Potential contributions of the Regional Arctic System Model (RASM) to ACME-Arctic

Andrew Roberts and Wieslaw Maslowski
Naval Postgraduate School

A brief chronology

RASM
Naval Postgraduate School
University of Colorado
University of Washington

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Regional Ocean-Sea Ice

18km POCM-ice
9km POP-ice
Navy PIPS3
9km POP-CICE

University of Colorado
Atmosphere

63km ARCSyM
atmosphere, land
sea ice, slab ocean

10-50km Polar MM5

University of Washington
Land-Hydrology

Variable Infiltration
Capacity (polar)

10-50km Arctic WRF

Fully Coupled

2007-2010: Regional Arctic
Climate Model (9/50km RACM)
DOE CCPP (A. Bamzai)

2010-2014: Regional Arctic
System Model (9/50km RASM)
DOE RGCM (R. Joseph)

2015-2018: RASM II (2.4/25km)
DOE RGCM (R. Joseph)

9/2.4km ice-ocean

1990
2000
2010
2020

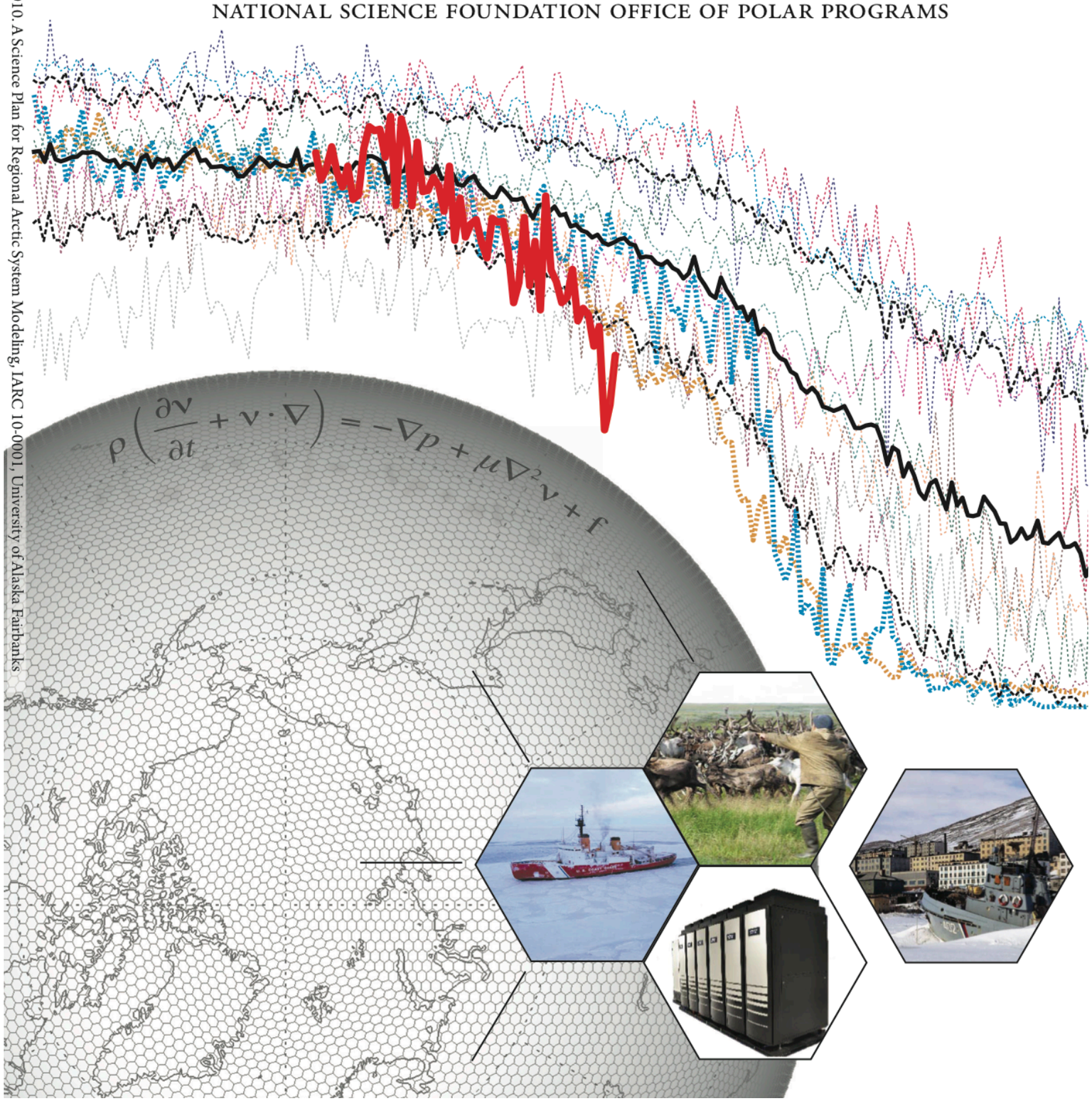
A SCIENCE PLAN FOR REGIONAL ARCTIC SYSTEM MODELING

A REPORT BY THE ARCTIC RESEARCH COMMUNITY

FOR THE

NATIONAL SCIENCE FOUNDATION OFFICE OF POLAR PROGRAMS

RASM



Roberts, A. and coauthors 2010. A Science Plan for Regional Arctic System Modeling, IARC 10-0001, University of Alaska Fairbanks

The Regional Arctic System Model

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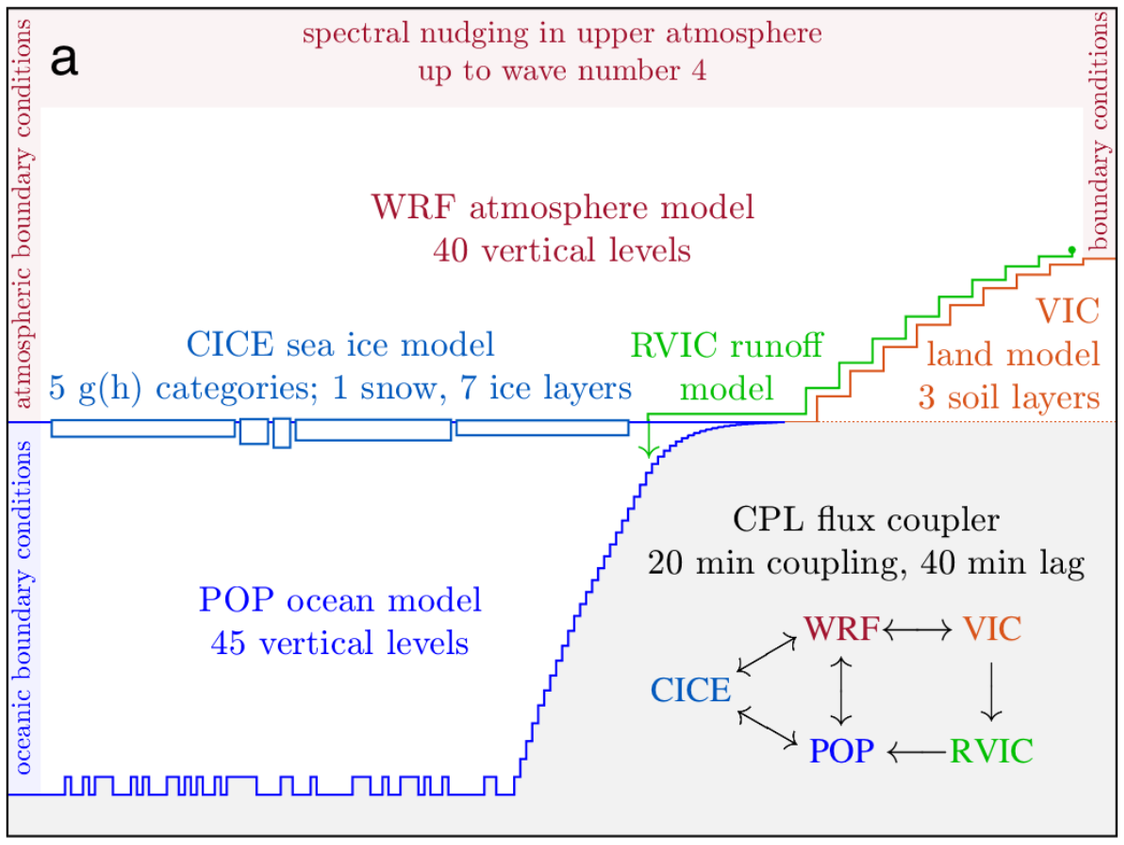
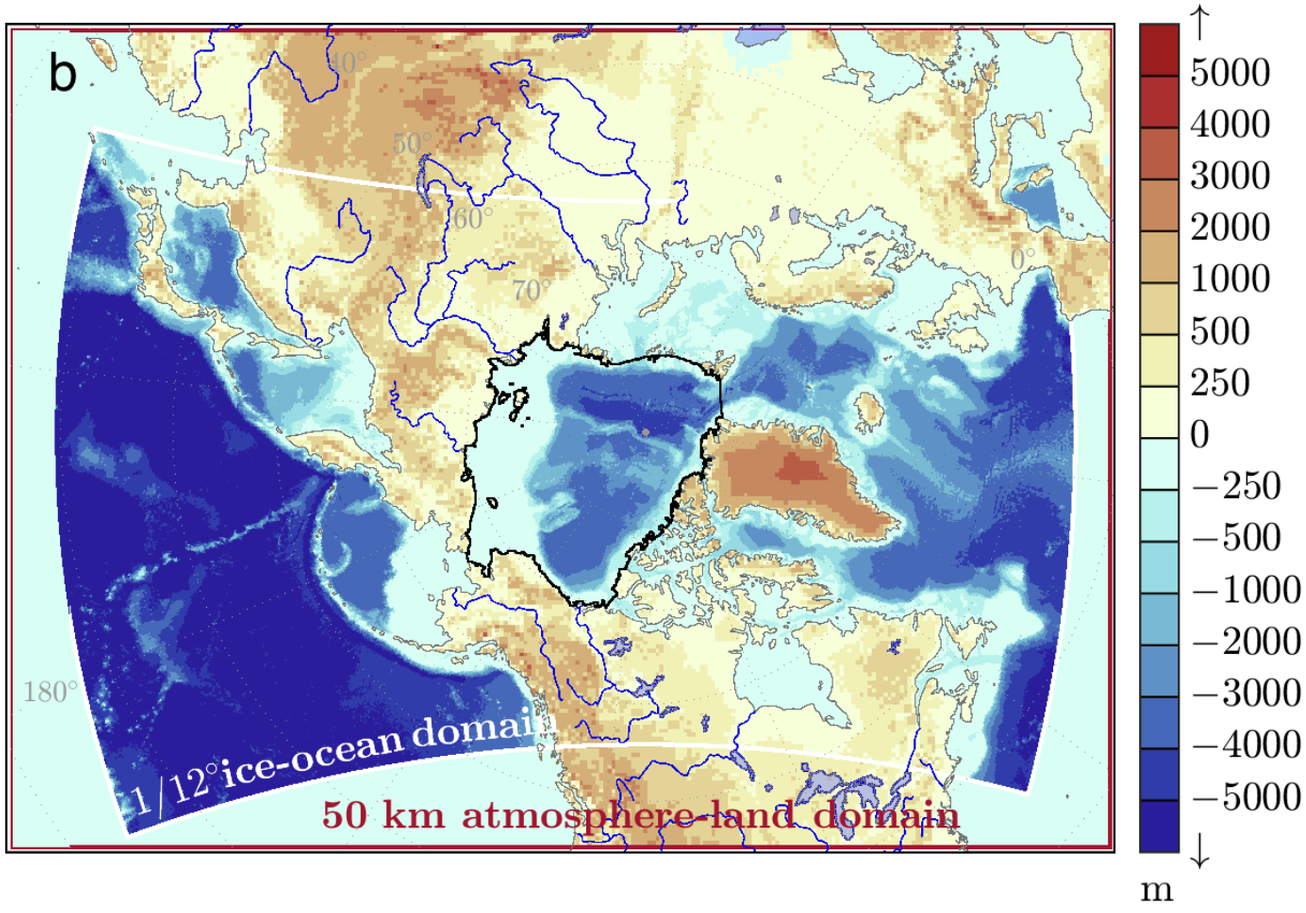
University of California
University of Arizona
Iowa State University
LANL





A university project funded by the Department of Energy

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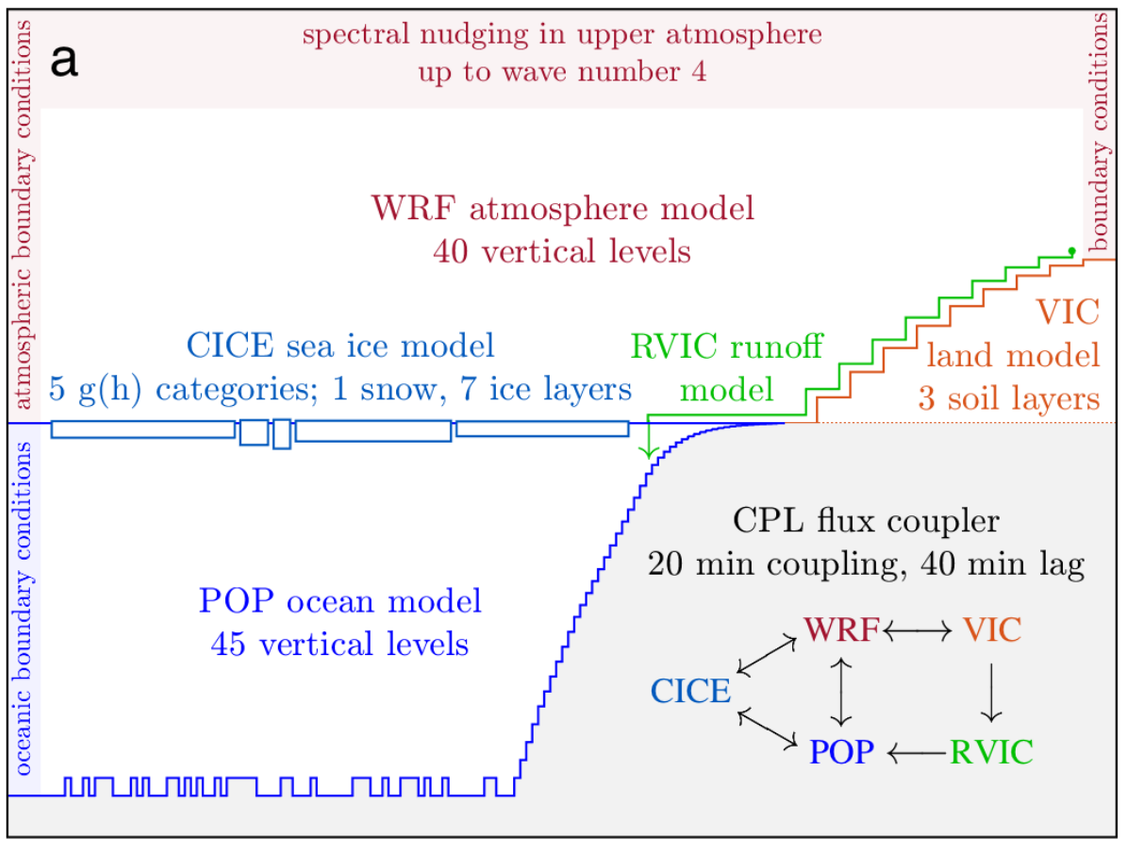

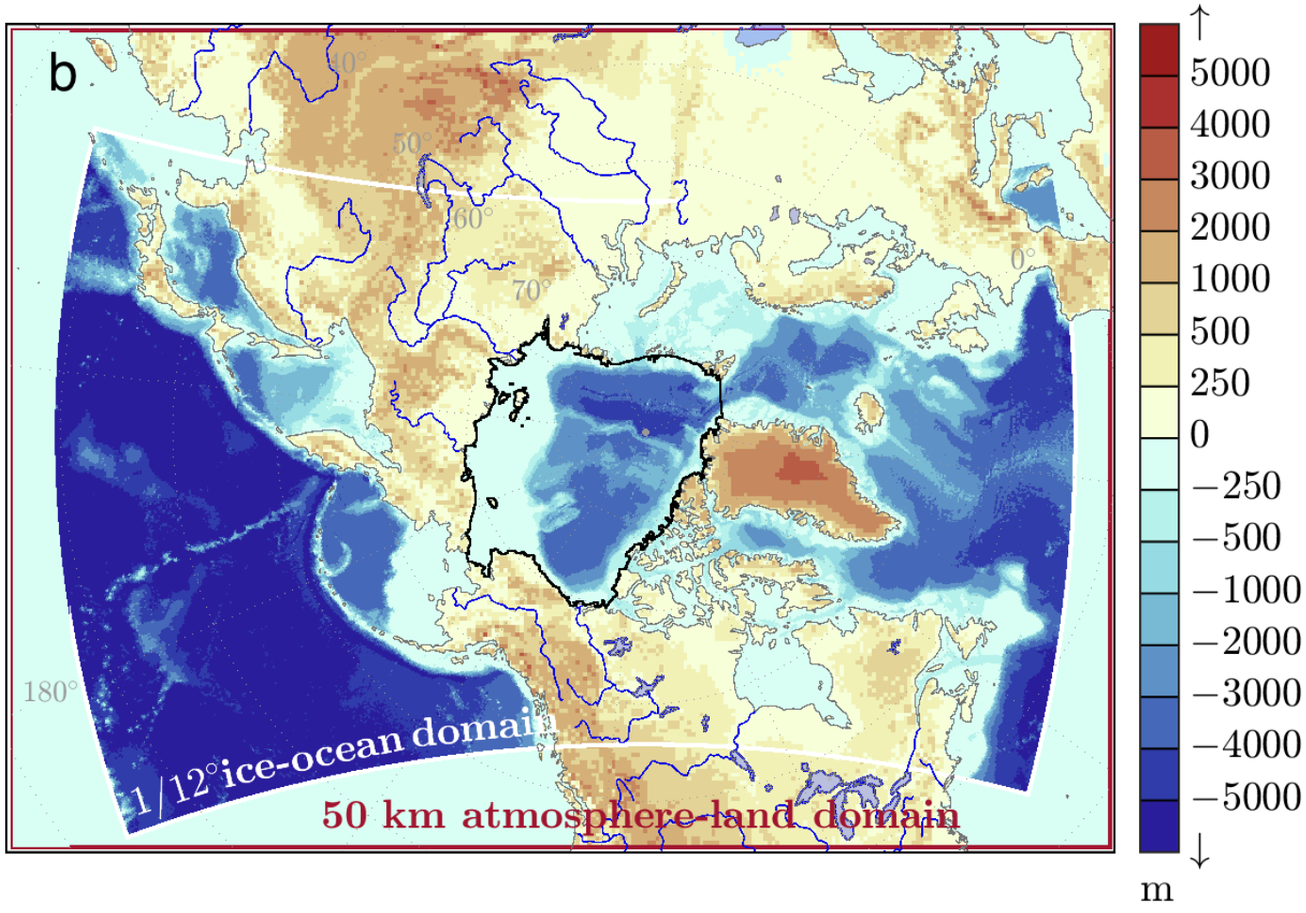

Department of Energy
Office of Naval Research
National Science Foundation
Department of Defense HPC

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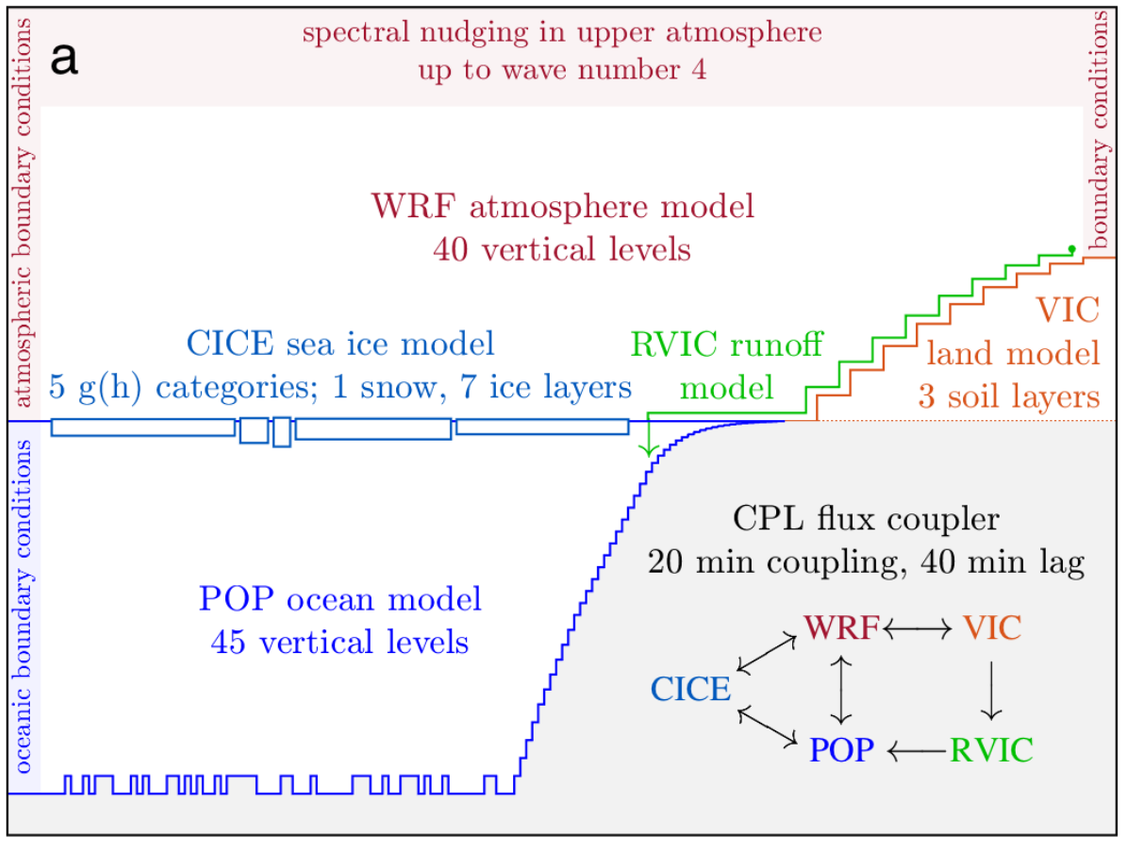

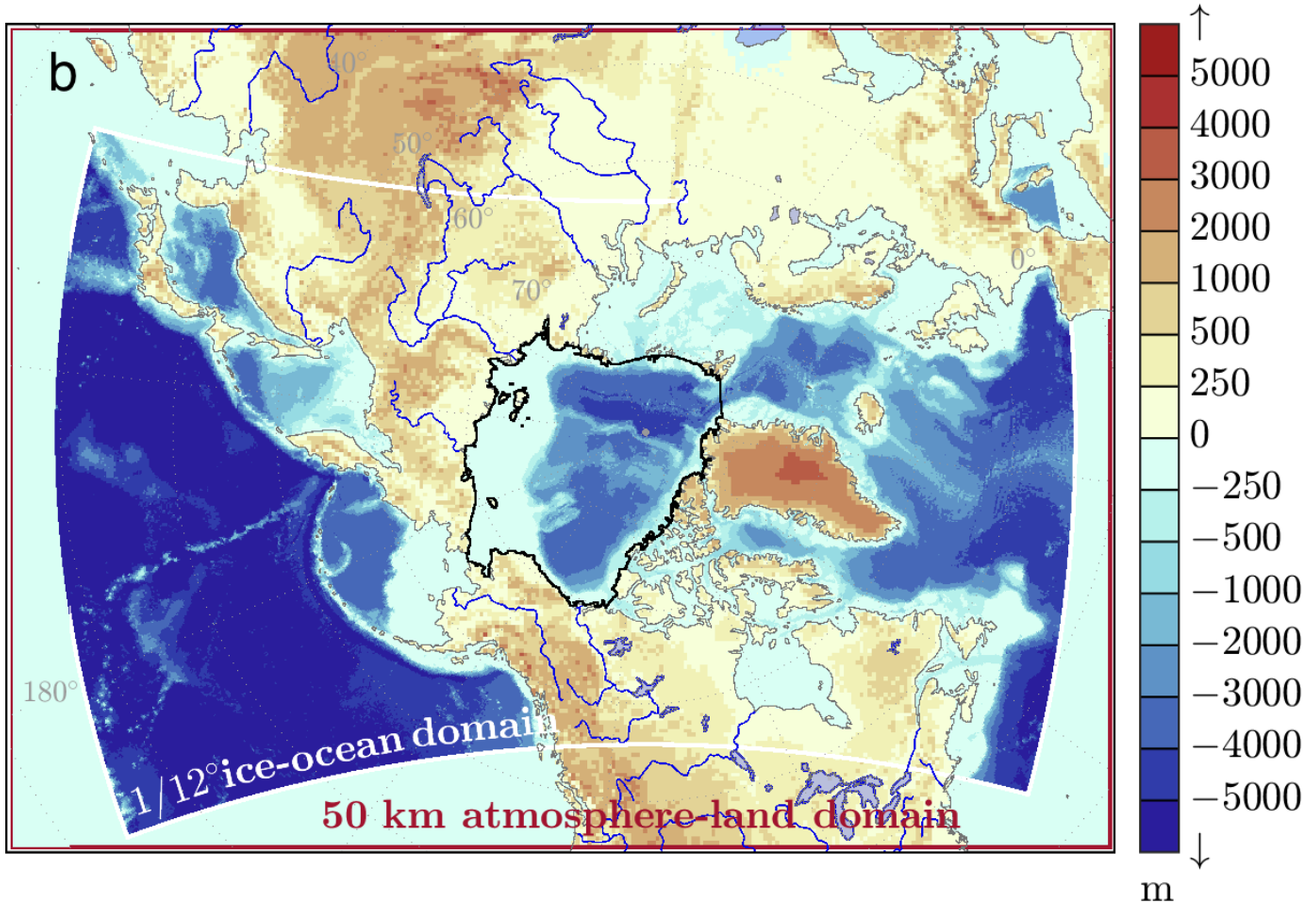

RASM focuses on understanding and improving simulations and prediction of Arctic climate, with emphasis on the ocean-ice-atmosphere boundary layer

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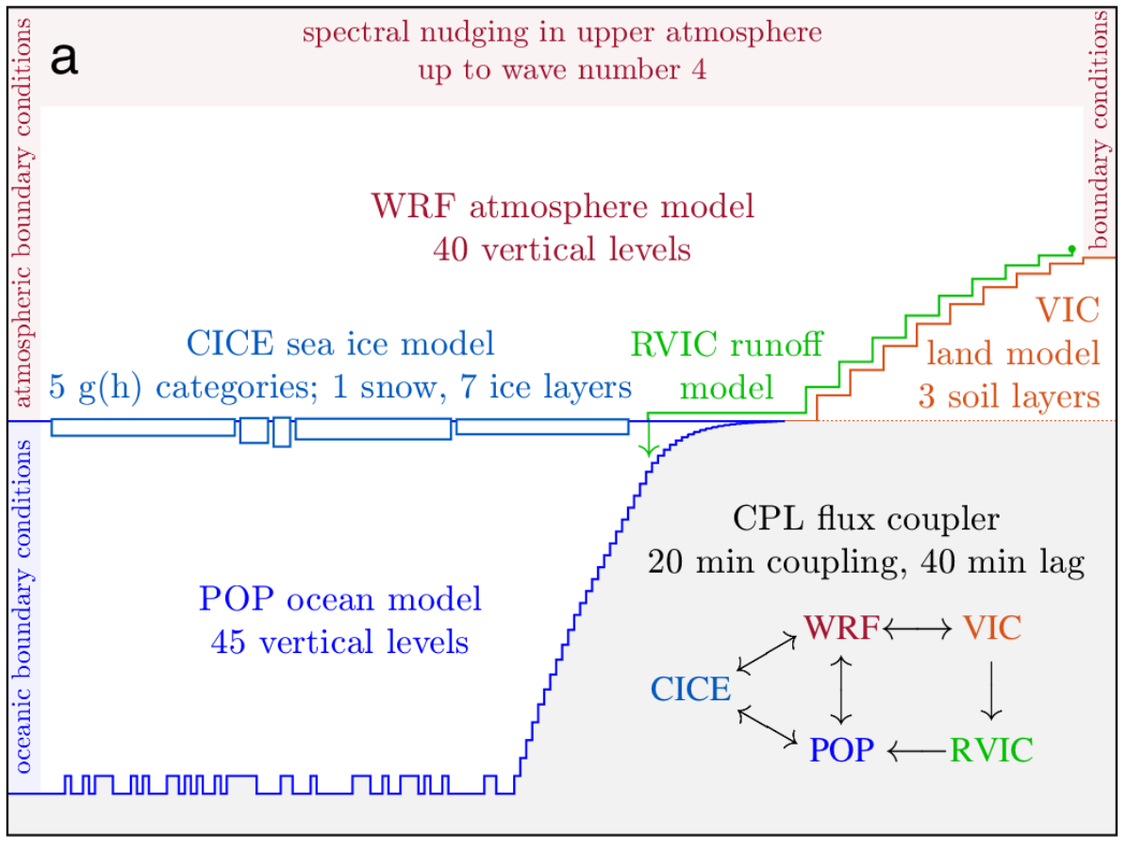

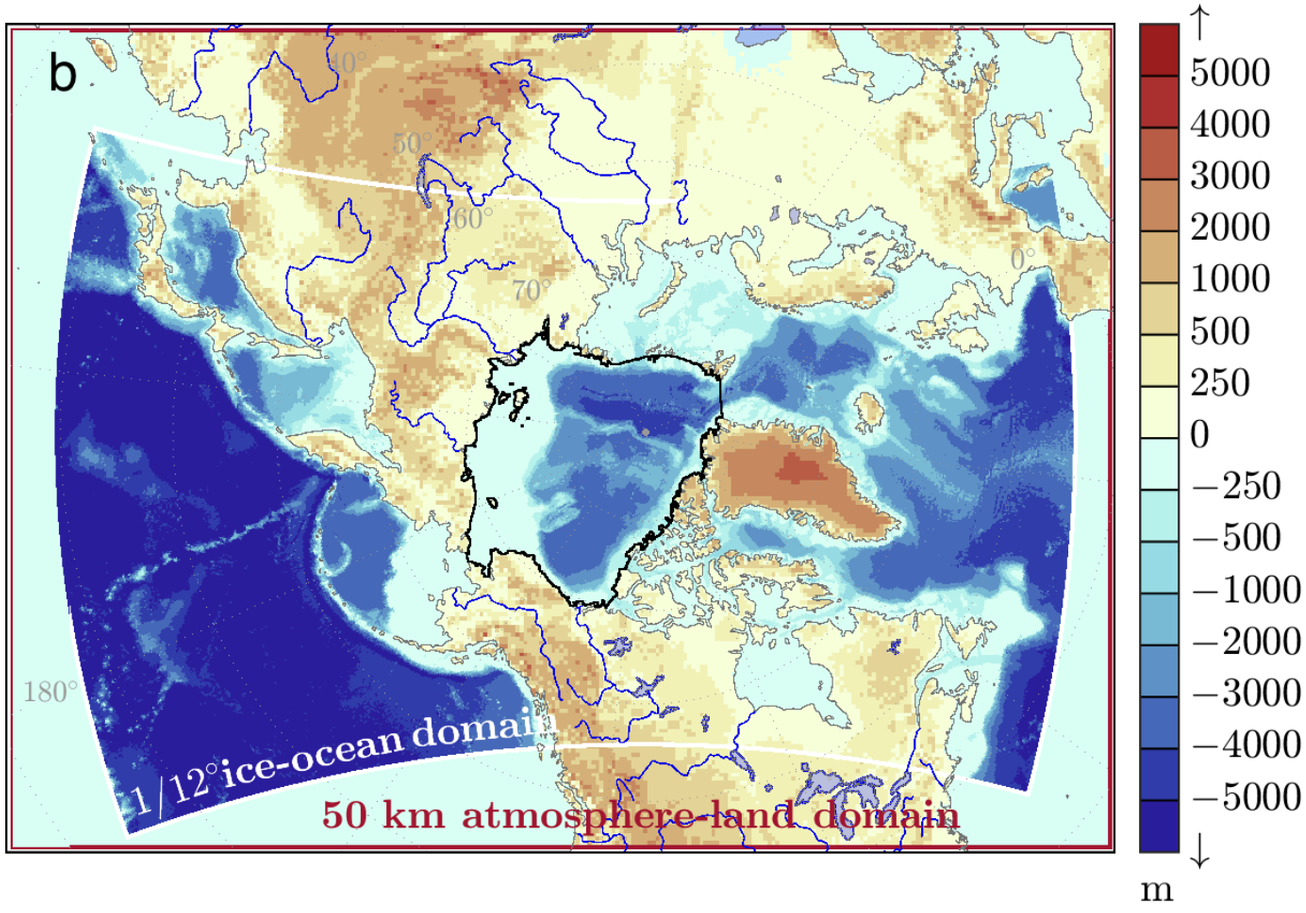

RASM Rationale

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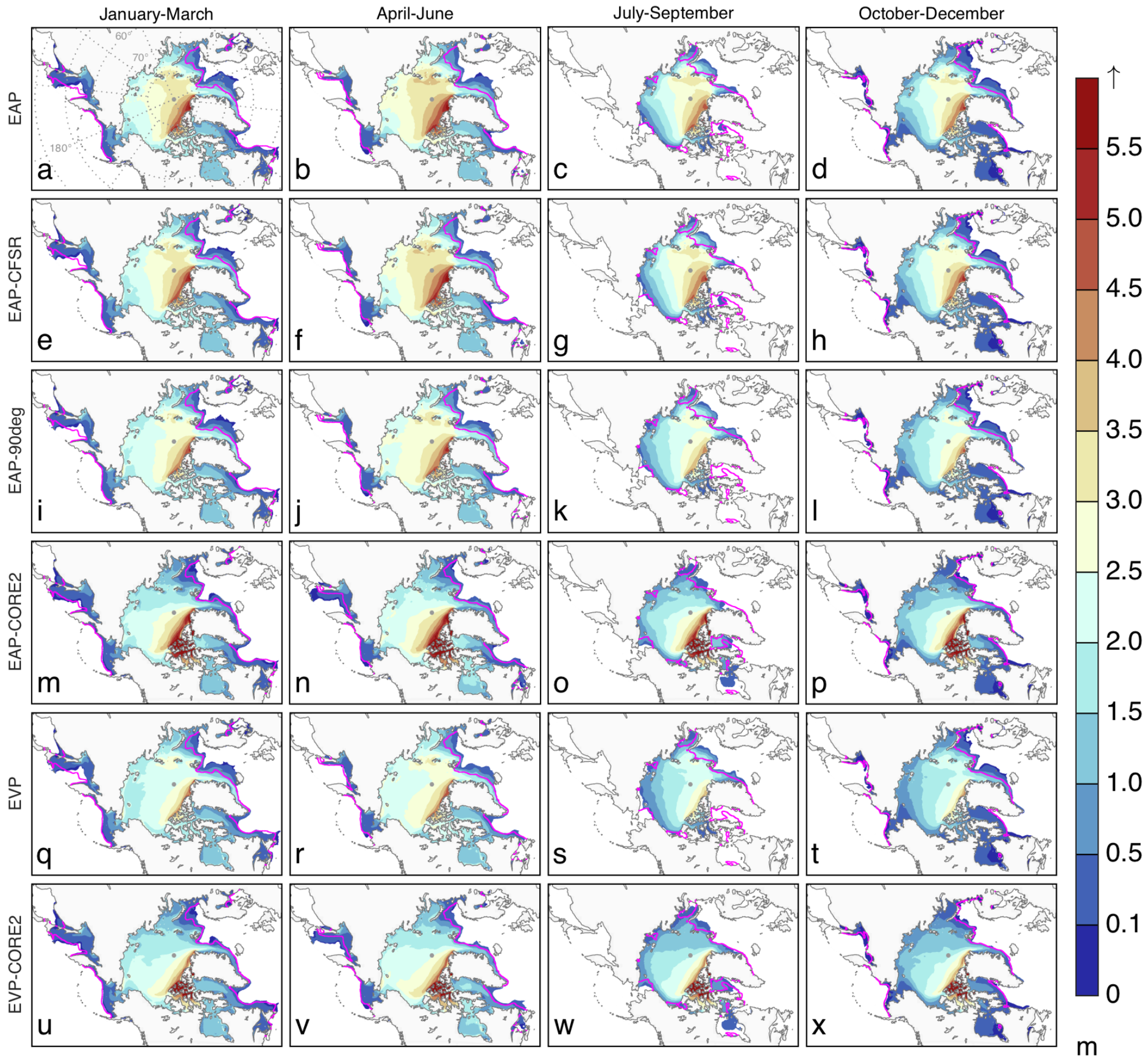
How can an Arctic System Model be used to advance understanding and prediction of Arctic change?

1. By resolving unresolved or under represented **processes** in individual system components.
2. By addressing inadequacies along **coupling** channels between different system components
3. By exploring space-dependent **sensitivities** in the parameter space
4. Through a **hierarchical modeling** approach using regional and global models to help quantify uncertainty **for seasonal to decadal prediction**.

ACME-Arctic allows expanding this approach to global scales.

1990-2010 Mean sea ice thickness and extent



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DOD HPC

RASM advances relevant to ACME-Arctic

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RASM advances relevant to ACME-Arctic

1.Improvements in coupled model analysis

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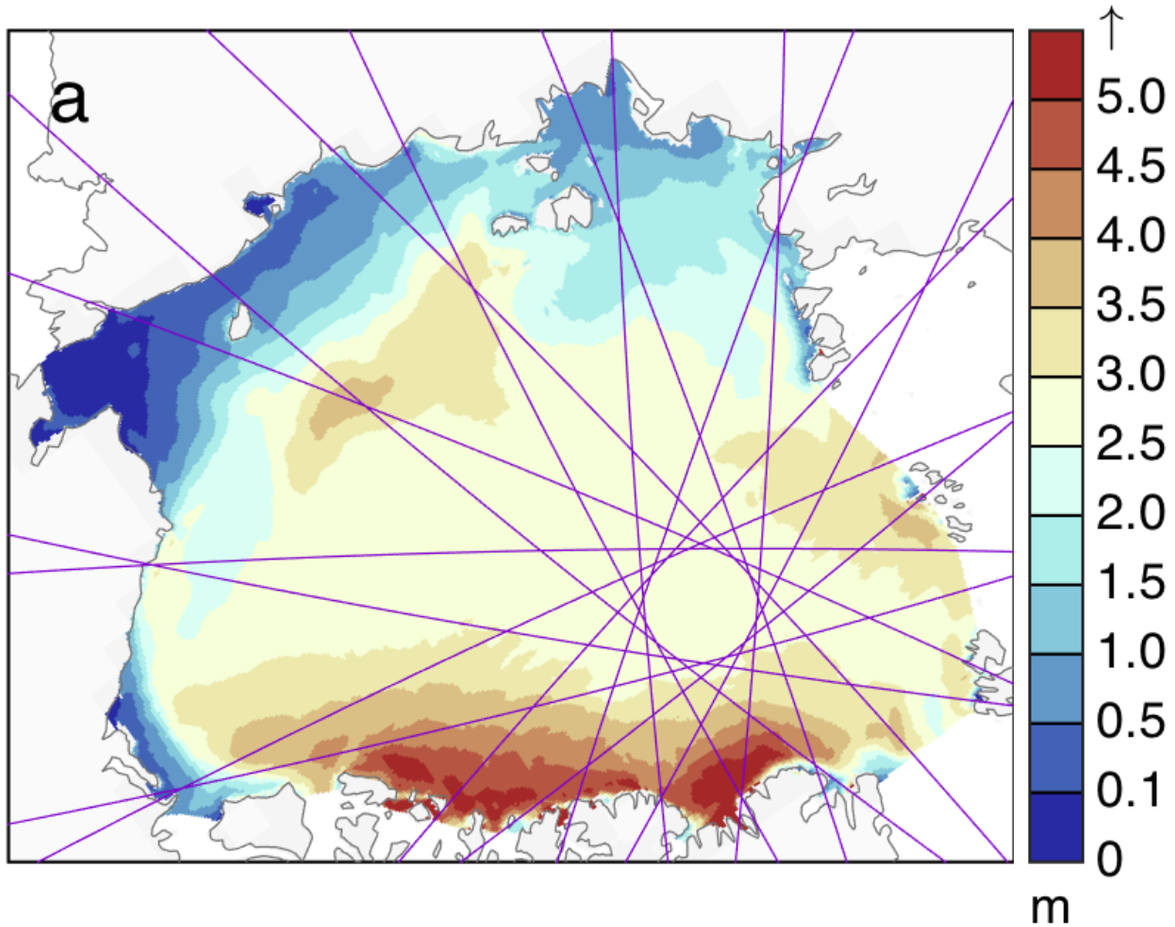

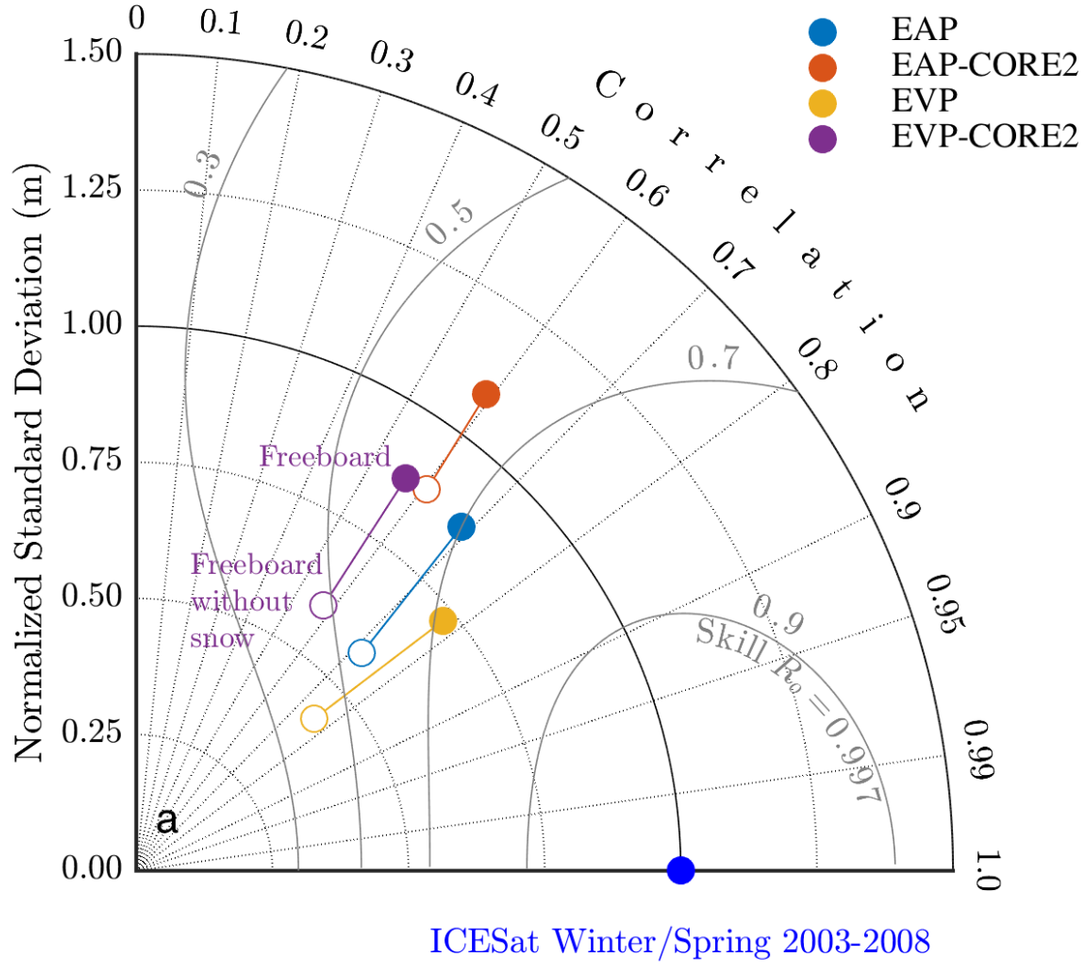

Example: Satellite emulator in readiness for ICESat-2

RASM advances relevant to ACME-Arctic

2. Scale-aware dynamics and analysis

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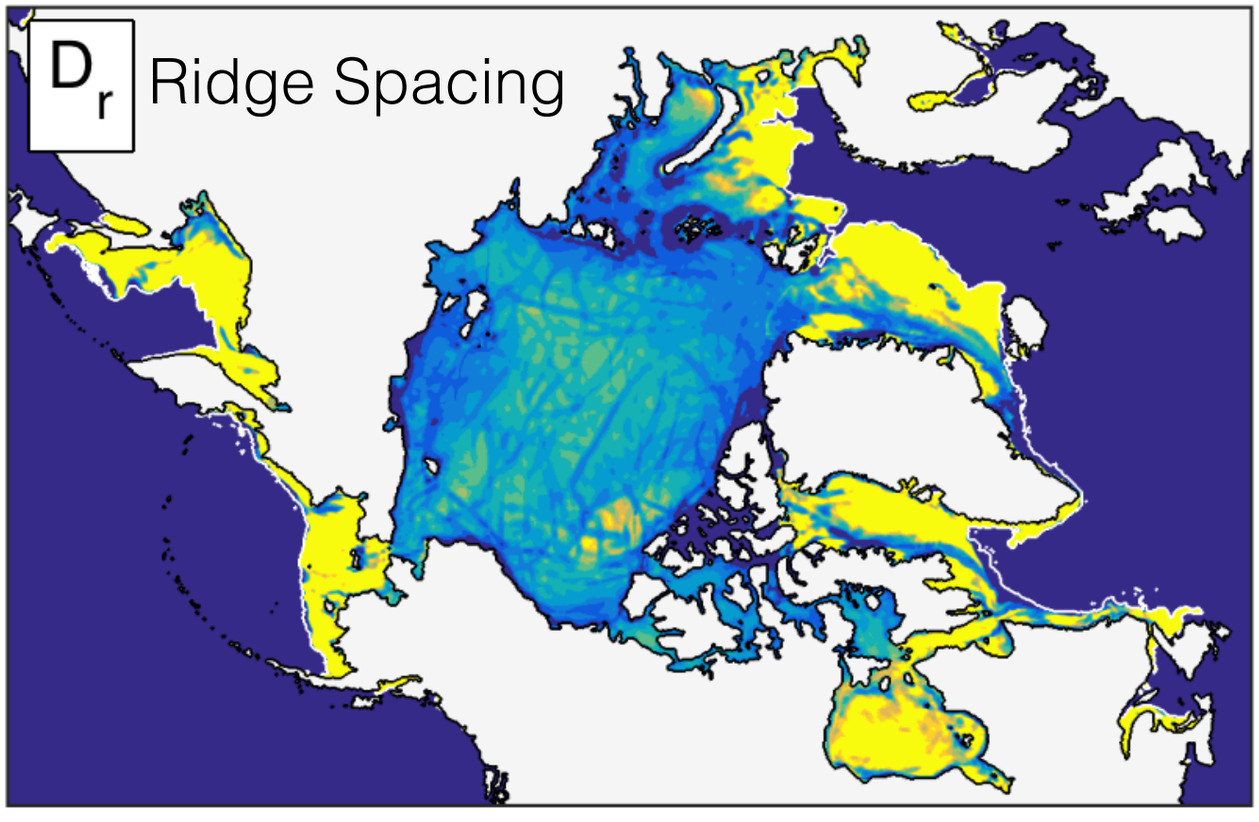

Example: Variational sea ice morphology

RASM advances relevant to ACME-Arctic

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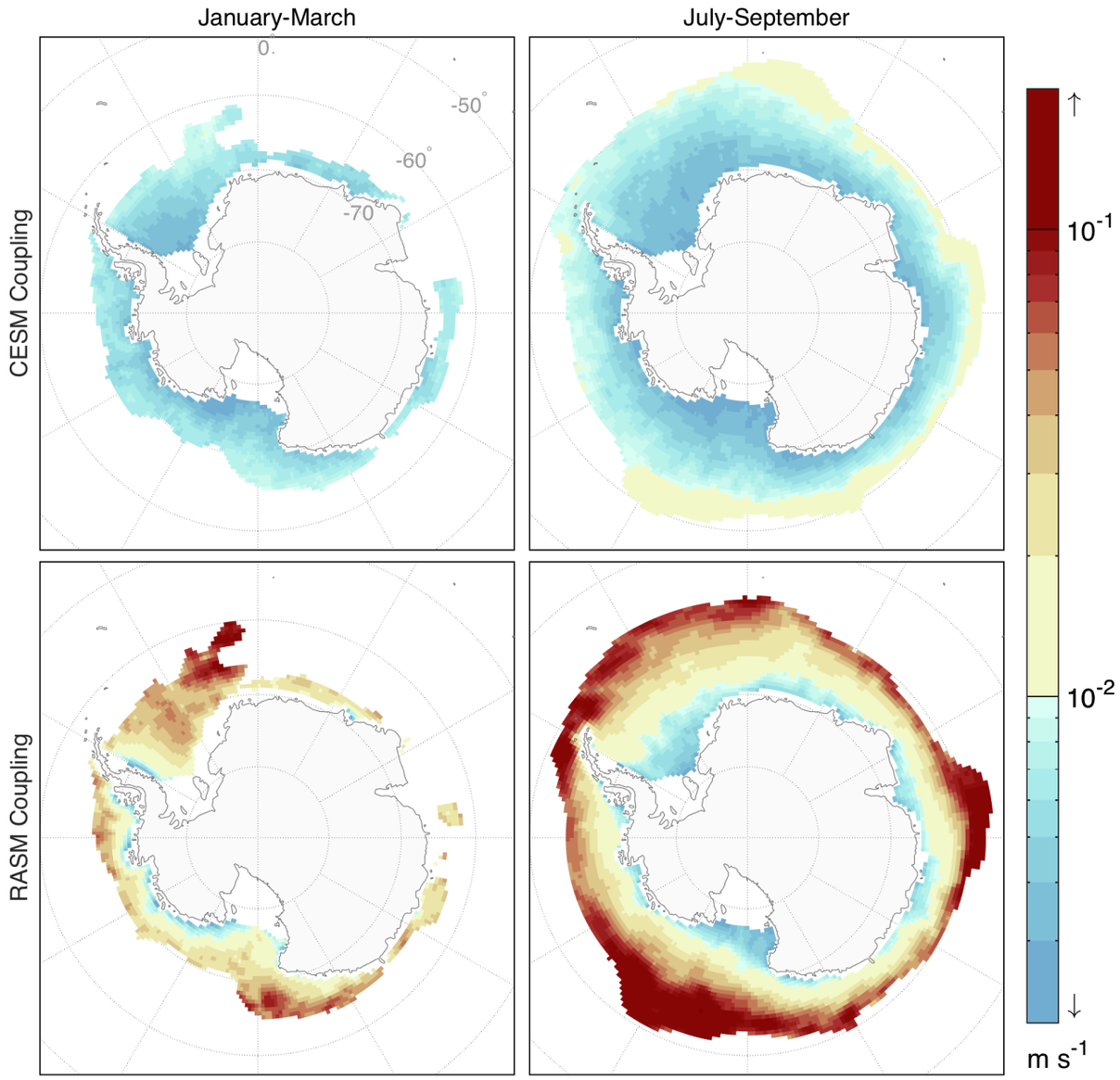
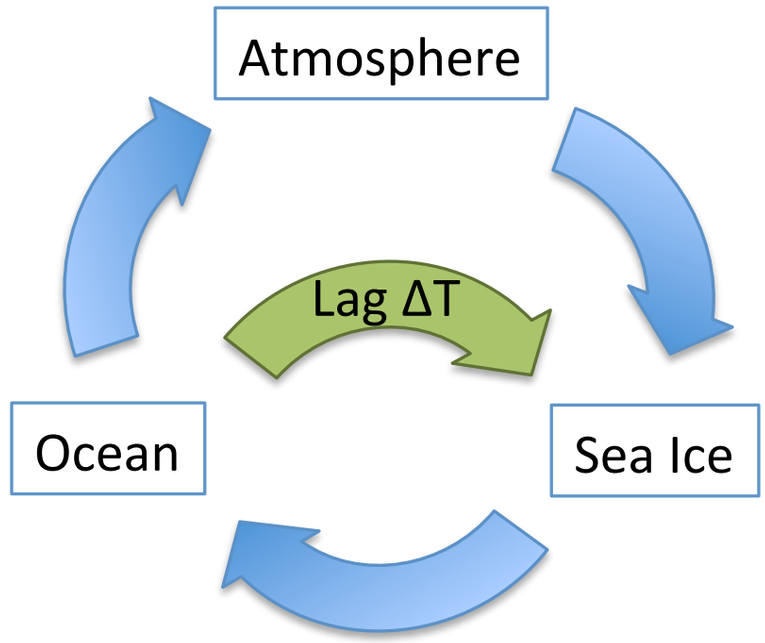
3. Advances in model coupling





Example: Reconfigured flux coupling

RASM advances relevant to ACME-Arctic

4. Advances in modeling Arctic processes

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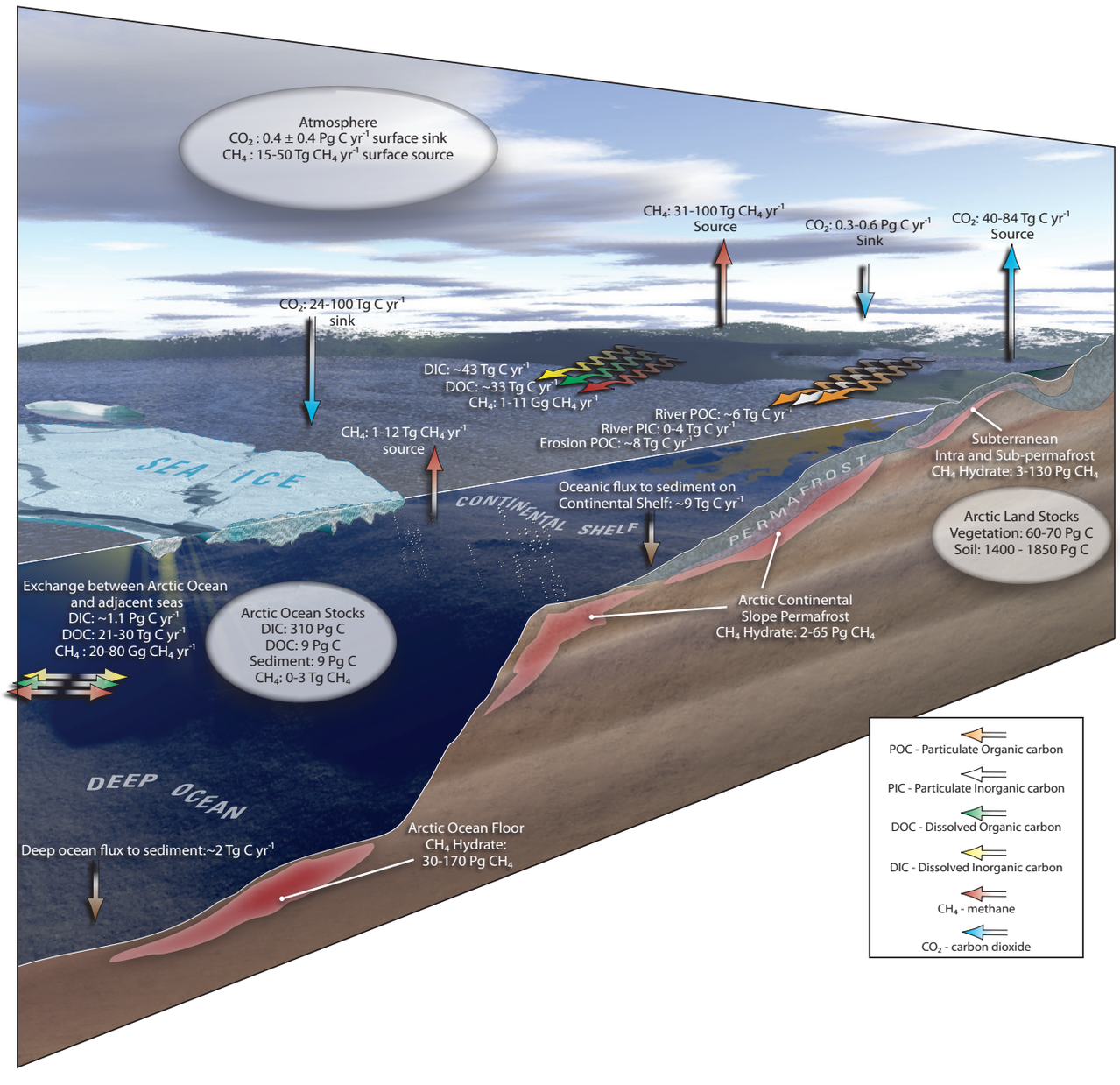
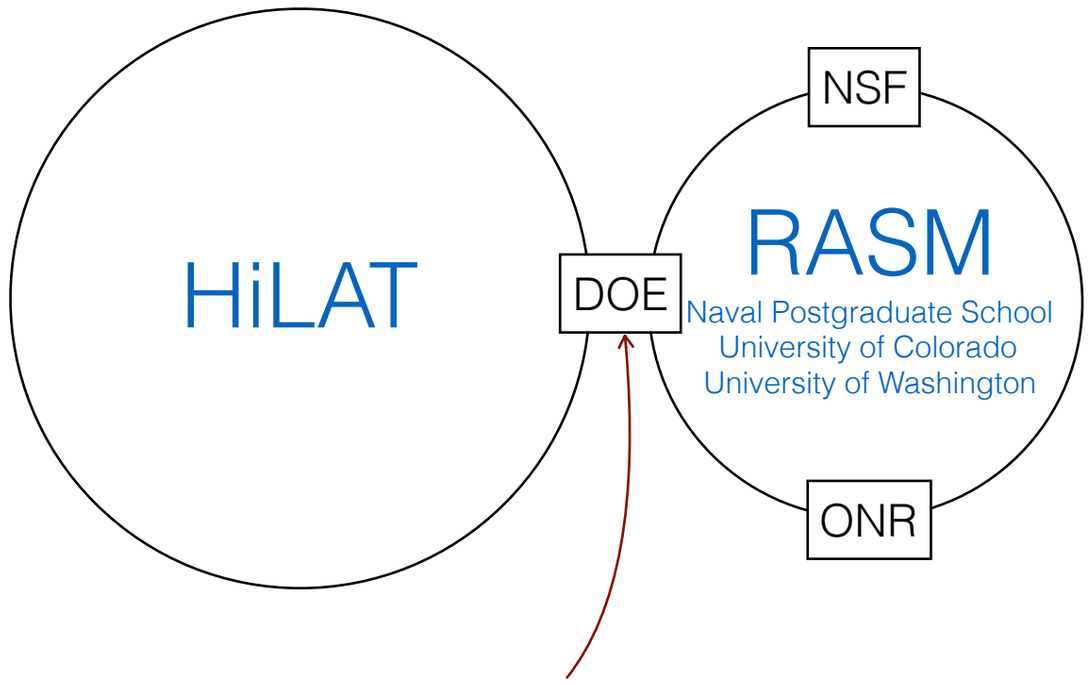
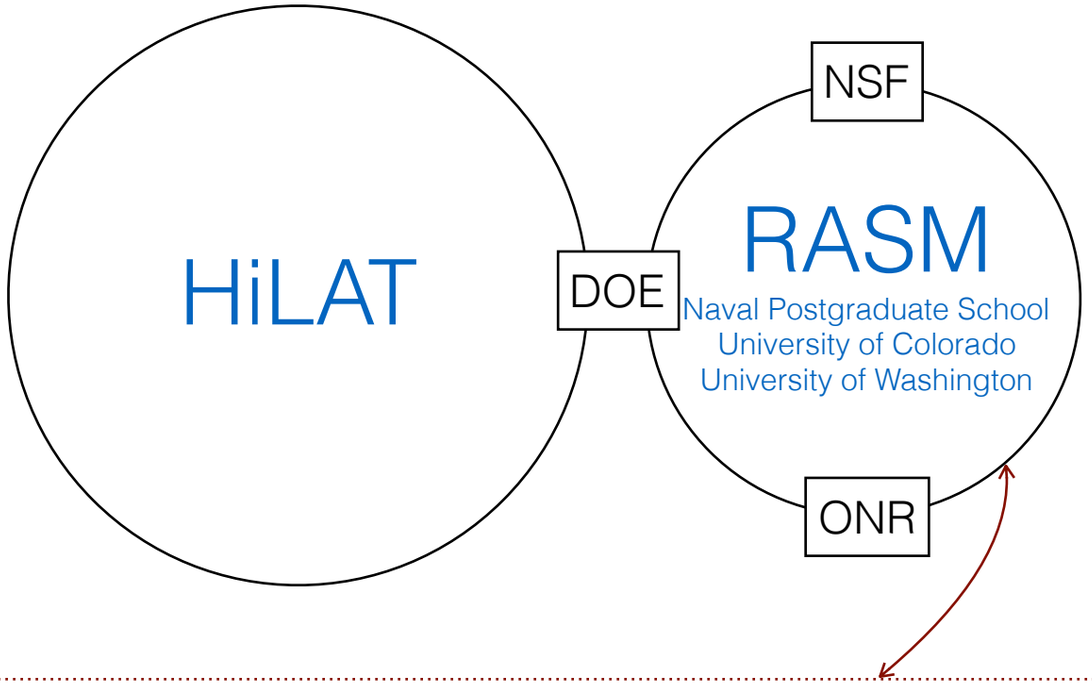


Example: Marine biogeochemistry in RASM

RASM's current RGCM project and relationship with HiLAT



The RASM group is interested in contributing to advancements in ACME Arctic



Proposed RASM contributions

- Satellite sea ice emulator for an adaptive grid
- Variational form drag for sea ice
- Scale-aware sea ice dynamics
- Evaluation and tuning of model components and their coupling
- Additional DOD HPC resources for multi-decadal simulations

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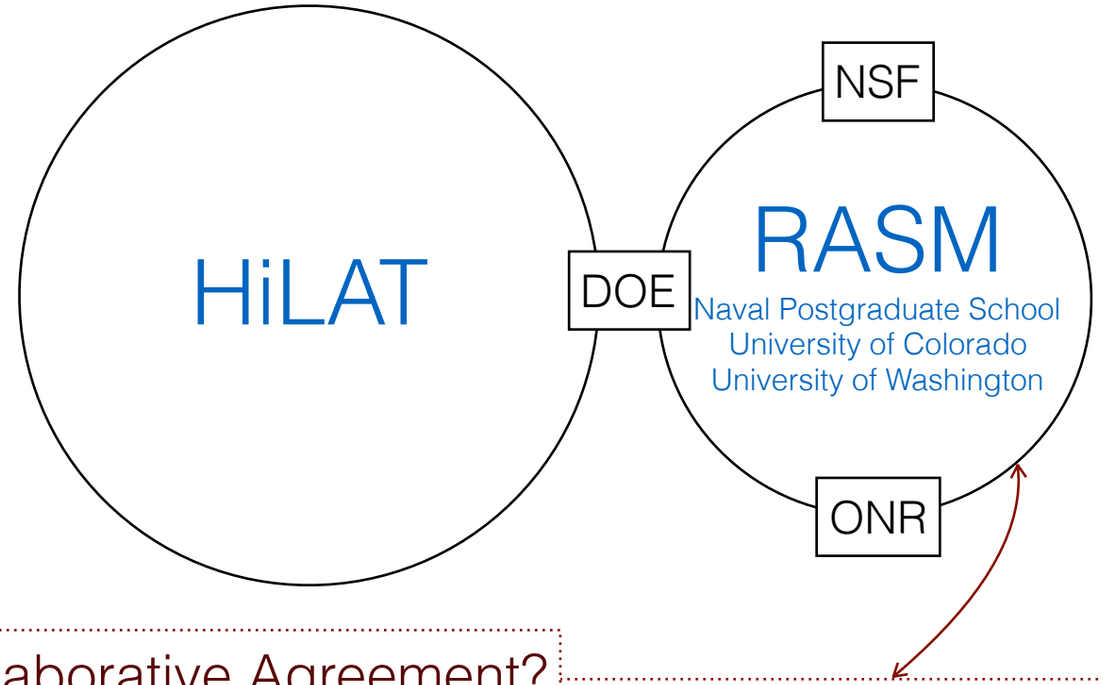

Collaborative Agreement?

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