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The role of tropospheric temperature in the El Niño-driven surface temperature warming over the remote tropics

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We demonstrate through atmospheric general circulation model simulations of the 97-98 El Niño that the observed 'remote' (i.e. outside the Pacific) tropical surface warming appearing a fewmonths after the peak of the El Niño event is causally linked to the tropics-wide warming of the troposphere resulting from increased atmospheric heating in the Pacific, with the latter acting asa conduit for the former. Unlike surface temperature, the surface flux behavior in the remote tropics in response to El Niño is complex, with sizable spatial variation and compensationbetween individual flux components; this dissimilarity suggests a more fundamental control (i.e. tropospheric temperature) for the remote tropical surface warming. For the remote oceans, increasing clear-sky downwelling longwave, a consequence of the increased tropospheric temperature and associated water vapor increase, acts as the important warming influence.However, it is the latent heat flux acting through boundary layer humidity variations is the important regulator linking the surface warming in the model simulations to the tropo-sphericwarming over the remote tropical oceans. The remote ocean surface warming seen in the models used is generally consistent with the "tropospheric temperature mechanism" previously proposedfor the tropical ENSO teleconnection, with the zonal propagation of tropospheric temperature anomalies from the eastern Pacific to the remote tropics accomplished by wave dynamics and thetroposphere-to-remote surface connection mediated by moist convective processes requiring the boundary layer moist static energy to vary in sympathy with the free tropospheric moist static energy. Over the remote land regions, idealized model simulations suggest that sensible heat flux regulates the warming response to El Niño, though the underlying mechanism is yet unclear.