Climate Change

C3S Energy Stakeholder Workshop

Consultation on data and indicators

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Copernicus Climate Change Service: data and tools for the energy sector

Chiara Cagnazzo, European Center for Medium Range Weather Forecast
Copernicus Climate Change

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C3S: An **operational** climate service embedded in the **Copernicus Earth** observation program

Implemented by ECMWF together with **over 300 public and private entities** from more than 40 countries in Europe and elsewhere

C3S provides **reliable, open, and free access** to state of the art data available on the past, present, and potential evolution of climate

Quality-assured data, tools, and applications to combine and transform those data into **useful information** products

10.1175/BAMS-D-21-0315.1

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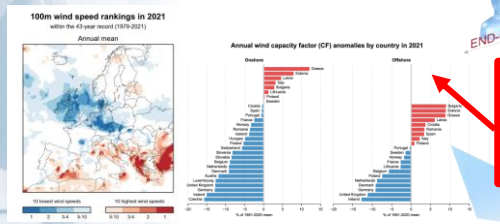
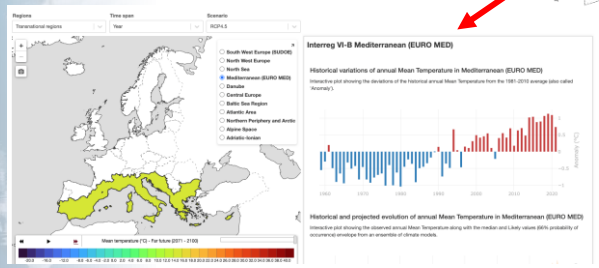
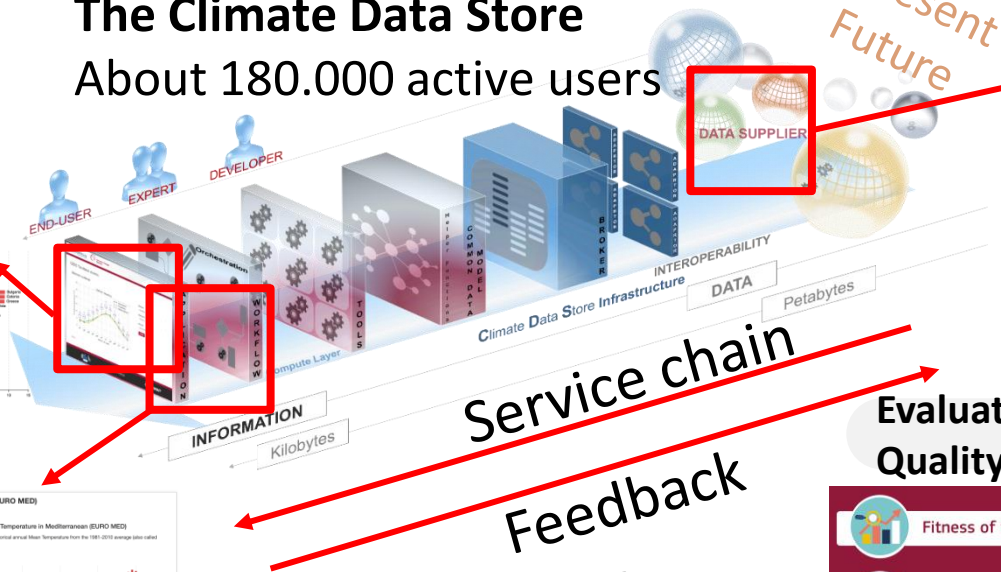
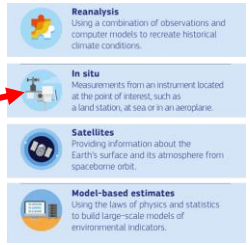
The Climate Data Store

About 180.000 active users

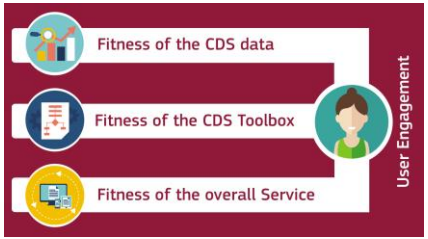








Evaluation & Quality Control



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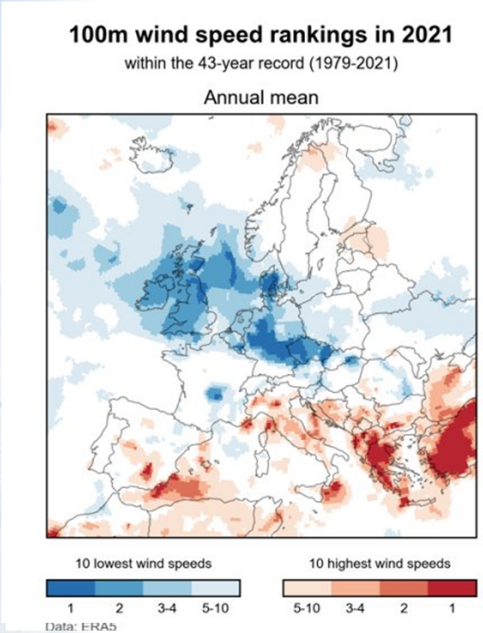
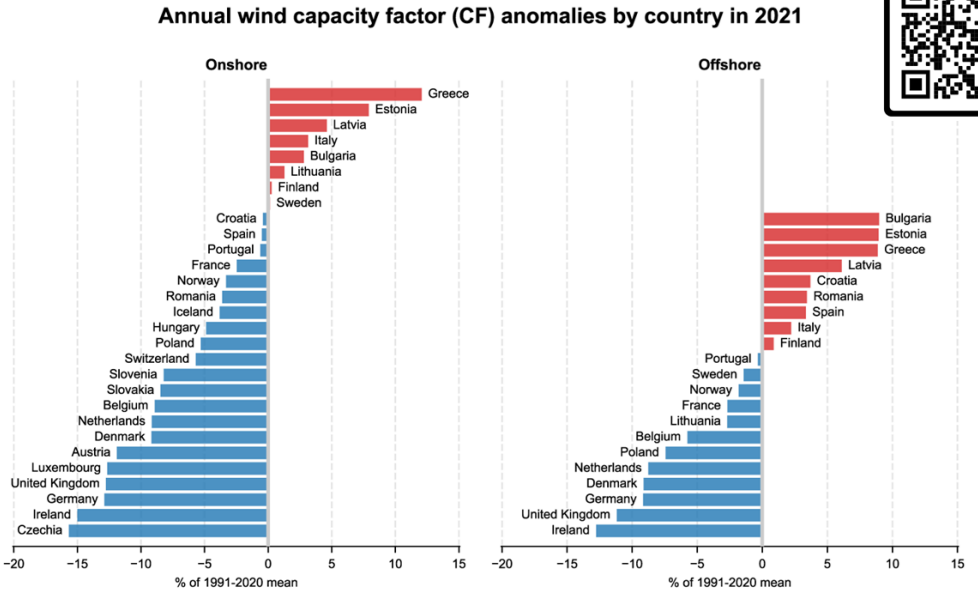
Climate Monitoring from ESOTC 2021 – Low wind



Wind speed and wind capacity factor derived from ERA5



European State of the Climate 2021, Copernicus Climate Change Service, Full report: climate.copernicus.eu/ESOTC/2021

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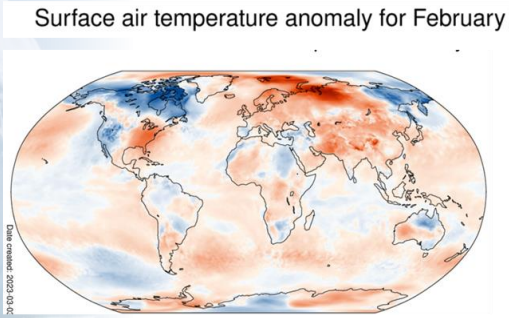
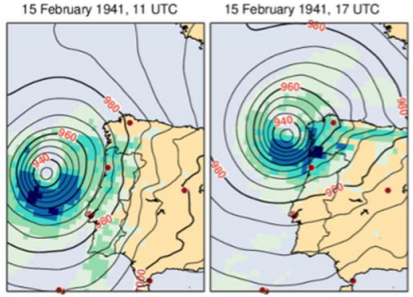
ERA5: A full-observing-system global reanalysis for the atmosphere, land and ocean waves





- Most popular dataset in the CDS (> 100.000 Users)
- No gaps in space/time
- Available from **1940 onwards**
- Daily updates 5 days behind real time

https://doi.org/10.1002/qj.3803

What is reanalysis used for ?

To obtain an accurate three-dimensional synoptic-scale situation (i.e. the “weather of the day”)
To compare the current situation with a consistent 30-year climate of the past
To estimate the variability of the mean state and obtain statistics for the climate-related extremes
To provide initialization, boundary conditions and drive impact models

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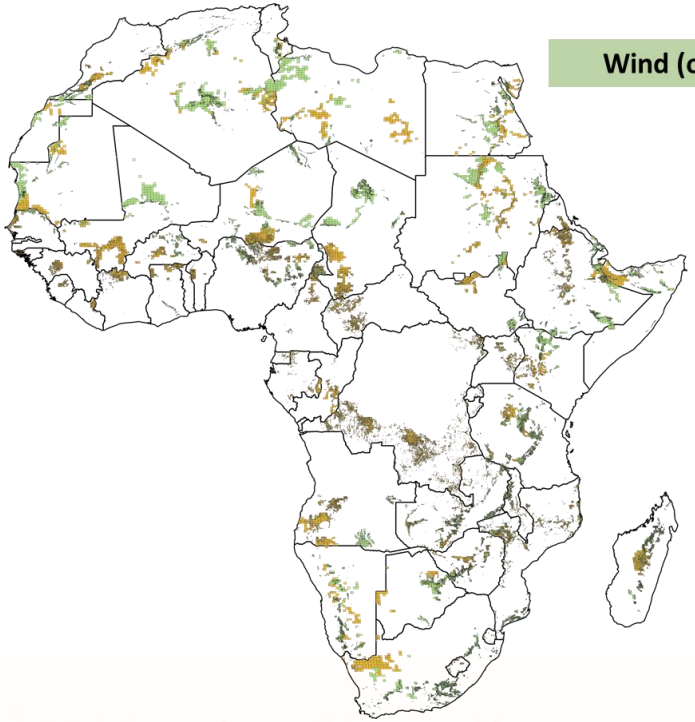
African Renewable Electricity Profiles open-access databases: solar and wind

IRENA
International Renewable Energy Agency

Solar PV

Wind (onshore)



Wind speed & solar radiation from reanalysis are used for **planning sites that are the best suited for investment** in new power plants in Africa

Map of locations of sites estimated to be the **most attractive for investment** in new solar and wind power plant

It makes use of:

- Wind and solar daily to seasonal variability
- The distance from the existing grid and road infrastructures
- Other: population density, elevation of the sites, slopes, land use, protected areas…

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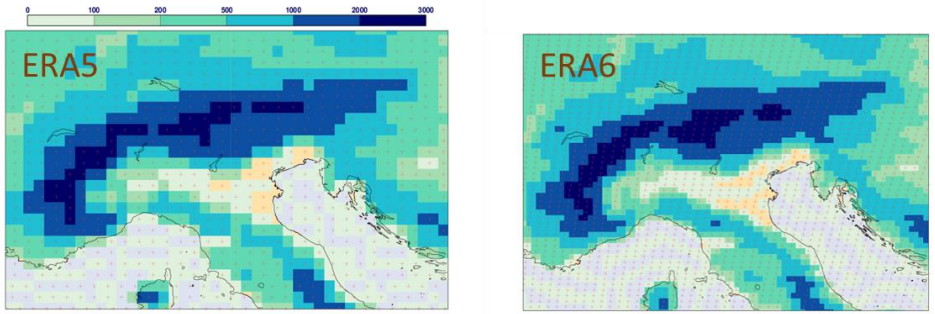
Energy Sector: users' needs & next reanalysis

What do you see are the most significant advances for the field of reanalysis in the next 5-10 years?

- Higher resolution reanalysis → More realism
- Reduce the bias → Handling of systematic errors
- Outputs tailored at energy modeling community→ New products
- Longer timeseries - back in time→ However, biases a problem

EVOLUTION TOWARD ERA6

- Additional 8 years of ECMWF R&D
- More and better observations, reprocessed and rescued, satellite and in-situ
- Higher resolution (18km vs 31 for ERA5), also for the ocean waves
- Towards coupled Earth system
- Improve on systematic model bias



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C3S SEASONAL PREDICTION: COMPONENTS

DATA PRODUCTS

http://cds.climate.copernicus.eu

Datasets available in the Climate Data Store
- atmospheric variables:
  - Daily and subdaily data (6h, 12h, 24h), for atmospheric variables
  - Monthly statistics (mean, max., min. and standard deviation)
  - Bias corrected data (monthly anomalies)
- ocean variables: monthly means

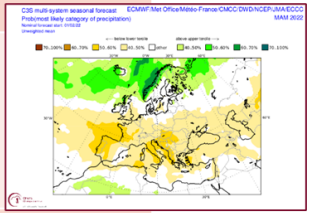
CDS API

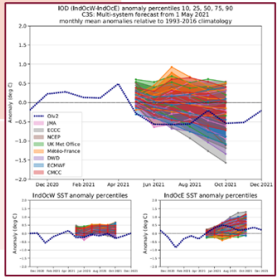
CDS Toolbox

GRAPHICAL PRODUCTS

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

Source	Individual contributing systems Multi-system combination
Variables	Total precipitation Near-surface temperature Mean sea-level pressure Sea surface temperature Geopotential height at 500 hPa Temperature at 850 hPa Zonal wind at 10 hPa
2D Maps - Global - Predefined regions	Ensemble mean anomaly Probabilities exceed quantiles: Median Terciles Quintiles
Time series - SST NINO regions - SST Indian Ocean - zonal mean zonal wind at 10hPa	Ensemble members Percentiles Probabilities





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Global and Regional Climate Projections

CMIP5 and CMIP6 Climate Projections

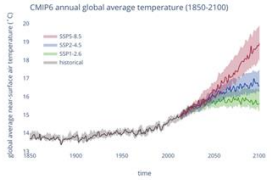
CMIP6 climate projections

Overview | Download data | Documentation

This catalogue entry provides daily and monthly global climate projections data from a large number of experiments, models and time periods computed in the framework of the sixth phase of the Coupled Model Intercomparison Project (CMIP6).

CMIP6 data underpins the Intergovernmental Panel on Climate Change 6th Assessment Report. The use of these data is mostly aimed at:

- addressing outstanding scientific questions that arose as part of the IPCC reporting process;
- improving the understanding of the climate system;
- providing estimates of future climate change and related uncertainties;
- providing input data for the adaptation to the climate change;
- examining climate predictability and exploring the ability of models to predict climate on decadal time scales;
- evaluating how realistic the different models are in simulating the recent past.



Contact

copernicus-support@ecmwf.int

Licence

CMIP6 - Data Access - Terms of Use

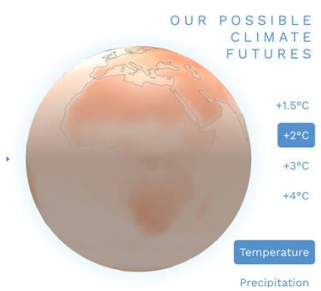
Publication date

2021-03-23

References

DOI: 10.24381/cds.d7eaec3d

The IPCC Climate Atlas in the CDS

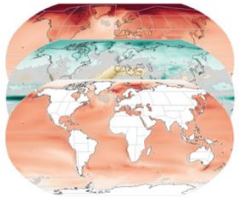


Copernicus Interactive Climate Atlas: IPCC AR6 Interactive Atlas

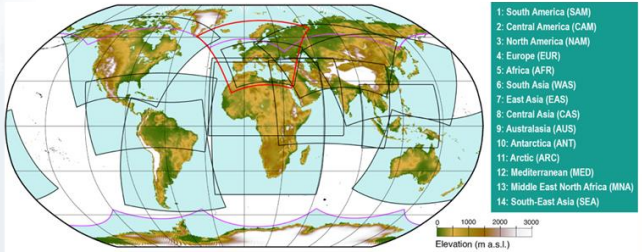
Overview | Download data | Documentation

This catalogue entry provides gridded data from global (CMIP5 and CMIP6) and regional (CORDEX) projections for the set of 22 variables and indices included in the IPCC Interactive Atlas, a novel WGI contribution to the Sixth Assessment Report (AR6 WGI). These variables and indices are used in the regional assessment conducted in AR6 (Chapters 10, 11, 12 and Atlas) to provide information on heat and cold, wet and dry, snow and ice, and wind, illustrating how multiple climatic impact-drivers are projected to change in all regions of the world. This dataset is particularly intended for CDS users/practitioners who want to develop customized products not directly available from the IPCC Interactive Atlas (e.g. regional information at national or subnational scales).

This dataset includes gridded information with monthly temporal resolution for historical and Representative Concentration Pathways (RCP) / Shared Socioeconomic Pathways (SSP) scenario data for CMIP5/6 and CORDEX multi-model ensembles for the 22 variables and indices (computed from daily data). The ensembles are harmonized using regular grids with 2° (CMIP5), 1° (CMIP6) and 0.5° (CORDEX, with 0.25° for the European CORDEX domain) horizontal resolution (see documentation links for details on the particular ensembles for each dataset).



Regional Climate Projections: CORDEX



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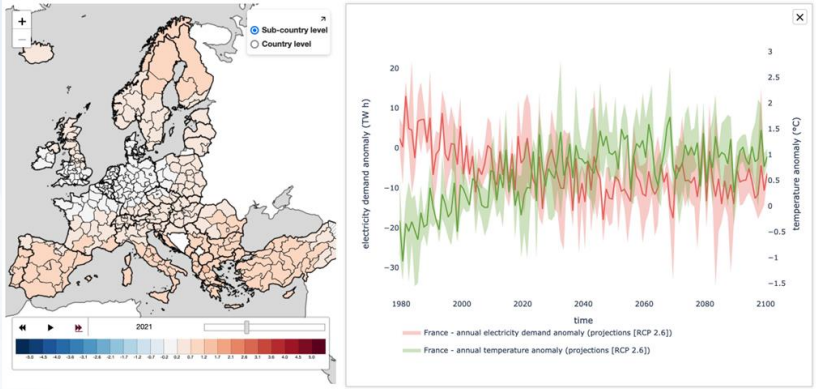
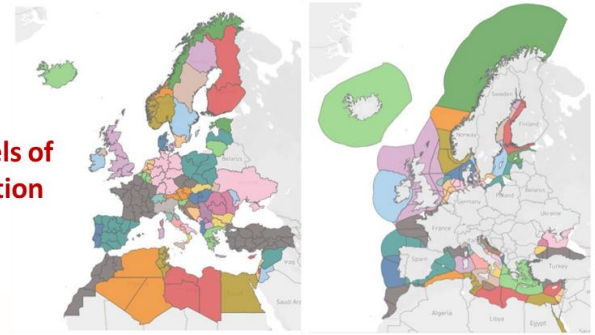
C3S Operational Energy Service



A multi-variable, multi-timescale view of the climate and energy systems

Supporting C3S Core Users: European Network of Transmission System Operators ENTSO-E to build the Pan European Database (PECD) v4

Different levels of data aggregation for the PECD



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