Session: C36 Poster: Th61A

Sensitivity of the extratropical Southern Hemisphere climate to changing ENSO conditions

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The El Niño Southern Oscillation (ENSO) has significant impacts on the global climate system, but the extent to which these global teleconnections are sensitive to the strength and location of the anomalous warming in the tropical Pacific basin is still largely unexplored. In this study, we compare the response of the extratropical Southern Hemisphere (SH) climate to the following two manifestations of ENSO: 1) canonical or "traditional" El Niño, characterized by anomalous warming centered in the eastern tropical Pacific and 2) El Niño Modoki, characterized by anomalous warming centered in the eastern Pacific, flanked by cooling to its east and west. Observational analysis reveals that during the austral cold season (June-September), a similar wave train pattern in the atmospheric circulation arises in response to both canonical and Modoki El Niño events. However, during the warm season (November-February), the SH atmospheric circulation response differs between the canonical and Modoki El Niño events. Under canonical ENSO conditions, the SH atmospheric circulation exhibits a more zonally symmetric structure that arises from the statistically significant relationship with the leading mode of extratropical atmospheric circulation, the Southern Annular Mode (SAM). During El Niño Modoki events, the teleconnections to the SH atmosphere and ocean have weakened significantly, no longer exhibiting a strong link to variability in the SAM. An atmospheric GCM is then used to examine the sensitivity of the SH climate response to the strength and location of warming in the tropical Pacific basin.