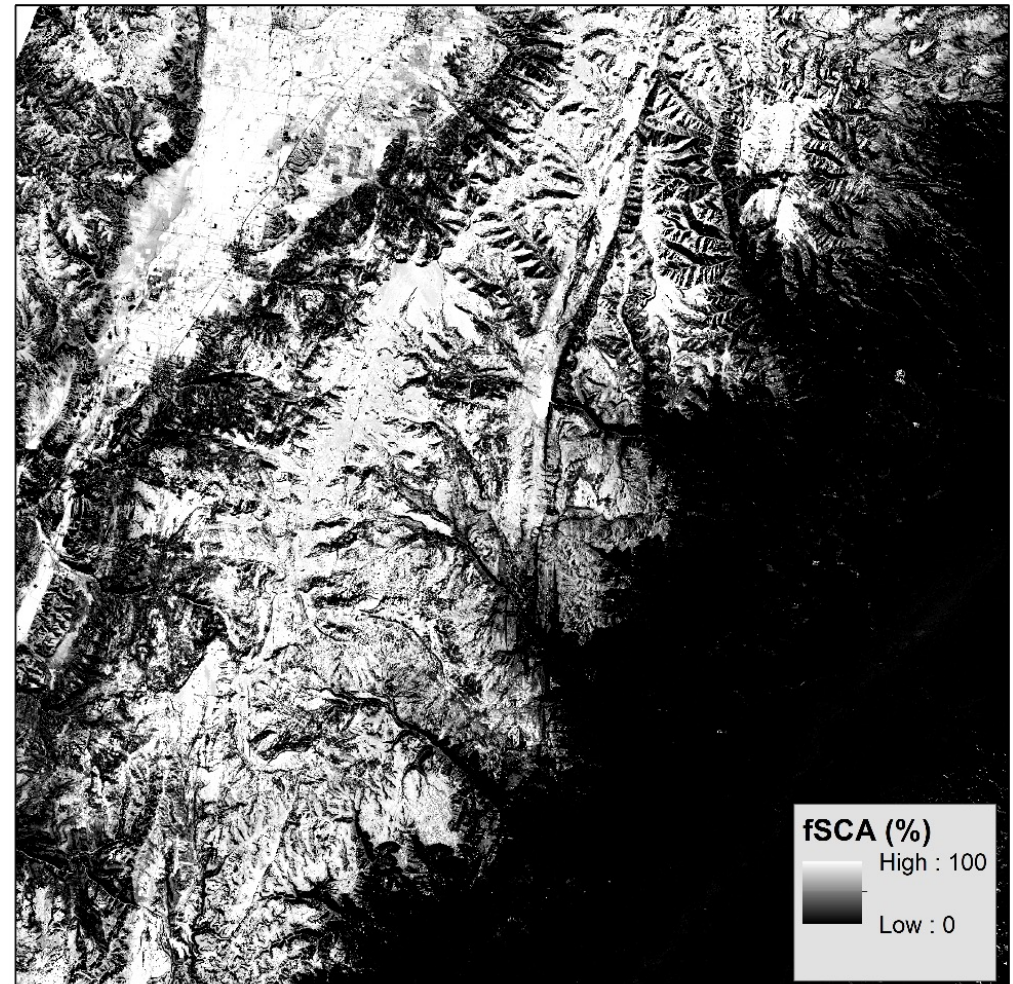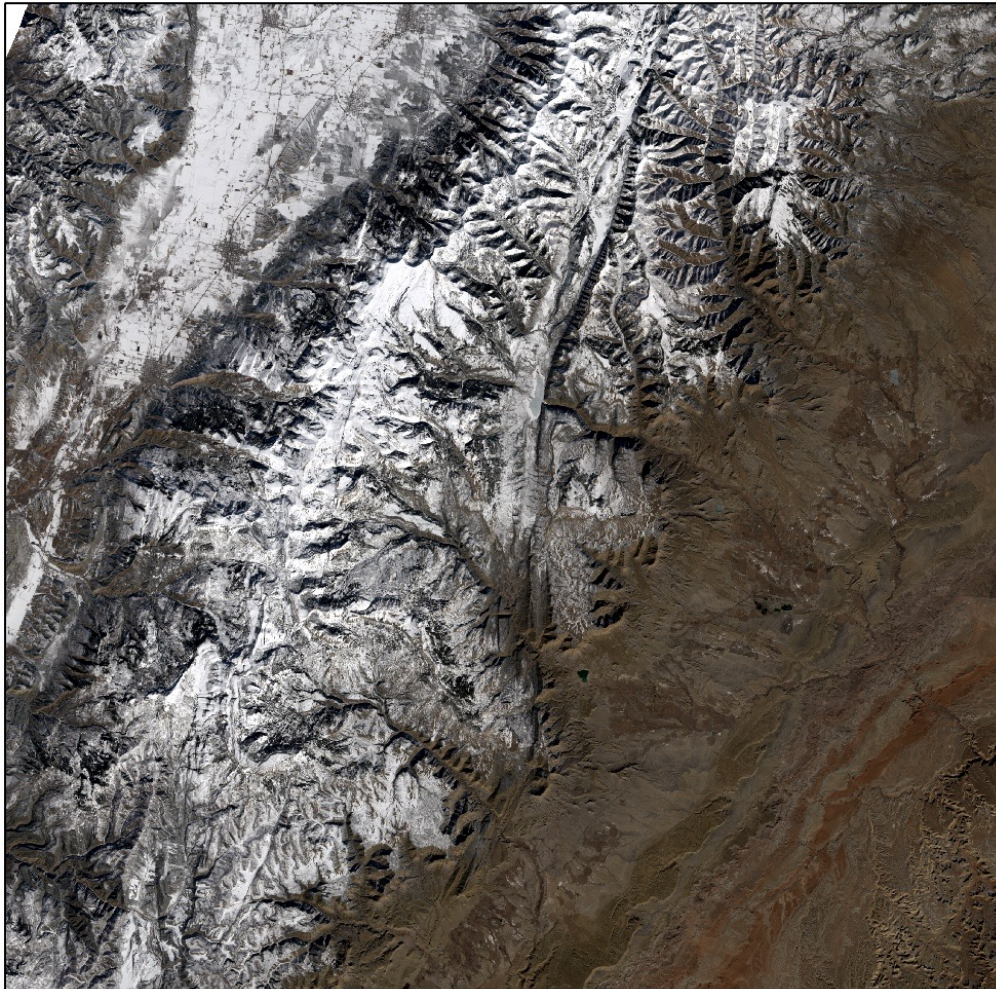
- Uses the Snow Covered Area and Grain Size (SCAG) algorithm (Painter et al. 2003, Rittger et al. 2021)

- Processed in the USGS virtual cloud and available for direct access through US-West AWS S3 bucket

Snow - Landsat Collection 2 fSCA Product Information

- Documentation
  - Data Format Control Book
    https://www.usgs.gov/landsat-missions/landsat-collection-2-level-3-fractional-snow-covered-area-science-product
  - Algorithm Description Document
  - Digital Object Identifier
    - https://doi.org/10.5066/P97ALZ2X

- Landsat Mission Website for Collection 2 Level-3 fSCA went live on March 15, 2022

LSDS-2043
Version 2.0

Department of the Interior
U.S. Geological Survey

Landsat Collection 2 (C2) Level 3 (L3)
Fractional Snow Covered Area (fSCA)
Data Format Control Book (DFCB)

Version 2.0

July 2021

≈USGS
science for a changing world

Snow - Landsat Collection 2 fSCA Product Example

An area in South Tent Mountain, Utah on February 11, 2022.
Left: Landsat 9 C2 U.S. ARD TOA Reflectance; Right: Viewable fSCA
Tile ID: LC09_CU_008009_20220211_20220216_02

Above Ground Biomass (1/2)

Biomass:

- GEDI gridded 1 km product released last week (press release today): https://earthdata.nasa.gov/learn/articles/gedi-l4b-data

- trying to lobby to keep GEDI on orbit, recent Guardian article: https://www.theguardian.com/environment/2022/mar/20/nasa-urged-to-extend-life-of-key-climate-sensor-that-maps-worlds-forests-gedi-aoe

- BRIX2 continues with validation in Gabon

- Tools for biomass validation following biomass protocol being developed for biomass harmonization, BRIX2 and validation of individual products (as Jupyter notebooks)

Above Ground Biomass (2/2)

Pilot projects up taking protocol:

1. FAO West Africa - collecting field and lidar this year, funded by Swedish government

2. World Bank MRV 2.0 in Mozambique (data collected by commercial company following protocol best practices)

These efforts will help lead us into a protocol on biomass change

- Plan for the next version of the Biomass Protocol to include a new chapter on validation of biomass change

  – lead TBD

Land Cover

General updates:

- Working on finalizing the outline of the Land Cover and Change validation guidelines. Next step – inviting potential contributors for each of the chapters.

- Proposal submitted (NASA ROSES 21 under the F2.Topical Workshop call) to fund the joint workshop between CEOS LPV and GEOGLAM on the validation of agricultural land cover products/essential agricultural variables.

    Updated in-person workshop date: early 2023

    Location: University of Maryland

    Workshop co-leads: Sasha Tyukavina (UMD/CEOS LPV), Sophie Bontemps (UCLouvain/CEOS LPV), Chris Justice (NASA Harvest), Alyssa Whitcraft (NASA Harvest), Jaime Nickeson (NASA/CEOS LPV)

Biophysical (1/3)

News

- CEOS LPV updated the DIRECT database (2.1) with new data from China (41 sites), and the ESA FRM4Veg data (2 sites)

- Sylvain is working on establishing a validation group at CCRS next year.

- Joint project to estimate LAI, FAPAR, and FVC from geostationary satellite data, PIs: H. Fang (CAS) and J. Garcia-Haro (UV), submitted to NSFC

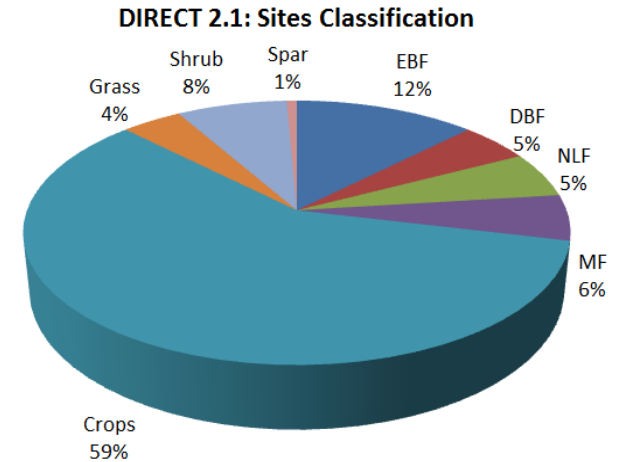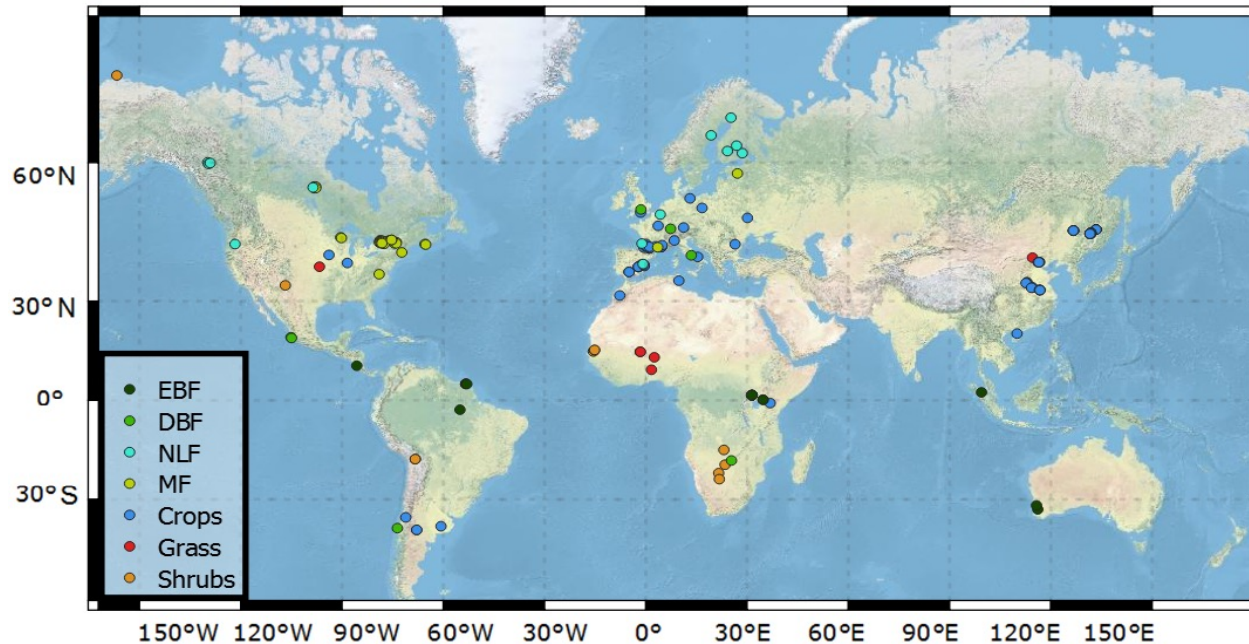- Journal of Remote Sensing (JORS), by the Chinese Academy of Sciences (https://spj.sciencemag.org/journals/remotesensing/)

Conferences

- Living Planet Symposium in Bonn, Germany (May 23-27, 2022)

- International Symposium RAQRS in Torrent, Spain (Sep 21-25, 2022), abstract due May 31, 2022.

LPV DIRECT 2.1

Direct 2.1

DIRECT 2.1: Sites Classification

- **From 2000 to 2021**
- **172 sites (7 main biome types)**
- **284 LAI upscaled values + FAPAR and Fcover data**

Database of LAI and FAPAR upscaled measurements (unique for the validation of CDR since 2000).
44 new sites multitemporal sampling in China (**valLAI_crop** database, **Chinese Academy of Science**) + 2 ESA FRM4Veg sites (with uncertainties)

Proposed to be hosted in CEOS WGCV portal -> Cal/Val Data

Biophysical (3/3)

China's National Standards for the Validation of Remote Sensing Products (Recommended, not enforced)

#	Reference #	National Standards	Release date
1	GB/T 36296-2018	**Guide** for the validation of remote sensing products	2018-06-07
2	GB/T 39468-2020	**General methods** for the validation of terrestrial quantitative remote sensing products	2020-11-19
3	GB/T 40033-2021	Validation of **land surface evapotranspiration** remote sensing products	2021-04-30
4	GB/T 40034-2021	Validation of **leaf area index** remote sensing products	2021-04-30
5	GB/T 40038-2021	Validation of **vegetation index** remote sensing products	2021-04-30
6	GB/T 40039-2021	Validation of **soil moisture** remote sensing products	2021-04-30
7	GB/T 41282-2022	Validation of **fractional vegetation cover** remote sensing products	2022-03-09
8	GB/T 41279-2022	Validation of **albedo** remote sensing products	2022-03-09
9	GB/T 41281-2022	Validation of **photosynthetically active radiation** remote sensing products	2022-03-09

(http://std.samr.gov.cn/gb, by Apr 1, 2022)