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Changes in the relationship between the East Asian winter monsoon and ENSO under global warming

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The East Asian winter monsoon (EAWM) is a prominent feature of the northern hemisphere atmospheric circulation during boreal winter, which has a large influence on weather and climate of the Asian-Pacific region. At interannual time scales, the strength of the EAWM is strongly influenced by the El Niño-Southern Oscillation (ENSO), while the ENSO-EAWM relationship displays pronounced interdecadal variations associated with changes in the ENSO teleconnection pathways to East Asia. Using future transient simulations from the Max Planck Institute-Grand Ensemble (MPI-GE), changes in the ENSO-EAWM relationship are examined at various global warming levels during the 21st-century. Results indicate that this relationship will enhance from present-day to +1.5°C, and then weaken until +3°C, strongly impacted by changes in anthropogenic forcing with internal variability playing a negligible role. The ENSO-EAWM relationship is strongly related to the background mean state of both the EAWM and ENSO under global warming. Both the climatological EAWM strength and the ENSO-related anomalies across the Asian-Pacific region contribute to changes in the ENSO-EAWM relationship. Furthermore, anthropogenic aerosols are also found to play a major role in influencing the ENSO-EAWM relationship under moderate warming (up to 1.5°C).