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Decomposition of the Quasi Biennial Oscillation in Hough modes and its interaction with the tropical troposphere

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The Quasi Biennial Oscillation (QBO) is characterized by a fairly regular approximately periodic behavior throughout the observational record, this regularity was, for the first time, disrupted in 2016. In order to elucidate the possible mechanisms behind the QBO and in particular the anomalous events of 2016 we present the decomposition of the QBO into atmospheric normal modes in form of Hough functions by performing a linear regression of the QBO index against the time series of the amplitudes of the Hough modes. Our results indicate that the dominant modes for the QBO are westward propagating internal gravity modes and the first asymmetric Rossby modes.
We show that these modes are highly connected interact significantly with normal modes associated to the Madden Julian Oscillation that had an anomalous period in 2014-2015, we therefore suggest that the MJO-QBO connection being responsible for the anomalous 2016 QBO events.