

## Hiatus and accelerated global warming due to tropical Pacific natural variability

KOSAKA, Yu<sup>1\*</sup> ; XIE, Shang-ping<sup>2</sup>

<sup>1</sup>RCAST, University of Tokyo, <sup>2</sup>Scripps Institution of Oceanography, UCSD

Annual global-mean surface temperature (GMT) has been flat since the beginning of this century. Mechanisms have been proposed for this hiatus of global warming. In our former study, we performed a climate model experiment called Pacific Ocean-Global Atmosphere (POGA), which forces tropical Pacific sea surface temperature anomalies to follow the observed history. When forced by the historical radiative forcing, POGA reproduced the observed annual-mean GMT variability strikingly well with a correlation coefficient  $R = 0.97$  for 1970-2012, including the current hiatus period. POGA showed that GMT decrease by the recent tropical Pacific decadal cooling opposed the radiatively forced warming, mostly explaining the current hiatus.

When we look back to the past, GMT has risen since the mid-19th century with notable interannual and interdecadal variability. In this study, we perform a long POGA experiment dating back to the late 19th century with GFDL CM2.1, and examine the role of tropical Pacific variability on the observed history of global climate. POGA reproduces annual-mean GMT variability with  $R = 0.96$  and 15-year running GMT trend with  $R = 0.80$  since 1870. We quantify relative contributions from the radiative forcing and tropical Pacific variability by comparing POGA with another experiment forced solely by the radiative forcing. The tropical Pacific variability was a major cause of global cooling from the late 1890s to around 1910, accelerated the first warming from the 1910s to 40s, advanced the beginning and delayed the end of the big hiatus for the mid-1940s to mid-70s, and accelerated the first half of the second warming for the mid-1970s to late 90s. POGA also captures observed regional trend of surface temperature for these periods with strong tropical Pacific influence, especially over the tropical Indian Ocean, Indian subcontinent, North and South Pacific and North America. Rate of the recent GMT decrease due to the tropical Pacific cooling is comparable with that occurred in the beginning of the 20th century, but the recent one is the longest for the past 150 years. The strengthening of the Pacific trade wind since the 1990s is at the fastest rate. In these regards, the recent hiatus is unprecedented in the instrumental records.

Keywords: tropical PDO, ENSO, trade winds, global climate, teleconnections