GLACIODYN

Hansbreen, Svalbard
c. J. Jania

1.0 PROPOSER INFORMATION

1.1 Title of Activity

The dynamic response of Arctic glaciers to global warming

1.2 Short Form Title of Proposed Activity

GLACIODYN

1.3 Activity Leader Details

First Name	Surname	
Johannes	Oerlemans	
Affiliation		Country
Utrecht University		Netherlands

1.4 Lead International Organisation(s) (if applicable)

IASC Working Group on Arctic Glaciology	

1.5 Other Countries involved in the activity

Iceland	Norway	Canada	Denmark
Switzerland	U.S.A.	Austria	France
United Kingdom	Sweden	Germany	Japan
Russia	Poland	Finland	China
Spain			

1.6 Expression of Intent ID #'s brought together in the proposed activity(Lead first)

30	654	756	684	685	897				

1.7 Location of Field Activities (Arctic, Antarctic or Bipolar)

Arctic

1.8 Which IPY themes are addressed (insert X where appropriate)

1. Current state of the environment	X	4. Exploring new frontiers	X
2. Change in the polar regions	X	5. The polar regions as vantage points	X
3. Polar-global linkages/tele-connections	X	6. The human dimension in polar regions	X

1.9 What is the main IPY target addressed by this activity (insert X for 1 choice)

1. Natural or social science	X	3. Education, Outreach, Communication	
2. Data management		4. Legacy	

2.0 SUMMARY OF THE ACTIVITY *(maximum of 1 page A4)*

Global warming will have a large impact on glaciers in the Arctic region. Changes in the extent of glaciers will effect sea level, and may lead to substantial changes in sediment and fresh water supplies to embayments and fjords.
In ACIA, a simple approach was taken to estimate the runoff of all glaciers in the Arctic for a set of climate-change scenarios. Changes in the surface mass balance were calculated without dealing with the fact that glacier geometries will change. It was also assumed that the rate of iceberg production at calving fronts would not change.
To arrive at more accurate predictions, we propose an internationally-coordinated effort to study the dynamics of Arctic glaciers and develop new tools to deal with this dynamic response. The key elements of this effort are (i) to *make better use of observational techniques* to assess the detailed dynamics of a key set of glaciers, and (ii) to *develop models* that can be used to aggregrate data and that are sufficiently robust to have predictive power. A set of target glaciers have been identified for intensive observations (in situ and from space) for the period 2007-2010. This set covers a wide range of climatic/geographical settings and takes maximum advantage of prior long-term studies.
The target glaciers are:

- Academy of Sciences Ice Cap (Severnaya Zemlya)
- Glacier No. 1 (Hall Island, Franz Josef Land)
- Austfonna (Svalbard)
- Hansbreen (Svalbard)
- Kronebreen (Svalbard)
- Kongsvegen (Svalbard)
- North Scandinavia transect (Langfjordjøkelen, Storglaciären, Marmaglaciären)
- Vatnajökull (Iceland)
- Kangerlussuaq basin (West Greenland)
- Devon Ice Cap (Canada)
- McCall Glacier (Alaska)
- Hubbard Glacier (Alaska)
- Columbia Glacier (Alaska)

Among the target glaciers are glaciers for which information is available on length/area in historical times [reports, drawings, photographs, old maps, etc.]. This information will be combined with the newly derived maps to reconstruct glacier evolution from the Little Ice Age into the present. This will provide a better perspective for projecting changes in the coming century.
Special attention will be given to tidewater glaciers. We want to look carefully at the interaction between surface processes and dynamics (e.g. the influence of meltwater supply on ice velocities and consequently calving rates; interactions between terminal moraines, sediment flux, and ice velocities). In a warming world some glaciers will transform from cold to polythermal, or from polythermal to temperate. We want to study the effect of such transitions on glacier dynamics and related rates of retreat. Another important aspect of study is the surface albedo. Poor drainage of meltwater may lead to more extensive zones of soaked snow and supraglacial lakes (as seen in large parts of the Greenland Ice Sheet), thus enlarging the sensitivity of ablation rates to warming.
Model development will be conducted in parallel with the observational programmes. The modelling work will deal with processes acting on the smaller scale (e.g. parameterization of the calving process) and on the larger scale (e.g. global dynamics of tidewater glaciers, response to climate change, interaction with sediment dynamics).

2.1 What is the evidence of inter-disciplinarity in this activity?

Researchers with very different backgrounds (remote sensing, geophysics, meteorology, hydrology, glaciology, sedimentology, palaeoclimatology) will work together to understand the behaviour and interaction of glaciers with their environment.

2.2 What will be the significant advances/developments from this activity? What will be the major deliverables, including the outputs for your peers?

Because the work is focusing on a limited set of target glaciers, it is hoped that research will be less scattered than has been the case so far. Getting a focus is a very important aspect of this programme. The major deliverables will be: #1 Extensive datasets for target glaciers around the Arctic. #2 A better understanding of the factors that control the dynamic response of Arctic glaciers to climate change. #3 Improved techniques to retrieve glacier parameters from satellite data. #4 Models that can be used to predict glacier behaviour for imposed climate change scenarios. #5 Improved estimates of the contribution of Arctic glaciers to future sea-level rise

2.3 Outline the geographical location(s) for the proposed field work (approximate coordinates will be helpful if possible)

Location(s)	Coordinates
Severnaya Zemlya	
Franz Josef Land	
Svalbard	
Northern Scandinavia	
Iceland	
West Greenland	
Northwest Canada	
Alaska	

2.4 Define the approximate timeframe(s) for proposed field activities?

Arctic Fieldwork time frame(s)	**Antarctic** Fieldwork time frame(s)
04/07 – 09/07	mm/yy – mm/yy
04/08 – 09/08	mm/yy – mm/yy
04/09 – 09/09	mm/yy – mm/yy

2.5 What major logistic support/facilities will be required for this project? (see notes)

Snow vehicles	Fixed wing aircraft
Helicopters	
Satellites (for acquiring data sets)	
Airborne Lidar and SAR for high-resolution topogaphic mapping	

Further details –
An attempt will be made to share part of the logistics for Austfonna ice cap with project #564 (Change and variability of the Arctic Systems - Nordaustlandet, Svalbard).

2.6 How will the required logistics be supplied? Have operators been approached?

Source of logistic support	X for likely potential sources	X where support agreed
Consortium of national polar operators		
Own national polar operator	X	
Another national polar operator	X	
National agency	X	
Military support		
Commercial operator	X	
Own support	X	
Other sources of support (details)		

2.7 If working in the Arctic regions, has there been contact with local indigenous groups or relevant authorities regarding access?

Yes. Austfonna Ice cap, Svalbard, is in a nature protected area where activities are restricted. Contacts have been made to the Governor of Svalbard and preliminary permissions are given.

3.0 STRUCTURE OF THE ACTIVITY

3.1 Origin of the activity(X for one choice)

Is this a new activity developed for the IPY period?	
Is this activity the start of a new programme that will outlive IPY?	X
Is this a pulse of activity during 2007-2009 within an existing programme?	
If part of an existing programme please name the programme -	

3.2 How will the activity be organised and managed? Describe the proposed management structure and means for coordinating across the cluster

The programme will be carried out under the auspices of the IASC Working Group on Arctic Glaciology (IASC-WAG). The annual IASC-WAG meeting and workshop will be the main occasion for discussion of results, planning of combined field work, analysis and synthesis of the results, and shaping of the output. The Working Group has national representatives from 21 countries (see http://www.phys.uu.nl/%7Ewwwimau/research/ice_climate/iasc_wag/).
The daily matters are being taking care of by the Steering Committee, consisting of:
J. Oerlemans (chair), Utrecht University, Netherlands
J.-O. Hagen (vice-chair), University of Oslo, Norway
A. Glazovsky, Institute of Geography RAS, Moscow, Russia
J. Jania, University of Silesia, Poland
M. Nolan, University of Alaska, Fairbanks, U.S.A.
R. Koerner, Geological Survey of Canada

The website of the IASC-WAG will be enlarged to maintain an overview of all activities, to provide a forum for discussion, and to store data at different levels.

3.3 Will the activity leave a legacy of infrastructure and if so in what form?

It is expected that a small number of measuring platforms at key locations, notably automatic weather stations, will be given a semi-permanent status.
Accurate maps of glaciers produced by modern technology will provide benchmarks for future studies of glacier change.

3.4 Will the activity involve nations other than traditional polar nations? How will this be addressed?

Yes, see table 1.5 and 4.2

3.5 Will this activity be linked with other IPY core activities? If yes please specify

See 3.11

3.6 How will the activity manage its data? Is there a viable plan and which data management organisations/structures will be involved?

After quality control and proper documentation data will be submitted to the relevant international databanks (e.g. World data Centers for Glaciology). A meta database will be established under the IASC Working Group on Arctic Glaciology web site. Data will be accessible freely without restrictions.

3.7 Data Policy Agreement (Place X in box for agreement)

Will this activity sign up to the IPY Data Policy (see website)	X

3.8 How will the activity contribute to developing the next generation of polar scientists, logisticians, etc.?

It is expected that within the framework of GLACIODYN a considerable number of Ph.D. students will be employed. High quality science and a strong interaction among the Ph.D. students through workshops will strengthen Arctic glaciology in the future. An exchange program for PhD's and researchers will be established between the partners to facilitate future links and joint work.

3.9 How will this activity address education, outreach and communication issues outlined in the Framework document?

We want to produce an e-learning course (interactive website) with clickable models and other tools. This will have several modules at different levels. It will be possible for students to impose climate-change scenarios to model glaciers of different type and see how these glaciers react in time.
State-of-the-art 3D visualisation techniques will be used to present information and results of research in an appealing way. This will be made available for the general public; for information centers, high schools etc.

3.10 What are the proposed sources of funding for this activity?

Mainly national science foundations and national polar programmes.

3.11 Additional Comments

1. Instead of clustering EOIs, we have chosen to do a general call through Cryolist (a mailing list to which virtually all glaciologists subscribe). This was done because otherwise the focus of the original proposal would have been lost. Suggestions and comments were received from 34 individual scientists

2. We will seek collaboration with glaciologists that study tidewater glaciers in other parts of the world (Patagonia, Antarctica).

3. We envisage a close collaboration with two other potential lead projects, namely, **Greenland's Ice Sheet – reactions to past and present climate change** (#561, convenor D. Dahl-Jensen) and **Change and variability of the Arctic Systems – Nordaustlandet, Svalbard** (#564, convenor Paula Kankaanpää)

4.0 CONSORTIUM INFORMATION

4.1 Contact Details

	Lead Contact	Second Contact
Title	Prof. dr.	Prof. dr.
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4.2 Other significant consortium members and their affiliation

Name	Organisation	Country
H. Björnsson	Science Institute, University of Iceland	Iceland
H. Blatter	ETH, Zürich	Switzerland
J.A. Dowdeswell	Scott Polar Research Institute	U.K.
A. Glazovsky	Institute of Geography RAS, Moscow	Russia
M. Nolan	University of Alaska	U.S.A.
P. Holmlund	University of Stockholm	Sweden
J. Jania	University of Silesia	Poland
R.M. Koerner	Geological Survey of Canada	Canada
M. Kuhn	University of Innsbruck	Austria
H. Miller	Alfred-Wegener-Institut	Germany
J.C. Moore	University of Lapland	Finland
N. Reeh	Technical University of Denmark	Denmark
C. Ferrari	LGGE, Grenoble	France
K. Goto-Azuma	National Institute of Polar Research	Japan
L. Yuansheng	Polar Res. Institute of China, Shanghai	China
A. Sharov	Joanneum Research	Austria
L. Andreassen	NVE, Oslo	Norway
T. Pfeffer	University of Colorado	U.S.A.
M. Sharp	University of Alberta	Canada
S. Boon	University of Victoria	Canada
D. Benn	University of St. Andrews	U.K.
F. Navarro	Polytechnical University of Madrid	Spain
D. Scherer	Berlin University of Technology	Germany
J. Wadham	University of Bristol	U.K.
A. Vieli	University of Bristol	U.K.
R. Hock	University of Stockholm	Sweden
J. Kohler	Norwegian Polar Research Institute	Norway
D. Lawson	Cold Regions Research and Engineering Lab	U.S.A.
T. Johannesson	Icelandic Meteorological Office	Iceland
R. Hodgkins	University of London	U.K.
M. Griselin	CNRS, Toulouse	France
S. Tulaczyk	University of California	U.S.A.