Scalability of regional climate change in Europe for high-end scenarios - DTU Orbit

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With the help of a simulation using the global circulation model (GCM) EC-Earth, downscaled over Europe with the regional model DMI-HIRHAM5 at a 25 km grid point distance, we investigated regional climate change corresponding to 6°C of global warming to investigate whether regional climate change generally scales with global temperature even for very high levels of global warming. Through a complementary analysis of CMIP5 GCM results, we estimated the time at which this temperature may be reached; this warming could be reached in the first half of the 22nd century provided that future emissions are close to the RCP8.5 emission scenario. We investigated the extent to which pattern scaling holds, i.e. the approximation that the amplitude of any climate change will be approximately proportional to the amount of global warming. We address this question through a comparison of climate change results from downscaling simulations over the same integration domain, but for different driving and regional models and scenarios, mostly from the EU ENSEMBLES project. For almost all quantities investigated, pattern scaling seemed to apply to the 6° simulation. This indicates that the single 6° simulation in question is not an outlier with respect to these quantities, and that conclusions based on this simulation would probably correspond to conclusions drawn from ensemble simulations of such a scenario. In the case of very extreme precipitation, the changes in the 6° simulation are larger than would be expected from a linear behaviour. Conversely, the fact that the many model results follow a linear relationship for a large number of variables and areas confirms that the pattern scaling approximation is sound for the fields investigated, with the identified possible exceptions of high extremes of e.g. daily precipitation and maximum temperature.

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