Implementation of Essential Climate Variables Services in the Copernicus Climate Change Service

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Climate Change

2nd Climate Observations Conference – Darmstadt, Germany– 17-19 October 2022

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Why Essential Climate Variables (ECVs)?

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.

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 bio-physical variable (or a group of linked variables) that critically contributes to the characterization of Earth' s climate.

→ Relevant, Feasible, Cost-effective

We use historical observations from satellite sensors to build <u>Climate Data Records of Essential Climate Variables (ECVs)</u>

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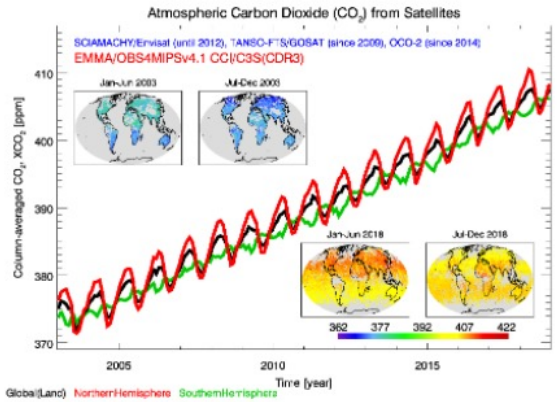

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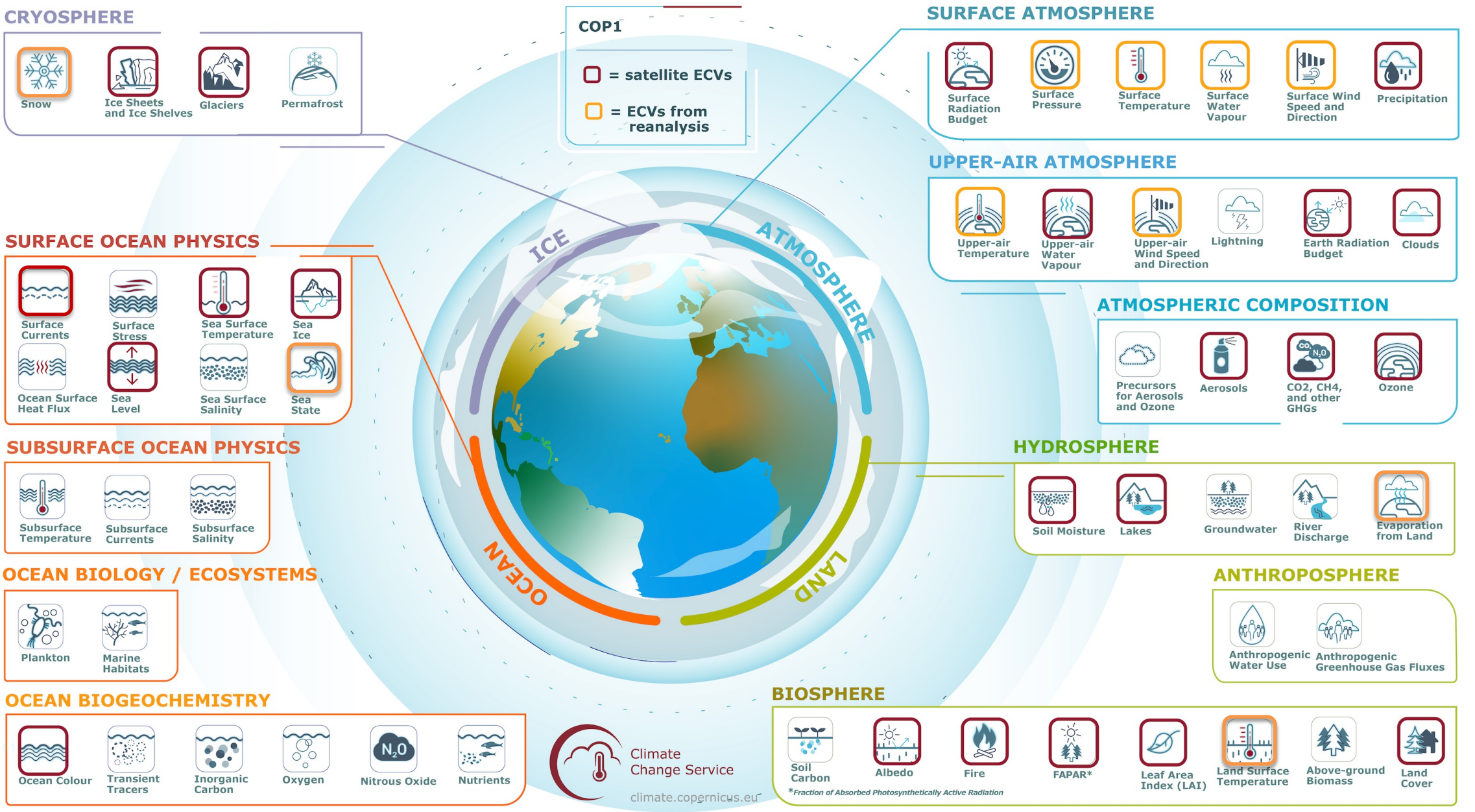
The Essential Climate Variables (ECVs)



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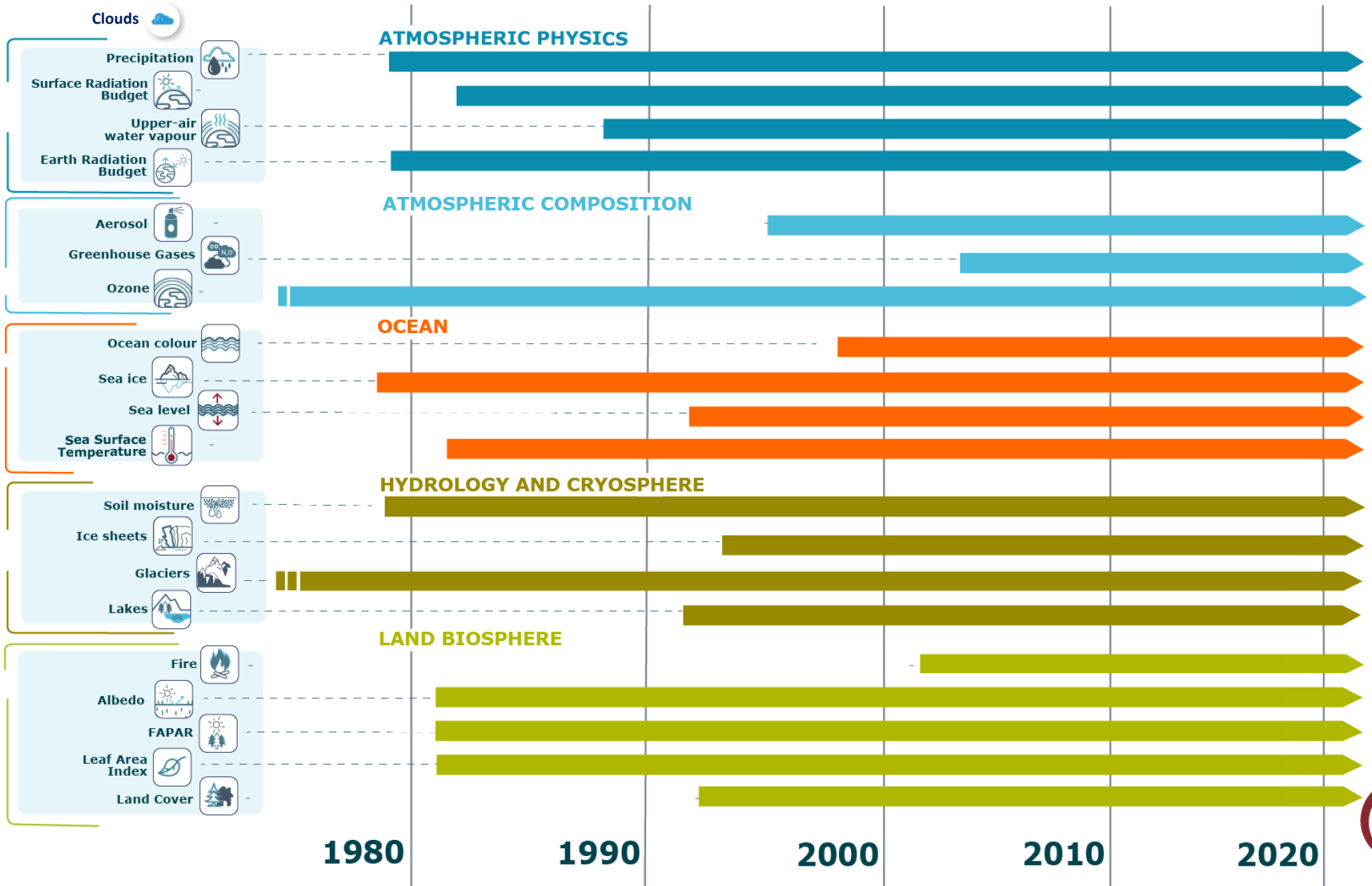
Providing long-term, quality-assured, homogeneous and accessible global climate data records



IN COLLABORATION with more than **50** organisations.

EUMETSAT

esa

Mainly use **Sentinel-3** data

Future use of other Sentinel data

Climate Change Service

climate.copernicus.eu

The Climate Data Store – ‘A one stop shop for ECV data & information’

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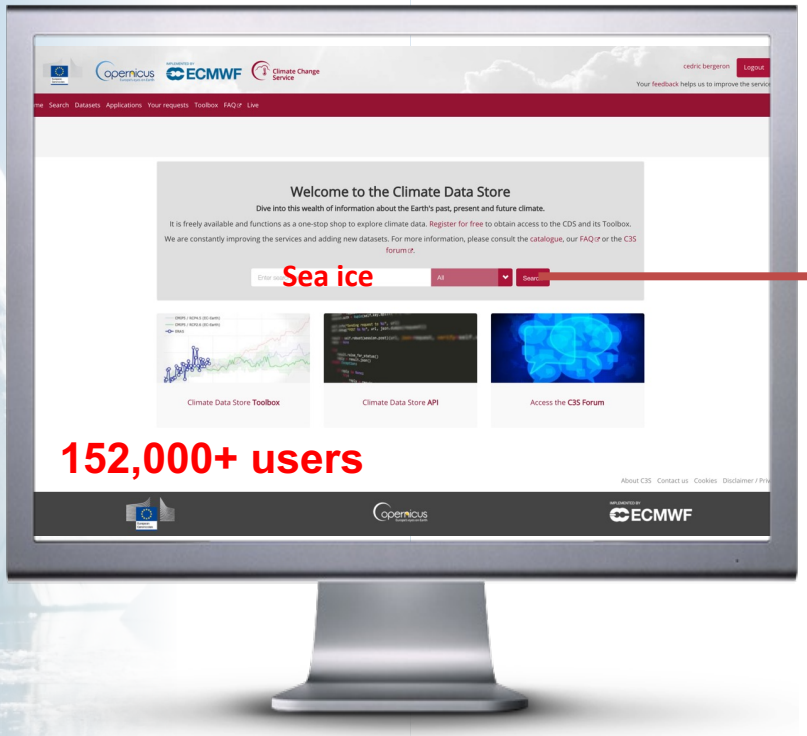


https://cds.climate.copernicus.eu

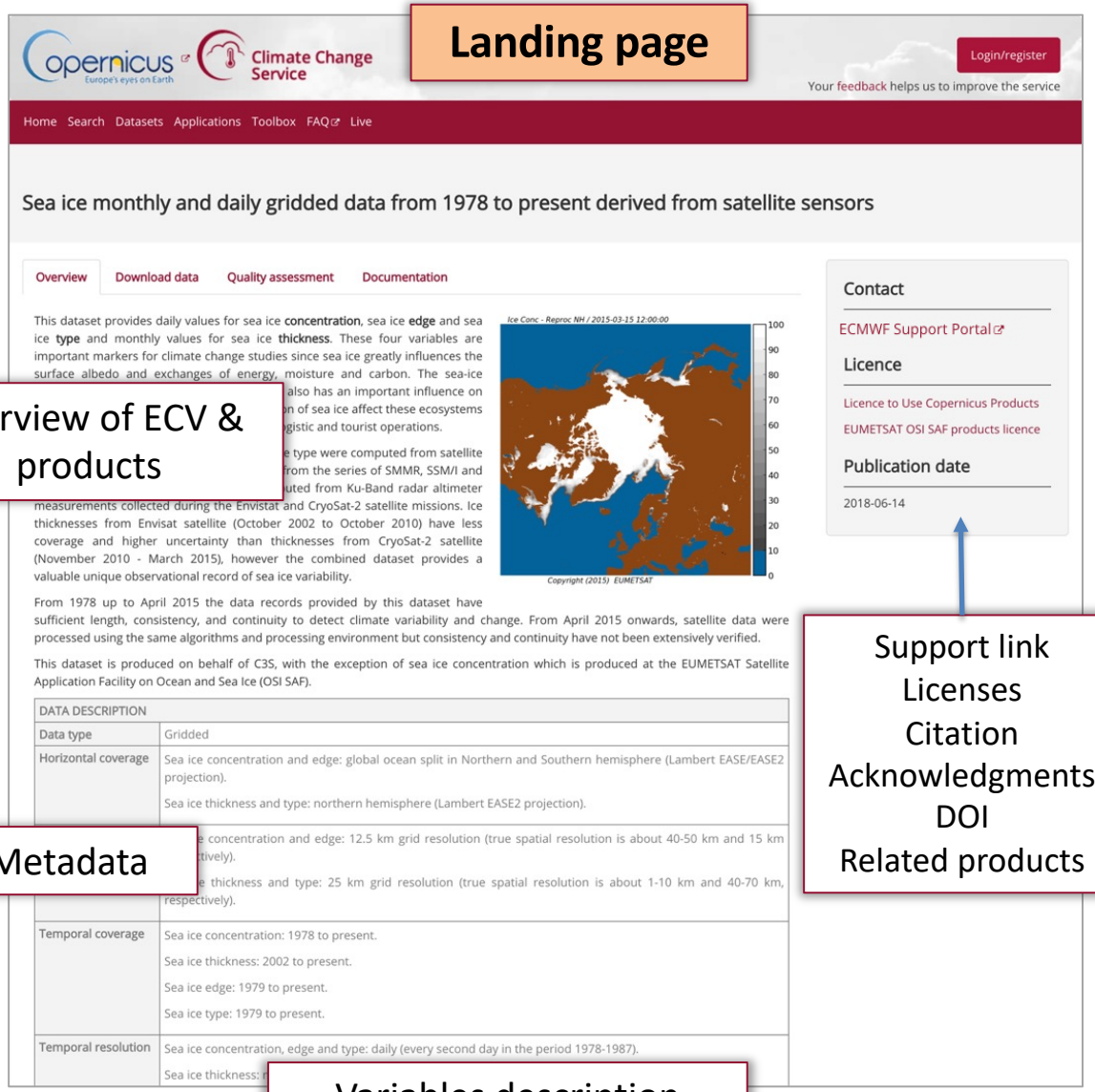
Landing page

Overview of ECV & products

Metadata

Support link
Licenses
Citation
Acknowledgments
DOI
Related products

Variables description



Total number users (ECVs)	Total volume downloaded (in GB)	Total number requests
22,966	307,201	712,407

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implemented by ECMWF

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Access to ECV data

Methane data from 2002 to present derived from satellite observations

Download form

Overview | Download data | Quality assessment | Documentation | View

Clear all

Processing level

At least one selection must be made

- [ ] Level 2
- [ ] Level 3

Variable

At least one selection must be made

- ( ) Mid-tropospheric column-averaged mixing ratios of methane (CH4) and related variables
- ( ) Column-averaged dry-air mixing ratios of methane (XCH4) and related variables

Sensor and algorithm

At least one selection must be made

- ( ) IASI (Metop-A) and NLIS
- ( ) IASI (Metop-B) and NLIS
- ( ) SCIAMACHY
- ( ) TANSO-FTS and OCFP
- ( ) TANSO-FTS and OCPR
- ( ) TANSO-FTS
- ( ) MERGED and EMMA
- ( ) MERGED and OBS4MIPS

Year

At least one selection must be made

```python
import cdsapi

c = cdsapi.Client()

c.retrieve(
    'satellite-methane',
    {
        'format': 'zip',
        'processing_level': 'level_2',
        'variable': 'xch4',
        'sensor_and_algorithm': 'sciamachy_wfmd',
        'year': '2004',
        'month': '03',
        'day': '09'
    },
    'download.zip')
```

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Comprehensive documentation & Tutorials

Documentation

Home Search Datasets Applications Toolbox Support Live

Home

Land cover classification gridded maps from 1992 to present derived from satellite observations

CDS Service disruption starting 8 September 2022 for 5-6 weeks. You can find more information here.

To improve our service, we need to hear from you! Please complete this very short survey. Thank you.

Overview | Download data | Quality assessment | Documentation

▸ Tutorial

▾ Documentation for version 2.1

- Product user guide (PDF)

  The product user guide summarizes the characteristics of the dataset in a concise manner with focus on space and time extent and resolution; data formats, metadata and flags; description of variables, strengths and limitations.

- Algorithm theoretical basis document for PROBA-V products (PDF)

  This document provides in-depth documentation on the algorithms used to derive the dataset.

- Algorithm theoretical basis document for Sentinel-3 products (PDF)

  This document provides in-depth documentation on the algorithms used to derive the dataset.

- Product quality assurance document (PDF)

  This document describes the data quality assurance process applied by the data producer before release of the dataset.

- Product quality assessment report (PDF)

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

- System quality assurance document for PROBA-V products (PDF)

  This document describes the processing chain and procedures in place at the data providers.

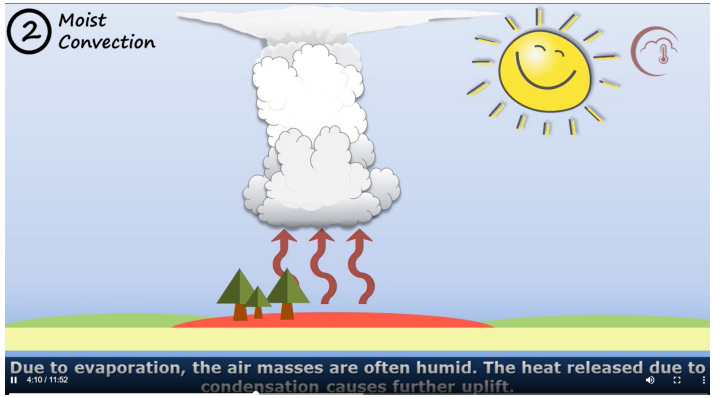
- System quality assurance document for Sentinel-3 products (PDF)

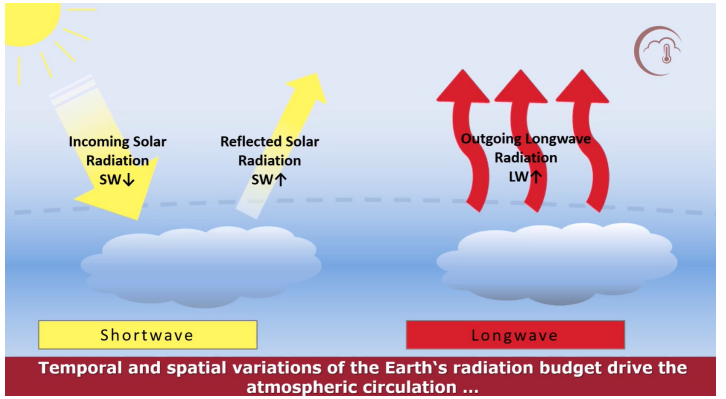
  This document describes the processing chain and procedures in place at the data providers.

- Target Requirements and Gap Analysis Document (PDF)

  Summarises the minimum requirements identified for the dataset and discusses identified gaps with respect to these target requirements.

▸ Documentation for version 2.0





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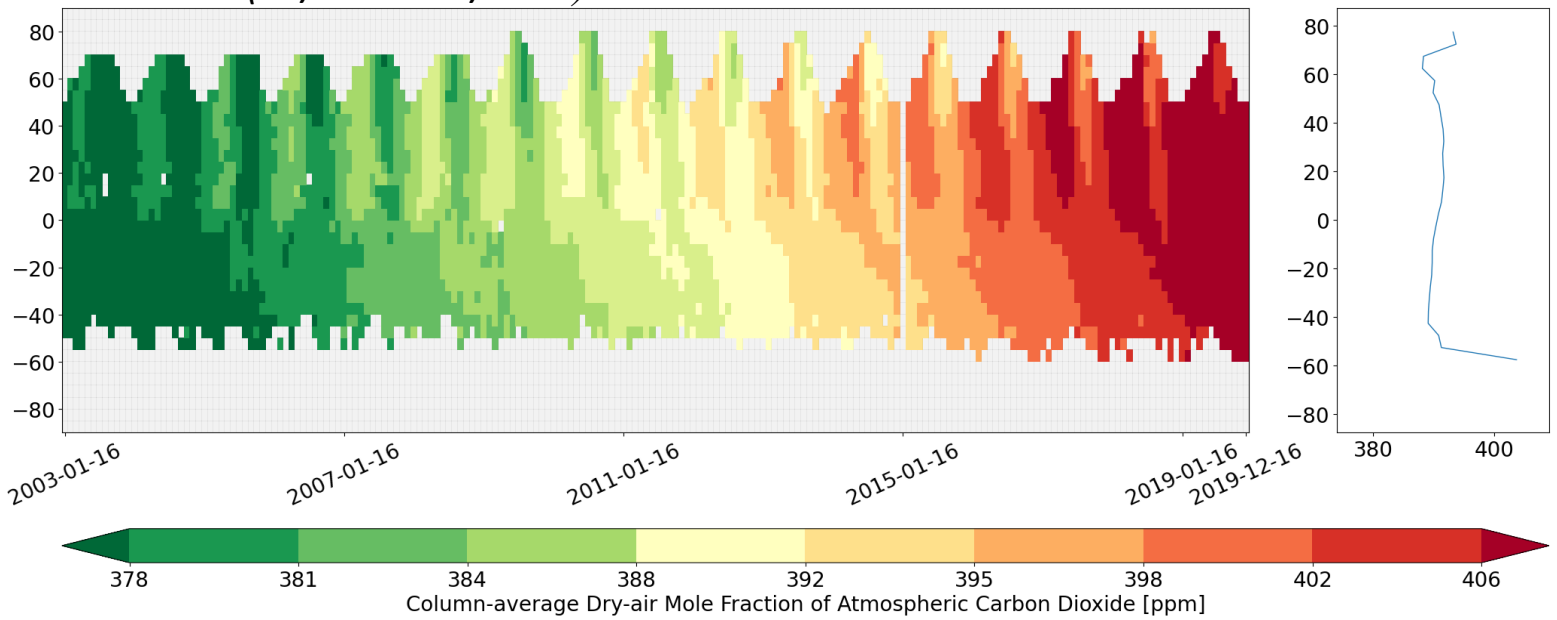
Quality assurance

Three levels of quality assurance:

- Scientific validation conducted by the data provider
- C3S pre-publication review
- Service independent evaluation and quality control

Carbon dioxide data from 2002 to present derived from satellite observations - XCO2 Level 3 v4.2 (01/2003- 12/2019)



Maturity Matrix

Metadata	User Documentation	Uncertainty Characterisation	Public access, feedback, and update	Usage
Standards	Formal description of scientific methodology	Standards	Public Access/Archive	Research
Collection level	Formal validation report	Validation	Version	Decision support system
	Formal product user guide	Uncertainty quantification	User feedback	
		Automated quality monitoring	Updates to record	

1	2	3	4	5	6

Mean values for XCO2 as function of latitude and time (aggregated over longitude; left), and as latitudinal averages (aggregated over longitude and time; right). Grey areas represent missing values. Based on the CDS data downloaded on 28 January 2021.

Data viewers and toolbox applications

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Data viewers

Carbon dioxide data from 2002 to present

CDS Service disruption starting 8 September 2022 for 5-6 weeks. You can find more information here.

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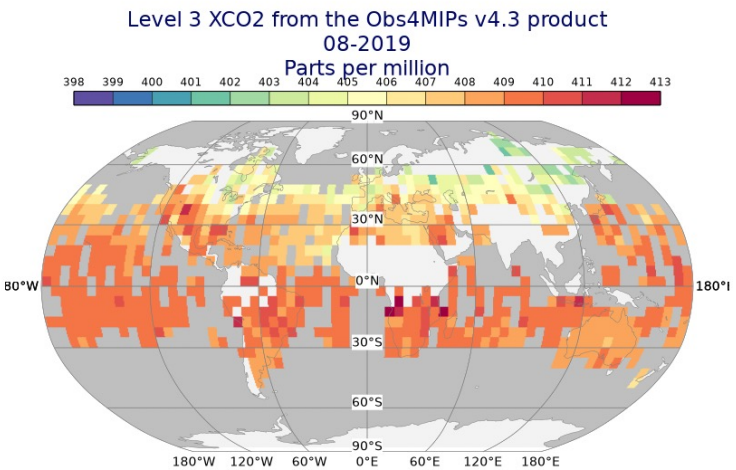
Overview | Download data | Quality assessment | Documentation | View

This data viewer allow users to view the column-average dry-air mole fraction of atmospheric Carbon Dioxide (XCO2) from the level 3 Obs4MIPs product. Users can select the version, year and month to view. The level 3 data are gridded monthly mean values using data from a number of satellites. Users are advised to read the product user guide for more details on the satellites and algorithms used to create the data.

Version: 4.3 | Year: 2019 | Month: 08



Version: 4.35.4 - build f8ced5bb

Show source code

Toolbox applications

Global glaciers explorer

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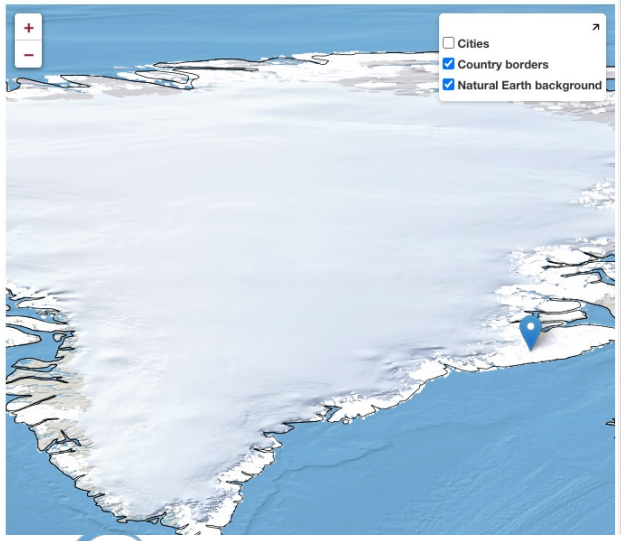
Overview | Application | Source code

Full screen

When country is set to "Global" the interactive map allows users to explore all the glaciers in the database. Clicking on a glacier (white regions) will produce a summary table and graphs of hypsometry for the glacier if such data is available for that glacier. Further clicks will append rows to the table and lines to the hypsometry graphs so that the glaciers can be compared.

Selecting a country allows users to explore the detailed survey records of elevation and mass change. Each glacier with elevation or mass change data is indicated with a blue (elevation) or red (mass) circle on the map. Users can still explore and compare glacier extent but now with added hover information, the glacier ID and area.

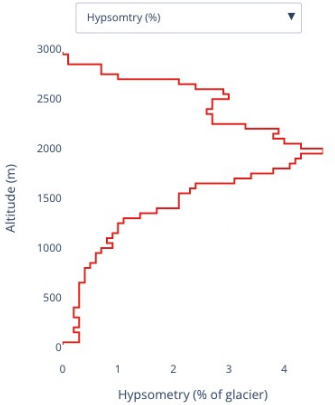
Country: Global



Position: 69.03°N, 28.12°W

Glacier ID	Name	Area km²	Hypsometry curve
RGI60-05.13536	Borggraven	2219.51	Yes

The figure below displays the hypsometry for the selected glaciers where hypsometry data is available. Users can select one of four display options using the drop-down selection menu.



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Climate monitoring

Climate Change

Key climate indicators

- ✓ Responding to monitoring and reporting for UNFCCC
- ✓ Capture long-term trends, but also year-to-year variability

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Evolution within the current framework agreement

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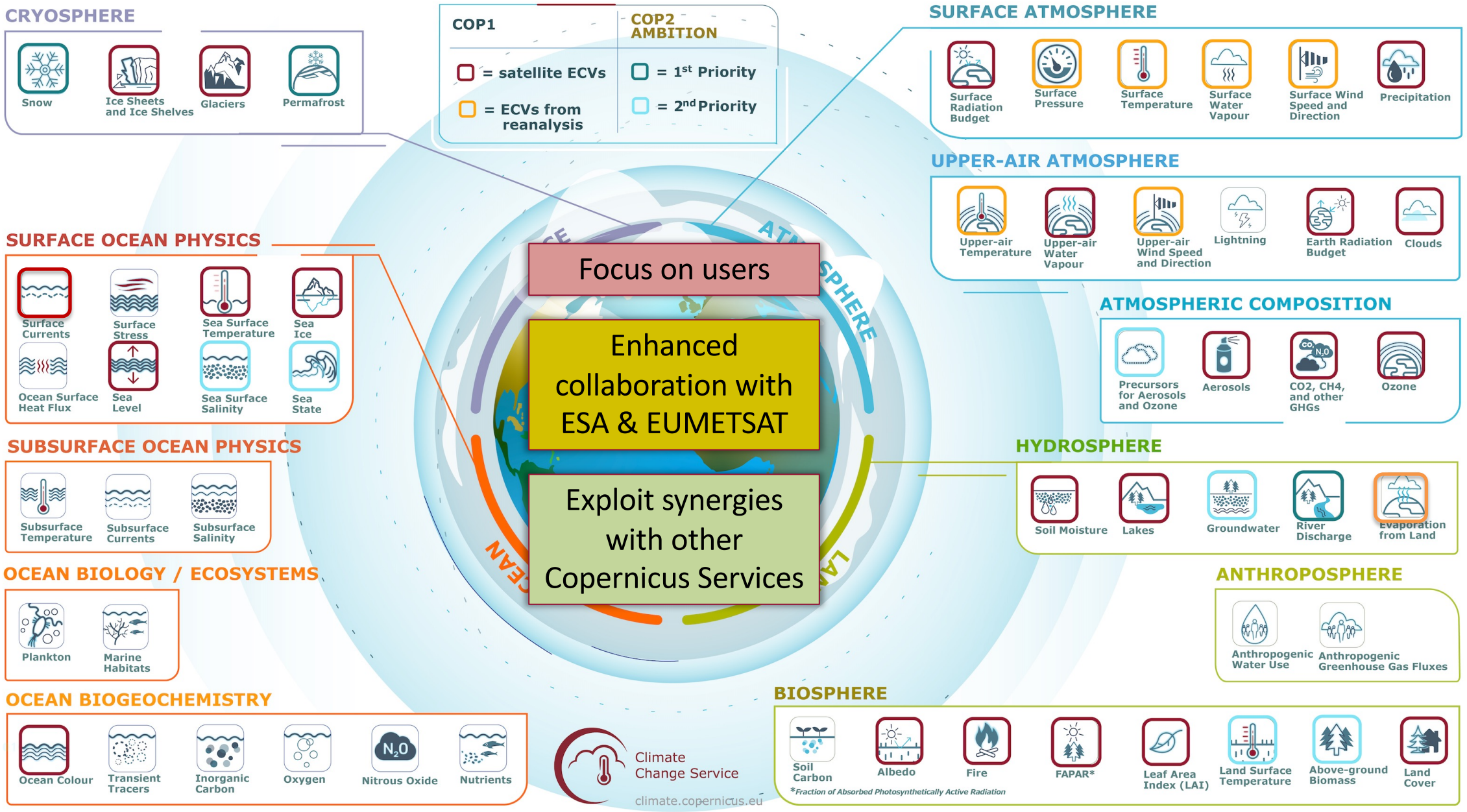

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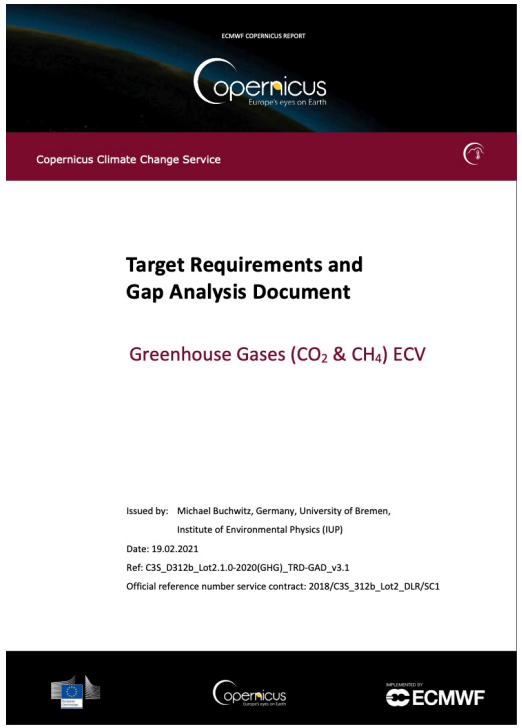
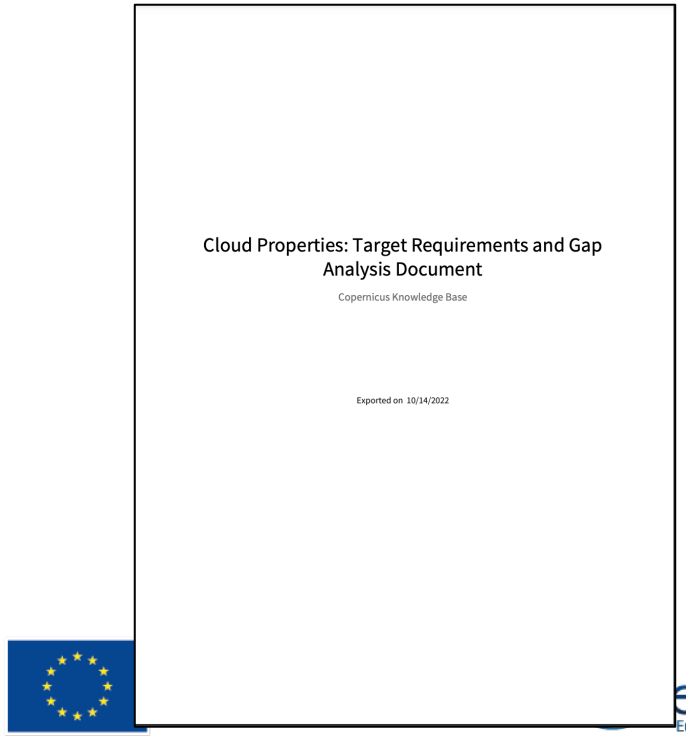
What are the bottlenecks in today's observations system in terms of…

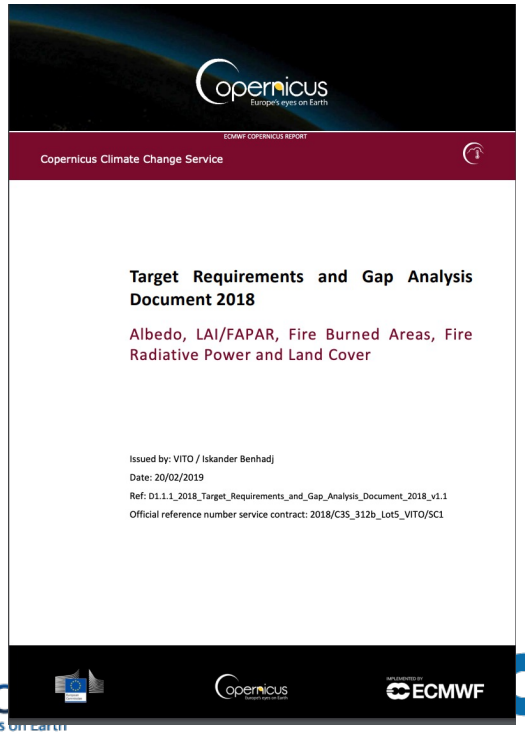
- meeting scientific needs in climate science (Topic 2, Cluster 1)
- building and sustaining climate data records (Topic 4)

Partially discussed in the C3S "Target Requirement and Gap Analysis" Document.

- Define and formulate the (potentially evolving) target requirements for satellite-derived ECV products based on [C3S] user needs, such as required precision (random error, scatter) and accuracy (systematic error, bias)
- Analyses the various aspects of the retrieval methodologies that limit the fitness for purpose of the current CDRs
- Identifies the remaining activities to be carried out to fully satisfy the scientific target requirements







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Thank you for your attention

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