Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

MIS34-05 Room:414 Time:May 2 15:15-15:30

Modeling basal melting of Antarctic ice shelves

KUSAHARA, Kazuya[1*] ; HASUMMI, Hiroyasu[2]

[1]Institute of Low Temperature Science, Hokkaido University, [2]Atmosphere and Ocean Research Institute, the University of Tokyo

We have incorporated an ice shelf component into a sea ice-ocean coupled model. Basal melting of all Antarctic ice shelves are investigated with the circumpolar ice shelf-sea ice-ocean coupled model and we have estimated the total basal melting of 770-944 Gt/yr under present-day climate conditions. We present a comparison of the basal melting with previous observational and modeling estimates for each ice shelf in detail. It is found that heat sources for basal melting are largely different among the ice shelves. From a series of numerical experiments, sensitivities of the basal melting to surface air warming and to enhanced westerly winds over the Antarctic Circumpolar Current are investigated. In this model the total basal melting strongly depends on the surface air warming but is hardly affected by the change of westerly winds. The magnitude of the basal melting response to the warming varies widely from one ice shelf to another. The largest response is found at ice shelves in the Bellingshausen Sea, followed by those in the Eastern Weddell Sea and the Indian sector. These increases of basal melting are caused by increases of Circumpolar Deep Water and/or Antarctic Surface Water into ice shelf cavities. By contrast, basal melting of ice shelves in the Ross and Weddell Seas is insensitive to the surface air warming, because even in the warming experiments there is high sea ice production at the front of the ice shelves that keeps the water temperature to the surface freezing point. Weakening of the thermohaline circulation driven by Antarctic dense water formation under warming climate conditions is enhanced by basal melting of ice shelves.

Keywords: Antarctic ice shelves, Ice shelf-sea ice-ocean coupled model, Climate change