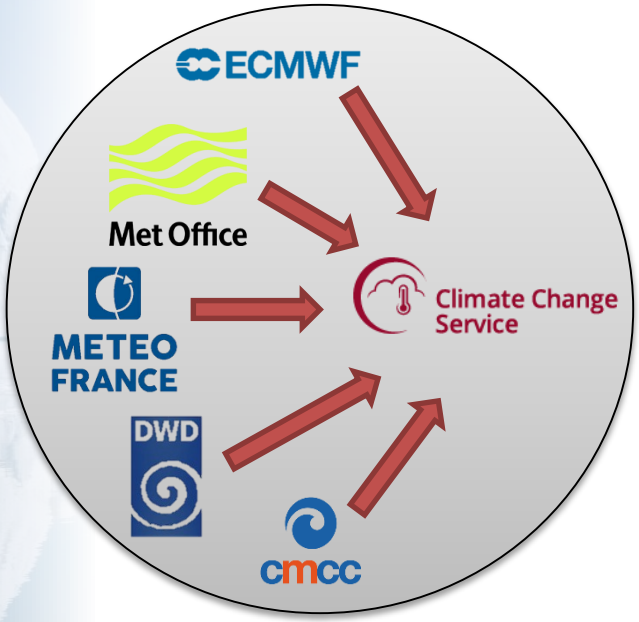
Climate Change

Seasonal prediction service from C3S

***Anca Brookshaw**, Eduardo Penabad Ramos and the C3S production team (ECMWF)*

multi-system setup



C3S seasonal forecast service

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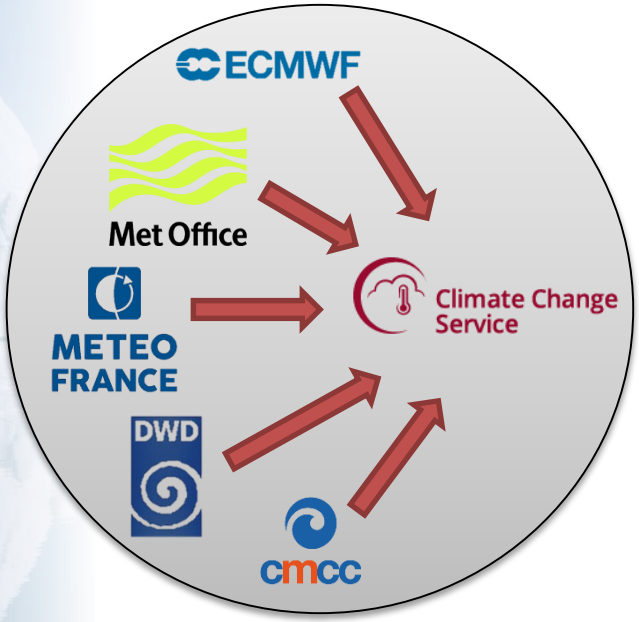

Protocol:

- time of submission of data; time of publication of forecasts (13th of each month)
- ensemble size (forecasts: ~50 members; hindcasts: ~25 members)
- reference period: 1993-2016 (24 years)

Data:
Variables

- Surface
  - 9 vars every 6h
  - +20 vars every 24h
- Pressure (11 levels, from 925 hPa to 10 hPa)
  - 5 vars every 12 h

Horizontal grid: global 1deg x 1deg

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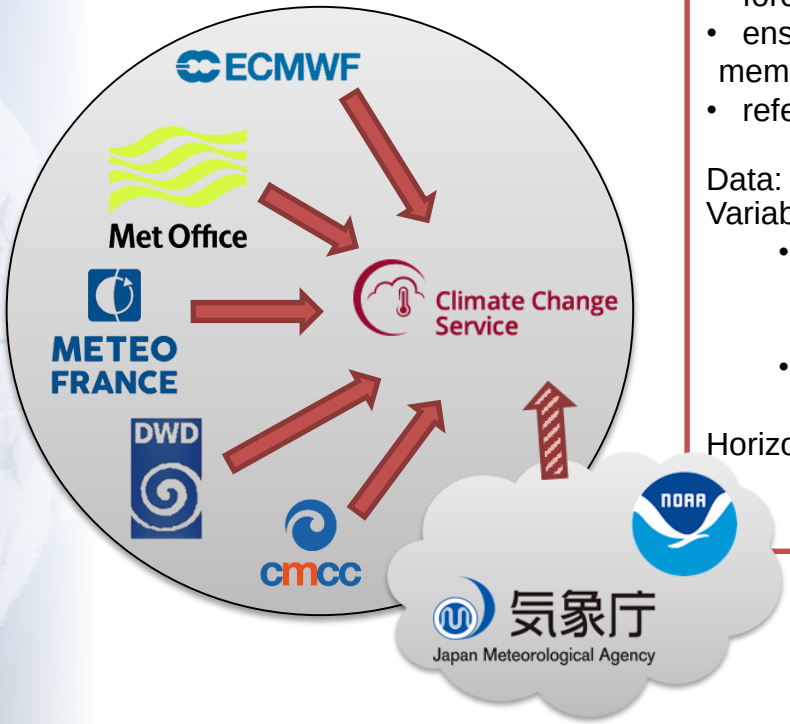

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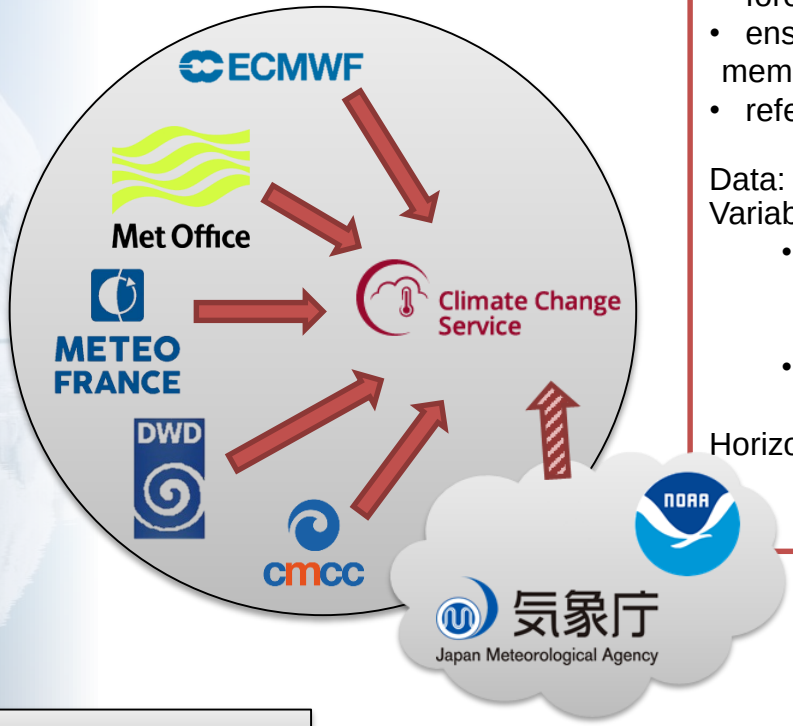

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Also likely: ECCC and BoM

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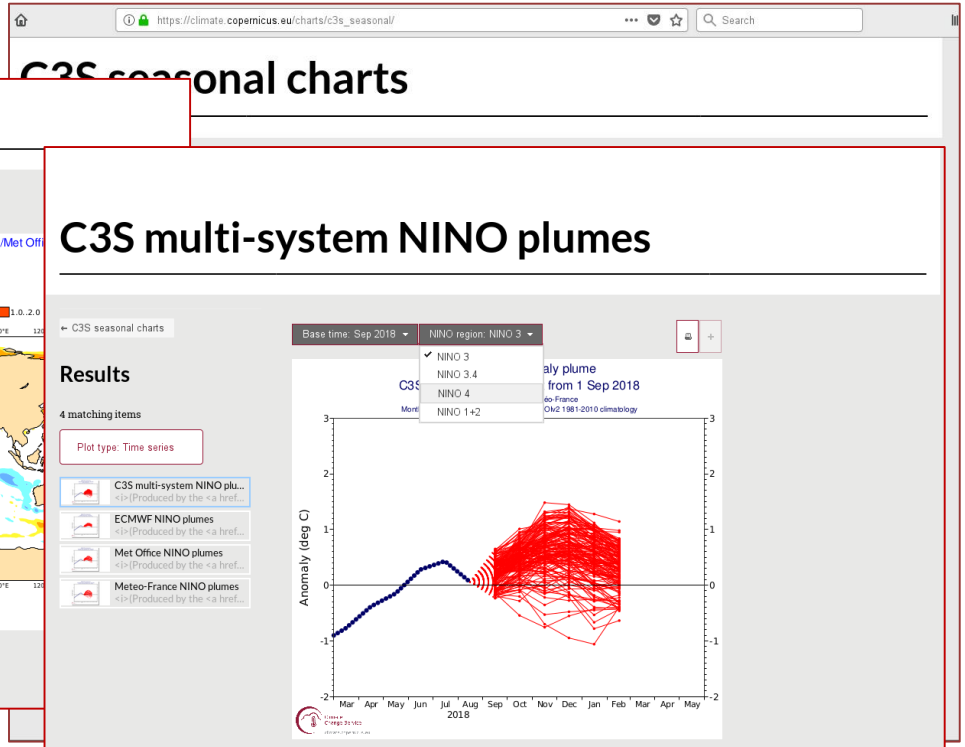
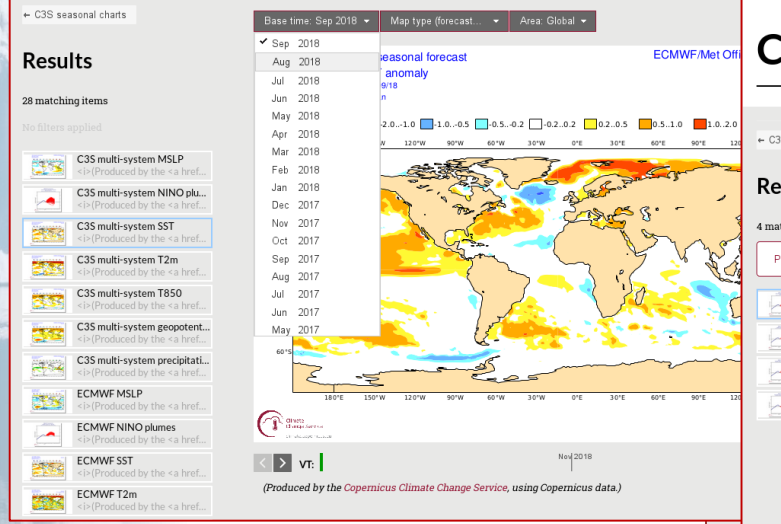
C3S seasonal forecasts – graphical products



C3S multi-system SST



C3S multi-system NINO plumes

https://climate.copernicus.eu/charts/c3s_seasonal/

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C3S seasonal forecasts – status of data service

- Original data (daily/sub-daily) from providers
- Monthly statistics (mean, max, min, stdev)
- Products based on monthly means (providers)
  - ensemble members and ensemble mean
  - anomalies: forecast – hindcast mean

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Real-time forecasts

Nominal start dates	ECMWF		Météo-France		Met Office		DWD	CMCC
	System 4	SEAS5	System 5	System 6	GloSea5 - GC2	GloSea5 - GC2 (C3S-0.1 netcdf)	GCFS2.0	SPSv3
September 2017 - October 2017	✓	✗	✓	✗	✓	✗	✗	✗
November 2017 - January 2018	✗	✓	✓	✗	✓	✗	✗	✗
February 2018 - October 2018	✗	✓	✓	✗	✗	✓	✗	✗
November 2018 - present	✗	✓	✗	✓	✗	✓	✓	✓

http://climate.copernicus.eu/seasonal-forecasts/

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C3S data service: the Climate Data Store

- Interface to data archives and download and analysis tools
- Does not require collocation of data; access is provided through ‘adaptors’ to existing repositories
- The Climate Data Store (CDS) and toolbox
  - launched in mid-June 2018, with seasonal forecasts available from first release.
  - access is via click-on forms or API
  - the current ‘source’ of C3S seasonal forecast data is the ECMWF MARS archive; this imposes some limitations on the options available to the data service (see later)
- Software (tools) and software development environment are provided in the CDS

https://cds.climate.copernicus.eu/#!/home

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C3S seasonal forecasts – CDS data service

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Home Search Datasets Toolbox Help & support

Seasonal forecast monthly statistics on pressure levels from 2017 to present

Overview | Download data | Documentation

Originating centre

At least one selection must be made

- [ ] ECMWF
- [ ] UK Met Office
- [ ] Météo France
- [ ] DWD
- [ ] CMCC

Select all

Variable

At least one selection must be made

- [ ] Geopotential
- [ ] Temperature
- [ ] V-component of wind
- [ ] Specific humidity
- [ ] U-component of wind

Select all

C3S seasonal forecasts – CDS data service

Home Search Datasets Toolbox Help & support

Search results

Search dataset

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)

All | Datasets

Showing 1-6 of 6 results for **Seasonal forecasts** x

Seasonal forecast monthly statistics on single 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 monthly statistics on pressure levels from 2017 to present

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Seasonal forecast anomalies on pressure levels from 2017 to present

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https://cds.climate.copernicus.eu/cdsapp#!/search?type=dataset

C3S seasonal forecasts – CDS data service

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Seasonal forecast monthly statistics on pressure levels from 2017 to present

Overview | Download data | Documentation

- Seasonal forecasts and the Copernicus Climate Change Service C3S
- Description of the C3S seasonal multi-system
- Summary of available data
- Detailed list of parameters
- Known issues

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https://cds.climate.copernicus.eu/cdsapp#!/dataset/seasonal-monthly-pressure-levels?tab=doc

CDS toolbox example

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Eduardo Penabad Ramos | Logout

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

Home | Search | Datasets | Applications | Your requests | Toolbox | Help & support

Toolbox editor

Applications | Data | Documentation

Search for app or example

your workspace

- NINOplumes
- Seasonal tercile summary
- test_multiple_vars
- UpwellingIndex
- 52 Format maps to allow visual comparison
- **example anomalies Gionatta**
- 01 Retrieve data ERA5 tests
- 01 Retrieve data CMIP5
- 01 Retrieve data water quality
- 00 Hello World
- 11 Mean and Standard Deviation
- seasonal retrieve mmsf based on 01
- test regrid
- 82 Seasonal Example
- 12 Climatology with edited linked dropdowns
- glaciers retrievedata
- seasonal plot based on 02
- seasonal retrieve based on 01

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

example anomalies Gionatta | Console | History

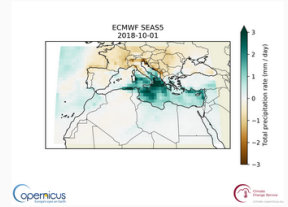
Run application (Shift+Enter)

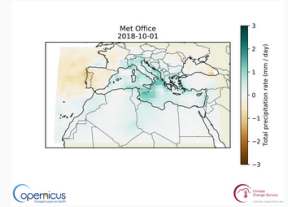
Layout | Copy | Save | Run

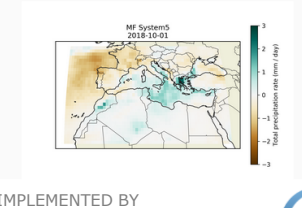
```
import cdstoolbox as ct
#from datetime import date
#from datetutil.relativedelta import relativedelta

#stdate=date(2018,10,1)
#print(stdate)
#leadmonths=[(stdate+relativedelta(months=mm)).strftime('%Y-%m-%d') for mm in range(6)]
leadmonths=['2018-10-01','2018-11-01','2018-12-01','2019-01-01','2019-02-01','2019-03-01']

@ct.application(title='Seasonal forecast anomalies')
#@ct.input.dropdown('fcmonth', label="Forecast month", values=['2018-10-01','2018-11-01','2018-12-01','2019-01-01','2019-02-01','2019-03-01'])
@ct.input.dropdown('stdate',label="Start date", values=['2018-10-01'])
@ct.output.carousel()
@ct.output.carousel()
@ct.output.carousel()
#@ct.output.download()
def application(stdate):

    print("stdate = %s" % stdate)


    d_centres={"ec": {"apiname":"ecmwf", "label":"ECMWF SEAS5"},
               "mf": {"apiname":"meteo_france", "label":"MF System5"},
               "mo": {"apiname":"ukmo", "label":"Met Office"}
              }
    data={}

    for cc in d_centres.keys():

        print('retrieving data for %s' % cc)

        datacc = ct.catalogue.retrieve(
        'seasonal-postprocessed-single-levels',
        {
            'format':'grib',
            'originating_centre': d_centres[cc]["apiname"],
            'variable':'total_precipitation_anomalous_rate_of_accumulation',
            'product_type':'monthly_mean',
            'year':'2018',
```

seasonal forecast anomalies

Start date: 2018-10-01







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https://cds.climate.copernicus.eu/cdsapp#!/dataset/seasonal-monthly-pressure-levels?tab=doc

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Seasonal forecast data in the CDS

Caveats

- The encoding of monthly means (derived from provider data) is incomplete.
- Metadata describing post-processing is not included in the data files (e.g. the anomaly files do not hold information about the baseline used as reference).
- The characterisation of data in the CDS/toolbox common data model has issues, which make it difficult (and possibly unsafe) to use toolbox with seasonal forecasts at present.
- For some providers, data from more than one system version is archived, but there is no option to select only one system before download; as a temporary solution, we recommend downloading in grib format, using off-line grib tools to select the desired system, then performing processing (including conversion to other formats)

Plans for progress on data service:

- fix problems which currently prevent use of seasonal forecasts in the toolbox;
- improve encoding of monthly-mean data from lagged-start ensemble to make it useable;
- develop toolbox applications to allow download of ‘meaningful’ subsets of data;
- define formatting standards to encode products.

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C3S seasonal forecasts – next steps

- Generate and display **verification scores for products** presented in the graphs
  - Add monthly-mean graphical products

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- Add **new providers to the multi-system**; regularly generate data and graphical products from all contributors
  - GPC Washington and GPC Tokyo – early 2019
  - also, possibly, GPC Montreal and GPC Melbourne later in 2019

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- 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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Thank you