**Idea357**

# Understanding and description of coupled arctic processes and global feedbacks with the help of numerical models and observations

## Idea for a contribution to the IPY 2007/2008 by the Swedish Meteorological and Hydrological Institute (SMHI)

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International polar years have traditionally been joint observational efforts. The upcoming IPY 2007/2008 offers the possibility to make use of numerical models to enhance the observational picture of the Polar Regions and to interact with observational campaigns. Numerical models can fill temporal and spatial gaps between observations and serve as tools to explore processes. In addition, global feedbacks of Arctic processes can be examined with models. Here we propose an integrated numerical modeling effort for the regional coupled Arctic ocean-ice-atmosphere system focusing on process studies, utilization of various kinds of observations and decadal hindcast simulations optimized by IPY observations and resulting in the best possible physical description of the year 2007/2008.

Models need to go through a phase of calibration and validation with respect to observations. Coverage of short scale processes is often a condition for good physical performance on the long time scales. The combined observations from the IPY 2007/2008 will enable modelers to enhance process descriptions and improve simulation capabilities on a wide range of time scales. For the IPY year, this will lead to a gridded and optimized description of the physical state of the Arctic. The improved use of satellite data assimilation over Polar regions will be of importance both for NWP initial states as well as for refinement and validation of model results. A EUMETSAT Climate Monitoring SAF will be operational during the IPY.

The simulation of the coupled Arctic system for 2007/2008 will be part of decadal simulations connecting earlier field campaigns with the upcoming IPY and will also incorporate decadal variability. The latter cannot be achieved by pure observations. As a result we get improved models with better capabilities in e.g. climate change scenario simulations.

Another aspect of improved modeling capabilities resulting from the IPY effort is the enhancement of global models in the Arctic. The strongest amplitudes of global warming are to be expected in the Arctic. This is a well established picture from scenario experiments with global climate models. At the same time differences between these models tend to be largest in the Arctic, thus pointing to the necessity of improved process descriptions either in the global models or in nested regional models. Such improvements can only be achieved by understanding and describing coupled arctic processes (e.g. role of freshwater runoff, interaction between Arctic and Atlantic Ocean, shelf-basin interaction, mixing processes, deepwater formation, ice-cloud-radiation interaction, sea ice processes, sea ice export, variability of the Arctic vortex and sea ice etc) in more accurate ways. This implies model development in close interaction with observation-based validation for interdecadal simulation periods. Such work is indispensable for more realistic studies on large scale decadal variability and long-term climate change. As a complement to 3D process studies,

simpler coupled ocean-ice- atmosphere column models could be used to explore a wider parameter space (collaboration with Göteborg University/Göran Björk). The IPY is a unique possibility to progress in this field. SMHIs effort will be coordinated with relevant international Arctic projects such as AOMIP, ARCMIP, CARE and THORPEX

Direct use of improved physical model performance is seen in impact studies. We plan to actively interact with impact groups with respect to e.g. land use, vegetation, runoff, etc. Collaboration with Stockholm University's institute for natural geography (Peter Kuhry) will cover key processes and parameterizations of the Arctic tundra regions.