Geophysical Research Abstracts
Vol. 17, EGU2015-11595, 2015
EGU General Assembly 2015

Globally consistent patterns of regional climate change from ensembles of GCMs

Marianne Sloth Madsen, Peter L. Langen, Fredrik Boberg, and Jens Hesselbjerg Christensen
Danish Meteorological Institute, Copenhagen, Denmark (msm@dmi.dk)

Percentiles at the grid point level are often used to present model spread in temperature and precipitation changes within an ensemble of models (e.g. IPCC Atlas, Annex1, AR5, 2013). Furthermore, pattern scaling of annual mean changes of temperature and precipitation based on multiple GCMs has been used to demonstrate robustness in climate change projections (e.g. Figure 12.41 in Chapter 12 in AR5). This implied agreement has been used to support probabilistic approaches towards regional climate change projections in the sense that model spread in any given point or region is associated with a likelihood assigned to the regional information extracted from multi-model ensembles.

Here we consider the CMIP5 models and demonstrate that there is a substantial disproportionality between global climate sensitivity and the regional distribution of temperature change. We argue that estimating a given probability for a change in any particular region prevents a probabilistic statement about the change in a different region, as this would potentially be in conflict with the global mean change being the overall constraint in any given model realization: if the largest climate change signal is chosen in each point, the global mean temperature change exceeds the change projected by any of the individual models. This is not physically justified. For precipitation, we find a large spread in projected precipitation changes in all grid points, using the CMIP5 models for the RCP8.5 scenario; basically consistent with no change and a large uncertainty everywhere. Each individual model shows a clear and statistically significant pattern of change. Further analyses at the grid point level including multiple climate variables stress that correlation between the variables needs to be addressed if physically consistent regional climate projections are to be extracted. Such consistent projections are needed for impact modelling within the IMPRESSIONS project.

Here, we propose a method where dominating patterns of regional climate change are identified from EOF analyses. These are used to construct globally consistent maps of the uncertainty in climate change scenarios. By going beyond the grid point level statistics, our method is designed to capture the spatial patterns in the uncertainty and the correlations between variables.