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OBSERVATIONAL EVIDENCES OF THE ADJUSTMENT OF THE MASS/WIND FIELDS DURING ABLE IIB

Pedro L. Silva Dias*

Center for Weather Forecasting and Climate Research
Institute for Space Research
São José dos Campos, SP, Brazil

1. INTRODUCTION

The objective of this paper is to present observational evidences of the adjustment process of the tropical atmosphere under the presence of transient convection (diurnal to a few days time scale). Previous model studies by Silva Dias et al (1983) indicated that a large percentage of the energy associated with convective bursts are transfered to high frequency modes (gravity and Kelvin waves). The slow response, associated with the Rossby projection of the perturbation, is associated with the upper anticyclonic circulation which is symmetric about the equator when the heat source is centered at the equator and with the Bolivian High during the summer season when the heat source in located over the central part of South America. During the Amazon Boundary Layer Experiment IIb (ABLE-IIb), several episodes of transient organized convection were observed and monitoring of the tropospheric circulation was possible through a network of several radiosonde stations.

2. DATA

The observational data for this study are based on the radiosonde observations collected during ABLE-2b from April 13 to May 13, 1989. The special upper air network operated 4 times per day at six locations (Belém, Boa Vista, Leticia, Vilhena, Alta Floresta and Manaus). Approximately 665 usefull radiosonde profiles were collected during the field experiment. Quality control of the radiosonde data was performed based on vertical and temporal consistency and inspection of horizontal consistency through the objectively analysed fields (a simple successive correction scheme based on Doswell, 1977). The Manaus data is still preliminary because of the on-going special quality control required in this case due to the use of a different radiosonde equipment.

3. RESULTS

An inspection of the time series of the zonal component of the wind at Belém shows several bursts of easterly and westerly jets at the upper troposphere. The diurnal variation of the upper zonal flow is also quite pronounced and is associated with the sea breeze convective lines which propagate inland with a life cycle of a few days in some cases. Complete reversal of the upper zonal flow in Belém are associated with very strong bursts of convection in the central part of the Amazon Basin.

(*)also Institute Astronomy Geophysics,Univ.São Paulo, São Paulo, SP, Brazil.

Two major episodes are discussed in more detail: (a) a typical equatorial heat source, associated with an intense convective line, which propagatec through the Amazon Basin from April 30 to May 2 and (b) a period with active convection over the Central part of Brazil, from April 26 to April 28.

The first case was caracterized by the pair of anticyclones symmetric about the equator and strong upper westerlies to the east of the heat source. The upper level divergence indicates the westerly displacement of the heat source during a period fo 2 days. The intensification of the subtropical jet in the southern hemisphere is clearly observed during this episode. Abrupt changes in the upper level circulation are also observed as identified in a sequence of upper level wind analysis every 6 hours.

The upper circulation in the second case was characterized by the development of an upper anticyclonic circulation which is a typical summertime pattern (Kousky and Kagano, 1981). The coupling between the upper and lower atmosphere shows that the circulation is associated with a baroclinic mode with phase reversal in the mid-troposphere . The time scale associated with the convective burst in this case is of the order of 2 days.

The observed time evolution of the tropospheric structure in both cases finds strong theoretical support from the the point of view of the wind/mass adjustement in the tropical region. The divergent component of the wind is of the same order of the rotational component during the convective burst. Thus, the evidences shown in this paper reinforce the need for an appropriate estimate of the divergent component of the wind in an operational assimilation cycle. The use of longwave autogoing radiation is strongly recommended.

4. REFERENCES

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