GERICS supporting climate-resilient wind energy sites

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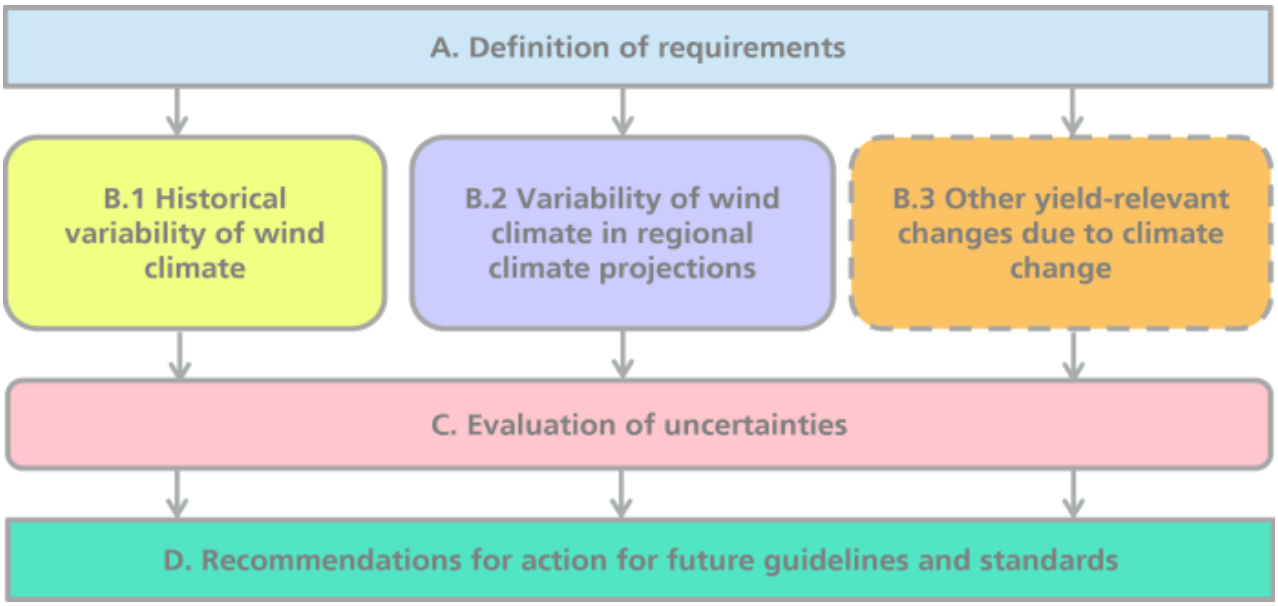

Figure 1: KliWiSt Project Overview

Dr. Irem Isik Cetin and Dr Elke Keup-Thiel offer expert insights on how GERICS supports the climate-resilient development of wind energy sites

Since the oil crisis in 1973, the use of modern wind turbines has clearly grown. By 2023, the installed capacity of wind energy globally surpassed 1 terawatt (TW). (1) With low costs and high emission reduction potential (2), wind energy has emerged as one of the most promising options for moving towards a low-carbon energy transition. For this reason, after COP28, more than 200 countries aimed to triple renewable energy capacity.

Plus, [the European Union (EU), as a leading continent in wind energy use and development, amended Renewable Energy Directive, which seeks to generate electricity from renewables up to 45% where 42.5% of this target is binding by 2030. In 2023, the share of wind energy in electricity generation in Germany exceeded 30%. (3)

The positive progress and contribution of wind energy for a more sustainable future will not be reduced by climate change. (4) However, the increased share of weather-dependent renewable energy sources requires special attention to investigations of the subject. Due to the variability of wind resources, the sector requires localised, up-to-date, robust climate information to ensure the proper planning of the wind energy produced and integrated into electricity systems. These energy systems are designed under current/ past climate conditions and must be adapted to changing climate conditions to secure energy supply for a sustainable future.

The importance of climate services in the energy sector is increasing due to the rapid increase in energy demand and supply. As one of the well-known climate services providers, GERICS has extensive and long-term experience in providing tailored climate change information to different sectors by developing science-based prototype products and services to support decision-makers in politics, business and public administration adapt to climate change. Now, GERICS is using this experience to investigate adaptation options for wind energy sites to climate change.

Figure 2: KliWiST participation in European Geosciences Union (EGU) General Assembly 2024

Insights from the KliWiSt Project

To address these challenges and to support the wind energy sector, the KliWiSt project was initiated in 2021. The project, a joint effort between GERICS and Fraunhofer IWES, is specifically designed to investigate the influence of climate change on wind energy site assessment. The project is funded by the Federal Ministry for Economic Affairs and Energy (BMWK) up to the end of 2024.

The KliWiSt project investigates the changes in wind resource magnitude and variability during historical and future periods in Europe. In addition, KliWiSt investigates other relevant parameters due to climate change that are considered in wind energy site assessment. It aims to provide recommendations for considering uncertainties resulting from climate change.

Appropriate methods for analysing climate data for use in wind farm planning are tested and derived. The project contributes to further optimising wind farm planning and adapting future wind farms to these conditions by considering changes caused by climate change that are already foreseeable today.

GERICS's contribution to KLiWiSt

Within this project, GERICS supports sustainable energy, guiding policies, and integrating climate data into real-world applications. GERICS contributes to accurate wind resource assessment for the future by providing and researching climate information from the latest climate model simulations and identifying possible options to reduce uncertainties in the use of climate models.

Since GERICS is highly experienced in regional climate modelling (RCM), which is one of the best options for reducing uncertainties, several state-of-the-art EURO-CORDEX simulations and Convection Permitting Simulations (horizontal resolution of 3 km) in NUCLEUS Project outputs are driven by CMIP6 (the 6th phase of the Coupled Model Intercomparison Project (CMIP)), where data are utilised to understand wind resource variability during the 21st century. Climate information at the kilometre scale derived from convection-permitting climate simulations is being used to produce more accurate wind source determination in cases where the estimation of wind resources is problematic, particularly in complex terrains.

Furthermore, GERICS is also investigating extreme low wind events or wind droughts over Europe, focusing on the region of Germany by using EURO-CORDEX ensemble data.

The results of the project are regularly shared with the stakeholders. A recent stakeholder workshop, scheduled for September 16th, 2024, is one of the key outcomes of the KliWiSt project. This workshop aims to provide an opportunity for a wide range of stakeholders in the energy sector to engage with the project's findings and contribute their perspectives. The project will be completed by the end of 2024, and its outputs, including recommendations for the sector, will be shared with the community. However, continuous research is still needed to fully understand the impacts of climate change on wind energy sites.

Looking ahead: Climate-resilient wind energy

In conclusion, wind energy is an important mitigation option. However, the gap between the wind energy sector and climate science needs to be bridged by acting on those kinds of projects and supporting decision-makers to reach climate targets more accurately and reliably. For this purpose, GERICS develops climate services within the KliWiSt project, which is contributing to the climate-resilient development of the wind energy sector, ensuring that it continues to play a central role in the global low-carbon energy transition.

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