



Regional Climate Change for Europe; From PRUDENCE and ENSEMBLES to CORDEX – a consistent story

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For more than 20 years, coordinated efforts to apply regional climate models to downscale GCM simulations for Europe have been pursued by an ever increasing group of scientists. This endeavor showed its first results during EU framework supported projects such as RACCS and MERCURE. Here, the foundation for today's advanced worldwide CORDEX approach was laid out by a core of six research teams, who conducted some of the first coordinated RCM simulations with the aim to assess regional climate change for Europe. However, it was realized at this stage that model bias in GCMs as well as RCMs made this task very challenging. As an immediate outcome, the idea was conceived to make an even more coordinated effort by constructing a well-defined and structured set of common simulations; this led to the PRUDENCE project (2001-2004). Additional coordinated efforts involving ever increasing numbers of GCMs and RCMs followed in ENSEMBLES (2004-2009) and the ongoing Euro-CORDEX (officially commenced 2011) efforts. Along with the overall coordination, simulations have increased their standard resolution from 50km (PRUDENCE) to about 12km (Euro-CORDEX11) and from time slice simulations (PRUDENCE) to transient experiments (ENSEMBLES and CORDEX); from one driving model and emission scenario (PRUDENCE) to several (Euro-CORDEX). So far, this wealth of simulations have been used to assess the potential impacts of future climate change in Europe providing a baseline change as defined by a multi-model mean change with associated uncertainties calculated from model spread in the ensemble. But how has the overall picture of state-of-the-art regional climate change projections changed over this period of almost two decades? Here we compare across scenarios, model resolutions and model vintage the results from PRUDENCE, ENSEMBLES and Euro-CORDEX. By appropriate scaling with global temperature change we identify robust results about the projected future of European climate expressed by temperature and precipitation changes, which confirm the basic findings of PRUDENCE. The large scale patterns of change show remarkable agreement across model resolution, ensemble strategy and emission scenario. But we also find that the inter-model agreement increases in the sequence from PRUDENCE to CORDEX-11, suggesting a much stronger robustness of state-of-the-art climate change information for Europe, which has not been realized sufficiently by neither the climate modeling community nor in the wider communities using down-scaled climate change information.