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Integrating ground observation data and meteorological reanalysis for wind mapping

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In this work we propose a methodology for gridding wind speed data by using a combination of ground-based observations, orographic corrected information extracted from MERRA-2 reanalysis data, and topographic variables.

Monthly wind speed data measured between 1981 to 2016 at 10 m above the ground were obtained from 118 meteorological stations belonging to the National Meteorological Administration. The Modern-Era Retrospective analysis for Research and Applications, Version 2 (MERRA-2) integrates a variety of observing systems with numerical models to produce a high-quality atmospheric and surface weather history dataset. For this study, the wind components (v, u) were extracted from MERRA-2 reanalysis data, and upscaled at 1000×1000 m spatial resolution by using a quasi–physically based meteorological model. Topographic variables were derived from the 1-km averages of the USGS SRTM30 DEM.

Two sets of monthly maps were constructed with the help of the Regression Kriging method: one with reanalysis and topographic variables and another with only topographic variables. The accuracy indicators computed between the original data and the leave-one-out cross-validation estimations at the station locations, reveal that the orographic corrected reanalyses data improved the overall spatial predictions.

The Regression Kriging method enabled us to describe the spatial variability of monthly wind speed data using orographic corrected reanalysis data and topographic variables. Results show that the greatest wind speeds are located in the high altitude areas, as well as in the southeastern part of the country and in the coastal region.

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