

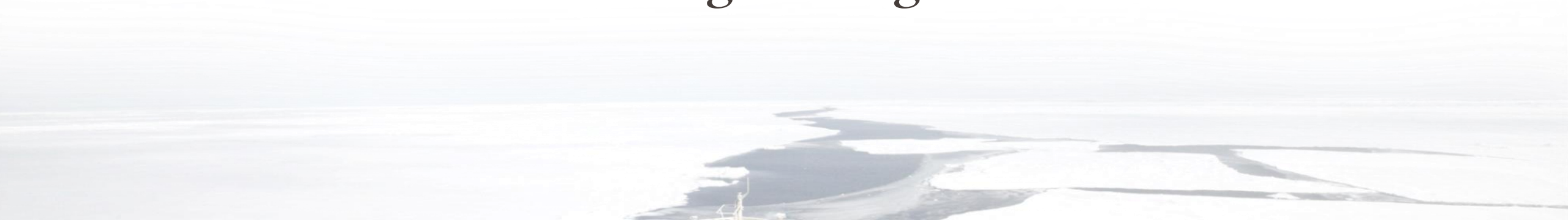


China's Arctic observation and research cooperation



Polar Research Institute of China (PRIC)

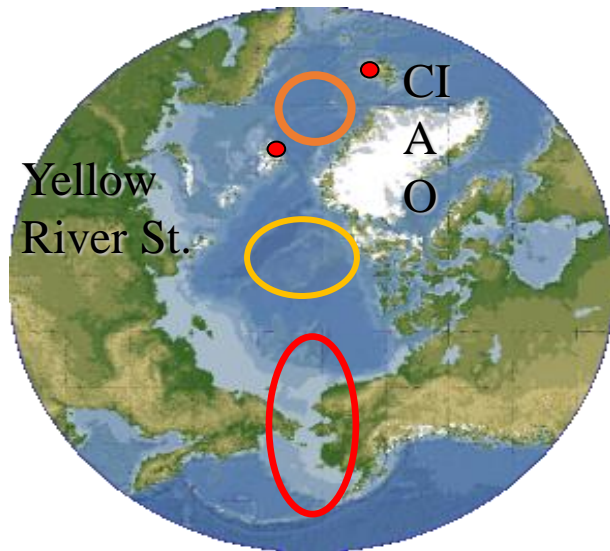
Huigen Yang



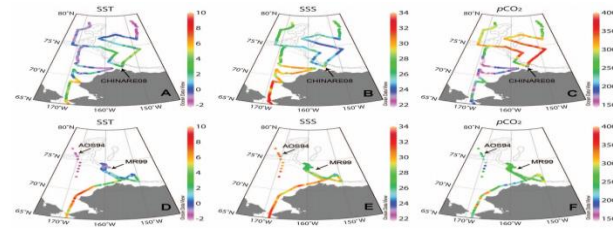
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Chinese National Arctic Research Expedition (CHINARE): China's Arctic research instrument and cooperation platform

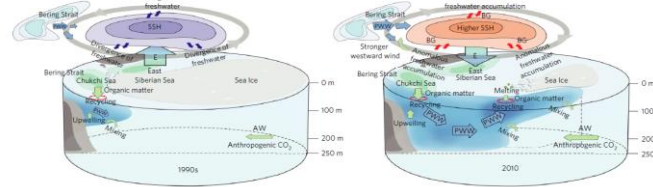


CO2 uptake in ice-free ocean 2008



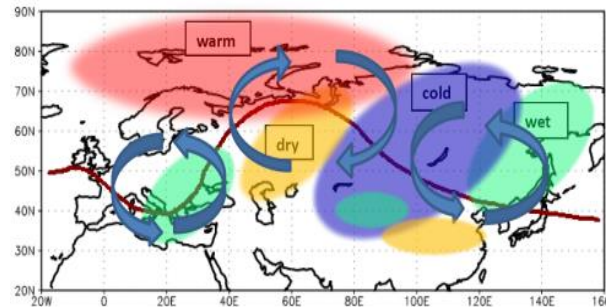
Cai et al., Science 2010

Acidification of the Arctic ocean



Qi. et al, Nature Climate Change, 2017.

Linkage of the Arctic sea ice retreat and Mid-lat weather anomalies



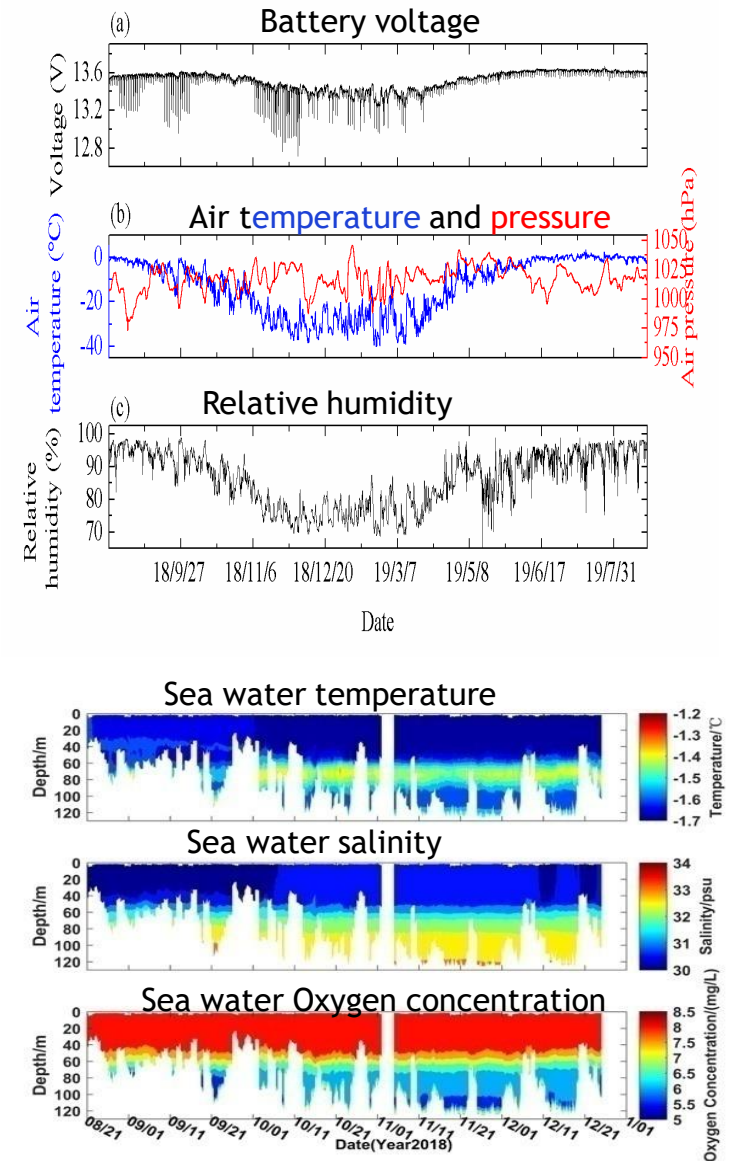
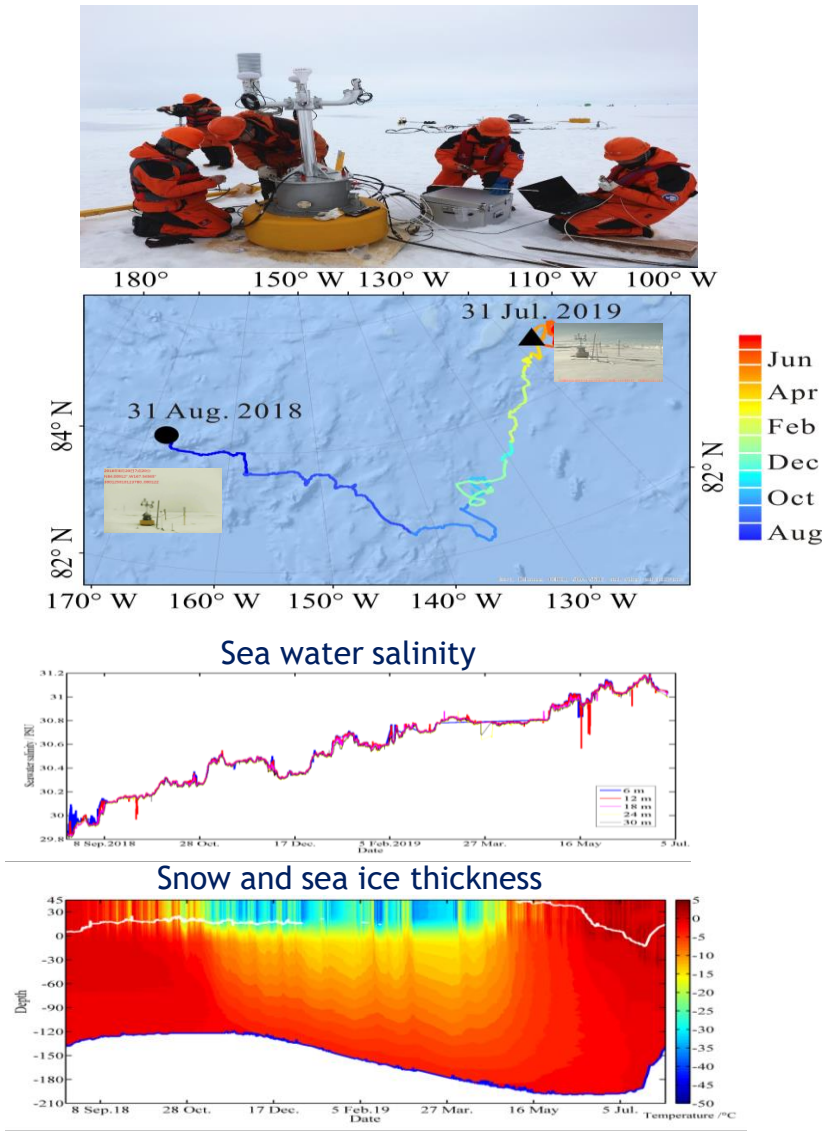
Wu et al., Monthly Weather Rev, 2013. Wu et al., J Climate, 2013; Li et al., Int. J. Climate, 2014

- **Cruise investigations:** So far 13 cruises have been carried out with R/V *Xuelong* & *Xuelong 2* since 1999, covering the Pacific, Central and Atlantic Arctic Ocean.
- **Research station:** Yellow River and CIAO
- **Research theme:** Arctic Rapid Change and its Tele-impacts on Mid-latitude (ARCTIML)
- **International cooperations** have been carried out with CHINARE onboard R/V *Xuelong*, such as the Pacific Arctic Group (PAG) DBO, EU Damocles, and IASC flagship project MOSAiC etc.
- **Important findings:** Such as CO2 uptake in ice-free ocean, more rapid acidification in the western than Pacific and Atlantic ocean, and the linkage of the Arctic sea ice retreat and Mid-lat weather anomalies, etc.



Unmanned Ice Station Observing System (UNIS): An example of observing technology and instrument innovation

In order to address how the Arctic sea ice retreats and its impacts on global climate change, making use of the ice buoy technology, two types of Unmanned Ice Station Observing System, namely UNIS-A & B, have been developed, which for the 1st time enabled both of in situ detecting of the sea ice growth/loss and that of the air-ice-sea system, by simultaneous profiling of the atmospheric boundary layer, sea ice and up-layer sea parameters in the central Arctic ocean. The UNIS instrumentation and its technologies can be applied to building observing networks of the air-ice-sea coupling system and to other fields such as marine ecology and fishery monitoring in the Central Arctic Ocean, making contribution to the SAON and Central Arctic Ocean Fishery Agreement implementation.



China-Iceland Joint Auroral Observatory (CIAO): An example of bilateral observing infrastructure cooperation

The cooperation between China and Iceland started since 2012,

- **Location:** at Kallhor, 66° in magnetic latitude, under the earth magnetosphere's plasmasheet
- **Purpose:** observing nightside auroras and its conjugacy with those observed at the Antarctic Syowa Station of Japan
- **Observation:**
 - Fluxgate and induction magnetometers
 - Panchromatic and monochromatic all-sky imaging
 - Imaging Riometers(an 8X8 antenna array)
 - Ionospheric TEC
- **Goals:** A platform for bilateral / global observation cooperation and museum for space science.



Icelandic institutes:

Arctic Portal
Husavik Academic Center
The Icelandic Centre for Research(RANNIS)
Icelandic Meteorological Office (IMO)
Science Institute, University of Iceland
University of Akureyri
Icelandic Arctic Cooperation Network

Chinese institutes:

Polar Research Institute of China
National Space Science Center, CAS
Institute of Geology and Geophysics, CAS
China Research Institute of Radio Propagation
National Center for Space Weather, CMA
Peking University
Wuhan University
University of Science and Technology of China
Shandong University

Lidar experiments for polar atmosphere detection : **New observation at the CIAO**

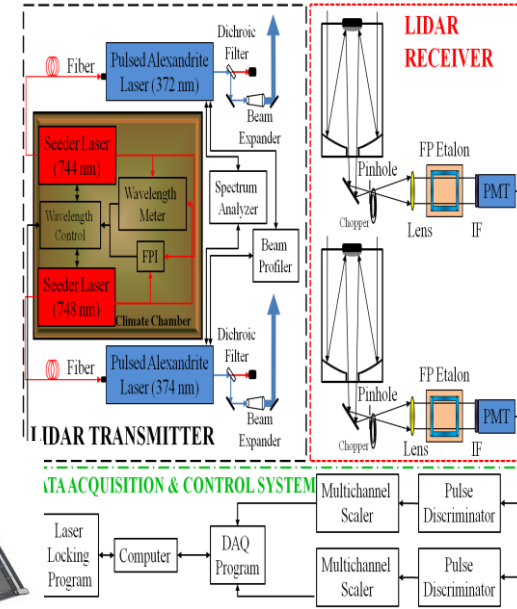
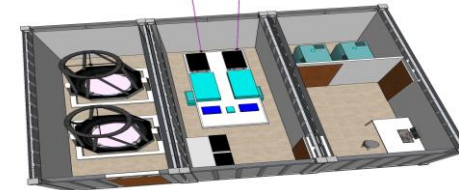
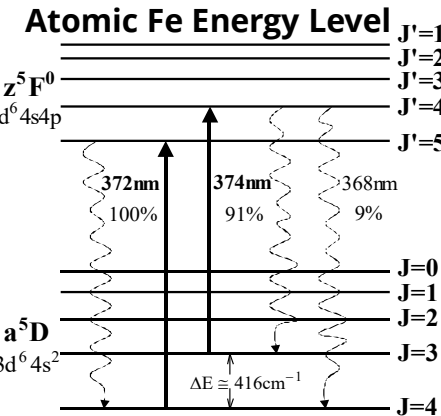
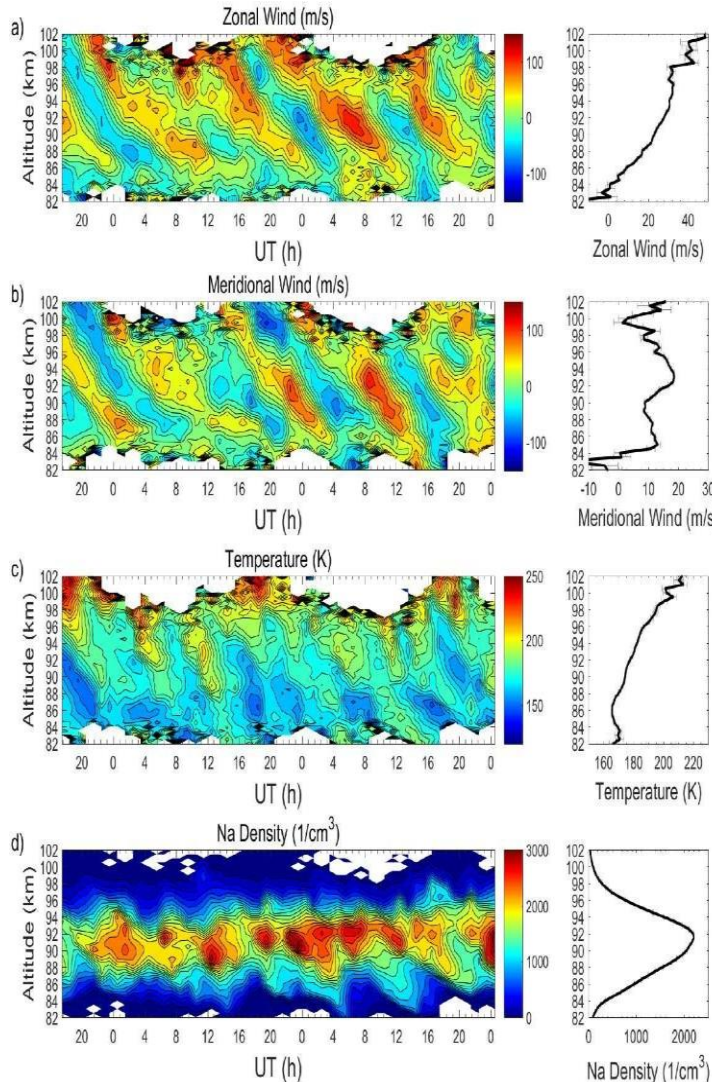
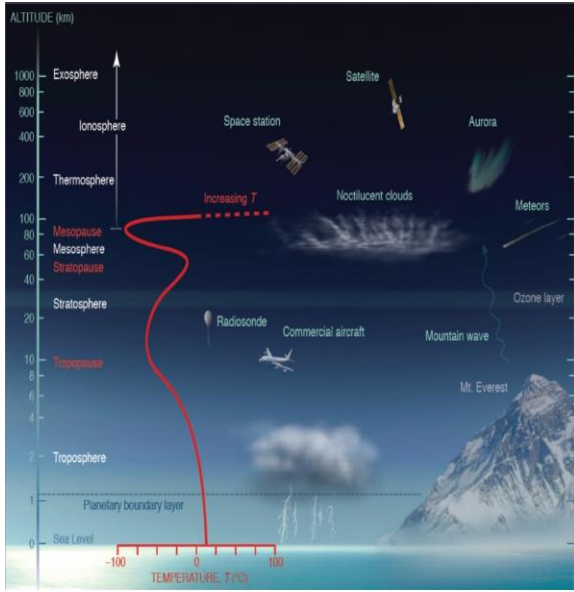
Making use of the metal layers in Mesosphere /Lower Thermosphere (MLT), a sodium fluorescent Doppler lidar has been developed at Zhongshan in Antarctica, **the 1st of the kind deployed in polar regions.**

Continuously profiling for both **day and night** the wind velocity and temperature of the MLT at the interface between ionized and neutral atmosphere, to study the dayside solar-terrestrial interaction in the cusp region.

Concept of Fe Boltzmann Lidar: The population ratio between two energy levels is determined by temperature of Atomic Fe with Maxwell-Boltzmann distribution in thermal dynamic equilibrium.

Aiming: developing novel Fe Boltzmann Lidar at CIAO to measure **the atmospheric temperature in the stratosphere and lower-Mesosphere, temperature & Fe density in MLT** for both day and night

Goals: To study on the coupling between ionosphere and lower atmosphere, esp. on the influence of space weather on climate change by **the nightside auroral substorms.**



China-Nordic Arctic Research Center (CNARC) :A platform for Arctic social science collaboration

CNARC extended from China-Iceland bilateral cooperation to a regional cooperation on Arctic issues. CNARC was established in Shanghai on 10th December 2013 by ten Member Institutes, 4 Chinese and 6 Nordic.

Purpose

- To increase awareness, understanding and knowledge of the Arctic and its global impacts
- To promote cooperation for sustainable development of the Nordic Arctic and coherent development of China in a global context

Activities

- China-Nordic Arctic Cooperation Symposium
- CNARC Fellowship / Internship Program
- Joint Research Projects
- Information sharing and cultural exchange in Arctic context

Research Themes

- Arctic climate change and its impacts
- Arctic resources, shipping and economic cooperation
- Arctic policy and legal studies

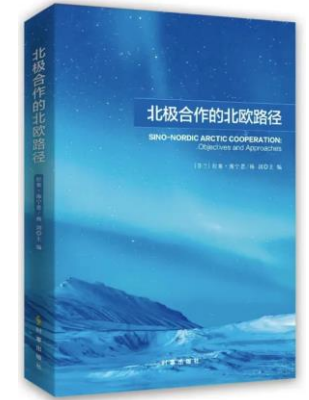
CNARC member institutes (18)

- Nordic

- Arctic Center, University of Lapland (Finland)
- Fridtjof Nansen Institute (Norway)
- Icelandic Centre for Research
- Nordic Institute of Asian Studies (Denmark)
- Norwegian Polar Institute
- Swedish Polar Research Secretariat
- Arctic University of Norway, UiT (Norway-2016)
- University of Akureyri (Iceland - 2017)
- Umea University (Sweden - 2017 - with SPRS)
- Nord University (Norway - 2018)

China

- Polar Research Institute of China (secretariat)
- Shanghai Institutes for International Studies
- Tongji University
- Ocean University of China
- Shanghai Jiao Tong University (2014)
- Dalian Maritime University (2016)
- Shanghai Ocean University (2018)
- South China Business College (2018)



CNARC was included in the Nordic Council of Ministers' Arctic Cooperation Program in 2018, and recognized as one of cooperation forum in the China's Arctic Policy White Paper in 2016.

Summary : A perspective on China's Arctic observation and research cooperation

There is great space to further China's Arctic Research cooperation with the Arctic states and other countries,

- to develop coordinated and collaborative observation/investigation on the Arctic land and ocean within the Sustainable Arctic Observing Network (SAON) framework to understand the vulnerability and resilience of Arctic environments and societies.
- to study the role of the Arctic in the global system, its climate dynamics and ecosystem responses, and tele-impacts on mid-latitude region.
- to share the scientific data, disseminate the Arctic knowledge and challenges to the public and bridge between people in China and the Arctic regions.