

Global temperature fluctuations due to tropical Pacific decadal variability and their uncertainty

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Marked slowdown of global mean surface temperature (GMST) increase from the late 1990s to mid-2010s highlights importance of internal climate variability in the tropical Pacific and its global influence. Evaluation of this tropical Pacific influence is therefore critical for global warming attribution. The present study assesses the global temperature variability associated with the tropical Pacific sea surface temperature (SST) variability based on pre-industrial control experiments by 25 CMIP5 climate models and the tropical Pacific pacemaker experiments by 3 models.

All the models commonly present larger GMST anomalies in decadal than interannual variability associated with 1°C increase of tropical Pacific SST. This time-scale dependence arises from wider meridional extent of SST anomalies in the tropical and subtropical Pacific and larger sensitivity in the mid- and high latitudes. The former has been recognized as the structural difference between El Niño-Southern Oscillation and the Interdecadal Pacific Oscillation. The latter is due to the longer intrinsic time scales of the extratropical oceans and sea ice. Furthermore, decadal GMST sensitivity is strikingly diverse among models, in contrast to the interannual variability. This diversity is pronounced in the Northern high latitudes and the Southern Ocean. Our analysis on Arctic sea ice variations demonstrates the time-scale dependence and multi-model diversity. The model uncertainty could lead to inconclusive attribution results on the recent global warming slowdown.

Keywords: Global warming, ENSO, IPO