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Drivers of multidecadal variability of East Asian surface temperature in CMIP5 simulations of the last millennium

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We study past climates to understand natural climate variability, to determine the response to external forcings and to predict how these may influence future climate change. In this study we examine simulated linkages between the multidecadal variability of surface temperature in East Asia and two extratropical modes of variability: the Pacific Decadal oscillation (PDO) and the Atlantic Multidecadal Oscillation (AMO), in order to assess the relative influences of external forcing and unforced variability. The CMIP5 models produce modes of PDO and AMO variability with realistic spatial patterns and we compare their spectral power density to reconstructed data. In the pre-industrial control simulations, the PDO and AMO both have significant influences on East Asian temperatures at multidecadal timescales. These statistical associations become weaker with the introduction of external forcing in the past millennium simulations, though this depends on how the PDO and AMO are themselves defined/diagnosed. This finding highlights the need to make like-with-like comparisons between models and climate reconstructions, with consistency in whether the influence of external forcing is imprinted on teleconnection indices or has been factored out (explicitly or by the methods used to diagnose them). We also compare the simulated behaviour with climate reconstructions of East Asian temperature, external forcing (especially volcanic) and modes of climate variability.