An analog ensemble method for downscaling

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This presentation describes a rapid downscaling method to create a regional 30-year mesoscale climatology of surface winds for a given region and monthly period. Specifically, the analog ensemble (AnEn) method is used to downscale from a coarser resolution numerical weather prediction model reanalysis. To demonstrate the AnEn downscaling technique, the Weather and Research Forecasting (WRF) model is run from 1986 to 2015 for the monthly period of early April to early May. Four nested WRF grids are included, with the two inner grids having 3.3-km and 1.1-km grid spacing, centered over southern Missouri, USA. For each hour of the day, the WRF configuration generates dynamically downscaled analysis from NOAA's Climate Forecast System Reanalysis. The AnEn is developed using a 5-year training dataset composed of these WRF reanalyses from 2011-2015. The remaining 25 years are used as a testing period, in which the finest grid (grid 4) reanalyses are created by first interpolating data from the coarser grid-3 analysis and then identifying analogs from interpolated grid-4 data in the training period. Twenty analogs from the training dataset are identified for each grid point at each testing diagnosis time, and the verifying WRF diagnoses of the finest grid-4 data are used as the ensemble diagnoses for grid-4 reconstructions in the testing period. Then, the median of AnEn diagnoses are compared to analyses produced from simple interpolation from grid 3 to grid 4. Compared to interpolation, the AnEn produces substantially lower bias and random error, demonstrating a computationally inexpensive way to produce reliable downscaled analyses.