

Accessing Climate Data and Tools for End Users

A Practical Overview for Users

Christian Pagé, CERFACS, Toulouse, France

IS-ENES3 virtual Autumn School on Climate data use
for impact assessments
4th Nov. - 11th Dec. 2020





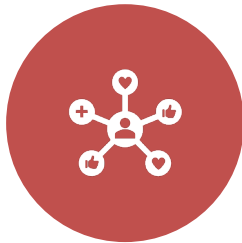
ESGF Infrastructure

ESGF represents a **multinational** effort to securely **access, monitor, catalog, transport, and distribute** reference **data** for **climate** research experiments and observations.





Introduction



The Earth System Grid Federation (ESGF) is a globally distributed e-infrastructure for the hosting and dissemination of climate-related data.



ESGF was originally developed to support CMIP5 (5th Coupled Model Intercomparison Project) ...



Provide a means for climate data users to access and analyse the data output



For 5th Assessment report made by the IPCC (Intergovernmental Panel on Climate Change).



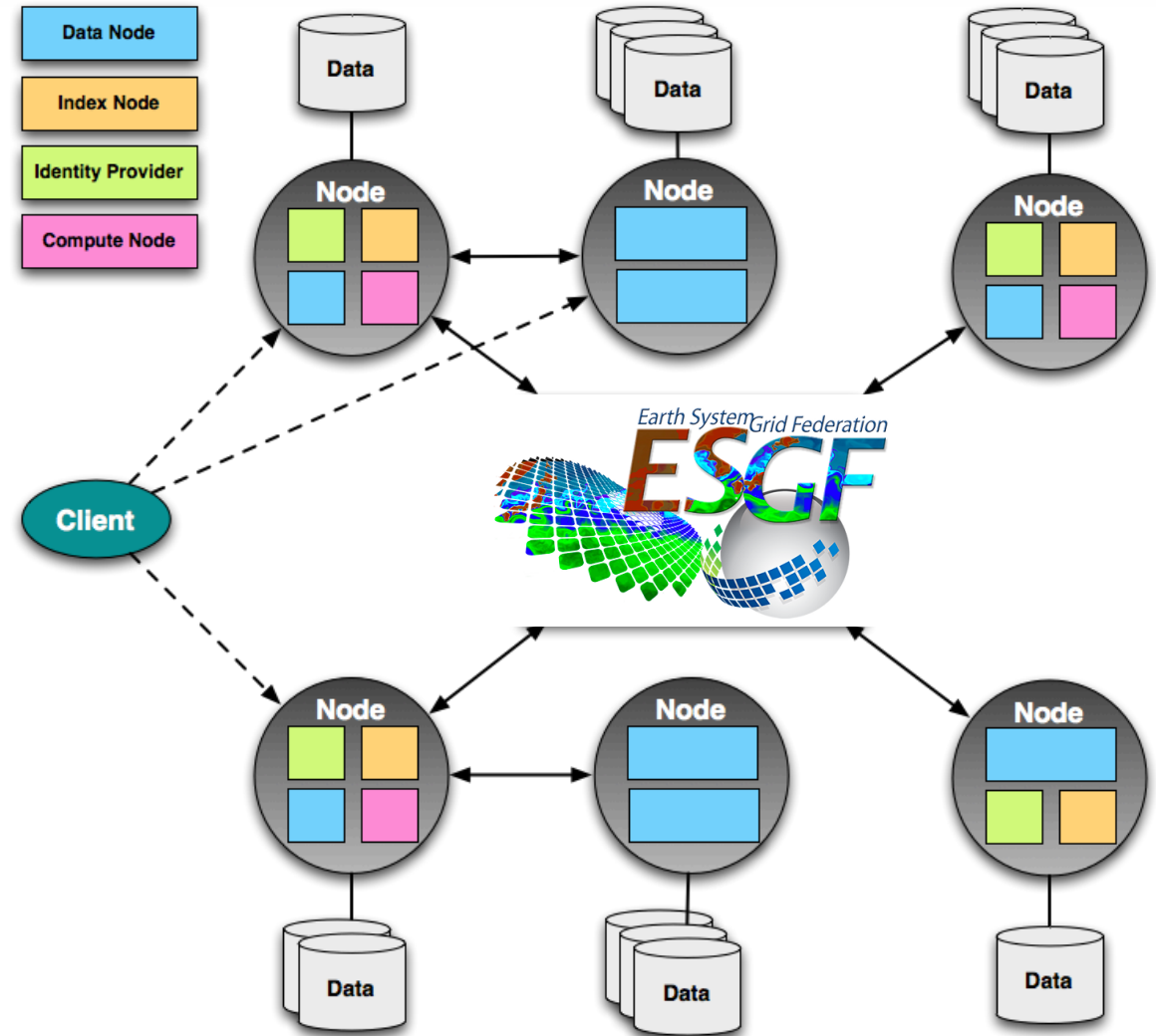
Ten years of Operations: History and Evolution

ESGF has grown to support over 25000 registered users

Besides the CMIPs, supports a range of other projects such as:

- Energy Exascale Earth System Model
- Obs4MIPS
- CORDEX
- European Space Agency's Climate Change Initiative Open Data Portal.

Important experience gathered over the years about community collaboration for a distributed infrastructure - operational procedures and governance





ESGF: Current Data Holdings

ESGF opened for CMIP6 data in June 2018

Data holdings:


~ 218 Experiments


~ 37 Institutions

~ 94 CMIP6 Models

~ 30 Data Nodes

~ 18 Petabytes Expected

Hosted by  Department of Energy
Lawrence Livermore National Laboratory

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WCRP CMIP6

World Climate Research Programme

You are at the [ESGF@DOE/LLNL node](#) [Technical Support](#)

[Home](#) [Contact Us](#) [Data Nodes Status](#)

MIP Era +

Activity +

Model Cohort +

Product +

Source ID +

Institution ID +

Source Type +

Nominal Resolution +

Experiment ID +

Sub-Experiment +

Variant Label +

Grid Label +

Table ID +

Frequency +

Realm +

Variable +

CF Standard Name +

Data Node +

WARNING: Not all models include a variant "r1i1p1f1", and across models, identical values of variant_label do not imply identical variants! To learn which forcing datasets were used in each variant, please check modeling group publications and documentation provided through ES-DOC.

CMIP6 project data downloads are unrestricted. Downloads should be performed with the -s option to a wget script without the need to login. When using this method for download, ensure you are not using additional options, eg. -s and -H should never be combined.

Enter Text: Display results per page [\[More Search Options \]](#)

Show All Replicas Show All Versions Search Local Node Only (Including All Replicas)

The search returned 0 results.

ESGF sponsors and partners
DoE Office of Science | IS-ENES | NASA | NOAA | NCI | NSF

CoG version v4.0.0b2
ESGF P2P Version v4.0.4

Earth System CoG sponsors and partners
NOAA | NASA | NSF | DoE Office of Science | IS-ENES

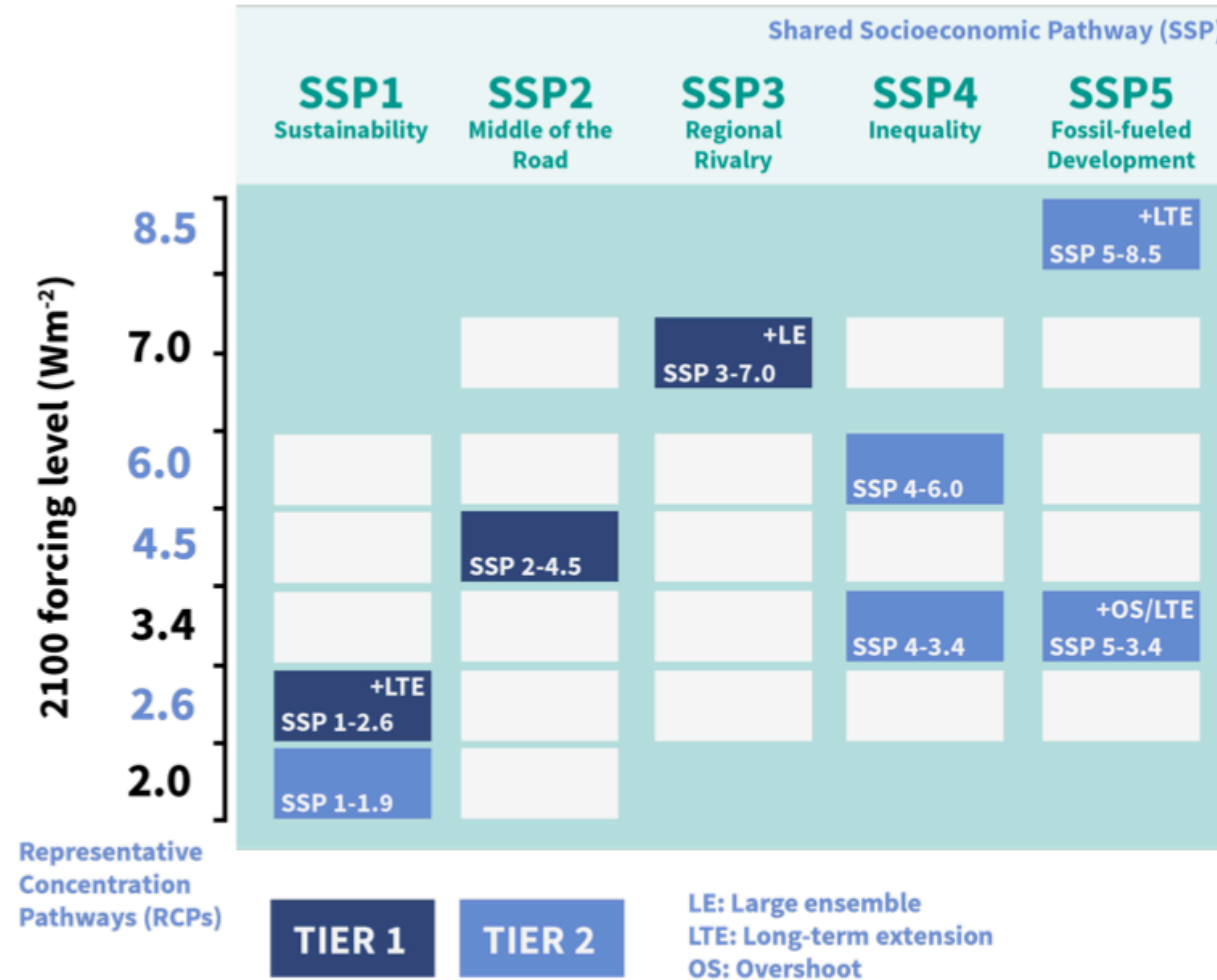
<http://esgf-node.llnl.gov> [Privacy & Legal Notice](#)



CMIP6 GES Scenarios

CMIP6

- Now we have SSPs instead of CMIP5 RCPs and CMIP3 SRES
- Here we have the correspondence between RCPs and SSPs



See: O'Neill et al., *The Scenario Model Intercomparison Project (ScenarioMIP) for CMIP6*, GMD, 2016

Accessing CMIP6 data using ESGF

CMIP6

- Accessing datasets using the ESGF Data Nodes

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WCRP CMIP6
World Climate Research Programme

Home Contact Us Data Nodes **Technical Support**

You are at the [ESGF@DOE/LLNL node](#)

MIP Era +
Activity +
Model Cohort +
Product +

Source ID +
Institution ID +
Source Type +
Nominal Resolution +

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Data Node +

WARNING: Not all models include a variant "r11ip1f1", and across models, identical values of variant_label do not imply identical variants! To learn which forcing datasets were used in each variant, please check modeling group publications and documentation provided through ES-DOC.

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Enter Text: Display 10 results per page [\[More Search Options \]](#)

Show All Replicas Show All Versions Search Local Node Only (Including All Replicas)

The search returned 0 results.

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DoE Office of Science | IS-ENES | NASA | NOAA | NCI | NSF

CoG version v4.0.0b2
ESGF P2P Version v4.0.4

Earth System CoG sponsors and partners
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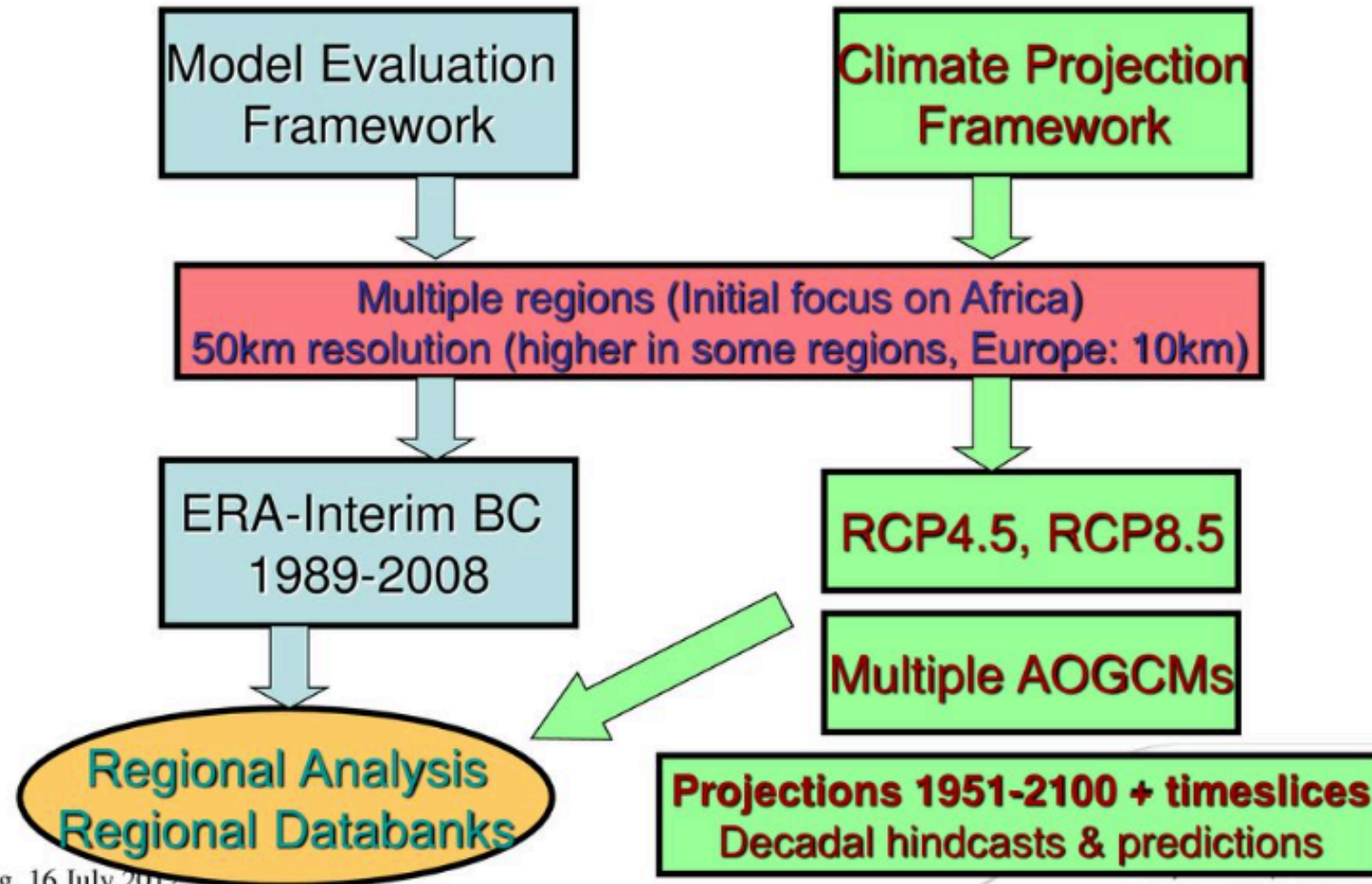
<https://esgf-node.llnl.gov/search/cmip6/>



CORDEX Experiments



**CORDEX datasets still
CMIP5-based only**



Beijing, 16 July 2012

CORDEX Data



**CORDEX datasets still
CMIP5-based only**

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<https://esgf-node.llnl.gov/projects/esgf-llnl/>

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[Home](#) [Contact Us](#) [Data Nodes Status](#)

[Technical Support](#)

ESGF@DOE/LLNL

Search & Download Data ?

 [More search options](#)

The [Earth System Grid Federation \(ESGF\)](#) is a collaboration that develops, deploys and maintains software infrastructure for the management, dissemination, and analysis of model output and observational data. ESGF's primary goal is to facilitate advancements in Earth System Science. It is an interagency and international effort led by the Department of Energy (DOE), and co-funded by National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), National Science Foundation (NSF), and international laboratories such as the Max Planck Institute for Meteorology (MPI-M) German Climate Computing Centre (DKRZ), the Australian National University (ANU) National Computational Infrastructure (NCI), Institut Pierre-Simon Laplace (IPSL), and the British Atmospheric Data Center (BADC). The ESGF mission is to:



- Support current CMIP activities, and prepare for future assessments
- Develop data and metadata facilities for inclusion of observations and reanalysis products for CMIP use
- Enhance and improve current climate research infrastructure capabilities through involvement of the software development community and through adherence to sound software principles
- Foster collaboration across agency and political boundaries
- Integrate and interoperate with other software designed to meet the objectives of ESGF: e.g., software developed by NASA, NOAA, ESIP, and the European [IS-ENES](#)
- Create software infrastructure and tools that facilitate scientific advancements

ESGF is a component architecture expressly designed to handle large-scale data management for worldwide distribution. The team of computer scientists and climate scientists has developed an operational system for serving climate data from multiple locations and sources. Model simulations, satellite observations, and reanalysis products are all being served from the ESGF P2P distributed data archive.

ESGF portals like this one provide access to the output of the climate models contributing to the next assessment report of the Intergovernmental Panel on Climate Change [IPCC](#) through the Coupled Model Intercomparison Project [CMIP](#). The [WGCM Infrastructure Panel](#) is the official CMIP document home.

Federated ESGF-CoG Nodes

CoG-CU
ESGF@CEDA
ESGF@DKRZ
ESGF@IPSL
ESGF@NASA/NCCS
ESGF@NCI
ESGF@NOAA/GFDL
ESGF@NSC/LIU
ESGF@PIK

Browse Projects

[This](#) [All](#) [My](#) [Tags](#)

Parent projects (0)

Peer projects (7)

ESGF-CEDA
ESGF-DKRZ
ESGF-GFDL
esgf-gsfc
ESGF-IPSL
ESGF-LIU
ESGF-PIK

Child projects (8)

CMIP3
CMIP5
cmip6
create-ip
E3SM
input4MIPs
obs4MIPs
esgf-p2p

Enter Tag

Start typing, or use the 'Delete' key to show all available tags.

ESGF-LLNL Tags: None

Search Data

The following projects are hosted on LLNL data or index nodes, and these are unrestricted. Downloads should be performed with the `-s` option to a `wget` script without the need to login. When using this method for download, ensure you are not using additional options eg. `-s` and `-H` should never be combined.



High CAUTION

Bias-adjusted RCM data

Note that even if bias adjustment (or bias correction) is widely used it is still a controversial approach with its own pros and cons. Bias-adjusted CORDEX simulations should be used carefully with full understanding of all potential limitations of the bias adjustment approach.

- Bias may not be removed completely
- When using only a bias-adjustment based on averages, **the extremes may still be over/underestimated**
- When an adjustment is performed per climate variable **this may reduce the consistencies between climate variables**
- The **bias may be different for different regions**, so adjustment should take this into account.
- The reference dataset determines strongly the bias and how it is adjusted. **If this reference dataset also contains biases, then the bias in the climate model runs can not be removed.**



IS-ENES climate4impact (C4I)

<https://climate4impact.eu> (also called C4I)

- Access all ESGF distributed datasets
 - CMIP5
 - CMIP6
 - CORDEX
 - CORDEX-Adjust
 - ...
- Exhaustive Documentation/Guidance
 - Climate System
 - Climate Numerical Modelling
 - Downscaling techniques
 - Case studies
- On-demand Processing Capabilities

The screenshot shows the homepage of the IS-ENES Climate4Impact portal. At the top left is the IS-ENES logo with the tagline 'Exploring climate model data'. To the right are links for 'IS-ENES', 'Contact', and 'Sign in'. Below the header is a navigation menu with 'Home', 'Data discovery', 'Downscaling', 'Documentation', 'Help', 'About us', and 'Sign in'. A search bar is located to the right of the navigation menu. The main content area is titled 'Welcome to IS-ENES Climate4Impact' and contains a paragraph explaining the portal's purpose. Below the text are three lines of instructions with links: 'Visualize and download data from global climate models (GCM), regional climate models (RCM) and downscaled high resolution climate data using Data discovery. Need some help with this tool?', 'Tools like indices calculations, downscaling, subsetting and regridding are available for tailoring data to your needs: goto Process data.', and 'Want to know more on how to use climate scenarios, how the climate models model the complex climate system, and see example use cases in several impact and adaptation themes? Go to guidance on using climate data.' A fourth line says 'New here? Create an account and sign in.' Below the text is a grid of eight images representing different climate change impact and adaptation themes: Agriculture/Forestry, Energy, Health, Infrastructure/Urban, Marine/Coastal, Nature/Biodiversity, Tourism, and Water Management. At the bottom of the grid is the text 'Click on one of these images to go to a specific climate change impact and adaptation theme.'



IS-ENES climate4impact: Search Interface

<https://climate4impact.eu>

- Search Interface with facets with Quick Selects
- Explore and use your own datasets
- On-demand Map & Plots
- On-demand Processing

A completely updated C4I portal is being developed and more will be explained next week!

is-enes
INFRASTRUCTURE FOR THE EUROPEAN NETWORK
FOR EARTH SYSTEM MODELLING

Exploring climate model data

Home Data discovery Downscaling Documentation Help About us Sign in

Search Catalogs Explore your own catalogs or files Map & Plot Processing

Filters ? Help

Project (47) Parameter (6374) Frequency (27) Frequency (17) Experiment (240) Domain (46) Model (159)

Source_id (327) Access (8) Date Geobox Free text > show all filters clear all filters

Quick select Project All Project properties (47)

CMIP

- GCM data CMIP6 project
- GCM data CMIP5 project
- GCM data NEXGDDP project

CORDEX

- RCM data CORDEX
- RCM data CORDEX-Adjust

OBSERVATIONS

- satellite data obs4MIPs
- station data CLIPC project

Selected filters
none

Found 8926200 datasets. Displaying page 1 of 357049.

« Previous 1 2 3 4 5 6 7 8 9 10 11 ... 357049 Next » Export to CSV

- ▶ CMIP6.CMIP.CSIRO.ACCESS-ESM1-5.esm-hist.r8i1p1f1.Emon.fracLut.gn.v20200730
- ▶ CMIP6.DCPP.CCCma.CanESM5.dcppA-hindcast.s1979-r4i1p2f1.Slday.sitimefrac.gn.v20190429
- ▶ CMIP6.AerChemMIP.NERC.UKESM1-0-LL.hist-1950HC.r2i1p1f2.Amon.cl.gn.v20201103
- ▶ CMIP6.DCPP.CCCma.CanESM5.dcppA-hindcast.s1975-r3i1p2f1.Slday.sitimefrac.gn.v20190429

Copernicus Climate Data Store

Copernicus CDS

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

- Operational Service
- Toolbox, API and Applications
- Climate-Service like approach
- CMIP5, CORDEX, EOBS, ... most used datasets are available (not all experiments)
- CMIP6 datasets not yet available
- Not all experiments/models are available, a selection is made
- There is a quality assurance
- Support is available

The screenshot shows the Copernicus Climate Data Store homepage. At the top, there are logos for the European Commission, Copernicus (Europe's eyes on Earth), ECMWF (Implemented by), and Climate Change Service. On the right, there is a user profile for Christian Pagé with a Logout button and a message: "Your feedback helps us to improve the service". Below the logos is a navigation menu with links: Home, Search, Datasets, Applications, Your requests, Toolbox, FAQ, and Live. The main content area features a large grey box with the heading "Welcome to the Climate Data Store" and the sub-heading "Dive into this wealth of information about the Earth's past, present and future climate." Below this, it states: "It is freely available and functions as a one-stop shop to explore climate data. Register for free to obtain access to the CDS and its Toolbox." Further down, it says: "We are constantly improving the services and adding new datasets. For more information, please consult the catalogue, our FAQ or the C3S forum." Below the text is a search bar with the placeholder "Enter search term(s)", a dropdown menu set to "All", and a "Search" button. At the bottom, there are three featured tiles: "Climate Data Store Toolbox" with a line graph showing data trends, "Climate Data Store API" with a code editor showing JSON and JavaScript code, and "Access the C3S Forum" with a blue abstract graphic.



Copernicus Climate Data Store: Download data

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

- Example for CMIP5 data selection
- Tutorials are available in the User Learning Service

The screenshot shows the Copernicus Climate Data Store interface. At the top, there are logos for the European Commission, Copernicus, ECMWF, and the Climate Change Service. A navigation bar includes links for Home, Search, Datasets, Applications, Your requests, Toolbox, FAQ, and Live. The user is identified as Christian Pagé with a Logout button. A feedback message states: "Your feedback helps us to improve the service".

The main content area is titled "CMIP5 monthly data on single levels". Below this title are four tabs: Overview, Download data (selected), Quality assessment, and Documentation. The "Download data" tab is active, showing a "Clear all" button in the top right corner.

The "Experiment" section has a title "Experiment ?" and a row of radio buttons for selecting an experiment: AMIP, Historical, RCP 2.6, RCP 4.5 (selected), RCP 6.0, and RCP 8.5. A "Clear all" button is located at the bottom right of this section.

The "Variable" section has a title "Variable ?" and a list of variables with checkboxes. The selected variable is "2m temperature".

Variable	Selected
<input type="checkbox"/> 10m wind speed	No
<input type="checkbox"/> 10m v-component of wind	No
<input type="checkbox"/> Eastward turbulent surface stress	No
<input type="checkbox"/> Maximum 2m temperature in the last 24 hours	No
<input type="checkbox"/> Mean sea level pressure	No
<input type="checkbox"/> Near-surface relative humidity	No
<input type="checkbox"/> Northward turbulent surface stress	No
<input type="checkbox"/> Sea ice fraction	No
<input type="checkbox"/> Sea ice thickness	No
<input type="checkbox"/> Sea surface temperature	No
<input type="checkbox"/> Sea surface height above geoid	No
<input type="checkbox"/> Snow depth over sea ice	No
<input type="checkbox"/> 10m u-component of wind	No
<input checked="" type="checkbox"/> 2m temperature	Yes
<input type="checkbox"/> Evaporation	No
<input type="checkbox"/> Mean precipitation flux	No
<input type="checkbox"/> Minimum 2m temperature in the last 24 hours	No
<input type="checkbox"/> Near-surface specific humidity	No
<input type="checkbox"/> Runoff	No
<input type="checkbox"/> Sea ice plus snow amount	No
<input type="checkbox"/> Sea surface salinity	No
<input type="checkbox"/> Sea ice surface temperature	No
<input type="checkbox"/> Skin temperature	No
<input type="checkbox"/> Snowfall	No

On the right side of the page, there is a sidebar with the following sections:

- Contact**: copernicus-support@ecmwf.int
- Licence**: [CMIP5 - Data Access - Terms of Use](#)
- Publication date**: 2018-06-14
- Related data**:
 - [CMIP5 daily data on pressure levels](#)
 - [CMIP5 daily data on single levels](#)
 - [CMIP5 monthly data on pressure levels](#)



Copernicus Climate Data Store: Toolbox

Copernicus CDS

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

- Toolbox using python code
- Processing done remotely
- Applications Community Sharing
- Can do the same using API for programming applications

Home Search Datasets Applications Your requests Toolbox FAQ Live

Toolbox Editor

Applications Data Documentation

Search for app or example

gallery

- 18_dynamic_map_slider
- 68_magics_shade_and_contour
- 67_magics_disjoint_legend
- 15_dynamic_map_child_app_point
- 54_box_plots
- 17_dynamic_map_mask_child
- 53_climate_stripes
- 52_wind_rose
- 51_heatmap_by_city
- 50_heatmap_world_map
- 3_extract_time_series_and_plot_graph
- 66_magics_contour_palette
- 65_magics_contour_gradient
- 64_magics_contour_list
- 63_magics_contour_interval
- 62_magics_contour_name
- 60_magics_default
- 61_magics_title
- 0_entry_point_plot
- 0_entry_point_download
- 14_dynamic_map_shapes
- 16_dynamic_map_point_time_series
- 13_dynamic_map
- 10_anomaly_plot**
- 42_use_cdo_functions
- 41_calculate_gdd
- 31_calculate_trend

```
1 import calendar
2 import cdstoolbox as ct
3
4 # Define the list of years to retrieve
5 ERAS_YEARS = [str(year) for year in range(1979, 2020 + 1)]
6
7 # Define the list of months to be retrieved
8 MONTH_IDS = ['%02d' % i for i in range(1, 12 + 1)]
9
10 # Define the list of abbreviations to be used in the dropdown
11 MONTH_ABBREVIATIONS = list(calendar.month_abbr)[1:]
12
13 # Dictionnary defining the selectable countries
14 COUNTRY_ID = {
15     'France': 'FR',
16     'Germany': 'DE',
17     'Italy': 'IT',
18     'Spain': 'ES'
19 }
20
21 # Dictionnary defining the selectable countries
22 YEARMONTHS = [f'{mon} 2020' for mon in MONTH_ABBREVIATIONS[1::-1]] + [
23     f'{mon} {year}' for year in range(2019, 2016, -1) for mon in
24     MONTH_ABBREVIATIONS[1::-1]
25 ]
26
27 # Defining custom colors for the plot
28 DARK_GRAY = 'rgb(72, 72, 72)'
29 GRAY = 'rgb(122, 122, 122)'
30 LIGHT_GRAY = 'rgb(182, 182, 182)'
31 LIGHTER_GRAY = 'rgb(236, 236, 236)'
32
33 # Defining tick values and ticktext for the plot's vertical axis
34 TICKVALS = [n / 2 for n in range(-8, 9)]
35 TICKTEXT = ['% 3d°C ' % v if int(v) == v else '%4.1f°C ' % v for v in
36     TICKVALS]
```

Surface air temperature anomalies relative to 1981-2010

Country: France

Bulletin for: Feb 2020

Monthly anomalies - France

12-month anomalies - France


France surface air temperature anomalies relative to the 1981-2010 average, from Jan 1979 to Feb 2020. The first graph shows the



WorldClim: basic methodology

WorldClim

<https://www.worldclim.org>

- Fine resolution observation and future projections
- Very basic scientific downscaling methodology
 - No corrections for inhomogeneities
 - Interpolation using elevation and distance
- Difficult to assess pros and cons of datasets
- Very sparse documentation and information on the methods used
- Be very cautious  know what you are using.... because data may not be appropriate and usable for your application



Home

Historical climate data

This is WorldClim version 2.1 climate data for 1970-2000. This version was released in January 2020.

There are monthly climate data for minimum, mean, and maximum temperature, precipitation, solar radiation, wind speed, water vapor pressure, and for total precipitation. There are also 19 "bioclimatic" variables.

The data is available at the four spatial resolutions, between 30 seconds (~1 km²) to 10 minutes (~340 km²). Each download is a "zip" file containing 12 GeoTiff (.tif) files, one for each month of the year (January is 1; December is 12).

variable	10 minutes	5 minutes	2.5 minutes	30 seconds
minimum temperature (°C)	tmin 10m	tmin 5m	tmin 2.5m	tmin 30s
maximum temperature (°C)	tmax 10m	tmax 5m	tmax 2.5m	tmax 30s
average temperature (°C)	tavg 10m	tavg 5m	tavg 2.5m	tavg 30s
precipitation (mm)	prec 10m	prec 5m	prec 2.5m	prec 30s
solar radiation (kJ m ⁻² day ⁻¹)	srad 10m	srad 5m	srad 2.5m	srad 30s
wind speed (m s ⁻¹)	wind 10m	wind 5m	wind 2.5m	wind 30s
water vapor pressure (kPa)	vapr 10m	vapr 5m	vapr 2.5m	vapr 30s

[Historical climate data](#)
[Historical monthly weather data](#)
[Future climate data](#)

Below you can download the standard (19) WorldClim [Bioclimatic variables](#) for WorldClim version 2. They are the average for the years 1970-2000. Each download is a "zip" file containing 19 GeoTiff (.tif) files, one for each month of the [variables](#).

Climate ADAPT: Resources on how to do adaptation plans

Climate ADAPT (EEA)

<https://climate-adapt.eea.europa.eu>

- Large documentation and guidance
- Explore other adaptation studies
- Guidance on how to develop adaptation strategies
- Not a data portal but give links to external resources

Climate ADAPT SHARING ADAPTATION INFORMATION ACROSS EUROPE

Search all site ... | Help | My Climate-ADAPT

ABOUT - EU POLICY - COUNTRIES, TRANSNATIONAL REGIONS, CITIES - KNOWLEDGE - NETWORKS

Monitoring and evaluation of national adaptation policies throughout the policy cycle

This report provides an overview of country developments in terms of strategies and plans for climate change adaptation (CCA) and their implementation in a context of global and European policy frameworks. The report brings together lessons learned — at the national level — on adaptation monitorin...

[» READ MORE](#)

Image credit: Amador Loureiro on Unsplash, 2014.

Getting Started | Search the Database | EU Sector Policies | Country Profiles | Case Studies | Adaptation Support Tool

Are you new to Climate-ADAPT?

I want to develop a **LOCAL** adaptation strategy or action plan, test message.

I want to develop a **NATIONAL** or **REGIONAL** adaptation strategy or action plan.

I want to develop a **TRANSNATIONAL** adaptation strategy or action plan.



ISIMIP: Impact Model Intercomparison

ISIMIP
<https://www.isimip.org>

- Inter-Sectoral Impact Model Intercomparison Project
- Large number of impact modelling datasets
- Guidance on how to run impact models
- Access to outputs of the impact models through the ESGF data nodes



[ABOUT](#) ▾

[GETTING STARTED](#) ▾

[PROTOCOL](#) ▾

[IMPACT MODELS](#) ▾

[OUTCOMES](#) ▾

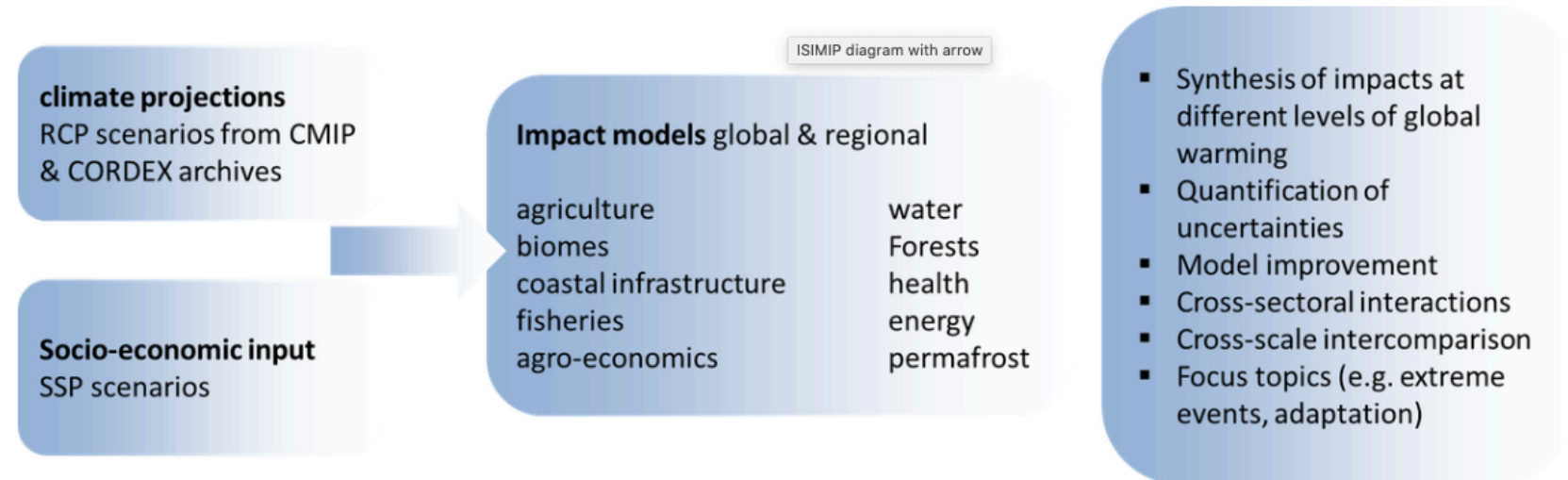
Search



Homepage > About ISIMIP

About ISIMIP

- [Simulation rounds](#)
- [Sectors and Contacts](#)
- [Sector-specific information](#)
- [Mission](#)
- [Organisational structure](#)





ISIMIP: Impact Model Intercomparison

ISIMIP

<https://www.isimip.org>

- Inter-Sectoral Impact Model Intercomparison Project



GETTING STARTED



Contact information, information for impacts modellers, including simulation protocol, input data, and ISIMIP newsletter.

IMPACT MODELS



Searchable and downloadable database of all climate-impact models participating in ISIMIP, with technical summaries, key characteristics and contact person.

OUTPUT DATA



See which climate-impact data have been generated within ISIMIP on a sector-by-sector basis, including a log of changes to uploaded data.

OUTCOMES



Papers, reports and other products based on ISIMIP climate-impacts simulations. Links to past ISIMIP workshops and events.



ENES Climate Analytics Service (ECAS)

<https://portal.enes.org/data/data-metadata-service/processing/ecas>

IS-ENES ECAS

- Remote Calculations
- Two endpoints: CMCC (Italy) and DKRZ (Germany)
- Significant computing resources
- Free registration
- Example workflows, python-based using Jupyter notebooks
- Training material available

ENES Climate Analytics Service (ECAS)

last modified May 02, 2019 09:29 AM

The ENES Climate Analytics Service (ECAS) allows end-users to perform server-side processing on climate data



The ENES Climate Analytics Service (ECAS) is a server-side processing service offered to ENES users with current cluster installations at CMCC and DKRZ. ECAS offers a virtual work environment based on Jupyter notebooks, allowing you to process and analyse data (including CMIP5 and CMIP6 data) using Python. Support for fast computations is provided via the Ophidia data analytics framework. The service is free for use by ENES users at the current installations at DKRZ and CMCC.

ECAS is integrated with other e-infrastructure services as part of the [European Open Science Cloud](#) in the frame of the EOSC-hub project.

CMCC service information

- The CMCC ECAS instance: <https://ophidialab.cmcc.it>
- Usage requires free registration. [Please follow the instructions](#) on the website.
- The CMCC instance offers access to multiple computing environments, including a "fat node" cluster.

DKRZ service information

- The DKRZ ECAS instance: <https://ecaslabs.dkrz.de>
- Usage requires free registration. [Please follow the instructions](#) on the website.
- The DKRZ instance offers direct access to the CMIP5 and CMIP6 data pools. During the CMIP6 operational phase, the CMIP6 data pool is continually updated with newly available data.

Example workflows available

Example experiments and Jupyter notebooks are available at the DKRZ and CMCC instances and [on GitHub](#). There is also [training material](#) available on GitHub.

Concerning use of the computing framework, the [documentation on the Ophidia framework websites](#) contains starter tutorials, descriptions of all processing operators and example workflows.



Some other portals

Portals with Data and Tools

- ◆ Climate Explorer: <https://climexp.knmi.nl/start.cgi> (new version under flag of WMO)
- ◆ ECA&D and ICA&D (European/international Climate Assessment Database): <https://www.ecad.eu/>, <https://www.ecad.eu/icad.php> (E-OBS through C3S CDS)
- ◆ Climate Data Guide: <https://climatedataguide.ucar.edu/>

Portal with Tools

- ◆ Climate Data Tool: <https://iri.columbia.edu/our-expertise/climate/tools/cdt/>

Impact Data

- ◆ Impact2C: <https://www.atlas.impact2c.eu/en/>

National Portals

- ◆ Example for France, the DRIAS portal: <http://www.drias-climat.fr>



Some thoughts

- A large variety of portals is available
 - Non-homogeneity in available datasets
 - Very different capabilities and interfaces
- May be difficult to know which one is suitable for specific needs and knowledge
- Guidance is usually not always sufficient
- Support may not be available
- Applicability and cautions about datasets and their possible use may not always be obvious
- On-demand remote calculations and subsetting is not always possible
- Downloading results in digital format is not always possible
- Also be attentive to FAIRness compliance, especially reproducibility and lineage

- For national, regional and local studies, always seek first for National portals, but be careful about uncertainties aspects
- The Climate Adapt portal is a good resource for guidance on how to perform an impact study properly



Some more thoughts ...

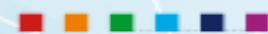
- There has never been so many accessible climate datasets!
- On-demand remote calculations is rapidly developing
- There is an increasing number of higher spatial and time resolution datasets
 - This is also true for gridded observation and reanalysis datasets
- Uncertainties can be better estimated thanks to the higher number of ensembles of simulations
- European-based portals integrating several infrastructures are being developed and launched
- Cloud-based solutions are emerging



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