



Climate Change

Accessing GLOFAS data using the Climate Data Store

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The Climate Data Store Objectives

The **Copernicus Climate Change Service (C3S)** provides information to support **adaptation** and **mitigation** policies



Make data discovery and access simple and relevant



Provide online capabilities to process the data and develop easy-to-use applications



Enable reproducible research



Spend less time handling the data



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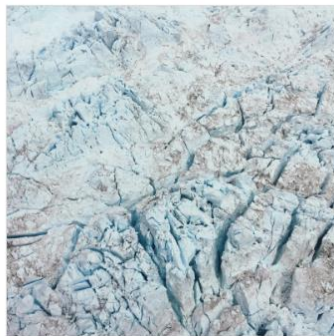
What kind of data?



Observations

Observations are key to understanding the climate system. C3S users can access a vast variety of instrumental data records, ranging from historic weather observations to the latest measurements from space.

[Read more](#) >



Climate reanalyses

Climate reanalyses combine past observations with models to generate consistent time series for a large set of climate variables. Reanalyses are among the most-used datasets in the geophysical sciences.

[Read more](#) >

[Reanalysis data on the CDS](#) >

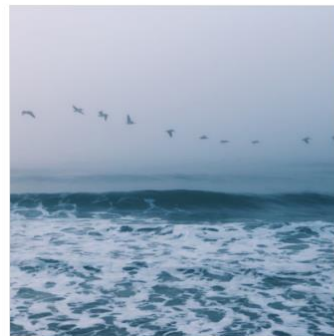


Seasonal forecasts

C3S seasonal forecasts combine outputs from several state-of-the-art seasonal prediction systems from providers in Europe and elsewhere. The latest data and products are published monthly on the Climate Data Store.

[Read more](#) >

[Seasonal forecast data on the CDS](#) >



Climate projections

Projections of future climate change are available for different scenarios for concentrations of greenhouse gases and aerosols, based on outputs from multiple global and regional climate models.

[Read more](#) >

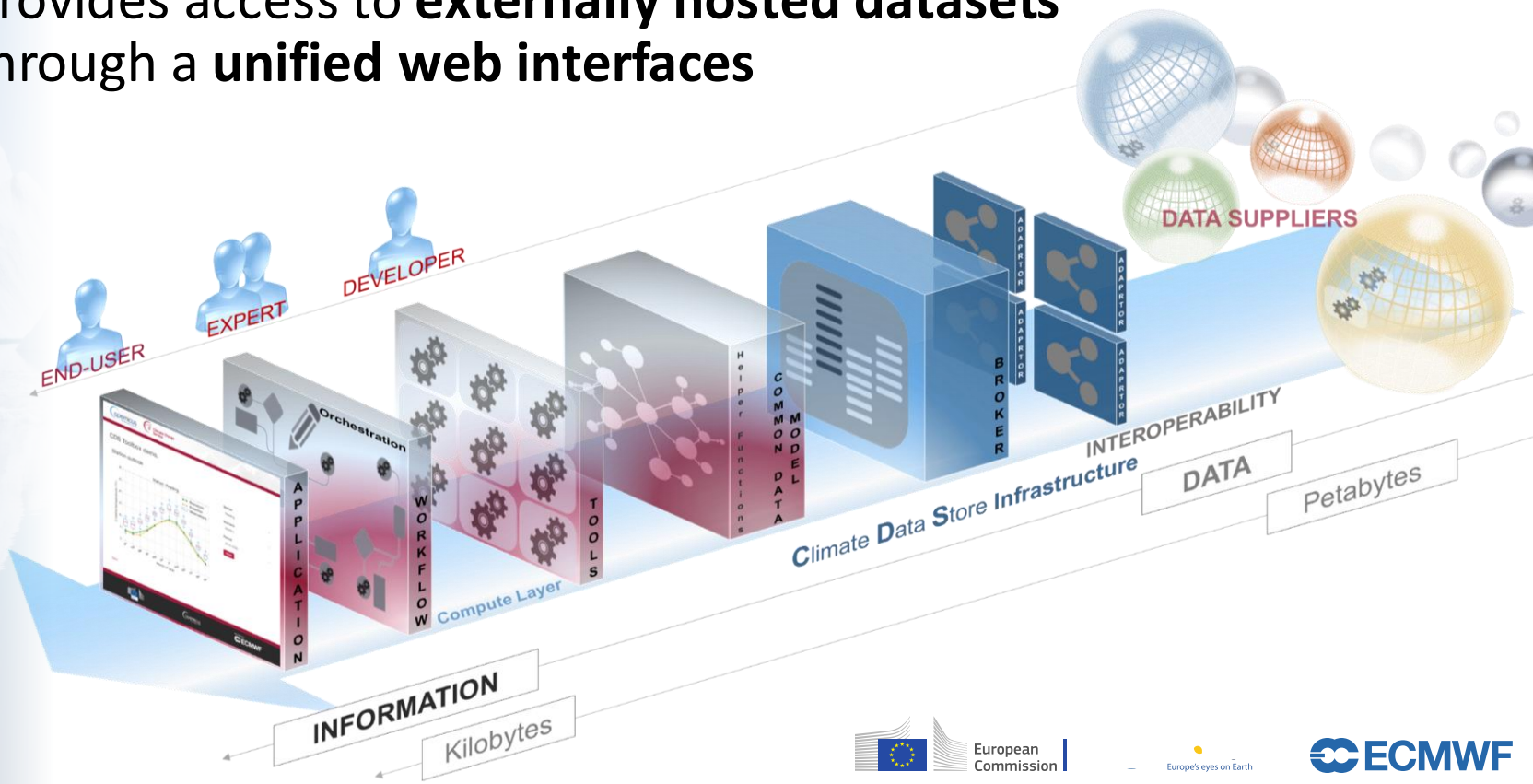
[Climate projection data on the CDS](#) >



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Concept


The CDS is a **distributed system** which provides access to **externally hosted datasets** through a **unified web interfaces**





Climate Change

Example catalogue entries


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Search results

🔍

All
Datasets
Providers

Sort by **Relevancy**

- Title
- ▶ Product type
- ▶ Variable domain
- ▶ Spatial coverage
- ▶ Temporal coverage
- ▶ Sector
- ▶ Provider

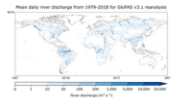
Showing 1-20 of 107 results for **global flood awareness**

River discharge and related historical data from the Global Flood Awareness System

[Dataset](#) [Reanalysis](#) [Global](#) [Land \(hydrology\)](#)

This dataset provides a modelled time series of gridded river discharge. It is a product of the Global Flood Awareness System (GloFAS) and offers a consistent representation of a key hydrological variable across the global domain. This dataset is accompanied by two ancillary files for interpretation, one containing upstream area data and the other elevation data (see the table of related variables...)

Updated 2023-02-09

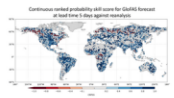


River discharge and related forecasted data by the Global Flood Awareness System

[Dataset](#) [Reanalysis](#) [Global](#) [Land \(hydrology\)](#)

This dataset contains global modelled daily data of river discharge forced with meteorological forecasts. The data was produced by the Global Flood Awareness System (GloFAS), which is part of the Copernicus Emergency Management Service (CEMS). River discharge, or river flow as it is also known, is defined as the amount of water that flows through a river section at a given time. This dataset is s...

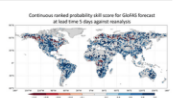
Updated 2023-02-09



Reforecasts of river discharge and related data by the Global Flood Awareness System

[Dataset](#) [Global](#) [Land \(hydrology\)](#)

This dataset provides a gridded modelled time series of river discharge, forced with medium- to sub-seasonal range meteorological reforecasts. The data is a consistent representation of a key hydrological variable across the global domain, and is a product of the Global Flood Awareness System (GloFAS). It is accompanied by an ancillary file for interpretation that provides the upstream area (see t...

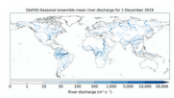


Seasonal forecasts of river discharge and related data by the Global Flood Awareness System

[Dataset](#) [Seasonal forecasts](#) [Global](#) [Land \(hydrology\)](#)

This dataset provides a gridded modelled time series of river discharge, forced with seasonal range meteorological forecasts. The data is a consistent representation of a key hydrological variable across the global domain, and is a product of the Global Flood Awareness System (GloFAS). It is accompanied by an ancillary file for interpretation that provides the upstream area (see the related varia...

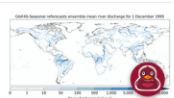
Updated 2023-01-10



Seasonal reforecasts of river discharge and related data from the Global Flood Awareness System

[Dataset](#) [Global](#) [Land \(hydrology\)](#)

This dataset provides a gridded modelled time series of river discharge forced with seasonal range meteorological reforecasts. The data is a consistent representation of a key hydrological variable across the global domain, and is a product of the Global Flood Awareness System (GloFAS). It is accompanied by an ancillary file for interpretation that provides the upstream area (see the related varia...





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Example catalogue entry (GLOFAS Historical)

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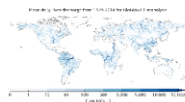
[Home](#) [Search](#) [Datasets](#) [Applications](#) [Your requests](#) [Toolbox](#) [Support](#) [Live](#)

River discharge and related historical data from the Global Flood Awareness System

Please note that accessing this dataset via CDS for time-critical operation is not advised and supported.

[Overview](#) [Download data](#) [Documentation](#)

This dataset contains global modelled daily data of river discharge from the Global Flood Awareness System (GloFAS), which is part of the Copernicus Emergency Management Service (CEMS). River discharge, or river flow as it is also known, is defined as the amount of water that flows through a river section at a given time.



This dataset is simulated by forcing a hydrological modelling chain with inputs from a global reanalysis. Data availability for the historical simulation is from 1979-01-01 up to near real time.

DATA DESCRIPTION		
Data type	Gridded	
Horizontal coverage	Global except for Antarctica (90N-60S, 180W-180E)	
Horizontal resolution	0.1° x 0.1°	
Vertical resolution	Surface level for river discharge	
Temporal coverage	1 January 1979 to near real time for the most recent version	
Temporal resolution	Daily data	
File format	GRIB2	
Conventions	WMO standards for GRIB2	
Versions	Current version - GloFAS v2.1 released 2019-11-05. For more information on versions we refer to the documentation.	
Update frequency	A new river discharge reanalysis will be published with every major update of the GLOFAS system. The latest version will always be the version used in operations. For more information on the model versions, we refer to the documentation.	
MAIN VARIABLES		
Name	Units	Description
River discharge in the last 24 hours	m ³ s ⁻¹	Volume rate of water flow, including sediments, chemical and biological material, in the river channel averaged over a time step through a cross-section. The value is an average over a 24-hour period.
RELATED VARIABLES		
Name	Units	Description
Upstream area	m ²	Static file - upArea.nc, upstream area for the point in the river network.

Record updated: 2021-06-17 10:58:05 UTC

Contact

ECMWF Support Portal

Licence

CEMS-FLOODS datasets licence

Publication date

2019-11-05

References

Citation

DOI: 10.24381/cds.a4f0d0b97

Related data

Reforecasts of river discharge and related data by the Global Flood Awareness System

River discharge and related forecasted data by the Global Flood Awareness System

Seasonal forecasts of river discharge and related data by the Global Flood Awareness System

Seasonal reforecasts of river discharge and related data from the Global Flood Awareness System

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River discharge and related historical data from the Global Flood Awareness System

Please note that accessing this dataset via CDS for time-critical operation is not advised and supported.

[Overview](#) [Download data](#) [Documentation](#)

System version

At least one selection must be made

Legacy

Version 2.1 [Select all](#)

Operational

Version 2.1 [Select all](#)

Hydrological model

At least one selection must be made

UFL000

HRESSEL_UFL000 [Select all](#)

Product type

At least one selection must be made

Consolidated

Intermediate [Select all](#)

Variable

River discharge in the last 24 hours [Clear all](#)

Year

At least one selection must be made

1979

1980

1981

1982

1983

1984

1985

1986

1987

1988

1989

1990

1991

1992

1993

1994

1995

1996

1997

1998

1999

2000

2001

2002

2003

2004

2005

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2007

2008

2009

2010

2011

2012

2013

2014

2015

2016

2017

2018

2019

2020

2021 [Select all](#)

Contact

ECMWF Support Portal

Licence

CEMS-FLOODS datasets licence

Publication date

2019-11-05

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Citation

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Related data

Reforecasts of river discharge data by the Global Flood Awareness System

River discharge and related to by the Global Flood Awareness System

Seasonal forecasts of river discharge related data by the Global Flood Awareness System

Seasonal reforecasts of river discharge related data from the Global Flood Awareness System

Month

At least one selection must be made

January

February

March

April

May

June

July

August

September

October

November

December [Select all](#)

Day

At least one selection must be made

01

02

03

04

05

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31 [Select all](#)

Geographical area

Whole available region

With this option selected the entire available area will be provided

Sub-region extraction

North

West

East

South

North

West

East

South

Clear all

Format

GRIB2 [Clear all](#)

Terms of use

CEMS-FLOODS datasets licence [View terms](#)

[Show API request](#) [Show dataset request](#)

[Please check mandatory fields](#)



<https://cds.climate.copernicus.eu/cdsapp#!/dataset/cems-glofas-historical>



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Example catalogue entry (GLOFAS Historical)

- | | | | |
|-----------------------------|-----------------------------|--|-----------------------------|
| <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 |
| <input type="checkbox"/> 19 | <input type="checkbox"/> 20 | <input type="checkbox"/> 21 | <input type="checkbox"/> 22 |
| <input type="checkbox"/> 25 | <input type="checkbox"/> 26 | <input type="checkbox"/> 27 | <input type="checkbox"/> 28 |
| <input type="checkbox"/> 31 | | | |

Format [?](#)

Zip file (.zip)

Compressed

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')
```

```
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')
```





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

`pip install cdsapi`



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Online processing

cedric bergeron Logout

Your feedback helps us to improve the service

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Toolbox Editor

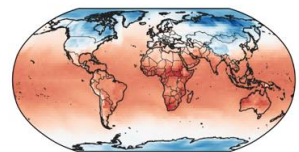
Applications | Data | Documentation

- your workspace
 - 41 Calculate GDD
 - 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

```
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
14     Catalogue
15     - print info about the data (see it in the 'Console'
16     tab!)
17     - show the data on a map.
18     """
19
20     data = ct.catalogue.retrieve(
21         'reanalysis-eras-single-levels',
22         {
23             'variable': '2m_temperature',
24             'product_type': 'reanalysis',
25             'year': '2017',
26             'month': '01',
27             'month_start': '01',
28             'day': '01',
29             'time': '12:00',
30             'grid': ['3', '3'],
31         }
32     )
33
34     print(data)
35
36     fig = ct.cdsplot.geomap(data, title='01 January 2017')
37
38     return fig
```

Hello World!

01 January 2017



Mean-Surface Air Temperature [°C]

Min tested browsers: Chrome 60, Firefox 52, Safari 10.1, Edge 15



<https://ecmwf-projects.github.io/copernicus-training-c3s/intro.html>

Climate Change Service (CCS) Training

PROGRAMME OF THE EUROPEAN UNION Copernicus ECMWF

Climatologies

About

In this tutorial we will access data from the Climate Data Store (CDS) of the Copernicus Climate Change Service (CCS), and analyse climatologies and trends in near-surface air temperature. The tutorial comprises the following steps:

1. Search, download and view data
2. Calculate a climate normal
3. Visualise anomalies with respect to the normal
4. Calculate monthly climatology and anomalies
5. View time series and analyse trends

How to access the notebook

This tutorial is in the form of a Jupyter notebook. You will not need to install any software for the training as there are a number of cloud-based services to create, edit, run and export Jupyter notebooks such as this. Here are some suggestions (simply click on one of the links below to run the notebook):

Binder	Kaggle	Colab	NDVViewer

(Binder may take some time to load, so please be patient) | (Kaggle may take some time to load, and switch on the internet via settings) | (Colab may need to run the command '!pip install ...' before importing the libraries) | (NDVViewer will not run the notebook, only the visualisation)

3. Anomaly calculation

The next step is now to calculate the anomaly of a specific year with respect to the climate normal. The term anomaly refers to the deviation of a value from the long-term average. Positive or negative anomalies indicate that the average temperatures of a particular year were respectively warmer or cooler than the reference value.

Let us calculate the near-surface air temperature anomaly for the year 2016. In a first step, we select the average near-surface temperature values for the year 2016 from the xarray.DataArray object `yearly_mean`. With the array function `sel()`, you can select a data array based on coordinate labels. The coordinate label of interest is `year=2016`.

```
ts_2016 = yearly_mean.sel(year=2016)
```

Next, we calculate the near-surface air temperature anomaly for 2016 by subtracting the climate normal (i.e. the reference near-surface air temperature values) from the average near-surface air temperature for 2016.

```
anom_2016 = ts_2016 - ref_mean
```

Let's visualize the global near-surface air temperature anomaly for 2016 to see which regions were warmer or cooler compared to the reference period. This time we will make use of a combination of the plotting libraries `matplotlib` and `Cartopy` to create a more customised figure. One of `Cartopy`'s key features is its ability to transform array data into different geographic projections. In combination with `matplotlib`, it is a very powerful way to create high-quality visualisations and animations.

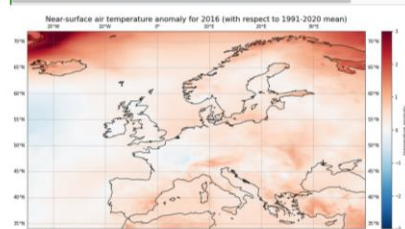
```
# create the figure panel and the map using the Cartopy PlateCarree projection
fig, ax = plt.subplots(1, 1, figsize=(16, 8), subplot_kw={'projection': ccrs.PlateCarree()})

# Plot the data
lon = np.arange(-180, 180, 2.5)
lat = np.arange(-90, 90, 2.5)
anom_2016 = yearly_mean.sel(year=2016)

# Set the figure title, add lat/lon grid and coastlines
ax.set_title('Near-surface air temperature anomaly for 2016 (with respect to 1991-2020 mean)')
ax.grid(linestyle='dotted', color='gray', alpha=0.5, linestyle='--')
ax.coastlines(color='black')
ax.set_extent([-25, 40, 34, 72], crs=ccrs.PlateCarree())

# Specify the colourbar
cbar = plt.colorbar(ax, fraction=0.85, pad=0.04)
cbar.set_label('temperature anomaly')

# Save the figure
fig.savefig('DATASZ/EMSL_label_2016_anomaly_eur.png')
```



Seasonal analysis of Arctic near-surface air temperature

In the final part of this tutorial we will compare seasonal trends in Arctic near-surface air temperature. To do this we return to our monthly geographically averaged dataset, and we will downsample the monthly averages to seasonal averages using the function `resample()`. By specifying `time='Q-DEC'`, the data is split into consecutive three-month periods, anchored at December. If we add additionally the function `mean()`, we calculate the average of the three-month period.

```
Arc_seasonal = Arc_mean.resample(time='Q-DEC').mean()
```

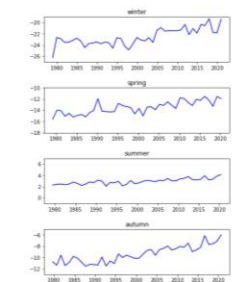
In the code below, before visualising the seasonal average air temperature data for the Arctic, we create for each season (`winter`, `spring`, `summer` and `autumn`) a pandas.DataFrame. We then create a `for` loop to visualise each seasonal time series in a successive plot.

```
fig, axs = plt.subplots(4, 1, figsize=(6, 9))
season_list = ['winter', 'spring', 'summer', 'autumn']

for i, s in range(4):
    df = Arc_seasonal[time.slice_indexer(s, s+3)]
    mid_range = np.around(df.mean().values)
    axs[i].plot(df.time, color='blue')
    axs[i].set_xlim(mid_range[0], mid_range[0]+4)
    axs[i].set_title(season_list[i], fontsize=12)
    axs[i].tick_params(axis='y', labelsize=10)
    axs[i].tick_params(axis='x', labelsize=10)

fig.suptitle('Arctic seasonal averages of 2m air temp - 1979-2020', fontsize=16)
fig.tight_layout(pad=1.0)
fig.savefig('DATASZ/Arctic_seasonal.png')
```

Arctic seasonal averages of 2m air temp - 1979-2020



Note the difference in variability of the seasonal average of air temperature in the Arctic: mean summer temperatures seem to be more constant compared to the other seasons.


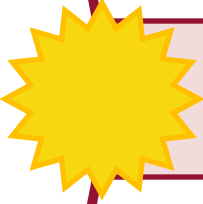
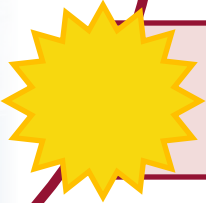
Previous Climate Data Store Tutorial Next Climate Indices

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Summery Summary

-  The CDS provides access to over 180 dataset using a simple consistent interface. This Includes the GLOFAS and EFAS datasets, and several hydrology dataset derived from climate model output
-  The CDS provides an online processing facility (CDS Toolbox) to help you reduce the data to what you need prior to download
-  Copernicus provide a suite of training material to help you start working with the data

Please visit me
at the CDS
stand in
Gathertown for
some hands on
demonstrations