



Robust signal of Northern Hemisphere summer monsoon variability during recent warming period

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Coupled global climate models (CGCMs) predict the overall weakening of tropical circulations in an anthropogenically warmed climate in accordance with a simple thermodynamic theory. However, the actual response of the climate systems, in particular, over the recent decades of unprecedented warming still remains a topic of debate. Here, we show that in a suite of cutting-edge atmospheric GCMs (AGCMs), the simulated Northern Hemisphere summer monsoon (NHSM) variability, measured by vertical wind shear of zonal winds, is in excellent agreement with observations on both interannual and inter-decadal timescales during 1979-2008. Furthermore, the trend of the NHSM variability is nearly unanimously enhanced among the AGCMs. The overriding factors in determining the simulated NHSM variations are El Niño on year-to-year timescale, and Mega-ENSO (defined as a leading mode of internal sea surface temperature variability over the Pacific) and Atlantic Multi-decadal Oscillation on decadal timescale and beyond, which ascertains the findings of a recent observational study. These results suggest that in contrast to the pivotal role of green-house gas forcing in the simulated future warmer climate, the basin-wide natural SST variability has exerted significant impacts on Earth's climate during the recent 30-year period.