Precipitation Postprocessing using an 2D Analog Ensemble based on Wavelet-Metric

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In recent years, several studies showed that the Analog Ensemble (AnEn) method can be a powerful postprocessing tool for meteorological applications. While being mostly applied on station observation data, we expand the AnEn method to gridded 2D-data by running it on overlapping subsets of the NWP model (COSMO-DE-EPS) and using satellite precipitation observation data (RADKLIM) to build up multiple AnEns across the NWP grid.

In general, the AnEn method uses a data set of predictors from NWP model output and corresponding observations. Specifically, the approach is to identify the most similar cases in the training data set to the time step for which the AnEn should be determined. The similarity is calculated based on a metric which takes into account the differences between the predictor data at the current time step and all time steps in the training data. For the most similar cases, the corresponding observations are then chosen as the AnEn members.

In our implementation for a 2D-AnEn, we employ a metric based on wavelet transformations. This allows for an estimation of similarity based on spatial structures and thus overcomes the so-called “double penalty” problem induced by spatial displacement of forecasts (especially found in precipitation forecasts). We use a “Dual Tree Complex Wavelet Transform” (DTCWT) which allows for an efficient extraction of structural information of a 2D field on various scales and angles. Further, we determine weights for the various predictor variables using the so called “Simplified Brute Force” approach.

The results from our experiments show that AnEn provides a reasonable approach to estimate spatially consistent post-processed precipitation fields.