Effects of external forcings on Northern Hemisphere monsoon precipitation.

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Abstract

The observed northern Hemisphere Land monsoon precipitation (NHLM) exhibits multidecadal variability. We assess the ability of CMIP6 climate models at simulating NHLM precipitation trends, exploring the roles of external forcings and driving trends in precipitation. We use the single-forcing simulations of the Detection and Attribution MIP (DAMIP), to analyse the effects of anthropogenic aerosol (AA), greenhouse gas (GHG) emissions and natural forcing. Drying trends are likely to be mainly due to increased AA emissions, which cause shifts of the atmospheric circulation and a decrease in moisture advection. The increase in GHG emissions causes monsoon precipitation to increase because of a strengthening of the moisture advection over land. We assess uncertainties at simulating effects of external forcing using three initial condition large ensembles. We then show that AA emissions have strong control on summer monsoon precipitation trends, exceeding the effects of internal climate variability. However, we found strong differences among models in surface temperature over the Atlantic Ocean, and precipitation pattern anomalies over West Africa, due to changes in AA emissions.

Keywords: Monsoon precipitation, External forcing, Anthropogenic Aerosols, Uncertainty, Large ensembles

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