Japanese programs
( Arctic Ocean sciences)

• JAMSTEC
  R/V Mirai cruise
  Joint Western Arctic climate Studies (Japan-Canada-US project)
  Sustained mooring observation in the Pacific Arctic Ocean
  Automated drifting buoy observation

• Hokkaido University
  T/S Oshoro-Maru cruises in the Bering Sea and its adjacent seas

Asymmetric distribution of ice cover in the ocean & land modulates the atmospheric circulation.
  ➔ Modulated atmospheric circulation enhances further sea ice reduction
  ➔ This positive feedback is essential mechanism to decline sea ice cover.
  ➔ Further sea ice reduction

This important feature has not been projected in global climate model!
Sea ice motion in 2006/2007 winter before melt onset

Movement of western part of purple line initially located along 76.5N (140-166W) from October 1 to June 1. The year indicated in the figure is the year after movement.

The rotation of sea ice was largest in 2007! This change would suggest a kind of catastrophe across a tipping point of Arctic climate.
Large scale crash of ice floe

Rapid movement of heavy ice toward warm southern Beaufort Sea

Warmest water under the ice in the Canada Basin

Sea Ice Concentration (June) 75-80N, 2000-3000m

Further acceleration of sea ice reduction

Atmospheric warming & circulation

1. Increase in outflow of sea ice
2. Atlantic Sector
3. Strengthening of We Salinization of SML
4. Activation of sea ice motion
5. Ice melt
6. Oceanic warming
7. Less ice formation
8. Activation of ocean circulation

New Positive feedback

Aug 6, on Northwind Ridge, from CCGS Louis S. St-Laurent
Japanese IPY cruises

R/V Mirai 2008 cruise
Aug. 28 (Dutch Harbor)
~ Oct. 11 (Dutch Harbor)

T/S Oshoro 2008 cruise
July 6 (Nome)
July 17 (Dutch Harbor)


Estimated heat flux @ eastern Bering Strait
Ocean heat Flux (J/Year)

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<th>Year</th>
<th>7.0E+19</th>
<th>1.1E+20</th>
<th>1.5E+20</th>
<th>1.9E+20</th>
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</table>

Mizobata et al., 2008

Notes: 開水期(6月〜10月)のみ

Recorded maximum sea ice motion and deformation

8 months

Just 3 months!

R/V Mirai 2008 cruise
August – October, 2008

Revisit to the hydrographic sections Larsen93, AOS94 and Mirai2004 to detect environmental changes in Pacific and East Siberian sector of the Arctic Ocean.

- **Hydrography**
  Hydrographic survey for full span of southern Canada and Makarov Basins.
  (temperature, salinity, nutrients, alkalinity, 18O, shipboard ADCP, meteorology, etc.)

- **Mooring array in the Chukchi Sea**
  Quantitative evaluation of ocean heat and salt flux from the Pacific into the Arctic.
Automated Drifting Buoy Observation

2007: one buoy deployment in the Makarov Basin.
2008: 3~4 buoys are planned to deployed under international collaboration.

Led by Takashi Kikuchi

Hydrographic survey using XCTD (~60 stations) aboard Polarstern 2006 cruise

EU IPY project
DAMOCLES
Developing Arctic Modeling and Observing Capabilities for Long-term Environmental Studies
Hokkaido University

International collaborative research cruises in the Chukchi and Bering Seas in summer 2007 and 2008

- Hokkaido University has already sent T/S Oshoro-Maru to the Chukchi Sea and northern Bering Sea in summer 1991 and 1992 and study oceanographic environment and demersal fish community. In the Chukchi Sea and northern Bering Sea, arctic cod, Boreogadus saida (Lepechin), is one of key species strongly responding to climate and atmospheric change. We will compare abundance and distribution of arctic cod and the other bottom fishes between in summer 1991/1992 and in summer 2007/2008 and examine affect of recent global warming to arctic and sub-arctic marine ecosystem.

Cruise plan of T/S Oshoro-Maru 2007-2008

Hokkaido University

Ocean Field Campaign for monitoring sea ice and Coccolithophores bloom with near-real time satellite data support from University of Alaska Fairbanks and Japan Aerospace Exploration Agency (JAXA) both in 2007 and 2008 of IPY Years.