Impact of tropical Pacific sea surface temperature on the regional heavy rainfall events in Japan

*Yukiko Imada[1], Hiroaki Kawase[1], Masahiro Watanabe[2], Izuru Takayabu[1]

1. Meteorological Research Institute, Japan Meteorological Agency, 2. Atmosphere and Ocean Research Institute, the University of Tokyo

To detect the impact of global-scale climate on regional extreme events is challenging especially for disastrous regional heavy rainfall events which are often strongly affected by local topography. Observed records are too short to obtain significant concurrent signals. General circulation models (GCMs) can represent background large-scale circulations causing regional heavy rainfall but cannot resolve the topography. On the other hand, high-resolution regional climate model can resolve orographic rainfall but cannot provide the information of key processes in larger-scale circulation. Here, we prepared a large-ensemble pair of GCM and nonhydrostatic regional model simulations covering 6800-year samples. It enables us to access local rainfall event directly and investigate cause-to-effect pathway to explain the impact of global scale climate. As an example, we cite 2-type heavy rainfall events around precipitous terrains in Japan: western Kyushu type and eastern Kyushu type. The western Kyushu type related to moisture transport is attributed to the development of the Pacific subtropical High which is often forced by an El Nino event during previous winter. On the other hand, the eastern Kyushu type is attributed to TC approach which correlates to the central Pacific El Ninos. Through this new flamework with large-ensemble pairs of global and regional simulations, we can verify various influence pathways of large-scale climate to specific regional extreme events.

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