

# Impact of future climate changes on wind distribution : a focus on wind drought episodes

Today more than half of newly installed electricity production capacity is **wind** and **photovoltaic** energy. In the EU Energy Outlook 2050, the share of these renewable energies will increase to approximately **55%** of the total supply by **2050** and renewable energies will represent **73%** of the electricity fleet, of which **25%** provided by **offshore wind**. This massive development of renewable energies represents major challenges for the supply-demand balance and the stability of the electricity system linked to the inherent volatility of this type of energy. For example, in **2021** some of northern European countries experienced a strong episode of weak winds, particularly the **UK**, which saw its wind production drop by **32%**, a record low wind never seen since 1950. This kind of events can be very alarming considering the UK's ambition to become a world leader in wind energy. The same event caused a drop in the French wind load factor, which fell below 10% in June 2021 (60% less than the average observed for this month). These periods of weak winds, also known as "**wind droughts**", have been observed since 1980 and are part of a more general decrease in surface winds the "**global wind stilling**" (Vautard et al., 2010). And although some studies have observed a reversal of this trend over the past ten years (Zeng et al., 2019), the latest IPCC report suggests a drop in future average wind in Europe of 8 to 10% for a warming scenario at 1.5°C. However, significant uncertainties are still present on the processes that drive this future wind decline, in particular on the respective contributions of climate change and internal variability (Carvalho et al., 2021, Wohland et al., 2021).

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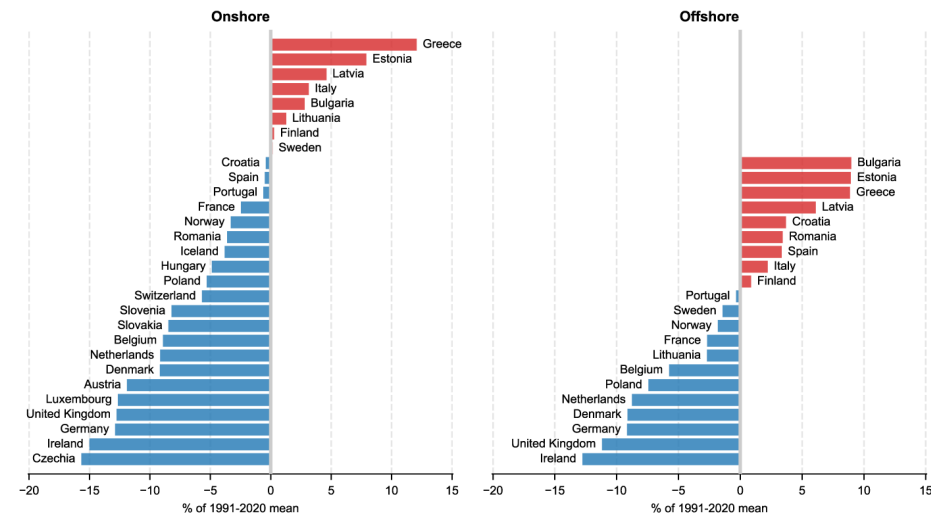
**Location :** EDF-Lab Saclay

## Main objectives

The objective of this work is to understand and anticipate the future change of these episodes of weak winds and more generally the wind distribution. To do this, it is necessary:

- To analyze and understand the evolution of the historical wind with a particular interest for the episodes of weak wind in Europe based on the observations.
- Understand how wind generation will evolve in the future under the effects of climate change:

Annual wind capacity factor (CF) anomalies by country in 2021



Data: C3S Climate and energy indicators for Europe (based on ERA5) • Reference period: 1991-2020 • Credit: C3S/ECMWF