

Observed cross-basin interaction of decadal climate variability over the Indo-Pacific region

*Yuma Miyaji¹, Youichi Tanimoto²

1. Hokkaido University, Graduate School of Environmental Science, 2. Hokkaido University, Faculty of Environmental Earth Science

We investigate remote effects of the decadal sea surface temperature (SST) variability over the tropical Pacific onto the thermal structure of the surface layers over the Indian Ocean. To extract the internal variability from the observed records, we employed the multi-model ensemble data of Coupled Model Intercomparison Project 5 (CMIP5) to evaluate the externally forced component contained in the observations.

An SST warming trend in recent decades is quite pronounced in the Indian Ocean than in the other tropical basins. Therefore, the SST warming trend and the decadal SST variability over the Indian Ocean have comparable variances and mixed in the observed records. While the previous studies attempted to obtain the cross-basin relationship of the decadal SST variability between over the Pacific and over the Indian Ocean, those results depend on the separating treatment of the internal variability and the externally forced component. Here, we present a new method to estimate the externally forced component in the observations by using multi-model ensemble mean of global mean surface temperatures from the CMIP5 historical simulations. Our analysis onto the extracted internal variability in the observed records shows positive correlation of decadal temperature anomalies over the Indian Ocean surface layers and the SST anomalies over the tropical Pacific. Intensification (weakened) of the wind-driven ocean circulation over the Indian Ocean has a significant contribution in forming positive (negative) temperature anomalies of surface layers. The enhanced (reduced) surface winds over the Indian Ocean are induced by the modified Walker Circulation associated with the positive (negative) SST anomalies over the tropical Pacific. This ocean advection effect on SST overwhelms the damping effect of surface heat flux on local SST. Thus, the internal variability extracted by this method shows the single coherent ocean-atmosphere interaction over the Indo-Pacific region all through the analyzed period.

Keywords: Air-sea interaction, Decadal variability, Global warming