

Chinese proposal and activities for IPY 2007-2008

March 12, 2004

(1) Our intent

China is willing to take part in the IPY 2007-2008 and is going to make contributions on the following interested scientific areas. And we welcome international cooperation both in scientific research and logistic support in polar operations. And International research cooperation in several research fields will be important way for promoting the better understanding of the polar regions and global change by exchanging research scientists in two-side or multi-side co-cruise and land base study, lab-based co-research, exchanging data and a series of symposium or workshop.

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(2) Comments on the three proposed overarching themes:

We agree with the three overarching themes in general. And we suggest the word "Poles" in the number 2 of the themes would be better changed as "Polar Regions", because, as our understanding, geographically "the poles" just indicating the two points on our earth.

(3) Proposed concepts for research activities

- a) The process of the Amery Ice Shelf and its interaction with the ocean

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- b) The Variability of the Southern Ocean

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- c) Establishment of an in-land Chinese scientific research station at East Antarctic Plateau

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- d) Chinese "ITASE" project from Zhongshan Station to Dome A

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- e) Monitoring of cryospheric change at Zhongshan Station

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f) Observation of Lambert Glacier and the Amery Ice Shelf system

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g) Conjugate Studies on Upper Atmospheric Phenomena in IPY 2007/8

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h) **Changing processes of Arctic Ocean circulation and sea ice**

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(4) Brief description of our activities

a) The process of the Amery Ice Shelf and its interaction with the ocean

Objective:

This investigation will study the process of Amery Ice Shelf and the

physical oceanographic processes occurring beneath and outside of the ice shelves, the interaction between the ocean and the shelf and their role in determining the mass balance of ice sheets and larger-scale oceanic conditions.

Action:

This will be achieved by remote sensing of satellite and aircraft, drilling ice cores, oceanographic measurements through the hot drilling holes in the sub-ice shelf cavity and a series of ROV missions (measurements and water sampling), closed by simultaneous ship-based measurements outside of the shelf front.

b) The Variability of the Southern Ocean

Why the Southern Ocean:

- The circumpolar extent of the Southern Ocean allows the global thermohaline circulation to exist and is critical to the global redistribution of heat, freshwater and other properties such as carbon.
- The Antarctic Circumpolar Current (ACC) carries anomalies from one basin to another, affecting both regional and global climate. The Antarctic Circumpolar Wave (ACW) is the most well known example.
- Water masses formed in the high and mid-latitudes of the southern hemisphere account for more than half the volume of the world ocean.
- Recent results have shown that properties of the circulation and water mass are changing obviously and thermal expansion of the oceans resulting from warming of these water masses is expected to be the largest contributor to sea-level rise during the 21st century.
- The Southern Ocean is carrying 20% of the poleward energy flux into the Antarctic in response to the Equator to Pole temperature difference induced by solar radiation.
- The Southern Ocean is capping with a layer of seasonally-varying sea ice that is important in the formation of Antarctic Bottom Water (AABW) and in modulating the climate of the coastal regions.

Therefore, the Southern Ocean oceanography is critical to many aspects of Global, Antarctic and Southern Hemisphere science and the ocean is playing an important role in the global climate system.

What should be studied in the Southern Ocean:

- (1) Variability of the coupled climate system: The ACW, teleconnections and low frequency variability;
- (2) Variability of the ACC system and inter-basin exchange;
- (3) Subantarctic Mode Water and Antarctic Intermediate Water: formation, sensitivity to change and exchange with lower latitudes;
- (4) Antarctic Bottom Water formation and the stability of the overturning circulation, Monitoring the variability of Southern Ocean frontal

- systems;
- (5) Southern Ocean meridional overturning circulation;
 - (6) Interaction among the ocean, atmosphere and sea ice;
 - (7) Interaction between the ocean and ice Shelf;
 - (8) Modeling.

c) Establishment of an in-land Chinese scientific research station at East Antarctic Plateau

Area:

East Antarctic Plateau at the traverse route from Zhongshan Station to Dome A region

Activities:

To carry out several inland traverses to the Dome A area from Zhongshan Station, select a location for setting up the inland scientific research station, measure the geographical coordinates of several special sites and investigate the request for the logistic supports for the inland station which we are planning to construct in the near future, etc.

d) Chinese “ITASE” project from Zhongshan Station to Dome A

Area: Zhongshan Station to Dome A

Activities: To set up observing systems on the ice sheet. The systems of the observation includes:

- Automatic meteorological stations
- Mass balance observing system
- Movement of ice sheet
- The atmospheric environmental observation
- Geophysical (gravity, geomagnetism) observation

Schedules for project 1 and 2 □

2004/2005 field season:

To carry out an inland traverse from Zhongshan to Dome A, to survey the summit of Dome A, and set up a temporary observation station at the summit of the Dome A, and to conduct a shallow ice core drilling there.

2006/2007 field season:

To carry out second traverse to Dome A area to transport the materials for establishing the inland scientific observation station.

2007/2008 field season:

To conduct third inland traverse to Dome A area to construct the new inland overwintering station.

e) Monitoring of cryospheric change at Zhongshan Station

Main items:

- 1) Mass balance and glaciological movement of Dulk glacier, and
- 2) Lake level measurements at selected points in Larsman hills.

Area: Dulk glacier and Larsman hills.

Schedule: 2004/2005, 2005/2006, 2006/2007, 2007/2008

f) Observation of Lambert Glacier and the Amery Ice Shelf system

Main items:

Elevation of the central part of the ice shelf; ice shelf dynamics and accumulation.

Areas: Lambert Glacier and Amery Ice Shelf

Actions □ 2004/2005, 2006/2007, 2007/2008

g) Conjugate Studies on Upper Atmospheric Phenomena in IPY 2007/8

Objective:

- To monitor bi-polar ionosphere, auroras and magnetospheric boundary layer processes at Zhongshan Station, Antarctica, at Chinese Arctic Station in Svalbard and at Chinese inland station in Antarctica, as a significant part of the ICESTAR Program of the SCAR.
- To study the polar ionospheric and auroral dynamics under the magnetospheric cusp
- To understand the interactions and couplings among solar wind, magnetosphere and ionosphere

Activities:

- To install multi-frequencies all sky auroral imaging system at Zhongshan in 2007
- To install an auto- magnetometer at Chinese inland station, Antarctica in 2007
- To install a HF radar at Zhongshan Station in Antarctica in 2008 and join in SuperDARN

Continuous Observations:

- Observations at Zhongshan, Antarctica jointly with National Institute of Polar Research, Japan and University of Newcastle, Australia by a digisonde DPS-4, an all sky camera, a scanning photometer, an imaging riometer, a fluxgate magnetometer and an inductive magnetometer (since 1995), and with Chinese new facilities including the HF radar (since 2008) and the multi-frequency all sky auroral imaging system (since 2007)
- Observations at Chinese Arctic station in Ny-Alesund with a multi-frequency all sky auroral imaging system (since 2003)
- Observations at Chinese inland station in Antarctica with an auto-magnetometer (since 2008)

Campaign period:

Every two weeks in four seasons during solstices and equinoxes. All Chinese and related instruments will be involved in the campaigns and

we welcome other institutions to take part in. And we are willing to join Campaigns proposed by any other organizations.

h) **Changing processes of Arctic Ocean circulation and sea ice**

Why the Arctic Ocean and sea ice

The arctic is one of the most sensitive regions to global change. A series of distinct changes occurred in the Arctic Ocean in the past decades. The area and thickness of Sea ice decrease largely, seawater structure varied greatly and Arctic climate changes tremendously. These changes in the Arctic had an important influence to globe and China. Within the complicated Arctic system, ocean, sea ice and atmospheric system interact each other, and surrounding land and land-source matter affect the Arctic Ocean deeply. Thus Arctic ocean and sea ice process study will be important for better understanding of the influence of ocean and sea ice to climate at global and regional scale. The priorities of Chinese national Arctic research activities are as the following:

- Sea water structure, oceanic circulation changes and water exchange processes
- Sea ice change and its climate effect
- Fresh water transportation and its effect
- Relationship between biological and chemical processes and ocean/sea ice changes
- Response and feed back of Ocean and sea ice processes to global climate change

The objectives

- Better understanding of Arctic Ocean and sea ice change phenomena and regularity
- The significance of biological and chemical processes to climate change
- Enhancing the ability of modeling on the influence and response of Arctic ocean and sea ice processes to global change
- Understanding of the key process of the Arctic affecting China climate change via cold air activity

Research activities

CHINARE-I Cruises and land-based observations

In the summer of 1999, the first Chinese national Arctic Research Cruise had been conducted in the Chukchi Sea, Canada Basin and

Bering Sea for the basic understanding of Arctic environmental, marine ecosystem structure and Arctic ocean/sea ice/climate feature and their interactions.

CHINARE-II Cruise

In the summer of 2003, the second Chinese national Arctic Research Cruise had been conducted in the Chukchi Sea and Canada Basin for further understanding of ocean/air/ice interaction and summer processes

Land-based observations

In the late of 2002, a new observation base was set up on Svalbard Island for the observation of high-latitude Arctic climate, environment and ecosystem

CHINARE-III ~ V

In the future 5 years, two to three national Arctic research cruises will be carried out for supporting the research activities of this national program