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Wind speed differences between a regional and global climate model simulation and their relation to the circulation

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Following the concepts of hierarchical modelling, a regional climate model simulation with COSMO-CLM (CCLM) is compared to the global model run with ECHAM5, which was used for lateral boundary forcing, to analyse the effects of the different spatial scales on the dynamical properties of the systems and the development of model differences.
The differences in wind speed are evaluated on several vertical levels. Especially in the middle troposphere a large dipole structure emerges, where the mean wind speeds in CCLM are higher than in ECHAM5 in the north eastern part of the model domain, whereas in the Mediterranean region the CCLM wind speeds are lower then those of ECHAM5.
To analyse differences in the wind speed distributions, wind speed percentiles are calculated and compared. The results show, that in particular the wind speeds of the highest percentiles are lower in CCLM than in ECHAM5 within a 10° wide region along the western model boundary.
To relate the observed wind speed differences to the circulation within the model domain, circulation weather types are determined by using a centroid-based cluster analysis method. A clustering of the ECHAM5 500 hPa geopotential height is performed and the mean wind speed and geopotential height differences of each cluster are calculated. The results show, that the CCLM produces higher wind speeds within troughs and lower wind speeds within ridges, according to changes in the geopotential height gradients. Furthermore, it becomes obvious, that there is an interaction between the geopotential height differences and orography.
The analysis of further vertical levels shows, that the mean CCLM wind speeds in the lower and middle troposphere are in general higher than in ECHAM5, while they are lower in the higher troposphere, especially at the jet stream level.