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Impact of Roughness Parameterization on Mistral and Tramontane Simulations

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The Mistral and Tramontane are mesoscale winds in the Mediterranean region that travel through valleys in southern France. The cold and dry Mistral blows from the north to northwest, and travels down the Rhône valley, between the Alps and Massif Central. The Tramontane travels the Aude valley between the Massif Central and Pyrenees. Over the sea, these winds cause deep-water generation, and thus impact the hydrological cycle of the Mediterranean Sea. The occurrence and characteristics of Mistral and Tramontane depend on the synoptic situation, the channeling effects through mountain barriers, and land and sea surface characteristics.

We evaluate Mistral and Tramontane wind speed and direction patterns in several regional climate models from the MedCORDEX framework with respect to these challenges for modeling. The effect of sea surface roughness parameterization on the quality of wind speed and direction modeling is evaluated.

Emphasis is on spatial patterns in the areas of Mistral and Tramontane as well as the overlapping zone. The wind speed development and error propagation along the wind tracks are 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.

Furthermore, time series of Mistral and Tramontane days events in historical and projection runs are derived from sea level pressure patterns. The development of Mistral and Tramontane days per year and the average length of such events are studied, as well as the development of wind speeds.