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Toward the Local Identification of Equatorial Waves

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Equatorial waves (EWs) are synoptic to planetary-scale disturbances in the tropical atmosphere and are associated to a variety of tropical atmospheric phenomena. For instance, EWs can couple with convection, modulating a substantial fraction of cloud and rainfall variability in the tropics. Space-time filtering techniques that rely on the projection of data onto the structures of EWs are widely used in the literature. Such projection methods are employed with multiple purposes, including the unravelling of physical mechanisms underlying tropical atmospheric phenomena and the evaluation of numerical weather predictions in the tropics. However, most projection techniques rely on the global structures of these waves and, to our knowledge, there have not been efforts toward developing methodologies that identify EWs locally, i.e. over regions covering specific longitude ranges. This type of approach would highly decrease both the amount of data required and the computational power needed to identify EWs. Furthermore, it could potentially reduce the artificial effects local forcings may have on global projections.

This work makes use of the meridional and zonal structures of the solutions to the free Laplace tidal equations, known as Hough vector harmonics. By exploiting the properties of these solutions, we propose a methodology that allows for the identification of EWs over specific longitude ranges and perform a local analysis of fundamental wave properties.

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