



Climate Change

The Copernicus **C**limate **D**ata **S**to**r**e

The Copernicus Climate Data Store: ECMWF's approach to provide online access to climate data and tools

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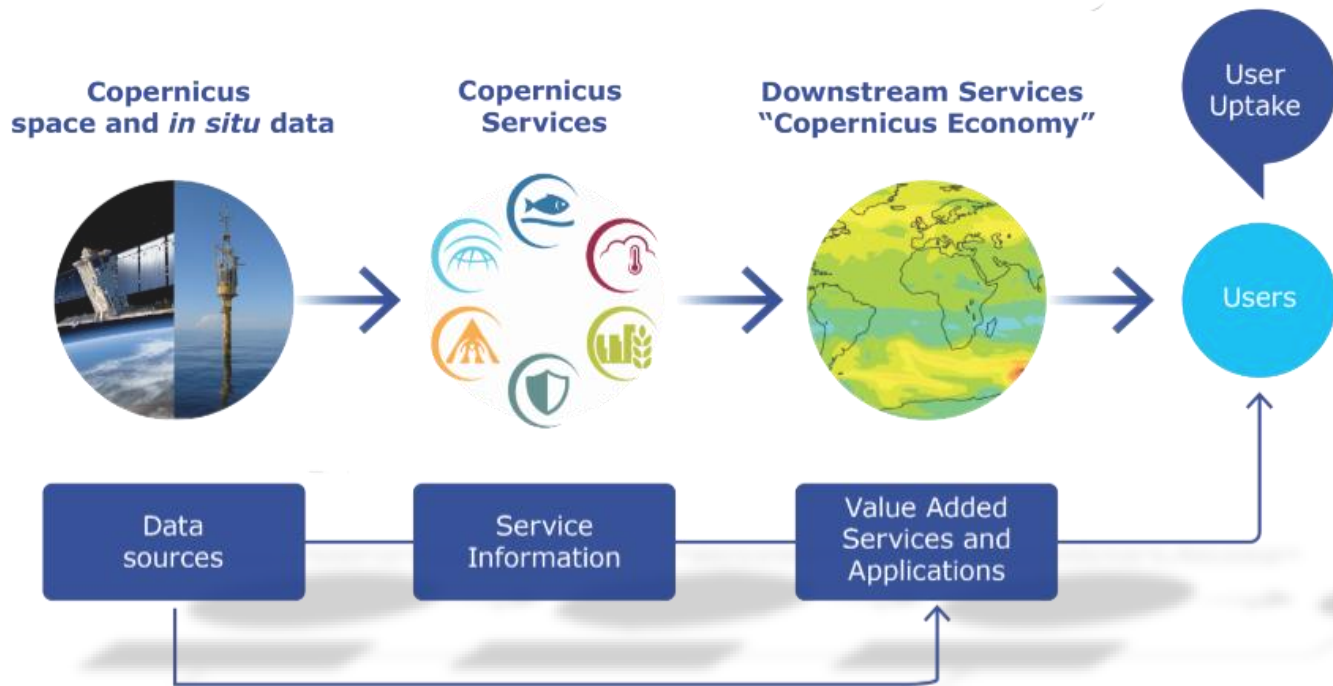
cedric.bergeron@ecmwf.int





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Why COPERNICUS?





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Copernicus Climate Change service - C3S

- The European Commission has entrusted **ECMWF** with the implementation of the Copernicus Climate Change Service – **C3S**
- The **Copernicus Climate Change** service will provide information to increase the knowledge base to support **adaptation** and **mitigation** policies.

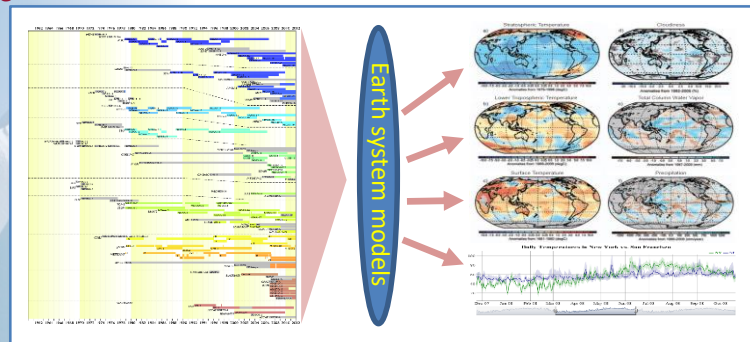




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What kind of data?

Access to past, present and future climate information

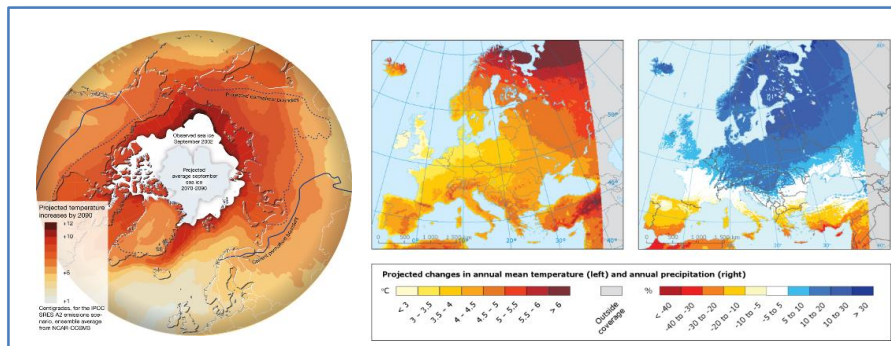
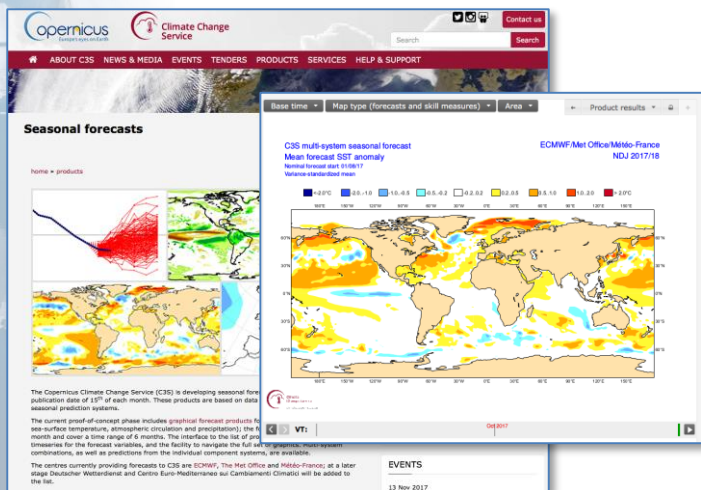


Observations and climate reanalysis

Seasonal forecast data and products

Climate model simulations

*Global
and pan European*

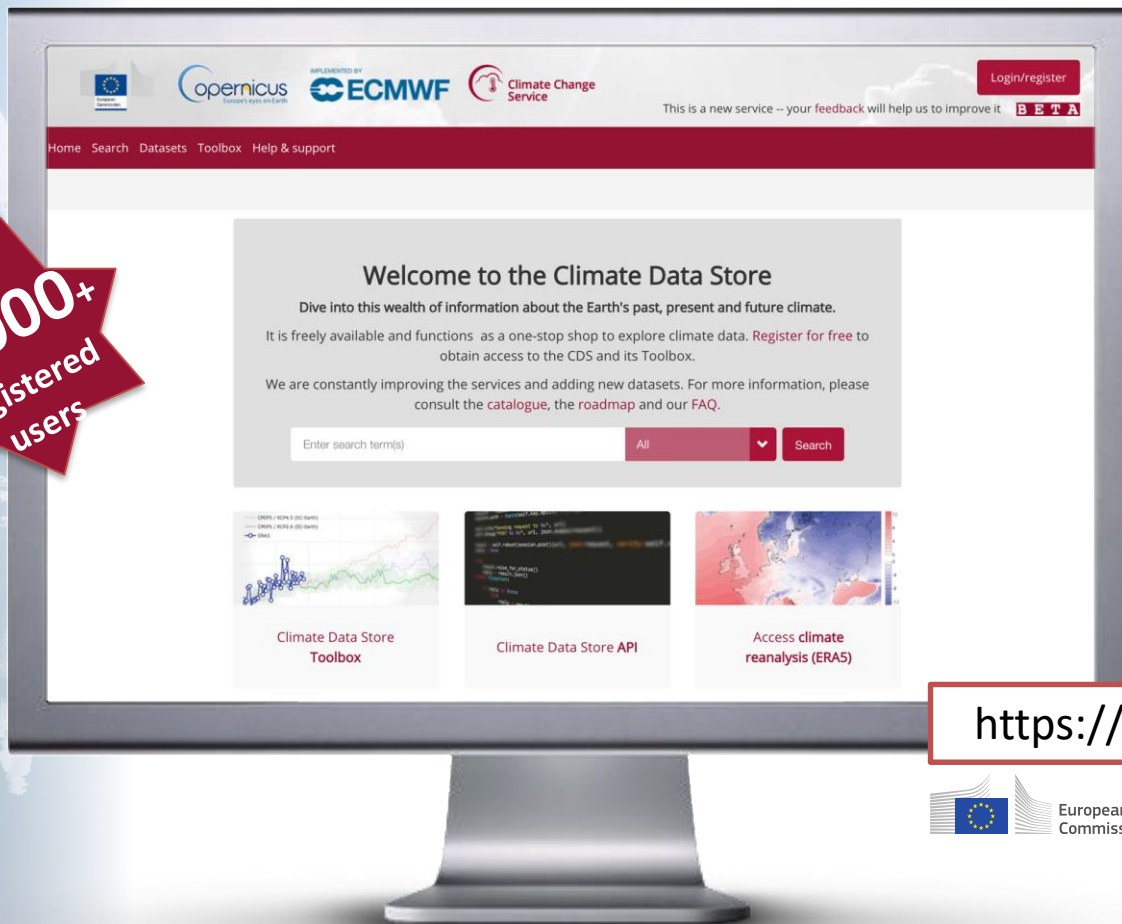




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How to find, Access, and Use these Data Online?

23000+
registered
users



The **Climate Data Store** also called CDS, is an **online open and free** service.

It allows users to browse and access the wide range of climate datasets via a searchable catalogue...

... It allows users to build their own applications, maps and graphs

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



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What is the CDS vision?

- Make data discovery, access easy and relevant for users
- Provide scalable data access
- Provide online capabilities to process the data
- Enable reproducible research



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The CDS: An operational system





- On-Premises Private Cloud
- 72+ nodes, 4000+ CPUs, 12TB memory
- 3.9 PB usable (of which 380TB SSD)





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Finding datasets




Login/register

This is a new service -- your **feedback** will help us to improve it **BETA**

Home Search Datasets Toolbox Help & support

Search results



All **Datasets**

Sort by

Relevancy

Title

▼ Product type

☐ Climate projections (5)

☒ Reanalysis (3)

☒ Satellite observations (12)

☐ Seasonal forecasts (6)

☐ Sectoral climate indices (2)

▼ Variable domain

☐ Atmosphere (composition)(3)

☐ Land (biosphere) (1)

☐ Land (cryosphere) (2)


☐ Land (hydrology) (1)

☐ Ocean (physics) (5)

▼ Spatial coverage


☐ Global (11)

Showing 1-15 of 15 results for **Reanalysis** × **Satellite observations** ×




Climate data for the European energy sector from 1979 to 2016 derived from ERA-Interim

The dataset contains wind speed, precipitation, relative humidity, global horizontal irradiance, sea level pressure, air temperature, snow depth and dewpoint depression near-surface data relevant to e...




ERA5 hourly data on single levels from 2000 to present

ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset...



ERA5 hourly data on pressure levels from 2000 to present

ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset...



Ozone monthly gridded data from 1970 to present

This dataset provides estimates of the montly mean values of the ozone concentration, mixing ration and content over the globe from a large set of satellite sensors. Most of the ozone data products in...

Metadata ISO 19115



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Simplicity and
consistency are key

Accessing datasets: Global reanalysis data

Quality Evaluation will come soon (2019)

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Search results

Search dataset

All Datasets

Sort by

Relevancy

Title

Product type

- ☐ Climate projections (4)
- ☒ Reanalysis (2)
- ☐ Satellite observations (11)
- ☐ Seasonal forecasts (6)
- ☐ Sectoral climate indices (2)

Spatial coverage

- ☐ Global (2)

Temporal coverage

- ☐ Past (2)

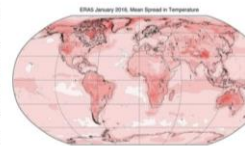
ERA5 hourly data on pressure levels from 2000 to present

Overview Download data Documentation

ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset using the laws of physics. This principle, called data assimilation, is based on the method used by numerical weather prediction centres, where every so many hours (12 hours at ECMWF) a previous forecast is combined with newly available observations in an optimal way to produce a new best estimate of the state of the atmosphere, called analysis, from which an updated, improved forecast is issued. Reanalysis works in the same way, but at reduced resolution to allow for the provision of a dataset spanning back several decades. Reanalysis does not have the constraint of issuing timely forecasts, so is more time to collect observations, and when going further back in time, to allow for the ingestion of improved versions of the original observations, which all benefit the quality of the reanalysis product.

The assimilation system is able to estimate biases between observations and to sift good-quality data from poor. The laws of physics allow for estimates at locations where data coverage is low, such as for surface temperature Arctic. The provision of estimates at each grid point around the globe for each regular output time, over a long period always using the same format, makes reanalysis a very convenient and popular dataset to work with.

The observing system has changed drastically over time, and although the assimilation system can resolve data from the initially much sparser networks will lead to less accurate estimates. For this reason, ERA5 includes an uncertainty



ERA5 hourly data on pressure levels from 2000 to present

ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset...

ERA5 hourly data on single levels from 2000 to present

ERA5 is the fifth generation ECMWF atmospheric reanalysis of the global climate. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset...

ERA5 hourly data on pressure levels from 2000 to present

Overview Download data Documentation

Variable

At least one selection must be made

- | | | |
|---|--|--|
| <input type="checkbox"/> Divergence | <input type="checkbox"/> Fraction of cloud cover | <input type="checkbox"/> Geopotential |
| <input type="checkbox"/> Ozone mass mixing ratio | <input type="checkbox"/> Potential vorticity | <input type="checkbox"/> Relative humidity |
| <input type="checkbox"/> Specific cloud ice water content | <input type="checkbox"/> Specific cloud liquid water content | <input type="checkbox"/> Specific humidity |
| <input type="checkbox"/> Specific snow water content | <input type="checkbox"/> Temperature | <input type="checkbox"/> Specific rain water content |
| <input type="checkbox"/> V-component of wind | <input type="checkbox"/> Vertical velocity | <input type="checkbox"/> U-component of wind |
| | | <input type="checkbox"/> Vorticity (relative) |

Select all

Pressure level

At least one selection must be made

- | | | |
|-----------------------------------|----------------------------------|----------------------------------|
| <input type="checkbox"/> 1 hPa | <input type="checkbox"/> 2 hPa | <input type="checkbox"/> 3 hPa |
| <input type="checkbox"/> 5 hPa | <input type="checkbox"/> 7 hPa | <input type="checkbox"/> 10 hPa |
| <input type="checkbox"/> 20 hPa | <input type="checkbox"/> 30 hPa | <input type="checkbox"/> 50 hPa |
| <input type="checkbox"/> 70 hPa | <input type="checkbox"/> 100 hPa | <input type="checkbox"/> 125 hPa |
| <input type="checkbox"/> 150 hPa | <input type="checkbox"/> 175 hPa | <input type="checkbox"/> 200 hPa |
| <input type="checkbox"/> 225 hPa | <input type="checkbox"/> 250 hPa | <input type="checkbox"/> 300 hPa |
| <input type="checkbox"/> 350 hPa | <input type="checkbox"/> 400 hPa | <input type="checkbox"/> 450 hPa |
| <input type="checkbox"/> 500 hPa | <input type="checkbox"/> 550 hPa | <input type="checkbox"/> 600 hPa |
| <input type="checkbox"/> 650 hPa | <input type="checkbox"/> 700 hPa | <input type="checkbox"/> 750 hPa |
| <input type="checkbox"/> 775 hPa | <input type="checkbox"/> 800 hPa | <input type="checkbox"/> 825 hPa |
| <input type="checkbox"/> 850 hPa | <input type="checkbox"/> 875 hPa | <input type="checkbox"/> 900 hPa |
| <input type="checkbox"/> 925 hPa | <input type="checkbox"/> 950 hPa | <input type="checkbox"/> 975 hPa |
| <input type="checkbox"/> 1000 hPa | | |

Select all

Product type

- | | | |
|--|---|--|
| <input checked="" type="checkbox"/> Reanalysis | <input type="checkbox"/> Ensemble members | <input type="checkbox"/> Ensemble mean |
| <input type="checkbox"/> Ensemble spread | | |

Select all Clear all

Year

At least one selection must be made

- | | | |
|-------------------------------|-------------------------------|-------------------------------|
| <input type="checkbox"/> 2000 | <input type="checkbox"/> 2001 | <input type="checkbox"/> 2002 |
| <input type="checkbox"/> 2003 | <input type="checkbox"/> 2004 | <input type="checkbox"/> 2005 |
| <input type="checkbox"/> 2006 | <input type="checkbox"/> 2007 | <input type="checkbox"/> 2008 |



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Home Search Datasets Applications Your requests Toolbox Help & support

Search results

Search dataset All Datasets

Sort by

Relevancy

Title

Product type

- ☐ Climate projections (4)
- ☐ Reanalysis (2)
- ☐ Satellite observations (11)
- ☒ Seasonal forecasts (6)
- ☐ Sectoral climate indices (2)

Spatial coverage

- ☐ Global (6)

Temporal coverage

- ☐ Future (6)
- ☐ Past (6)

Seasonal forecast monthly statistics on single levels from 2017 to present

Overview Download data Documentation

Seasonal forecasts provide a long-range outlook of changes in the Earth system over periods of a few weeks or months, as a result of predictable changes in some of the slow-varying components of the system. For example, ocean temperatures typically vary slowly, on timescales of weeks or months; as the ocean has an impact on the overlying atmosphere, the variability of its properties (e.g. temperature) can modify both local and remote atmospheric conditions. Such modifications of the 'usual' atmospheric conditions are the essence of all long-range (e.g. seasonal) forecasts. This is different from a weather forecast, which gives a lot more precise detail - both in time and space - of the evolution of the state of the atmosphere over a few days into the future. Beyond a chaotic nature of the atmosphere limits the possibility to predict precise changes at local scales. This is the reason long-range forecasts of atmospheric conditions have large uncertainties. To quantify such uncertain range forecasts use ensembles, and meaningful forecast products reflect a distributions of outcomes.



Given the complex, non-linear interactions between the individual components of the Earth system, the best long-range forecasting are climate models which include as many of the key components of the system and typically, such models include representations of the atmosphere, ocean and land surface. These models are with data describing the state of the system at the starting point of the forecast, and used to predict the evolution of this state in time. While uncertainties coming from imperfect knowledge of the initial conditions of the complex Earth system can be described with the use of ensembles, uncertainty arising from approximations in the models are very much dependent on the choice of model. A convenient way to quantify the effect approximations is to combine outputs from several models, independently developed, initialised and operated.

To this effect, the C3S provides a **multi-system seasonal forecast service**, where data produced by state-seasonal forecast systems developed, implemented and operated at forecast centres in several European countries are collected, processed and combined to enable user-relevant applications. The composition of the C3S season

Seasonal forecast to present

Seasonal forecasts provide a long-range outlook of changes in the Earth system over periods of a few weeks or months, as a result of predictable changes in some of the slow-varying components of the s...

Seasonal forecast monthly statistics on pressure levels from 2017 to present

Seasonal forecasts provide a long-range outlook of changes in the Earth system over periods of a few weeks or months, as a result of predictable changes in some of the slow-varying components of the s...

Seasonal forecast daily data on pressure levels from 2017 to present

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Seasonal forecasts provide a long-range outlook of changes in the Earth system over periods of a few weeks or months, as a result of predictable changes in some of the slow-varying components of the s...

Seasonal forecast monthly statistics on single levels from 2017 to present

Overview Download data Documentation

Originating centre

At least one selection must be made

- ☐ ECMWF ☐ UK Met Office ☐ Météo France

Select all

Variable

At least one selection must be made

- | | | |
|--|--|--|
| <input type="checkbox"/> 10m u-component of wind | <input type="checkbox"/> 10m v-component of wind | <input type="checkbox"/> 10m wind gust since previous post-processing |
| <input type="checkbox"/> 10m wind speed | <input type="checkbox"/> 2m dewpoint temperature | <input type="checkbox"/> 2m temperature |
| <input type="checkbox"/> East-west surface stress rate of accumulation | <input type="checkbox"/> Evaporation | <input type="checkbox"/> Maximum 2m temperature in the last 24 hours |
| <input type="checkbox"/> Mean sea level pressure | <input type="checkbox"/> Minimum 2m temperature in the last 24 hours | <input type="checkbox"/> North-south surface stress rate of accumulation |
| <input type="checkbox"/> Runoff | <input type="checkbox"/> Sea surface temperature | <input type="checkbox"/> Sea-ice cover |
| <input type="checkbox"/> Snow density | <input type="checkbox"/> Snow depth | <input type="checkbox"/> Snowfall |
| <input type="checkbox"/> Soil temperature level 1 | <input type="checkbox"/> Surface latent heat flux | <input type="checkbox"/> Surface sensible heat flux |
| <input type="checkbox"/> Surface solar radiation | <input type="checkbox"/> Surface solar radiation downwards | <input type="checkbox"/> Surface thermal radiation |
| <input type="checkbox"/> Top solar radiation | <input type="checkbox"/> Top thermal radiation | <input type="checkbox"/> Surface thermal radiation downwards |
| <input type="checkbox"/> Total precipitation | | <input type="checkbox"/> Total cloud cover |

Select all

Product type

At least one selection must be made

- ☒ Ensemble



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Search results

Search dataset

Sort by **Relevancy**

Product type

- ☒ Climate projections (4)
- ☐ Reanalysis (2)
- ☐ Satellite observations (11)
- ☐ Seasonal forecasts (6)
- ☐ Sectoral climate indices (2)

Variable domain

- ☐ Atmosphere (surface) (4)
- ☐ Atmosphere (upper air) (4)

Spatial coverage

- ☐ Global (4)

Temporal coverage

- ☐ Future (4)
- ☐ Past (4)
- ☐ Present (4)

Showing 1-4 of 4 results for **Climate projections**

CMIP5 daily data on pressure levels

This catalogue entry provides daily climate projections on pressure levels from a large number of models, members and time periods computed in the framework of fifth phase of the Coupled Model Intercomparison Project (CMIP5) for the Historical experiment. Information on how to access the complete CMIP5 dataset can be found in the Documentation section.

The term "pressure levels" is used to express that the variables were computed at multiple vertical levels, which may differ in number and location among the different models. The term "experiments" refers to the four main categories of CMIP5 simulations:

- Pre-industrial control experiments (PI-control) with prescribed, non-evolving concentrations of data and aerosols as they are supposed to be before the industrial period;
- Historical experiments which cover the period where climate observations do exist;
- Ensemble of experiments from the Atmospheric Model Intercomparison Project (AMIP), which oceanic variables for all models and during the all period of the experiment. This configuration complexity of ocean-atmosphere feedbacks in the climate system;
- Ensemble of climatic projection experiments following the Representative Concentration Path 6.0 and 8.5.

Typically, the same experiment was done using different models. In addition, for each model, it was repeatedly done using slightly different conditions producing in that way an ensemble of related. Each member of that ensemble is named after a triad of integers associated to the letters

CMIP5 daily data on pressure levels

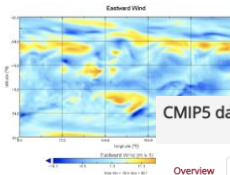
Overview Download data Documentation

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CMIP5 daily data on pressure levels

Overview Download data Documentation

Variable

At least one selection must be made

☐ Temperature ☐ U-component of wind ☐ Geopotential height

Model

At least one selection must be made

<input type="checkbox"/> Inmcm4 (INM, Russia)	<input type="checkbox"/> ACCESS1-0 (BoM-CSIRO, Australia)	<input type="checkbox"/> bcc-csm1-1 (BCC, China)
<input type="checkbox"/> CMCC-CM (CMCC, Italy)	<input type="checkbox"/> CMCC-CMS (CMCC, Italy)	<input type="checkbox"/> CNRM-CM5 (CNRM-CERFACS, France)
<input type="checkbox"/> GFDL-CM3 (NOAA, USA)	<input type="checkbox"/> GFDL-ESM2G (NOAA, USA)	<input type="checkbox"/> GFDL-ESM2M (NOAA, USA)
<input type="checkbox"/> HadGEM2-CC (UK Met Office, UK)	<input type="checkbox"/> HadGEM2-ES (UK Met Office, UK)	<input type="checkbox"/> IPSL-CM5A-LR (IPSL, France)
<input type="checkbox"/> IPSL-CM5B-LR (IPSL, France)	<input type="checkbox"/> NorESM1-M (NCC, Norway)	<input type="checkbox"/> IPSL-CM5A-MR (IPSL, France)
<input type="checkbox"/> MPI-ESM-LR (MPI, Germany)	<input type="checkbox"/> MPI-ESM-MR (MPI, Germany)	<input type="button" value="Select all"/>

Ensemble member

☒ r1i1p1 ☐ r2i1p1 ☐ r3i1p1
☐ r4i1p1 ☐ r5i1p1 ☐ r6i1p1

Period

At least one selection must be made

☐ 18600101-18641231 ☐ 18610101-18651231 ☐ 18650101-18691231



European
Commission

Europe's eyes on Earth





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Home Search Datasets Applications Your requests Toolbox Help & support

Search results

Search dataset All Datasets

Sort by **Relevancy**

Title

- Product type
 - ☒ Climate projections (4)
 - ☐ Reanalysis (2)
 - ☐ Satellite observations (11)
 - ☐ Seasonal forecasts (6)
 - ☒ Sectoral climate indices (2)
- Variable domain
 - ☐ Land (hydrology) (2)
- Spatial coverage
 - ☐ Europe (2)
- Temporal coverage
 - ☐ Future (2)

Showing 1-2 of 2 results for **Sectoral climate indices**

Water quality indicators for European rivers

This dataset contains modelled data for phosphorous and nitrogen concentrations and loads. The data comes from the Swedish Meteorological and Hydrological Institute E-HYPE model at catchment level for Europe. These water quality indicators were computed as a part of a proof of concept contract designed to speed up the workflow in impact assessments and to simplify climate change adaptation of water management practices across Europe.

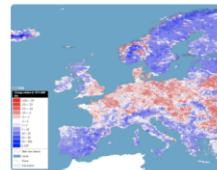
Water quantity indicators for Europe

This dataset contains modelled data for water runoff and wetness, river flow, snow water equivalent, soil water content and other water related quantities for the European region. These variables were...

Water quality indicators for European rivers

Overview Download data Documentation

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These indicators are provided as averages over 30 year periods, either for each calendar month or for the whole period. For the reference period (1971-2000) the absolute values are given, whereas for the future periods the relative changes are provided. In addition to the organic and inorganic parts are provided for nitrogen. For phosphorous, in addition to the total amount and soluble parts are provided. Values of the temperature of the water is provided for the same periods.

More details about the product are given in the Documentation section.

DATA DESCRIPTION

Horizontal coverage	Pan European domain.
Horizontal resolution	Irregular catchment polygons, median catchmentsize 215 km ² .

Water quality indicators for European rivers

Overview Download data Documentation

Variable

At least one selection must be made

- | | | |
|---|--|---|
| <input type="checkbox"/> Inorganic nitrogen concentrations | <input type="checkbox"/> Organic nitrogen concentrations | <input type="checkbox"/> Particulate phosphorous concentrations |
| <input type="checkbox"/> Soluble phosphorous concentrations | <input type="checkbox"/> Total nitrogen concentrations | <input type="checkbox"/> Total phosphorous concentrations |
| <input type="checkbox"/> Inorganic nitrogen loads | <input type="checkbox"/> Organic nitrogen loads | <input type="checkbox"/> Particulate phosphorous loads |
| <input type="checkbox"/> Soluble phosphorous loads | <input type="checkbox"/> Total nitrogen loads | <input type="checkbox"/> Total phosphorous loads |
| <input type="checkbox"/> Water temperature | | |
- Select all

Emissions scenario

At least one selection must be made

- | | | |
|----------------------------------|----------------------------------|----------------------------------|
| <input type="checkbox"/> RCP 2.6 | <input type="checkbox"/> RCP 4.5 | <input type="checkbox"/> RCP 8.5 |
|----------------------------------|----------------------------------|----------------------------------|
- Select all

Time aggregation

At least one selection must be made

- | | |
|--|--|
| <input type="checkbox"/> 30-year average | <input type="checkbox"/> Month average |
|--|--|
- Select all

Period





At least one selection must be made

- | | | |
|--|------------------------------------|------------------------------------|
| <input type="checkbox"/> 1971-2000 (reference) | <input type="checkbox"/> 2011-2040 | <input type="checkbox"/> 2041-2070 |
| <input type="checkbox"/> 2071-2100 | | |



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Using the data online: The CDS Toolbox Editor



cedric bergeron [Logout](#)

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Toolbox editor

[Applications](#) [Data](#) [Documentation](#)

▼ your workspace

Nice demonstration

▼ examples

00 Hello World

01 Retrieve data

02 Plot map

03 Extract time series and plot graph

11 Calculate time mean and standard deviation

12 Calculate climatologies

21 Calculate regional mean and anomalies

31 Calculate trends

41 Calculate GDD

42 Use cdo functions

51 Calculate zonal means

52 Format maps to allow visual comparison

00 Hello World

Console

Your queue

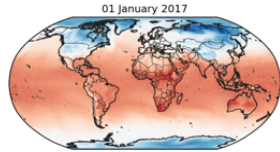
Layout

Copy

Run



```
1 import cdstoolbox as ct
2
3
4 @ct.application(title='Hello World!')
5 @ct.output.figure()
6 def application():
7     """
8     HELLO WORLD!
9     This is your first application using the CDS Toolbox.
10
11     Here, 3 basic tasks:
12
13     - retrieve the 2 meter temperature from the CDS Catalogue
14     - print info about the data (see it in the 'Console' tab!)
15     - show the data on a map.
16     """
17
18     data = ct.catalogue.retrieve(
19         'reanalysis-era5-single-levels',
20         {
21             'variable': '2m_temperature',
22             'product_type': 'reanalysis',
23             'year': '2017',
24             'month': '01',
25             'day': '01',
26             'time': '12:00',
27             'grid': ['3', '3'],
28         }
29     )
30
31     print(data)
32
33     fig = ct.cdsplot.geomap(data, title='01 January 2017')
34
35     return fig
36
```

Hello World!



01 January 2017

40
20
0
-20
-40
Near-Surface Air Temperature (°C)



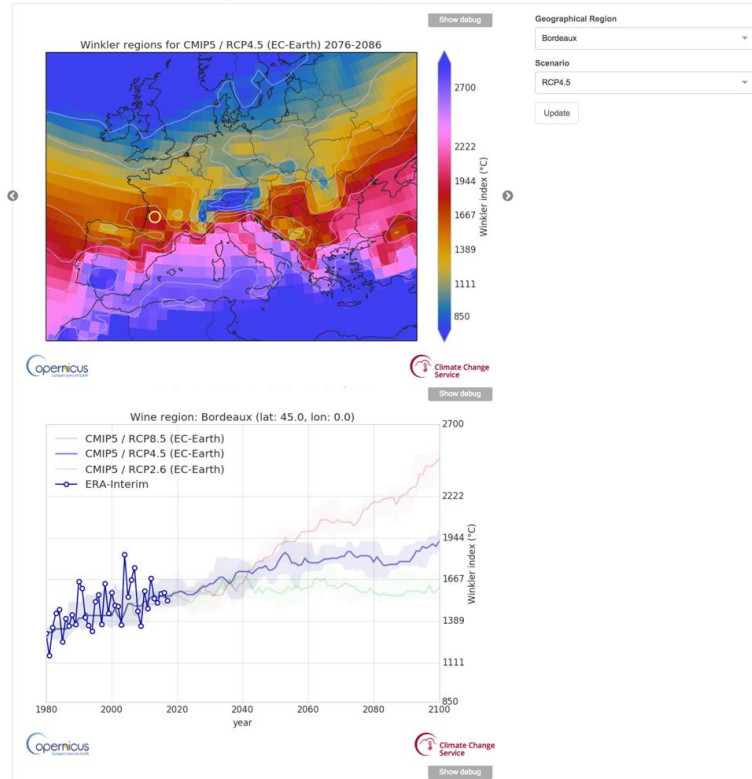


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Using the data online: Building Online Applications



Climate change impact on wine production



- Web page/components with possible parameterization from users
- Perform specific tasks
- Provide one or more of:
 - Data
 - Processed results
 - Plots / Maps





Climate
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Using the data online: Building Online Applications

WHAT WE DO ► SECTORAL IMPACTS ► DEMONSTRATOR PROJECTS

Demonstrator projects

We create projects to demonstrate how our data and tools can be used to address key climate challenges in different sectors. Working with industry and experts, the demonstrators are designed to focus on specific themes. These projects make data, tools and indicators available in an accessible format to help users make informed adaptation decisions. Within these projects, *case studies* are developed that show the demonstrators' tools in action.

Current demonstrator projects



15TH APRIL 2019

European storm surges



21ST NOVEMBER 2018

Global users in the Copernicus Climate Change Service



29TH AUGUST 2018

European Tourism

The service will provide a user driven climate information system for the tourism sector by early 2019.



18TH JULY 2018

Global shipping project



18TH JULY 2018

Global agriculture project

The Global Agriculture Sectoral Information System (GIS) project aims to develop climate services in support of decision-making in agriculture.



18TH JULY 2018

Operational windstorm service for the insurance sector

The aim of the Operational Wind Storm Service for the Insurance Sector is to provide new data resources for the insurance sector that can be used to enhance the understanding of the nature of windstorms over the European continent and their economic loss.



18TH JULY 2018

Operational service for the energy sector

The CSE Damage operational service will have the key elements of historical, seasonal forecast and projection periods for climate, electricity demand and the production of power, from wind, solar and hydropower, with focus placed on Europe.



18TH JULY 2018

Marine, coastal and fisheries project



18TH JULY 2018

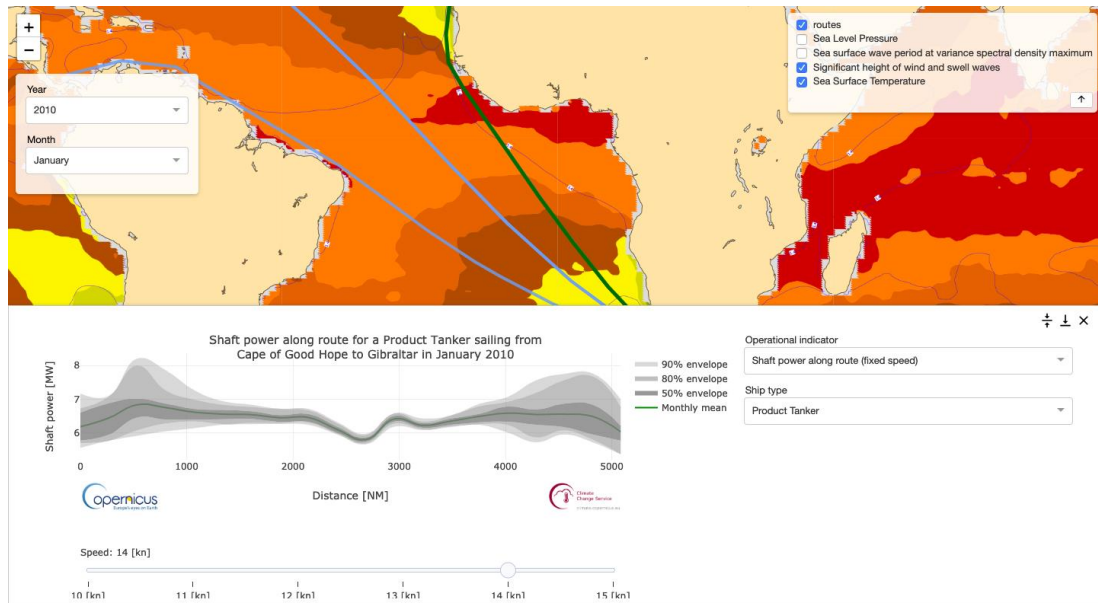
European health service



18TH JULY 2018

Operational service for the water sector

This service aims to help a broad range of water managers in the fields of, for instance, water allocation, flood management, ecological status and industrial water use, to adapt their strategies in order to mitigate the effects of climate change.





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Accessing datasets through the CDS API

<input type="checkbox"/> 07	<input type="checkbox"/> 08	<input checked="" type="checkbox"/> 09	<input type="checkbox"/> 10
<input type="checkbox"/> 13	<input type="checkbox"/> 14	<input type="checkbox"/> 15	<input type="checkbox"/> 16
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<input type="checkbox"/> 25	<input type="checkbox"/> 26	<input type="checkbox"/> 27	<input type="checkbox"/> 28
<input type="checkbox"/> 31			

Format ?

☒ Zip file (.zip)

☐ Com

Terms of use

✓ GHG-CCI Licence

[View terms](#)

Hide API request

Show Toolbox request

Please go to [the documentation page](#) for information as to how to use the CDS API.

```
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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```

<https://cds.climate.copernicus.eu/api-how-to>

pip install cdsapi

ECMWF



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Tuning

- Broker queue (“Quality of Service”)
 - Simultaneous request limits
 - Per user (current 10)
 - Per dataset (e.g. 40 for ERA5, 2 for ESA CCI, 10 for seasonal,...)
 - Priorities
 - ↑ Interactive
 - ↓ API
- Caching
 - Currently ~30 TB
 - Per type policies: PNG, NetCDF, GRIB, etc.
- A lot of tuning required





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R e p r o d u c i b i l i t y

- CDS is a data store, not a data archive (we broker access to datasets maintained by third parties)
- We have an agreement with our data provider to store all data releases for up to 5 years
- When serving a datasets we assign a DOI to offer an easy way to reference the dataset.
- When there are changes in the dataset (a new version is released) we instantiate a new DOI using the DataCite API
- The CDS DOIs are easy to recognise: ***10.24381/cds.[xxxxxxxxx]***



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Reproducibility and the toolbox

Reproducibility and the toolbox

The toolbox has several components:

- A user defined code called workflow
- Functions to access data stored in the CDS
- A set of tools that can perform several data processing from data reduction, statistical analysis and plotting



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Reproducibility and the toolbox

- All workflows are tracked using git
- Software used by the toolbox is also tracked with git, in particular we know what version of each package is used at a certain time
- When there are major changes in the software we keep old versions for backward compatibility (a time span is not defined yet)

The screenshot shows a web interface with a table of revisions. The table has columns for 'Tag name', 'Revision', 'Author', and 'Date'. The revisions are listed in descending order of date. The interface also includes tabs for 'Your requests', 'Toolbox', and 'FAQ', and a 'Run' button at the bottom left.

Tag name	Revision	Author	Date
	77ed5d4	cdteam	6/10/2019 17:45
	906d3445	cdteam	6/11/2019 12:6
	0507904	cdteam	6/11/2019 11:51
	6d8ba23	cdteam	6/11/2019 10:14
	3425658	cdteam	6/11/2019 10:12
	538231ba	cdteam	6/11/2019 10:12
	ca83982	cdteam	6/11/2019 10:12
	20e47495	cdteam	6/11/2019 10:11
	80a0958	cdteam	6/11/2019 9:58



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Toward a more reproducible workflow

- Toolbox outputs includes different formats. Adding all necessary metadata for reproducing the steps taken to have a certain output is not trivial
- We have currently on going actions (EQC) to improve the reproducibility of workflows and tracking tools changes



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Thank you

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

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