
biomass cci


fire cci


high resolution land cover cci


lakes cci


land cover cci


soil moisture cci


land surface temperature cci

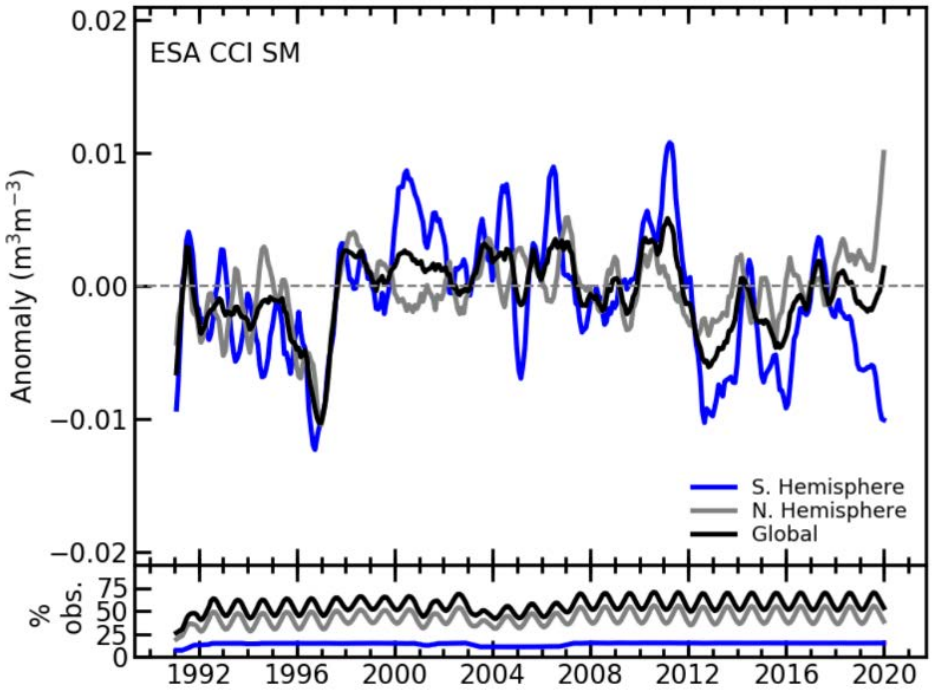
LAND ECVS

Emilio Chuvieco (Fire), Lorenzo Bruzzone (HR LC), Pierre Defourny (MR LC). Shaun Quegan (Biomass),
Stefan Simis & Jean-Francois Cretaux (Lakes), Darren Ghent (Land ST), Wouter Dorigo (Soil Moisture)

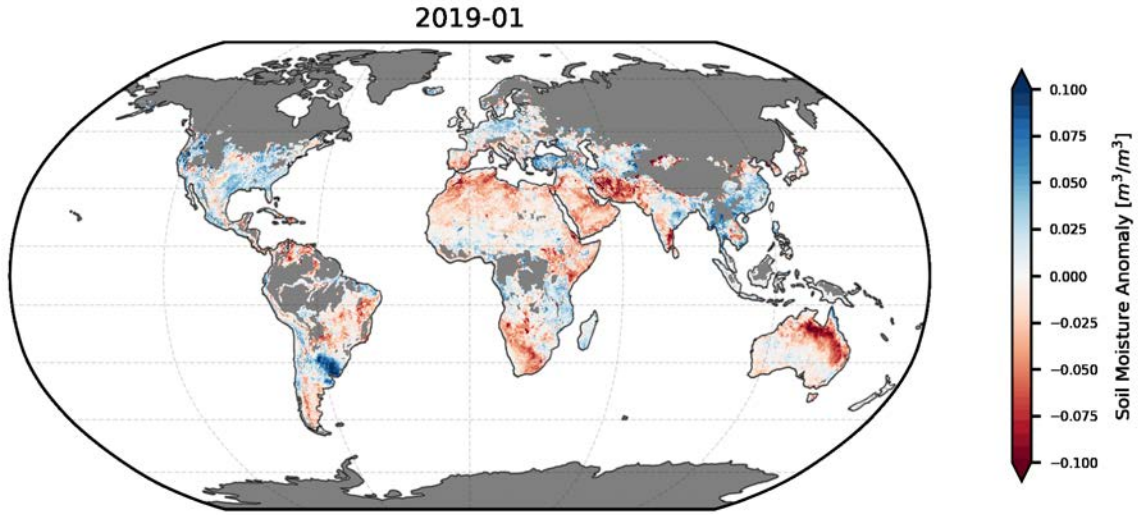
Soil Moisture: Overview

The longest satellite-based global CDR of daily soil moisture (1978-2019) at 0.25º.

Systematic merging of 12 sensors (now including SMOS and SMAP) to provide 40+ years of consistent soil moisture data



SM anomalies



ESA CCI COMBINED v05.2 2019 monthly anomalies from 1991-2010 climatology

Soil Moisture: Impacts and challenges

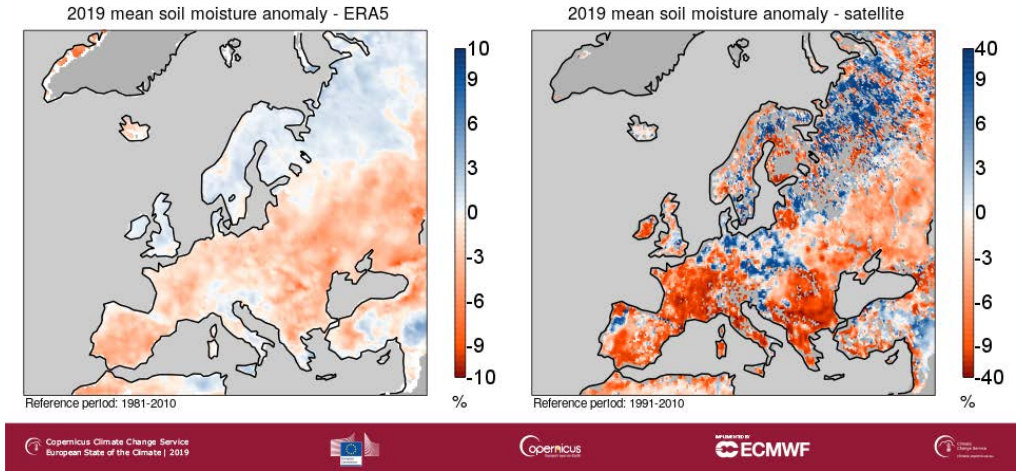
- >8000 registered users, hundreds of scientific publications
- Annual contributions to annual BAMS and European SotC reports
- Basis for the ECMWF C3S operational soil moisture products delivered in near real-time

Inclusion and improved inter-calibration of passive sensors

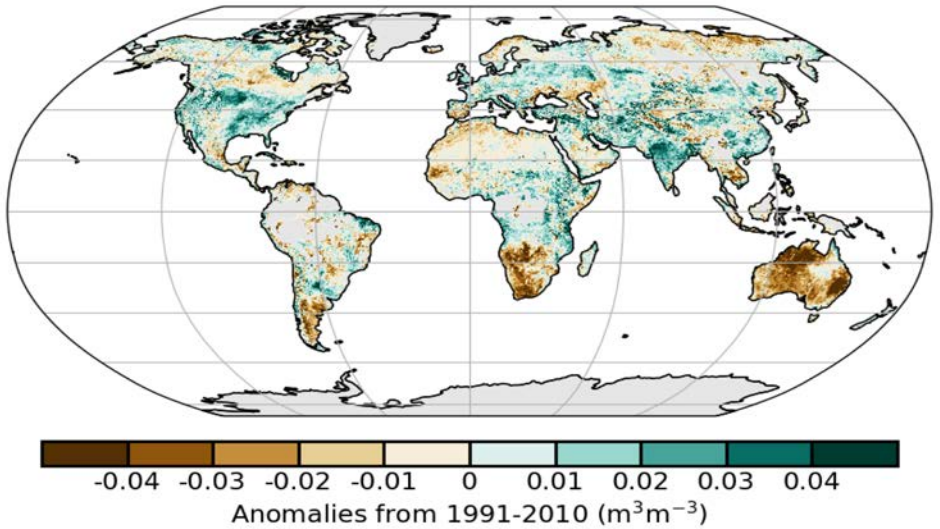
Prepare for Inclusion of Metop Second Generation (>2023)

Inclusion of Sentinel-11 CIMR? (>202x)

Improved spatial and temporal resolutions, e.g. using Sentinel-1 (>202x)



European SotC 2019: CCI v04.7 PASSIVE vs ERA5 mean annual anomalies 2019



BAMS StoC 2019: CCI v04.7 COMBINED anomalies 2019

Fire: Global and continental Burned Area Products

Global BA Products:

MERIS FireCCI41: 2005-2011, 300 m.

MODIS FireCCI50: 2001-2016, 250 m.

MODIS FireCCI51: 2001-2019, 250 m & S-3 SYN

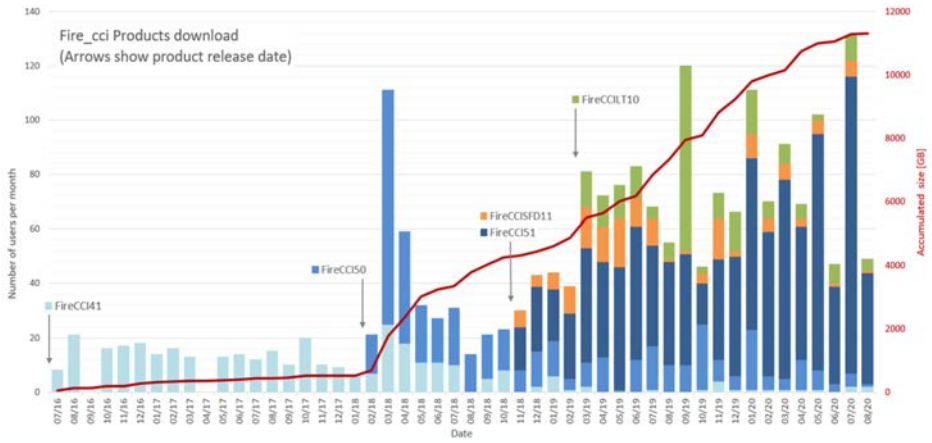
AVHRR FireCCILT11: 1982-2017, 5 km.

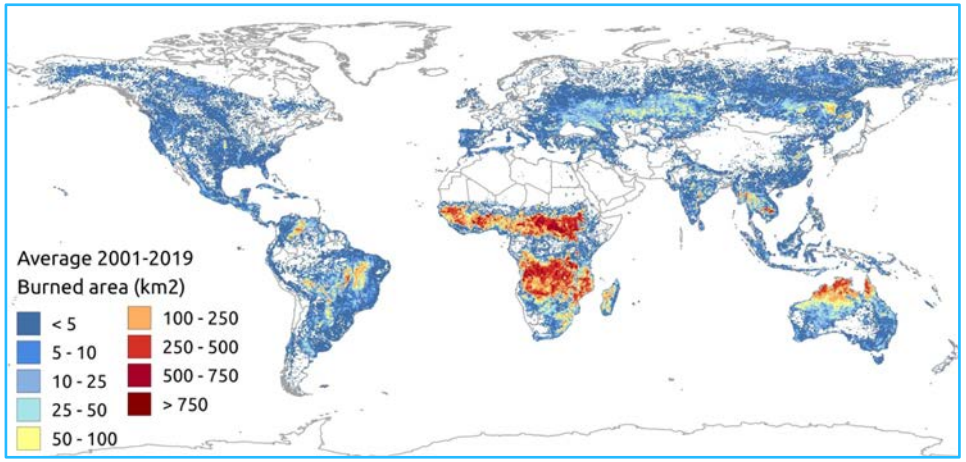
Regional BA products

Africa: MSI S-2 2016 (+2019), 20m

Africa, Amazon & Indonesia: S-1 SAR, 2015-6.

Product downloads (>11.500)

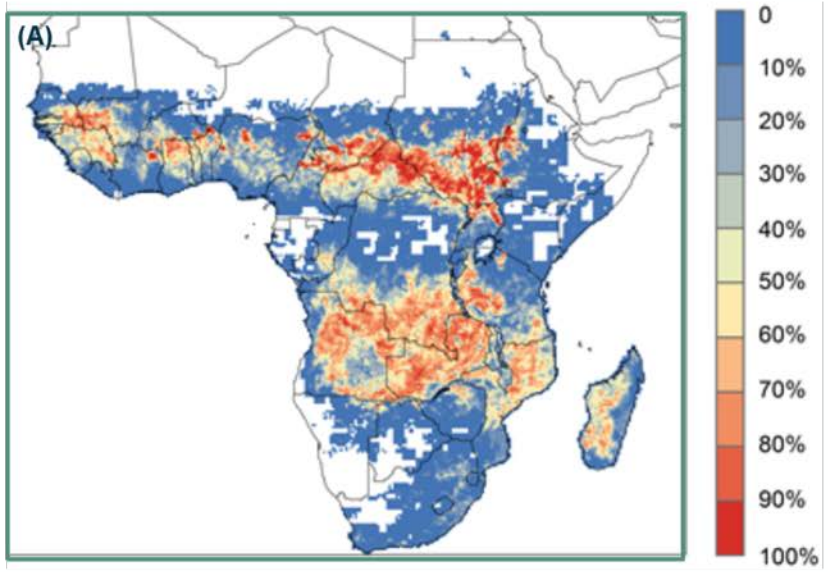


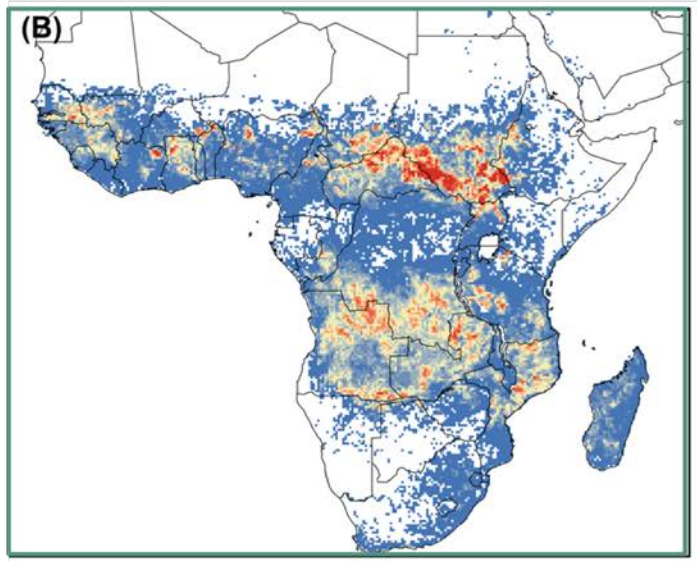


First demonstration of the relevance of small fires

Product	<100 ha	>100 ha	Total
FireCCISFD11 (Sentinel-2)	2,024,070	2,871,045	4,895,115
MCD64A1 (NASA MODIS)	161,377	2,555,626	2,717,004
% of FireCCISFD11	7.97	89.01	55.50

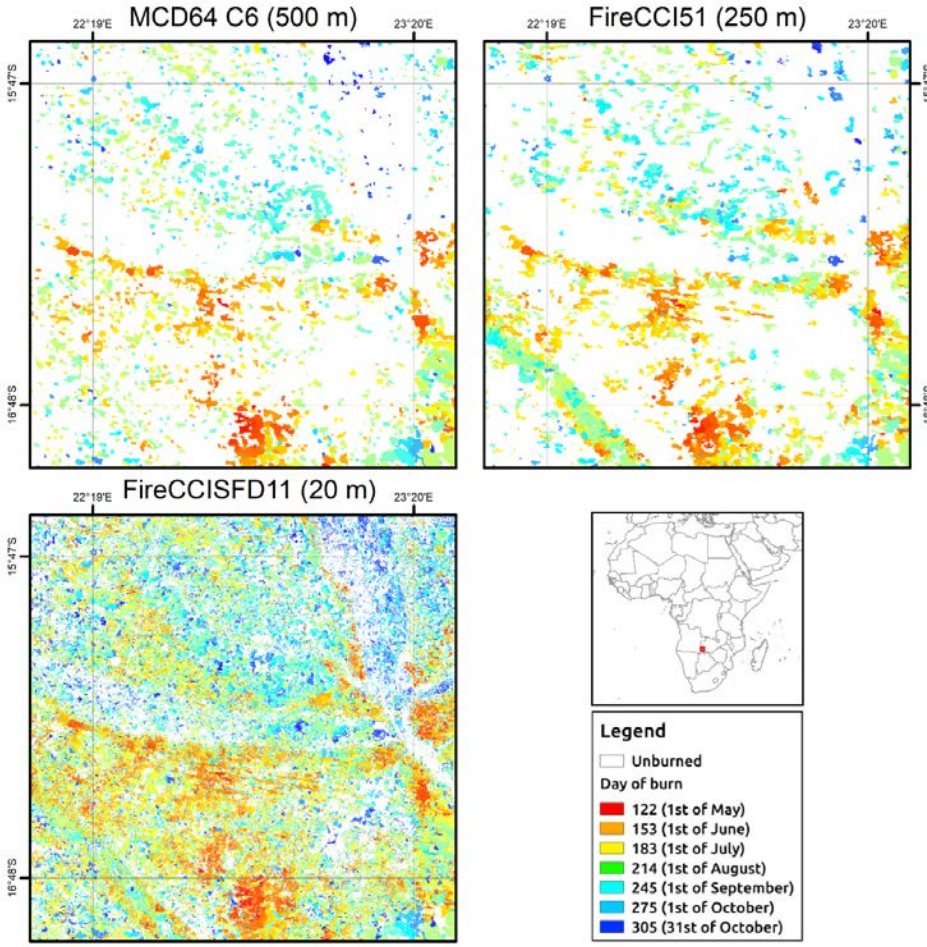
More tan 90% of small fires are missed in coarse resolution burned area products





% of BA FireCCISFD11

% of BA GFED4s



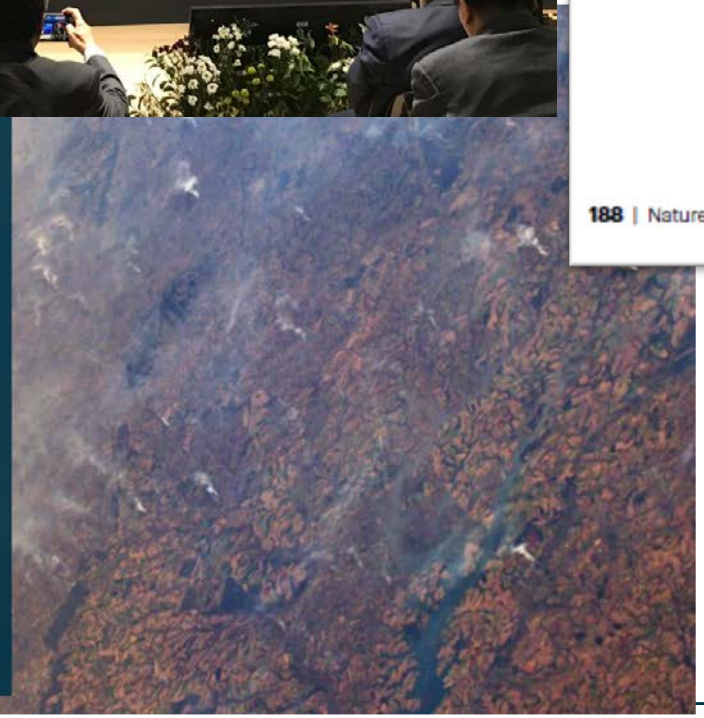
(Ramo et al., 2020, PNAS, in review)

Fire: Impacts and challenges

Satellite Estimations Of The Amazonian 2019 Fire Crisis

Scientific letter published on Amazonian 2019 fire crisis

(Jan. 8, 2020)



Wildfires: Australia needs a national monitoring agency

nature
International weekly journal of science

David Bowman, Grant Williamson, Marta Yebra, Joshua Lizundia-Loiola, Maria Lucrecia Pettinari, Sami Shah, Ross Bradstock & Emilio Chuvieco

Comprehensive fire surveillance will strengthen resilience and adaptation to climate change.

Just before the COVID-19 pandemic, bush fires in Australia destroyed more than 3,000 homes and burnt millions of hectares of vegetation. The crisis exposed the nation's fire monitoring system as being unfit for purpose. Precise real-time information about the area burnt and the intensity of the fires was not available when it was needed.

Australia does not have a central system for gathering and storing essential information about bush fires. State and territory governments, and even agencies within states, have different approaches. This worked fine when fires were smaller. But those in the 2019–20 season crossed multiple state borders.

The blazes engulfed a huge geographic range and burnt for a duration and intensity that was beyond the experience of communities and fire managers[1]. Many Australians endured five months of smoke pollution that breached national air-quality standards. Usually, people would experience shorter bouts covering smaller areas[2].

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- Adaptation of burned area algorithm to Sentinel-3 SYN data.
- Detection of small patches in Africa from combined Sentinel-2A and B.
- 20 year extension of BA products with AVHRR-LTDR data.

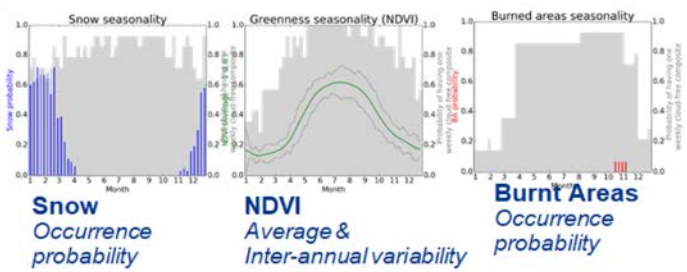
Medium Resolution Land cover: overview

Unique long-term (29 years) global and consistent Land Cover dataset to meet the requirements from the climate and land cover communities

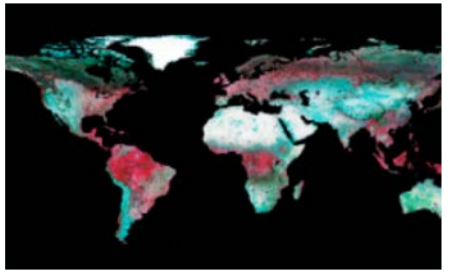
Transversal role of the MR Land Cover dataset and integration by other ECVs (e.g. Burned Areas) enhances terrestrial ECV consistency for climate models

A portfolio of 9 specific datasets

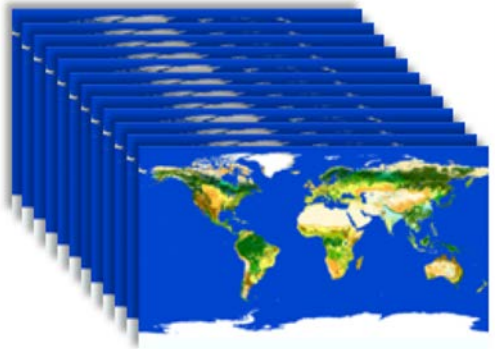
3 per-pixel land surface seasonality climatologies



1 user tool for climate modellers to convert the annual LC maps in Plant Funtional Types maps



3 surface reflectance archives of 7-day composites:
- **AVHRR HRPT (1 km, 1992-1999)**
- **MERIS (300 m and 1 km, 2003-2011)**
- **PROBA-V (1 km, 2014-2015)**



1 series of annual consistent LC maps 300 m (1992-2019)

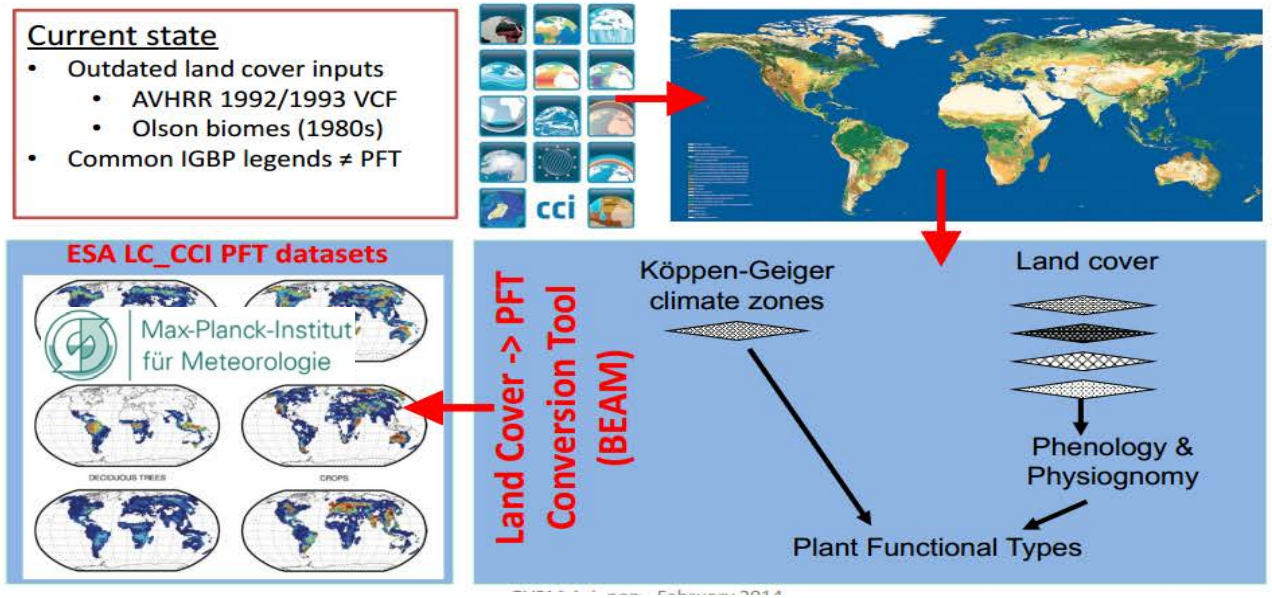
1 static map with the distinction between ocean and inland water at 150 m spatial resolution used across terrestrial ECVs

Land cover: Impacts and challenges

Download statistics with a worldwide distribution

- 60400 downloads since 2017
- 55 TB downloaded
- 18337 IP addresses

Land Cover to Plant Functional Type Map



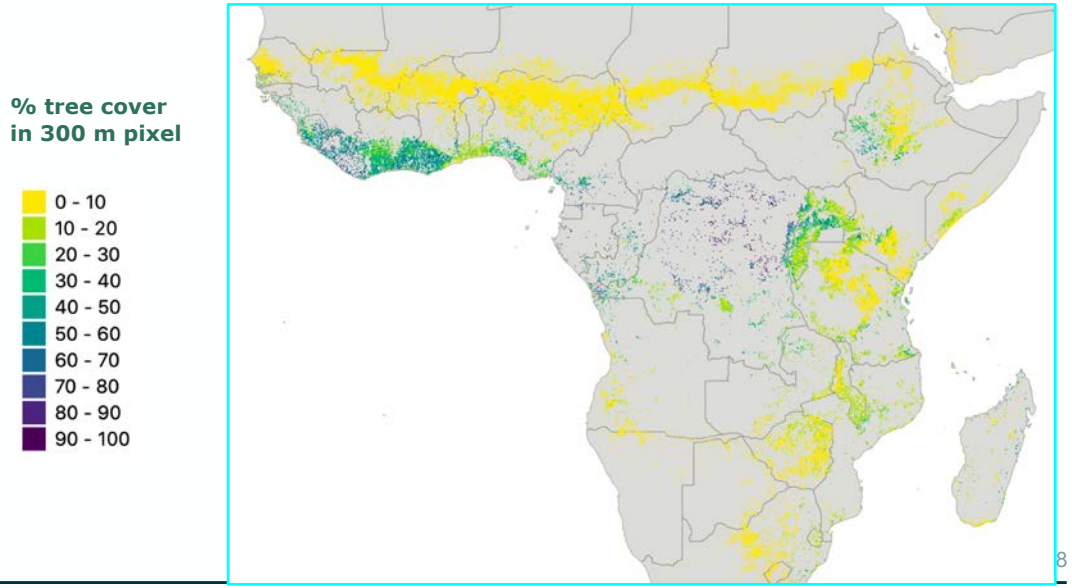
Poulter et al., 2011, 2015

Enhanced quality of long-term land cover change

Advanced global Land Cover Change validation strategy

End-to-end Uncertainty Characterization, from surface reflectances to LC classes

Scaling up method across spatial resolutions in a semantically consistent manner



High Resolution Land Cover (HRLC): Overview

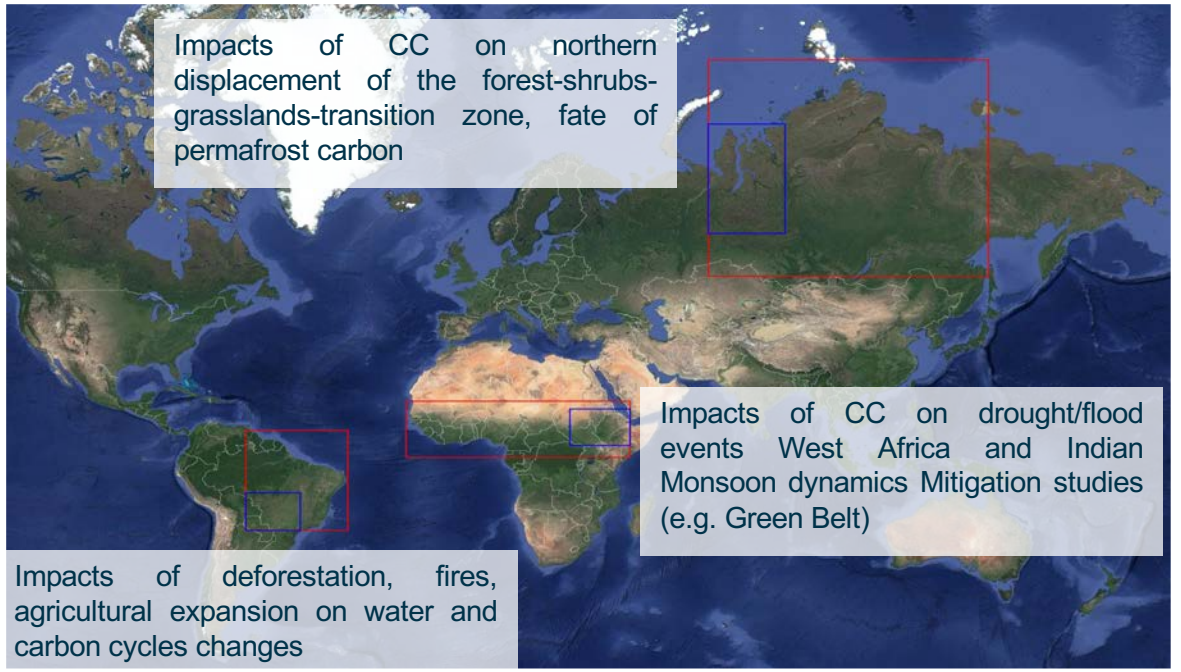
A static HRLC map at subcontinental level at 10m.

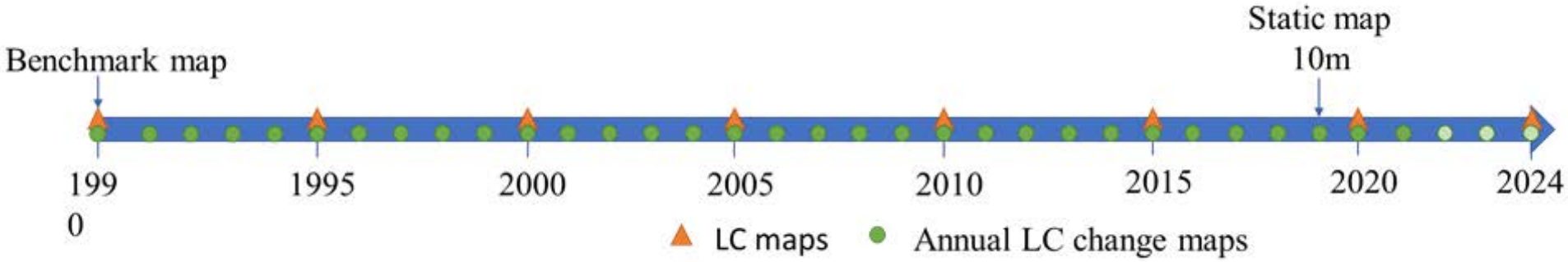
The long-term record of regional HRLC maps at 30m in the sub-regions every 5 years.

The change information at 30 m and yearly scale for HRLC map update.

The rescaled maps at intermediate multiple spatial resolutions

CCI HRLC climate regions defined in the project





Sub-continental areas for static maps in 2019

Regional areas for long-term record of HRLC maps

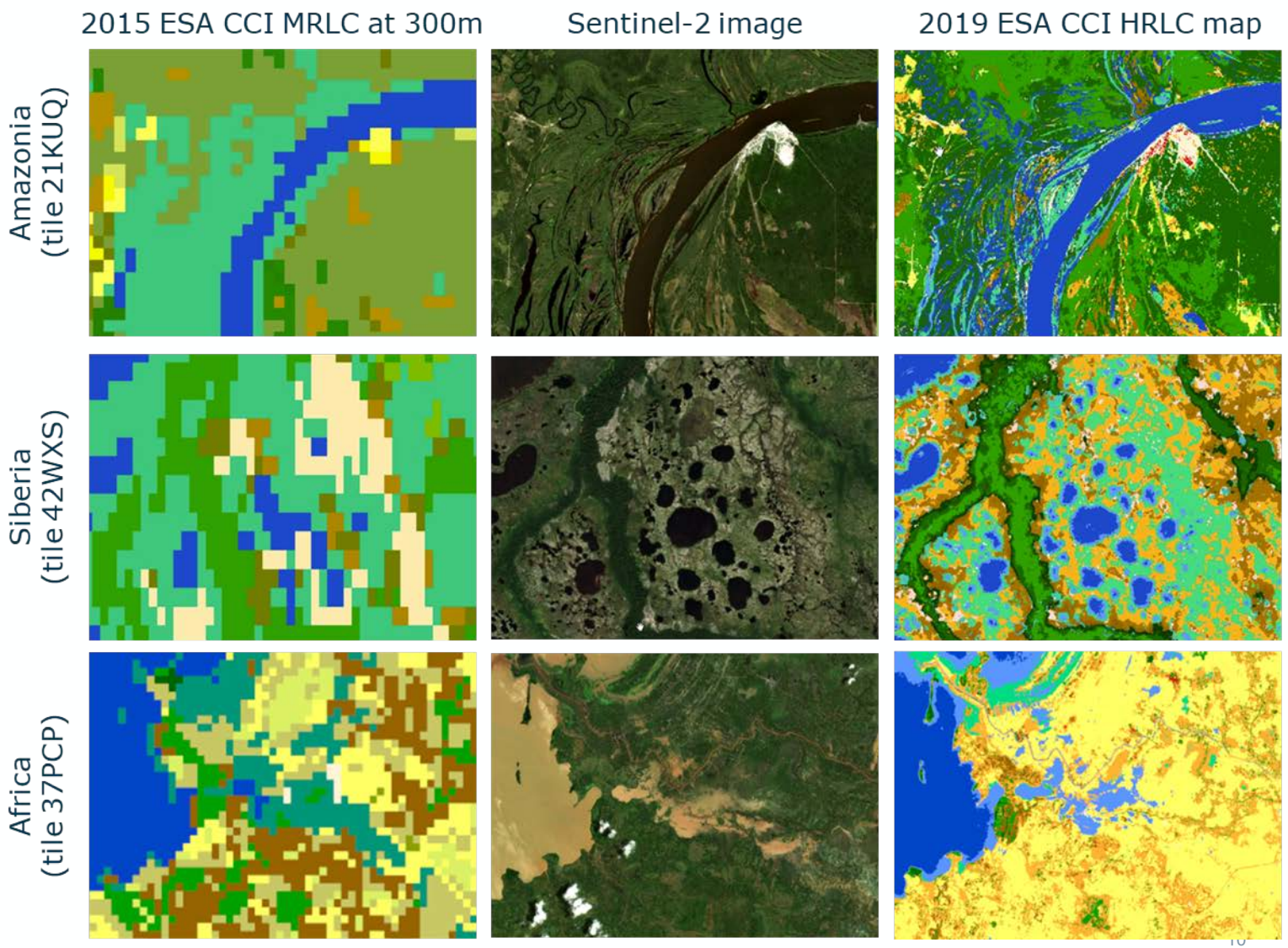
HRLC: Impacts and challenges

The first production has been focused on the generation of products on **regional areas** (products are currently in the final validation phase):

- HRLC maps at 10 m for 2019.
- Long-term record of HRLC maps at 30m every 5 years.

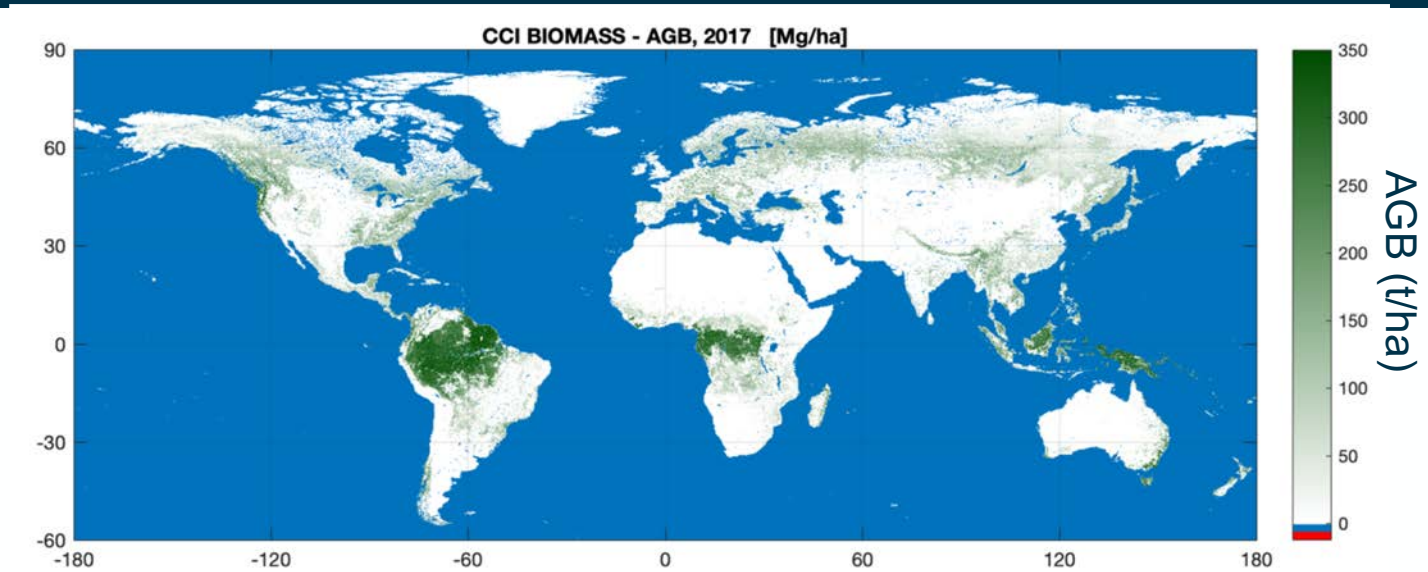
Next challenges:

- Optimize the processing chain.
- HRLC maps at 10 m for 2019 on sub-continental areas.
- Change maps at 30 m and yearly scale for HRLC map updating on regional areas.
- Updated long-term record of HRLC maps at 30m every 5 years on regional areas.

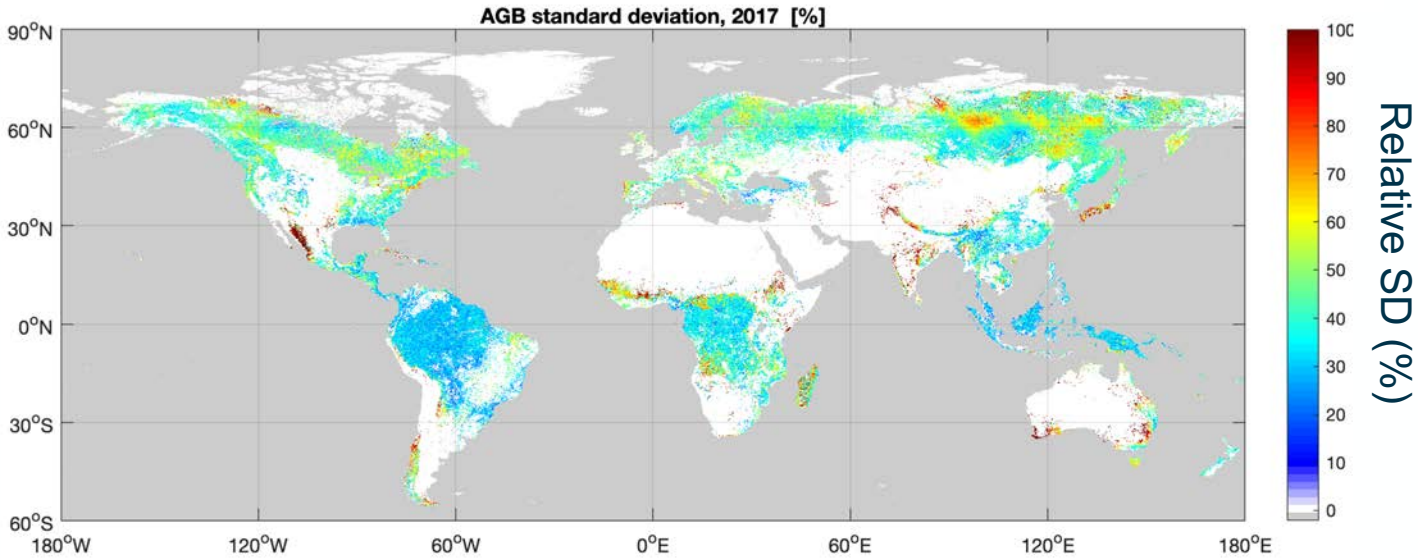


Biomass: overview

Above-ground biomass (AGB) 2017



Relative standard deviation

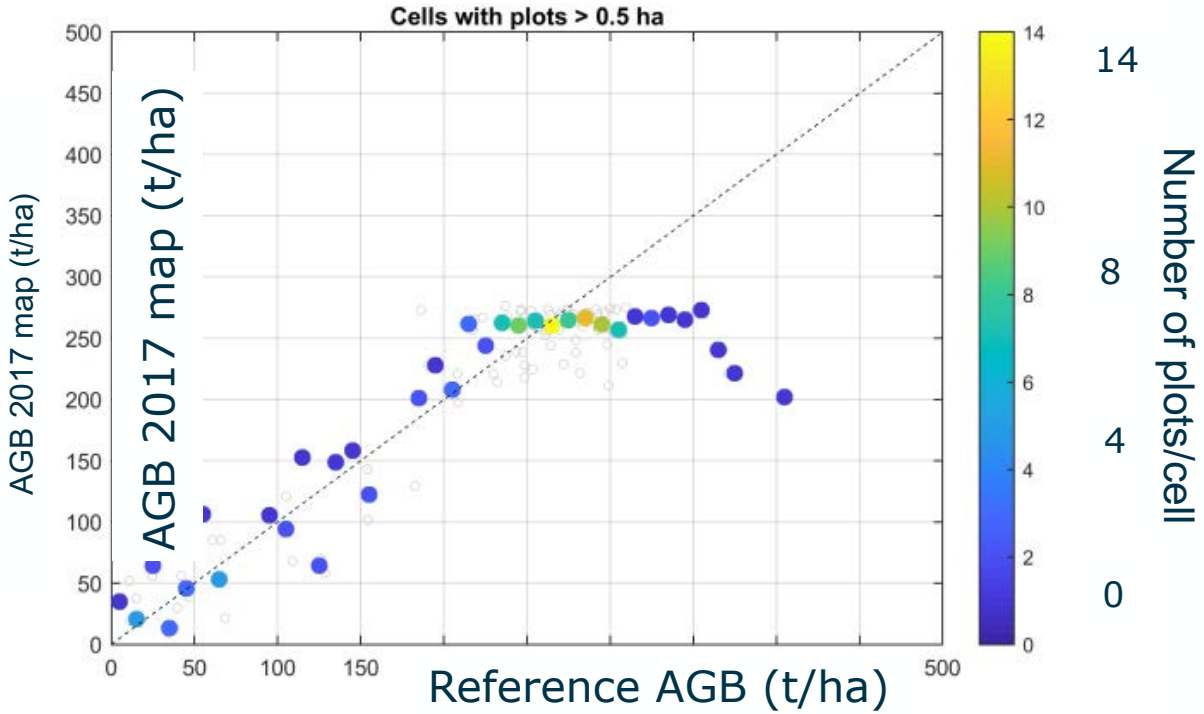


The main datasets used to produce the map (with 100 m pixel size) were PALSAR-2 mosaics & Sentinel-1, supported by a range of other satellite and environmental data.

Maps for 2010 and 2018 have just been released.

The 2010 map is based on PALSAR-1 and Envisat.

Biomass: Impacts and challenges



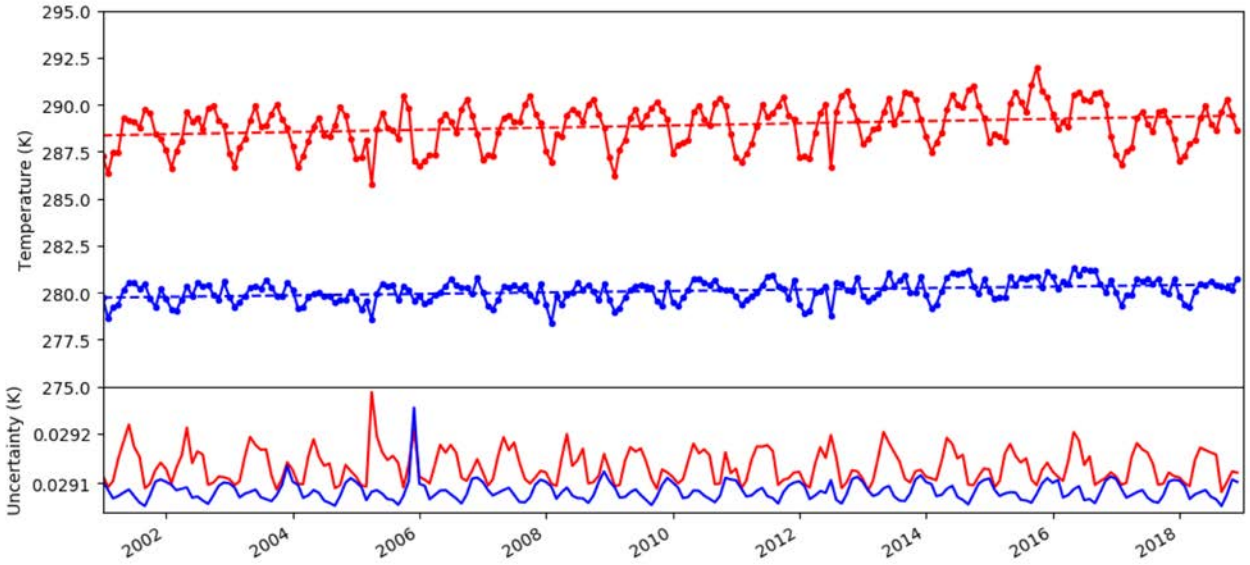
Comparison of average plot AGB (plot size > 0.5 ha) and average map AGB in 0.1 degree cells.

The colours indicate the number of reference plots in the cell.

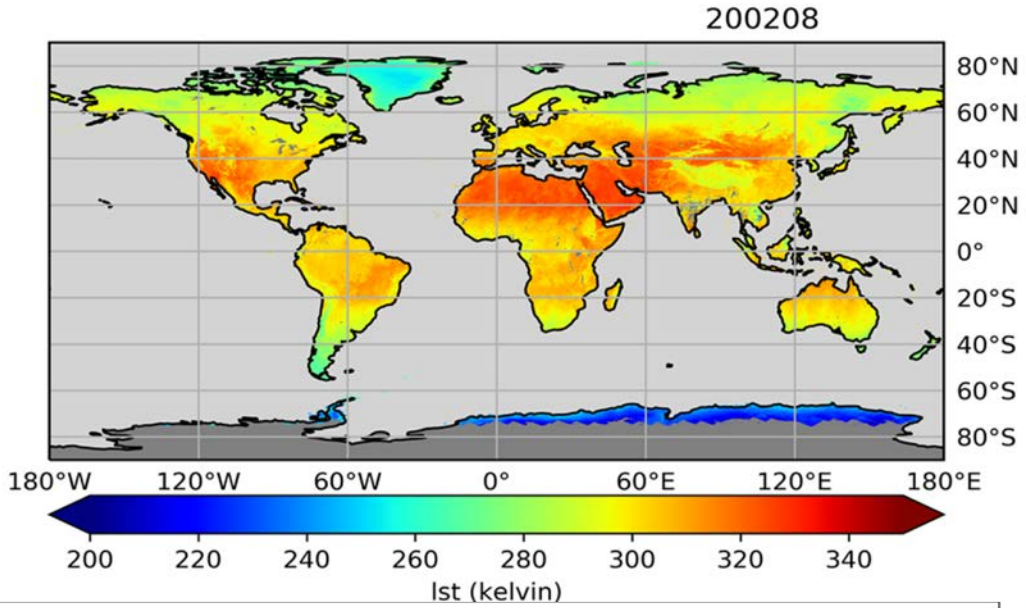
Key current activities:

- Validation of the biomass maps
- Development of methods to estimate biomass change

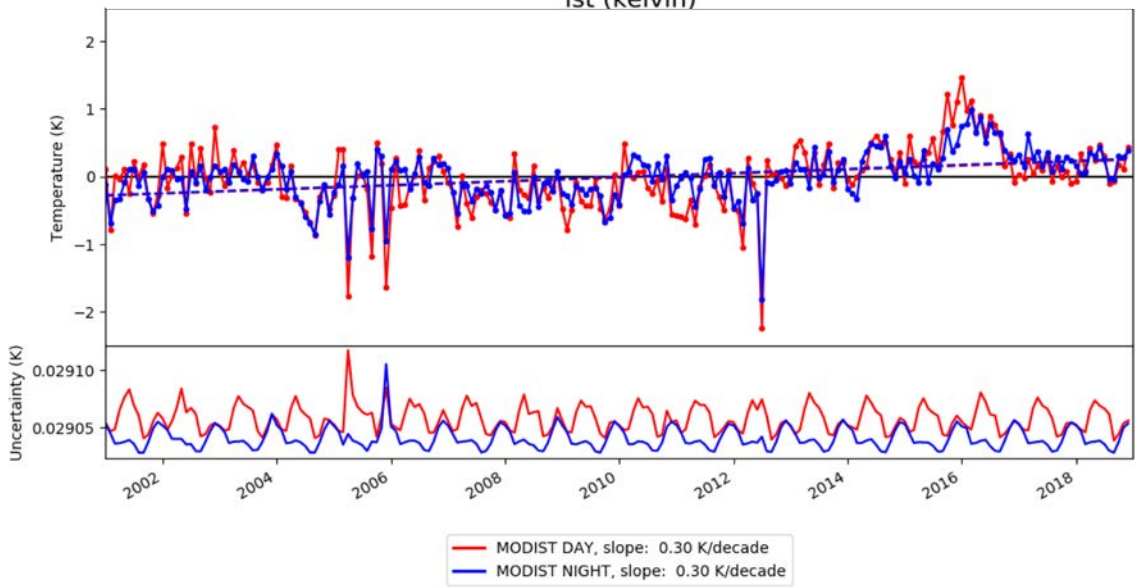
Land Surface Temperature: overview



18-Year Terra MODIS LST



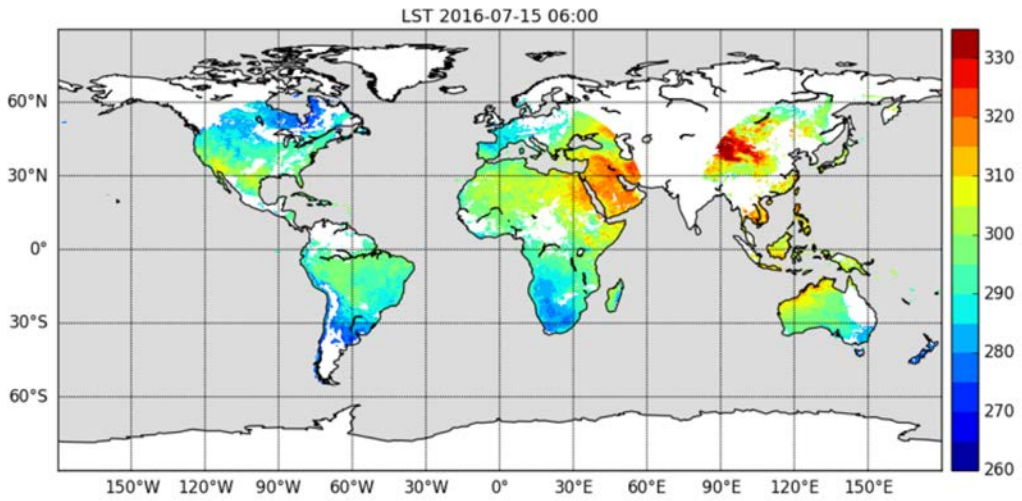
Terra MODIS Monthly
LST Anomalies



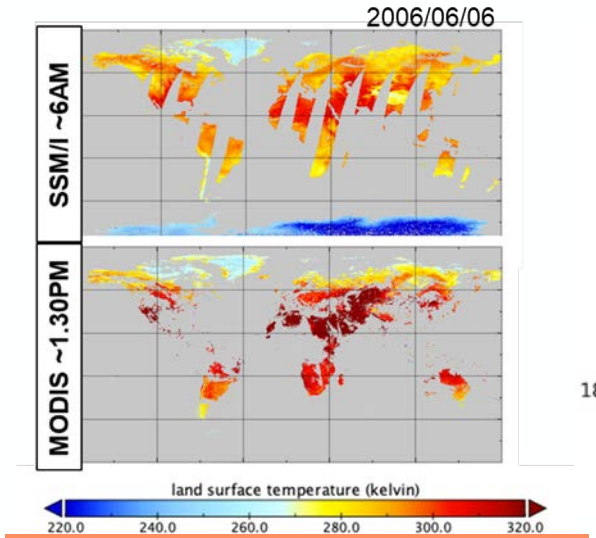
LST: Impacts and challenges

- Intercalibration and time difference corrections for CDRs
- Input into cross-ECV activities
- Improvements on pre-cursor datasets
- Significantly increasing maturity levels of all LST ECV Products

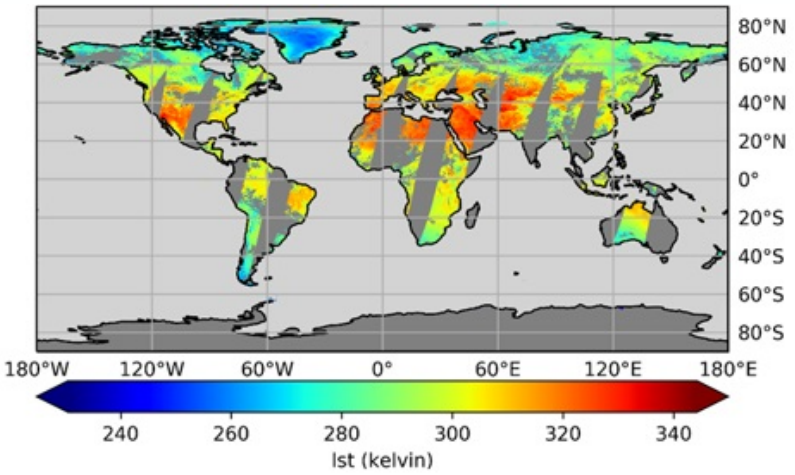
- Applying instrument intercalibrations and time corrections
- Uncertainty characterization across all LST ECV Products
- Extending the CDRs to include Sea Ice temperature
- Extending the CDRs backwards in time for AVHRR into the 1980s and Landsat



A first climate quality Global Merged Product resolving the diurnal cycle



A first passive MW time series with > 20 years



Climate quality Sentinel-3A and -3B LST

Lakes: overview

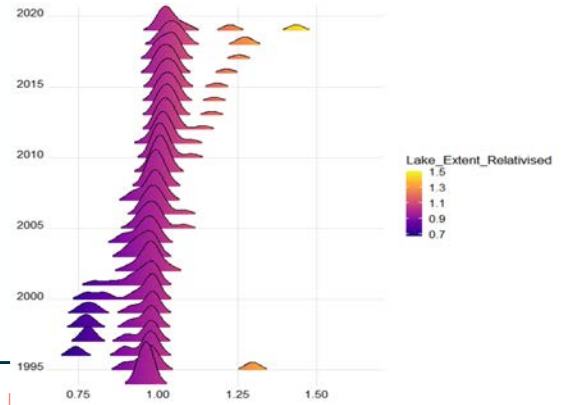
- Provide the first consistent, longest attainable time-series of the largest possible number of lakes covering all variables under the Lakes ECV
  - Lake Water Extent & Lake Level
  - Lake Ice Cover
  - Lake Surface Water Temperature
  - Lake Surface Water Reflectance
- Achievements:
  - 250 lakes common for all variables
  - 1km daily gridded resolution (sub/super-sampled)
  - Level/Extent per lake
  - netCDF files
    using climate vocabularies
  - Per-pixel product uncertainties

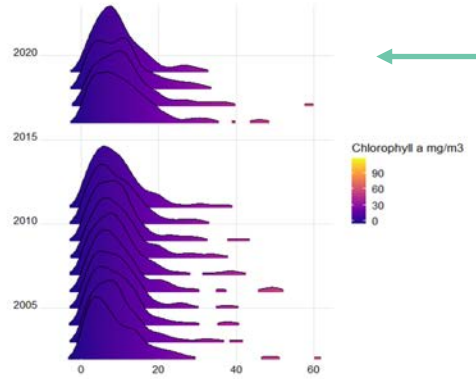
Lakes: Impacts and challenges

- Analysis of ECVs for Greenland lakes: Temperature, Ice Cover, Water Level.
- Physical/biogeochemical linkages in large lakes to support SDG 6: Colour, Temperature.
- Added value of Lakes ECVs in Long Term Ecosystem Research: integrating in situ and satellite data records (all Lakes tECVs).
- Brownification in Scandinavian lakes: Colour, Level, Ice on/off.
- Consistency of ECVs in the Danube river-lake-lagoon and added value to transitional water management: Colour-derived biogeochemical products, Temperature.

- Improving spatial and temporal coverage: 2000 lakes in 2021, filling gap between MERIS and OLCI (Colour)
- Improving uncertainty characterizations in several thematic ECVs
- AI methods for image segmentation for Lake Ice Cover
- Global consistency in observations between the thematic ECVs
- Lake Ice Thickness retrieval

Lakes have globally shifted towards increasing water extent.





No globally consistent increase/decrease in phytoplankton biomass. Regional, seasonal and community composition level change more important?

Links and interconnections between Land ECVs

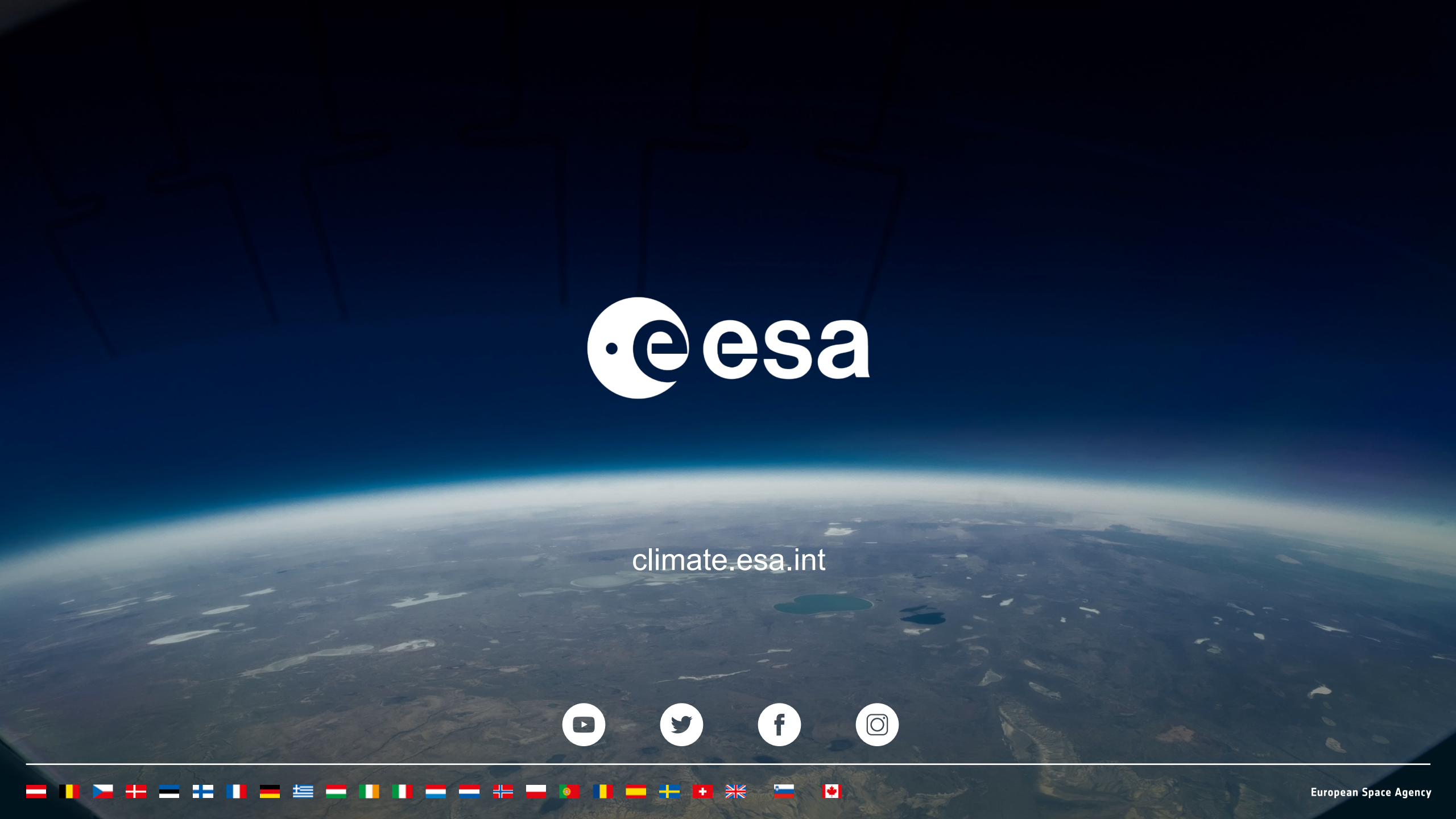
Common auxiliary datasets: Water mask / internal water bodies.

Common methods for uncertainty characterization.

Extension of the historical series (AVHRR/Landsat records for Land Cover, Fire, Lakes and Biomass).

Improve spatial resolution (Land cover, Fire, Soil moisture…).

Potential Focus on extreme events (fires, droughts, disturbances…)


esa
climate.esa.int
European Space Agency