# SCALE SEPARATION OF THE MECHANISM OF THE WIND RESPONSE TO SEA SURFACE TEMPERATURE IN THE NORTHERN EQUATORIAL PACIFIC

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## Abstract

The dynamics of air-sea interaction in the mesoscale have a two-fold scale separation. In physical space, basin scale and mesoscale winds have opposing responses to SST: negative correlation on the basin scale and positive correlation in the mesoscale. In wavenumber space, there is a further scale separation delineated by Rossby number, $R_0 = \frac{U}{fL}$. At $R_0 \geq +1$, turbulent mixing processes, spatially in phase with SST, govern the dynamics; at $R_0 \ll 1$ pressure gradient responses, spatially phase shifted from SST, predominate. Spectral transfer functions can be used to elucidate these dynamics using the regression coefficient between SST and wind response in wavenumber space. Similar to prior research in the low and mid-latitudes, transfer functions for the Eastern Equatorial Pacific about tropical instability waves show distinct scale separation with increasing wind speeds. Impulse response functions show the hypothesized dynamics based on the scale-dependent signals in the transfer functions. When winds are reconstructed using impulse response functions for $R_0 \ll 1$ and $R_0 \geq 1$, the results are consistent with expected dynamics for pressure gradient response and vertical mixing response, respectively. $f$-scaling shows similar rotation dependent dynamics, supporting the conclusion of $R_0$ scale separation of the dynamics of wind response to SST.