

Tropical Atlantic warming as a possible trigger for the recent decadal trend in global monsoon

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During the satellite era since 1979, global-mean land monsoon rainfall, including Asian, African and American monsoon, exhibits an increasing trend. From a paleoclimate perspective, global monsoon rainfall especially over the Northern Hemisphere shows coherent increasing/decreasing trends accompanied with inter-hemispheric asymmetry in seasonal insolation associated with variability in Earth's orbit on millennium timescale. The recent decadal trends are not attributed to orbital forcing, volcano nor anthropogenic aerosol forcing, therefore its physical mechanism remains unclear. Since 1979, decadal trend of sea surface temperature (SST) exhibits a remarkable zonal asymmetry in the tropics, i.e. warming over the Indian, Atlantic Ocean and western Pacific but cooling over the eastern Pacific. Li et al. (2016) showed that the recent Atlantic warming possibly favors the observed tropical SST trend through trans-basin interactions between the Indian, Pacific and Atlantic Oceans. Rossby and Kelvin waves favored by the Atlantic warming-induced atmospheric heating enhance/weaken the tropical trade winds/monsoonal circulation, resulting in tropical atmosphere-ocean interactions and the SST trend. Using ocean temperature restoring experiments in a coupled climate model, we find that the Atlantic warming is also a trigger for the recent decadal trend in global monsoon. The subtropical atmospheric warming over North and South America, Atlantic, and North and South Africa in response to the Atlantic warming result in a larger temperature gradient between land and ocean and stronger monsoonal circulation. In contrast, the Indian Ocean and Pacific temperature restoring do not produce the recent SST trends. The results of this study indicate that the tropical Atlantic variability can explain large parts of the observed decadal trends in global climate.

Keywords: Trans-basin interactions, Atmosphere-ocean interactions, Rossby wave, Kelvin wave, Monsoon