A SCIENCE PLAN FOR
REGIONAL ARCTIC SYSTEM MODELING
A REPORT BY THE ARCTIC RESEARCH COMMUNITY
FOR THE
NATIONAL SCIENCE FOUNDATION OFFICE OF POLAR PROGRAMS

Arctic System Modeling
A short rationale of the ASM Science Plan

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A community report

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ISAB meeting August 18, 2010
Regional models as they are used now

Contribution to simulation uncertainty (%)

- Scenarios of human response
- Response from different global models
- Internal variability of global models
- Response from different regional models

[Example adapted from PRUDENCE e.g. Giorgi et al. (2008)]

Chapman and Walsh, 2007
Regional models as they are used now

Contribution to simulation uncertainty (%)

- Scenarios of human response
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- Response from different regional models

[Example adapted from PRUDENCE e.g. Giorgi et al. (2008)]
“…narrowing uncertainty in regional climate predictions is not just about climate sensitivity. A much wider range of processes is relevant, and improving the representation of these processes in models is both a major challenge and a real opportunity.”

(Hawkins and Sutton, 2009)
Arctic System Modeling

A short rationale of the ASM Science Plan

possible Arctic System states

uncertainty

Earth System Models
Unified Arctic System Models
Human Decisions (scenarios)
System Response

ensemble

complexity in an ensemble member
Arctic System Modeling
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possible Arctic System states

uncertainty

Earth System Models
Unified Arctic System Models
Human Decisions
System Response

ensemble

complexity in an ensemble member

Resolved Processes
Number of Processes

Humans
System
Arctic System Modeling

possible Arctic System states

uncertainty

Earth System Models
Unified Arctic System Models
Human Decisions → System Response

ensemble

complexity in an ensemble member

Humans
System

Global Model Nest

Arctic System Model

ASM Nest
Arctic System Modeling

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Possible Arctic System states

Uncertainty

Earth System Models
Unified Arctic System Models
Human Decisions → System Response

Humans
System

Resolved Processes
Number of Processes

Complexity in an ensemble member

Global Model Nest
Arctic System Model
ASM Nest
The ASM program must concentrate on coupling the core model components and adapting them to the Arctic where necessary. No basic development work should be attempted on the physical core unless it is absolutely necessary for bringing the accuracy of ASM simulations to within a defined tolerance. If so, this work should be conducted in close consultation with the modeling center from which the concerned model derives. The prime ASM focus should be on expanding capabilities of its biospheric and human dimensions components.

1. Decadal arctic climate projections.
2. Weekly and seasonal arctic prediction.
3. Downscaling (upscaling) from (to) global climate models for \textit{in situ} arctic observations and civil operations.
4. Model-and-observation synthesis aiding an arctic observing system design, interpretation of measurements, process studies, and model validation.
5. Understanding complexity, variability and adaptation of the arctic system and society’s role and response in the evolution of that system.