Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

ACG32-16 Room:202 Time:May 27 09:45-10:00

Recent slowdown of upper tropospheric warming associated with the tropical SST variability

KAMAE, Youichi[1*] ; SHIOGAMA, Hideo[1] ; WATANABE, Masahiro[2] ; ISHII, Masayoshi[3] ; UEDA, Hiroaki[4] ; KIMOTO, Masahide[2]

[1]Nat. Inst. for Environ. Studies, [2]AORI, Univ. Tokyo, [3]Meteor. Res. Inst., [4]Life and Environ. Sciences, Univ. Tsukuba

In future climate projections by using atmosphere-ocean coupled general circulation models (AOGCMs), simulated zonal-mean warming have two major peaks in (1) upper troposphere over the tropics and (2) near-surface in the polar regions. AOGCMs tend to simulate larger increase in tropical upper-tropospheric temperature (TTUT) during these 15 years relative to radiosonde observations. Projected increase in TTUT is important for climate feedbacks, changes in tropical atmospheric circulation, and tropical cyclone activity in a warming climate. The recent observation-model discord in TTUT is an underlying issue regarding the reliability of future climate projections based on AOGCMs.

To examine reasons for this observation-model discord, we conducted ensemble simulations using an atmospheric general circulation model (AGCM) forced by sea surface temperature (SST) both with and without anthropogenic influences [1].

The recent TTUT increase is significantly overestimated in the CMIP5 AOGCMs but simulated accurately in the AGCM run. The largest discrepancy in the upper-tropospheric warming is found over the central Pacific (CP), which can be attributed to recent SST variability over the tropical Pacific associated with the ENSO cycle; however, the CMIP5 AOGCM ensemble is not intended to simulate this cycle. The effect of recent tropical SST variability can explain the spatial pattern, interannual variability, and about half of the bias in the warming trend in the CMIP5 AOGCMs. These results suggest that a large part of the recent slowdown in tropical upper-tropospheric warming can be ascribed to natural variability, refuting the suggestion of low reliability of climate change projections by CMIP-based AOGCM simulations.

Reference

1. Kamae, Y., H. Shiogama, M. Watanabe, and M. Kimoto, 2014: Attributing the increase in Northern Hemisphere hot summers since the late 20th century. Geophys. Res. Lett., 41, 5192-5199, doi:10.1002/2014GL061062.

Keywords: tropospheric temperature, decadal variability, CMIP, radiosonde, MSU, sea surface temperature