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Sensitivity Analysis of Filtering Methods for Tropical Easterly Waves Classification

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Tropical easterly waves (TEWs) are quasi-periodic wave disturbances found within the easterly trade winds during boreal summer and autumn. They influence the synoptic-scale circulation dynamics in tropical America and contribute up to 50% of the seasonal precipitation (June to November) over northern South America. This study evaluates the sensitivity of different spectral bands in classifying TEWs based on daily vorticity at 700 hPa during the Organization of Tropical East Pacific Convection (OTREC) campaign. TEWs were identified in real-time using data from NOAA's Marine Tropical Surface Analysis. Complementarily, we refined TEWs identification by correlating it with 700 hPa filtered relative cyclonic vorticity from ERA5. To consider the uncertainties associated with the TEWs chronology selection, we employed two filtering methodologies: the Fast Fourier Transform (FFT) with periodicity bands of 3–10 days, 2.5–12 days, and 2.5–15 days, as well as the Ensemble Empirical Mode Decomposition (EEMD) with periodicity bands of 3–6 days, 4–12 days, and 3–15 days. Thirteen TEWs were initially reported by NOAA as crossing the Caribbean at 80°W. In our study, we further analyzed these waves by correlating areas characterized by westward-moving features of filtered relative cyclonic vorticity at the same longitude. Through this analysis, distinct classifications emerged using different filters, revealing the presence of 5 to 9 TEWs. The results show that TEWs classification is sensible to the filtering methods and periodicity band windows.