A13A-199 “Moisture variability over the maritime continent during the coordinated MJO field campaign in 2011-12”

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1. Introduction

A field campaign whose purpose was to collect in-situ observations to advance our knowledge of MJO initiation process was conducted in and around the tropical Indian Ocean from October 2011 through January 2012 as an intensive observing period (IOP), and through March 2012 as extended observing period (EOP). This campaign consisted of several projects including CINDY2011, DYNAMO, AMIE, LASP, and HARIMAU2011. During the IOP/EOP, three/five MJO events developed over the Indian Ocean. One of specific features of these events was the short interval of its occurrence (25-35 days). In particular, convection associated with the second MJO event, which occurred in late November, stagnated over the maritime continent and then abruptly the third event was identified over the eastern Indian Ocean in late December. Since high resolution radiosonde sounding data at 13 sites are available over the maritime continent, we examined moisture variability to view any relationship to the convective activity over the maritime continent.

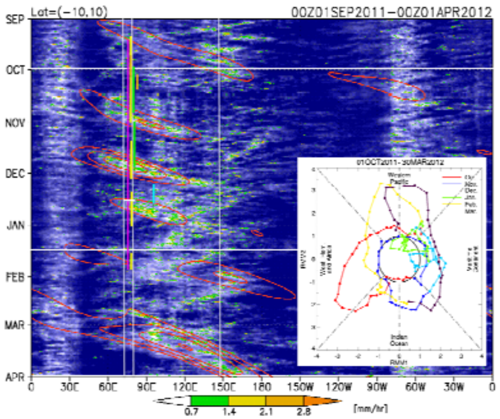

Fig. 1. Time-longitude diagram of infrared radiation brightness temperature (white shading) and precipitation (color shading) along the equator averaged over 10°S - 10°N. Red contours indicate convective MJO signals based on the Wheeler and Weickmann (2001) method applied to OLR, with only negative contours plotted (interval 10 Wm^{-2}). Vertical lines indicate the time of observations by ships and moorings. The Wheeler and Hendon (2004) MJO index is shown in the inlet for the period of 1 October 2011 - 30 March 2012, with dots and color indicating days and months, respectively.

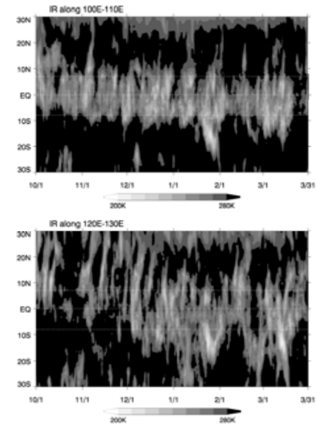

Fig. 2. Time-latitude cross section of TBB averaged over 100E-110E (top) and 120E-130E (bottom).

2. Sounding Data

BMKG has 13 radiosonde sounding stations and adopts MEISEI RS-06G Radiosonde for 12 sites and MODEM M2K2DC for Ranai site (Fig. 5). As for the data accuracy, dry bias problem in the upper troposphere due to solar radiation is known as shown in Fig. 3 which shows the results of intercomparison among MEISEI, Vaisala RS92, and CFH sondes. However, since we used only early morning/evening data, their effect was small. In addition, erroneous data near-surface caused by surrounding infrastructures have been removed. However, these correction schemes are still under-development, careful reexamination will be made.
Please ask KY about the details of correction procedure, if you are interested in.

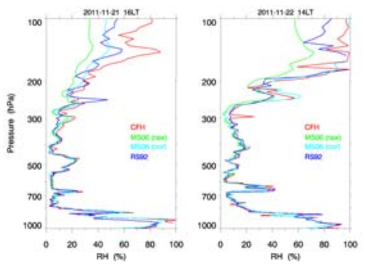

Fig. 3. Intercomparison among 3 types of radiosonde. It was done onboard the R/V Mirai at 80.5E, 8.0S. Blue/green lines show RH profiles of MEISEI raw/corrected data.

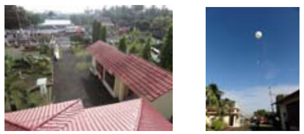

Fig. 4. BMKG Radiosonde station at Manado Site.

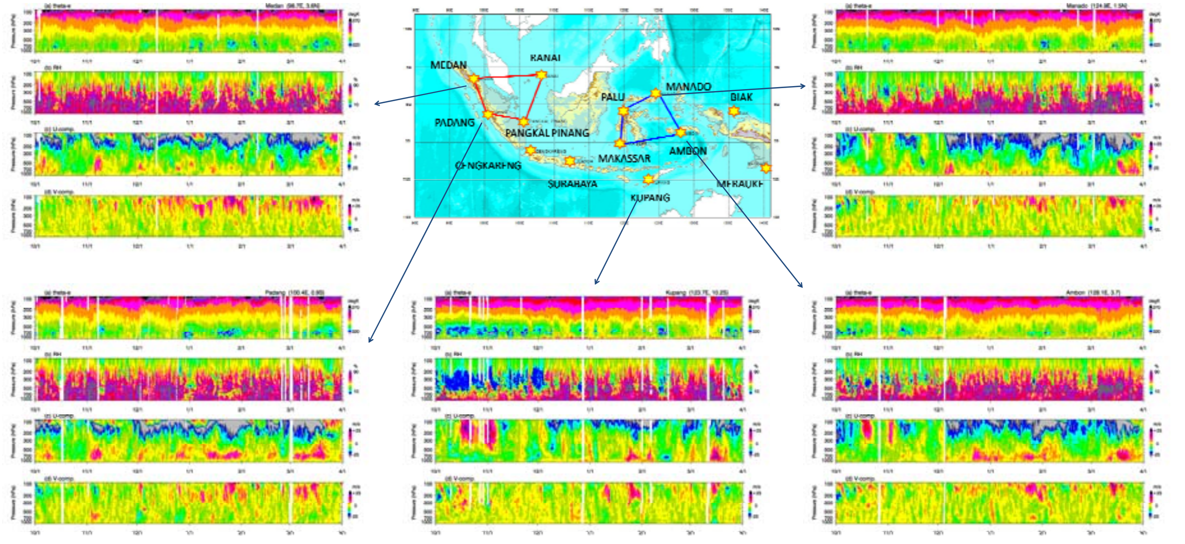

Fig. 5 (Upper/Center) BMKG radiosonde sounding sites. Time-height cross sections of equivalent potential temperature, relative humidity, zonal and meridional winds at Manado, Ambon, Kupang, Padang, and Medan (clockwise from upper/right) .

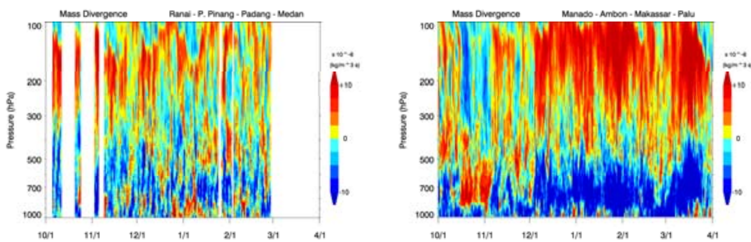

Fig. 6. Time-height cross section of mass divergence calculated over the western (left) / eastern (right) area indicated in Fig. 5.

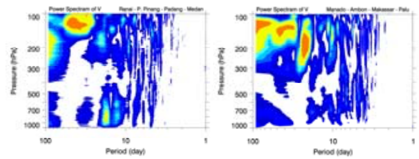

Fig. 7. Power spectrum of meridional wind at western/ eastern areas as a function of period and height.

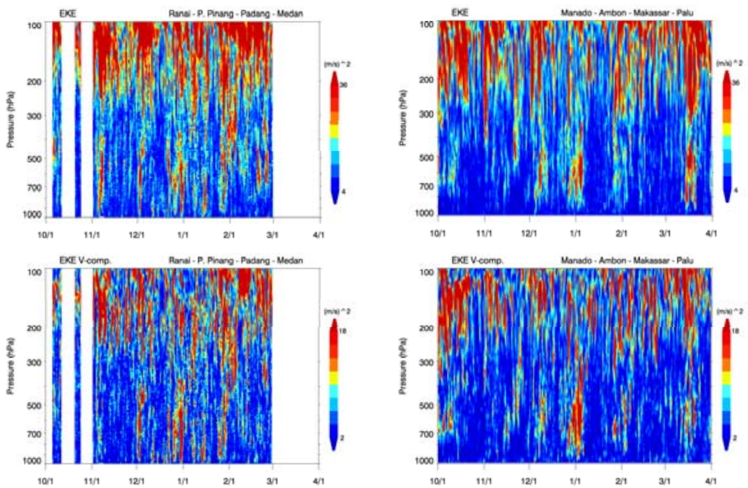

Fig. 8 Time-height cross section of Eddy Kinetic Energy (EKE) for western (upper/left) and eastern (upper/right) areas. Lower panels show meridional component. EKE is defined as

$$EKE = (u'^2 + v'^2) / 2$$

where u’ and v’ are zonal and meridional wind deviations from the 10-day running mean.

3. Results

From the mass divergence (Fig. 6), it is shown that both western / eastern areas indicated by red / blue lines in Fig. 5 were convectively active during the EOP. However, it was often terminated over the western area, while gradual deepening can be found over the eastern area. In particular, abrupt strong convergence was developed at the beginning of December.

Over the maritime continent, meridional wind component shows longer (>20 days) period only in the upper troposhere (Fig. 7), while shorter scale features can be found in the the whole troposphere. Thus, we examined the behavior of EKE by defining the small scale feature shorter than 10-day (Fig. 8). The enhancement of EKE is found at almost one month cycle and in both areas. In addition, meridional component mainly contributes this feature in the western region, indicating the influence from off equatorial regions.

Remarks.
In-situ radiosonde sounding data seem to be useful to view synoptic-scale feature even over complicated geographical region. However, it is still necessary to evaluate the influence from local circulation.