

# DYNAMO Review

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# ***DYNAMO: Dynamics of the Madden-Julian Oscillation***

*CINDY2011*: Cooperative Indian Ocean Investigation on  
Intraseasonal Variability in the Year of 2011

*AMIE*: ARM MJO Investigation Experiment

*LASP*: Littoral Air-Sea Processes

Objective: To expedite the progress of advancing our understanding of MJO initiation processes and improving simulation and prediction of the MJO





# CINDY/DYNAMO Field Campaign (Oct 2011-Nov 2012)



Falcon



S-PolKa



SMART-R



AMF2



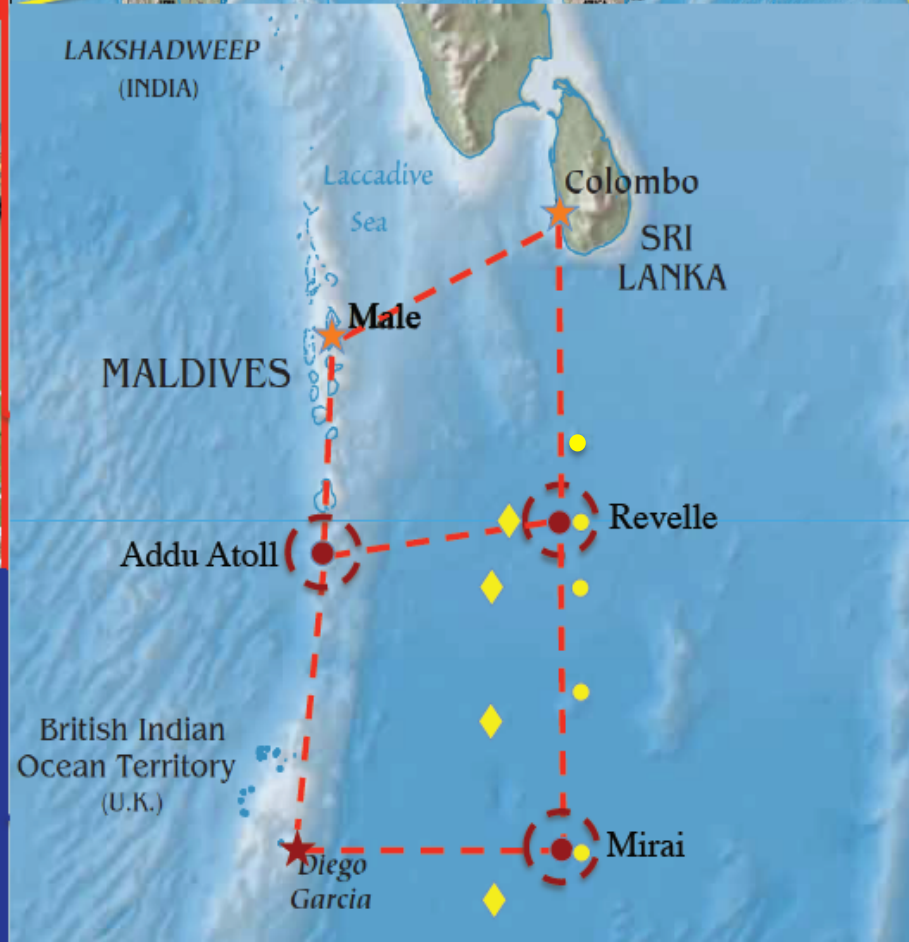
ISS



P-3



Sounding Network



R/V B. Jaya-III



R/V R. Revelle



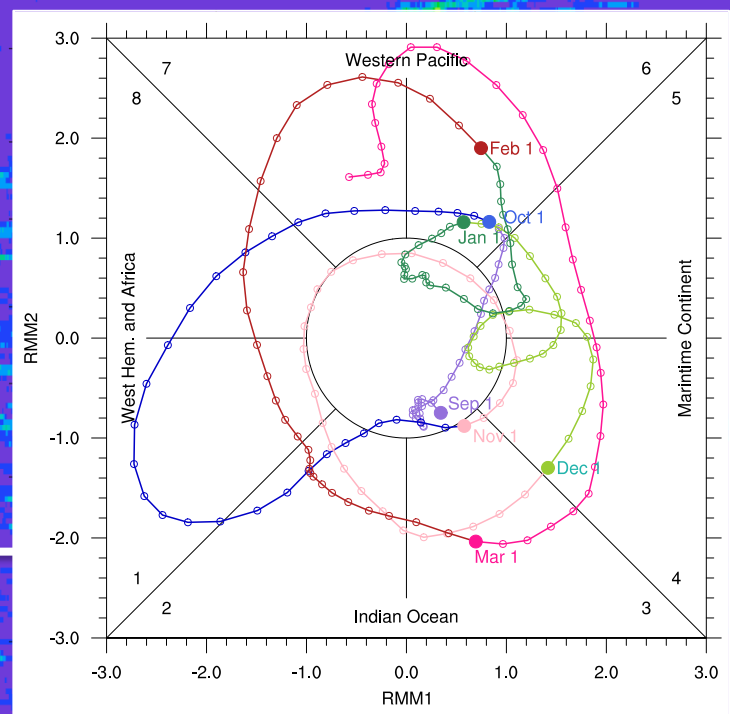
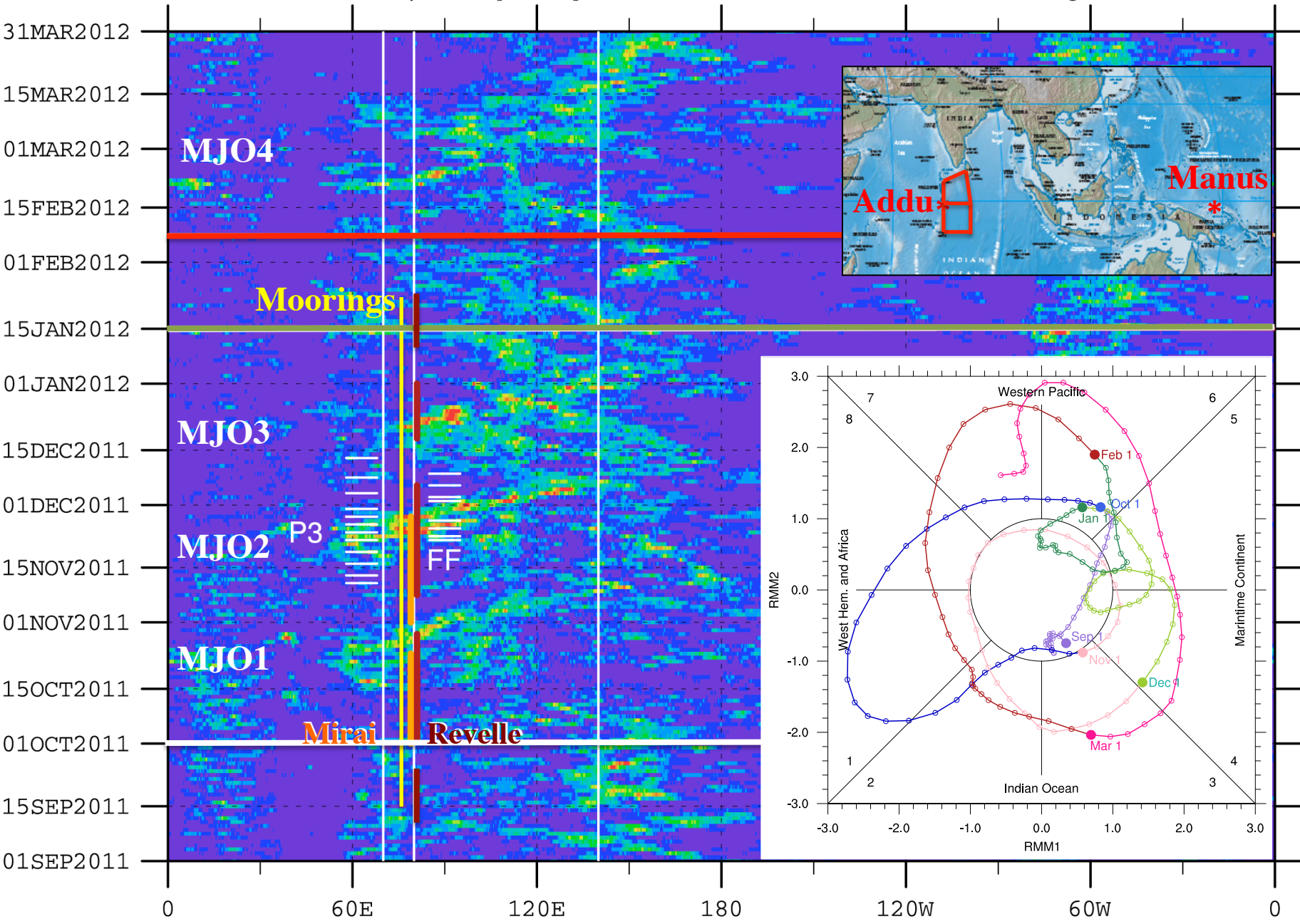
R/V S. Kanya



R/V Mirai

TRMM\_3B42RT Precipitation [mm/hr]

Average Lat: 10°S - 10°N



# **DYNAMO Achievement:**

## **1. Data (~ 10 TB)**

- **Release for public use since March 2013**
- **Archived at**

**NCAR EOL** ([http://data.eol.ucar.edu/master\\_list/?project=DYNAMO](http://data.eol.ucar.edu/master_list/?project=DYNAMO))

**ARM** (<http://www.arm.gov/campaigns/amf2011amie-gan>)

**JAMSTEC** (<http://www.jamstec.go.jp/iorgc/cindy/obs/obs.html>)

- **Plan: DYNAMO Legacy Data Products**
  - **processed and bundled data and products**
  - **uniform format (NetCDF, Matlab)**
  - **one-stop access (NCAR EOL)**



# **DYNAMO Achievement:**

## **2. Observation-Model Integration:**

- **DYNAMO MJO case for the Pan-GASS Global Model Evaluation Project on Vertical Structure and Diabatic Processes of the MJO (40 GCMs)**
- **DOE CPM Comparison and Validation Project (2 CRMs, 1 regional model, 2 global models)**

**Transform field observations to model improvement is a long, painstaking process. DYNAMO data will be used by the modeling community for many years to come.**

## **DYNAMO Achievement:**

### **3. Education, Training, Capacity Building:**

- **More than 100 students and postdoctoral associates from 37 universities of 14 countries were involved;**
- **More than 50 staff members of Maldivian Meteorology Service (MMS) were trained in applications of precipitation radar data and MJO forecast**
- **1 MMS staff visited US and was trained in quality control of Maldivian rainfall data**
- *Two more MMS staff are planned to visit NCEP and be trained on applications of intraseasonal forecast.*

# **DYNAMO Achievement:**

## **4. Hypothesis Testing**

**DYNAMO Hypotheses on three essential factors for MJO initiation:**

**I. Interaction between convection and its environmental moisture**

**II. Distinct roles of different types of convective clouds at each MJO initiation stage**

**III. Upper ocean processes and air-sea interaction**

- **~ 40 publications**
- **7 AMS, AGU, and EGU sessions**



## **DYNAMO Unexpected Outcome:**

- (1) Aerosol regime changes from before to after local convectively active phases of the MJO: fine, continental industrial pollution => coarse marine sea salt.**
- (2) Interaction between the ITCZ and MJO initiation.**
- (3) Ocean memory of atmospheric forcing carried by the Wyrтки jet.**

## **DYNAMO Lessons Learned:**

**1. Use of an Indian port for R/V Revelle: Caught in between bureaucracy, a lack of proactive approach, and inexperience – 16 days of ship station time lost.**

- It is not the blessing from the Gods you worship, it is the curse from the Gods you fail to worship that determines your fate.

**2. Need a risk management protocol.**

**3. The role of the US Clivar:**

- **Critical in communication among the IAG and between the IAG and PIs;**
- **Disconnection between expectations from the PSMI and peer reviewers.**

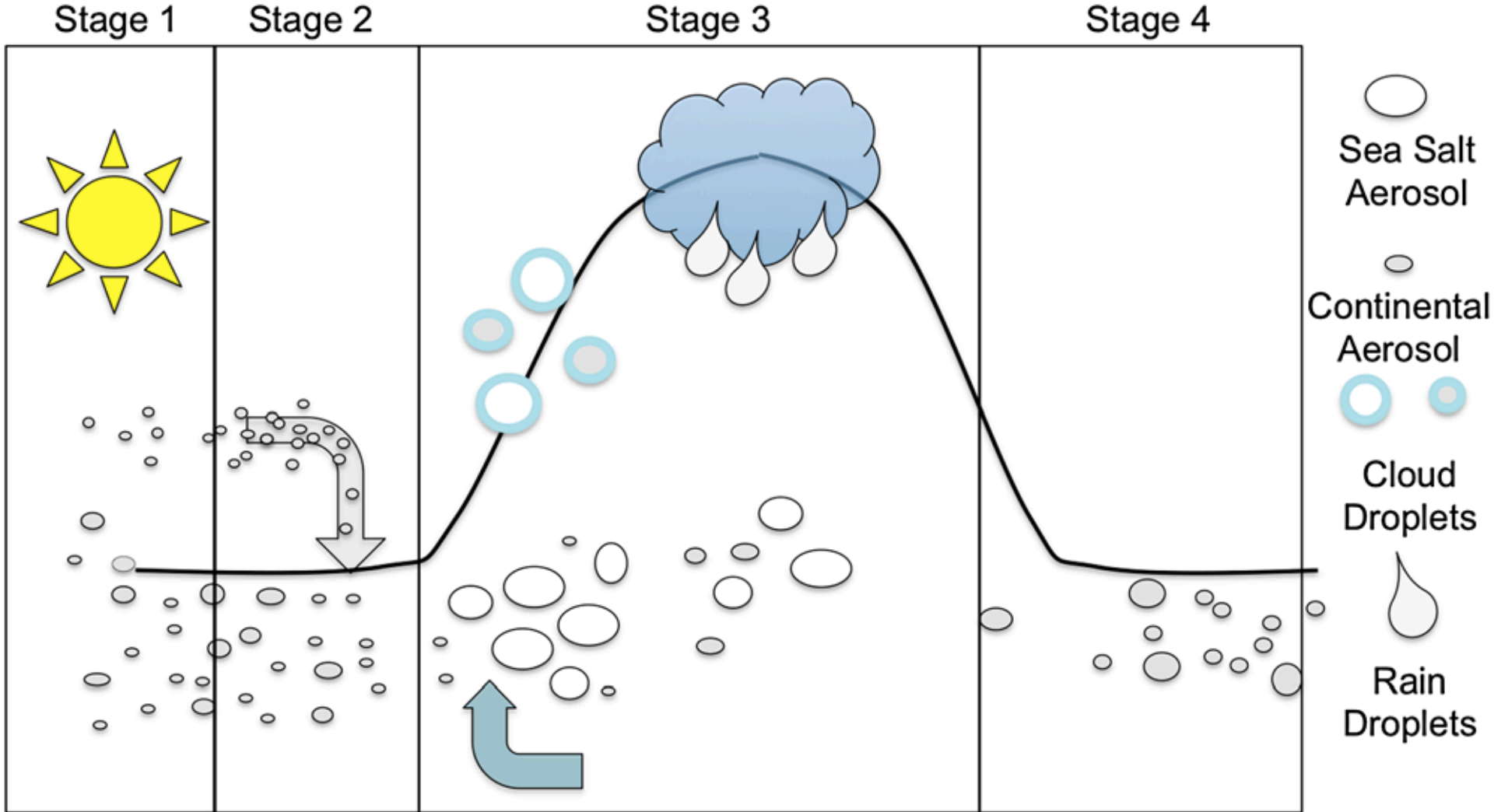


Figure 12. A representative cartoon of the aerosol response to MJO-related convection. Stage 1: Suppressed convection, longer aerosol lifetime. Stage 2: Disturbed convection, overturning of the troposphere, and introduction of aerosol from the upper atmosphere. Stage 3: Enhanced wind and precipitation, increased sea salt aerosol mass, eventual rainout of aerosol. Stage 4: Return to suppressed convection. (DeWitt et al 2013)

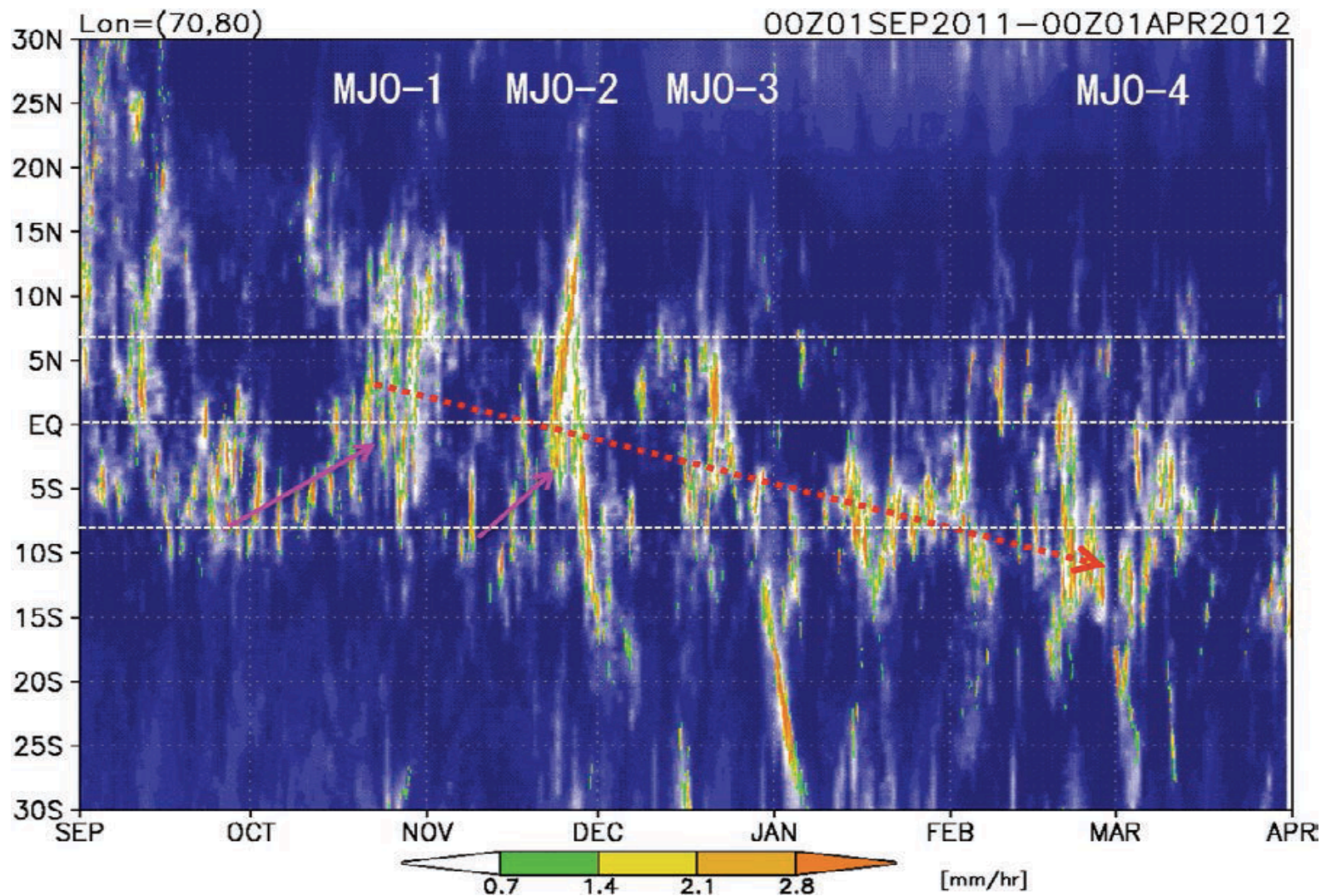


Fig. 8. Time–latitude diagram of infrared radiation brightness temperature (white shading) and precipitation (colored) averaged over the longitudes of the sounding/radar array (70°–80°E). White dashed lines indicate the locations of Colombo, the equator, and *Mirai*, respectively. Red dashed arrow indicates the seasonal migration of convective centers. Pink arrows denote the intraseasonal meander of the ITCZ. (Yoneyama et al. 2013)



mixed layer base  
 $1024.5 \text{ kg m}^{-3}$   
Isopycnal surface

