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Linear interference effects on tropical-extratropical teleconnections

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In the northern extratropics, seasonal prediction depends mainly on finding teleconnections linking modes of daily atmospheric variability with persistent sea-surface temperature (SST) anomalies in the Tropics. These links can be maintained for weeks, months or even years by, for example, El Nino/Southern Oscillation (ENSO) episodes or secular warming trends in the tropical Indian Ocean. In this study we provide new insight into the underlying dynamics of wintertime tropical-extratropical teleconnections using a series of atmospheric GCM experiments forced with prescribed (i) warm ENSO and (ii) warm Indian Ocean SST anomalies. The resulting extratropical zonal mean responses have opposite sign: Indian Ocean warming produces a positive Northern Annular Mode (NAM) response, while ENSO warming produces a negative NAM response. Most of this difference can be explained using recently developed linear wave interference arguments. The two forcings are separated by approximately 180-degrees of longitude and their associated Rossby wave responses have opposing projections onto the background stationary waves. Finally, using an idealized 'perturbed topography' experiment, we show that changing the model's climatological stationary waves can significantly alter the extratropical response to tropical forcing.