EXPRESSION OF INTENT

FOR ACTIVITIES IN IPY 2007-2008.

Deadline for Submission - January 14, 2005
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1.0 PROPOSAL INFORMATION

1.1 Title of proposed activity

Short-Term Arctic Predictability (STAP):
A study of the variability and predictability of Arctic atmospheric, ice, ocean, and land surface events, and their interaction with global processes on the 3-90 days time scale

1.2 Acronym or short form title of proposed activity

Short-Term Arctic Predictability - STAP

1.3 Concise outline of proposed activity

SUMMARY: This scientific study will explore the variability, and associated predictability of weather, sea ice, ocean wave, and land surface processes in the Arctic region in the 3-90 days time range, with special emphasis on improving forecast guidance for high impact events in the 3-14 day lead time range.
MOTIVATION: Alaska, and the Arctic as a whole, is experiencing significant climate change, including permafrost melt, an increase in the frequency of storms and associated problems with ocean waves, storm surges, and sea ice. With these changes, more Arctic coastal communities with low coastal relief are experiencing a greater risk of coastal erosion and flooding from coastal storms. Operational forecast agencies like NOAA face increasing pressure from the emergency management and other decision-making communities for providing forecasts and warnings with ever increasing lead-time and accuracy. In particular, users require forecasts for the track, intensity, and timing of damaging storms that have a consistency from one day to the next, provide information on forecast uncertainty, and are in a probabilistic format.
BACKGROUND: Arctic weather, and other processes driven by weather, such as sea ice, ocean waves, and storm surges, are all determined and/or strongly influenced by atmospheric conditions within and outside of the Arctic. Since influences in the jet areas of the atmosphere can propagate at or above a speed of 3500 km per day, the scope of this study will expand beyond the Arctic region, to include processes in mid-latitude and tropical regions. The two-way interactions between polar and extra-polar processes on the 3-90 day time scale will be an important aspect of this study.
EXPECTED RESULTS: This study will lead to a better understanding of atmospheric, sea ice, and oceanic processes responsible for high impact weather events both within the Arctic (influenced also by mid-latitude and tropical processes), and in areas adjacent to the Arctic (influenced by Arctic weather processes). The

accumulated new scientific knowledge will enable the investigators to develop new weather forecast procedures in the areas of observing system, data assimilation, numerical modelling, and socio-economic applications, that will lead to improved weather forecasts both in the Arctic and in the surrounding areas.

RESEARCH PROGRAM ELEMENTS:

1) *Observing system*
   a) Study the effect of all supplemental IPY atmospheric, land surface, and oceanic observations in the Arctic on the skill of Numerical Weather Prediction (NWP) models, coupled with ocean wave and sea ice models
   b) Test new satellite and in-situ observing platforms and instruments
   c) Collect adaptive observations along the north Pacific Storm track, and its source region over the western tropical Pacific, for improving weather forecasts for critical Arctic IPY and other activities
2) *Data Assimilation*
   a) Develop adaptive observational methods to be used for collecting targeted observations for improved high impact Arctic weather forecasts
   b) Improve the assimilation of current and future atmospheric, sea ice, and ocean and land surface data, e. g., radiance and other satellite (AIRS, MODIS) and in-situ data, especially over ice/snow, over both polar regions:
   i) Address surface emissivity issues by utilizing satellite-derived cloud products for the direct assimilation of cloudy radiances
   ii) Use in-situ observations to better characterize satellite observation error covariances,
   c) Contribute to the design of the next generation global atmospheric, ice, and land surface observing system in the two polar, and the adjacent regions of the Earth, in the framework of the GEOSS program
3) *Numerical Modeling*
   a) Identify and diagnose model weaknesses critical for polar regions and polar – extra-polar interactions (e. g., representation of boundary layer processes in Arctic; cold air outbreaks from polar regions; moisture and heat transport from low latitudes to polar regions, etc)
   b) Improve atmospheric, sea ice, and land surface model formulation in areas of weakness
   c) Accelerate testing and operational implementation of Hybrid Coordinate Ocean Model (HYCOM) for storm surge prediction
   d) Develop capacity to represent model related uncertainty in NWP ensemble forecasting
   e) Asses the value of high resolution Limited Area Modeling (LAM) with the Climate Weather and Research Forecast (CWRF) model for high impact Arctic events
   f) Contribute to TIGGE (THORPEX Interactive Grand Global Ensemble) research goals, based on NAEFS (North American Ensemble Forecast System), develop prototype ensemble component of future Global Forecast System (GIFS)
4) *Arctic Socio-Economic Applications and Outreach*
   a) Provide new probabilistic weather, ice, and ocean products to support the Arctic user community
   b) Develop, in partnership with user community, innovative new procedures for the beneficial use of weather forecast information in different Arctic applications
   c) Quantify the effect of existing and improved weather forecast information on key groups of users

1.4 Which IPY 2007-2008 theme(s) will be addressed by the project (see Note 1)

Theme 1 – The current state of the polar environment	Yes
Theme 2 - Change in the polar regions	No
Theme 3 - Polar-global linkages and interaction	Yes
Theme 4 - Investigating new frontiers	Yes
Theme 5 -The polar regions as vantage points	No
Theme 6 - Human societies in polar regions	Yes

1.5 What is the major target of the proposed activity (specify one – see Note 1)

Natural or social science research	Yes
Education/Outreach and Communication	No
Data Management	No
Legacy	No
Other Targets	No

1.6 What significant advance(s) in relation to the IPY themes and targets can be anticipated from this project?

The major contribution of this study will be under the 2nd IPY theme:
1) "Quantify and understand […] present environmental and human changes in the polar regions in order to improve predictions". The scientific advances achieved through this project will facilitate improved weather, sea ice, ocean wave/surge, and land surface (permafrost) forecasts for polar societies in the 3-90 day time range. The major goal of the project will be supported by work toward three other IPY themes:
2) "Determine the present status of the polar regions by quantifying their spatial and temporal variability." Work under the Observing System and Data Assimilation program elements will contribute to this theme;
3) "To investigate the cultural, historical, and social processes that shape the sustainability of circumpolar human societies…" Work under the Arctic Socio-Economic Applications and Outreach program elements will address this IPY theme;
4) "Investigate the frontiers of science in the polar regions". This theme will be addressed by the scientific research listed under all program elements.

1.7 What international collaboration is involved in this project? (see Note 2)

This project will have extensive collaboration with scientists from Canada, Russia, and all other countries that contribute to the enhancement of the Arctic and Antarctic observing system for the atmosphere, sea ice, ocean, and land surface. Collaboration is also likely with scientists from other countries surrounding the Arctic, where the improved forecasts and user procedures can be utilized. Collaboration is also expected to develop with participants from Japan and other Asian and European countries with respect to the targeted observation component of the project.

2.0 FIELD ACTIVITY DETAILS

2.1 Outline the geographical location(s) for the proposed field work (see Note 3)

Field activities will take place over the northwest Pacific, that is the starting point of the Pacific jet that is responsible for the development of storms affecting Alaska and other Arctic areas, as well as the region of the Maritime Continent and surrounding Equatorial oceans where the moisture and energy influencing the jet originates. Atmospheric data collected in these areas will complement the large array of Arctic observations, allowing for new studies of polar to global interactions.

2 2 Define the approximate timeframe(s) for proposed field activities?

Arctic Fieldwork time frame(s)	Antarctic Fieldwork time frame(s)
01/08-03/08	
12/08-02/09	

2.3 What significant logistic support/facilities will be required for this project? Can these resources be usefully shared with other projects? (see Note 4)

Manned fixed-wing aircraft (dropsonde and other observations) Remotely operated vehicles (aerosondes) High altitude balloons with dropsonde capabilities (driftsondes) Data collected by these facilities will be shared in real time by the entire user community and will be used for at least three purposes: a) Studying global-to-polar interactions b) Calibrating new satellite instruments c) Assimilating the data to improve Arctic weather, ice, ocean wave/surge, and land surface forecasts The experimental data will be complemented by dropsonde data collected within the operational Winter Storm Reconnaissance program over the northeast Pacific, between Hawaii and Alaska

2.4 Will the project leave a legacy of infrastructure? (see Note 1)

1) Procedures developed by the project for the optimal design of the configuration of the atmospheric observing system for weather, sea ice, ocean wave/surge, and land surface forecasting, that can be used when new platforms and/or instruments are developed and/or tested 2) Global, multi-center ensemble weather, sea ice, and ocean wave forecast system providing data out to 14 days in advance for Arctic applications 3) Procedures and guidelines developed for Arctic applications of weather forecasts

2.5 How is it envisaged that the required logistics will be secured? (one or more options can be identified)

Consortium of national agencies	Yes
Own national polar operator	No
Another national polar operator	No
National agency	Yes
Military support	No
Commercial operator	No

Own support	No
Other sources of support	No
The PI, Z. Toth, was a lead scientist and/or organizor of ten, and participated in a number of other successful field programs. Some of the other listed investigators have similarly extensive field work experience.	

2.6 Has the project been "endorsed" at national or international level (see Note 5)

	The US IPY Committee is not endorsing projects at this time, but will provide comments later. The present proposal is consistent with the IPY-related THORPEX plans described in the THORPEX International Implementation Plan (TIP) that the THORPEX International Core Steering Committee (ICSC) endorsed at its December 2004 meeting.

3.0 PROJECT MANAGEMENT AND STRUCTURE

3.1 Is the project a component (established over the IPY 2007-2008 timeframe) of an existing plan, programme or initiative or is it a new autonomous proposal?

New Project Yes	Component of an existing or planned activity Yes
This proposal is one of a set of ten coordinated submissions by NOAA. In particular, links are noted with the following NOAA submissions: Causes and impacts of recent changes in Pacific Arctic (John Calder & Kathy Crane) Data Management/Arctic Change Detection (Florence Fetterer) Decision Support in Alaska and the Arctic (Juniper Neill) Arctic climate modelling (Tony Beesley) Arctic System Reanalysis (John Calder) Advances in Satellite Products and Their Use in Numerical Weather Prediction (Jeff Key) This project is also part of THORPEX activities directed at polar regions and as such will be coordinated with THORPEX plans at the US national (David Parsons), and international levels.	

3.2 How will the project be organised and managed? (see Note 6)

It is anticipated that the present project will be led by the NOAA THORPEX Program Manager (NTPM). The NTPM will be assisted by a NOAA IPY-THORPEX group, formed by the investigators listed below, and by interested scientists from the well established NOAA THORPEX Science and Implementation Committee (NTSIC) that the NTPM leads. Depending on available resources, the NOAA THORPEX program may solicit additional IPY investigators from the academic community through its grant program. The present project will be carefully coordinated with the other nine NOAA IPY submissions.

Activities under this proposal will also be well coordinated with related other research work. In particular, it is expected that the present proposal will be carried out as part of US national, and international efforts aimed at understanding and better predicting large-scale atmospheric processes under the THORPEX international program.

3.3 What are the initial plans of the project for addressing the education, outreach and communication issues outlined in the Framework document? (see Note 7)

The education, outreach, and communication issues will be handled through four channels:
1) Separate NOAA submission: Decision Support in Alaska and the Arctic (Juniper Neill) – Reach out to the general public
2) NOAA THORPEX Grant Program - Engage the academic community, including students and young scientists
3) Activities listed under the Arctic Socio-Economic Applications and Outreach Program element of this proposal – Reach out to Arctic user communities
4) Socio-Economic Application (SEA) of International THORPEX program – Reach out to general user community to raise awareness about advances in, and applications of polar science

3.4 What are the initial plans of the project to address data management issues (as outlined in the Framework document)? (see Note 8)

Data management issues will be addressed at 3 levels, through:
1) Separate NOAA submission on Data Management (Florence Fetterer)
2) Possible establishment of US IPY-THORPEX Data Base, coordinated with other US agencies
3) Taking advantage of expected THORPEX developments at the international level (e. g., contributions by the THORPEX Data Policy and Management Working Group; TIGGE Working Group, etc).

3.5 How is it proposed to fund the project? (see Note 9)

It is anticipated that a significant portion of the NOAA THORPEX funds ($2.3M total in FY2006 budget) will be directed toward funding certain activities described in this proposal. Other activities are expected to be funded through separate initiatives within NOAA and the JCSDA. Availability of additional funding within NOAA will be explored for further studies within the present proposal.

3.6 Is there additional information you wish to provide?

The goals of the present IPY proposal for improved understanding and prediction of Arctic processes at the interface of weather and climate, are shared by two other major programs: the Global Earth Observing System of Systems (GEOSS), aimed at a better description of global processes, and THe Observing system Research, and Predictability EXperiment THORPEX), aimed at improved global weather forecasting. Polar sciences will greatly benefit from the synergistic collaboration with these other communities, as a large number of scientists become involved in research of mutual interest. The investigators of the present proposal believe that additional benefits of this collaboration for both the polar research and polar user communities will come to light as the participants become more engaged in the project. Examples for such added benefits include forecasts for air quality and other processes that depend on successful coupled atmosphere-ocean-land surface modeling on the 3-90 days time scale.

4.0 PROPOSER DETAILS

4.1 Lead Contact for the Expression of Intent

Title	NOAA THORPEX Program Manager
First Name	Zoltan
Surname	Toth
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Email	Zoltan.Toth@noaa.gov
Repeat Email	Zoltan.Toth@noaa.gov

4.2 List up to six other project members and their affiliation.

Name 1	Satellite data/assimilation: Jeff Key / Chris Velden / John LeMarshall
Organisation	NOAA / SIMSS / JCSDA
Name 2	Coupled Atmosphere-ice-ocean-land surface diagnosis and modelling: Michael Van Woert / Robert Grumbine / Julian Wang / Mel Shapiro
Organisation	US National Ice Center / NCEP / OGP / OAR
Name 3	Socio-economic applications: James Partain / Rebecca Morss / Arun Kumar
Organisation	NWS / SIP / NCEP
Name 4	
Organisation	
Name 5	
Organisation	
Name 6	
Organisation	

Accompanying Notes for submission of IPY 2007-2008 Expressions of Intent

Note 1 – IPY projects can take a number of forms.
a) 1.4 - They may address one or more of the IPY 2007-2008 themes and if so will be expected to have component activities addressing education, outreach, data management and possibly legacy.
b) 1.5 - The main focus can be on science or on one or more aspects of education, outreach and communicating the Polar Year, an activity that addresses data management or that explicitly leaves a legacy (such as building a new polar facility or establishing new systems).
Note 2 - An important characteristic of IPY 2007-2008 projects will be their international structure in order to facilitate research impractical for a single nation to undertake. Whilst project components are likely to be primarily funded at a national level, the projects are expected to be established and coordinated internationally. The Joint Committee will be looking for evidence of international collaborations developing in the Expressions of Intent and established by the June 2005 full proposal deadline.
Note 3 – The geographic locations need not be precise but logistic operators will want to broadly know where activities will occur, e.g. West Antarctic Ice Sheet, Weddell Sea, Svalbard, Greenland, etc. If you have more detail please supply.An IPY project can also be one that involves no field activities.
Note 4 - This refers to major facilities and infrastructure and some examples (not comprehensive) are given below.

Ice-breaker	Multi-instrumented platforms	Snow terrain vehicles
Ice strengthened research ship	Helicopters	Existing field stations
Ship-based drilling capability	Fixed wing geophysical aircraft	New field station
Ship recovery of buoys etc	Fixed wing transport aircraft	Observatories
Submarines	Rockets	Fuel depots
Autonomous Underwater Vehicle	Satellites	Ice drilling capability
Remotely Operated Vehicle	Radars	Rock-drilling capability

Please note if your project will share facilities with other IPY activities, or if there is capacity to support other projects as part of your activity (e.g. a marine biodiversity cruise could feasibly offer to deploy or recover buoys, moorings, etc., for an ocean/climate project)
Note 5 - All IPY projects will ultimately be subject to assessment by National (and/or International) funding agencies. However it will be important to establish coordination of IPY 2007-2008 at the national and international level. Both National IPY Committees and International bodies supporting IPY 2007-2008 will have an important role in this. Contact with these bodies may occur before January 14 2005 but should certainly take place before the June 2005 deadline for full proposals.
Note 6 – The Joint Committee for IPY 2007-2008 will be overseeing Polar Year activities but will not be managing the individual projects. It is anticipated that IPY projects will be self-managed, free-standing activities or be part of a planned or existing programme that has an established management structure. The JC will need to be satisfied that all proposals have realistic plans for structuring and managing activities. For the larger proposals the JC anticipates that a Project Steering Committee will be established.
Note 7 – It will be a requirement of IPY proposals that there is a clear plan for Education, Outreach and Communication (EOC) activities in the full proposal for the June 2005 deadline. If initial ideas for EOC have been established these can be outlined in the Expression of Intent.
Note 8 – It will be a requirement of IPY proposals that there is a clear plan for the management of project data, including its early availability to the community, presented in the full proposal for the June 2005 deadline. Initial ideas for data management should be outlined in the Expression of Intent, including which data organisations are likely to be involved, e.g. ICSU World Data Centres, Joint Committee for Antarctic Data Management, WCRP, etc.
Note 9 – It is anticipated that funding for IPY 2007-2008 will be primarily obtained through national funding agencies but in some cases will involve international funding agencies (e.g. European Union) and in some cases will come from private sources. Certain projects will be part of programmes already funded and if so these can be identified here.