Near-surface wind climate over the eastern Adriatic coast in an ensemble of RCM simulations

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Motivation & Aim

The eastern Adriatic coast is characterized by the complex coastline, strong topographic gradients and specific wind regime. The most famous typical winds along the Adriatic coast are bora (usually blowing in the direction perpendicular to the Dinaric Alps and experiencing a strong influence of the terrain), sinoco (usually parallel to the coastline) mostly during the wintertime and sea/land breezes (dominantly in the warm part of the year) as a part of the regional Mediterranean wind system.

Aim:

The Adriatic represents excellent test area for the latest generation of the regional climate models (RCMs) applied for the European domain.

Near-surface (~ 10 m) wind simulated by RCMs

- CCLcom-CCLM4-8.17
- DMI-HIRHAM5
- IPSL-INERIS-WRF3.1F
- KNMI-RACMO22E
- SMHI-RCA4
- DMI-R ECMG

from the EURO-CORDEX initiative are compared against surface station observations and forcing ERA-Interim reanalysis

Data & Methodology

- 6 RCMs at 12.5 km resolution and 50 km resolution, 6 upscaled models (from 12.5 km to 50 km) and ERA-Interim (~ 85 km resolution) compared to surface station data (here shown: Split Airport and Zagreb Airport).
- Each grid point value is associated with the corresponding surface station using two interpolation approaches: the nearest neighbour (NN) and bilinear interpolation (BIL).
- Modelled and measured data sets are compared using several skill scores (e.g. Brier skill score, Perkins skill score, RMSE, ...)
- To better understand and visualize the results Taylor diagram and probability density estimation are also analyzed.
- Across the whole set, the data are divided and analyzed seasonally (DJF and JJA seasons).

Results

Taylor diagram:

(a) Zagreb Airport

(b) Zagreb Airport

Brier skill score (BSS):

- The error variances (MSD) are computed relative to the same predictand (observations).
- BSS can vary between –1 (reanalysis exactly matches the observations) and +1 (RCM exactly matches the observations).
- Negative values indicate a better performance of the reanalysis, positive values indicate an added value of the regionally modelled winds in comparison with reanalysis time series.

Table 1: BSS comparison between U and V component of the wind for Split Airport. Note the higher score for the V component and for the 12.5 km resolution.

Probability density estimation (PDE):

- Calculates the cumulative minimum value of two distributions of each binned value, measuring the common area between two PDFs. Observed and modelled data are binned around centers determined by the range of the observed data.
- If a model simulates the observed conditions perfectly, the skill score will equal to 1.

Table 2: PSS in V component of the wind for Split Airport. Comparison between resolutions and interpolation approaches.

Conclusions

- Our analysis reveals strong sensitivity of the simulated wind flow and wind pattern to the RCM horizontal resolution (12.5 km vs. 50 km).
- Different (non)dimensional skill measures discussed (e.g. Brier skill score, Perkins skill score) depend on both seasons and locations analyzed.

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References
