IPY 2012 Conference: From Knowledge to Action

Poles and China : Dimensional Development of Linkage through IPY 2007-2008

Dr. Huigen Yang

Polar Research Institute of China

22-27 April 2012, Montréal, Canada

Outline

- Poles and China： IPY China Program
- Legacy of IPY in China： new dimensions of linkage
- Post-IPY: a perspective for the coming decade

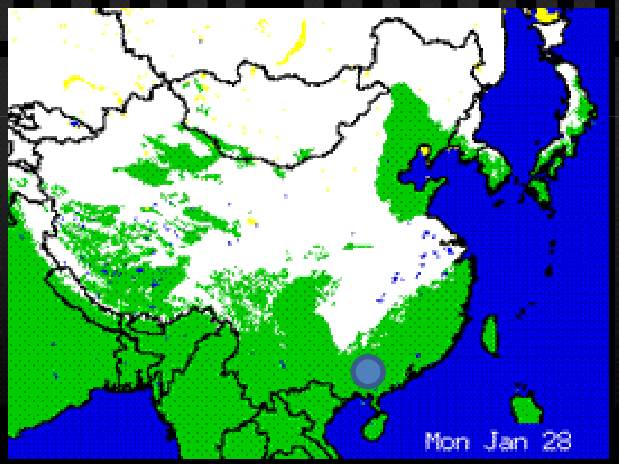
Outline

- Poles and China： IPY China Program
- Legacy of IPY in China： new dimensions of linkage
- Post-IPY: a perspective for the coming decade

The Significance of Poles to China

The greatest retreat of sea ice in Arctic Ocean in Sept.,2007

– snowstorms in south China in Jan. 2008



The Significance of Poles to China

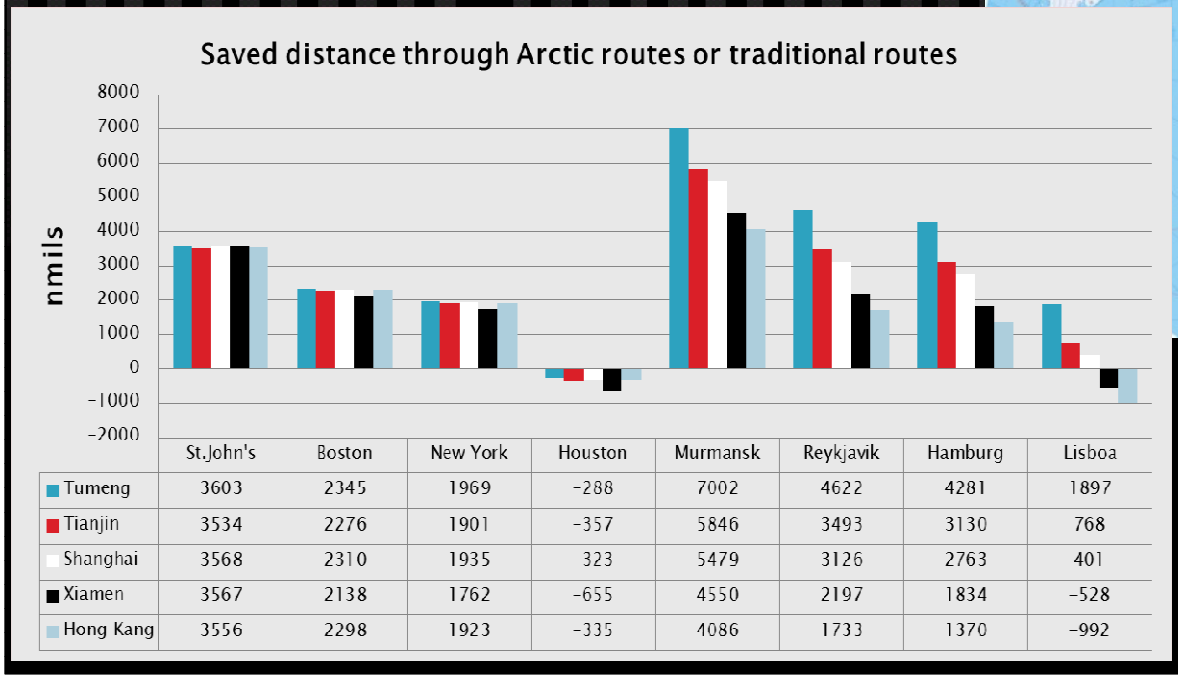
Possible sea level rise if the Antarctic ice sheet totally melts

The coast would retreat 400km inland, the most populated and prosperous regions of China, such as Shanghai, Tianjin, Guangzhou will be totally under the sea.

The Significance of Poles to China

Economic consequences of the Arctic sea ice melting

Arctic passages will greatly shorten the distances from China to North America and Europe



	St.John's	Boston	New York	Houston	Murmansk	Reykjavik	Hamburg	Lisboa
Tumeng	3603	2345	1969	-288	7002	4622	4281	1897
Tianjin	3534	2276	1901	-357	5846	3493	3130	768
Shanghai	3568	2310	1935	323	5479	3126	2763	401
Xiamen	3567	2138	1762	-655	4550	2197	1834	-528
Hong Kang	3556	2298	1923	-335	4086	1733	1370	-992

The Significance of Poles to China

Public Interests- Chinese tourists has shown increasing interests in the Arctic and Antarctic

The Significance of Poles to China

(picture of the earth system)

Chinese scientists have attached great importance to the Antarctic and Arctic in understanding the earth system, global climate change and sustainable development issues.

IPY China Program

IPY China Program

- The Prydz Bay, Amery Ice Shelf and Dome A Observatories （PANDA）
- Arctic Change and its Tele-impact on Mid-latitudes （ARCTIML）
- International Cooperation
- Outreach, Education and Data Sharing

IPY China Program: PANDA

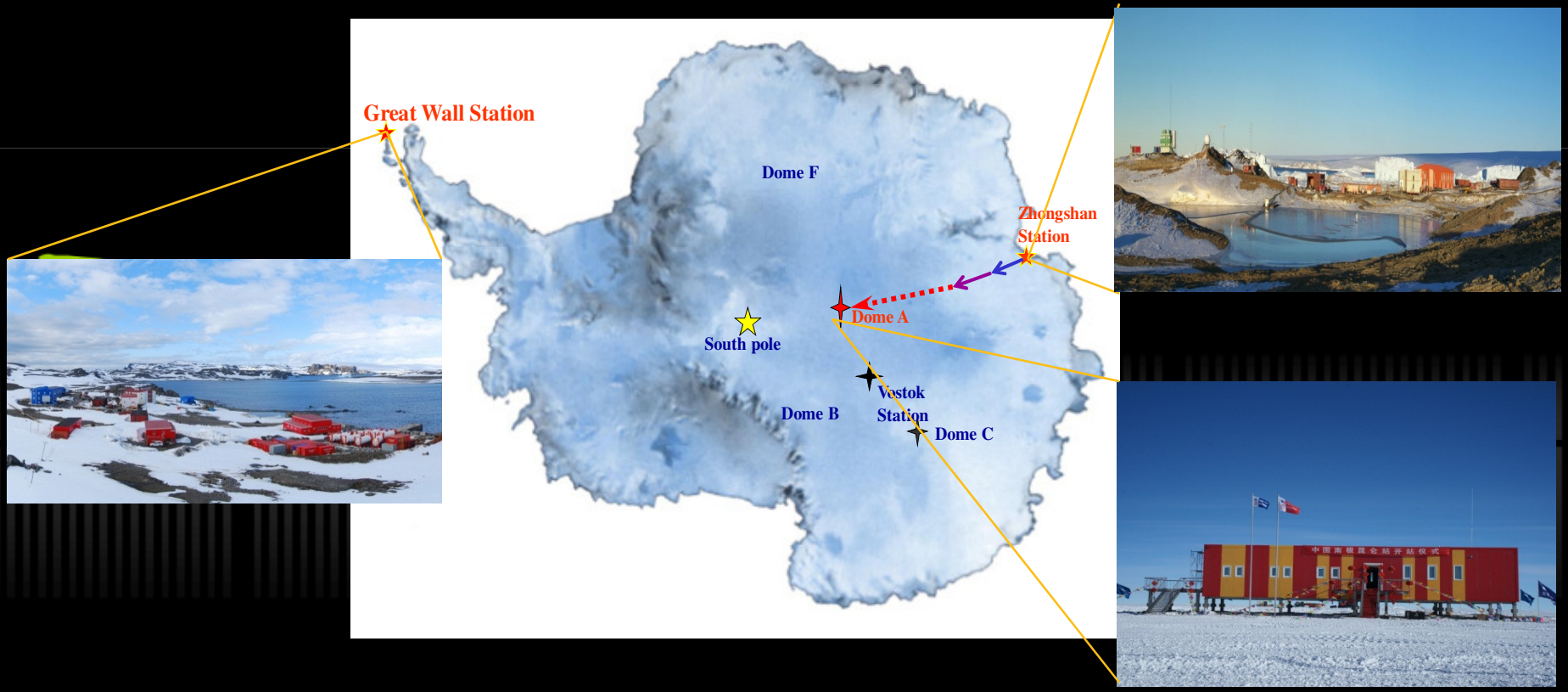
Arctic Investigation

Outline

- Poles and China： IPY China Program
- Legacy of IPY in China： new dimensions of linkage
- Post-IPY: a perspective for the coming decade

Expanded Infrastructure in Polar Regions

Chinese Antarctic research stations



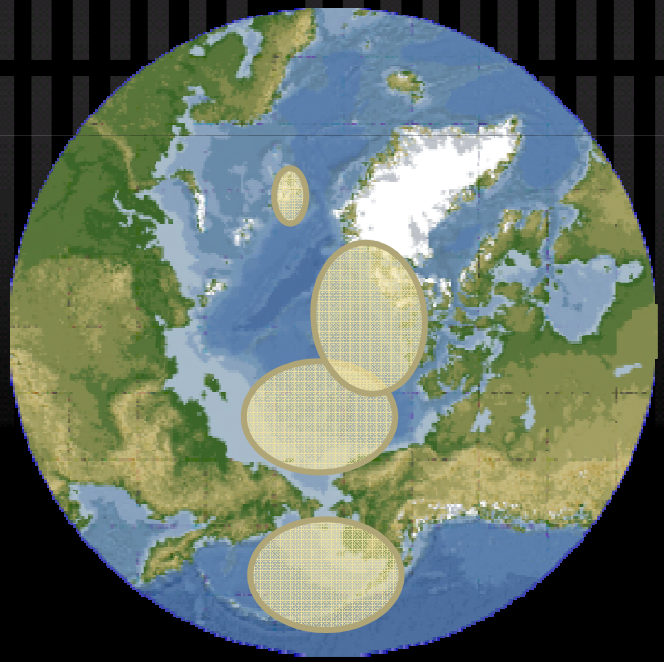
Chinese Arctic research station

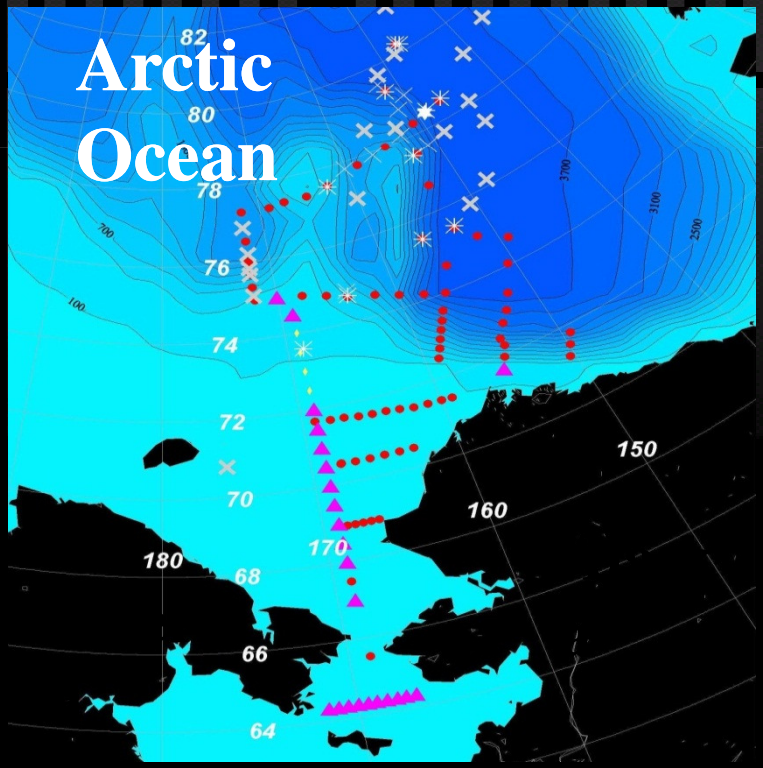
Yellow River Station

Chinese icebreaker R/V ‘Xuelong’

Antarctic cruise routes of icebreaker R/V XUELONG

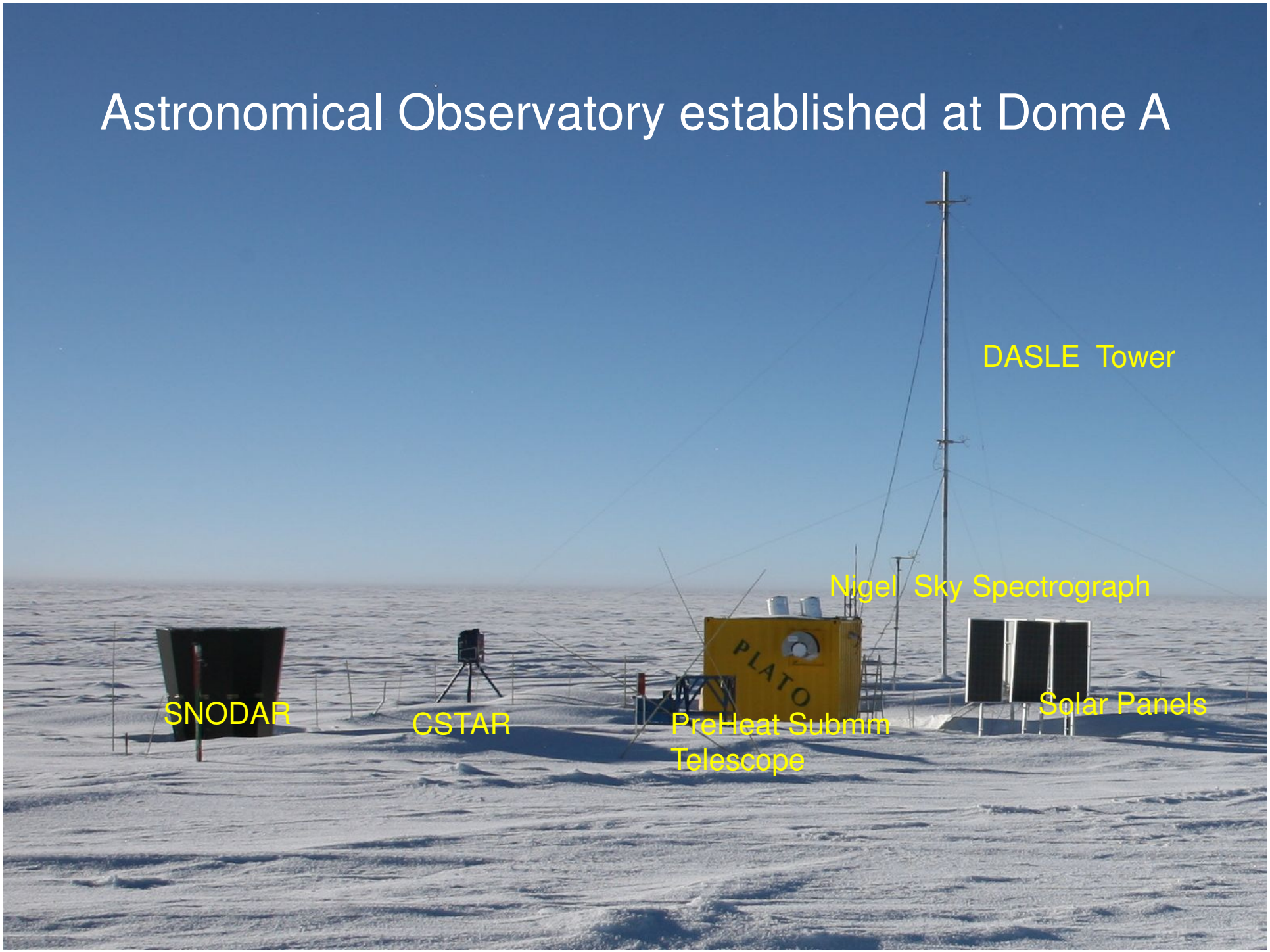
Investigated Arctic ocean areas by R/V Xuelong





The Heaven Tripod set up on the top of Dome-A

Astronomical Observatory established at Dome A

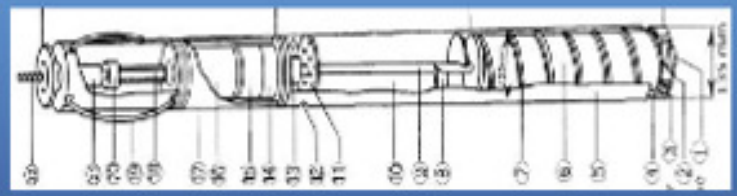


Deep ice core drilling on Dome A

Drilling Workshop

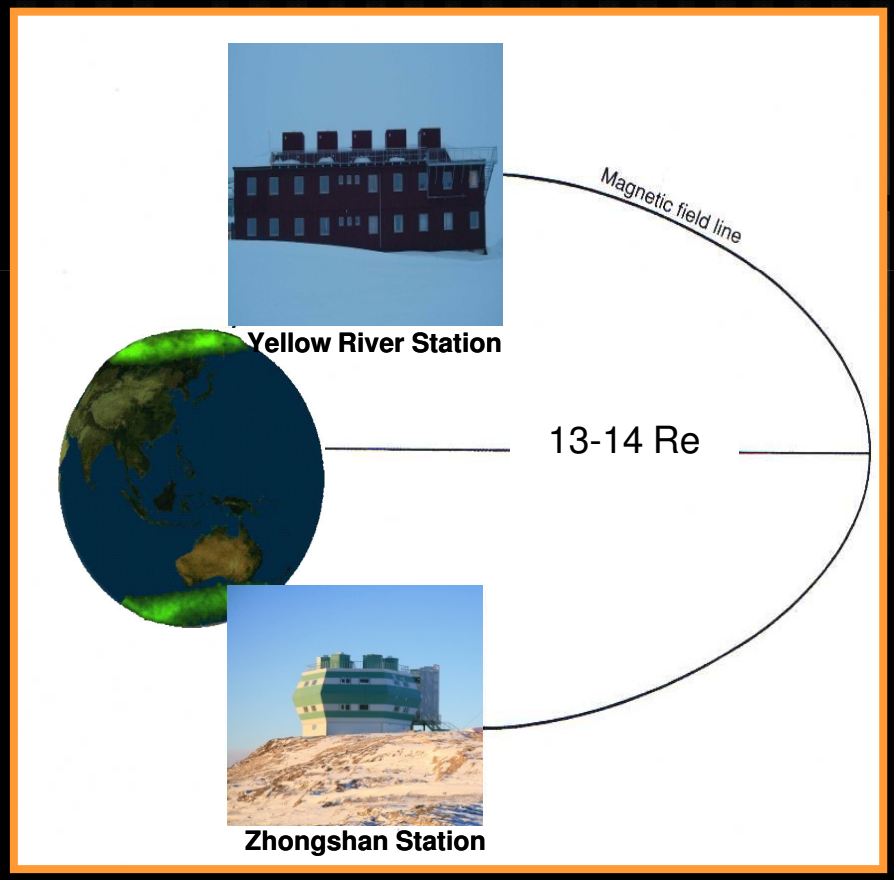
Drilling System

Complete the system in 2011

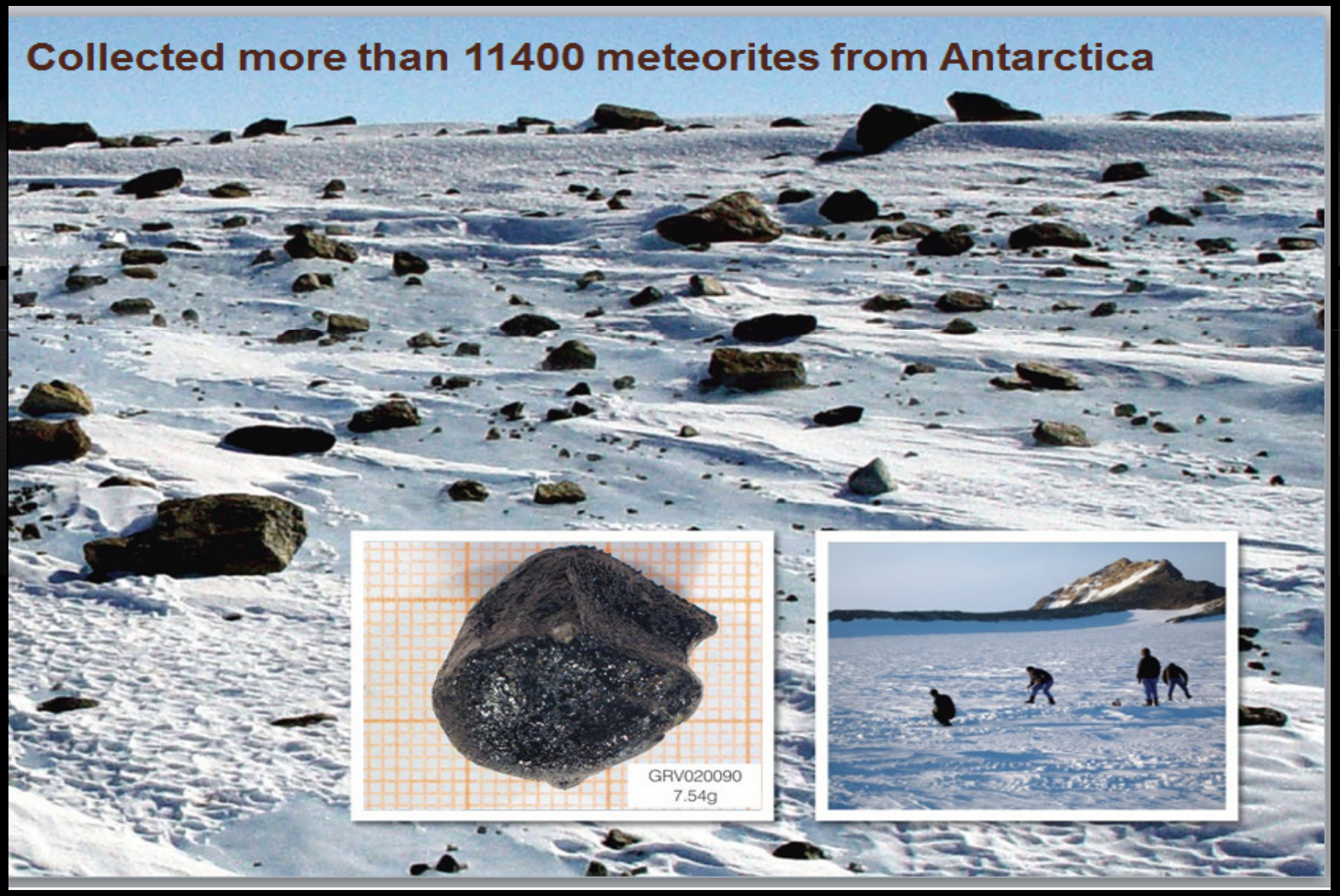


Deep ice coring: Recovering climate change of 1 Ma

Conjugate observation of dayside aurora



Meteorites collection from Antarctica



Study on evolution of the Antarctic Ice sheet

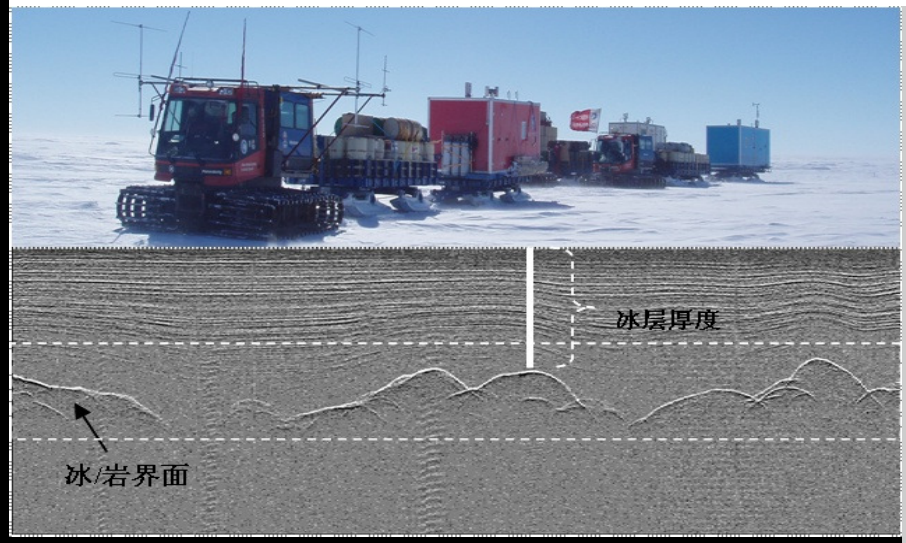
nature

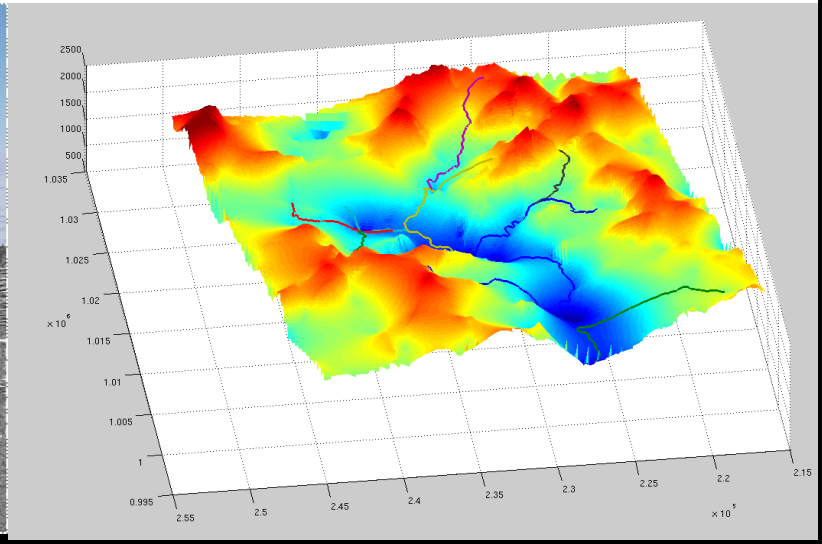
Vol 459|4 June 2009|doi:10.1038/nature08024

LETTERS

The Gamburtsev mountains and the origin and early evolution of the Antarctic Ice Sheet

Sun Bo[1], Martin J. Siegert[2], Simon M. Mudd[2], David Sugden[2], Shuji Fujita[3], Cui Xiangbin[1], Jiang Yunyun[1], Tang Xueyuan[1] & Li Yuansheng[1]





Subglacial topography with ice radar

Study on CO2 uptake by open sea in the Arctic

Science
AAAS

Decrease in the CO2 Uptake Capacity in an Ice-Free Arctic Ocean Basin
Wei-Jun Cai, *et al.*
Science **329**, 556 (2010);
DOI: 10.1126/science.1189338

Decrease in the CO_2 Uptake Capacity in an Ice-Free Arctic Ocean Basin

Wei-Jun Cai,[1]* Liqi Chen,[2] Baoshan Chen,[1] Zhongyong Gao,[2] Sang H. Lee,[3] Jianfang Chen,[4] Denis Pierrot,[5,6] Kevin Sullivan,[5,6] Yongchen Wang,[1] Xinping Hu,[1] Wei-Jen Huang,[1] Yuanhui Zhang,[2] Suqing Xu,[2] Akihiko Murata,[7] Jacqueline M. Grebmeier,[8] E. Peter Jones,[9] Haisheng Zhang[4]

It has been predicted that the Arctic Ocean will sequester much greater amounts of carbon dioxide (CO_2) from the atmosphere as a result of sea ice melt and increasing primary productivity. However, this prediction was made on the basis of observations from either highly productive ocean margins or ice-covered basins before the recent major ice retreat. We report here a high-resolution survey of sea-surface CO_2 concentration across the Canada Basin, showing a great increase relative to earlier observations. Rapid CO_2 invasion from the atmosphere and low biological CO_2 drawdown are the main causes for the higher CO_2, which also acts as a barrier to further CO_2 invasion. Contrary to the current view, we predict that the Arctic Ocean basin will not become a large atmospheric CO_2 sink under ice-free conditions.

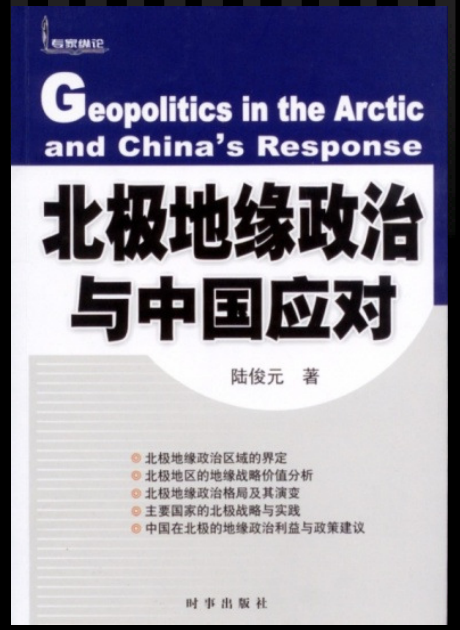
The CO_2 concentration in the atmosphere has increased greatly since the industrial revolution, and ~30% of the CO_2 released has been taken up by the ocean. This process slows the increase of this greenhouse gas in the (*2*, *3*). The Arctic Ocean has great potential for taking up atmospheric CO_2 owing to high biological production in the large ocean margin areas and low temperature (*4*, *5*). A recent synthesis suggested that the Arctic Ocean, though

In the summer of 2008, we conducted a high-resolution underway survey of partial pressure of CO_2 (pCO_2) across the Canada Basin in the western Arctic Ocean where substantial melting of ice had occurred (Fig. 1 and fig. S1). Surface-water temperature was as high as 0° to 5°C in the central Canada Basin (Fig. 2A). Extensive ice melt in this region resulted in salinity values as low as 24 parts per thousand (‰) (Fig. 2B) and ice concentration less than 15% (Fig. 1). Compared to an earlier underway survey in summer 1999, temperatures had increased by 3°C and salinities decreased by ~2‰ (Fig. 2, D and E). During the Arctic Ocean Section (AOS) study in summer 1994, all areas north of 72°N were under ice cover (Fig. 1) with surface seawater temperatures below −1.5°C and salinities above 30‰ (Fig. 2, D and E).

During the summer of 2008, surface-water pCO_2 was below the atmospheric level (~375 μatm) in the entire survey area (Fig. 2C). The lowest pCO_2 (120 to 250 μatm) occurred in marginal sea areas, in agreement with earlier observations (*4*, *10*–*13*). In the ice-free region of the Canada Basin to the northeast, however, there was a large area of relatively high pCO_2 (320 to 365 μatm) that had not

Studies on Social Issues in Polar Regions

- Studies on Arctic passages, laws, economics, governance, geopolitics, and international cooperation have been carried out intensively and internationally.



Stronger Supports from the Government

State Counselor HE Yandong Liu visited Antarctic Great Wall Station

Public awareness on poles has been greatly raised

University students expedition on Arctic Svalbard was jointly carried out by China and Norway (Feb-Mar, 2008)

Literature and art works of polar themes

theater dance drama created and performed at Shanghai

- Pop songs
- Paintings
- Photograph
- Literatures
- Documentary videos
- Theater drama

International Cooperation

Australia
Australian Antarctic Division
La Trobe University
University of Tasmania
Newcastle University
University of New South Wales

Canada
University of Quebec
Laval University
University of Calgary

Denmark
University of Copenhagen

Finland
Finnish Institute of Marine Research
University of Helsinki

France
Institute Paul Emile Victor
Laboratoire des Sciences du Climate et de l'Environment
Laboratoire de Glaciologie et Geophysique de l'Environnement

Germany
Alfred Wegener Institute for Polar and Marine Research
Kiel University

Japan
Hokaido University
Kyoto University
Nagoya University
National Institute of Polar Research

Korea
Korea Polar Research Institute
Korea Ocean Research and Development Institute

Norway
Norwegian Polar Institute
Oslo University
Tromso University
University Center in Svalbard

Russia
Arctic and Antarctic Research Institute

UK
British Antarctic Survey
Bristol Glaciology Center
University of Leicester

USA
University of Maine
University of New Hampshire
South Dakota State University
Lamont-Doherty Earth Observatory
Columbia University
University of Housto
University of Arizona
Office of Polar Programs, National Science Foundation
National Oceanic and Atmospheric Administration

Others: Chile, Argentina and Romania etc.

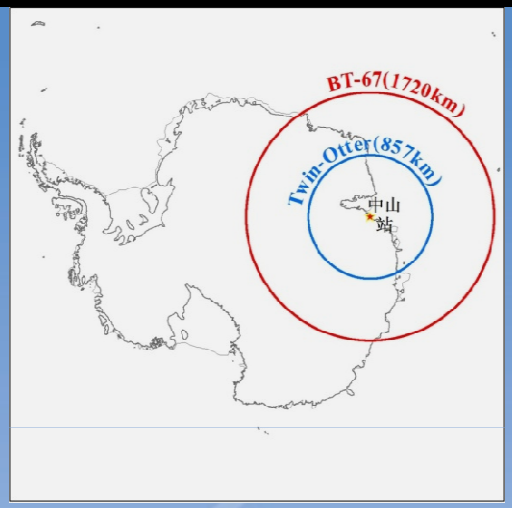
Outline

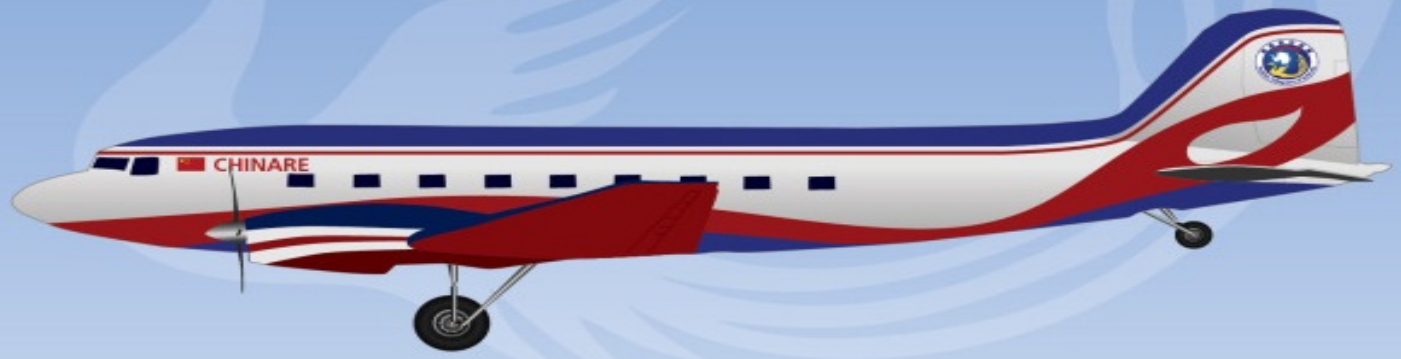
- Poles and China： IPY China Program
- Legacy of IPY in China： new dimensions of linkage
- Post-IPY: a perspective for the coming decade

New icebreaker under design

- **Displacement of 8000 tons, 20,000 nm endurance, self-sustaining for 60 days**
- **Ice breaking capability of 1.5m sea ice plus 0.2m snow, at speed of 2 to 3 knots**
- **Hydrographic, chemical , biological, geological and geophysical investigation**

To establish an aviation supporting system for Antarctic operation and airborne observation/remote sensing



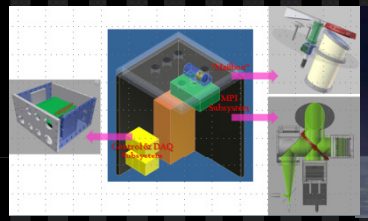


To develop Kunlun station from a summer base to a wintering station

A roadmap for Dome-A astronomical observatory development

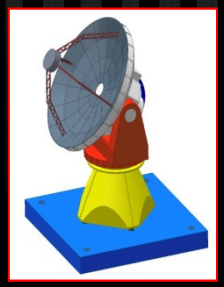
2006-2010 — Site Survey & Small Telescope


2010-2012 — +Site Testing & Middle-size Telescope



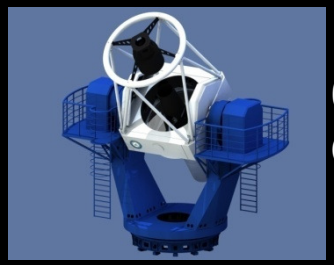

2012-2020 — Dome A Observatory Phase I

2.5m Opt/NIR
KDUST

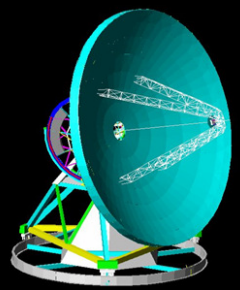


5m THz
DATE5

2020-2030 — Dome A Observatory Phase II

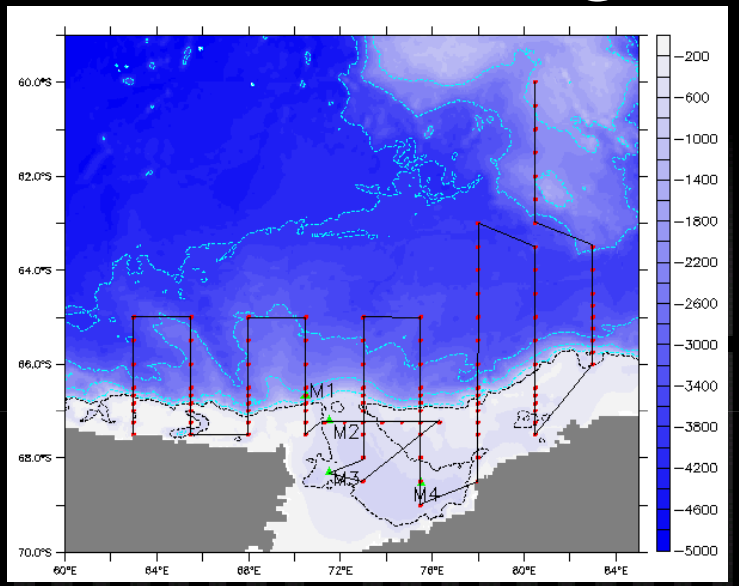


6-8m
Opt/NIR



15m THz

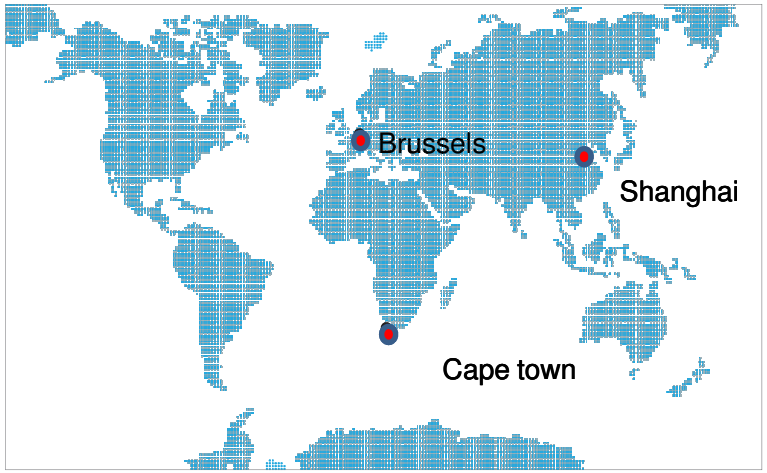
Polar environments monitoring

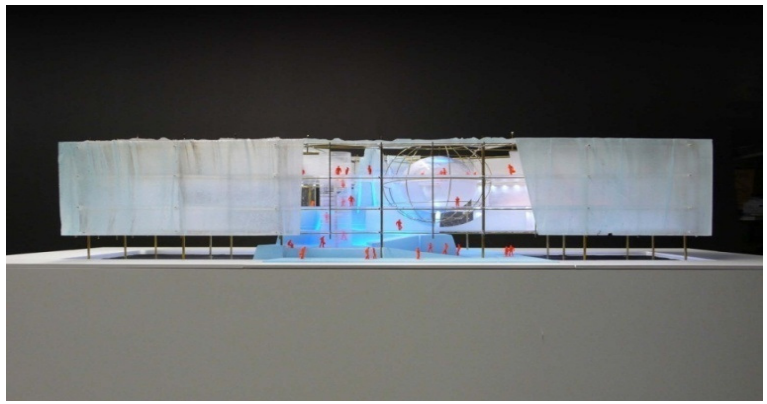


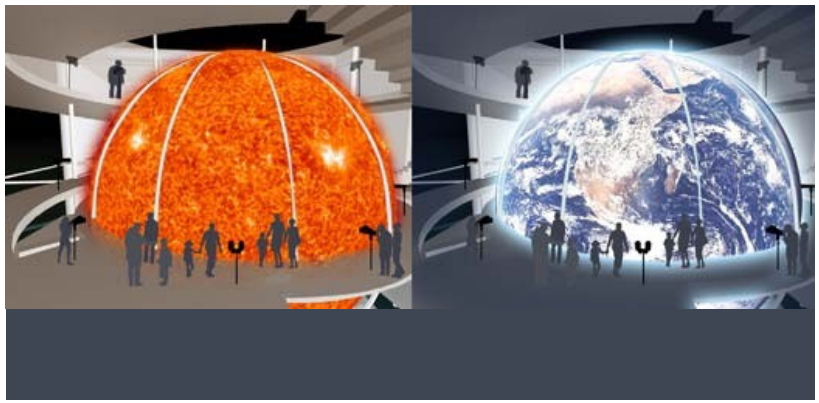
- Period:2012~2016
- Expeditons: Antarctic 5+Arctic 3

CHINARE's domestic base at Shanghai

Polaris Climate Change Observatory Shanghai (PCCOS)







Summary

- The rapid climate and environments change of the polar regions have imposed unprecedented influence on China's economy and social development. The IPY 2007-2008 has for the first time given China a great opportunity to explore frontiers of polar science in cooperation with international partners.
- By launching a national program, China has achieved dimensional developments of polar linkage, especially, in understanding of the earth system and global climate change, in raising of public and governmental polar awareness and interests, in innovation of polar science, technology and culture, and in promoting international cooperation.
- In the future, more Chinese will go to polar regions to understand the environmental change and bio-ecological evolution there, to explore unknown frontiers on the earth and in the deep universe, to innovate novel engineering and technology for the benefit and better life of humankind, and to create an advanced culture to safeguard a more harmonious and sustainable planet.

Thanks !