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Analysis of a high-resolution regional climate simulation for alpine temperature: validation and influence of the NAO

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To determine whether the increase in resolution of climate models improves the representation of climate is a crucial topic in regional climate modelling. An improvement over coarser-scale models is expected especially in areas with complex orography or along coastlines. However, some studies have shown no clear added value for regional climate models. In this study a high-resolution regional climate model simulation performed with REMO over the period 1958-1998 is analysed for 2m temperature over the Greater Alpine Region (GAR). REMO is driven with perfect boundary conditions by the ERA40 reanalysis through spectral nudging of the large-scale wind field. The added value is analysed between the regional climate simulation with a resolution of 1/6° and the driving reanalysis with a resolution of 1.125°.

Both REMO and ERA40 are validated against the dense, homogenised and quality controlled HISTALP dataset of monthly mean 2 m temperature covering the whole GAR. The temporal variability of temperature, as quantified by correlation, is well represented by both REMO and ERA40. However, both show considerable biases. The REMO bias reaches 3 K in summer in regions known to experience a problem with summer drying in a number of regional models. The comparison of REMO and ERA40 shows that the added value of the former varies between seasons and regions but shows a better performance of REMO during the whole year in regions with the

most complex orography.

In addition, the question is addressed whether the higher resolution also leads to more detailed structures in the temperature response to circulation variability. In this study the temperature response to the North Atlantic Oscillation (NAO) with its strong influence on European winter climate is analysed over the GAR. The temperature signals based on the station data and based on the model data have very similar patterns and are in agreement with the European-wide pattern. The highly resolved model data show an additional clear small-scale pattern with a strong signal south of the main Alpine ridge potentially caused by the föhn effect. This small-scale structure is not visible in the reanalysis due to the coarser resolution and was also not found in previous studies based on both station and model data for the same reason.