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Evaluating the Method of Pattern-scaling in Time

E. Kjellström (1), L. Bärring (1)

(1) Rossby Centre, Swedish Meteorological and Hydrological Institute, Norrköping, Sweden. (Erik.Kjellstrom@smhi.se, Fax: +46 11 4958001)

Traditionally, dynamical downscaling of global climate change simulations include a control period in the late 20th century and a future time period by the mid or end of this century. Pattern-scaling in time is a method used to infer information on climate change in time periods that have not been simulated by the regional climate models. This is accomplished by multiplying the regional climate change signal from the period that has been simulated with the ratio between the changes in global mean temperature for the corresponding two periods.

At the Rossby Centre we have performed two long transient climate change experiments with our regional climate model covering the full time period 1961-2100. By use of these simulations we test how well the method of pattern-scaling in time works by comparing the simulated climate change signal for some time period to that derived by pattern-scaling in time based on some other time period.

The results show that the pattern-scaling in time works well for many variables for large parts of the year. But, there are exceptions to this. An example is temperature and precipitation over Sweden for which pattern-scaling works well in summer and in mid winter but fails in the transition seasons. For those periods the regional changes do not follow the increase in global mean temperature. This implies that the climate change signal derived through pattern-scaling differs from to the simulated one. The inherent assumption in the method of pattern-scaling in time is that the regional change occur at the same rate as the global change. The presented results clearly show how the method fails when this assumption is violated.