



Climate Change

C3S data: Observations and Essential Climate Variables (ECVs)

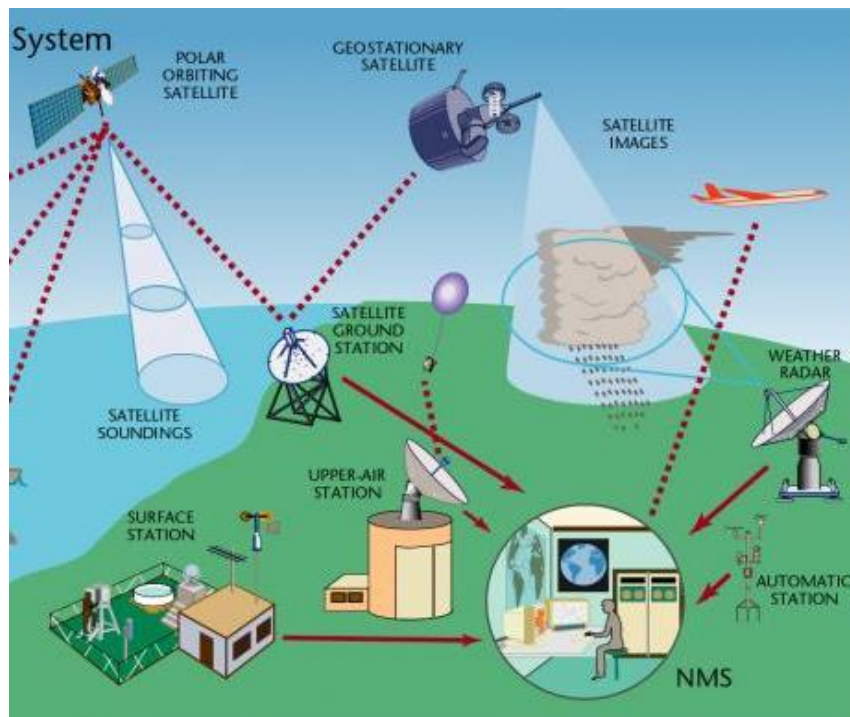
Joaquín Muñoz Sabater
Senior scientist / ECV manager





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Why observations?



- Source WMO -

Observations are key to understand the climate system (historical & present)

Uses:

- Reanalysis (see next presentation by H. Hersbach),
- Essential Climate Variables



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ECVs

We use historical observations from in-situ and satellite sensors to build Climate Data Records of Essential Climate Variables (ECVs)

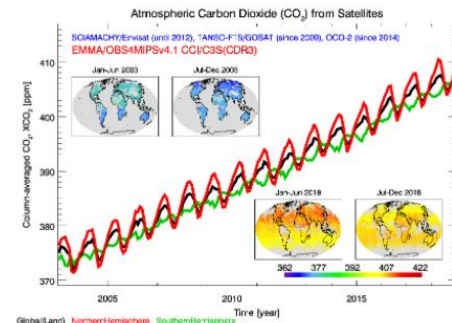
Climate Data Record: A (Thematic) Climate Data Record is a time series of measurements of sufficient length, consistency, and continuity to determine climate variability and change.

Essential Climate Variables: An Essential Climate Variable is a geophysical variable (or a group of linked variables) that critically contributes to the characterization of Earth's climate.

→ Relevant, Feasible, Cost-effective

Required to support the work of the UNFCCC and the IPCC

- Provide empirical evidence to understand the evolution of climate (climate indicators)
- Guide mitigation and adaptation measures (decision making)
- Assess risks and enable attribution of climate events to underlying causes
- Underpin climate services.

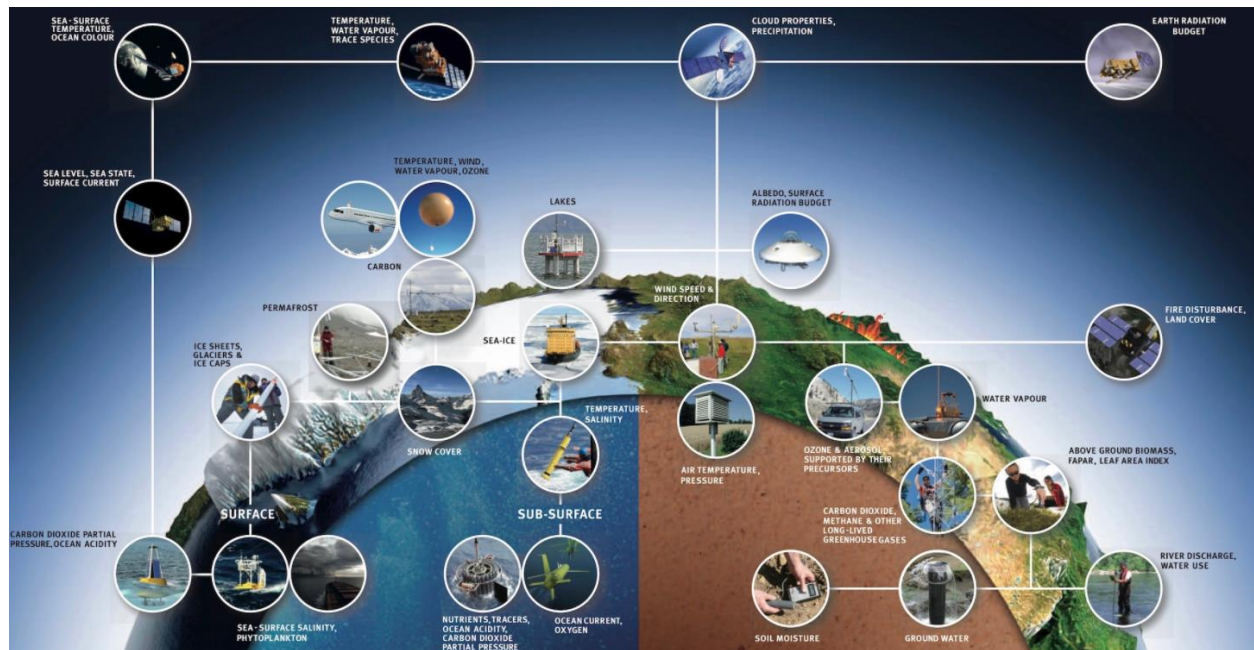




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GCOS and ECVs

Scientific requirements for observations are based on the framework provided by the [Global Climate Observing System](#) (GCOS).



→ 54 Essential Climate Variables



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ECV services in C3S (satellite data)

| | | C3S_312a | | C3S_312b | | | C3S2_312 | | |
|--|--------|----------|------|----------|------|------|----------|------|------|
| | GCOS | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
| Atmospheric physics | | | | | | | | | |
| Precipitation | 4.3.5 | | | | | | | | |
| Surface Radiation Budget | 4.3.6 | | | | | | | | |
| Water Vapour | 4.5.3 | | | | | | | | |
| Cloud Properties | 4.5.4 | | | | | | | | |
| Earth Radiation Budget | 4.5.5 | | | | | | | | |
| Atmospheric composition | | | | | | | | | |
| Carbon Dioxide | 4.7.1 | Lot 6 | | | | | | | |
| Methane | 4.7.2 | Lot 6 | | | | | | | |
| Ozone | 4.7.4 | Lot 4 | | | | | | | |
| Aerosol | 4.7.5 | Lot 5 | | | | | | | |
| Ocean | | | | | | | | | |
| Sea Surface Temperature | 5.3.1 | Lot 3 | | | | | | | |
| Sea Level | 5.3.3 | Lot 2 | | | | | | | |
| Sea ice | 5.3.5 | Lot 1 | | | | | | | |
| Ocean Colour | 5.3.7 | | | | | | | | |
| Land hydrology & cryosphere | | | | | | | | | |
| Lakes | 6.3.4 | | | | | | | | |
| Glaciers | 6.3.6 | Lot 8 | | | | | | | |
| Ice sheets and ice shelves | 6.3.7 | | | | | | | | |
| Soil moisture | 6.3.16 | Lot 7 | | | | | | | |
| Land biosphere | | | | | | | | | |
| Albedo | 6.3.9 | Lot 9 | | | | | | | |
| Land Cover | 6.3.10 | | | | | | | | |
| Fraction of Absorbed Photosynthesis | 6.3.11 | Lot 9 | | | | | | | |
| Leaf Area Index | 6.3.12 | Lot 9 | | | | | | | |
| Fire | 6.3.15 | | | | | | | | |
| | | 2019 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |

Table 1: From proof-of-concept phase (9 Lots) to operations (5 Lots) of C3S ECV services. The column labelled GCOS shows the relevant section in the GCOS Status Report (GCOS-SR 2015).

Coordination with CM-SAF / ROM SAF / ESA CCI / Uni. Maryland / NASA / NOAA

Coordination with ESA-CCI and other national projects

Coordination with ESA-CCI

Coordination with ESA-CCI, GloboLakes, Arc-Lake, HydroWeb

Coordination with ESA-CCI, CGL, QA4ECV, LSA-SAF



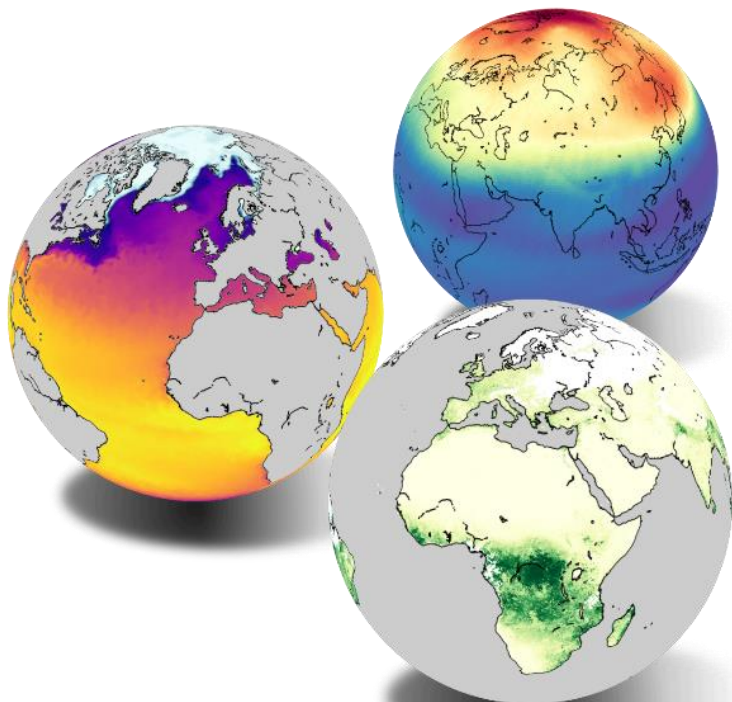
Europe's eyes on Earth





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ECVs operational services



ECV products that are

- State-of-the-art
 - **Coordination with ESA CCI, EUMETSAT/SAFs & other Copernicus services**
- Long-term, consistent, complete (CDR)
 - **Single/Multi sensor approach**
- Regularly extended in time (ICDR)
 - **Frequent updates of data records**
- Gridded, aggregated
 - **Meeting user requirements**
- *Accessible & Tracible*
 - Access through the Climate Data Store*
 - Creation of adaptors, integration in CDS Toolbox**
 - Documentation*
 - Supporting documentation (ATBD, PQAD, PUGS, ...)**
 - Evaluation and Assessment*
 - EQC, own QC procedures, benchmarking, cross-ECV consistency**
 - User support*
 - Service desks opened for all services**



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Example of Dataset access in the CDS






Joaquin Munoz Sabater [Logout](#)

This is a new service -- your feedback will help us to improve it [BETA](#)

Home Search Datasets Applications Your requests Toolbox Help & support

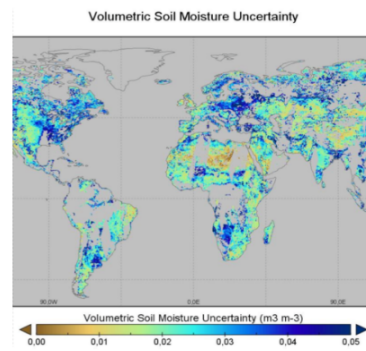
Soil moisture gridded data from 1978 to present

- Overview
- Download data
- Quality assessment
- Documentation

This dataset provides estimates of **soil moisture** over the globe from a large set of satellite sensors. It is based on the ESA Climate Change Initiative soil moisture version 03.3 and represents the current state-of-the-art for satellite-based soil moisture climate data record production, in line with the "Systematic observation requirements for satellite-based products for climate" as defined by GCOS (Global Climate Observing System). Data are on a regular latitude/longitude grid expectedly with gaps in space and time.

When dealing with satellite data it is common to encounter references to Climate Data Records (CDR) and interim-CDR (ICDR). For this dataset, both the ICDR and CDR parts of each product were generated using the same software and algorithms. The CDR is intended to have sufficient length, consistency, and continuity to detect climate variability and change. The ICDR provides a short-delay access to current data where consistency with the CDR baseline is expected but was not extensively checked. The dataset contains the following products: "active", "passive" and "combined". The "active" and "passive" products were created by using scatterometer and radiometer soil moisture products, respectively. The "combined" product results from a blend based on the two previous products.

This dataset is produced on behalf of the Copernicus Climate Change Service (C3S).



Contact

[ECMWF Support Portal](#)

Licence

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Publication date

2018-10-25

| DATA DESCRIPTION | |
|-----------------------|--|
| Data type | Gridded |
| Projection | Regular latitude-longitude grid |
| Horizontal coverage | Global |
| Horizontal resolution | 0.25° x 0.25° |
| Temporal coverage | 1978 to present |
| Temporal resolution | Daily, 10-day, Monthly |
| File format | NetCDF |
| Conventions | Climate and Forecast (CF) Metadata Convention v1.8 |
| Versions | v201706, v201812, v201912, v202012 |
| Update frequency | ICDR: 10-day with a 10-day latency. CDR: annual. |

| MAIN VARIABLES | | |
|-----------------------|-------|--|
| Name | Units | Description |
| Surface soil moisture | % | Content of liquid water in a surface soil layer of 2 to 5 cm depth expressed as the percentage of total saturation |

Landing page

IWF



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Example of Dataset access in the CDS

Retrieving data

Home Search Datasets Applications Your requests Toolbox Help & support

Soil moisture gridded data from 1978 to present

Overview **Download data** Documentation

Variable [?](#)

Soil moisture saturation

Time aggregation [?](#)

Day average 10-day average

Year

| | | |
|-------------------------------|-------------------------------|-------------------------------|
| <input type="checkbox"/> 1978 | <input type="checkbox"/> 1979 | <input type="checkbox"/> 1980 |
| <input type="checkbox"/> 1984 | <input type="checkbox"/> 1985 | <input type="checkbox"/> 1986 |
| <input type="checkbox"/> 1990 | <input type="checkbox"/> 1991 | <input type="checkbox"/> 1992 |
| <input type="checkbox"/> 1996 | <input type="checkbox"/> 1997 | <input type="checkbox"/> 1998 |
| <input type="checkbox"/> 2002 | <input type="checkbox"/> 2003 | <input type="checkbox"/> 2004 |
| <input type="checkbox"/> 2008 | <input type="checkbox"/> 2009 | <input type="checkbox"/> 2010 |
| <input type="checkbox"/> 2014 | <input type="checkbox"/> 2015 | <input type="checkbox"/> 2016 |

Month

| | | |
|----------------------------------|-----------------------------------|--------------------------------|
| <input type="checkbox"/> January | <input type="checkbox"/> February | <input type="checkbox"/> March |
| <input type="checkbox"/> July | <input type="checkbox"/> August | <input type="checkbox"/> Septe |

Day

| | | | | | |
|-----------------------------|-----------------------------|--|-----------------------------|-----------------------------|-----------------------------|
| <input type="checkbox"/> 01 | <input type="checkbox"/> 02 | <input type="checkbox"/> 03 | <input type="checkbox"/> 04 | <input type="checkbox"/> 05 | <input type="checkbox"/> 06 |
| <input type="checkbox"/> 07 | <input type="checkbox"/> 08 | <input type="checkbox"/> 09 | <input type="checkbox"/> 10 | <input type="checkbox"/> 11 | <input type="checkbox"/> 12 |
| <input type="checkbox"/> 13 | <input type="checkbox"/> 14 | <input checked="" type="checkbox"/> 15 | <input type="checkbox"/> 16 | <input type="checkbox"/> 17 | <input type="checkbox"/> 18 |
| <input type="checkbox"/> 19 | <input type="checkbox"/> 20 | <input type="checkbox"/> 21 | <input type="checkbox"/> 22 | <input type="checkbox"/> 23 | <input type="checkbox"/> 24 |
| <input type="checkbox"/> 25 | <input type="checkbox"/> 26 | <input type="checkbox"/> 27 | <input type="checkbox"/> 28 | <input type="checkbox"/> 29 | <input type="checkbox"/> 30 |
| <input type="checkbox"/> 31 | | | | | |

Select all Clear all

Format [?](#)

Zip file (.zip) Compressed tar file (.tar.gz)

Type of sensor [?](#)

Active Passive Combined passive and active

Select all Clear all

Type of record [?](#)

ICDR (Intermediate climate data record) CDR (Climate data record)

Select all Clear all

Version

v201706.0.0 v201801.0.0 v201812.0.0

Select all Clear all

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Show API request Not yet toolbox compatible [Submit Form](#)





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Example of Dataset access in the CDS

The screenshot shows the top navigation bar with logos for the European Commission, Copernicus, ECMWF, and Climate Change Service. Below the navigation bar is a dark red header with the text 'Home Search Datasets Applications Your requests Toolbox Help & support'. The main content area has a light grey background with the title 'Soil moisture gridded data from 1978 to present'. A green message states: 'The system session is complete. Please report any issues to user support.' Below this are three tabs: 'Overview', 'Download data', and 'Documentation', with 'Documentation' being the active tab.

Overview

Download data

Documentation

- **Algorithm theoretical baseline document v2.2 (3.2M PDF)**

Provides in-depth documentation on the algorithms used to derive the dataset(s).

- **Product user guide and specification document v2.3 (1.9M PDF)**

Summarizes the characteristics of the dataset(s) in a concise manner with focus on: space and time extent and resolution; data formats, metadata and flags; description of variables, strengths and limitations.

- **Product quality assurance document v1.1 (2.5M PDF)**

Describes the data quality assurance process applied by the data producer before release of the dataset(s).

- **Product quality assessment report v1.1 (3.4M PDF)**

Provides the latest report on data quality obtained according to methodologies described in the product quality assurance document

- **Target requirements document v1.0 (845.7K PDF)**

Summarises the minimum requirements identified for the dataset(s) regarding, among others, data quality, timeliness and data format.

- **Gap analysis document v1.0 (1.4M PDF)**

Discusses identified gaps of the dataset(s) with respect to their target requirements.

- **System quality assurance document v1.1 (1.1M PDF)**

Describes the processing chain and procedures in place at the data provides.

Documentation

CMWF



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Example of Dataset access in the CDS

Overview Download data Quality assessment Documentation

This is a new feature, work in progress. Should any inconsistency be found, please report to copernicus-support@ecmwf.int

The CDS datasets are assessed by the Evaluation and Quality Control (EQC) function of C3S independently of the data supplier. EQC encompasses a framework of processes aimed to assure technical and scientific quality harmonized across all dataset types available through the CDS. During the EQC process, the documentation provided with the dataset is scrutinized and data are checked for usability and reliability.

Variable:

Volumetric surface soil moisture ✕

Type of sensor:

Combined passive and active ✕

Time aggregation:

10-day average ✕

Type of record:

CDR (Climate data record) ✕

Version:

v201812.0.0 ✕

Quality Assurance

▼ Variable: Volumetric surface soil moisture - Type of sensor: Combined passive and active - Time aggregation: 10-day average - Type of record: CDR (Climate data record) - Version: v201812.0.0 [🔗](#) Last updated on 23/08/2021

| INTRODUCTION | USER DOCUMENTATION | ACCESS | INDEPENDENT ASSESSMENT |
|--|----------------------------|-----------------------|-------------------------------|
| Dataset overview | User guide | Toolbox compatibility | Data check |
| Temporal and spatial coverage and resolution | Scientific methodology | Archive | Expert evaluation |
| Providers | Uncertainty quantification | | Dataset maturity |
| Dataset version | Validation | | Key strengths and limitations |
| Data update | Inter-comparison | | |



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Thank you!



@copernicusEU
@copernicusECMWF
@j_munoz_sabater

C3S: <https://climate.copernicus.eu/>

Climate Data Store: <https://cds.climate.copernicus.eu/>