

ESA Climate Change Initiative

LST_cci User Workshop, 27 Sep 2022

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ESA ECSAT

21/09/2022

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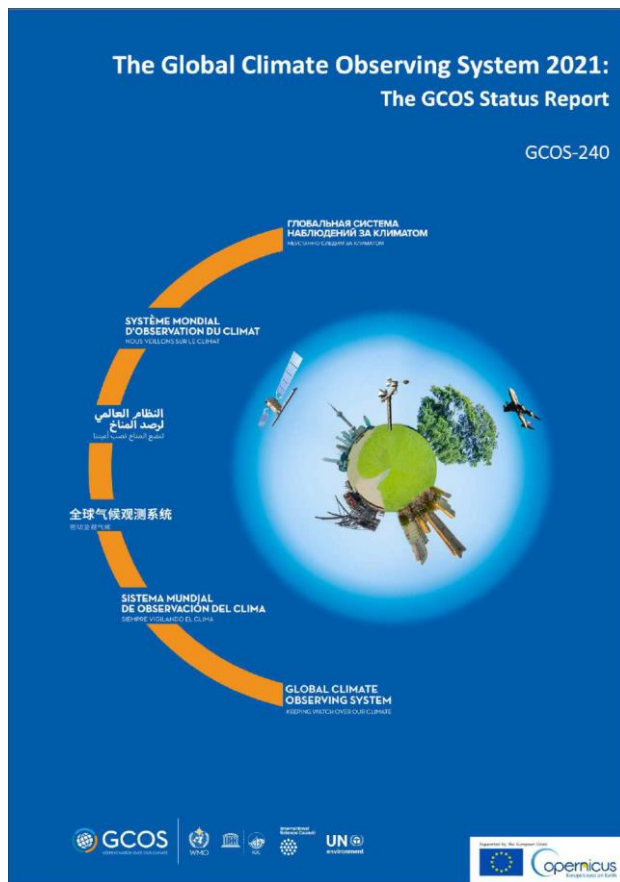
Objective:

*To realise the full potential of the **long-term global EO archives** that ESA, together with its Member States, has established over the last 40 years...*

*... as a significant and timely contribution to the **Essential Climate Variable (ECV*) databases** required by the **United Nations Framework Convention on Climate Change (UNFCCC)***

* An ECV is a physical, chemical, or biological variable or a group of linked variables that critically contributes to the characterization of Earth's climate.

S. Bojinski *et al.*, BAMS 2014, doi.org/10.1175/BAMS-D-13-00047.1



<https://gcos.wmo.int/en/gcos-status-report-2021>

Essential Climate Variables

[For graphical version click here](#)
 What are Essential Climate Variables (ECVs)?

Atmosphere

Surface

- [Precipitation](#)
- [Pressure](#)
- [Radiation budget](#)
- [Temperature](#)
- [Water vapour](#)
- [Wind speed and direction](#)

Upper-air

- [Earth radiation budget](#)
- [Lightning](#)
- [Temperature](#)
- [Water vapor](#)
- [Wind speed and direction](#)

Atmospheric Composition

- [Aerosols](#)
- [Carbon dioxide, methane and other greenhouse gases](#)
- [Clouds](#)
- [Ozone](#)
- [Precursors for aerosols and ozone](#)

Land

Hydrosphere

- [Groundwater](#)
- [Lakes](#)
- [River discharge](#)

Cryosphere

- [Glaciers](#)
- [Ice sheets and ice shelves](#)
- [Permafrost](#)
- [Snow](#)

Biosphere

- [Above-ground biomass](#)
- [Albedo](#)
- [Evaporation from land](#)
- [Fire](#)
- [Fraction of absorbed photosynthetically active radiation \(FAPAR\)](#)
- [Land cover](#)
- [Land surface temperature](#)
- [Leaf area index](#)
- [Soil carbon](#)
- [Soil moisture](#)

Anthroposphere

- [Anthropogenic Greenhouse gas fluxes](#)
- [Anthropogenic water use](#)

Ocean

Physical

- [Ocean surface heat flux](#)
- [Sea ice](#)
- [Sea level](#)
- [Sea state](#)
- [Sea surface currents](#)
- [Sea surface salinity](#)
- [Sea surface stress](#)
- [Sea surface temperature](#)
- [Subsurface currents](#)
- [Subsurface salinity](#)
- [Subsurface temperature](#)

Biogeochemical

- [Inorganic carbon](#)
- [Nitrous oxide](#)
- [Nutrients](#)
- [Ocean colour](#)
- [Oxygen](#)
- [Transient tracers](#)

Biological/ecosystems


- [Marine habitats](#)
- [Plankton](#)

ESA Climate Change Initiative



- 2010 - 2025
- €165 million
- 450 scientists
- 23 CCI ECVs in total
- 14 CCI ECVs operational under the Copernicus Climate Change Service (climate.copernicus.eu)



 climate modelling
user group
cci



climate change initiative

Oceanic

 sea level
budget closure
cci

Terrestrial

 reccap-2
cci

Atmospheric

Research Fellowships

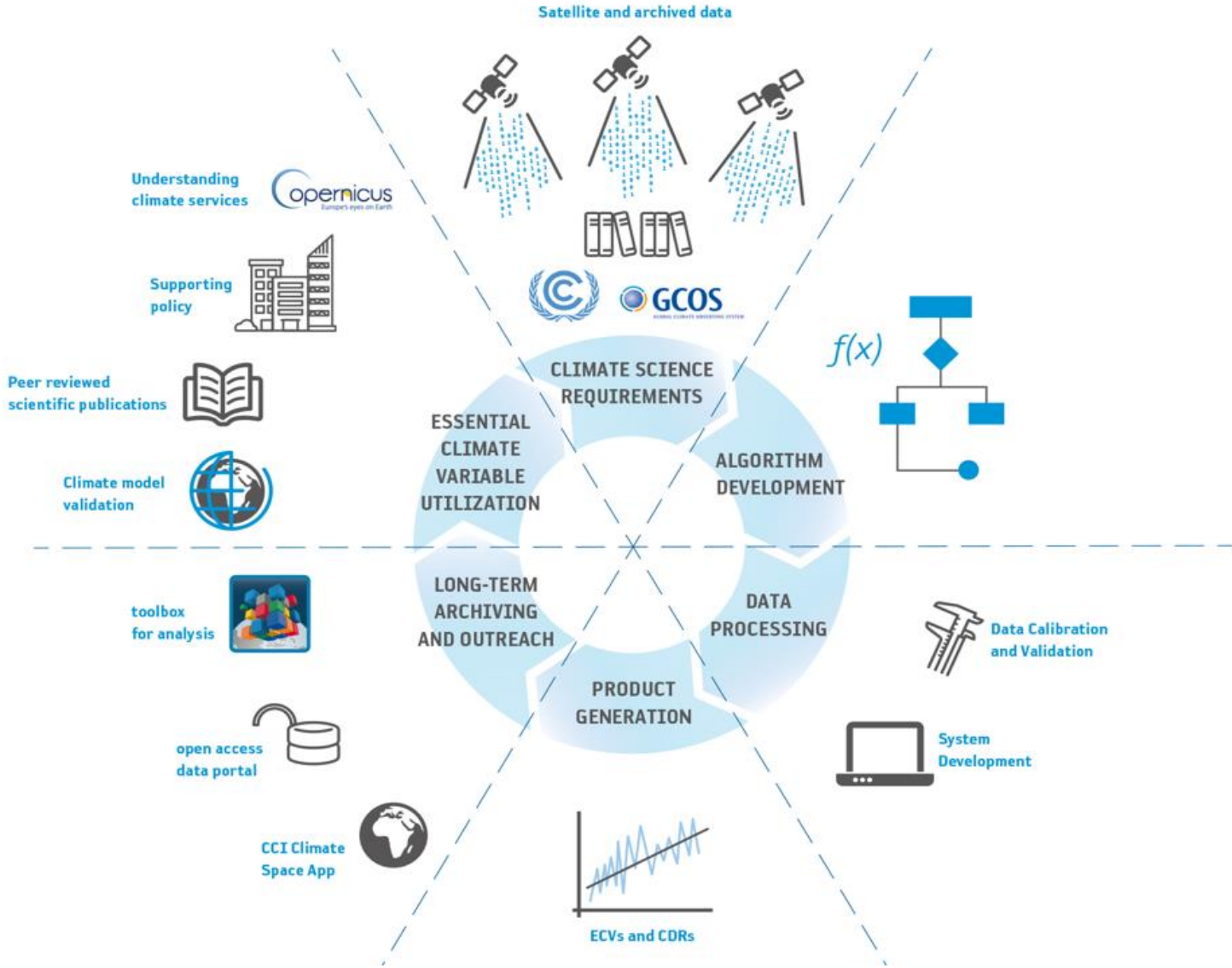
Open Data Portal

Toolbox

Tablet App

Education Resources

CCI Project Activities



ESA climate office
Home > Open Data Portal Evidence | Explore | Educate | ESA & Climate

Climate Data Dashboard → **Climate Data Search interface**
of the ESA Climate Change Initiative for the ESA Climate Change Initiative

- Aerosol
- Cloud
- Greenhouse Gases
- Ozone
- Ocean Colour
- Sea Ice
- Sea Level
- Sea State
- Sea Surface Salinity
- Sea Surface Temperature
- Water Vapour
- Antarctic Ice Sheet
- Above-Ground Biomass
- Fire
- Glaciers
- Greenland Ice Sheet
- Lakes
- Land Cover
- Land Surface Temperature
- Permafrost
- Snow
- Soil Moisture

Dataset

ESA Soil Moisture Climate Change Initiative (Soil_Moisture_cci): COMBINED product, Version 06.1

Update Frequency: Not Planned
Status: Completed
Online Status: ONLINE
Publication State: Published
Publication Date: 2021-04-19
Download Stats: last 12 months

Open Access Download See Related Documents

Latest Info: 2021-04-19: This dataset forms part of the ESA Soil Moisture Climate Change Initiative (Soil_Moisture_cci): Version 06.1 data collection. doi: 10.5285/28935552223242ca97953a8db99c2821. <http://dx.doi.org/10.5285/28935552223242ca97953a8db99c2821>

Abstract
The Soil Moisture CCI COMBINED dataset is one of three datasets created as part of the European Space Agency's (ESA) Soil Moisture Essential Climate Variable (ECV) Climate Change Initiative (CCI) project. The product has been created by directly merging Level 2 scatterometer and radiometer soil moisture products derived from the AMI-WS, ASCAT, SMMR, SSM/I, TMI, AMSR-E, WindSat, AMSR2, SMOS, SMAP, FY-3B and GPM satellite instruments. PASSIVE and ACTIVE products have also been created.

The v06.1 COMBINED product, provided as global daily images in NetCDF-4 classic file format, presents a global coverage of surface soil moisture at a spatial resolution of 0.25 degrees. It is provided in volumetric units [m³ m⁻³] and covers the period (yyyy-mm-dd) 1978-11-01 to 2020-12-31. For information regarding the theoretical and algorithmic base of the product, please see the Algorithm Theoretical Baseline Document. Additional reference documents and information relating to the dataset can also be found on the CCI Soil ...

Citable as: Dorigo, W.; Preimesberger, W.; Moesinger, L.; Pasik, A.; Scanlon, T.; Hahn, S.; Van der Schalie, R.; Van der Vliet, M.; De Jeu, R.; Kidd, R.; Rodriguez-Fernandez, N.; Hirschi, M. (2021): ESA Soil Moisture Climate Change Initiative (Soil_Moisture_cci): COMBINED product, Version 06.1. NERC EDS Centre for Environmental Data Analysis. [datarefinitive](#)

Abbreviation: Not defined

Keywords: ESA, Soil Moisture, CCI, Combined

Related Records: Details / Docs (6) Process Variables (11) Tools (4)

Datasets (11) Collections (1) Projects (1)

Coverage
Temporal Range
Start time: 1978-11-01T00:00:00
End time: 2020-12-31T23:59:59

Geographic Extent
World map showing global coverage with bounding box: 90.0000° to 180.0000° longitude and -90.0000° latitude.

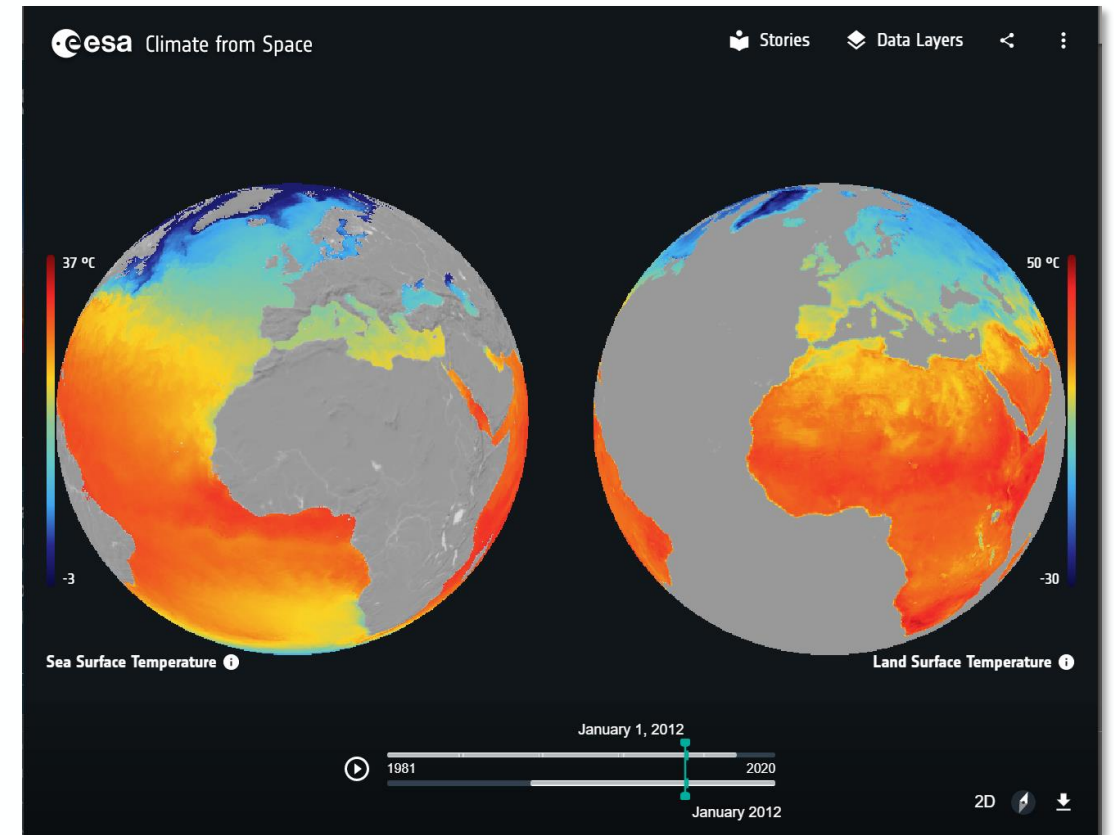
Related parties
Authors (12)

Teaching packs



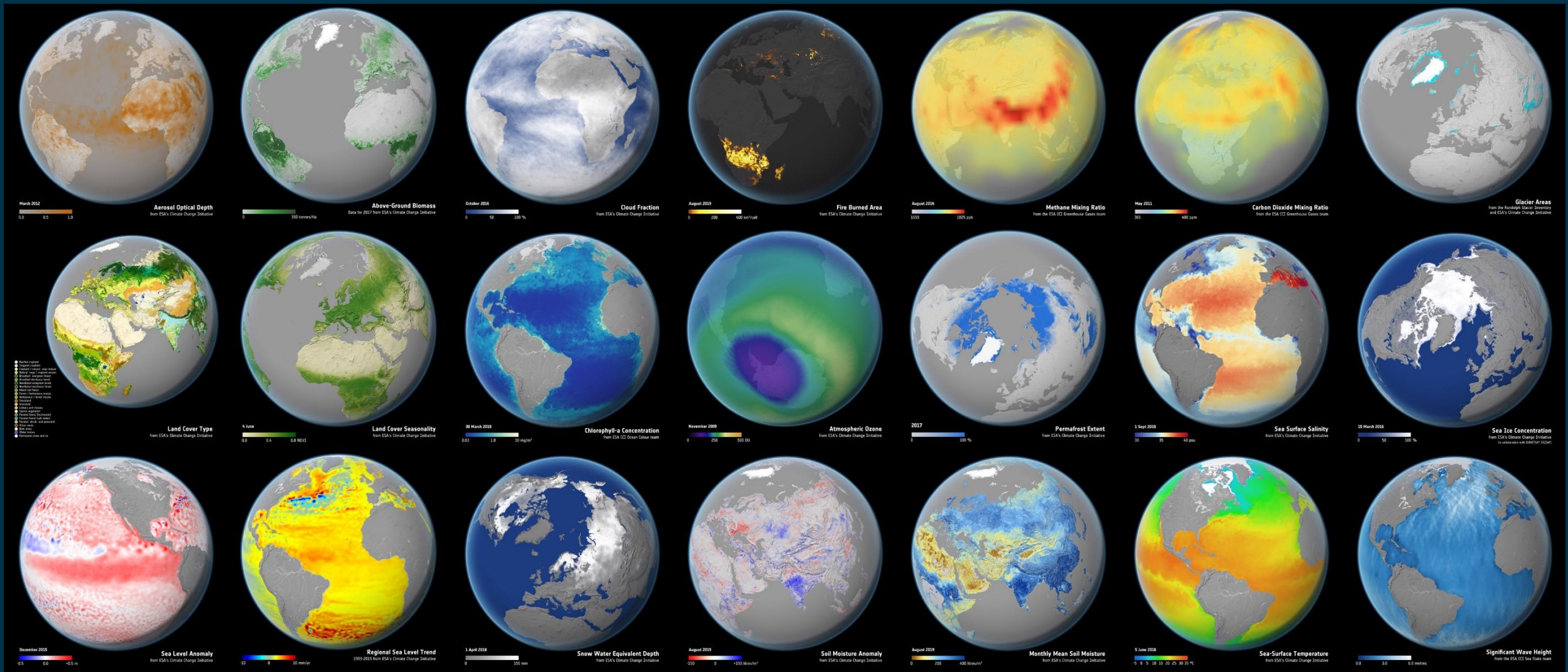
climate.esa.int/educate

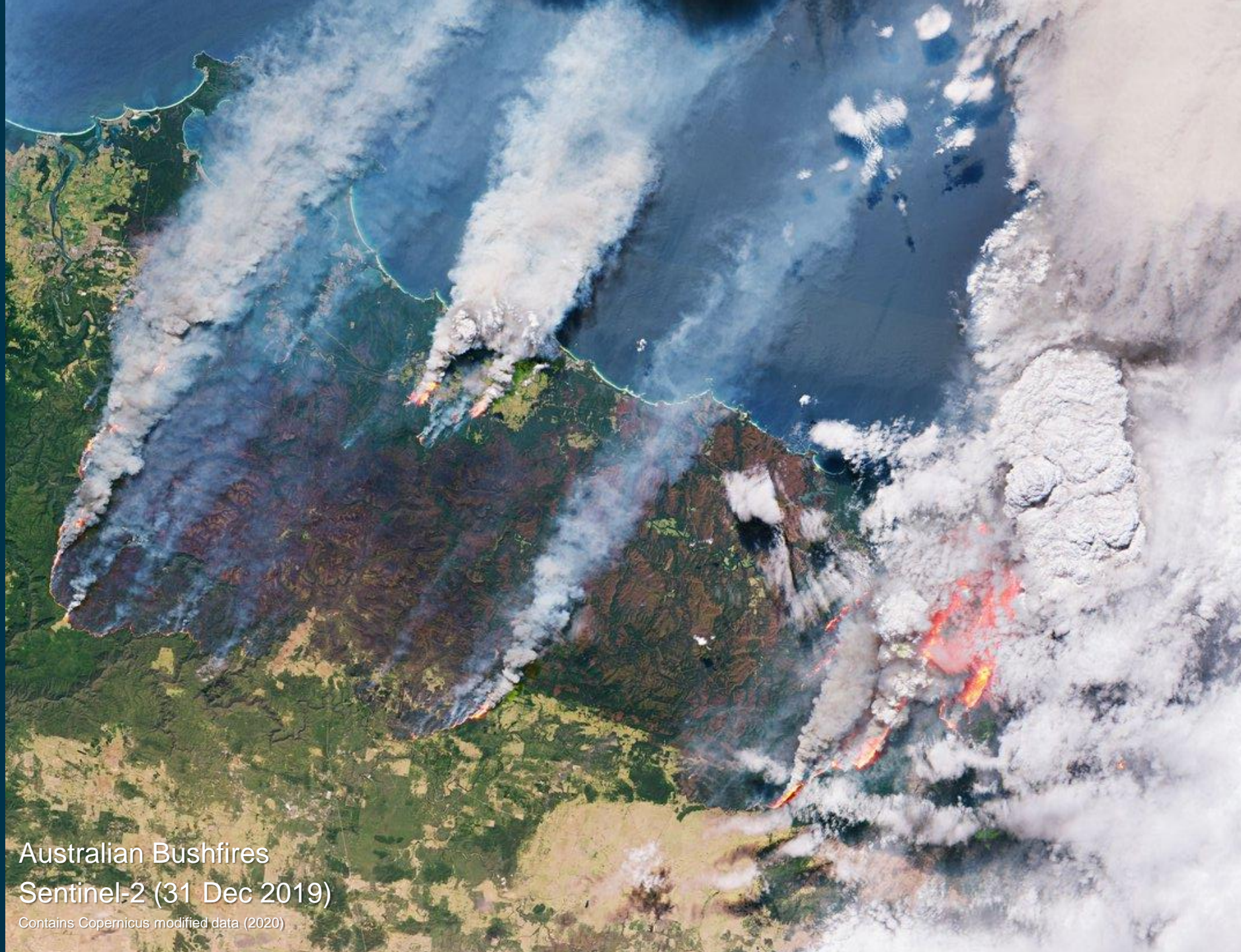
Web-based visualisation tool



cfs.climate.esa.int

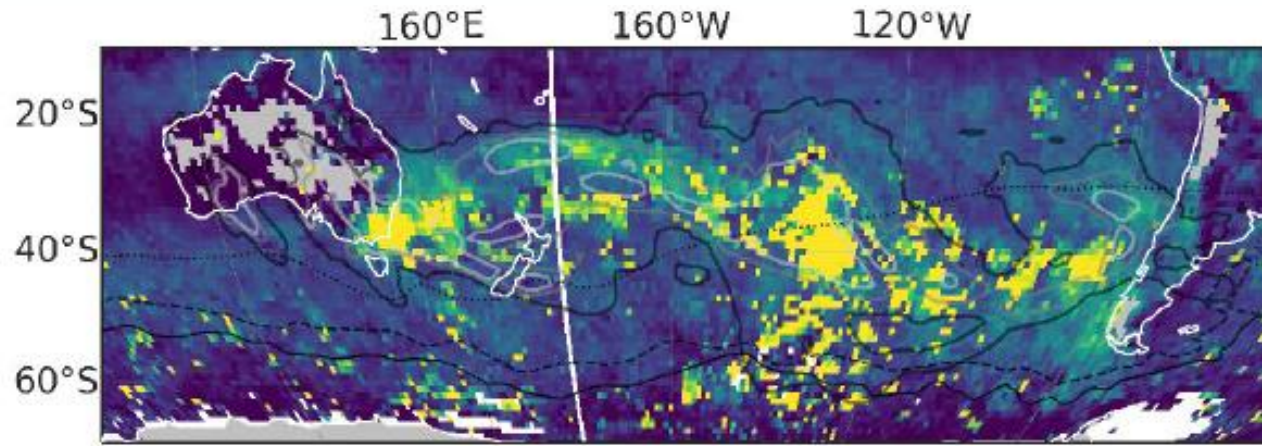
Examples:





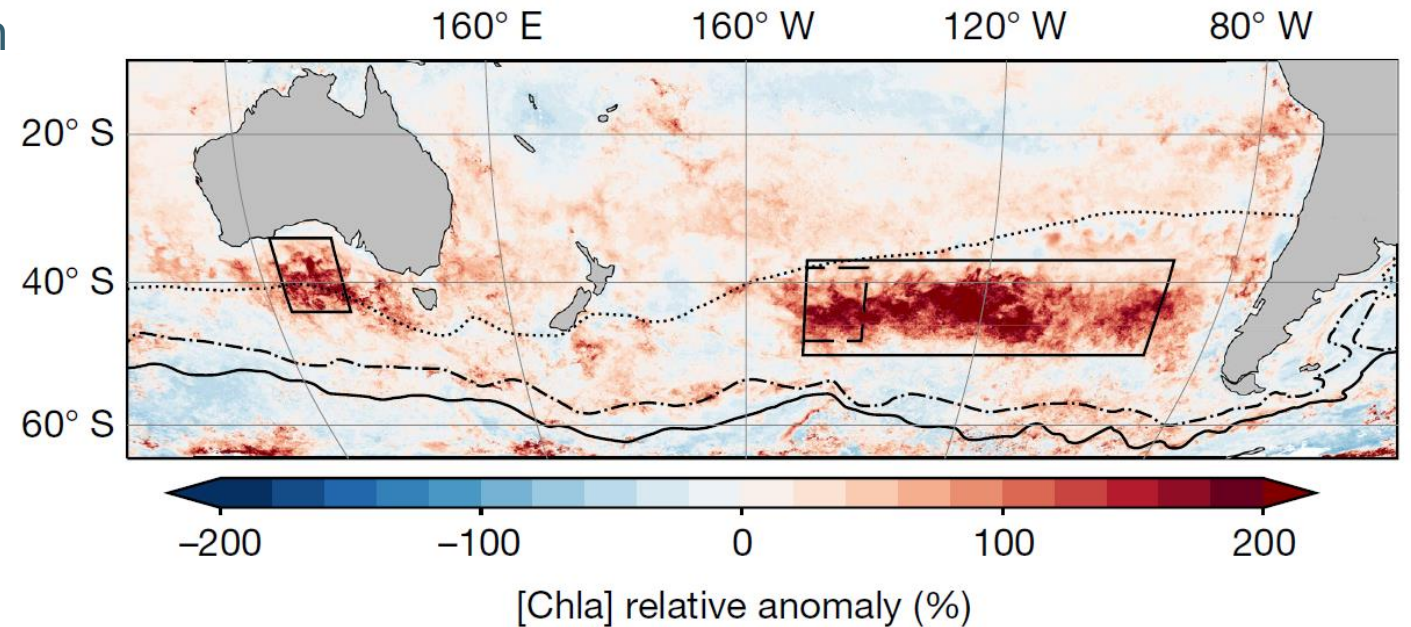
Australian Bushfires
Sentinel-2 (31 Dec 2019)

Contains Copernicus modified data (2020)



MODIS aerosol optical depth

Phytoplankton Chla anomaly



Weiye Tang *et al.*, 2021
Nature, vol 597, p370
doi: 10.1038/s41586-021-03805-8

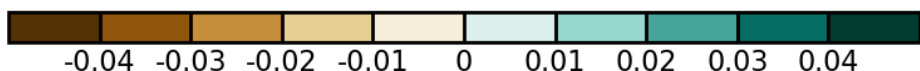
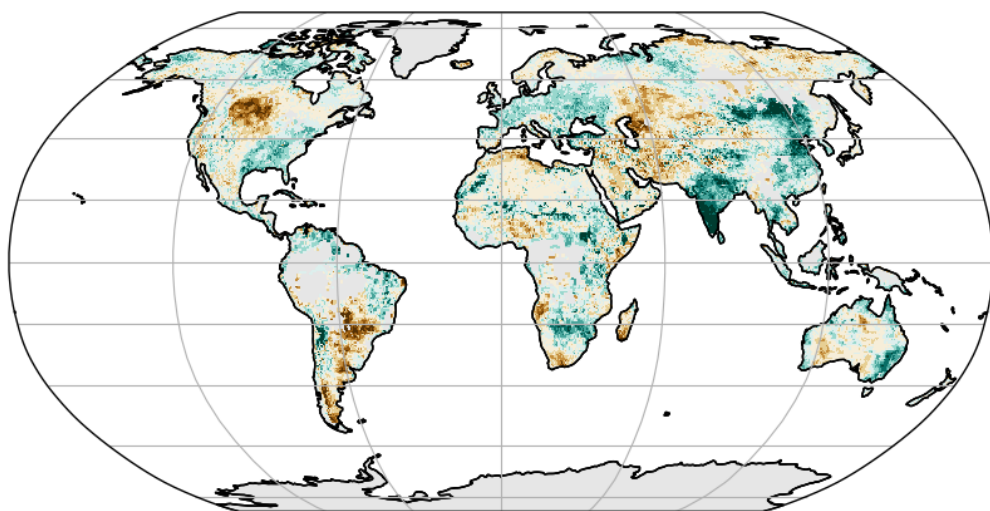
- Soil Moisture
- Fire
- Land Cover
- Vegetation Parameters
- Biomass
- Snow
- Permafrost



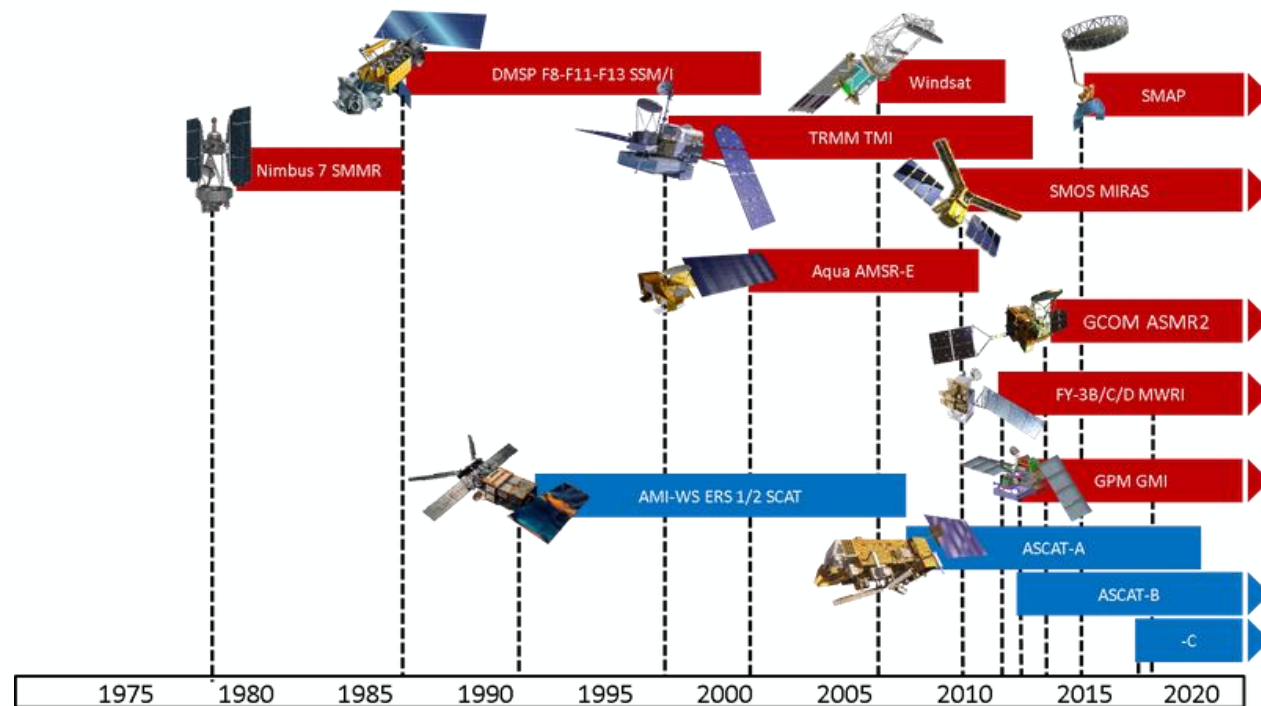
soil moisture

cci

- Annually updated global climate data record of soil moisture spanning more than 40yrs
- 0.25 deg spatial resolution
- 3 separate soil moisture products derived from active, passive and combined (active + passive) sensors
- 13 public releases to date



Anomalies from 1991-2020 (m^3m^{-3})



ESA CCI soil moisture v07.1 products utilize 5 active and 12 passive microwave sensors (released May 2022)

climate.esa.int/en/projects/soil-moisture/
Led by the Earth Observation Data Centre (EODC), Austria



fire cci

Global burnt area products 1982–2020 from:

- Copernicus Sentinel-3 (OLCI and SLSTR)
- NASA MODIS
- NOAA AVHRR GAC

Regional burnt area products

- Copernicus Sentinel-2 MSI (Sub-Saharan Africa, 20m, 2019 and 2016)
- Sentinel-1 SAR (Amazon basin, 40m, 2017)
- Sentinel-1 SAR (Indonesia, 10m, 2015-2016)

Key Result: Ramo et al., PNAS, 2021.

doi: 10.1073/pnas.2011160118

Importance of small fires and their carbon emission

Over Africa, nearly double the number of fires were detected with Sentinel-2 than with MODIS for 2016

Contribute 2.02 million km² of the 4.89 million km² total burned area detected

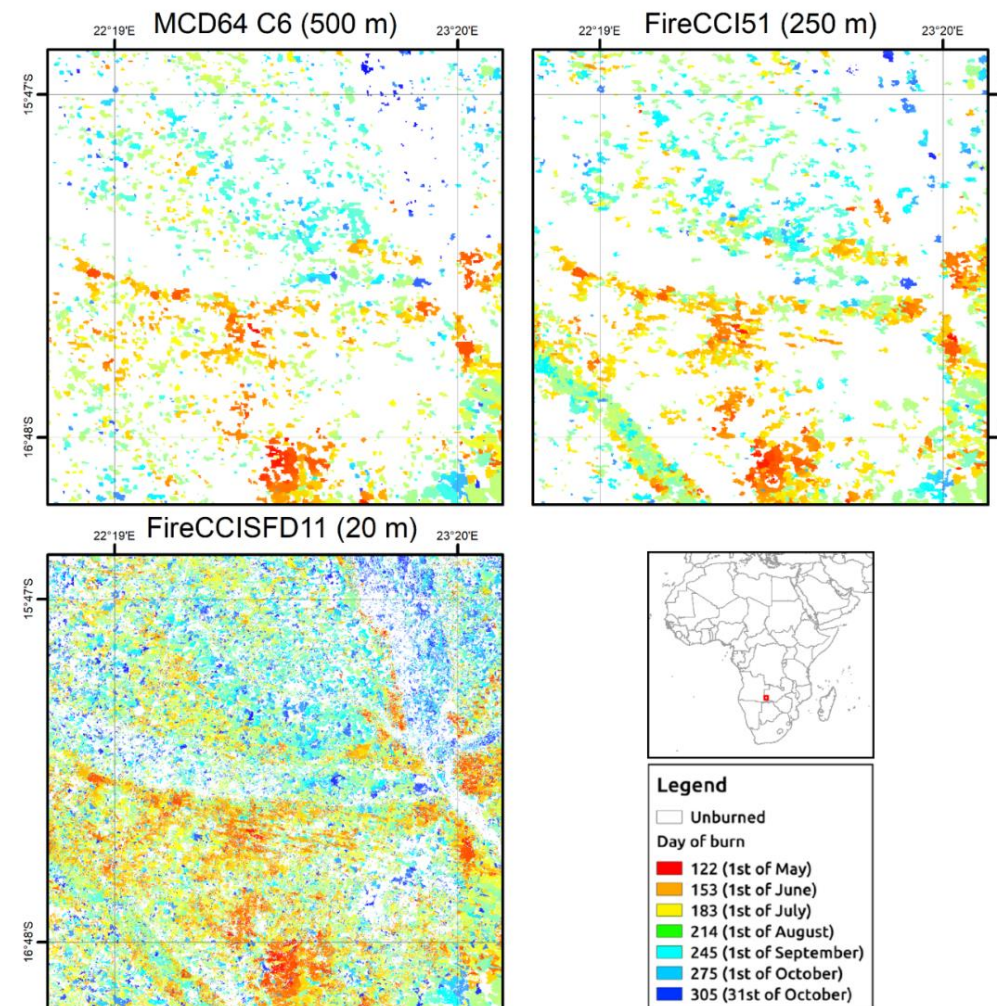
Corresponding Fire C emission estimated are 1.44 PgC

31-101% higher than previously thought

14% of global C emission from FF burning

Critical component of BA in Sub-Saharan Africa

Raises the contribution of biomass burning to global GHG and aerosols

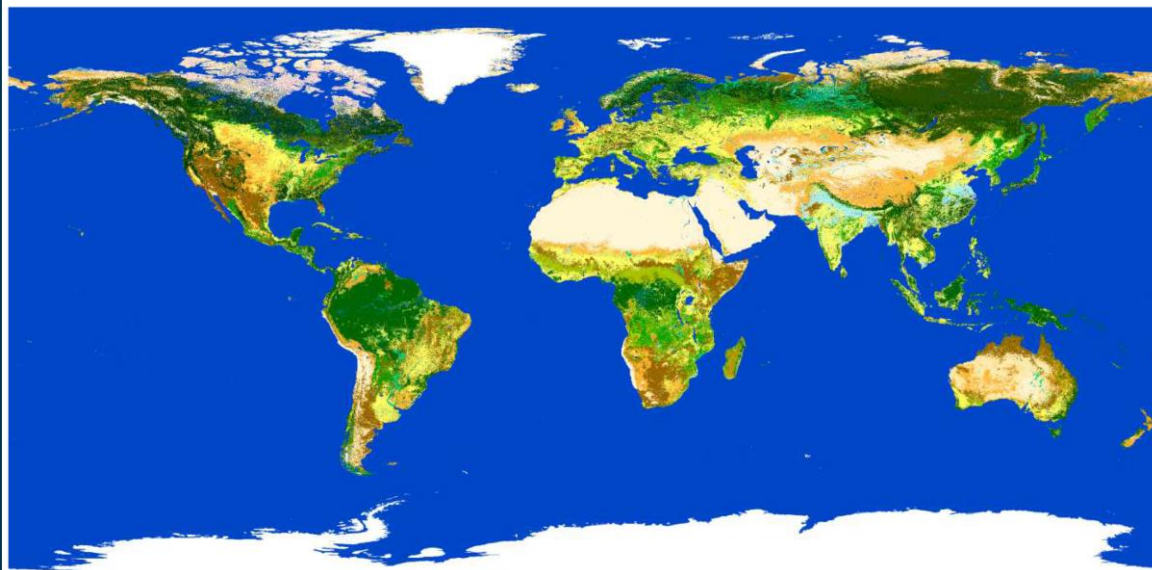


The finer resolution (20m) of the FireCCISFD11 product allows detecting much smaller burned area patches (and hence a larger total BA) compared to medium-resolution sensors (e.g. FireCCI51 at 250m)

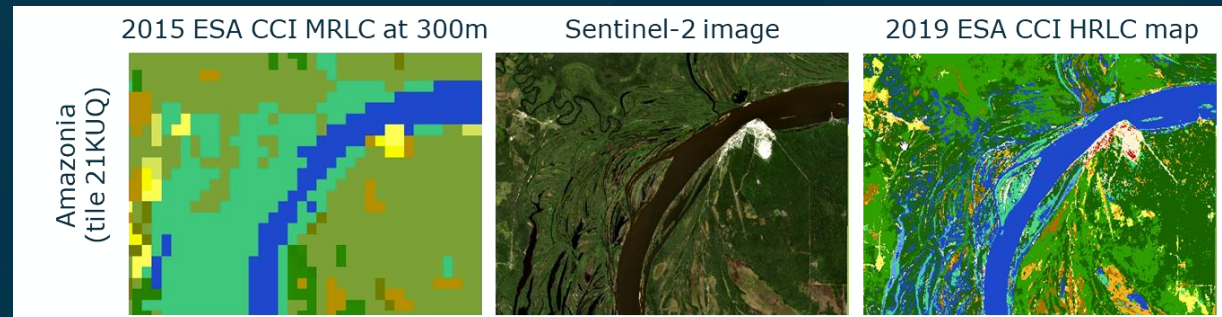
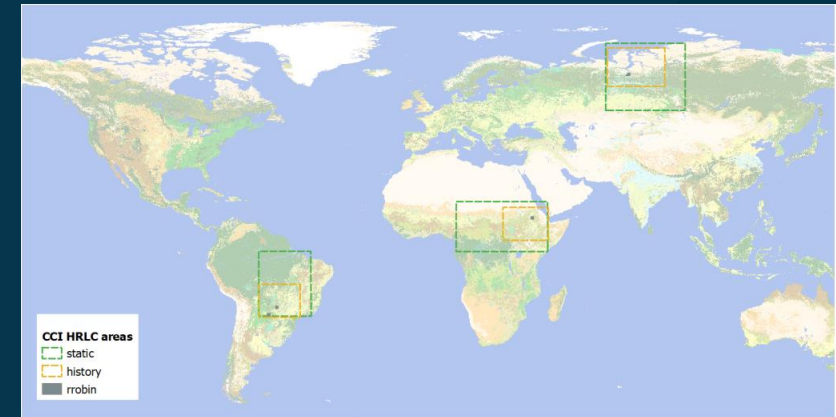


- Series of annual maps, 300 m, 1992-2020,
- UN Land Cover Classification System (22 classes)
- Consistent analysis-ready annual Plant Functional Type maps for climate modelling
- Generated operationally via C3S from 2016 onwards
- Led by UCL-Geomatics, Belgium

climate.esa.int/en/projects/land-cover



- Static subcontinental maps at 10m, long-term record of regional maps at 30m in the sub-regions every 5 years (with change information yearly)
- Led by U. Trento, Italy



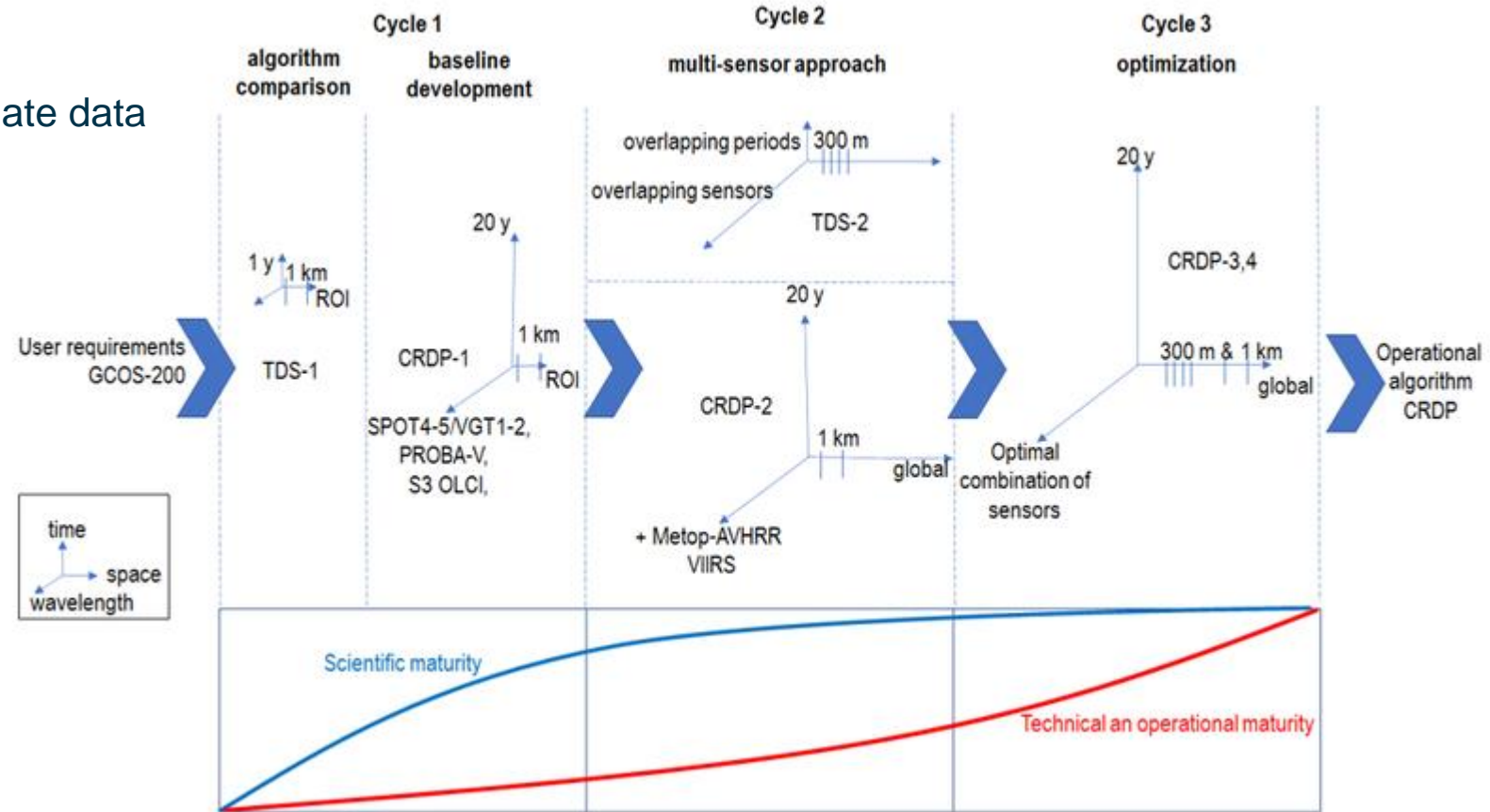
climate.esa.int/en/projects/high-resolution-land-cover



New CCI project started in July 2022

Aims to develop improved LAI and FAPAR climate data records

- Global maps, 2000-2021
- 300m to 1km resolutions
- Multi-mission merging:
 - SPOT-VGT
 - PROBA-V
 - Sentinel-3 OLCI
 - Envisat MERIS
 - Terra and Aqua MODIS
 - MetOp AVHRR
 - VIIRS



climate.esa.int/en/projects/vegetation-parameters
 Led by Vito, Belgium and the University of Twente, NL

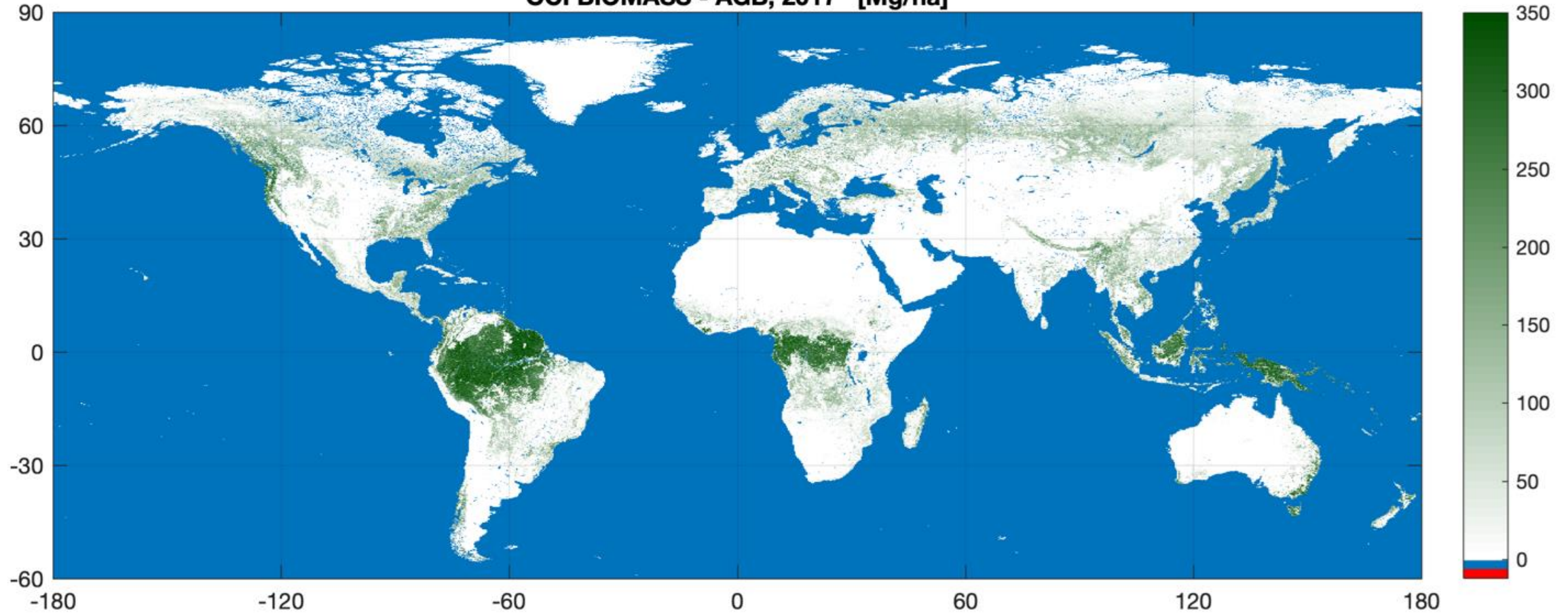


biomass

cci



CCI BIOMASS - AGB, 2017 [Mg/ha]



- Data to inform the Global Stocktake for the UNFCCC Paris Agreement commitments and REDD+
- Series of maps to quantify the change in forest biomass over time (2010, 2017, 2018, 2020)
- cci.esa.int/biomass, led by University of Aberystwyth, UK





SNOW

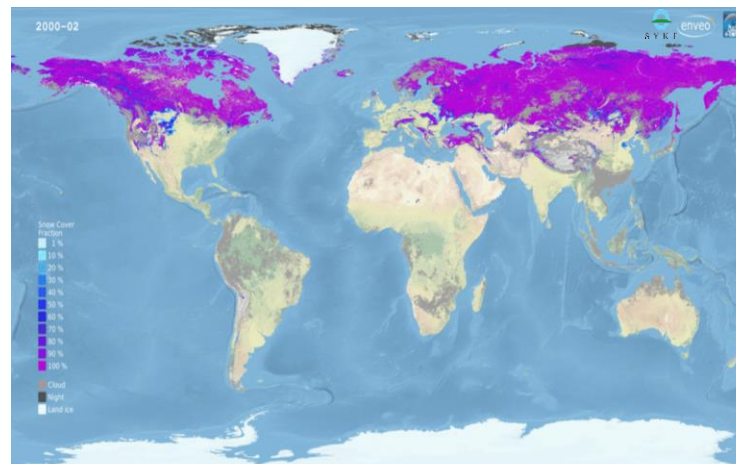
cci

Global Snow products:

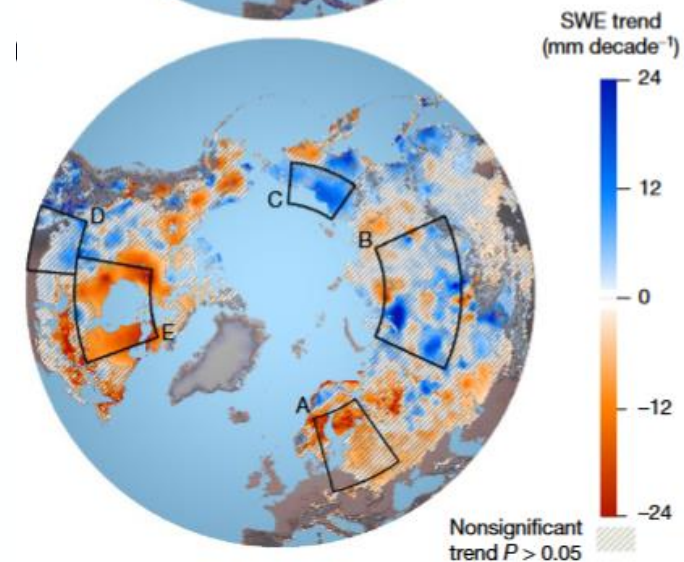
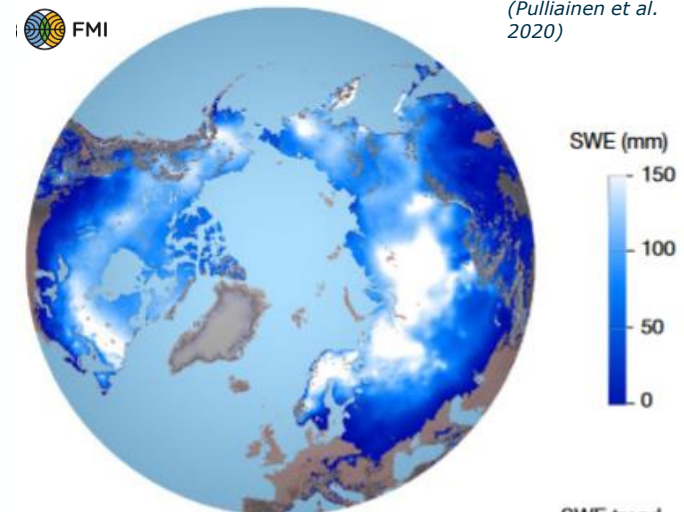
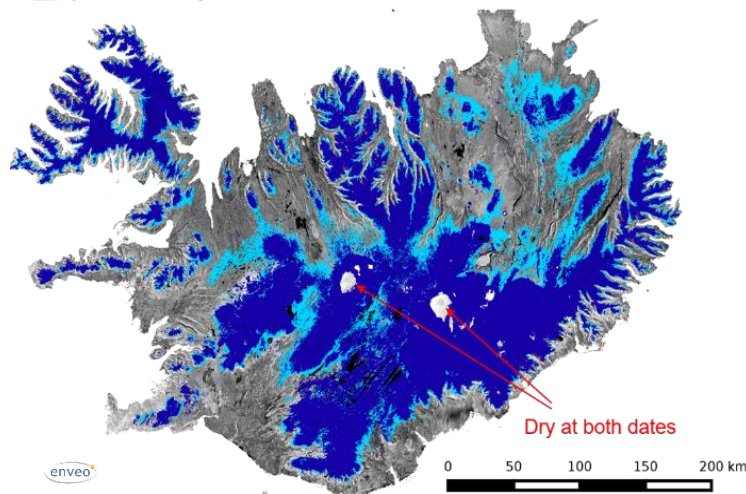
- Snow Cover Fraction
 - 2000 – 2020 (MODIS / SLSTR, 1km)
 - 1982 – 2018 (AVHRR, 5km)
- Snow Water Equivalent:
 - 1979 – 2020 (SSM/I/S, 12.5km)
- v2.0 available now
- v3.0 planned for mid 2023

Mountain Snow Products:

- Alps, Pyrenees, Scandinavia, Alaska, Iceland
- Wet snow maps at 100m from 1992 onwards
- Study snow melt onset and duration
- Consistent with SCF products
- First release in mid 2023



■ wet snow extent on 10-15 June 2015 ■ decrease of wet snow extent from 17-22 May to 10-15 June 2015
■ layover / foreshortening





permafrost cci

climate.esa.int/en/projects/permafrost
Led by Gamma, Switzerland and b.geos, Austria

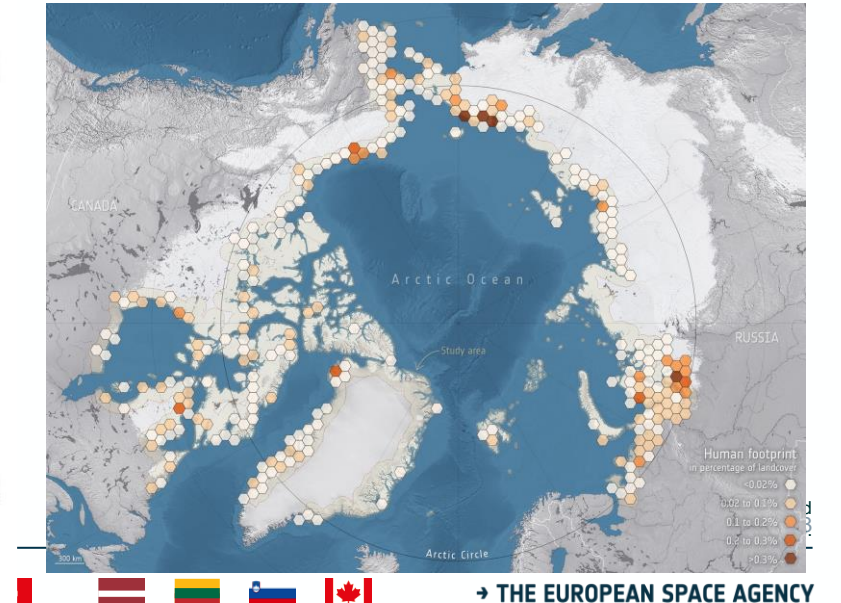
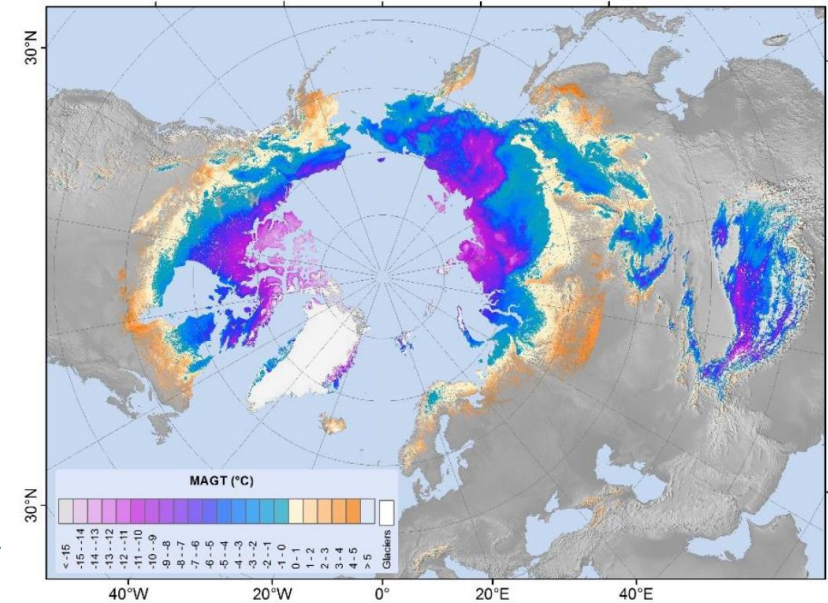
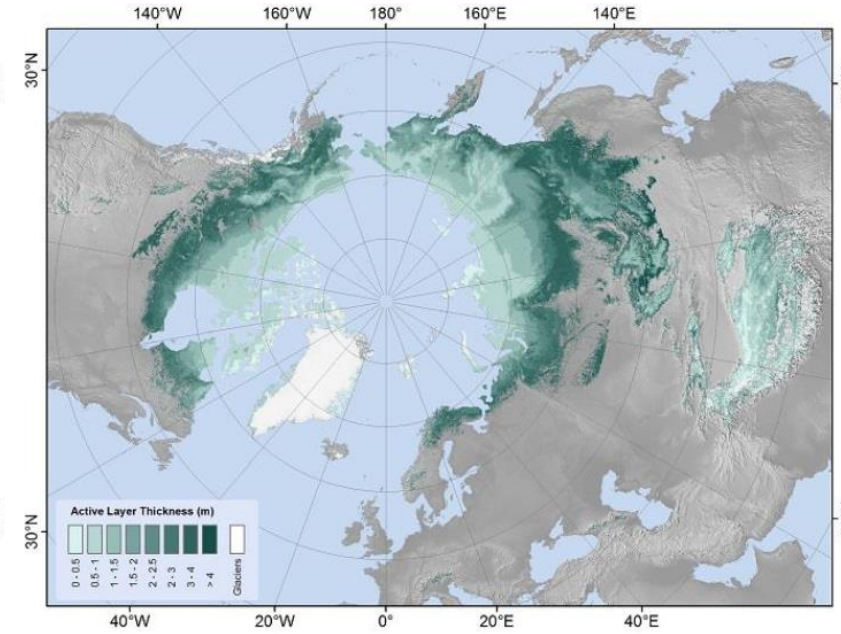
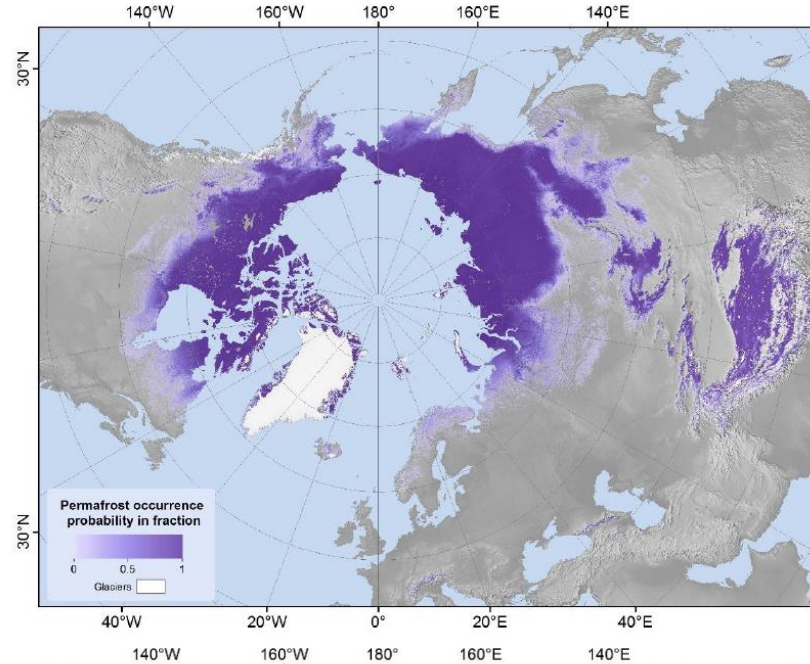


Aim: To provide consistent global maps of permafrost parameters

- Extent
- Temperature
- Active layer thickness
- 1km, monthly resolution

Based on Earth Observation records ingested into a permafrost model:

- Land cover
- Land surface temperature
- Snow



Thanks for your attention



Please visit climate.esa.int for more info



climate modelling user group
cci



climate change initiative

Oceanic



Terrestrial



Atmospheric

Research Fellowships

Open Data Portal

Toolbox

Tablet App

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