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Importance of fully interactive aerosols in regional climate modeling for renewable energy resource evaluations

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Regional Climate Models are powerful tools allowing in-depth characterizations of the variable renewable wind and solar resources abundance and variability and the climate change impact on these, among others. Their suitability to provide both surrogate climate databases to overcome the limitations of the observational records and to assess regional impacts of the global warming is well known. However, they still miss some important physical-chemical processes, mainly due to their high computational cost. As this latter is increasingly assumable, an evaluation of the effects and actual importance of these processes, such as aerosol-radiation (ARI) and aerosol-cloud (ACI) interactions, is key to advance in the optimal design of new regional climate model experiments. Here we assess the extent at which the climatologies of the wind and the solar resources are sensitive to the costly inclusion of the aerosols effects. Euro-Cordex compliant ERA20C-driven WRF and WRF-CHEM (including fully two-way ARI and ACI) simulations for the period 1991-2010 are compared for the purpose. Results depict non-negligible signals, larger for the solar resource, indicating a general decrease in the resource availability and usability when evaluated from the most complex simulation despite the fact that ACI effects were found to offset part of the sensitivity signals to the ARI effects, a novel finding itself.
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