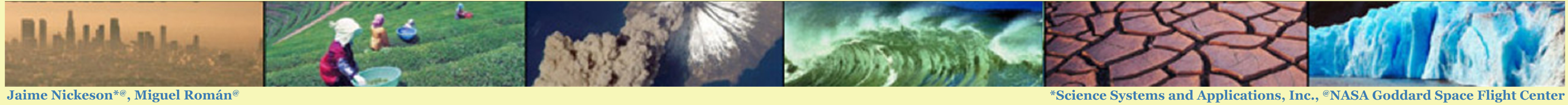


The CEOS Land Product Validation Subgroup



Jaime Nickeson*, Miguel Román*

*Science Systems and Applications, Inc., *NASA Goddard Space Flight Center

Organization

LPV Chair: Miguel Román
LPV Vice-Chair: Fernando Camacho

Additional support provided by Jaime Nickeson, EOS Land Validation

Mission

To foster and coordinate quantitative validation of *higher level global land products* derived from remotely sensed data in a traceable way, and to relay results so they are relevant to users.

Web Site

<http://lpvs.gsfc.nasa.gov>

Now with structured information on validation stage, best practices, references, and links to products for each variable.

Goals

To increase the quality and efficiency of global satellite product validation by developing and promoting international standards and protocols for:

- Field sampling
- Scaling techniques
- Accuracy reporting
- Data & information exchange

Focus Areas	Focus Area Leaders and Affiliations	
Land Cover	Martin Herold Pontus Olofsson	Wageningen University, The Netherlands Boston University, USA
Biophysical	LAI Fapar	Stephen Plummer Oliver Sonnentag Nadine Gobron Arturo Sánchez-Azofeifa
Surface Radiation	Crystal Schaaf Alessio Lattanzio	University of Massachusetts, Boston, USA EUMETSAT
Fire	Luigi Boschetti Kevin Tansey	University of Idaho, USA University of Leicester, United Kingdom
Soil Moisture	Wolfgang Wagner Tom Jackson	Vienna University of Technology, Austria USDA Agricultural Research Service, USA
LST & Emissivity	Simon Hook Jose Sobrino	NASA Jet Propulsion Laboratory, USA University of Valencia, Spain
Phenology	Jadu Dash Matthew Jones	University of Southampton, UK University of Montana, USA
Snow Cover	Thomas Nagler Tao Che	ENVEO, Austria Chinese Academy of Sciences, China

Activities within the LPV Focus Areas

The primary aim of the Focus Areas is to engage the international community in the development of data sets and protocols supporting consistent validation of remote sensing based global land products.

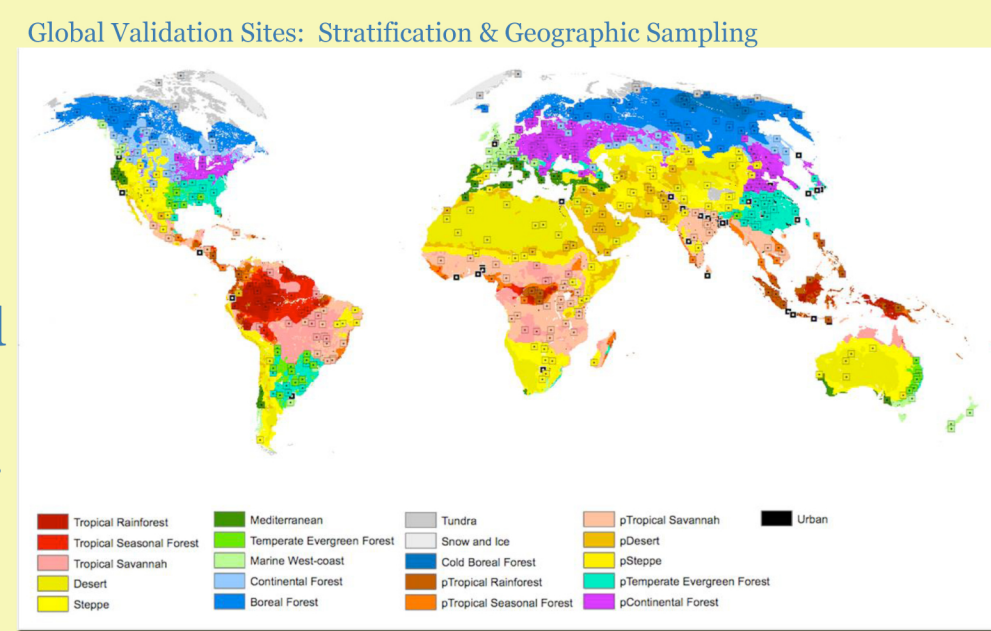
Land Cover

ECV: T09, GCOS-IP138: T26, T27, T28

Collaborating with GOCF-GOLD Land Cover Implementation Team on the development of a **global land cover validation dataset**. Harmonization of validation data, metadata, and guidelines for appropriate application of each dataset under development. Training underway.

Validation Protocols:

- Standards for validation and accuracy assessment of regional and global land cover products exist (CEOS, Strahler 2006).
- GFOI framework - module being developed on how to assess national forest change.
- **Best practices guidelines** (Olofsson et al., 2014) for the validation and accuracy assessment of land cover area change estimates provide MRV systems for land cover area change required by developing countries within the context of REDD.
- ESA Climate Change Initiative (CCI), phase 2 completed and land cover product validation for phase 2 is currently being designed.
- Open access to available land cover reference datasets has been arranged, portal is: http://www.gofcgold.wur.nl/sites/gofcgold_refdataportal.php
- User-oriented accuracy reporting procedures are being developed



Land Surface Phenology (LSP)

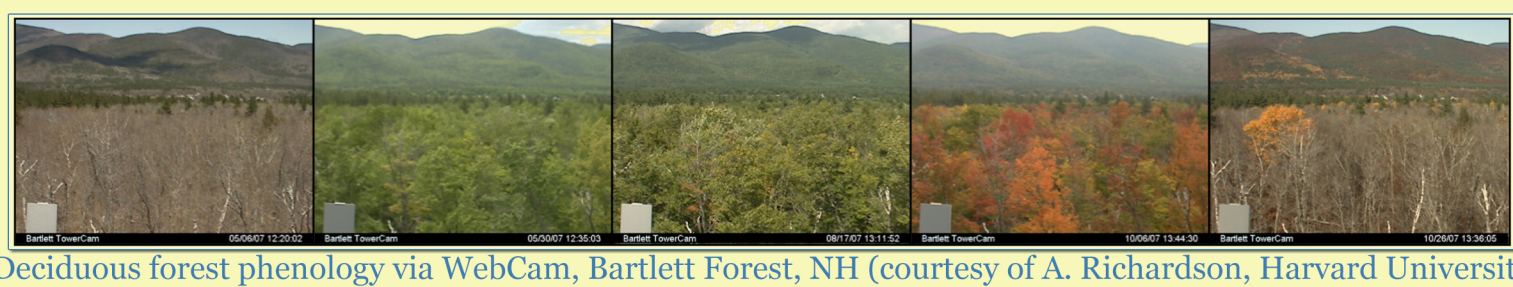
Discussing how to **quantify uncertainty** in both satellite and ground phenological measurements.

3rd Phenology Validation Workshop at Phenology Conference, Oct 5-8, 2015, Kusadasi, Turkey.

Currently identifying core validation sites for LSP validation activities. Considering two types of sites:

- Type A** - sites with detailed spatial and temporal ground phenological observations incorporating multiple resolution scaling opportunities;
- Type B** - sites with phenology cameras (phenocams) and good representation from citizen science observations within national phenological networks (NPNs)

Once these core sites are agreed upon, along with corresponding remote sensing data, ground observation and phenocam data will be compiled into data bundles that will be made publicly available for data sharing and coordinated assessment/intercomparison.



Deciduous forest phenology via WebCam, Bartlett Forest, NH (courtesy of A. Richardson, Harvard University)

Satellite-derived LSP Products -

- MODIS, MERIS, AVHRR, VEGETATION, VIP, PHAVEOS

Near Surface Remote Sensing Networks -

- Phenological Eyes Network (Asia), PhenoCam Network (USA), NEON (USA), SPECNET (Lund Univ)

In situ Phenology Observation Networks -

- NPN, Pan-European Phenology Network, NEON (US), ClimateWatch (AU), Nature Canada PlantWatch, Swedish NPN, Phenology Network of Turkey, Nature's Calendar (UK)

Biophysical (LAI and Fpar)

ECV: T11, GCOS-IP138: T29, T30, T31

- **Best practices guidelines** for the validation of leaf area index (LAI) products has been published! Available on LPV Web site <http://lpvs.gsfc.nasa.gov/documents.html>
- First LPV Workshop on Fpar held in Jan 2014 at the European Research Commission, Ispra, Italy.
- The **OLIVE** (OnLine Interactive Validation Exercise) tool, Baret et al., has been launched for LAI and FPAR products. The tool will be instrumental in moving land products to Stage 4 validation. Visit: <http://calvalportal.ceos.org/web/olive>
- The FAPAR focus area of CEOS LPV is currently reviewing existing validation methods and will consequently develop a good practice protocol for the validation of satellite-derived FAPAR products.
- A Land project S3VT (Sentinel 3 validation team) has been accepted by ESA to prepare a validation plan for Ocean Land Colour Instrument (OLCI) products.
- Collaborating with NPL on the **calibration of PAR sensors** and longtime drift (about 40 calibrated sensors at NPL will be employed in Costa Rica, Germany, England, and Brazil).

Snow Cover

ECV: T05, GCOS-IP138: T15, T16

The ESA Satellite Snow product Intercomparison and Evaluation Experiment (**SNOWPEX**) aims to intercompare and validate hemispheric and global satellite snow products for estimation of temporal trends of the seasonal snow cover and assessing their accuracy. Community consensus on methods and protocols for intercomparison of products and their validation using varied reference data sets.

MODIS Collections 6 reprocessing underway. Comparisons with C5 show significant improvement in snow cover in mountainous areas.

A integrated watershed-scale experiment in China is making use of radiometers, cameras, and aircraft data to determine accurate snow depth, fraction of snow cover, and snow water equivalent, will address the validation of snow products over this area in the two winter seasons 2012/13 and 2013/14.

New snow water equivalent product and validation methods are being developed by the Chinese Meteorological Administration.

Surface Radiation

ECV: T08, GCOS-IP138: T24, T25

Currently focusing on Land Surface Albedo products.

Collaborating on validation efforts for:

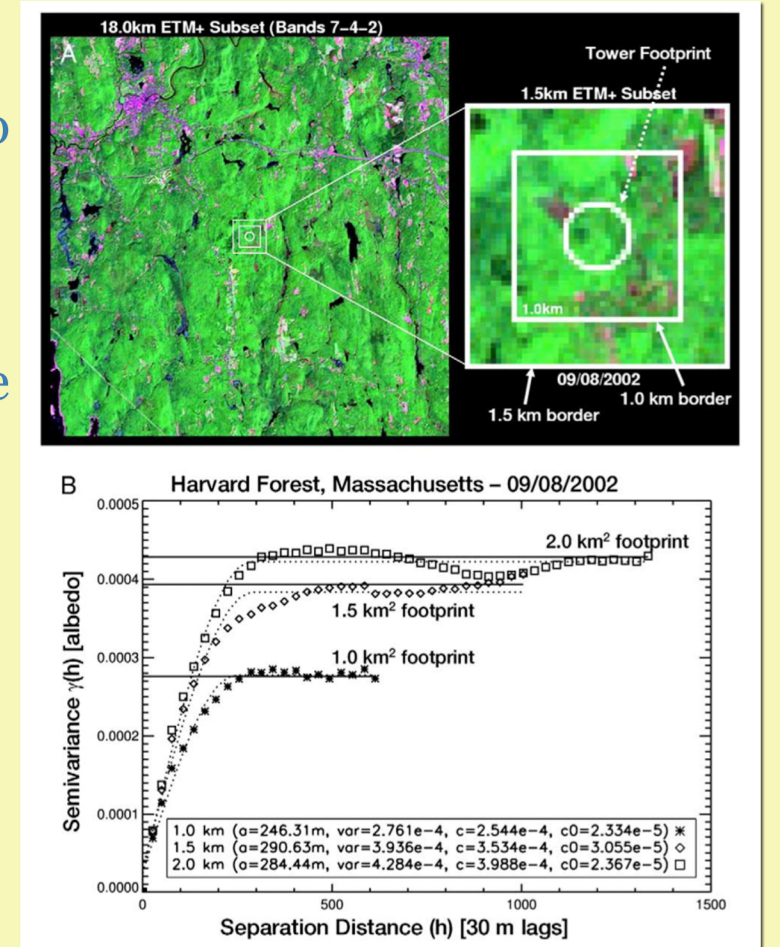
MODIS - Collection 6 code for BRDF/albedo delivered and tested, reprocessing began in first quarter of 2015.

Geoland2 - Validation report officially released, Geoland2 Spot/VGT global Surface Albedo product available 1999-present.

GlobAlbedo - GlobAlbedo data are now available for 1998-2011

<http://www.globalbedo.org/>
VIIRS - Albedo is now at validation Stage 1 maturity and is undergoing testing

Landsat-MODIS - Production of a new merged albedo product is underway



Best Practices

Albedo in situ measurement standards defined and published (McArthur 2005 and Roman et al. 2010). Working to support and standardize validation procedures for existing and emerging products.

LST & Emissivity

The **GlobTemperature Data Portal** now active, currently includes AATSR and SEVIRI products. ESA GlobTemperature User Consultation Meeting, June 11-12, 2015, University of Reading.

Recent work by Guillevic, et al., (2014) serves as a baseline **protocol document** for LST.

Validation measurements continue to be worked for **MODIS, VIIRS, Landsat, NIRST** and **ASTER**.

The **HyspIRI** airborne campaign continues. A very large campaign with AVIRIS and MASTER on the ER2 in CA. Flights in 3 seasons for 3 years through 2015.

Several **HyTES** airborne campaigns have been completed. Next campaign will take place in April 2015 over Four Corners. Level 1 and 2 products are available for the 2013 and 2014 campaigns. Product validation is in progress.

Development of the new T-E separation algorithm for **S-NPP/VIIRS** is in progress.

Collaboration of GCOS and LPV on LST definition in preparation of **LST as future Essential Climate Variable (ECV)**.

The new T-E separation algorithm for **MODIS (MOD21)** has been implemented as part of Collection 6 reprocessing. This algorithm is similar to the ASTER algorithm and is designed specifically to retrieve accurate emissivity at 1 km resolution.

Soil Moisture

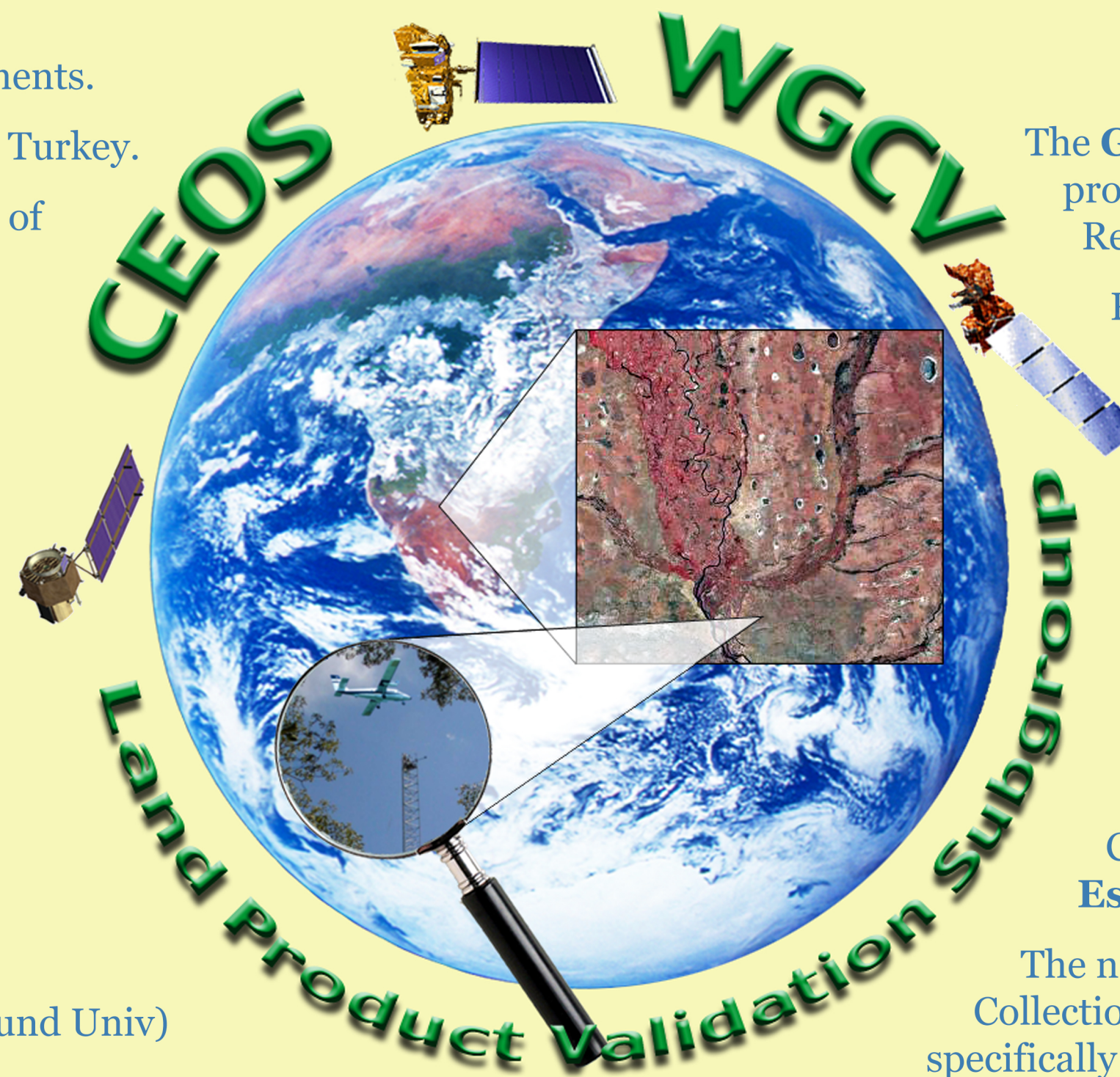
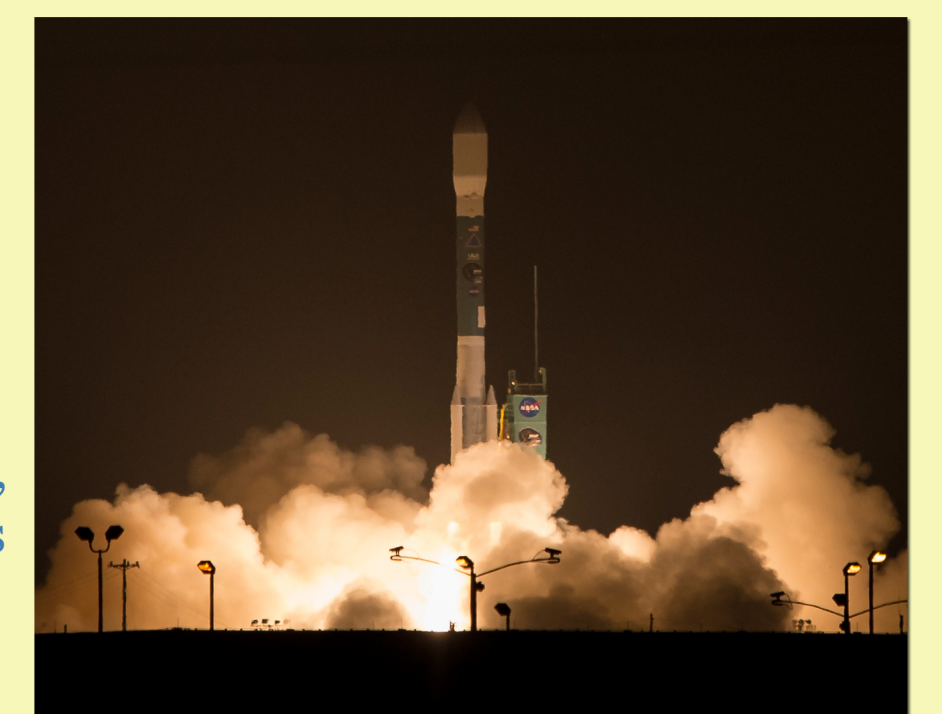
ECV: TBD, GCOS-IP138: T13, T14

NASA launched a new Soil Moisture Mission, the **Soil Moisture Active Passive (SMAP)** observatory, on Jan. 30, 2015, beginning a 3-year mission to produce the most accurate, high-resolution soil moisture maps ever. Cal/Val check out to begin in early May. Product delivery expected to commence 9 months post-launch.

The **International Soil Moisture Network (ISMN)**, established in 2010, continues to grow its networks, data sets and user base. There are currently over 1400 stations worldwide.

ESA Climate Change Initiative (CCI) soil moisture project is conducting ASCAT and AMSR-E SM retrieval exercises and is planning validation.

The 30-year data record of SM has been released and the initial validation results show a promising correlation of values with existing SM models. Negative trends with precipitation need to be explored further.



Fire/Burned Area

ECV: T13, GCOS-IP138: T35, T36, T37

Collaboration with GOCF-GOLD Fire Implementation Team

The standard procedure to generate reference data for Burned Area products includes the use of Landsat-class image pairs. Production and standardization of validation reference data has been documented as the first part of a **Burned Area validation protocol**. Part II, accuracy reporting, is currently under development.

A **Fire Disturbance ECV** effort - the ESA Climate Change Initiative (CCI) is now in Phase II. Documentation of validation and level 2 reference data is underway, with a primary focus on **burned area**, but also including **fire radiative power**.

Efforts are underway to update fire ECV definition in a way such that the products can be validated within the **GCOS framework of targeted requirements**.

Strong validation components exist within several pending Active Fire proposals (MODIS, VIIRS, USPD). An active **Fire Protocol** activity will begin after funding is identified from proposal efforts.

The Committee on Earth Observation Satellites coordinates civil space-borne observations of the Earth. Participating agencies strive to enhance international coordination and

CEOS Committee on Earth Observation Satellites

data exchange and to optimize societal benefit. Currently 28 space agencies along with 20 other national and international organizations participate in CEOS planning and activities.

