Modeling ocean-ice shelf interaction over the Southern Ocean under RCP8.5 scenario

*Kazuya Kusahara[1], Hiroaki Tatebe[1], Tomohiro Hajima[1], Fuyuki SAITO[1]

1. Japan Agency for Marine-Earth Science and Technology

Much attention has been paid to ocean-cryosphere interactions over the Southern Ocean. Basal melting of Antarctic ice shelves has been reported to be the primary ablation process for the Antarctic ice sheets. Warm waters on the continental shelf, such as Circumpolar Deep Water (CDW) across the shelf break, play a critical role in active ice shelf basal melting. The temporal evolution and mechanisms of the basal melting and warm water intrusions under future warming climates would be crucial for better understanding Antarctic Ice sheets stability and the associated sea-level rise. Here, we conduct a numerical experiment of an ocean-sea ice-ice shelf model forced with future atmospheric conditions derived from the RCP8.5 scenario of MIROC-ESM for the period 2000–2140 to examine responses of the Antarctic ice shelf basal melting and the role of coastal water masses in the future. The modeled total mass loss from Antarctic ice shelf basal melting has gradually increased about 2-fold from 1500 Gt/yr to 3000 Gt/yr over the study period, while basal melting at the Amery Ice Shelf, East Antarctica, is dramatically increased from about 50 Gt/yr in the first half of the 21st century to about 300 Gt/yr in the 22nd century. The regional boost of the ice shelf basal melting is explained by the sudden enhancement of CDW intrusion into the ice shelf cavity. This study demonstrates that changes in the Antarctic coastal water masses are vital metrics for a better understanding of the ocean-cryosphere interaction over the Southern Ocean.

Keywords: ice-ocean interaction, Southern Ocean

