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Characterization of frontal air-sea interaction by spectral transfer functions

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The atmospheric response to fronts of sea surface temperature is typically characterized by regressions between wind speed, wind stress curl and divergence, with frontal scale variations of sea surface temperature and its down- and cross-wind gradients. We extend this approach spectral space to test underlying dynamics. Recently, we introduced a linear model for the response of the atmospheric boundary layer to mesoscale variations the sea surface temperature. The model includes the impact of sea surface temperature fronts on vertical mixing and on pressure gradients, and includes advection by a background Ekman spiral. Model dynamics are governed by transfer function in wave-number space between sea surface temperature, and frontally boundary layer variables. To test the physics of this linear model, we use frontally induced wind speed and direction as simulated by a high resolution atmospheric general circulation model, and evaluate the spectral transfer functions. For the Southern Ocean results show encouraging agreements and suggest that the linear model captures the underlying physics. In contrast, the Kuroshio region is more challenging.