Scaling of regional climate signals investigated with regional model quasi-ensembles

Abstract:
Climate change is believed to lead to significant changes in the Nordic region, both in managed systems and in natural systems. Increased international attention is now being devoted to regional climate scenarios. The Intergovernmental Panel on Climate Change (IPCC) has recently assessed regional climate information of global models and techniques used to enhance regional detail.

Nordic expertise exists on especially regional climate modeling and on using a mix of techniques to study scenario uncertainties. National activities exist in Sweden, Denmark, Norway, Finland, and Iceland, and the initiatives are only loosely linked to each other. Initiatives towards better utilization of the similar capabilities of the Nordic groups are aimed for now.

An initial attempt to exploit the combined expertise has been made through the NordEnsClim initiative. A set of regional climate change scenario experiments performed in Denmark, Norway, and Sweden were analyzed jointly by the groups involved. Four downscaling experiments of regional climate change covering the Nordic countries have been conducted with three different regional climate models (RCMs) and using quite diverse domain size, resolution and boundary conditions. A short synthesis of the outcome of the suite of experiments is presented as a quasi-ensemble, reflecting the different driving atmosphere- ocean general circulation model (AOGCM) conditions, RCM model resolution and domain size, and choice of emission scenarios, using a pattern scaling technique. This allows the sources of uncertainties in the projections to be estimated, and at the same time the analysis of the climate change signal for temperature and precipitation over the period 1990-2050 reveals strong similarities, suggesting a high reliability of the projected climate changes. In particular, all experiments in the suite simulate changes in the precipitation distribution towards a higher frequency of heavy precipitation.

We also present new evidence that supports the applicability of the adopted scaling technique by analysing new 30-year control and climate change simulations with the same model usig boundary conditions from two different transient SRES scenarios.