Oceanic heat transport to the Dotson Ice Shelf and its inter-annual variation

Tae-Wan Kim

Tae-Wan Kim[1], Heewon Yang[1], Ho Kyung Ha[2], Chang-Sin Kim[3], Kyoung-Ho Cho[1], Anna K. Wåhlin[4], Taewook Park[1], Sanghoon Lee[1], Adrian Jenkins[5], Pierre Dutrieux[6], Stan Jacobs[6]and Yang-Ki Cho[7]

[1]Division of Polar Ocean Sciences, Korea Polar Research Institute, Incheon, Korea
[2] Department of Ocean Sciences, Inha University, Incheon South Korea
[3] National Institute of Fisheries Science, Busan South Korea
[4] Department of Marine Sciences, University of Gothenburg, Gothenburg, Sweden
[5] British Antarctic Survey, Natural Environment Research Council, Cambridge, U.K.
[6]Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY, U.S.A.
[7]School of Earth and Environmental Sciences, Seoul National University, Seoul, Korea

twkim@kopri.re.kr

ABSTRACT

Recently, the widespread thinning of ice shelves in the coast around the Amundsen Sea has been recorded in recent decades due to intrusions of relatively warm Circumpolar Deep Water (CDW) onto the continental shelf. Such an intrusion of CDW supplies heat to the Ice shelves and leads to ice shelves basal melting and spreading of meltwater from the glacier. Dotson Ice Shelf (DIS) is an ice shelf south of Amundsen Sea polynya (ASP), which has been found to have a high basal melting rate due to oceanic heat transport steered towards it in the Dotson-Getz Trough (DGT). Modified CDW (mCDW) was observed to intrude along the bottom of the eastern slope of DGT. This warm salty water melts glacial ice, mixes with the meltwater and spreads to the north along the western slopes of DGT. A strong seasonal variation was observed, with the maximum southward flow during austral summer and minimum in austral autumn and winter. The seasonal variation correlated with the local Ocean Surface Stress Curl (OSSC) by sea ice and wind distribution in the ocean surface, in similarity with previous studies from nearby regions. Meltwater outflows showed maximum during autumn and minimum during spring at the western slope and it was lagging heat transport at eastern slope by 145 days. The thickness and bottom temperature of mCDW at the entrance of DGT showed a strong inter-annual variation and its variability was intensified in front of DIS affected by Ekman upwelling along DGT. During austral summer, southeasterly wind on the eastern boundary of ASP shows the strong inter-annual variability associated with the longitudinal location of Amundsen Sea Low (ASL).