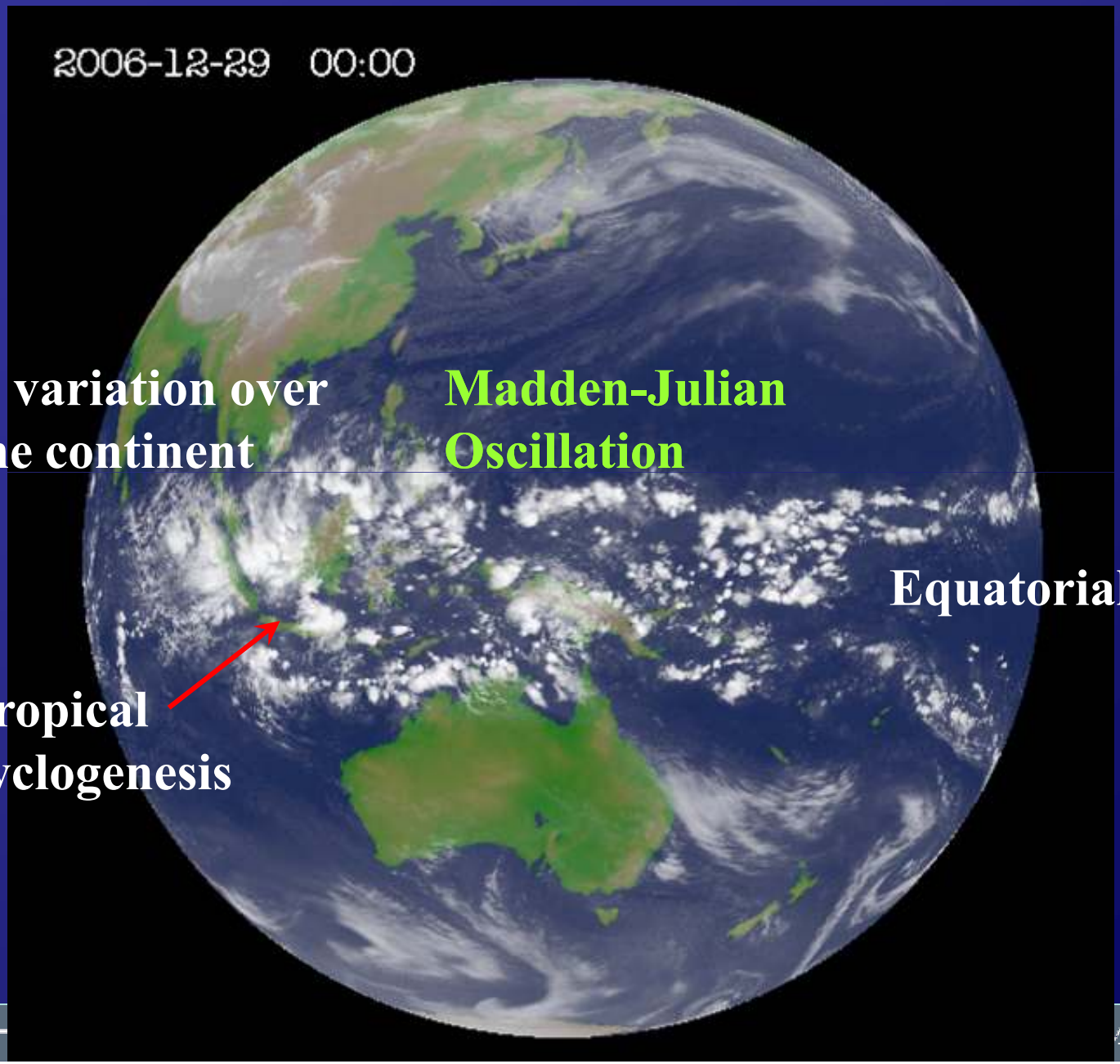
# Role of diurnal cycle of convection & precipitation in tropical and monsoon climate system

Joint HyARC-MAHASRI workshop

In Danang, Vietnum

Convener: Tetsuzo Yasunari

HyARC, Nagoya University




Diurnal variation over maritime continent

Madden-Julian Oscillation

Equatorial waves

Tropical cyclogenesis

# Need to understand Multi-Scale Interrelation In Monsoon ISO

**Hakazawa 1988**

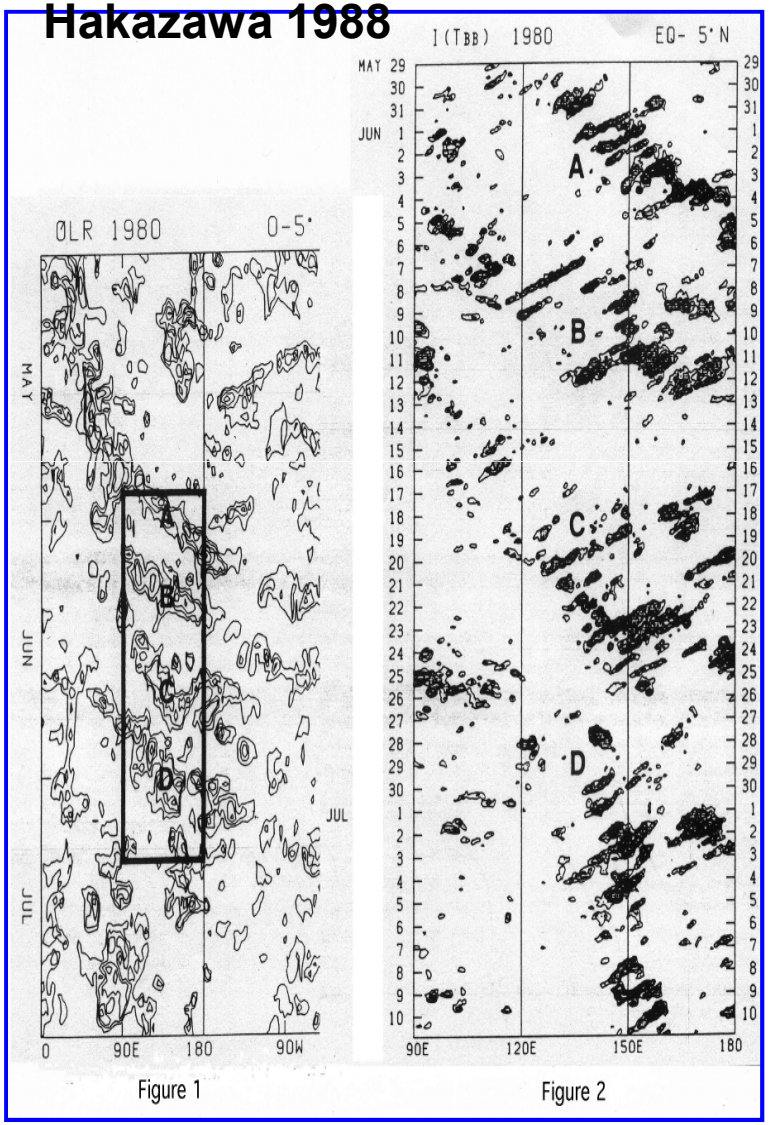
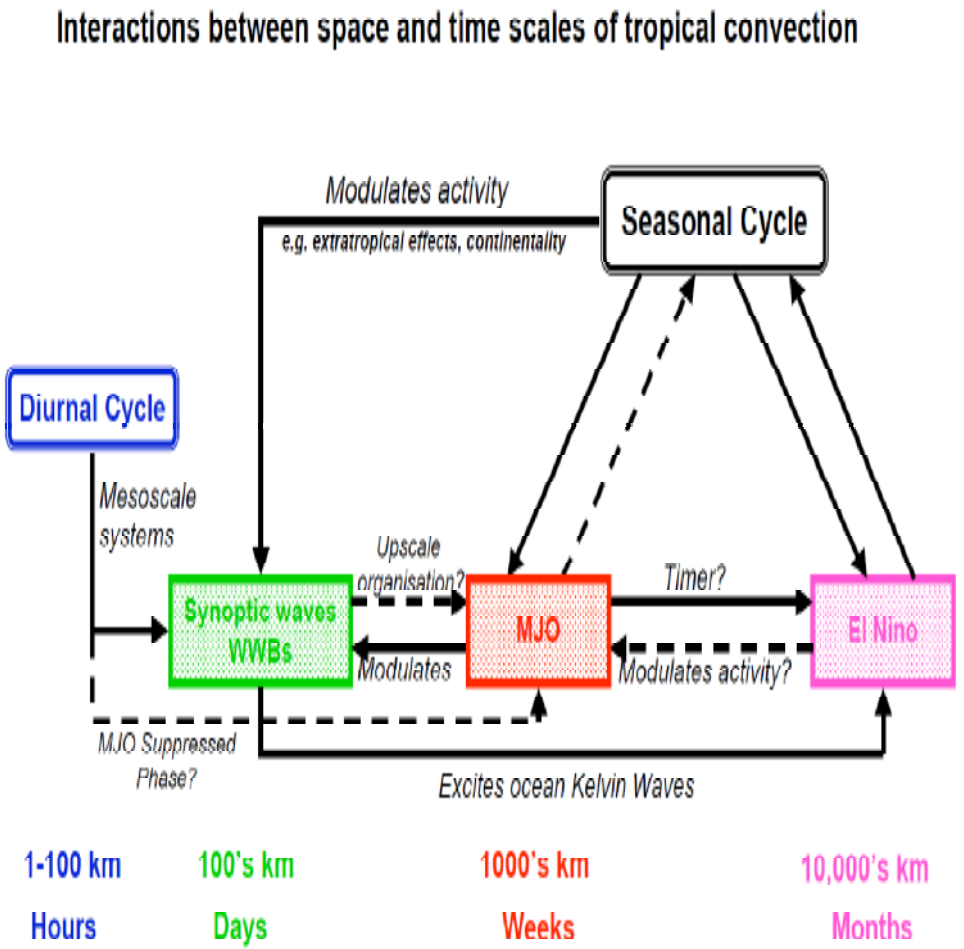


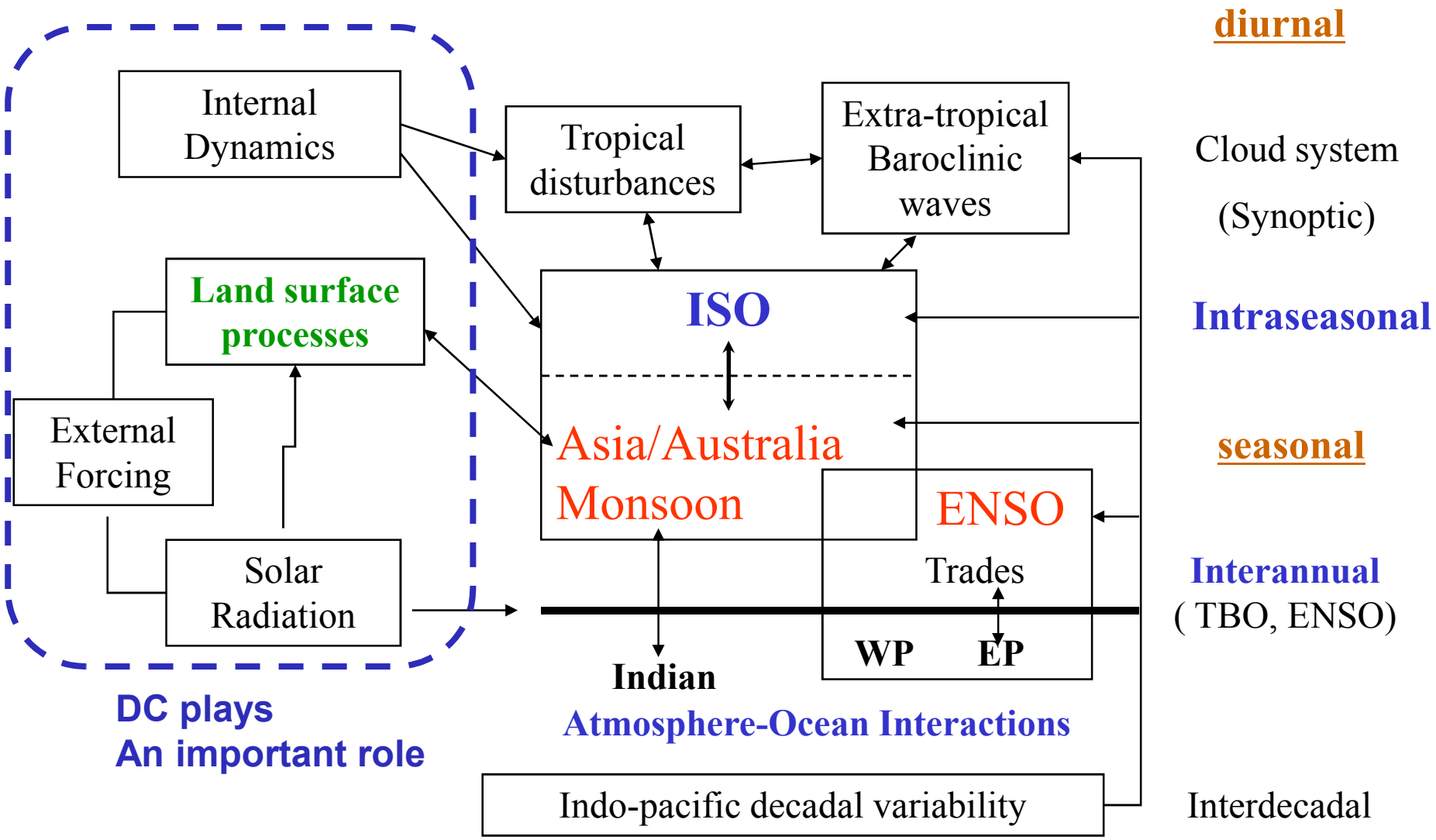

Figure 1 Figure 2




**THORPEX/WCRP Workshop report (Bing Wang)**

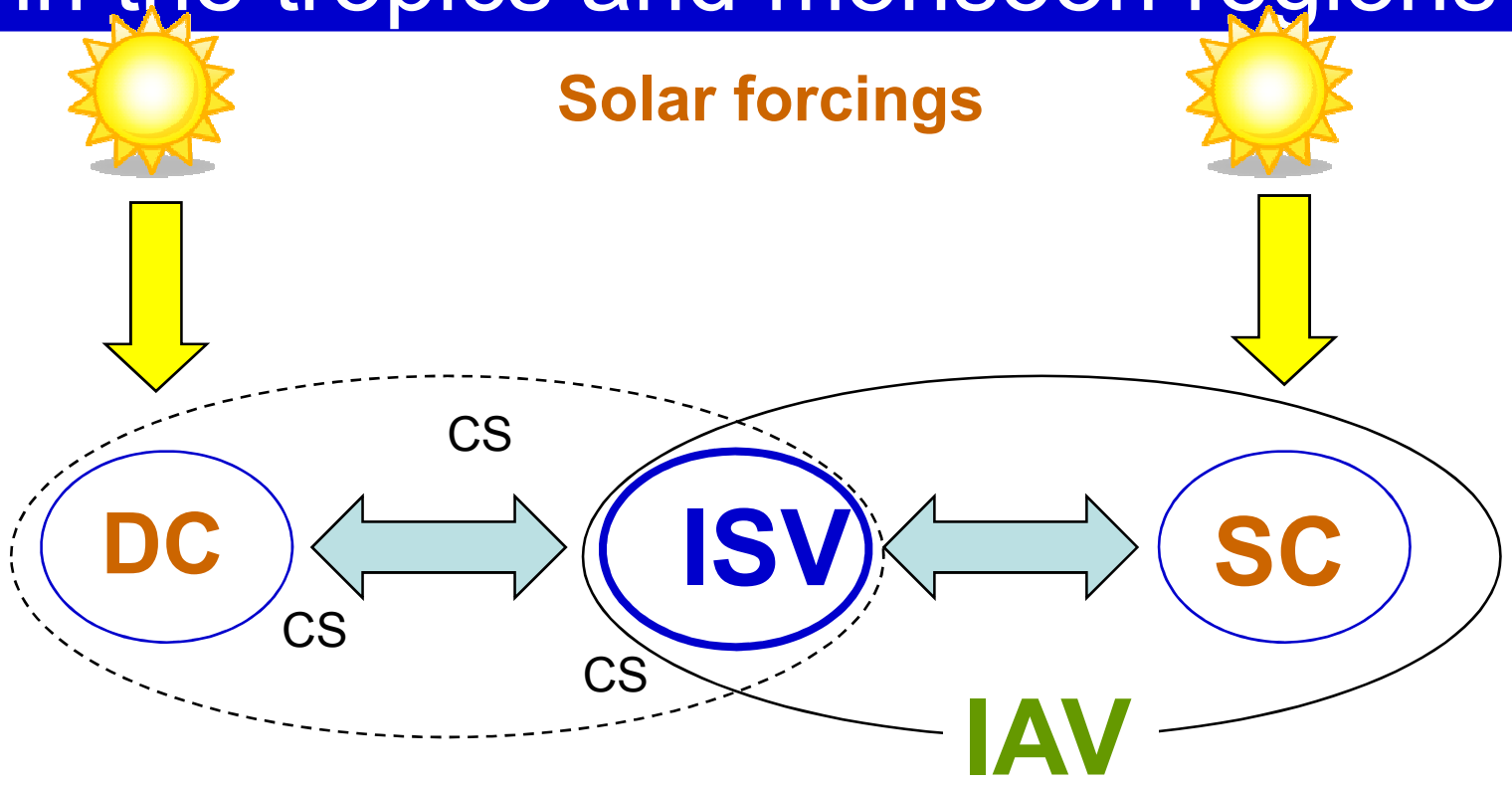
# What are the issues for monsoon studies ?

**From discussion in the 1st Pan-WCRP Monsoon Workshop, 05.Jun**




*from --- Bin's note ---*

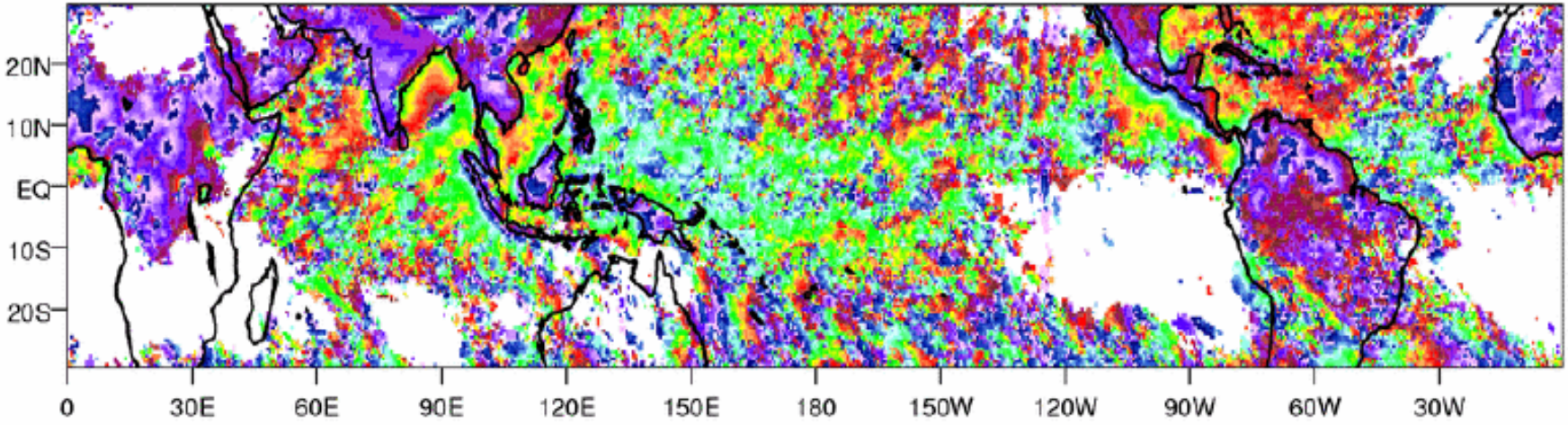
# Multi-scale interaction in the tropics and monsoon regions



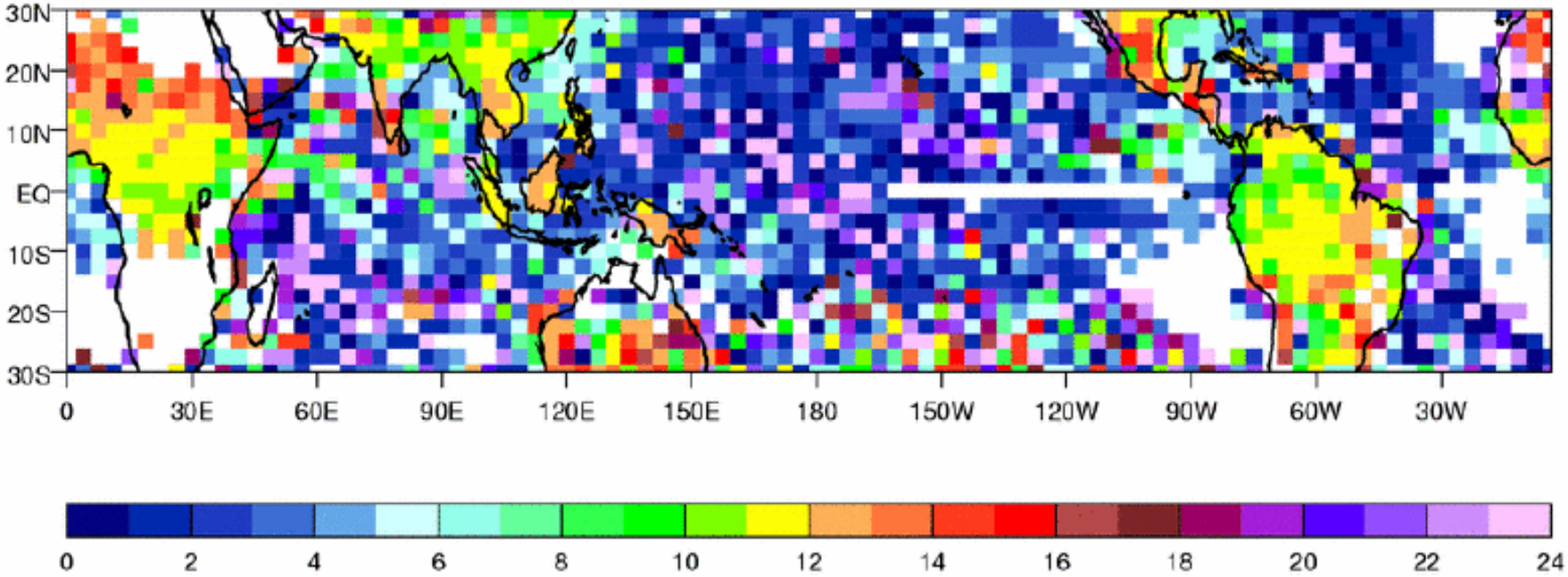

Land-Atmosphere-Ocean Ineractions
Orographic forcings

# Diurnal Cycle: Local time of maximum precipitation

Satellite '**Observations**'




**Model Simulation**

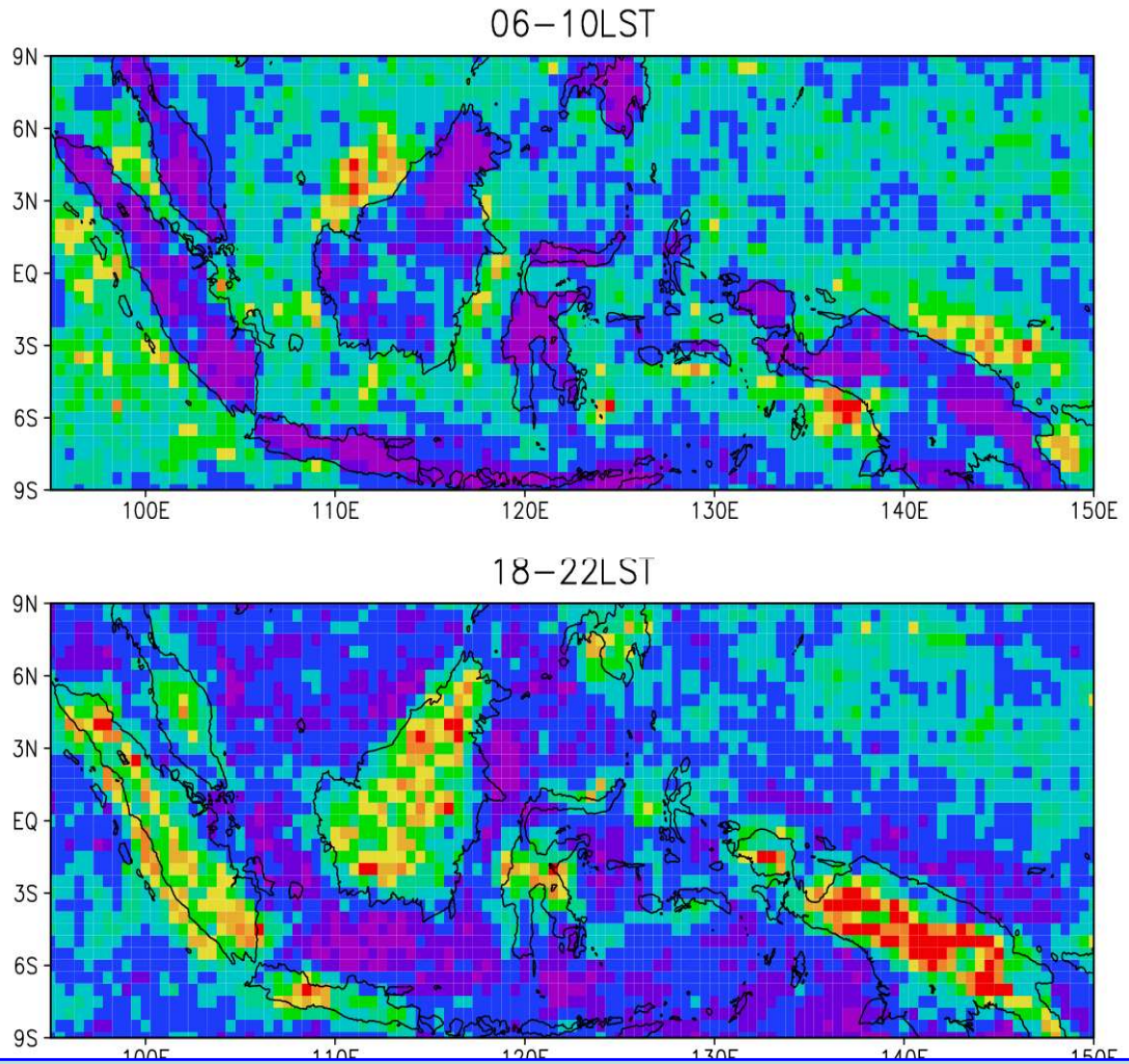


# Propagating Diurnal Disturbances embedd in the Madden-Julian Oscillation over the Maritime Continent*

Tetsuzo Yasunari and Hiroki Ichikawa
HyARC, Nagoya University

* J. Climate, 19 (2006)
Geophys.Res. Lett., 34 (2007)
J. Climate, 21 (2008)

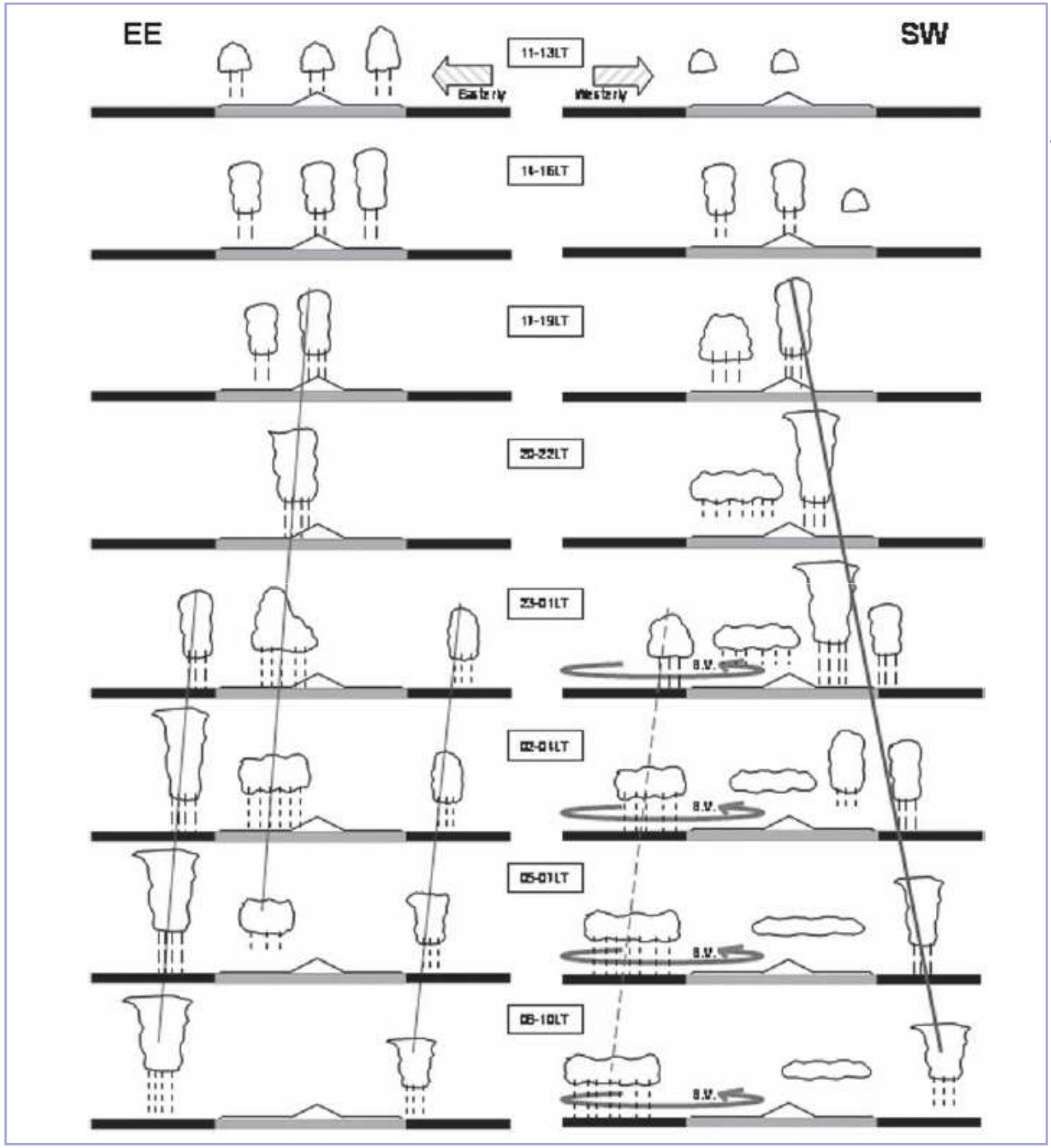
# Diurnal cycle of rainfall by TRMM-PR




The most humid area in the tropics show large DC in time-space.

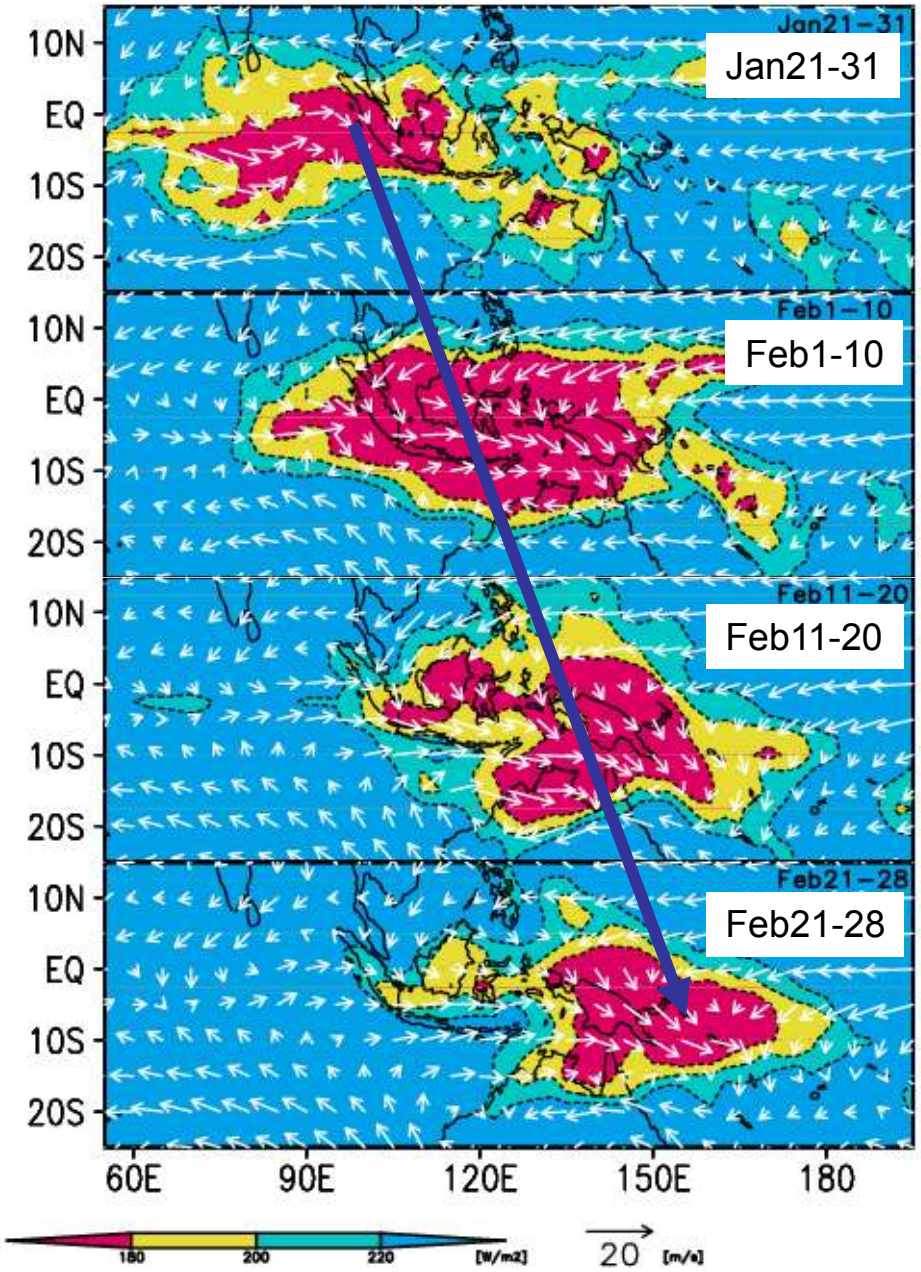
(Ichikawa and Yasunari, 2006 J. Climate)

Easterly




Strong W-ly

OLR and wind (850hPa)




MJO disturbance developed between Jan to Feb in 2001

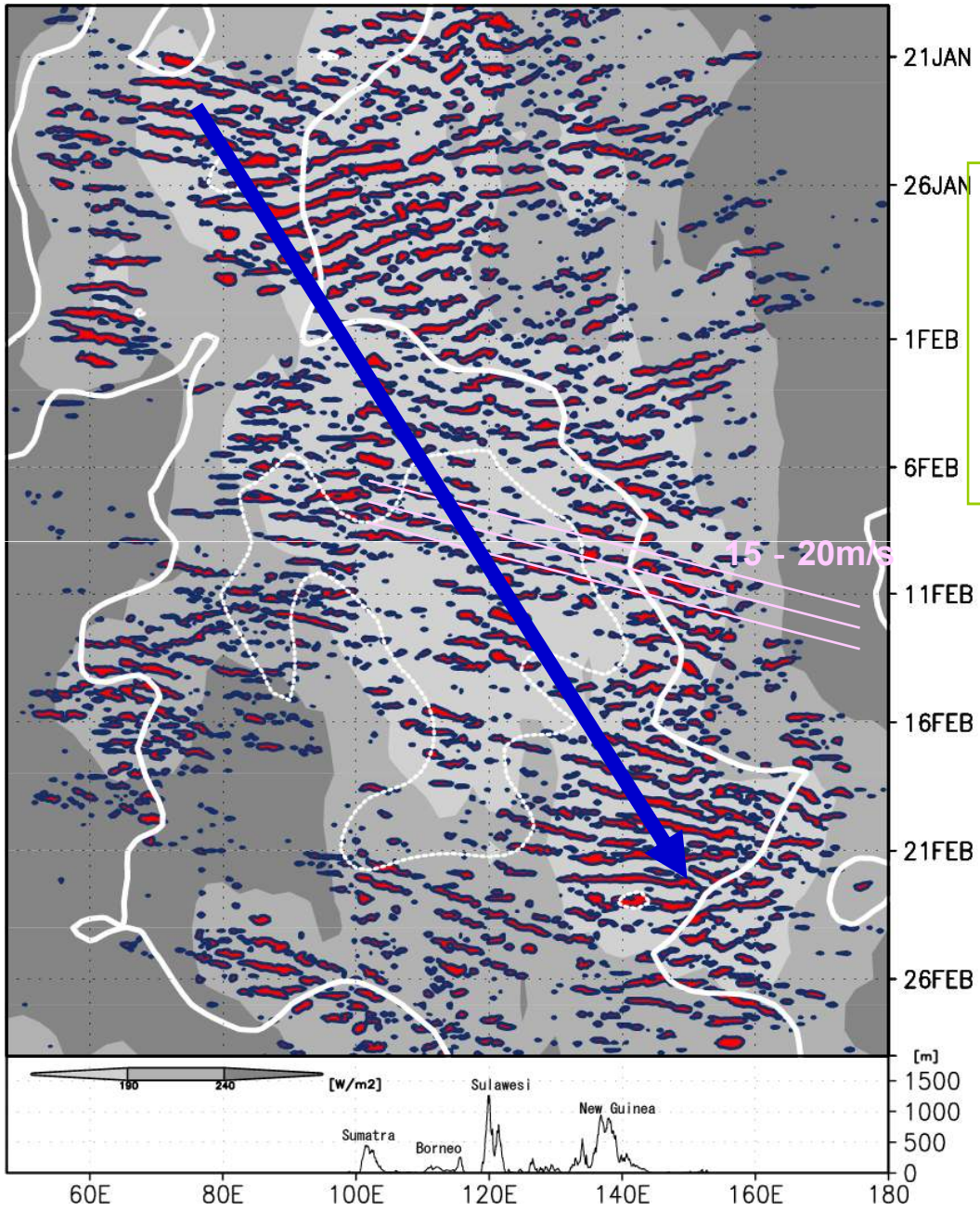
ISO propagated through the islands, with apparent Kelvin-Rossby response.

Ichikawa and Yasunari, GRL 2007

# Fine structure of MJO

shaded･･･OLR(－190－240－ [W/m2])
white･･･zonal wind at 600hPa(solid:2,dash:10[m/s])
color･･･diurnal cycle filtered rainfall 0.2, 0.4 [mm/h]

Time-longitude section of rainfall between Eq-5S

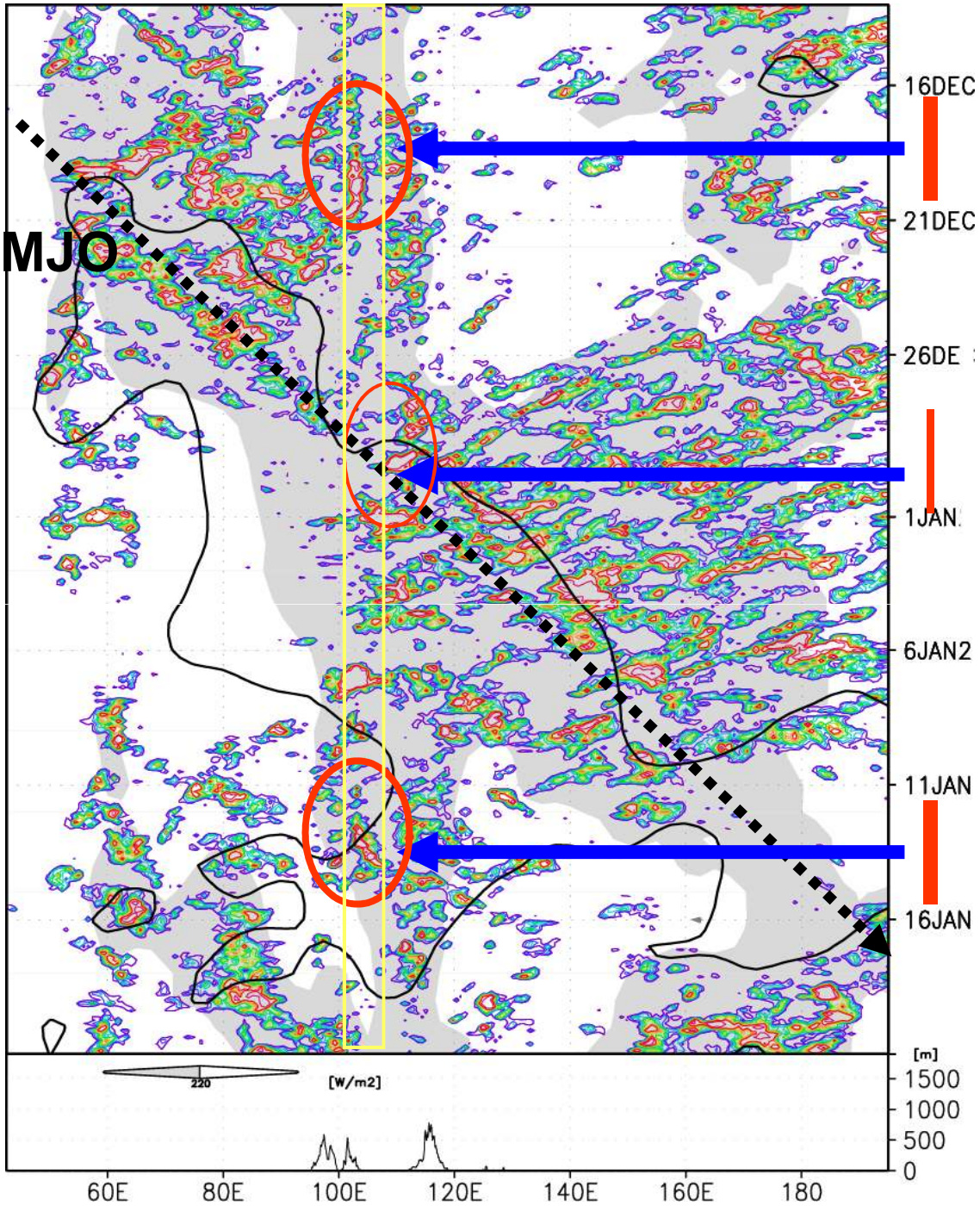



Propagating rainfall activity associated with the diurnal cycle over and around the island

↓↓

Propagating diurnal disturbance (**PDD**)

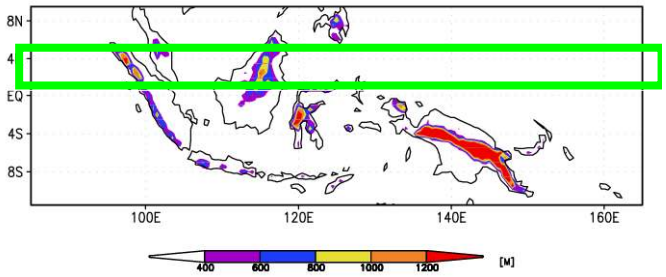
(Ichikawa and Yasunari, 2007 GRL)




**Case 3:**
Flood over Malay peninsula
→ stagnant heavy rainfall

**Case 4: passage of MJO**

2N-6N Average

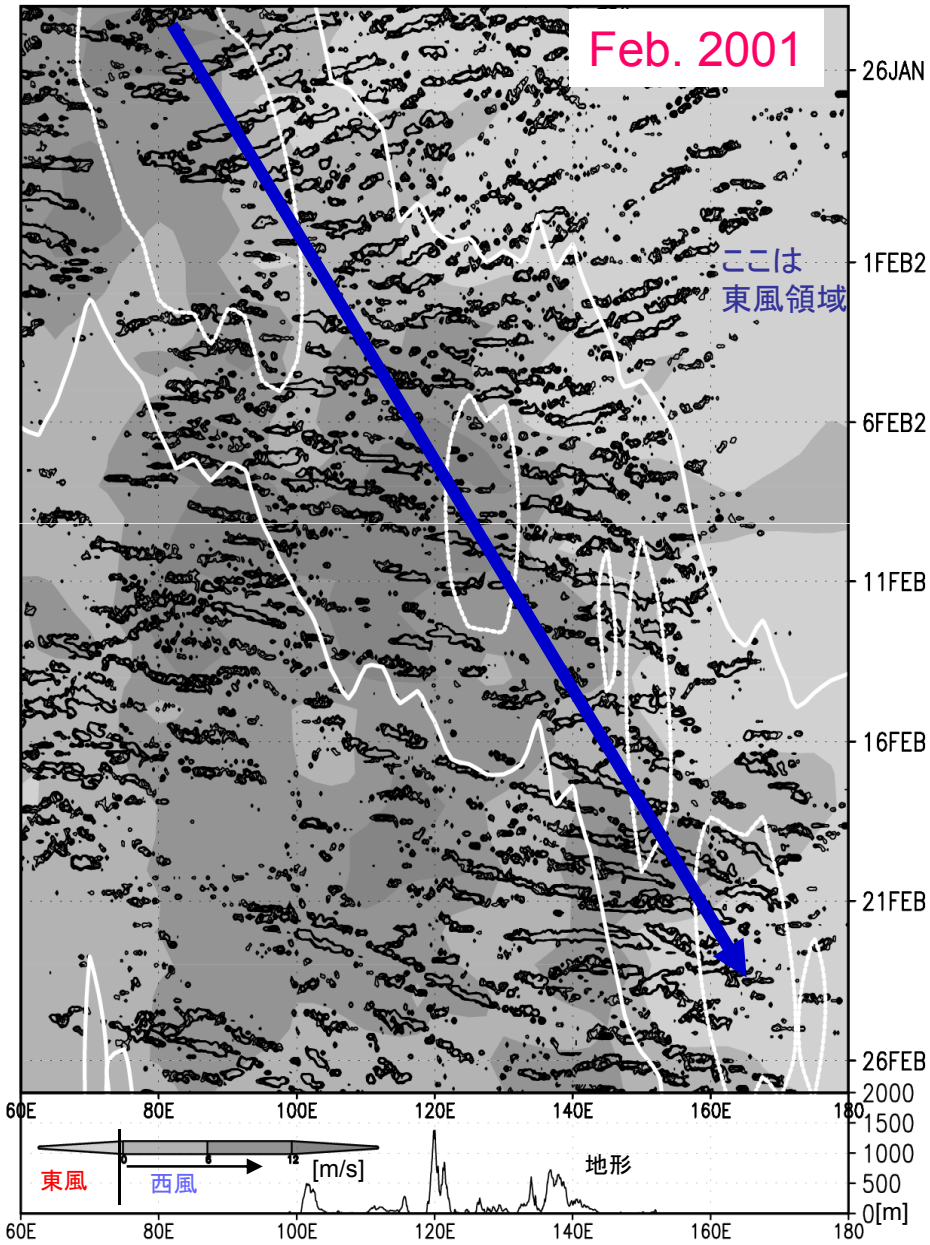


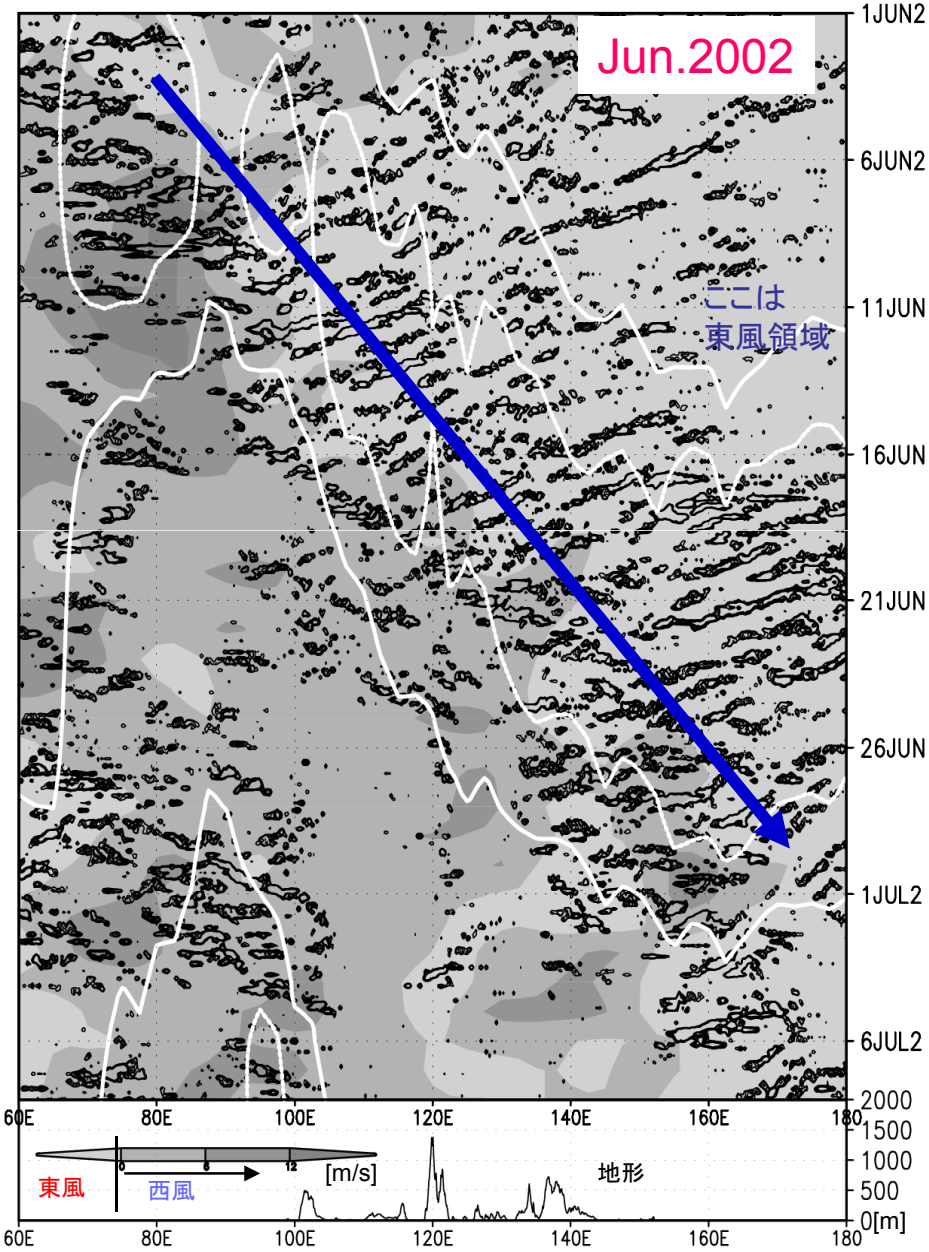

**Case 5:**
Flood over Malay peninsula
→ gradual eastward shift

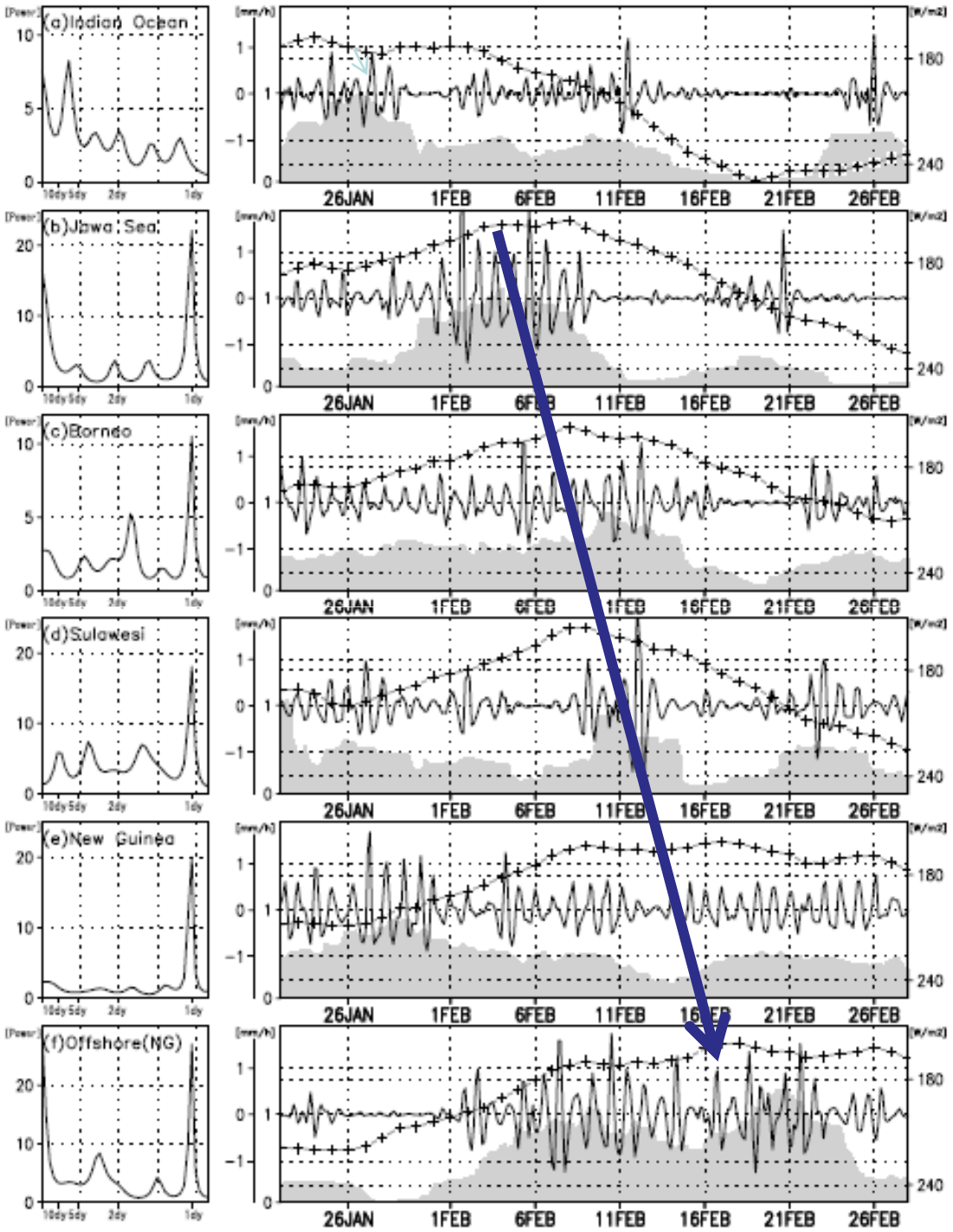
Shade –OLR ‥ 220W/m2
Contour –Zonal wind (600hPa)
‥0m/s
Color –3horly rainfall ‥0.4,0.6,
0.8,1.0,1.2,1.6,1.8,2,3

# Comparison with westward propagating case (June 2001)

・・・日周変化フィルタをかけた降雨量　TRMM3B42
(正偏差0.1、0.2、0.4、0.6、0.8、1mm/h)
・・・30-60日フィルタをかけたOLR(負偏差-5、-20W/m2)
・・・700hPa高度の東西風速(最も薄い色のみ東風を示す!!)






Propagating DCs play as a carrier wave of the MJO disturbances ?

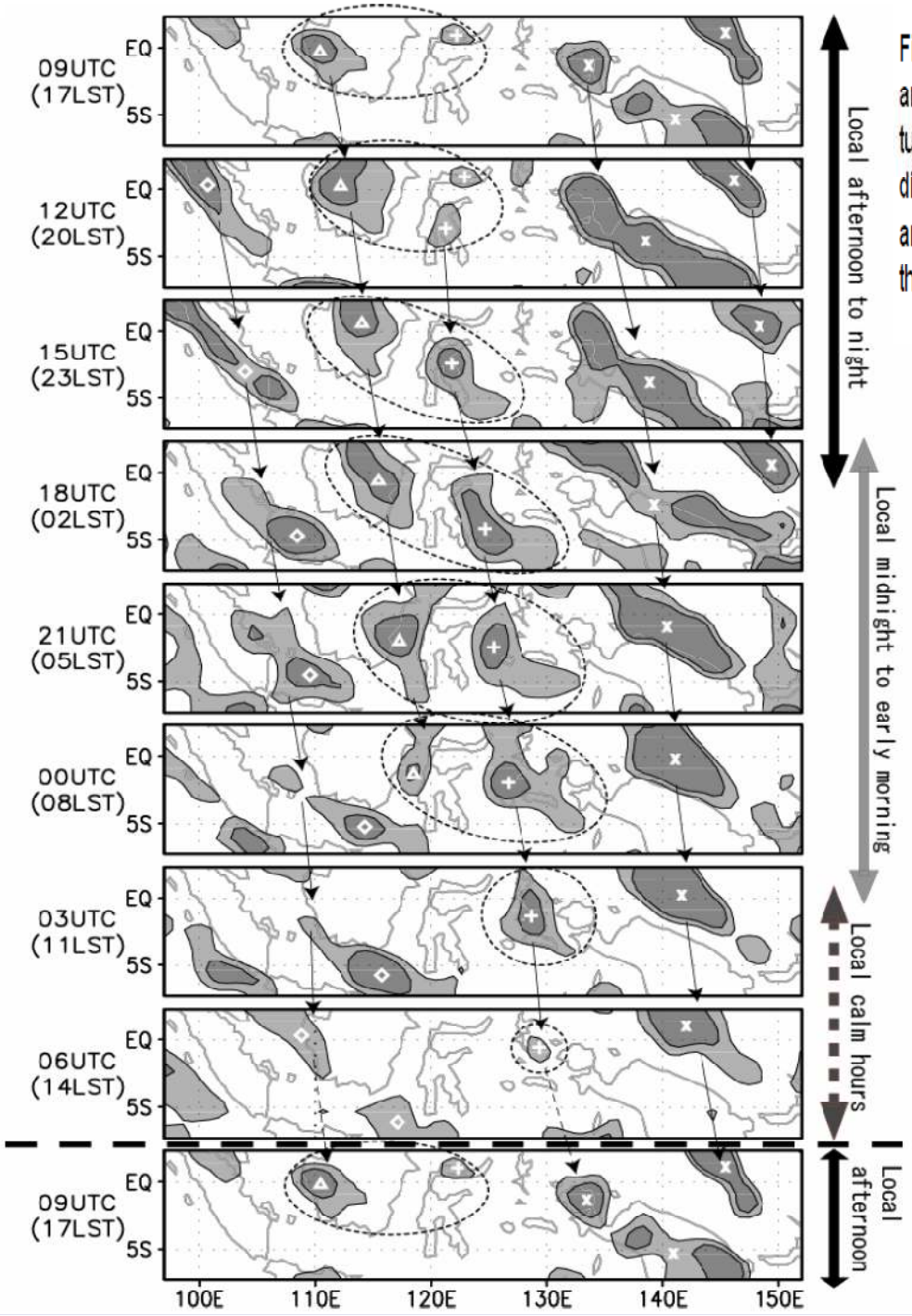



Fig.4 Spatial distribution of composite propagating diurnal disturbance described by diurnal rainfall anomaly averaged between 5-20 in February, 2001. Local standard time (LST) is at midmost longitude (125°E). The 09UTC is described at twice for both top and bottom for a reference. The rainfall disturbances are indicated by symbols of '◇' (from Sumatra), '△' (from Borneo), '+' (from Sulawesi), and 'x' (from New Guinea). Dotted circle denotes the diurnal disturbances from Borneo and Sulawesi that propagate as a packet.

Ichikawa and Yasunari, GRL, 2007

**Propagating diurnal cycle embedded in the eastward propagating MJO disturbances are noticed over the maritime continent of Indonesia, using TRMM 3B42 data**