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Solar surface radiation and wind speed projections for use in the energy sector in Europe

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The increased interest on solar and wind energy applications in the context of mitigating climate change in parallel with sustainable development makes a major challenge to introduce these types of renewable energy sources into the energy system supply. This assumes not only the implementation of new technologies, but also detailed information regarding the atmospheric environmental conditions. In this way climate change scenarios are indispensable in the future technical and thereafter economic planning of renewable energy use.
The Copernicus Climate Change Service (C3S) funded by the European Commission and operated by the European Centre for Medium-range Weather Forecasts aims at delivering cutting-edge climate information for the society facing climate change adaptation and mitigation. Its energy proof-of-concept projects, the Clim4Energy and the European Climatic Energy Mixes (ECEM) projects are providing bias-corrected long-term projections coming from 11 high-resolution (0.11°) regional climate models, along with uncertainty estimates, tailored for the energy sector. All the data are published and freely available on the Earth System Grid Federation (ESGF) data portal.
However, regional climate projections have limitations which must be taken into account in any decision or policy making. This limitations should be quantified and communicated to the users. In the study first we validate surface solar radiation and wind speed products by comparing them with observations (356 ISDLite stations for wind speed and 61 GEBA stations for surface solar radiation). The validation indicates an underestimation of monthly wind speed by 7.3% (0.27 m/s) in the models, a bias of +4.4% (6.1 W/m2) in case of yearly surface solar radiation data bias-corrected with WFDEI reference data, and a bias of – 5.7% (7.9 W/m2) using HelioClim satellite data for bias-correction. The study also validates the distributions indicating a shift around the mean and also in the tails in case of the modeled data. Furthermore, due to different forcing data and physics parametrisations different regional climate models might produce different results. An assessment of agreement among the models in terms of mean changes and changes in extreme values is also included.
By quantifying the uncertainties the study emphasis the need of an overall validation of different climate models before introducing them in impact studies in order to have an overview regarding the robustness of the projections.