PIPS 3.0

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LONG-TERM GOALS

To develop, test, demonstrate and evaluate nowcast/forecast systems for polar sea ice. These systems are developed and tested in this 6.2 program and then transitioned into a 6.4 program for final evaluation and testing under near real time operational conditions. This project is specifically designed to address improvements to the sea ice model presently used by the U.S. Navy as part of its Polar Ice Prediction System 2.0 (PIPS 2.0).

OBJECTIVES

The objective of this project is to upgrade the existing PIPS 2.0 sea ice forecasting system by including in the model advances in our knowledge of sea ice dynamics and thermodynamics that have taken place over the past decade. In addition, improvements to the interaction of sea ice with both the atmospheric forcing (one way coupling) and ocean forcing (two-way coupling to the ocean model) are a key part of the PIPS 3.0. Data assimilation is also a key part of this system and as such new strategies for data assimilation will be incorporated into the PIPS 3.0 system. Once the appropriate model is developed and tested, it will be transitioned into the U.S. Navy's 6.4 programs for advanced developmental testing before transition into operations, the ultimate goal of the project.

APPROACH

The approach being taken to upgrade the PIPS 2.0 to a PIPS 3.0 system is through the interaction of a team of scientists that spans from the academic community directly to the operational user of the product. The academic community is working with the numerical modeling group at the Naval Post Graduate School (NPS) to incorporate changes to the existing code. NPS scientists test these changes for valid improvement to the PIPS 2.0 system. The final improved system is then forwarded to the Naval Research Laboratory for 6.4 near operational testing before operational delivery. Throughout this procedure, the ultimate user of the product, the National Ice Center (NIC), is kept advised of progress. As the user, the NIC is also asked for input concerning the resultant products and how they

may be used. Key individuals working on this project are: Pamela Posey who obtains and provides atmospheric forcing, and who runs the test versions of the PIPS 2.0/PIPS 3.0 systems.

WORK COMPLETED

During this year we have interacted with other team members at two PIPS 3.0 working group meetings, held at the Fleet Numerical Meteorology and Oceanography Center, and attended by personnel from the National Ice Center (NIC), users of the operational product. Briefs on PIPS 3.0 development and testing were given at both meetings.

During this year, the bulk of our effort was directed at testing the Los Alamos CICE model with respect to PIPS 3.0 applications. CICE was obtained from the Los Alamos website and example tests were run. In addition, tests on a 9 km Arctic grid, set up by the Naval Postgraduate School, were run. These test cases included a monthly mean climatological ocean. Tests of the CICE model on this grid were forced by a year of ECMWF forcing. In addition, NOGAPS forcing for several years has been interpolated to the 9 km grid for model testing.

The goal of the PIPS 3.0 modeling project is to provide an improved sea ice forecast system consisting of an improved ice model and an improved ocean model. The decision was made this year to couple the ice model to a global ocean model as opposed to an ocean model limited to the high latitudes of the northern hemisphere. The CICE model will be coupled to the Navy's 1/8 degree Global NCOM model during the coming fiscal year. Before this coupling takes place, most of the testing of this CICE model application will use the 9 km Arctic region grid using the climatological ocean. These tests will be more manageable then tests run using the entire global grid.

RESULTS

Tests of the CICE model were successfully generated using 1984 ECMWF atmospheric forcing. For this run, five categories of ice thickness were used. The five categories were defined by the following ice thickness values: 1) 0-0.644 meters, 2) 0.645 – 1.391 meters, 3) 1.392 – 2.470 meters, 4) 2.471 – 4.567 meters and 5) 4.568 – 10 meters. Ice concentration associated with each of these thickness categories represents a unique way to distinguishing new ice grow and ice edge movement during the grow season. Figure 1 shows the ice thickness for each of the 5 categories for March of 1984.

IMPACT/APPLICATIONS

Although this project should provide a valuable demonstration of how improvements to forecast systems or even the development of forecast systems can be accomplished by creating a team of scientists covering the entire pathway from 6.1-6.2-6.4-operations-users. The ultimate goal is to provide an improved ice model that will result in upgraded products for the end user.

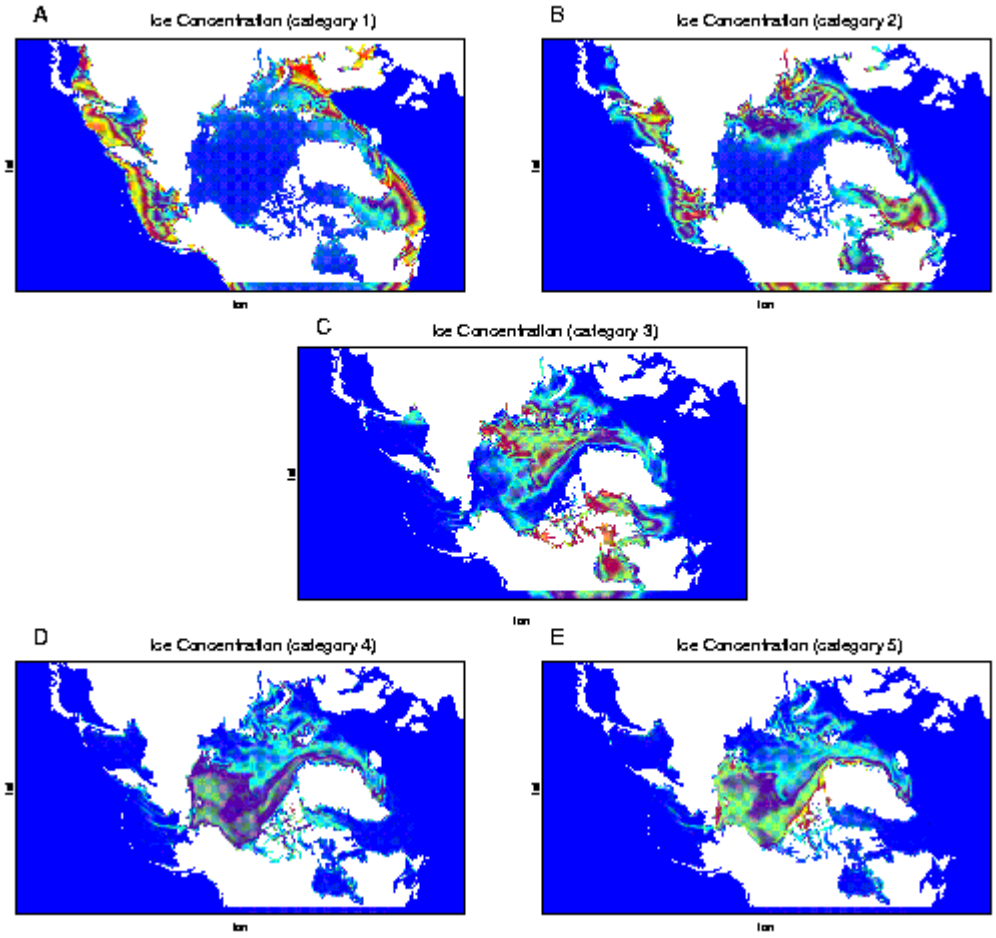

Figure 1. Ice concentration from March, 1984 for the PIPS 3.0 9 km grid. Each figure represents the concentration for a different ice thickness category A) 0 - 0.644m, B) 0.645 – 1.391m, C) 1.392 – 2.47m, D) 2.471 – 4.567m and E) 4.568 – 10.0 m. Teal blue colors indicate lowest concentration while red indicates highest concentration.

TRANSITIONS

Transitions from this project will go directly into the 6.4 SPAWARS PIPS 2.0 Scalable Upgrade project with the ultimate goal being an upgrade to the PIPS 2.0 operational system.

RELATED PROJECTS

Several ONR Arctic program funded projects, such as the development of new ice rheologies and the evaluation office and ocean models used in these forecasts systems.

NIC Post Doctoral Program

REFERENCES

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PUBLICATIONS

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