Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05622, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05622
EGU General Assembly 2008

Large-Scale Tropical Atmospheric Circulations: Asymptotically Nondivergence with Balance?: Observational Analysis

S. Mulet (1), M. Bonazzola (1), **J. I. Yano** (2)

(1) LMD-IPSL, UPMC, Paris, (2) CNRM, Meteo France -CNRS, Toulouse (yano@cnrm.meteo.fr)

A current common view on the large-scale tropical atmospheric circulations is that they consist of various equatorial waves coupled with moist convection. This appears to be well vindicated by the Wheeler and Kiladis's wavenumber-frequency spectra, which present a good fit of convective variability with dry linear equatorial wave dispersions with an effective equivalent depth 25m.

However, a classical scale analysis performed in 1963 by Charney suggests a completely different view: the tropical atmosphere is nondivergent to the leading order with the diabatic heating (notably convective heating) well balanced with the vertical advection (thermodynamic balance). The latter implies that the tropical atmosphere is effectively neutrally stratified to the leading order, thus all the gravity-wave type modes are suppressed.

In order to know an extent of this alternative possibility compared to the commonly accepted wave view, a data analysis is performed with use of a gridded data set prepared at CSU over TOGA-COARE LSA region.

A root-mean-square (RMS) is used as a measure of a variability of each variable as well as a contribution of a term in equations. Either a variable or a term in equations in concern is moving averaged both in time and space in order to see time and space scale dependence. After each moving averaging, RMS is evaluated. Tendency for nondivergence is examined by taking a ratio of RMS between divergence and vorticity, whereas

the tendency for thermodynamic balance is examined by taking the same between the local temporal tendency and the vertical advection in heat equation.

The obtained result is most impressive for the transient component of divergence and vorticity, in which the transience is defined as a deviation from a time mean of the four-month data set. Against an expectation from a conventional scale analysis, the analysis shows that the tropical atmosphere is less divergent for larger horizontal scales with well-defined minimums at the 1500km scale with the periods of 40 days and 90 days. The result is intriguing, implying a link of this tendency to Madden-Julian oscillations.

The thermodynamics balance is well satisfied for all the scale range examined, spanning from 1 day to 4 months in time, from 100km to 2000km in space. There is still a surprise in analysis, because we see a definite tendency of an improvement in thermodynamic balance when both the time and the space scales are increased simultaneously. This is again against a prediction from the convectional scale analysis that suggests the other way round.

Possible implications of these results are discussed during the presentation.