Radiative impacts of low-level clouds on the subtropical high in the South Indian Ocean and their seasonal differences simulated in a coupled general circulation model

*Ayumu Miyamoto[1], Hisashi Nakamura[1], Takafumi Miyasaka[1,2], Yu Kosaka[1]

1. Research Center for Advanced Science and Technology, The University of Tokyo, 2. Japan Meteorological Business Support Center

Radiative impacts of low-level clouds are important for air-sea coupled systems because they can not only drive large-scale atmospheric circulation through cloud-top radiative cooling but also cool the underlying SST by shielding sunlight (albedo effect). In the present study, we assess their effects on the subtropical high in the South Indian Ocean, using a coupled general circulation model. By comparing a freely coupled control run (CTL) and no low-cloud run (NoCRE) where the radiative effects of low-level clouds are artificially turned off, we find that low-level clouds act to reinforce the subtropical high. In winter, enhanced in-atmosphere radiative cooling from their cloud-top strengthens the subtropical high. In summer, in addition to the above mechanism, lowered SST by their albedo effect reduces deep convective precipitation, which strengthens the subtropical high by inducing a Matsuno-Gill type response. Associated reduction of high-top clouds further augments in-atmosphere radiative cooling. Their summertime impacts on the subtropical high are so significant that the subtropical high is almost missing in the NoCRE experiment, suggesting their essential role in the existence of the subtropical high.

Keywords: low-level clouds, subtropical high, South Indian Ocean

