

Using ECMWF's Forecasts (UEF2019)  
Reading, UK, 3 - 6 June 2019



Climate Change

# Seasonal forecasts from the Copernicus Climate Change Service

**Eduardo Penabad Ramos, Simona Briceag, Anca Brookshaw**





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# C o n t e n t s

- Copernicus
  - Copernicus Programme and ECMWF
  - Copernicus Climate Change Service (C3S)
- The Climate Data Store (CDS)
  - Description
  - Catalogue
  - Access: download, API, applications, Toolbox
- C3S seasonal forecast activity
  - Description
  - Current status and live-demo
  - Next steps



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Sentinels



CLIMATE CHANGE



MARINE MONITORING



ATMOSPHERE MONITORING



LAND MONITORING



SECURITY



EMERGENCY MANAGEMENT





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Climate Change Service

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European Commission

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IMPLEMENTED BY ECMWF

X close

We provide authoritative information about the past, present and future climate, as well as tools to enable climate change mitigation and adaptation strategies by policy makers and businesses.

Key products and services

www.copernicus.eu

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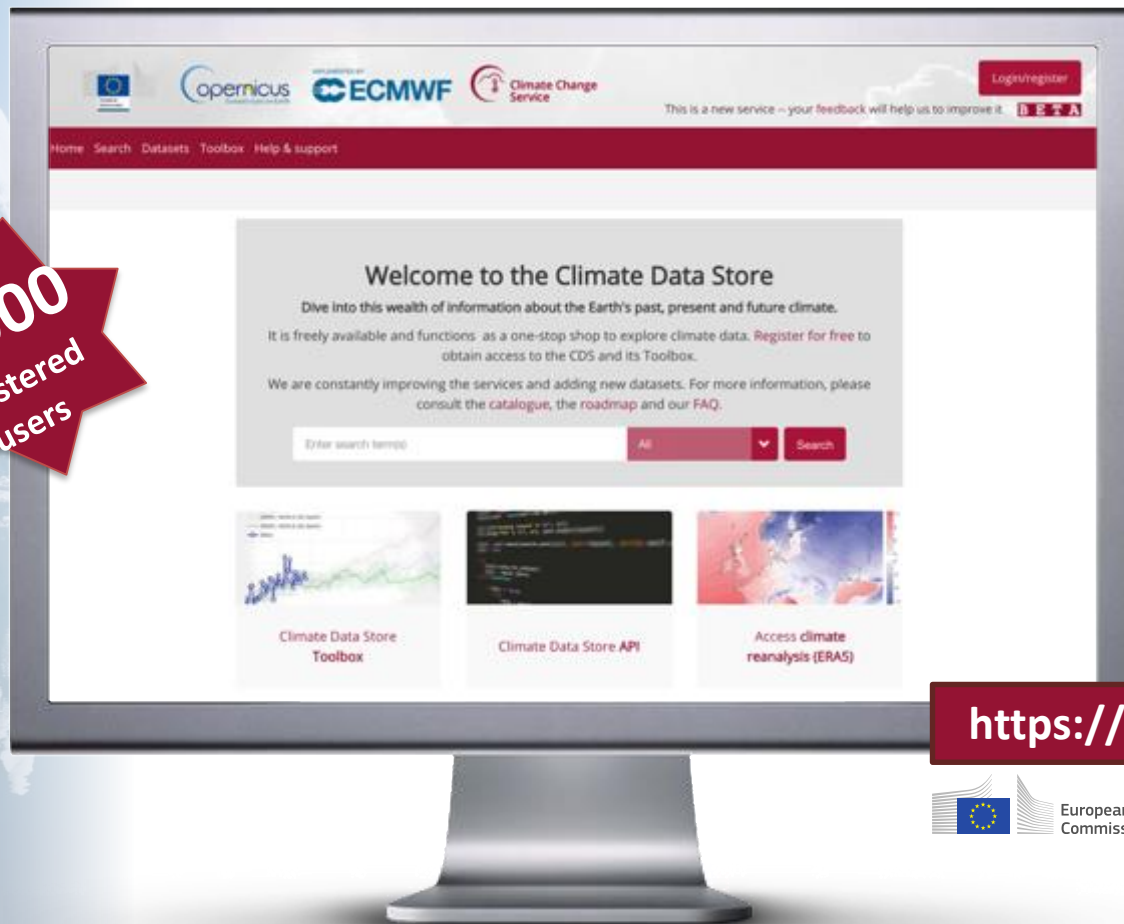
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# The C3S Climate Data Store (CDS)

15000  
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

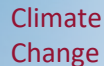
<https://cds.climate.copernicus.eu>



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?

[illegible]

Reading, UK, 5 - 6 June 2019

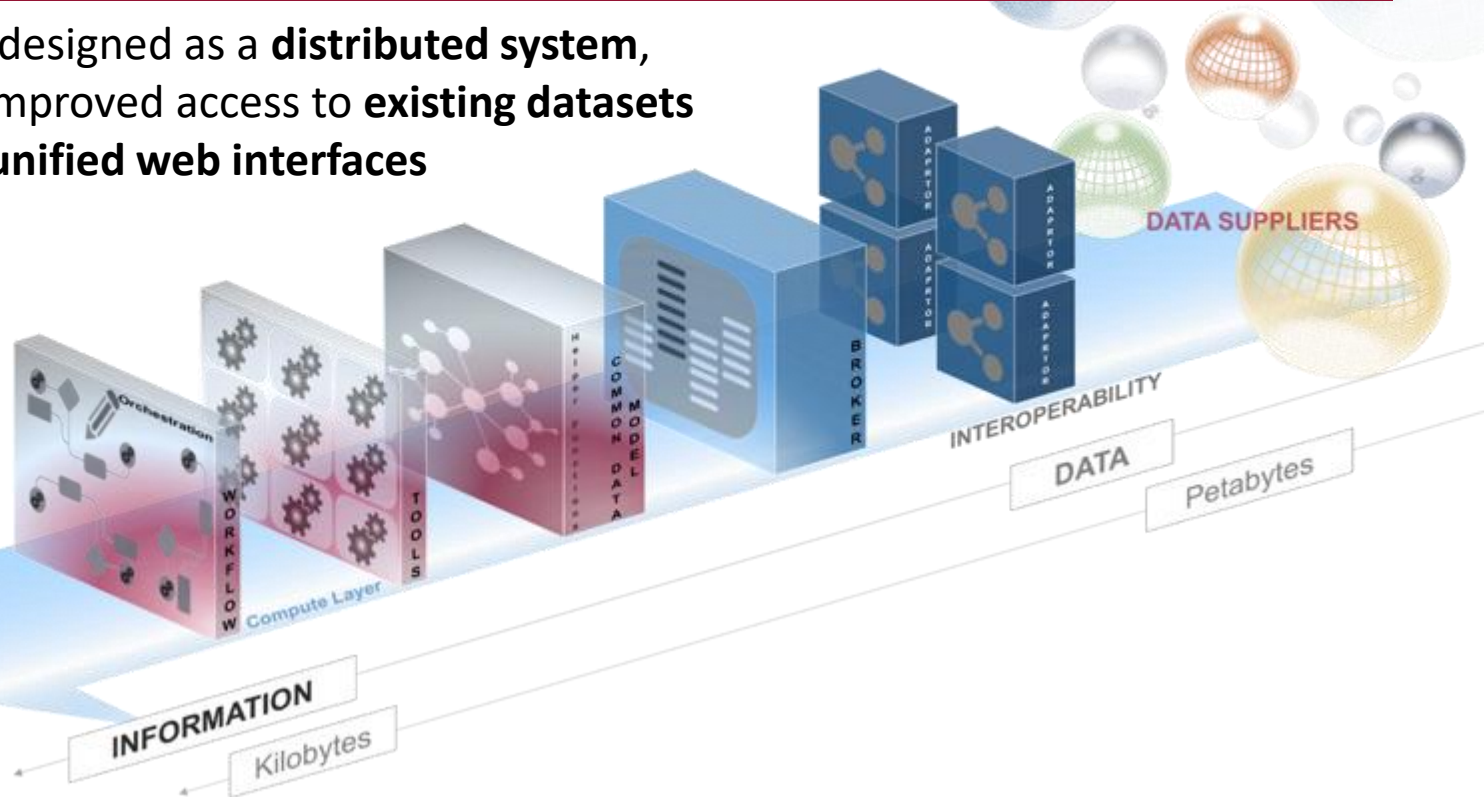




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## What is the CDS concept?

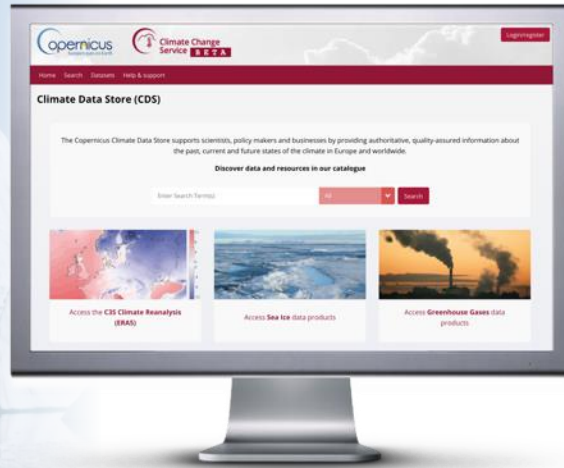
The CDS is designed as a **distributed system**, providing improved access to **existing datasets** through a **unified web interfaces**





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# Climate Data Store – Data catalogue



- Global reanalysis
- Regional reanalyses: Europe, Arctic
- ECVs global estimates
- Multi-system seasonal forecasts
- Climate projections
- Sectoral indices (SIS)

Past Climate

Present Climate

Future Climate



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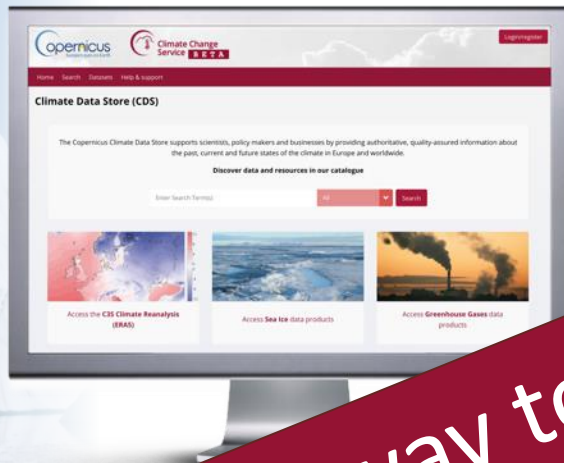


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# Climate Data Store – Data catalogue



- Global reanalysis
- Regional reanalysis
- ECVs of the climate system
- Seasonal forecasts
- Climate projections
- Sectoral indices (SIS)

Gateway to climate information

Past Climate

Present Climate

Future Climate



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# CDS – Datasets catalogue



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## Glaciers elevation and mass change data from 1850 to present from the Fluctuations of Glaciers Database

**Overview**

[Download data](#)

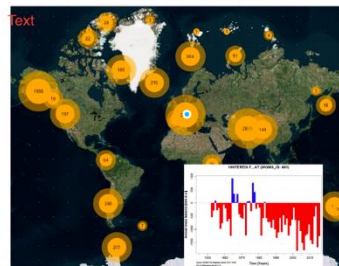
[Documentation](#)

A glacier is defined as a perennial mass of ice, and possibly firn and snow, originating on the land surface from the recrystallization of snow or other forms of solid precipitation and showing evidence of past or present flow. There are several types of glaciers such as glacierets, mountain glaciers, valley glaciers and ice fields, as well as ice caps. Some glacier tongues reach into lakes or the sea, and can develop floating ice tongues or ice shelves. Glacier changes are recognized as independent and high-confidence natural indicators of climate change. Past, current and future glacier changes affect global sea level, the regional water cycle and local hazards.

This product consists of two data sets providing time series of glacier changes: 1. The glacier elevation change series, and 2. the glacier mass balance series. These data sets are an extract of the World Glacier Monitoring Service (WGMS) Fluctuations of Glaciers database.

Both data layers are provided as ESRI shapefiles containing the location of each glacier label point in geographic coordinates (longitude and latitude in degrees) in the World Geodetic System 1984 (WGS84) datum and some general statistical information about each glacier. Both shapefiles come with one ancillary .csv file containing the individual glacier change series linked to the corresponding point shapefile through the World Glacier Monitoring Service identification number (WGMS ID).

### Glacier Elevation



Worldwide distribution of glaciological series. The blue dot refers to the location of the Hintereis Ferner glacier in Austria. Its glaciological series is shown in the graph.

### Contact

[copernicus-support@ecmwf.int](mailto:copernicus-support@ecmwf.int)

### License

[UZH Glaciers licence](#)

### Publication Date

2018-06-14

### Related data





[Glaciers distribution data from the Randolph Glacier Inventory for year 2000](#)





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# CDS – Evaluation and Quality Control (EQC)



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## Glaciers elevation and mass change data from 1850 to present from the Fluctuations of Glaciers Database

Overview

Download data

Documentation

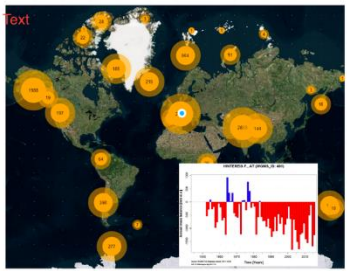
Data quality

A glacier is defined as a perennial mass of ice, and possibly firn and snow, originating on the land surface from the recrystallization of snow or other forms of solid precipitation and showing evidence of past or present flow. There are several types of glaciers such as glacierets, mountain glaciers, valley glaciers and ice fields, as well as ice caps. Some glacier tongues reach into lakes or the sea, and can develop floating ice tongues or ice shelves. Glacier changes are recognized as independent and high-confidence natural indicators of climate change. Past, current and future glacier changes affect global sea level, the regional water cycle and local hazards.

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# CDS – Evaluation and Quality Control (EQC)

Home Search Datasets Applications Toolbox FAQ

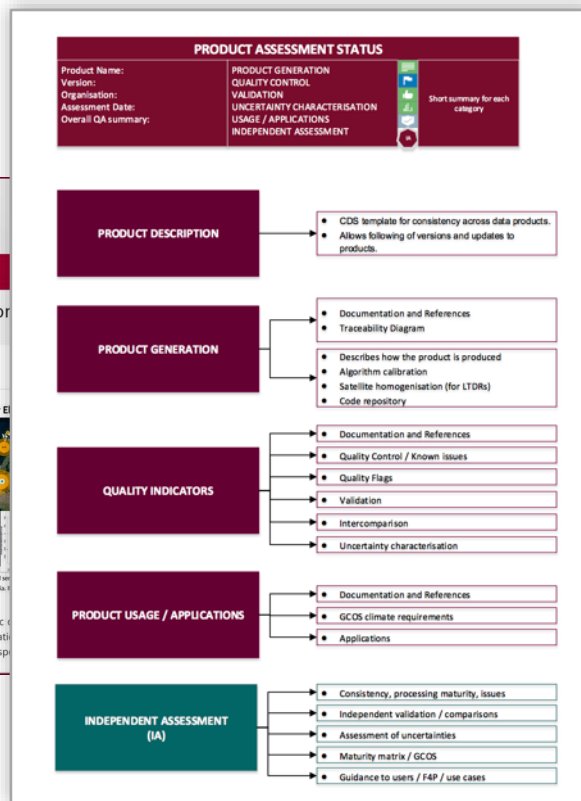

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Overview Download data Documentation **Data quality**

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## Quality of data

- Assessments
- User guidance
- Gaps and limitations

## Quality of tools

- Fitness for purpose
- Best practices





## Quality of service

- Speed, responsiveness
- System availability, ...



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# CDS - Personal Space



cedric.bergeron [Logout](#)

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



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## Your requests

[All](#) [Queued](#) [In progress](#) [Failed](#) [Unavailable](#) [Complete](#)

Auto refreshed : 11:14:34 [Delete selected](#)

Product	Submission date	End date	Duration	Size	Status	
▶ ERAS hourly data on single levels from 2000 to present	2019-01-07 11:10:31	2019-01-07 11:13:54	0:03:23	2.1 MB	<a href="#">Download</a>	<input type="checkbox"/>



## Your requests

[All](#) [Queued](#) [In progress](#) [Failed](#) [Unavailable](#) [Complete](#)

Auto refreshed : 11:11:33 [Delete selected](#)

Product	Submission date	End date	Duration	Size	Status	
▶ ERAS hourly data on single levels from 2000 to present	2019-01-07 11:10:31		0:01:51		In progress	<input type="checkbox"/>

Request ID: d7508403-6808-49d3-8d48-6232f3a6f83b

Variable: 2m temperature

Product type: Reanalysis

Year: 2006

Month: January

Day: 02

Time: 07:00

Format: GRIB



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# CDS – 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
<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)

☐ 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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c = cdsapi.Client()

c.retrieve(
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        'format': 'zip',
        'processing_level': 'level_2',
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        'year': '2004',
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        'day': '09'
    },
    'download.zip')
```

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

[pip install cdsapi](#)

ECMWF



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# CDS – The CDS API (for ECMWF webAPI users...)

- Were you using webAPI? Are you familiar with EUROSIP?

Copernicus Knowledge Base

<https://confluence.ecmwf.int/display/CKB>

The screenshot shows the ECMWF Copernicus Knowledge Base interface. The left sidebar contains a list of links, including 'What data and maps are available', 'CAMS Global data: What is "GEMS"', 'CDS: What is the Climate Data Store', 'FTP access to CAMS global data', 'C3S Seasonal Forecast data: Web API to CDS API', 'C3S seasonal forecasts: wrong values', 'C3S global reanalysis ERA5: wrong values', 'C3S global reanalysis ERA5: wind values', 'CAMS global AOD evaluation version', 'What are the differences between...', 'Sea level daily gridded data for the...', 'C3S seasonal forecasts: wrong data', 'CDS: How can I be sure I can rely on...', 'CDS: How can I find more information', 'C3S: What information is the Climate Data Store?', 'CDS: What is the data policy to use...', 'CDS: The Quality Assessment page', 'CDS: What is the Climate Data Store', and 'CDS: Where can I find the Climate Data Store?'. The main content area displays the article 'C3S Seasonal Forecast data: Web API to CDS API', created by Xiaobo Yang and last modified by Anabelle Guillory on Jan 07, 2019. The article text states: 'This article describes how users who used to use ECMWF Web API to access the C3S seasonal forecasts data need to migrate to using the CDS API instead. Before proceeding with the steps below, users must be CDS registered and have gone through the steps described on [How to migrate from ECMWF Web API to CDS API](#).' The article is structured into two main sections: '1. Basic CDS API request generated using the CDS forms' and '2. Syntax changes introduced to CDS API'. Section 1 explains that users can use the CDS web interface to build their CDS API download script. Section 2 details syntax changes: (a) 'Dataset name' replaces web API 'stream', (b) 'originating\_centre' replaces web API 'origin', and (c) 'variable' replaces 'param'. It also lists specific changes for pressure level datasets, daily datasets, and monthly statistics/anomalies datasets.

ECMWF Spaces

Pages / Copernicus Knowledge Base

## C3S Seasonal Forecast data: Web API to CDS API

Created by Xiaobo Yang, last modified by Anabelle Guillory on Jan 07, 2019

This article describes how users who used to use ECMWF Web API to access the C3S seasonal forecasts data need to migrate to using the CDS API instead.

Before proceeding with the steps below, users must be CDS registered and have gone through the steps described on [How to migrate from ECMWF Web API to CDS API](#).

- 1. Basic CDS API request generated using the CDS forms**

As described in on [How to migrate from ECMWF Web API to CDS API](#), you can use the CDS web interface to help you build your CDS API download script. In the download form, make some selections, then click the button **Show API request** and you will be presented with the script.

> Basic CDS API script example is shown [HERE](#)
- 2. Syntax changes introduced to CDS API**
  - a. Dataset name** replaces web API "stream"

Using CDS API, you give the name of the dataset, instead of **stream** used in Web API. See table below for changes made to seasonal forecasts data.

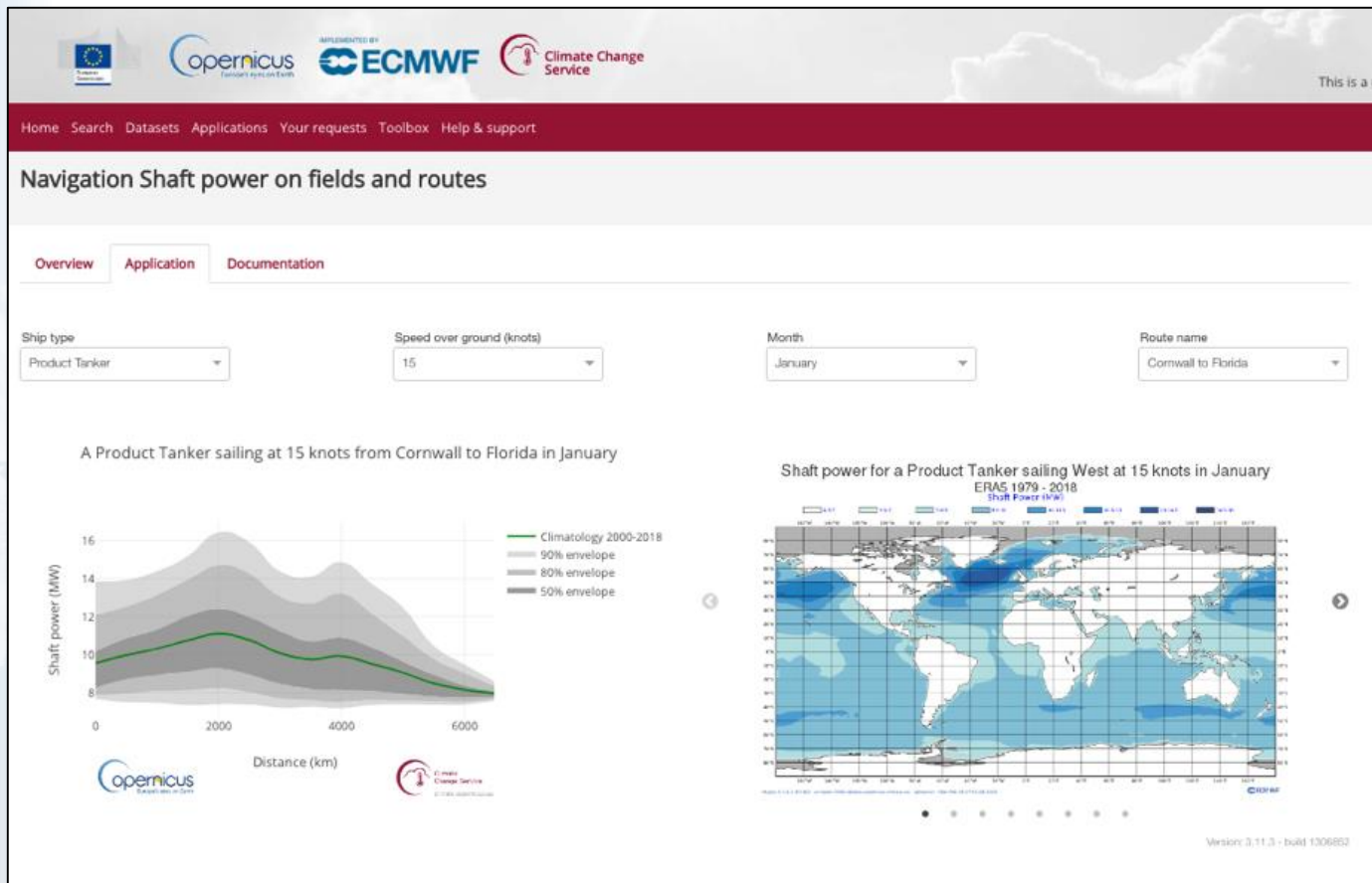
> [See table below for changes made to seasonal forecasts data.](#)
  - b. originating\_centre** replaces web API **origin** and the values have been changed.
  - c. variable** replaces **param**. Please use the web interface to look for new values: the "Show API request" button in the relevant CDS form ("Download data" tab) reveals the CDS API names for the variables you have selected.
  - d. For pressure level datasets:** (a) **levtype** no longer exists, (b) **pressure\_level** replaces **levelist**.
  - e. For daily datasets (stream=MMSF):** (a) **year**, **month** and **day** replace **date**, (b) **leadtime\_hour** replaces **step**.
  - f. For monthly statistics and anomalies datasets (stream=MSMM/MMSA):** (a) **year** and **month** replace **date**, (b) **leadtime\_month** replaces **step**.

Space tools



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# CDS – Applications catalogue



CMWF





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# CDS – Toolbox Editor

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shaft-power-on-fields-and-ro...

Console Your queue

Layout Copy Run

```
1 import calendar
2 import collections
3 import math
4
5 import cdstoolbox as ct
6 import cdstoolbox.navigation as navigation
7
8 BEARINGS = collections.OrderedDict({
9     ('West', 180.),
10    ('South-West', -135.),
11    ('South', -90.),
12    ('South-East', -45.),
13    ('East', 0.),
14    ('North-East', 45.),
15    ('North', 90.),
16    ('North-West', 135.),
17 })
18
19 SHIP_TYPE = {
20     'Product Tanker': {
21         'id': 'product_tanker',
22         'contour_list': [4., 5.5, 7., 8.5, 10., 11.5, 13., 14.5, 16.],
23     },
24     'New Panamax Containership': {
25         'id': 'new_panamax_containership',
26         'contour_list': [60., 65., 70., 75., 80., 85., 90., 95., 100.],
27     },
28 }
29
30 KNOTS_TO_M_PER_S = 0.514444
31
32 MAP_CONFIG = {
33     'contour': {
34         'contour': 'off',
35         'legend': 'on',
36         'contour_label': 'off',
37         'contour_shade': 'on',
38         'contour_shade_method': 'area_fill',
39         'contour_shade_colour_method': 'palette',
40         'contour_level_selection_type': 'level_list',
```

Ship type  
Product Tanker

Speed over ground  
(knots)  
15

Month  
January

Route name  
Cornwall to Flo

Tanker sailing at 15 knots from Cornwall to Florida

16  
14  
12  
10  
8  
0 2000 4000 6000

— Climatology 20  
— 90% envelope  
— 80% envelope  
— 50% envelope

Distance (km)

Shaft power for a Product Tanker sailing West at 15 knots in January



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# Contents

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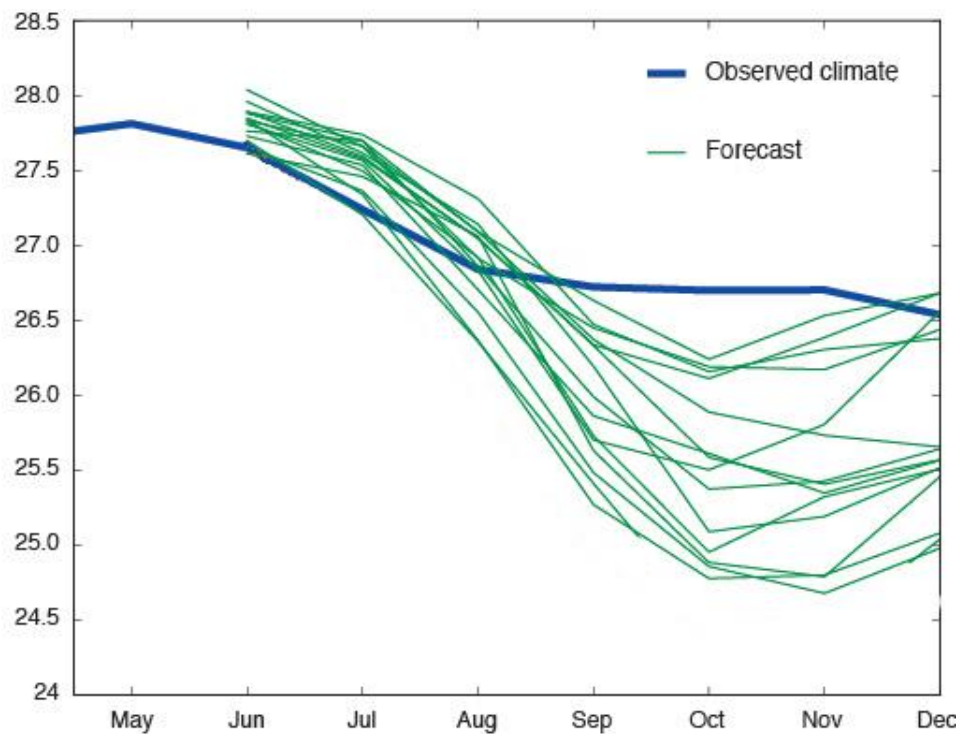


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# C3S Seasonal Forecasts



[www.menti.com 81 18 55](https://www.menti.com/811855)



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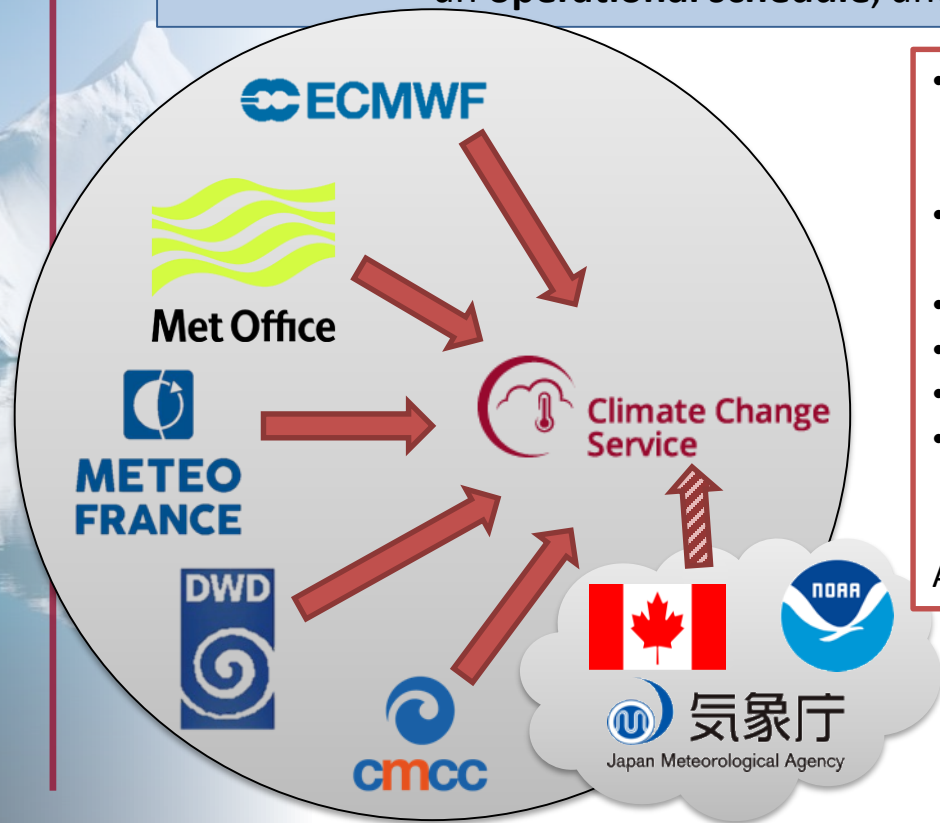
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# C3S Seasonal Forecasts - Introduction

Aim: to generate **seasonal forecast** products based on the **best information available**, to an **operational schedule**, and make them **publicly available**.



- Issued every month on the 13<sup>th</sup> (to be moved to the 10<sup>th</sup>)
- Large ensembles (members: ~50 forecast, ~25 hindcast)
- Common reference period (1993-2016)
- Common horizontal resolution (1-degree)
- ~30 single-level variables (every 6h or 24h)
- 5 variables in pressure levels (every 12h) (11 levels from 925hPa to 10hPa)

Agreed NetCDF specification C3S-0.1 (based on CF)



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# C3S Seasonal Forecasts – Forecast systems

Status on 📅 07 Nov 2018	Time range (forecasts and hindcasts)	Forecast initial conditions	Forecast ensemble size	Hindcast initial conditions	Hindcasts ensemble size	Hindcast period	Hindcast production schedule
<b>ECMWF</b> (ecmf)	215 days	1st of month	51 members	1st of month	25	1981-2016	fixed
<b>UKMO</b> (egrr)	215 days	each day of month	2 members/day	1st, 9th, 17th, 25th of month	7 members/start time	1993-2016	on-the-fly
<b>Météo-France</b> (lfpw)	215 days	20th, 25th of previous month 1st of month	25 members each 1 member	20th, 25th of previous month 1st of month	12 members each 1 member	1993-2016	fixed
<b>DWD</b> (edzw)	6 calendar months	1st of month	50 members	1st of month	30 members	1993-2017	fixed
<b>CMCC</b> (cmcc)	6 calendar months	1st of month	50 members	1st of month	40 members	1993-2016	fixed





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# C3S Seasonal Forecasts

- Live demonstration...

<https://climate.copernicus.eu>



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## C3S Seasonal Forecasts – Next steps

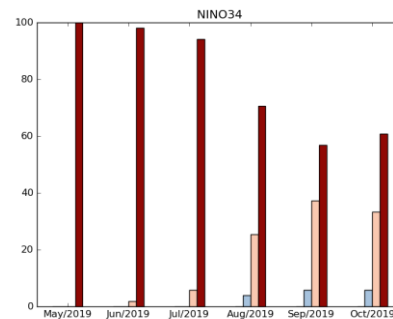
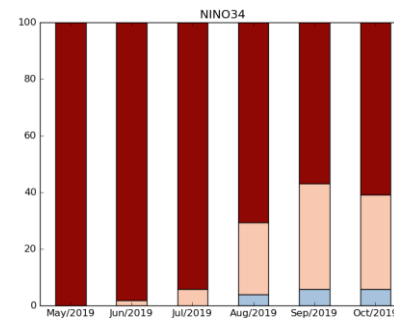
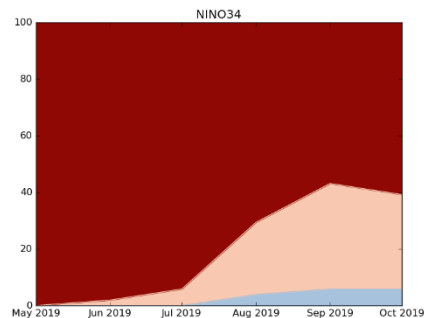
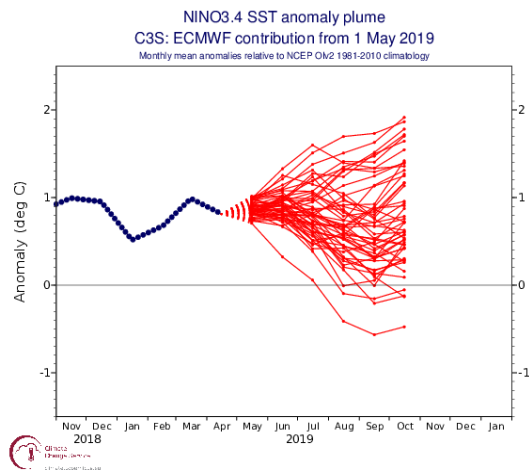
- Generate and display **verification scores for products** presented in the graphs (By Q2 2019)
  - Add monthly mean based products to the plots
- Add **new providers to the multi-system** (By Q3 2019)
  - NCEP, JMA, ECCC
- Produce example **workflows/applications** and develop **tools in the CDS Toolbox**
- Introduce **new products** in the C3S suite of outputs
  - probability forecasts for ENSO indices
  - indices of atmospheric circulation (NAO, SOI)
  - products based on within-season statistics (frequency/length of spells)
  - ...



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# C3S Seasonal Forecasts – Next steps

- Example of new products: El Niño probabilities



[www.menti.com 42 56 53](https://www.menti.com/425653)

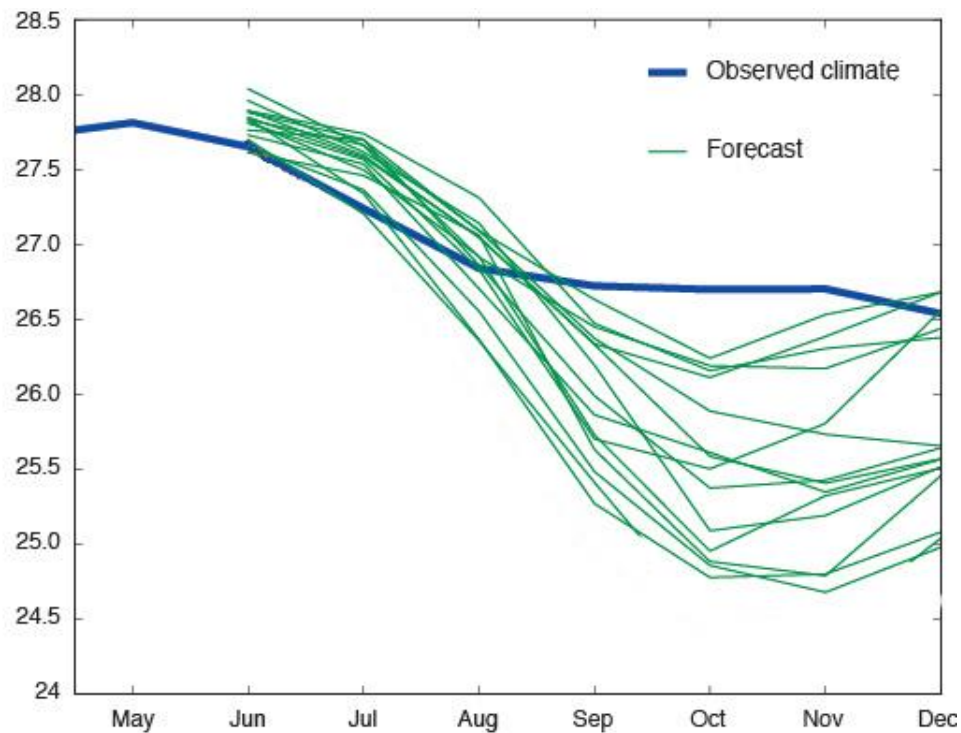


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# C3S Seasonal Forecasts



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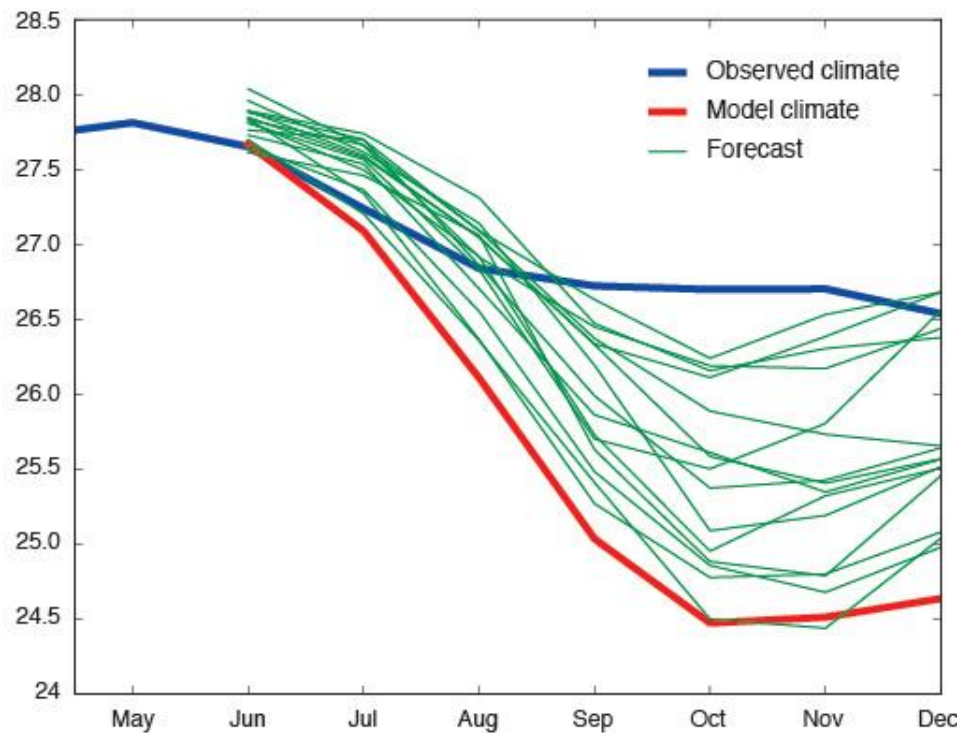


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Climate Change

# Seasonal forecasts from the Copernicus Climate Change Service

**Eduardo Penabad Ramos, Simona Briceag, Anca Brookshaw**





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## Bonus track



### Training

<https://climate.copernicus.eu/user-learning-services>



### User Support

<https://climate.copernicus.eu/help-support>



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# Thank you!

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**Using ECMWF's Forecasts (UEF2019)**  
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