



Large-scale tropical atmospheric dynamics: waves or balance?

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It is often considered that the large-scale tropical atmosphere is not in any balanced state but characterized by an ensemble of equatorial waves. Observationally speaking, various longitudinally-propagating moist convective coherencies are seen with the Madden-Julian wave probably, as the best known example. These coherencies are often interpreted as equatorial waves generated under a coupling with moist convective processes. However, a conventional scale analysis (as used for deriving the midlatitude quasi-geostrophy) fail to convincingly support this view.

The present talk proposes an alternative possibility that the tropical large-scale is dominated by a balanced dynamics. The proposed balanced dynamic consists of the two parts. The first and a more dominant balance is the one between the vertical advection and the diabatic heating in the thermodynamic equation (the thermodynamic balance). An equivalent balance condition may also be posed on the moisture equation. These are well known dominant balances in the tropical convective observations, and applied to the large-scale dynamic context as a weak-temperature gradient (WTG) approximation by Sobel et al. The second one is the nondivergence condition to the leading order, as originally proposed by Charney (1963).

The formulation for the tropical balanced dynamics, observational evidences, and the implications will be discussed.