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ENSO forcing of the Northern Hemisphere atmosphere in a warmer climate

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Changes in winter atmospheric response to sea surface temperature (SST) anomalies associated with El Niño–Southern Oscillation (ENSO) in a warmer climate conditions are estimated from two 20–member ensembles using the SPEEDY, an atmospheric general circulation model (AGCM) of intermediate complexity. The current climate was simulated using observed monthly SST and climatological sea–ice fraction for the period 1855–2002. The warmer climate is associated with carbon dioxide (CO2) concentration that is twice time larger than in current climate runs. The SST forcing in warmer climate experiment is represented by the same monthly mean SST anomalies as in current climate experiment, but they are superimposed on climatological SST projected by a coupled atmosphere–ocean general circulation model (AOGCM) in conditions with doubled CO2.
Consistent with the atmospheric response in the current climate, the strongest extratropical signal forced by ENSO in the warmer climate experiment is found over the Pacific–North American (PNA) region, particularly significant for strong warm events. A detectable signal linked to ENSO is also found over the NAE region. The main features of tropical–extratropical teleconnections are maintained in the both experiments (e.g. irrespective of the sign of SST anomalies, the amplitude of the atmospheric response is positively correlated with the intensity of ENSO event; the El Niño impact is stronger than La Niña of the same intensity; the atmospheric response is mainly liner since there is no phase shift between the centers of action). Changes in the ENSO teleconnections due to doubled CO2 concentration are estimated from the differences between the atmospheric responses in the warmer and current climate. Results indicate on discernible decrease of ENSO impact on the PNA region, while it is strengthened over the NAE region. Such atmospheric response in warmer climate is found to be associated with alterations of the mean state followed by changes in waveguiding effect and stationary wave activity.