Geophysical Research Abstracts
Vol. 21, EGU2019-3415, 2019
EGU General Assembly 2019

Idealized Modeling of the Atmospheric Boundary Layer Response to SST Forcing in the Western Indian Ocean

Adam Rydbeck (1), Tommy Jensen (2), and Matthew Igel (3)

(1) U.S. Naval Research Laboratory, Ocean Dynamics and Prediction Branch, Stennis Space Center, United States (adam.rydbeck@nrlssc.navy.mil), (2) U.S. Naval Research Laboratory, Ocean Dynamics and Prediction Branch, Stennis Space Center, United States , (3) Department of Land, Air and Water Resources, University of California Davis, Davis, CA

The atmospheric response to sea surface temperature (SST) variations forced by oceanic downwelling equatorial Rossby waves is investigated using an idealized convection-resolving model, CM1. Downwelling equatorial Rossby waves are observed to sharpen SST gradients in the western Indian Ocean. These changes in SST cause the atmosphere to hydrostatically adjust, subsequently modulating the low-level wind field. In an idealized cloud model, surface wind speeds, surface moisture fluxes, and low-level precipitable water maximize in regions of strongest SST gradients, not necessarily in regions of warmest SST. Simulations utilizing the increased SST gradient representative of periods with oceanic downwelling equatorial Rossby waves show enhanced patterns of surface convergence and divergence that are linked to a strengthened zonally overturning circulation. During these conditions, convection is highly organized, clustering near the region of maximum surface fluxes and the ascending branch of the SST induced overturning circulation. When the SST gradient is reduced, as occurs during periods of weak or absent oceanic equatorial Rossby waves, convection is much less organized and rainfall is decreased. This demonstrates the previously observed upscale organization of convection and rainfall associated with oceanic downwelling equatorial Rossby waves in the western Indian Ocean. These results suggest that the enhancements of surface fluxes and low-level convergence that result from a steepening of the SST gradient are the leading mechanisms by which oceanic equatorial Rossby waves prime the atmospheric boundary layer for convective development.