

**PARALLEL SESSION A : BENEFITS OF DOWNSCALING
A2: MODELS OF THE COUPLED REGIONAL CLIMATE SYSTEM**

**HIRHAM5: A Regional Coupled Model System to Examine Ocean-Atmosphere-Sea Ice,
Ice Sheet and Permafrost Interactions in the Arctic**

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We introduce a high resolution fully coupled regional model system that describes ocean, atmosphere and sea ice processes in the Arctic Ocean and North Atlantic and treats atmosphere / ocean / ice sheet interactions as well as land and sub-sea permafrost processes in an advanced semi-coupled form. The system has been developed using five existing model components: the high resolution regional climate model HIRHAM5, the regional ocean model HYCOM and the CICE model that describes sea ice dynamics, the PISM ice sheet model and the GIPL permafrost model. These models have been interactively coupled which enables us to perform experiments examining the relative importance of ocean and atmospheric forcing as well as internal dynamics, to explain the recent rapid decline of Arctic sea ice, recent changes in the Greenland ice sheet mass balance together with both land and sub-sea permafrost conditions. Analysis of the model results indicates the model can successfully reproduce the interannual and seasonal variability in sea ice extent, describe recent changes in the Greenland ice sheet surface mass balance as well as permafrost conditions around Greenland and possibly under the Arctic Ocean sea floor. This opens up the possibility of a range of process based experiments as well as simulations to project the future and study the past of Arctic sea ice that we plan to run using the EC-Earth GCM as boundary forcing.

Examples, focusing on various coupling issues will be presented and the need for further refinements will be assessed by highlighting processes that appear to be essential to the interactions and hence possibly important at climate scales.

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