



The University of  
**Montana**

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September 16, 2011

Dr. Ian Rutt

Department of Geography, College of Science

Swansea University

Singleton Park, Swansea SA2 8PP

United Kingdom

Dear Ian:

On behalf of our research group at the University of Montana, and as the co-chair of the Community Earth System Model (CESM) Land Ice Working Group (LIWG), I am writing to outline our support for your NERC proposal "Shared frameworks for next-generation ice sheet modelling".

Presently, the land ice component of Glimmer/CISM is in a state of frenetic development. Significant financial and human resources are being devoted to its improvement, and multiple federal agencies are supporting the efforts (see for instance letter of support from Lipscomb, outlining DOE efforts). Important ice sheet modelling tasks have been broken down into manageable components, and I am confident that these components will represent *state-of-the-art* improvements to the physical and numerical portions of Glimmer-CISM, as well as unique couplings to other Earth systems.

However, there is a key component that is presently missing from these efforts: the infrastructure to facilitate data transfer between the components. This is the very same infrastructure you propose to create. To date, data transfer, or communication between model components has been done in an ad-hoc manner, and based upon the existing infrastructure of Glimmer-CISM. It is a credit to your earlier efforts that so much has been accomplished with the model interface that you created nearly a decade ago.

However, it is now clear that the coupling of climate models to improved ice sheet models will require additional resources. I believe that you and your colleagues are far and away the best-qualified team to lead this essential activity. Indeed, you already have been providing software



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assistance as a steering committee member. The proposal allows you to formalize your role, and find some compensation for your efforts.

My research group will benefit tremendously from the proposed activities. Coordination of the software interface will greatly reduce the time until Glimmer-CISM a world-class platform for conducting ice sheet research. Our existing funded efforts are sure to benefit from such a tool, as will future research programs. Specifically, we are assimilating data from multiple sources to arrive at a credible present state for the ice-sheet, an essential component of forward modeling and sea-level prediction. We look forward to the day when these experiments are carried out with Glimmer-CISM and a more sophisticated and tightly coupled climate forcing.

The proposed research will also provide a significant boost to the LIWG and its activities. As a co-chair of the group, I know that many loose ends of existing research would be cleaned up with your help. I also know that teams could focus on core strengths rather than the software engineering. This would be a major benefit to the CESM development as well. Moreover, a centralized program with a global view of the software interconnections would accelerate efforts to provide refined estimates of the sea-level change associated with a warming climate.

The LIWG will provide a management structure and meeting schedule that should make your efforts easier. Presently we organize meetings twice a year. Funded projects report at those meetings, and there are many informal meetings happening between sessions. Should you receive funding, this meeting structure will allow you to learn about other efforts, and collaborate with their leaders to assure that the correct software coupling takes place.

At this time, our total funding for ice sheet modeling in the next four years is **\$1.37 million**. Our research group is developing two components for Glimmer-CISM. One is a model for basal water transport, which is now moving to LANL. We started that work and are familiar with the modules that are used, and the structure of the coupling between ice sliding and basal water. Our other project involves improvements to the momentum balance of Glimmer-CISM and production of an adjoint to that code. Both will ultimately need to be included in Glimmer-CISM in a more prominent way, and we look forward to working with you to assure that it is done in a manner that you define as consistent with best practices in software engineering.

Summarizing, we are excited about your proposal as it will provide a badly needed level of software coordination. Through the LIWG, we are happy to contribute a meeting and management structure to your efforts. Through our funded efforts, we will also be contributing new components of Glimmer-CISM, which will become a part of your own software efforts.



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Finally, we understand how Glimmer-CISM works, and look forward to being testers of your newly developed couplings. I wish you all the best with this proposal.

Sincerely,

Jesse V. Johnson

Associate Professor of Computer Science

The University of Montana, Missoula