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The analog-based gridded data post-processing

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Analogies between similar past forecasts, measurements, or analyses are a potentially useful tool when the training dataset is long enough, thus enabling an adequate identification of true analogs. Reducing the number of degrees of freedom in the matching procedure makes the analog-based method an excellent candidate for point-based post-processing. However, accurate forecasts at remote locations are used to drive many user-specific applications (e.g., road temperature forecasts along an entire roadway or wind speed for windfarms). For that reason, besides the point-based post-processing for the measuring sites, there is also an increasing demand for gridded (2D) products. The latter is a direct motivation for the adaptation of analog-based method to produce gridded output based on an analysis.

In this work, the control member of the ECMWF ensemble forecast is used as a raw forecast as input to the analog method, whereas the gridded INCA analysis fields are used similar to the observations in the point-based analog approach. All experiments use wind speed and direction variables as predictors, normalized by standard deviation. The domain is defined by ECMWF resolution and INCA domain size, covering Austria. The first experiment (EX1) is based on the simplest transfer from point-based to gridded products: treating every grid point as an independent location. Alternatively, an average error on the entire field is used to choose the most similar historical field (EX2). The latter generates comparable results to the EX1 when using training datasets of the same length. In addition to these experiments, a simplification of the procedure for choosing the best analogs using empirical orthogonal functions (EOF) is also tested (EX3). The training data is used to calculate EOFs for EX3, and training is thus saved as EOFs and corresponding principal components (PCs) time series. Results show that using only a few EOFs might capture the majority of the variance in the training. The best match to the current raw forecast is determined using PCs. Even though EX3 is not as skillful as EX1 and EX2, the approach using EOFs is notably more computationally efficient. For that reason, it is possible to include longer training than for EX1 and EX2. Moreover, the setup can be further optimized to improve results (e.g., increasing the number of predictors or implementing a predictor-weighting strategy), which is a natural next step in future work.