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Regional climate simulations of surface wind over complex terrain

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The surface circulations can present a high spatial and temporal variability as a consequence of the synoptic scale interaction with the surface characteristics. This is specially the case of complex terrain regions wherein the synoptic circulations are strongly modified due to channelling, forced ascents, blocking, etc. Observational networks need to present a high density of stations in order to capture the main characteristic of the flow over these areas. Regional climate simulations accomplished at a high horizontal resolution to accurately represent the topography over the region can help to increase the spatial and temporal coverage of the observations, and therefore contribute to increase our understanding of the surface circulations. However, simulating at high horizontal resolution (a few kilometers) requires large computational resources specially if the simulated period is long (decades) and thus, the potential of this kind of simulations has not been widely explored.

This work uses wind observations over the 1992-2005 period and a numerical simulation form 1960 to 2005 performed at a high horizontal resolution (2 km) to analyse the surface wind variability over a complex terrain region in northern Iberia. The observations are used to understand the surface wind variability over the area and to evaluate the simulation. Overall, the simulation reproduces the wind variations over the region, but some limitations of the downscaling methodology were found. Problems to reproduce the synoptic situation as well as limitations to represent the topography, even though we are simulating at a high resolution, introduce errors in the surface wind estimations.

On the basis of the performance shown by the simulation during the evaluation, its higher spatial and temporal resolution is used to inspect the wind behaviour where and when observations are not available. Two principal modes of variation explain a large percentage of the wind variations over the region (about 80 \%). A strong relationship was found between these two main modes and the zonal and meridional large scale pressure gradients over the area. These relationships allowed us to analyse the wind trends over the area using sea level pressure information during the last century (1899-2006). Significant trends were encountered.