Is it possible to improve the "value" of a climate model ensemble by means of statistics?

Risk assessments and economic analyses used in for instance climate adaptation planning are increasingly based directly on the findings obtained from regional climate models. A regional climate model covers a geographically defined area and uses typically a spatial scale from 10 to 50 km, while the underlying data forming the basis for e.g. a risk assessment usually cover a number of different calculations based on different regional climate models – also called an "ensemble" of climate models. The number of "members" in an "ensemble" may vary from a few to more than 20 different calculations made by different research teams all over the world. The UN's climate panel recommends to always use the findings of more than one climate model when making analyses in order to be able to estimate the uncertainties of the projections and thus also their reliability.

Calculations based on regional climate models used among others by municipalities, public authorities and engineering companies often rely on a similar calculation applying a global climate model. For this reason, and because both global and regional calculations are very resource demanding and practically only made when carrying out large research projects, large "gaps" are found in the existing international ensembles of regional climate models, such as for example CORDEX or ENSEMBLES. In this pilot project, the Technical University of Denmark's (DTU) Department of Management Engineering will study whether it is possible to use a statistical method to compensate for the missing ensemble members and thereby obtain a more complete picture of the uncertainty associated with the projected climate changes. This could potentially result in a markedly improved database, thus improving the reliability of the decisions and risk assessments based hereon.

The primary method used in the project will be based on a scaling principle, which is called pattern scaling. The method will be used for simulating the results obtained for e.g. temperature and precipitation from a regional climate model, which is driven by a known global climate model based on knowledge of the behaviour of the same regional model when linked to another global climate model. The scaling technique has not previously been applied in this way, but a recent preliminary study carried out by a team of researchers from the Danish Meteorological Institute (DMI) and the DTU has shown very encouraging results, and the present project will attempt to further investigate the possibilities. Besides improved knowledge of scaling techniques and their applicability in connection with regional climate model ensembles, the project also aims at developing a new set of processed data based on existing model ensembles, which can be made available for users, who are already using these data.