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DISCUSSION PAPER

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Discussion on A high-resolution bilevel skew-*t* stochastic generator for assessing Saudi Arabia's wind energy resources

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First, I would like to thank the Editor-in-Chief for the opportunity of discussing this very interesting paper and also congratulate the authors for their excellent work. It provides a substantial contribution both to the theory and to the application of stochastic generators (SGs) and addresses the topical problem of assessing wind resources for energy production over a certain region (Arabian Peninsula in this case), which question is of crucial interest for policymakers creating strategies of transition towards green energy.

Model parameters of the proposed efficient high-resolution SG for simulating wind speed fields are estimated using the corresponding Weather Research and Forecasting (WRF) model forecasts. However, there are a few aspects of verification on which I would like to focus most of my discussion.

1. The SG simulated wind speed values are verified against the wind speed predicted by the WRF model just at two locations and only with the help of Q-Q plots (see figure 6e,f). As for each location and time point 100 simulations are generated, they can be considered as a sample (or forecast ensemble) on the WRF prediction. Hence, the goodness of fit to the WRF forecasts can be visualized either by a verification rank histogram (or Talagrand diagram) over all forecast cases, or by plotting the reliability indices (Delle Monache, Hacker, Zhou, Deng, & Stull, 2006) for the various locations as a heat map. That would give a more detailed overview, how well the simulated wind speeds capture the distribution of the WRF outputs taken here as actual.
2. Going beyond the WRF simulations, as an alternative, one can consider the ECMWF high-resolution (HRES) deterministic forecast as reference, since it has a 9-km horizontal resolution. In this case either the SG grid points should be interpolated bilinearly to the ECMWF HRES grid points, or to each point of the coarser grid we should find the closest point in the final one. In this way the simulated wind fields would be verified not only against the WRF model providing data for the SG.
3. Verification of high-resolution simulated wind speed values against observations or reforecasts is also not an impossible mission, see for example Peleg, Fatichi, Paschalis, Molnar, and Burlando (2017). Here the ECMWF ERA 5 reanalysis product (Hersbach et al., 2018) with a 31-km grid resolution might be a reasonable choice. The matching with the SG grid can be performed as in point 2. A reasonable distributional fit to reforecasts would provide a more convincing argument in favour of the reliability of the simulated wind fields.
4. As argued, for example, in Gneiting, Stanberry, Grimit, Held, and Johnson (2008) or Pinson (2012), bivariate normal distribution provides a reasonable model for (possibly transformed) wind vectors. I just wonder whether this fact might be utilized in designing an efficient Gaussian SG, obviously on the cost of doubling the dimension of data vectors to be simulated.

DATA AVAILABILITY STATEMENT

NA

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