



# KNOWLEDGE EXCHANGE

Climate Change Initiative

## Building Foundational Climate Data Skills Through Hands-On Training with ESA-CCI's Essential Climate Variables

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EGU, Vienna, 2026

# What are Essential Climate Variables (ECVs)?

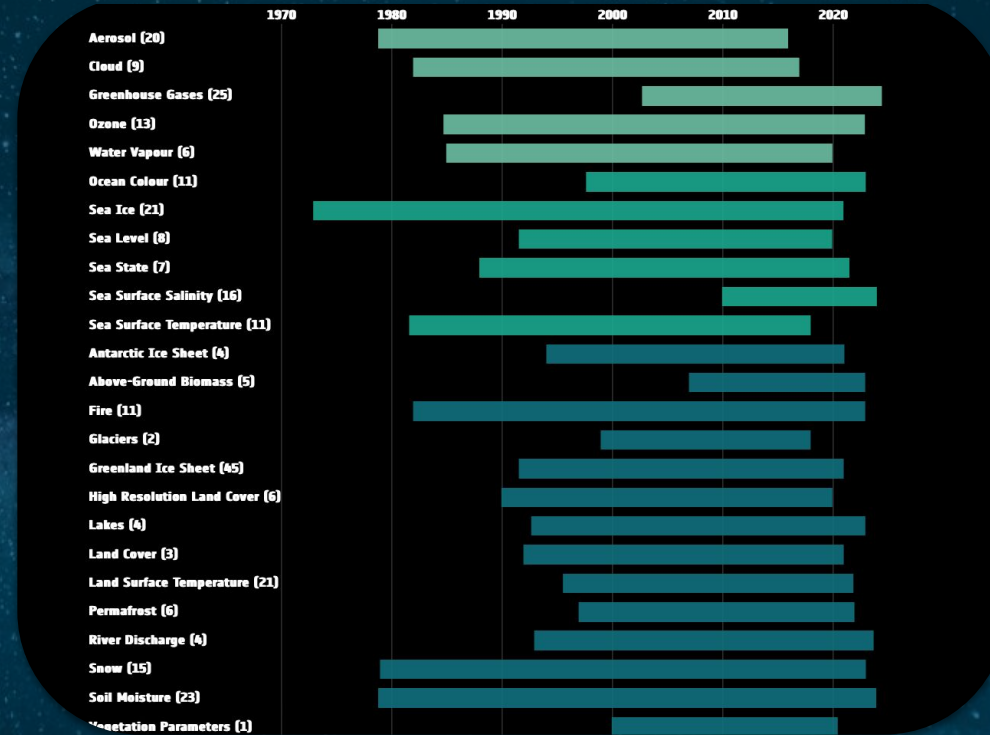
- GCOS defines **55 Essential Climate Variables** (GCOS, 2022)
- 36 benefit from space observations



# What are Essential Climate Variables (ECVs) ?

- GCOS defines 55 Essential Climate Variables (GCOS, 2022)
- 36 benefit from space observations
- 27 are generated by ESA's Climate Change Initiative

[climate.esa.int/data](https://climate.esa.int/data)



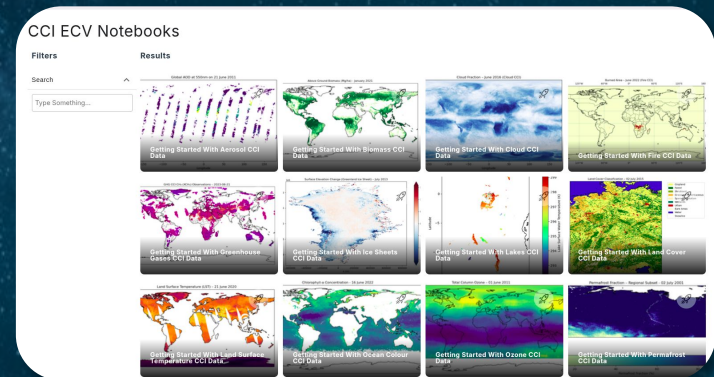
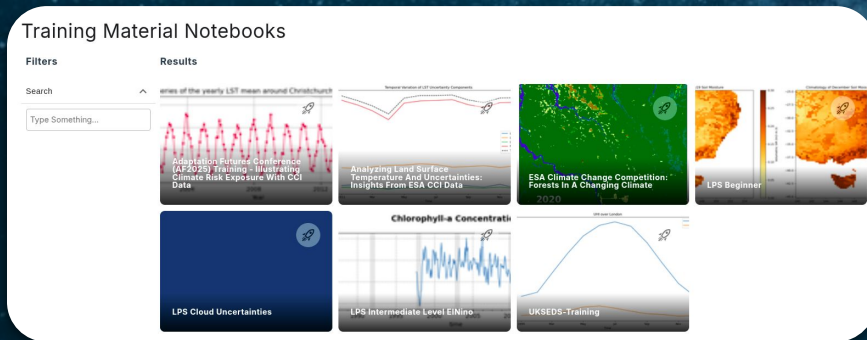


## Increase knowledge of ECVs' definitions and how space-based observations enable their monitoring and support climate change applications

- What are ECVs and which components of the Earth's climate system do they represent?
- How can we measure ECVs from space?
- How can we analyse ECVs to study how the climate is changing?
- How can ECVs projects support climate change adaptation and mitigation ?

To solve this, we set up a JupyterLab workspace with pre-configured Python environments including the ESA CCI Toolbox and other key packages. This includes:

- 22 Notebooks explaining the usage of the Toolbox
- 20 Notebooks to get started with looking at ESA-CCI ECVs data
- 7 self-paced notebooks on the use of ESA-CCI ECVs to analyse climate change applications with guided questions



# ESA-CCI Toolbox: Behind the package

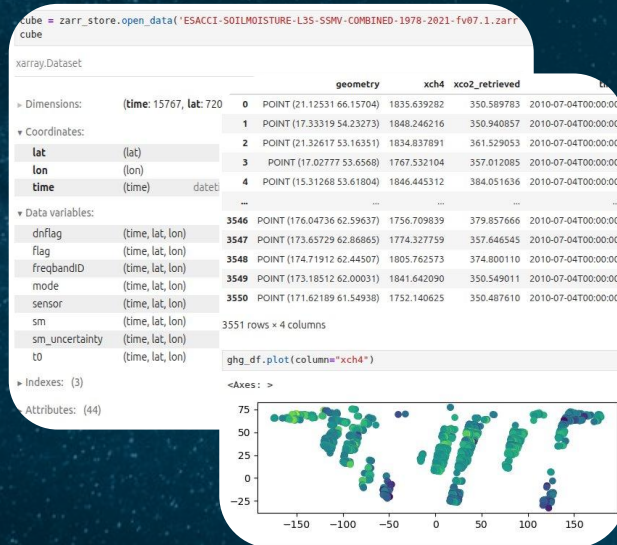
The Toolbox is a Python package created to

1. Access ESA-CCI ECVs
2. Process Operations to analyse and visualise climate variables

Example of operators:

- Anomaly Detection
- Co-registration
- Gap Filling
- Resampling
- Subsetting
- Climatologies
- Time Series

...



ESA CCI Toolbox

latest

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TABLE OF CONTENTS

1. Introduction
2. About the ESA CCI Toolbox
3. Installation Guide
4. Quick Start
5. Using the ESA CCI Toolbox with the xcube Viewer

6. API Reference

- 6.1. Datasets and Datastores
- 6.2. Functions
- 6.3. Operations
- 6.4. Operation Registration API
- 6.5. Operation Execution API
- 6.6. Task Monitoring API

### 6. API Reference

#### 6.1. Datasets and Datastores

##### 6.1.1. Exploring Data

`esa_cci_toolbox.core.find_data_store(ds_id:str)→ Tuple[str | None, DataStore | None]`

Find the data store that includes the given `ds_id`. This will raise an exception if the `ds_id` is given in more than one data store.

Parameters: `ds_id` – A data source identifier.

Returns: All data sources matching the given constrains.

`esa_cci_toolbox.core.get_store(store_id:str)`

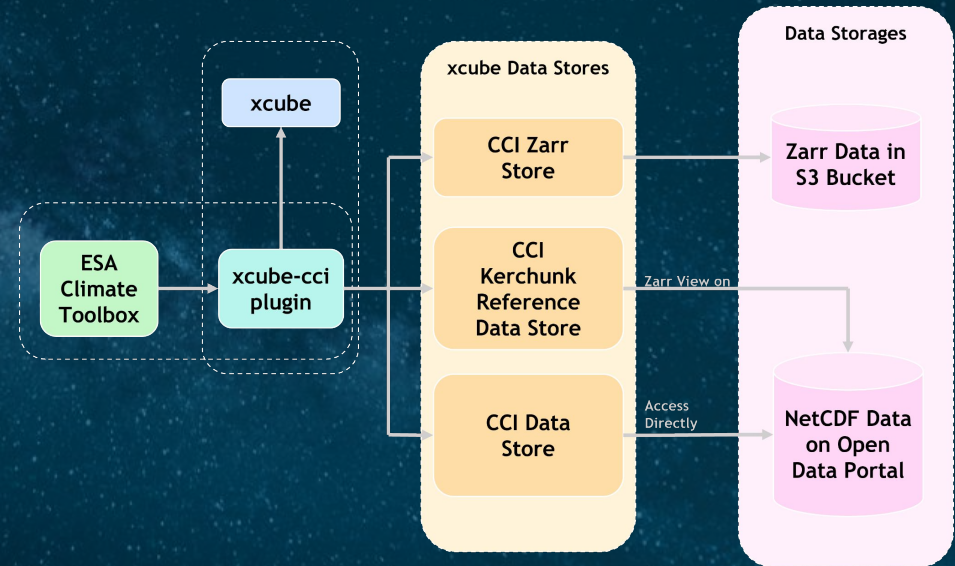
Returns the data store of the given name. `param_store_id`: The name of the store should have.

Returns: A data store



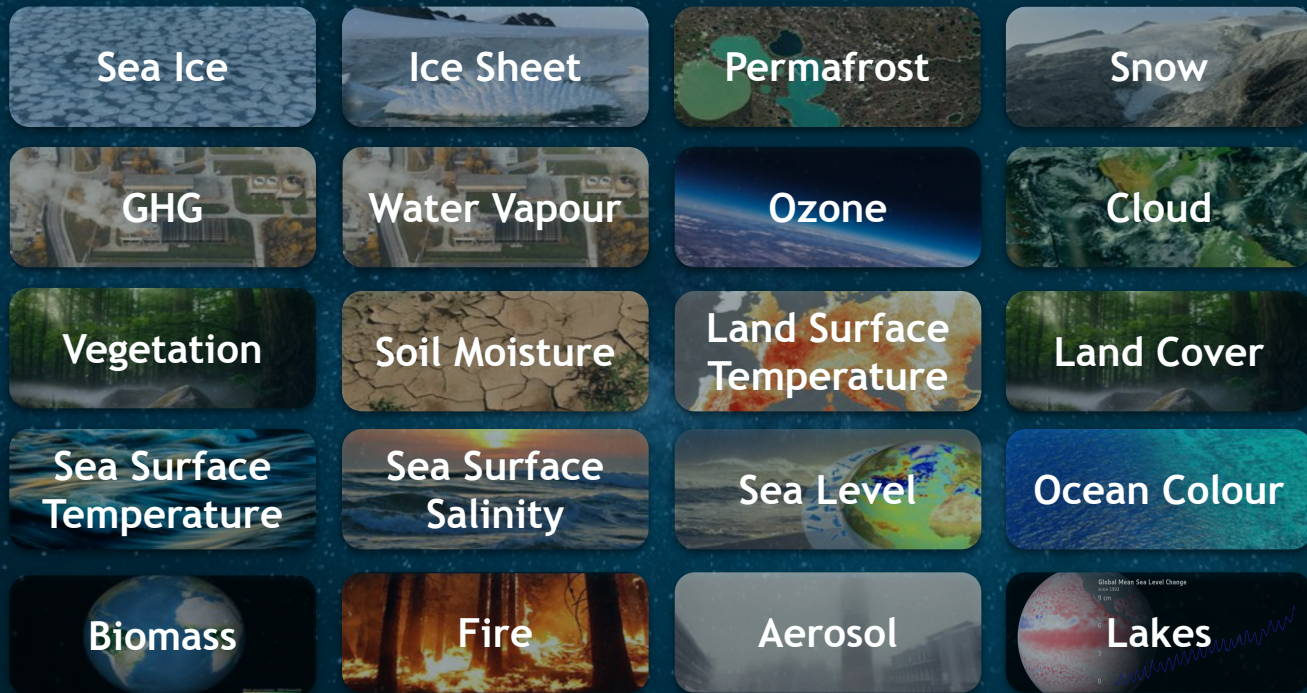
<https://climate.esa.int/en/data/toolbox/>

1. Data are read as
  - a. xarray datasets
  - b. geopandas geodataframes
  - c. xarray datatrees
  - d. vector data cubes
2. The Toolbox relies on widely used and well-maintained technology stack
3. Compatible with other packages



# Climate data at a glance!

The Toolbox contains simple ready-to-use notebooks to access and visualise 20 of the ESA-CCI ECVs:



<https://github.com/esa-cci/cci-notebooks>

- Do heat waves affect urban and rural areas the same way?
- How has sea surface temperature evolved over the last decades?
- How is climate change affecting sea level rise?
- What made recent extreme wildfires so intense?

All these questions can be investigated using satellite-derived ECVs, and applying the Toolbox for simplified analysis:

## LPS Training – Beginner Level: Illustrating Climate News Headlines with CCI Data

### CLIMATE CHANGE INITIATIVE

#### 1. Introduction:

In this beginner-friendly notebook, we will use real satellite-based data from the [ESA Climate Change Initiative \(CCI\)](#) to explore recent climate trends. The goal is to understand and illustrate **climate news headlines** using satellite-based measurements of essential climate variables.

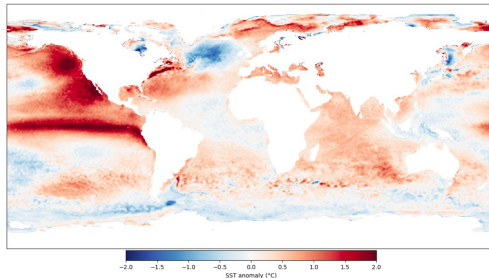
We will use simple Python code and visualisations to explore questions such as:

- Has global sea surface temperature an sea levels increased over the last decades?
- What did sea temperatures look like in record-warm years?
- What did LST and soil moisture conditions look like in record extreme fire events?

This notebook is designed for **participants with no prior experience in Python or climate**.

- How to access CCI climate data using the CCI Toolbox python Package
- How to navigate and subset climate data using Xarray
- How to create basic plots and statistics with Matplotlib
- How to save a figure you generated
- How to map and interpret ECVs changes over time and space

Anomaly of SST in 2015 w.r.t 1982-2016



## Adaptation Futures Conference (AF2025) Training – Illustrating Climate Risk Exposure with CCI Data

### CLIMATE CHANGE INITIATIVE

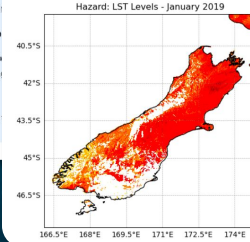
#### 1. Introduction:

In this beginner-friendly notebook, we will use real also look at how to combine population dataset with

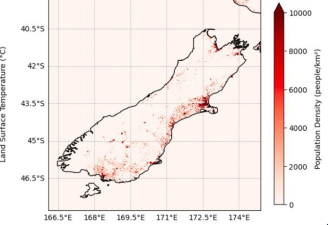
This notebook is designed for **participants with no**

- How to access CCI ECVs using the CCI Toolbox
- How to navigate and subset climate data using Xarray
- How to compute basic plots using Matplotlib
- How to save a figure you generated
- How to map and interpret ECVs changes over

New Zealand 2019 Heatwave



Exposure: Population Density Levels - 2019



To learn more about the climate science using ESA-CCI ECVs, join our seminar series!

*The webinars are occurring every penultimate Wednesday of the month at 16:00 CEST.*

## This month's webinar:

### Satellite Retrievals of Vegetation Parameters

**Date:** 20 May 2026

**Time:** 16:00 - 17:00 CEST

Join Christiaan van der Tol on May 20th for an insightful webinar on how satellite data can be used to monitor vegetation from space. Christiaan van der Tol is an Associate Professor at the University of Twente, as well as the Science Lead for ESA's [Climate Change Initiative \(CCI\) Vegetation Parameters project](#).



Christiaan van der Tol,  
University of Twente

This webinar will focus on the [ESA Vegetation Parameters CCI+ project](#) explaining how the CCI+ Vegetation dataset was built, what makes it unique, and how you can use it in your own research.

[Register for the Webinar here](#)

👉 [Register for the next webinar:](https://climate.esa.int/en/climate-change-initiative-training/webinars/)

<https://climate.esa.int/en/climate-change-initiative-training/webinars/>



Home • Climate Change Initiative Training • Training Sessions

**Training Sessions**

Explore Climate Change Initiative training incl interactive tools, resources & Jupyter Notebooks for data analysis

This archive contains recordings, materials, and resources from past training sessions relating to ESA's Climate Change Initiative. These sessions featured interactive Jupyter Notebooks, offering hands-on learning for effectively analysing and extracting valuable insights from CCI data.

**Analysing LST and Uncertainties: Insights from ESA CCI Data**

This Training will guide you through analysing Land Surface Temperature (LST) data from ESA CCI to study Urban Heat Islands

**Communicating Climate Change with the ESA CCI's ECVs**

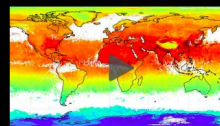
Learn how to use ESA CCI climate data and the CCI Toolbox to investigate the effects of climate change through hands-on exercises at beginner to advanced levels.

Helpdesk

## Training sessions

<https://climate.esa.int/en/climate-change-initiative-training/>

## Watch past webinars and explore upcoming sessions below



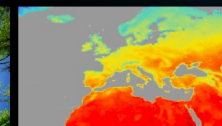
**Satellite retrievals of carbon dioxide and methane & related applications**  
Date: 18 February 2026  
Speaker: Michael Buchwitz

This webinar with Michael Buchwitz (University of Bremen) explored space-based observations of CO<sub>2</sub> and methane, explained how atmospheric concentrations were retrieved from satellite measurements, how these data were used to assess human-made emissions and natural sinks, and highlighted the ESA GHG-CCI project and its links to wider climate services.



**ESA CCI Vegetation Parameters**  
Date: 20th May 2026  
Speaker: Christiaan van der Tol

This webinar will present a 21-year, high-resolution satellite dataset measuring foliage density and leaf light absorption - key climate variables affecting the carbon budget. Learn how to access the data and apply it in research and environmental monitoring.



**ESA CCI Land Surface Temperature**  
Date: 17th June 2026  
Speaker: Abigail Waring

This webinar will explain Land Surface Temperature (LST): what it is, how it is measured from space, its role as an Essential Climate Variable (ECV), and how the data are validated and checked.



**ESA CCI Fire**  
Date: 22nd July 2026  
Speaker: Emilio Chuvieco

This webinar will cover how wildfires impact ecosystems and vegetation, how climate trends influence wildfire risk, and how fires, in turn,



**ESA CCI SAtACI**  
Date: 23rd Sept 2026  
Speaker: Marta Luffarelli

This webinar will present the SAtACI project, using satellite data to study aerosol-cloud interactions - a key uncertainty in climate forcing.



**ESA CCI Glaciers**  
Date: 21 Oct 2026  
Speaker: Frank Paul

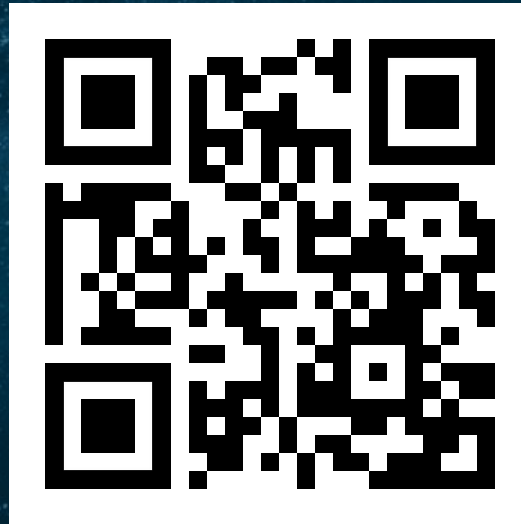
This webinar will show how satellite and climate data are used in the X-ECV Karakoram Anomaly project to study glacier dynamics, improve mass

## Our past Webinars

# Join our mailing list!

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<https://tally.so/r/5BEKQb>



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