

MMS ENVIRONMENTAL STUDIES PROGRAM: ONGOING STUDIES

Region: Alaska

Planning Areas: Beaufort Sea, Chukchi Sea, Hope Basin

Title: Sea Ice Modeling for Nearshore Beaufort and Chukchi Seas (AK-03-04)

MMS Information Needs to be Addressed: The importance to the MMS is to increase the accuracy of estimates of oil spill movement in ice in the Beaufort and Chukchi Seas. Current models are suspect inshore and have a resolution of 100-km to a few-km. This study will help resolve modeling issues for the Alaska OCS Region, increase confidence in the models used by the OCS Program, and help in review of oil-spill-contingency plans. The information will also be used for NEPA analysis and documentation for Beaufort Lease Sales and DPPs.

Total Cost: \$1,000,000

Period of Performance: FY 2003-2008

Conducting Organization: NASA

MMS Contact: [Chief, Alaska Environmental Studies Section](#)

Description:

Background The MMS used the results of the FY 2002 sea ice modeling workshop to focus on what is needed from this next-generation effort addressing the specific problem of modeling fine scale ice/ocean and ice/ice interactions.

Most basin-scale dynamic-thermodynamic models use relatively simple thermodynamics and an ice thickness distribution that approximates the ice as slabs of one to a few meters mean thickness plus open water. While sufficient as a first approximation of the arctic ice pack, such treatment lacks the ability to sufficiently resolve the observed spectrum of ice thickness from thin new ice to thick ridged ice to fast ice. The ice models in current state-of-the-art coupled ice/ocean models, including those current Rutgers and CMI models contracted by MMS, are based on empirical ice physics valid at a 100-km scale and extrapolated to smaller grid dimensions. Even at the larger scale, new satellite remote sensing data demonstrates that the first order physics of lead formation is not correctly depicted in existing ice models.

Development of this next-generation ice model is being jointly funded through an IA with NASA. Some aspects of the model are being developed under separate, additional funding by the National Science Foundation and Office of Naval Research. For MMS purposes, this new generation ice model would need to increase spatial resolution, improve modeling of fracture patterns and ice formation, better track observed ice interactions and lead toward better modeling of nearshore interactions.

Objectives The objective of this study is to improve the state of the art in ice or ice/ocean modeling and to produce either a stand alone ice/ocean model or an improved ice model that can be coupled to and or nested in the current MMS ice/ocean model. The existing or new model

would be applied to the nearshore Beaufort and Chukchi Seas.

Methods

1. Participate in interagency working group to co-fund new generation ice model.
2. Develop new ice model based on smaller scale parameterization.
3. Produce stand-alone ice/ocean model or couple the ice model to the current MMS ocean model.
4. Run coupled model simulations.
5. Conduct sensitivity testing and validation of the model results.

Current Status: A new concept for data assimilation using ice strength has been developed that helps to reduce model inconsistencies. Simulations of the ice pack have been performed. The model formulation and parameterization is nearly finished and model solutions are now being computed.

Final Report Due: September 2008

Publications Completed:

Schreyer HL, Sulsky DL, Munday LB, Coon MD, and Kwok R. Elastic-Decohesive Constitutive Model for Sea Ice. *Journal of Geophysical Research* 2006; 111: 21 pp.

Sulsky DL, Schreyer HL, Peterson K, Kwok R, and Coon MD. Using the Material-Point Method to Model Sea Ice Dynamics. *Journal of Geophysical Research* 2007; 112:49 pp.

Coon MD, Kwok R, Levy G, Pruis M, Schreyer HL, and Sulsky DL. AIDJEX Assumptions Revisited and Found Inadequate. *Journal of Geophysical Research* 2007; 112:34 pp.

Affiliated WWW Sites: <http://www.math.unm.edu/~sulsky/research/seaice/seaice.html>
<http://www.mms.gov/alaska/>

Revised Date: March 2008