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Investigating the ENSO teleconnection response to global warming using a multi-model large-ensemble experiment

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The El Niño-Southern Oscillation dominates interannual variability of the climate system, with widespread global teleconnections that influence regional precipitation and temperature. ENSO teleconnection patterns are generally projected to shift eastward over the Pacific-North America sector under global warming (medium confidence in IPCC AR5 report; approximately 25% of models disagree), due to either an eastward shift of tropical convection associated with the warm pool expansion or changes in the midlatitude circulation. Better constraining future changes in ENSO teleconnections remains a challenge because of model uncertainty in how (a) tropical convection and (b) the midlatitude circulation will respond to global warming, as well as (c) large internal variability of the teleconnection pattern, which makes it challenging to isolate the forced signal. Here, we tackle (b) and (c) using five models of the HAPPI large-ensemble simulations (at least 100 members per experiment). Prescribed-SST experiments are designed to test how teleconnections from the same ENSO events evolve under different background climates (present and future). The present day teleconnection pattern is relatively well simulated, with the models placing the North Pacific centre-of-action within 400 km of its position in ERA-Interim. A slight northeastward shift of the North Pacific centre is found in 3 out of 5 models, despite large internal variability (ensemble spread) in the position of this centre. In these models, tropical convection also shifts eastward, despite no change in the ENSO SST forcing. Some asymmetry exists between the two ENSO phases, with La Niña exhibiting a smaller northeastward shift than El Niño in 4 out of 5 models. Associated shifts in temperature impacts are weak, while precipitation impacts in regions along the North American west coast are accentuated and expand inland. Finally, the results for the HAPPI ensemble are compared with the results for the corresponding periods and warming in the CMIP5 ensemble.