# Justification of resources: Shared frameworks for next-generation ice sheet modelling

## Directly Incurred

## *Framework development workshops*

A major aspect of this proposal is the need to bring different areas of expertise together to discuss and agree on the needs and specification of an Ice Sheet Model/ Climate model Application Programming Interface(API). Very little collaborative work of this nature has so far been done by the communities who work directly with ice sheet models, or on their coupling to Ice Sheet Models, although many individuals have developed their own solutions. We feel it important that we can bring our partners, and some of our supporters, together for focused workshops as a primary means to tackling this problem. We thus request support for two workshops.

The first workshop will permit the wider partnership the opportunity to explore the nature of the problem, to share existing approaches, and to begin to explore aspects of an API needs specification that will be adequate to tackling this problem. We need to make sure there is enough time to define and agree on the bare bones of an API, encompassing both process/ scientific (what and when ice sheet/ climate systems need to exchange information about) and technical/ software aspects (what are the data models used, what software tools will best permit coupling across a range of different models and platforms). In total we feel it will thus be necessary to devote *four days* to the first workshop. Equally, we feel a similar period is required for the second workshop if we are to report fully on the implementation of the API within Glimmer-CISM and Hadley Centre models as an instance of the working API, to resolve possible areas of difficulty, and to consider how best to extend and move the API forward on the basis of the initial experience. We also wish to allocated time at each workshop to discuss the best ways to further bring the community together in a longer-term network. To each workshop we will invite our current list of 20, direct project participants, with an additional 2 (flexible) spaces for Research staff working with our Partners at Los Alamos and Montana. We request a further two unallocated spaces to allow us some latitude to invite further participants into the project given the rapid turnaround of this call. We have budgeted a per-head allocation of £150 per day for all-inclusive accommodation, and for £500 in respect of travel costs though we anticipate that some costs will be higher and others lower. In addition we request support for the rental of meeting rooms to run the workshop. The costs for one workshop are each allocated to Edinburgh and Swansea respectively as the responsible investigator’s organisation respectively. We appreciate that major costs are involved with this workshops but we feel this is the most effective way of making a step-advance in developing a community-shared API implementation. Additionally we request funds for secretarial/ administrative support for the workshops at both Swansea and Edinburgh (For internal reasons this appears as a Directly Allocated cost in Edinburgh’s case)

***Training events***

In our overall aim of widening awareness of the API, and increasing experience with Glimmer-CISM in particular, will be made possible to a large degree by the provision of the training events. We thus request support in the running of the training events, though we will request that participants support their own travel and accommodation requirements. We aim to seek additional funding in respect of graduate student travel. We will run three training events and request support for the team’s investigators to be able to travel to these, and to provide for rooms in which the training can be held.

***Support for investigator team meetings.***

## The investigator team needs to be able to meet frequently in order to ensure good communication and reporting in respect of the project’s progress. We will meet in approximate rotation in Swansea, Bristol and Edinburgh with occasional visits to Partner Ridley (Exeter) and Gregory (Reading). We thus request for each institutional moderate funds in support of travel and subsistence in support of these visits.

***Conference Attendance.***

The nature of the project, and in particular the intended impact pathways means it is best exposed at international inter-disciplinary conferences. In particular, we intend that in the final year of the project we will convene special sessions at each of EGU and AGU to report on our work, promote the API, and to further establishment of the longer term network proposed. We thus request funding to support conference attendance for each of the investigators to attend two international conferences

***Dedicated programmer to support GUI development (Swansea)***

An important aspect of our proposed research is to ensure that we can widen accessibility and use of Glimmer-CISM to the international community. The training events are one aspect of this, but in addition we will develop a new Graphical User Interface (GUI) front-end to Glimmer-CISM that will make set-up and operation of the model far easier, and also support particular pre-compiled versions of the code. This is particularly targeted at providing good tools for student (particularly Postgraduate) use, and in support of new user of the model, but we intend that it would permit wider public access to the model. We request 4 months of a graduate programmers time (Swansea) to support this development. Considering the substantive investment (>£1M), that has gone into the recent development of Glimmer in the US, increasing its use and accessibility this way represents significant added value.

## Other directly incurred costs:

We request funds to support a laptop for the project, principally for Co-I researcher Hagdorn specifically to mount and prepare the new GUI and other resources for preparation at workshops, training events and conferences. We request two portable drives to enable backup of large data sets in support of these events.

## Directly allocated

### Investigator effort

PI Rutt will spend 10% of his time on the project over its duration. In addition to managing the project as a whole, and in particular the liaison with our project Partners, he will be primarily responsible (with Hagdorn) for developing the API specification, and overseeing its implementation in Glimmer-CISM in collaboration with Partners at Los Alamos(Lipscombe) and Montana(Johnson). He will manage Workshop 2. Co-I Payne will spend 6% of his time on the project. He will be primarily responsible for ensuring the implementation of the API in the Hadley centre models in collaboration with partners Ridley and Gregory. Co-I Hulton will also spend 6% of this time on the project. He will steer the initial API requirements specification and organise the first workshop

Technical developments in the project are predicated on the ability to produce excellent software design, and to be able to modify existing versions of Glimmer-CISM. We request a 50% Researcher-Co-Investigator position for Magnus Hagdorn for the duration of the project. Dr Hagdorn was responsible for many of the original major developments within Glimmer, particular in the design of the software architecture and external interfaces. Much of this original design is still reflected in the code and Dr. Hagdorn is uniquely positioned to be able to work on the design interface. He currently has a specialist software support role in Edinburgh, in particular supporting model installation and adaptation in the Centre for Earth System Modelling; he has maintained his links with Glimmer-CISM, serving on the steering committee. He will be released from 50% of his current role for dedicated work on this project. Hagdorn will be mainly responsible for the API specification and its implementation within Glimmer-CISM including any overall code architecture redesign that is necessary. He will take the lead in the preparation of API and Glimmer-CISM documentation.

All of the investigators will be involved in the preparation and delivery of the training events, require time for meetings and communication, workshop and conference attendance relating to the project. In addition, all of the investigators will be involved in the preparation of academic publications and in the preparation of documentation for the API and Glimmer