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Roughness Length Parameterizations of Regional Climate Models: Influence on Mistral and Tramontane Patterns

Anika Obermann, Benedikt Edelmann, and Bodo Ahrens

University of Frankfurt, Institute for Atmospheric and Environmental Sciences, Frankfurt am Main, Germany (bodo.ahrens@iau.uni-frankfurt.de)

Mistral and Tramontane are regional winds in southern France. The correct forecast of wind speed in this area is important for evaluation of fire risks, damage due to strong winds and the modeling of deep-water formation in the Mediterranean Sea. Both winds are funneled through valleys and show extensive air flow patterns in complex terrain, which makes them difficult to simulate correctly in climate models.

This study deals with Mistral and Tramontane in the regional climate models CCLM, ALADIN, WRF, PROMES, and LMDZ of the MedCORDEX project. The effect of sea surface roughness parameterization on the quality of wind speed and direction modeling is evaluated. Additionally, several parameterizations of other models are tested within CCLM.

Emphasis is on spatial patterns in the areas of Mistral and Tramontane as well as the overlapping zone. Furthermore, the wind speed development and error propagation along the wind tracks is evaluated. Windy days (with Mistral and Tramontane) are distinguished from not windy days. A Bayesian Network is used to filter for days on which model sea level pressure fields show a Mistral/Tramontane pattern or not.

On windy days, models tend to underestimate wind speed over the sea, but are able to simulate Mistral and Tramontane events in general. Wind speed is underestimated but wind direction errors are smaller on these days than on days without Mistral and Tramontane.