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Analog-based high wind speed predictions in complex topography

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Post-processing techniques improve weather prediction by combining dynamical and statistical information to generate effectively relevant and timely information. Research on statistical post-processing is predominantly focused on the average case, while rare or extreme weather events, which are of high socio-economic impact, remain a substantial challenge. In order to improve automated predictions of rare and extreme weather events, the focus in this work is on a group of stations in coastal complex terrain prone to high wind speeds (e.g. bora wind). The analog-based predictions generated by Aire Limitée Adaptation dynamique Développement InterNational model (ALADIN) are tested at several climatologically and topographically different regions of Croatia for point-based wind speed predictions at 10 m AGL (Above Ground Level). The verification procedure is formulated and used to assess and improve the performance of analog-based wind speed predictions.

This study shows that deterministic analog-based predictions, compared to model used to generate them, improve the correlation between predictions and measurements while reducing bias and root-mean-square error. This is especially the case in the coastal complex terrain. Analog ensemble mean forecasts (AN) exhibit the highest correlation, while applying Kalman filter to the AN removes bias almost completely. Distribution of analog-based deterministic predictions of high wind speeds is more similar to the distribution of observations than the distribution of raw model or Kalman filter approach predictions, particularly for the small ensemble size. Furthermore, predictions of high wind speeds are improved by using additional predictors.