Wind Energ. Sci. Discuss., author comment AC1
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Reply on CC1

Thomas Muschinski et al.

Author comment on "Predicting power ramps from joint distributions of future wind speeds" by Thomas Muschinski et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2022-48-AC1, 2022

Dear Jethro,

We would first like to thank you very much for taking the time to review our manuscript and for giving such positive and constructive feedback! The paper you referenced is not only interesting, but also highly relevant to our work and will be incorporated into future revisions.

As you noted, a parameterization of the covariance matrix based on its Cholesky decomposition allows for estimation of flexible temporal dependency structures, but has the drawback that variances and correlations are no longer modeled directly. Since the elements of a standard Cholesky decomposition are very difficult to interpret, we employ the modified decomposition of Pourahmadi (1999), whose elements — the innovation variances and generalized autoregressive parameters — have more intuitive meanings for response vectors with a natural ordering (such as the temporal case considered here).

The innovation variance of a specific response component can be thought of as the uncertainty which remains if values are known for all preceding components. Generalized autoregressive parameters are analagous to partial correlation coefficients, but controlling only for these preceding components rather than all other components as well.

The paper you referenced highlights the need for a covariance parameterization which is not only interpretable and unconstrained, but also parsimonious. This can be achieved by not considering all preceding response components for the generalized autoregressive parameters, but only those up to a certain lag r. Setting higher lag generalized autoregressive parameters to zero a priori results in a structured covariance of type order-r antedependence (AD-r) where the number of covariance parameters to be modeled only has a linear — rather than a quadratic — dependence on the distributional dimension.

Regarding your comment on multivariate scoring: using multivariate Gaussian regression to postprocess the wind speed forecasts does not improve predictive skill according to the energy score. Since the energy score is much more sensitive to errors in the marginal forecast distributions than their dependencies, improved Dawid-Sebastiani scores and binary ramp predictions likely result from better capturing the temporal dependencies, rather than improving the marginal forecasts they connect.

The idea to modify the power curve in order to test the sensitivity of our ramp results is a

good one! We may take this into account when revising the manuscript.