

THE WIND ENERGY USE CASE

Providing information on key global indicators relevant to the onshore and offshore wind farm industry

Status of October 2024

The importance of wind energy

Wind power is a vital source of renewable energy and plays a key role in the decarbonization of the energy system. Given its importance, the production of onshore and offshore wind energy is expected to see significant growth in the coming decades. However, in expanding capacities, it is essential to guarantee the reliability and security of the electricity system. This application will help developers estimate future wind energy resources and the suitability of specific regions for new installations.

WHAT IS THE CHALLENGE?

Currently, estimates of wind resources used for planning new wind energy installations rely on regional reanalysis data. However, this data does not account for climate change-driven shifts in weather patterns or support global-scale analysis. This lack of high-resolution global projection data could lead to the suboptimal usage of land and ocean areas that can have other societal and conservation usages. Moreover, having reliable estimates of the upcoming energy production is crucial for ensuring a stable electricity system as the power grid will need to adjust to the changing amount of renewable energy production.

THE CLIMATE DT SOLUTION

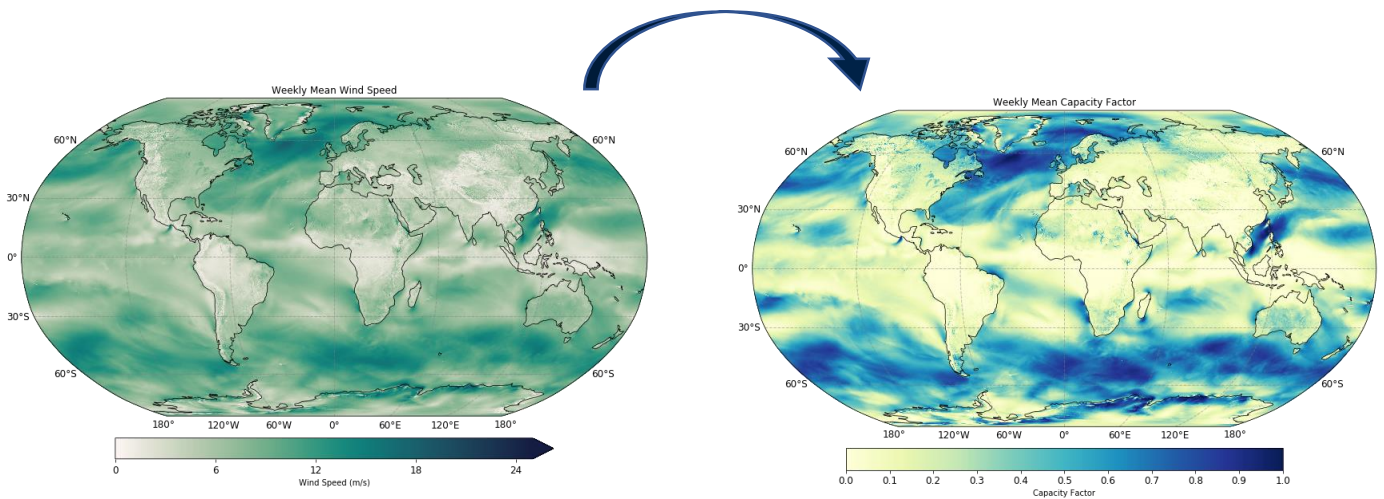
To address the challenge of providing global climate change induced wind energy information, the Climate DT is developing a wind energy application that includes high-resolution global information on both on-shore and off shore wind energy.

The application is divided into the Energy Onshore and Energy Offshore components and are being developed in parallel providing information on key global indicators relevant to the wind farm industry at various temporal and spatial scales. Both applications are able to work independently but share parts of the code and several functionalities. This fact sheet will demonstrate the added value of the Climate DT and the application, e.g. for informing the investment strategies of the wind power sector.

The energy use case utilizes the wind component factor from the Climate DT model to provide user relevant information using indicators for the onshore and offshore applications. These indicators are available as long term means, their inter-annual variability and extreme values.

What's new?		
Feature	Current state-of-the-art	Added value of the Climate DT
Climate variable	10m wind component (u10,v10) requires vertical interpolation	Several height (100m, 150m) wind components & windspeed
Temporal resolution	3 to 6 hourly	1 hourly
Spatial resolution	100 km (CMIP), 12.5 – 50 km (CORDEX) requires horizontal interpolation	5 km
Location	Downscaling required for regional climate information	Regional climate information available globally

From climate data to climate information



Wind speed at 100m and 5km horizontal resolution averaged over one week in November 2022 (11/11 to 18/11), from 1 hourly wind components (100u, 100v). Data was obtained from the ClimateDT IFS-FESOM production simulation in Marenstrum5. Credit: BSC.

Capacity factor at 5km horizontal resolution averaged over one week in November 2022 (11/11 to 18/11), from 1 hourly wind components (100u, 100v). It shows the capacity factor for a Class I wind turbine (Enercon E70-2.3MW).

The application provides estimates of future wind turbine resources and wind turbine vulnerability, including hourly wind speed distribution with its changes at the multi-decadal scale to help improve wind farm design. Another key aspect of the application will be to evaluate how the energy supply will change in future climate scenarios.

Who are the key users?

- The primary key user for this use case is the Joint Research Center (JRC) which supplies policymakers with evidence-based facts to push European energy objectives forward.
- In addition, the needs of maritime spatial planners and Offshore windfarm operators have been discussed directly with the Finnish Maritime Spatial Planning group, and industry actors, in workshops facilitated by the Finnish Maritime Spatial Planning (MSP) platform.



Where you can find and interact with the data

The entry point for DestinE users will be the **DESP** (Destination Earth Core Service Platform) implemented by ESA:

<https://platform.destine.eu/>

An interactive dashboard will be established for users to interact and download data related to the energy use case. A support channel will offer support and provide users of Climate DT data with scientific guidance and technical support to enhance their understanding and utilization of the data.

More information

Climate DT fact sheet
Scan the QR-code below



DestinE use case catalogue
Scan the QR-code below



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