Marine-based Western Antarctic Ice Sheet is vulnerable to global warming and subsequent sea level rise, and retreat of the West Antarctic Ice Sheet can accelerate global sea level rise and climate change. Recent disintegration and collapse of ice shelves in West Antarctica has drawn much attention because ice shelves buttress ice sheets. This project is establishing a monitoring system for ice shelf movements and environmental changes of the ice shelf system in West Antarctica. We also reconstruct the past environmental changes caused by past climatic warming in the ice shelf area to understand the mechanism of ice shelf stability and impact of ice shelf collapse on environment.

Study area.
(A) Antarctic Peninsula region: Larsen ice shelves, northwestern part of the Weddell Sea, fjords in the western part of the Antarctic Peninsula, Drake Passage, Bransfield Strait.
(B) Ross Sea region: Ross embayment and Ross sector of Southern Ocean (map from Rignot et al., 2011, Science)

Monitoring of abrupt environmental change in the ice shelf system and reconstruction of Quaternary deglaciation history in West Antarctica

Collapse of Larsen B ice shelf in March 2002 (MODIS satellite image)

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Partner Organizations
South Florida Univ (US), NSIDC, Colorado (US), Scripps (US), GNS (NZ), NZARI (NZ), Victoria Univ Wellington (NZ), Korea Univ (Korea), PNU (Korea), SNU (Korea), POSTEC (Korea)

Research Duration
Jan 2014 – Dec 2016 (3 yrs)

Research Area
- Antarctic Peninsula region: Larsen ice shelves, northwestern Weddell Sea, fjords of the western Antarctic Peninsula, Southern Ocean and Drake Passage near Antarctic Peninsula
- Ross Sea region: Ross embayment and Southern Ocean of Ross Sea sector

*Ross Sea region: Ross embayment and Southern Ocean of Ross Sea sector

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**Research Method**

- **Collaborations for the project**
  - Multidisciplinary
  - KOPRI-Academic
  - Internationall

**Ice shelf monitoring system**
- Installation of AMIGOS (Automated Met-Ice-Geophysics Observing Stations) systems: Drygalski Ice Tongue, Ross Sea
- Installation of seismometers in Antarctic Peninsula region

**Sedimentation model for Marian Cove, Antarctic Peninsula**

**Methods**

- Field work and sampling (Araon): seismic survey, multibeam swath bathymetry, sediment coring (long core system, box core, gravity core, etc.), Sediment trap, CTD, etc.

**Main research contents**

- Establishment of monitoring system (AMIGOS, GPS, seismometer, sediment trap, etc.) of abrupt environmental change of the ice shelf system in West Antarctica
- Reconstruction of the stratigraphic record from the Last Glacial Maximum to the Last Interglacial (~125 ka) when global conditions of sea level and average climate were higher and warmer, respectively, than today
- Reconstruction of late Quaternary glacial history and configuration of the West Antarctic Ice Sheet
- Marine biological, geochemical, and photochemical study of the role of meltwater and sea ice in ecosystem and impact of ice shelf collapse on marine ecosystem

**Purpose of the study**

- To establish an monitoring system for ice shelf movements
- To reconstruct the environmental changes caused by past climatic warming in the ice shelf area of West Antarctica

**Sea Ice, Feb 2015.**
- Sediments. Ross Sea, collected marine core system, box coring (left) and gravity core system, box core, gravity core, etc.), Sediment coring (long core system, box core, gravity core, etc.), Sediment trap, CTD, etc.

**Paleoceanography**

- **Paleoenvironment**: Glacial History, Cosmogenic isotope dating, Radiocarbon age dating, Sediment analysis, Proxy development, Stable isotopes, etc.

**Paleoclimate reconstruction:** sediment coring, radiocarbon age dating, cosmogenic isotope dating, proxies for paleotemperature and paleoproductivity, sediment geochemistry, etc.

**Overall Outcomes**

- **Ice shelf monitoring system**
- Sedimentation model for Marian Cove, Antarctic Peninsula

**Future Plans and Application**

- Establishment of ice shelf-monitoring system and assessment of the stability of the West Antarctic ice shelves will help to predict the future deglaciation trend of the West Antarctic Ice Sheet, which is one of the most serious environmental threat facing mankind.
- Reconstruction of past environmental changes caused by climate warming will help to predict environmental impacts in response to future climate warming.
- Paleoclimate studies will help to improve paleoclimate proxies by applying them to ice shelf-proximal sediment samples which are less well studied than sediments from other regions in high latitudes.
- International collaboration with countries of more experience in polar marine cruise will be advantageous to the polar research activities of Korea.
- Further development of this project will be able to provide scientific information to policy makers of the impact of climate change on environment.
- Research activities and research conclusions can give a valuable information in science education and public outreach programs.