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Regional modelling of the Earth System: a summary of recent work

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Climate and Earth System models are important tools for mapping and interpreting environmental monitoring data – both remotely sensed and in-situ observations – in a regional and global context. They are also crucial for projecting possible future states of the Earth in an increasingly variable and extreme climate system, which will pose one of the most significant challenges to global long-term sustainable development. In this contributed paper we will present examples of recent advances in regional earth system modelling carried out in the context of the Centre for Regional Change in the Earth System (CRES) and the project HYACINTS (Hydrological Modelling for Assessing Climate Change Impacts at different Scales); in each of the examples different kinds of observations played an important role for the model development.

The first example stems from a concerted effort within CRES to address the implications of extreme global warming in Northern Europe, which involved researchers from DTU Management Engineering and DTU Environment (Drews & Christensen 2015, Bøssing Christensen et al. 2015). In the combined study we assessed the impacts of climate change at the upper limits of the IPCC climate scenarios from a transdisciplinary point of view, while testing the applicability of existing tools for projecting the present and future states of the earth system (atmosphere, hydrology, groundwater, sea level) as well as socio-economic systems (economy, urban development). The second example concerns the development of a novel coupled climate and hydrology model based on DMI's regional climate model and DHI's hydrological modelling system MIKE-SHE; this integrated modelling tool represents a significant stride towards achieving detailed regional earth system models e.g. as required for solving the nexus of energy-water-land use-food security at local scales. In conclusion we will briefly offer perspectives on future work and offer ideas for collaborative research within the overlapping fields of modelling climate change and sustainable development.

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