

# **East-Asian Monsoon Experiment (EAMEX): Summer and Winter**

- I. Summer Rainstorm Experiment**
- II. Winter Rainfall Experiment**

## **International Coordination**

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Iowa State University  
Ames, Iowa, U.S.A

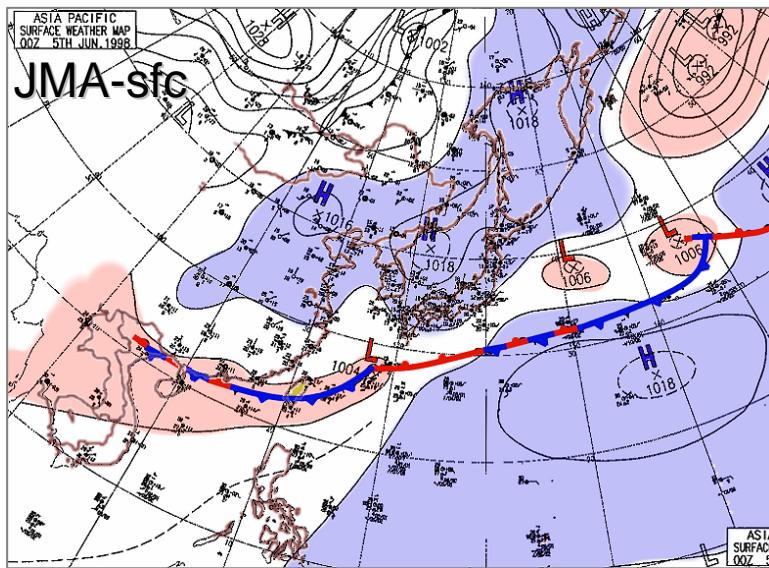
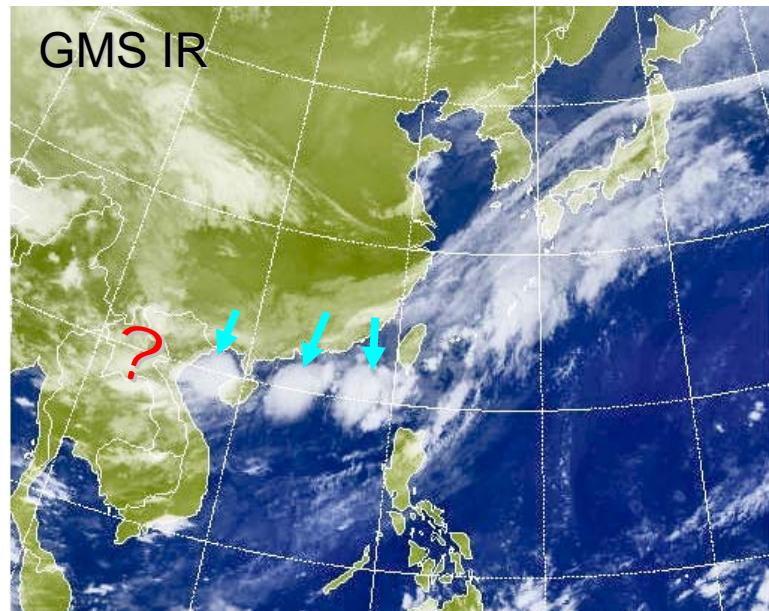
**First MAHASRI/AMY Workshop  
Tokyo, Japan, January 8-10, 2007**

## **Scientific goal:**

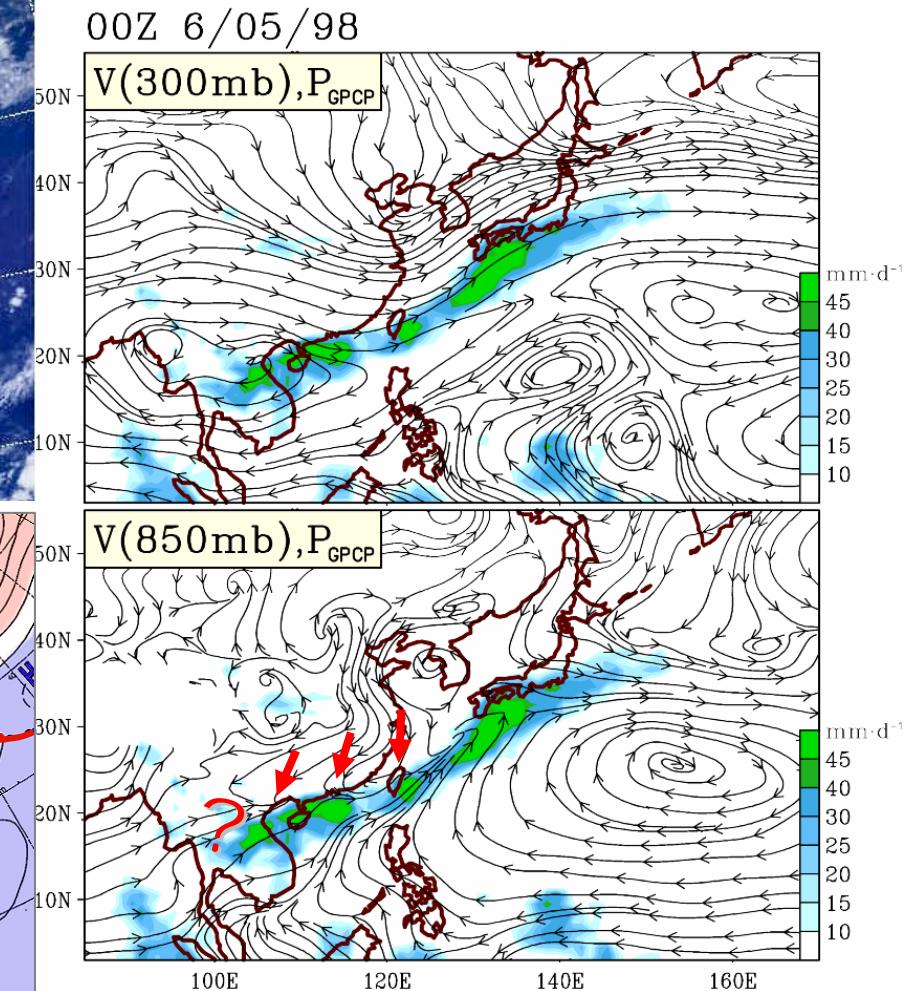
- 1) To explore genesis mechanisms, and structure/dynamics of weather disturbances generating heavy rainfall in East Asia during the summer and winter monsoon seasons.**
- 2) To improve forecasts of weather disturbances in East Asia during both seasons, particularly heavy rainfall events for reducing flood damage.**

# I. Scientific issues

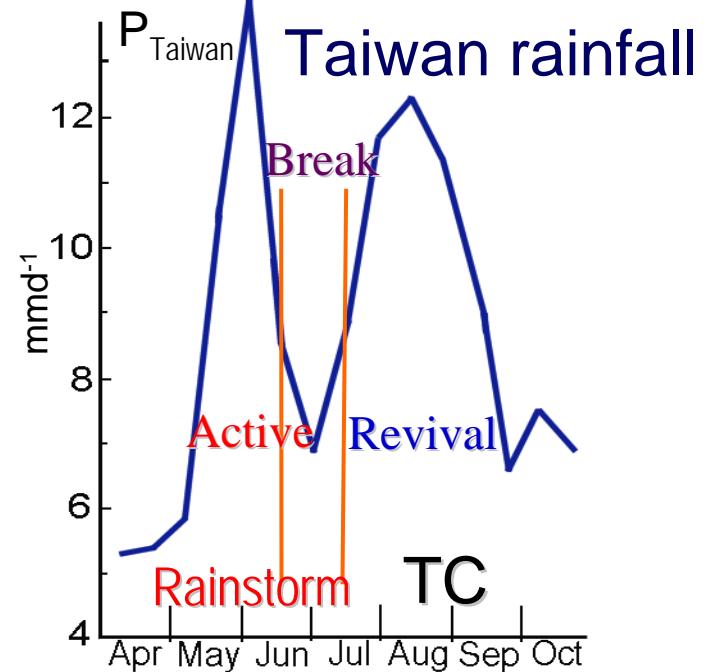
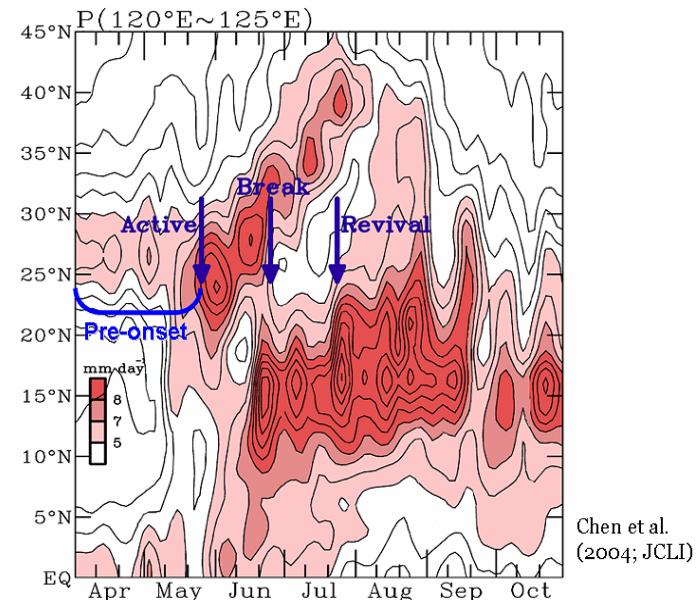
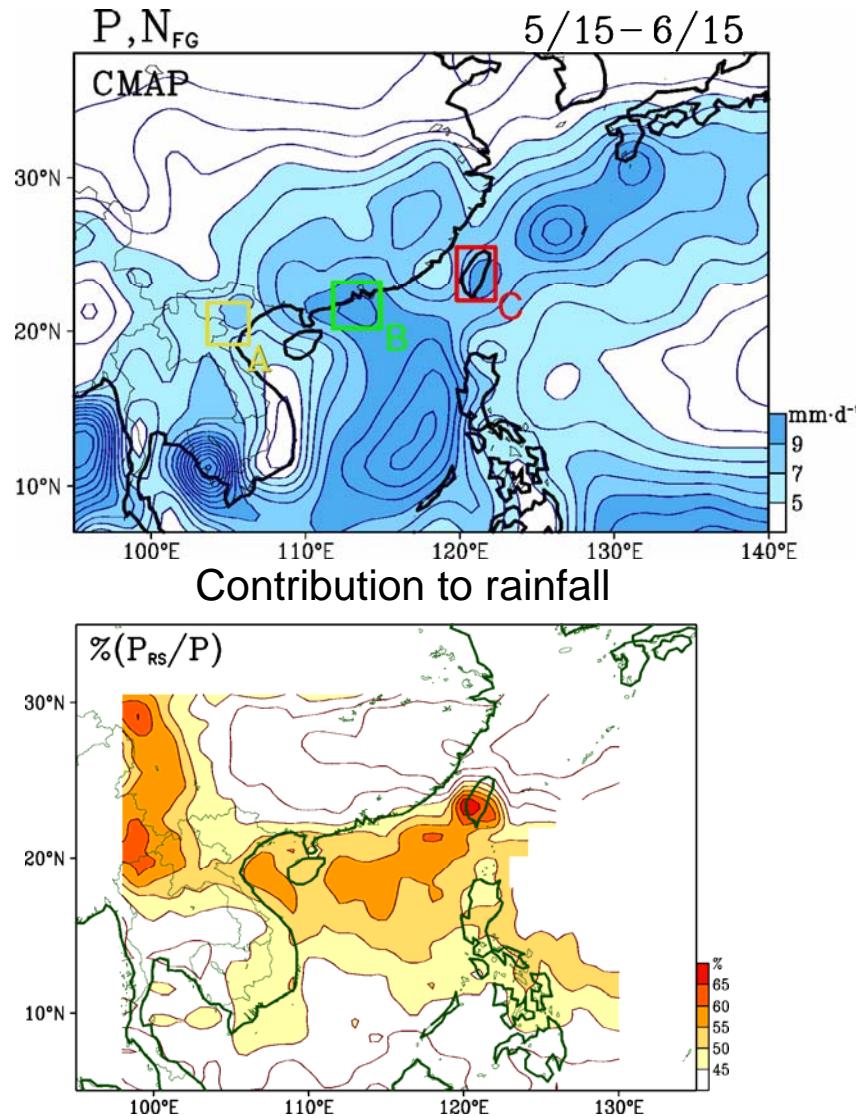
# Summer



## A 1998 SCSMEX case

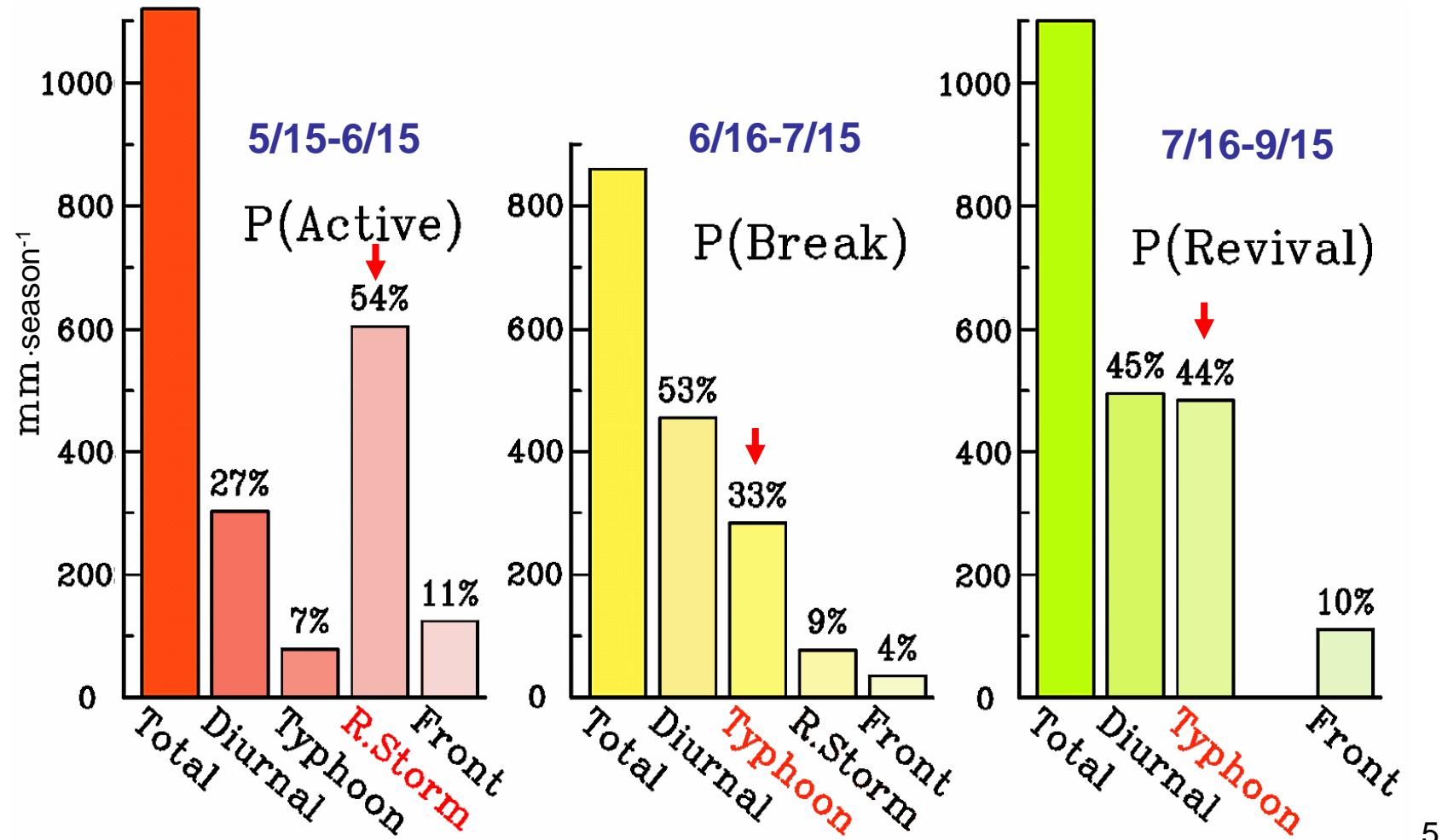


# 1. Importance of Rainstorms



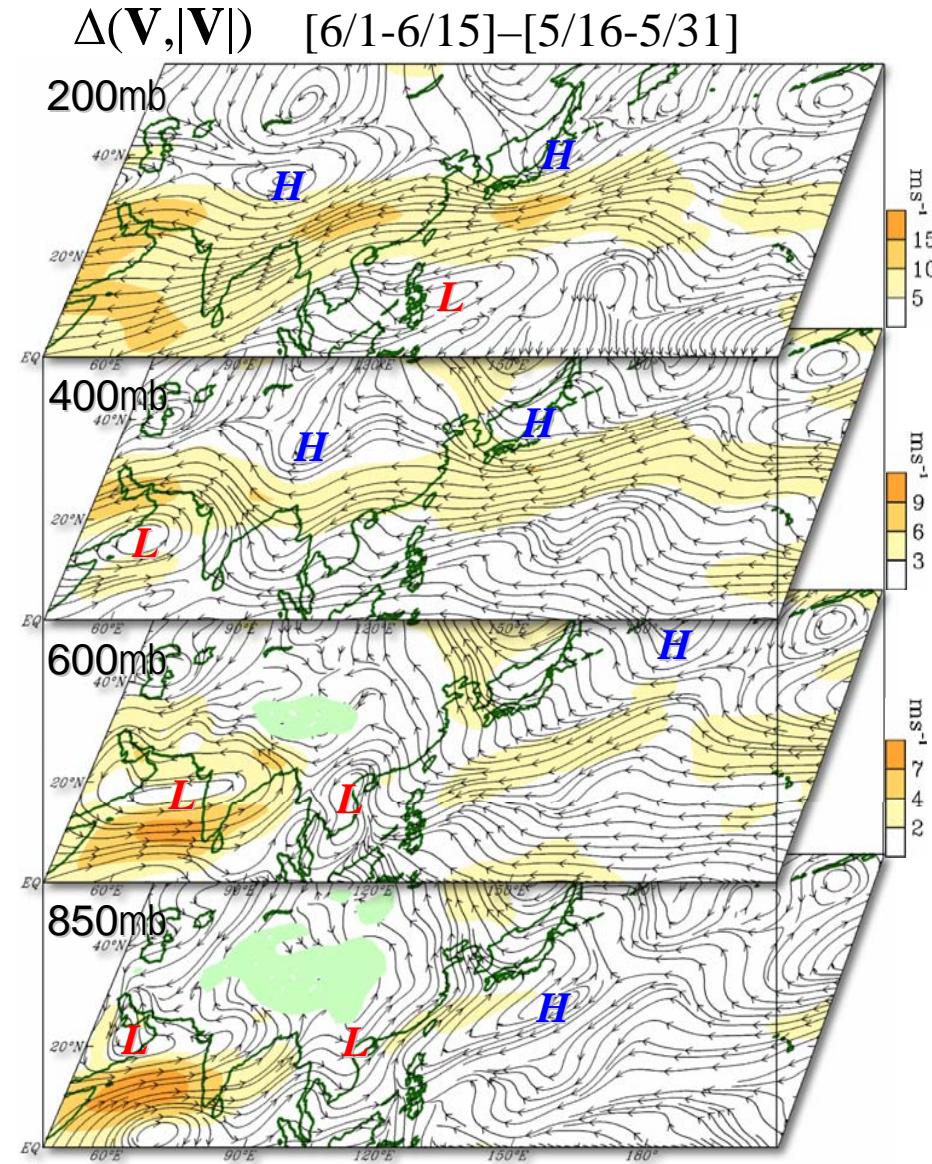
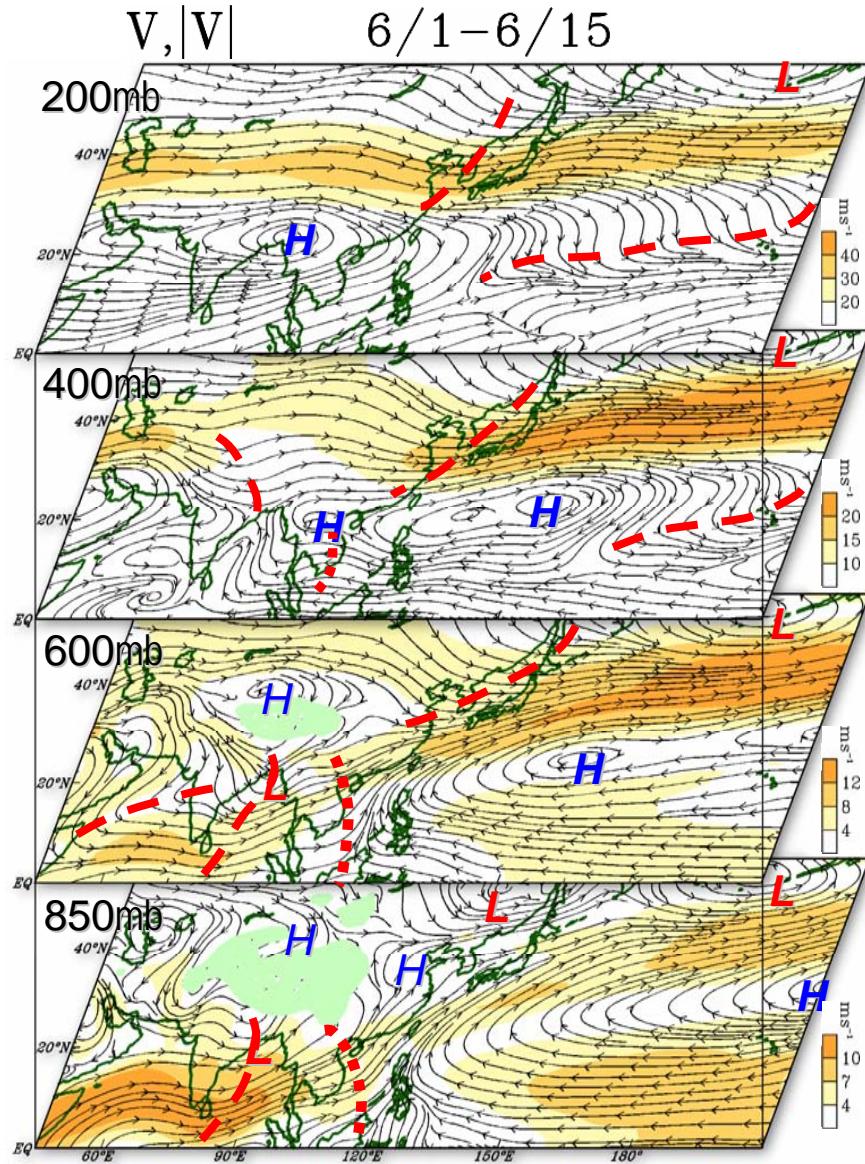
# Seasonal rainfall contributions from rainstorms and TCs

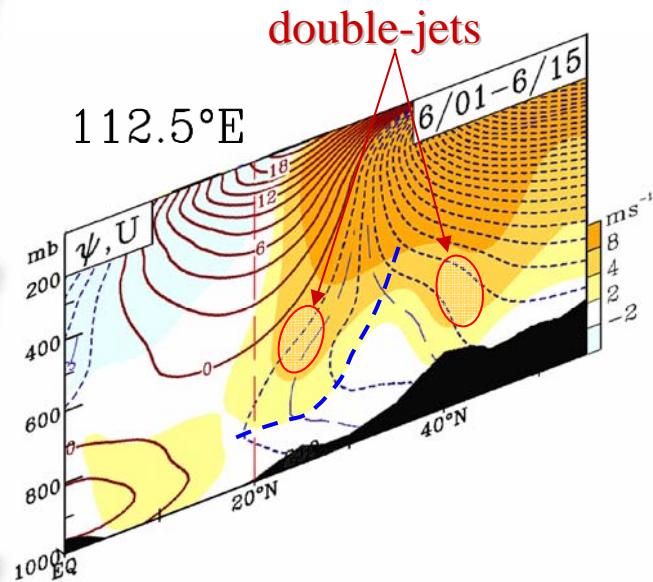
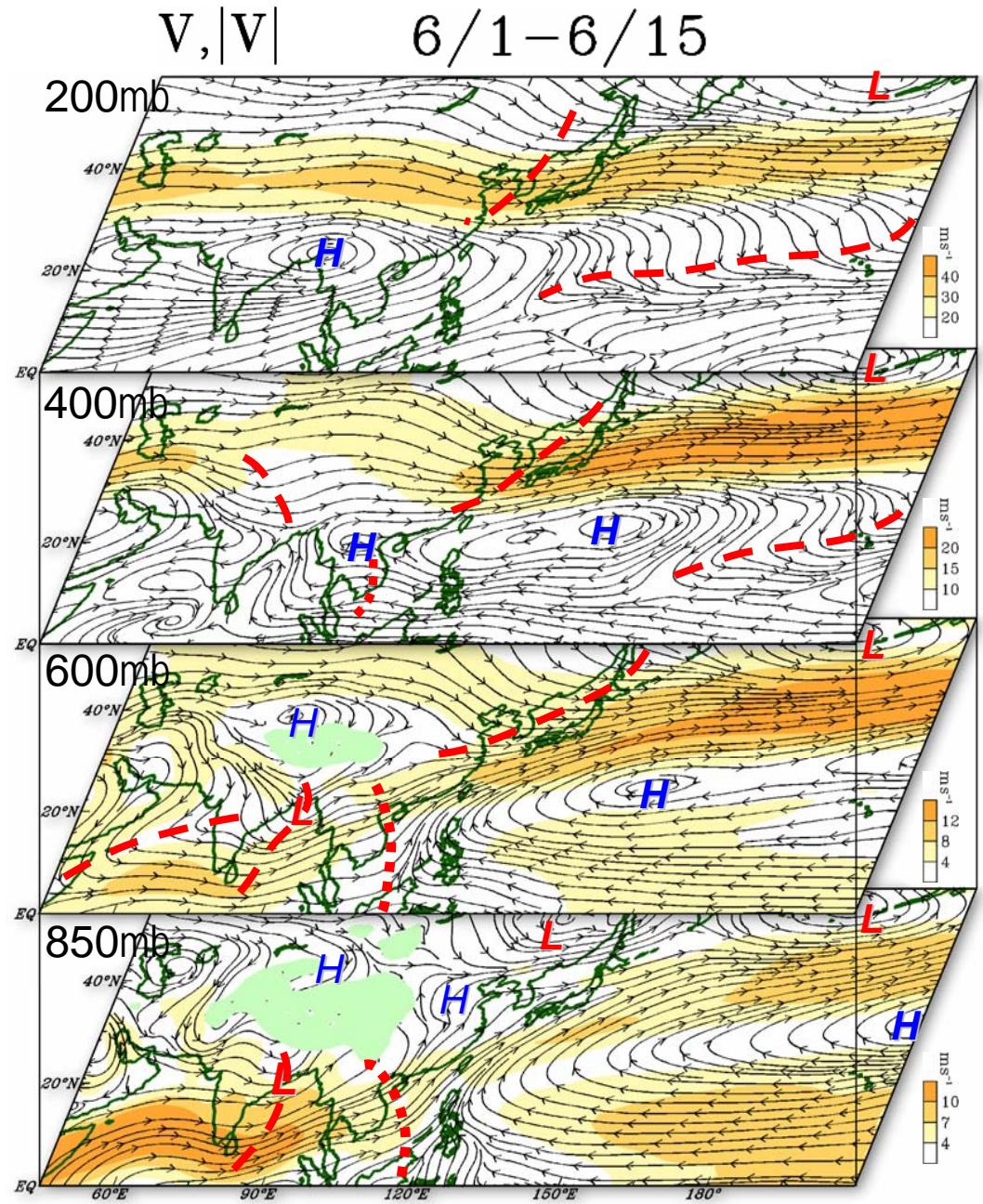
## Taiwan rainfall

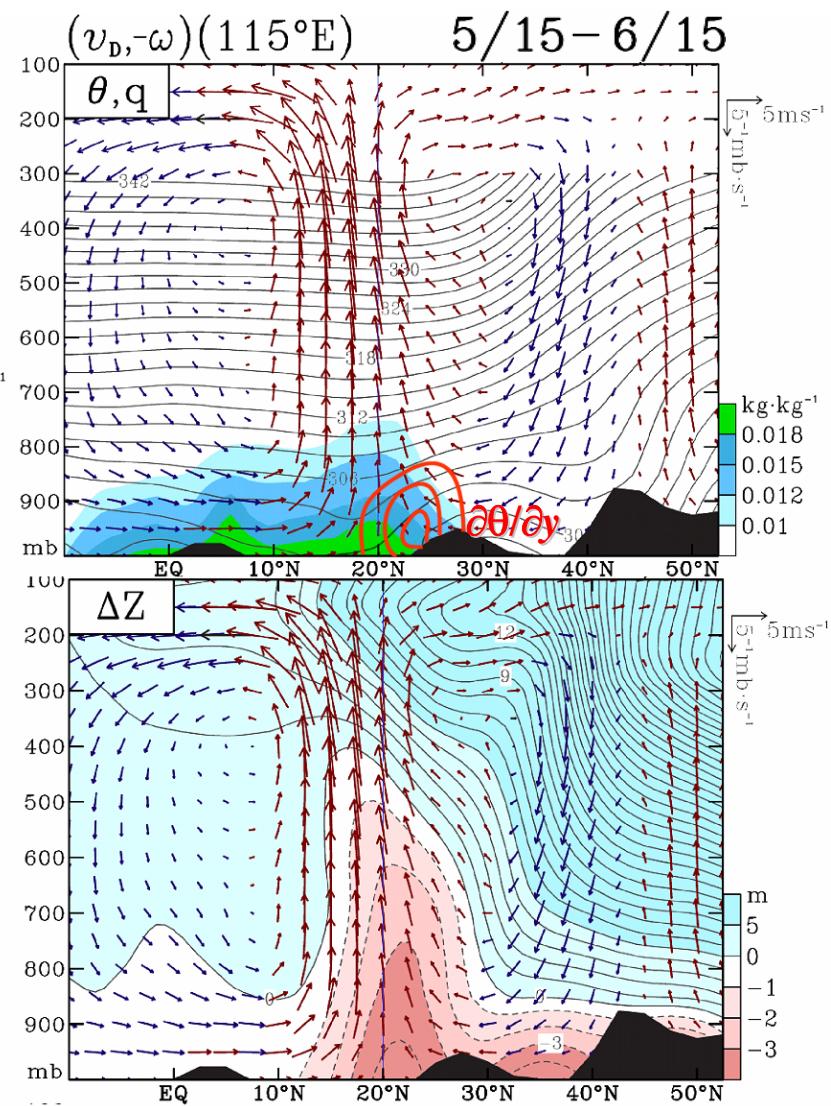
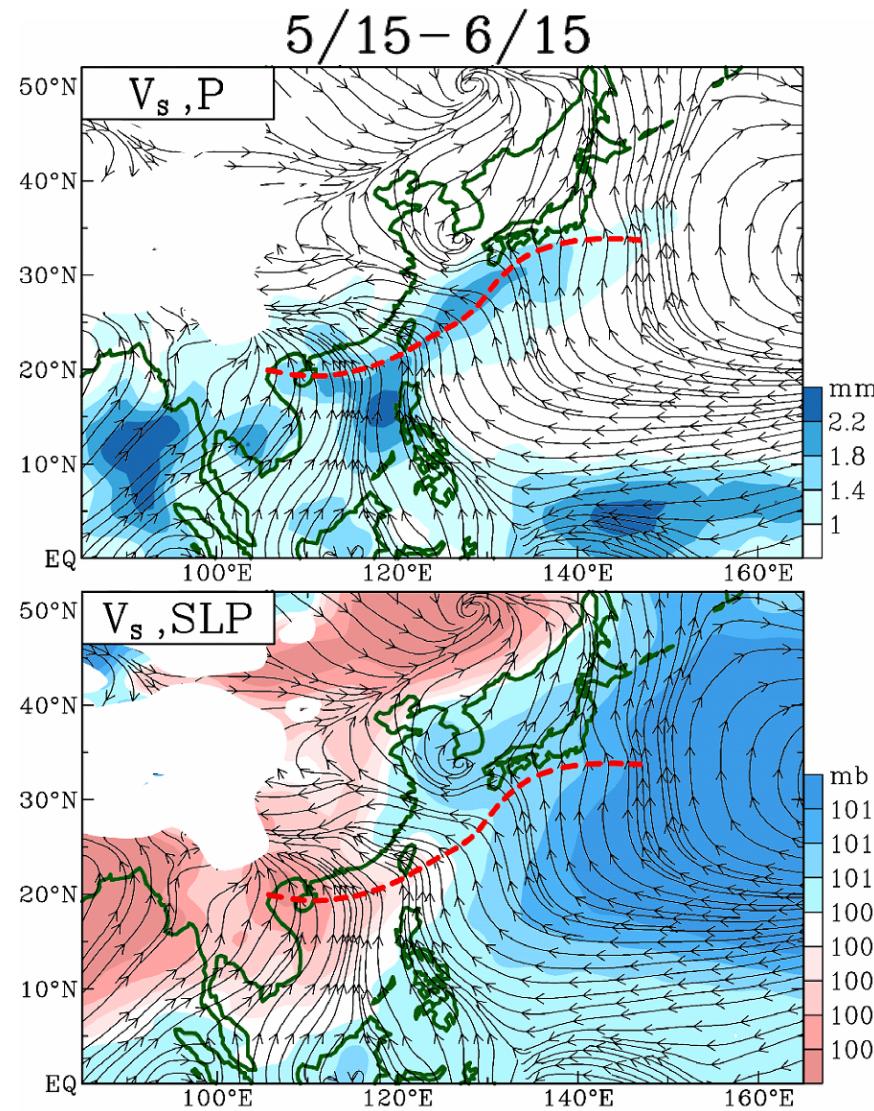


## 2. Rainstorm Genesis Mechanism

### a. Environmental Flows

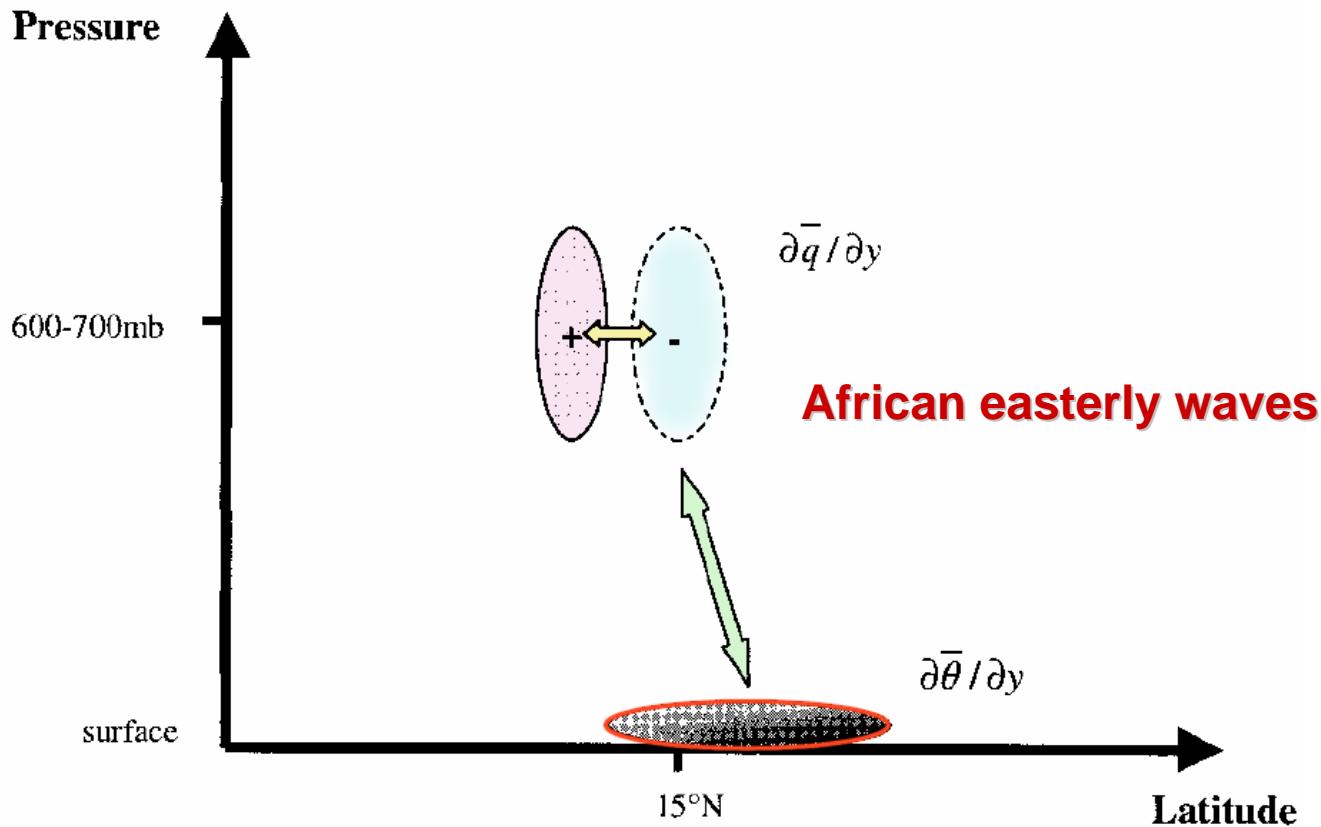


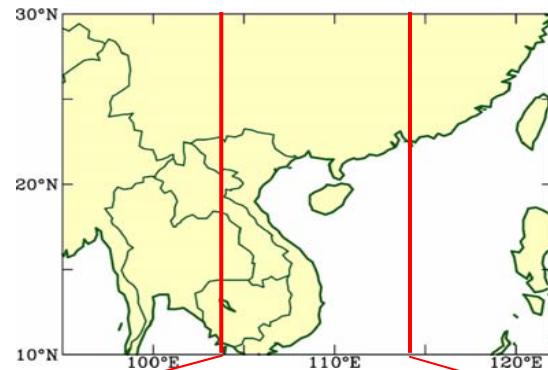




## b. Genesis Mechanism

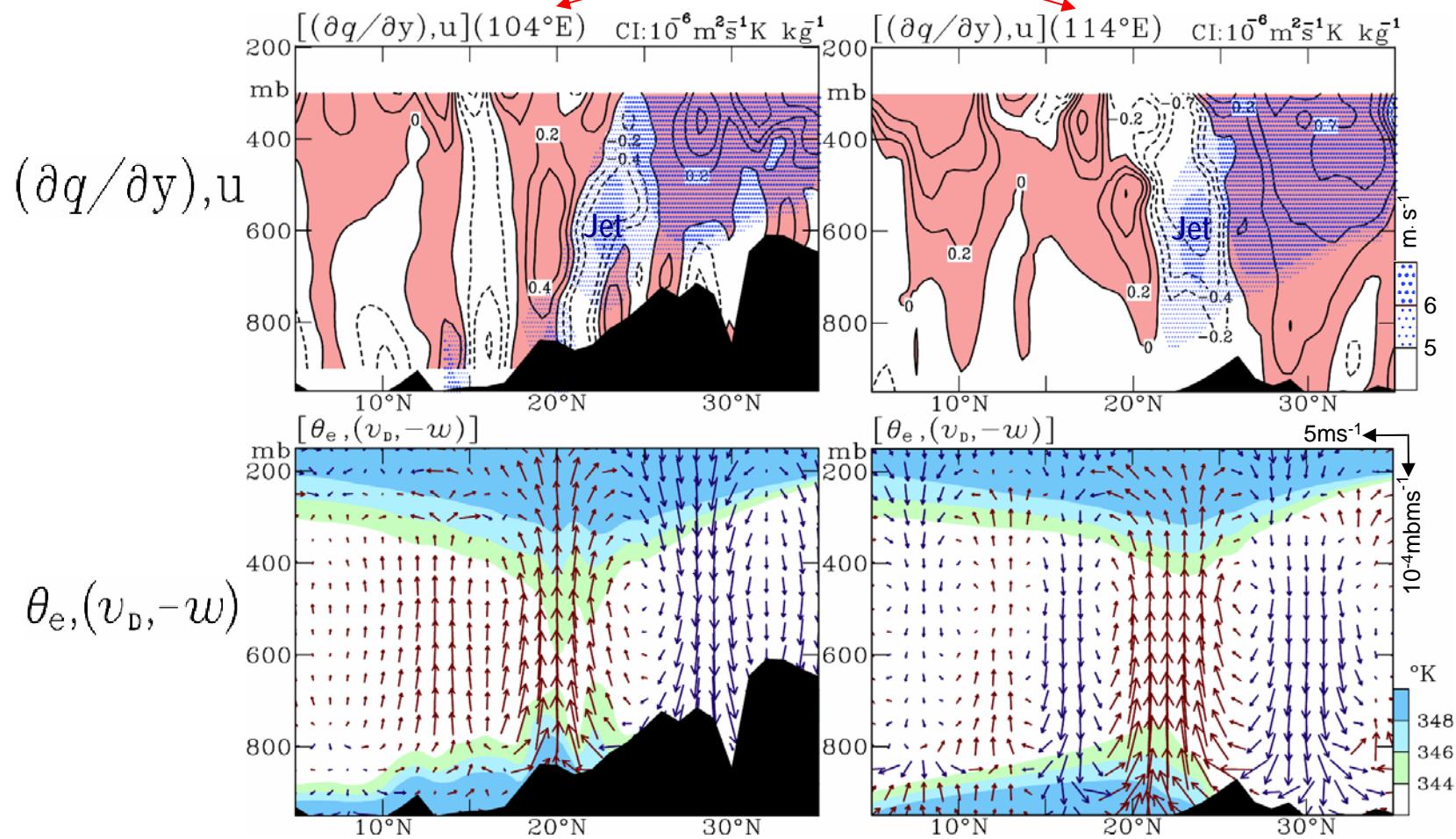
### Charney-Stern baroclinic instability





15 May ~ 15 June, 2005 and 2006

## Instability

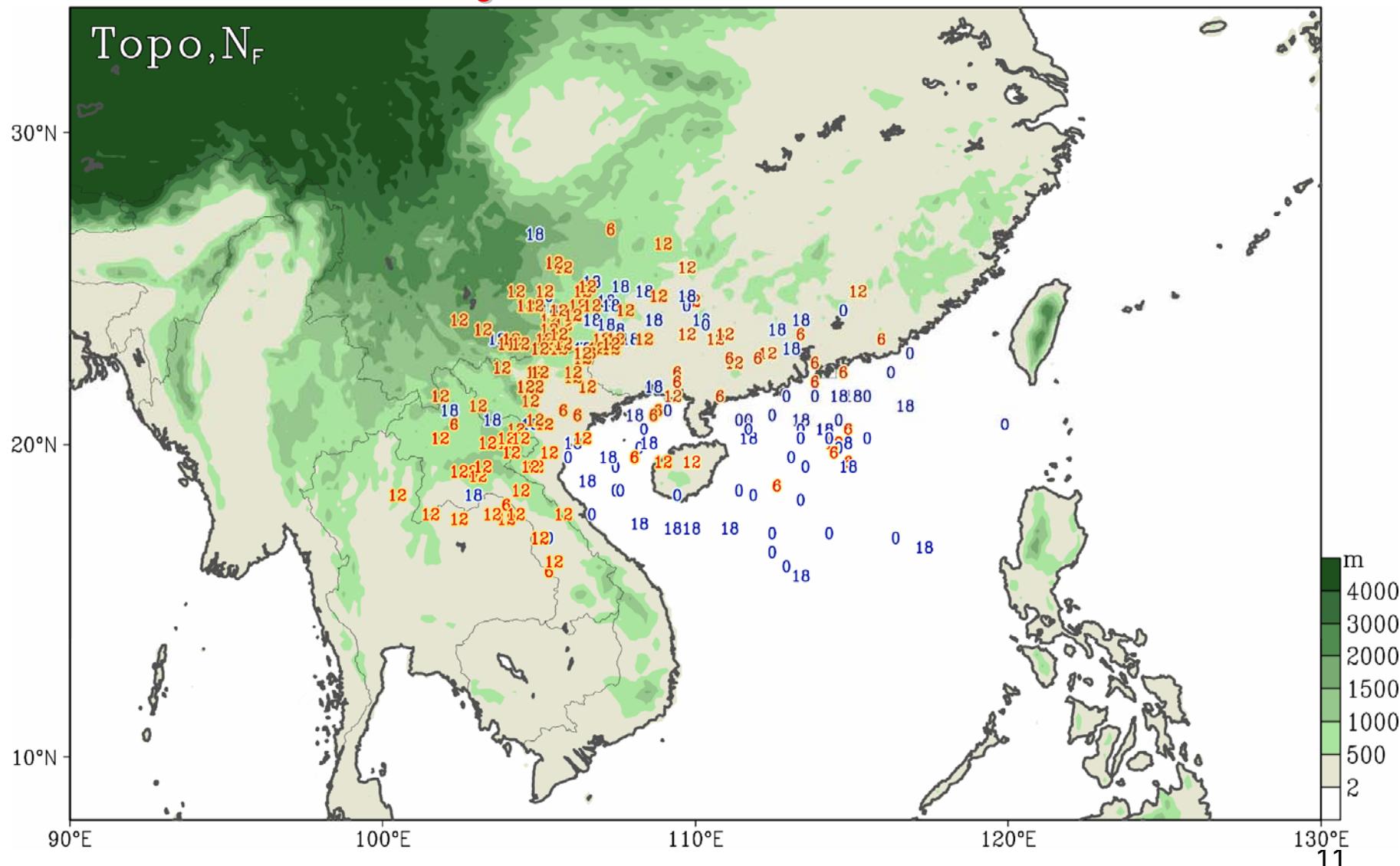


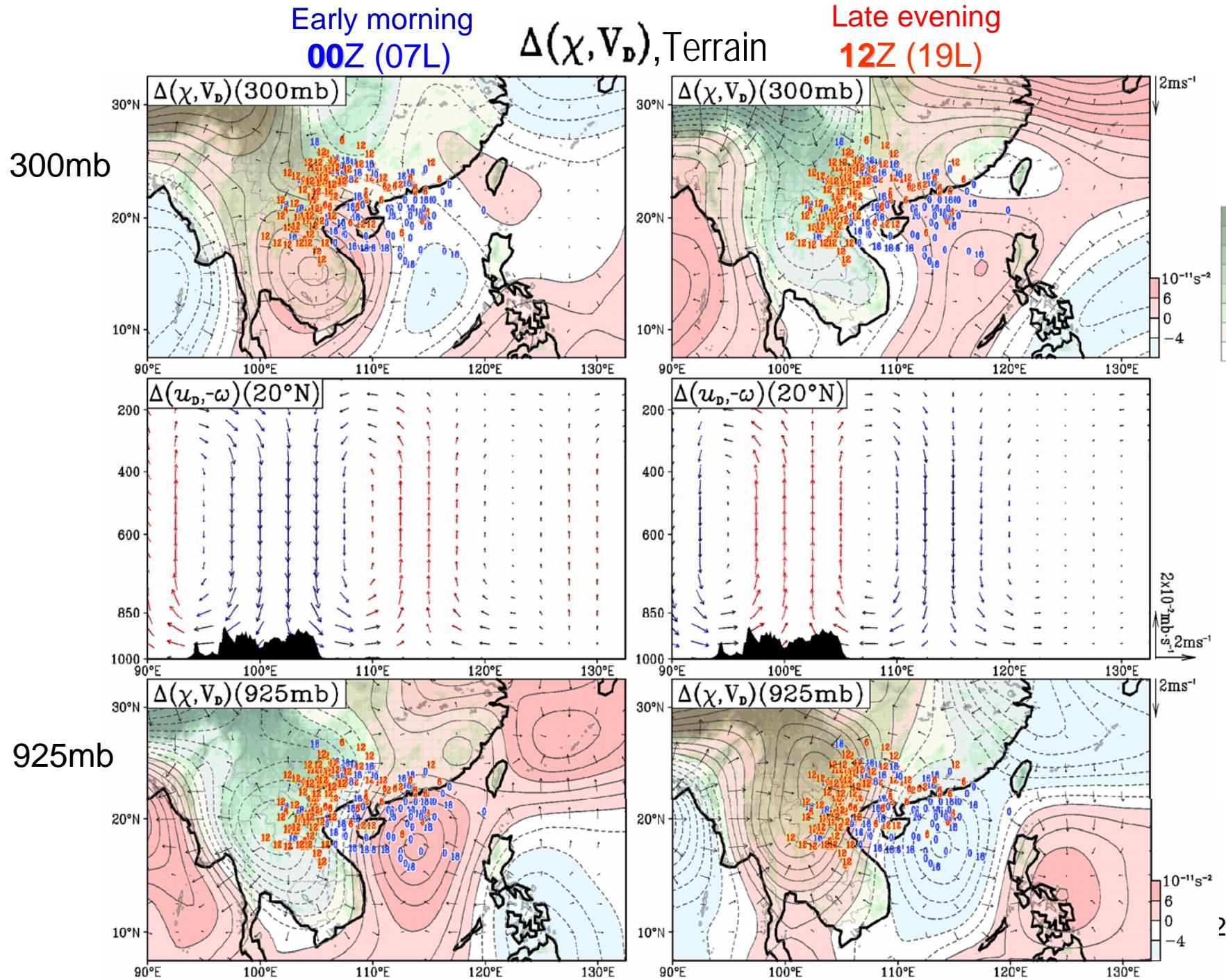
### c. Diurnal Variation

Genesis location/timing of rainstorm

6Z, 12Z → Afternoon/Evening

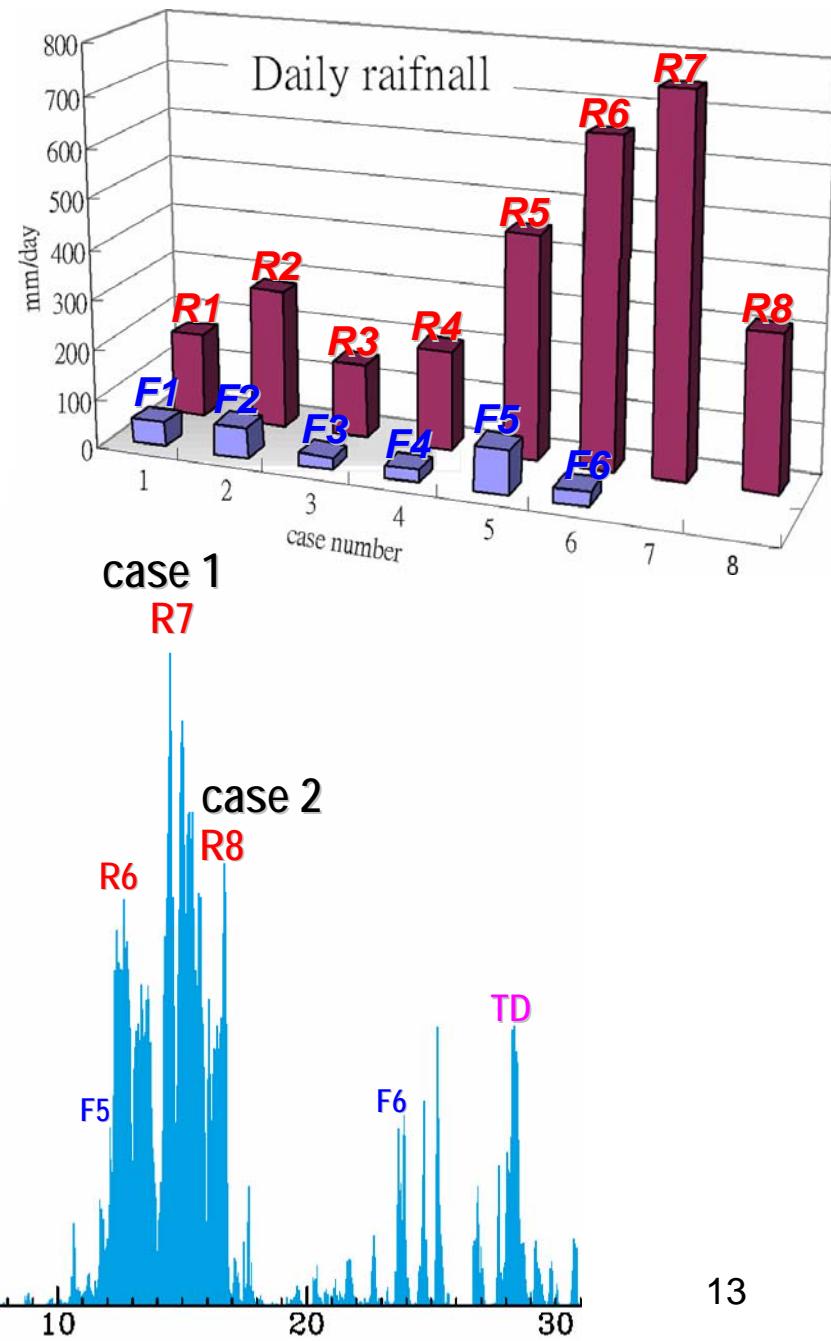
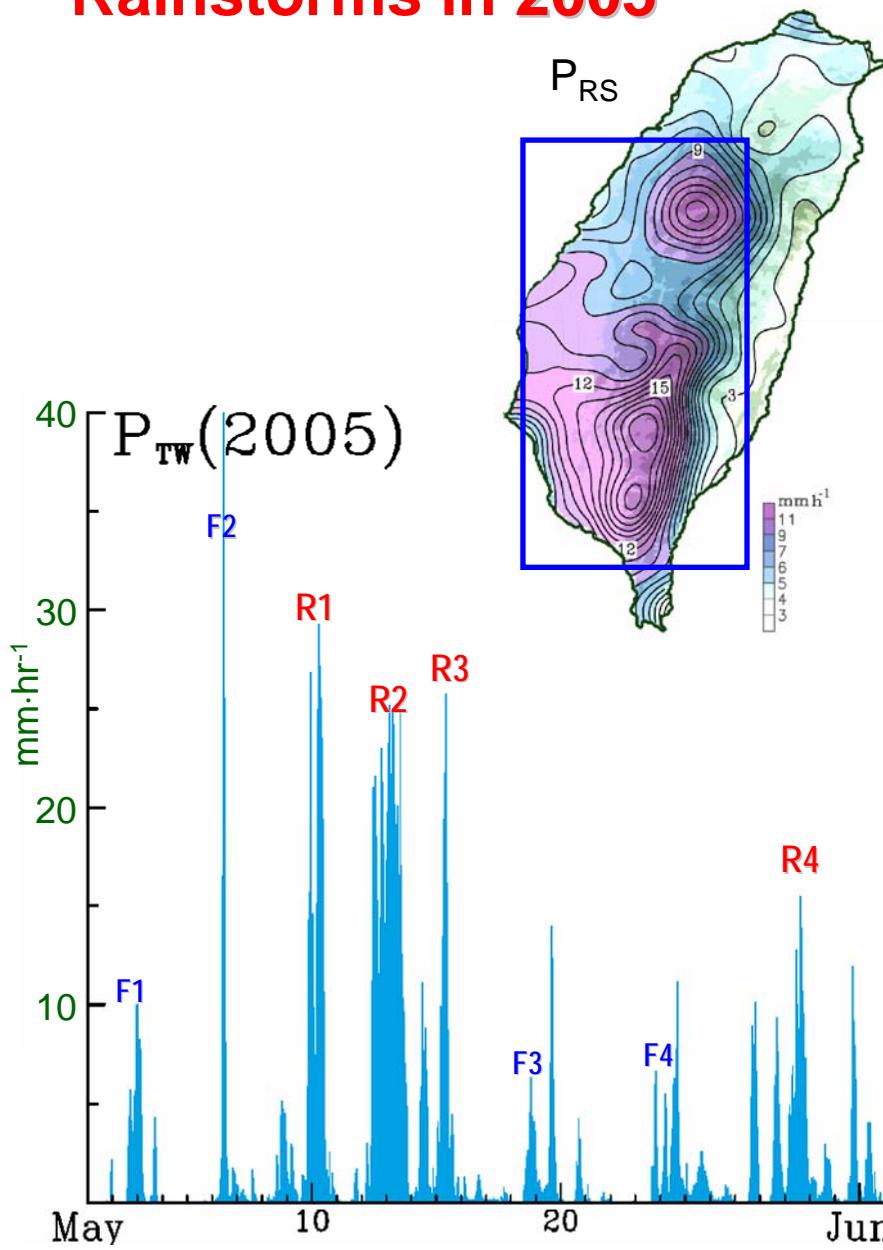
0Z, 18Z → Midnight/Morning



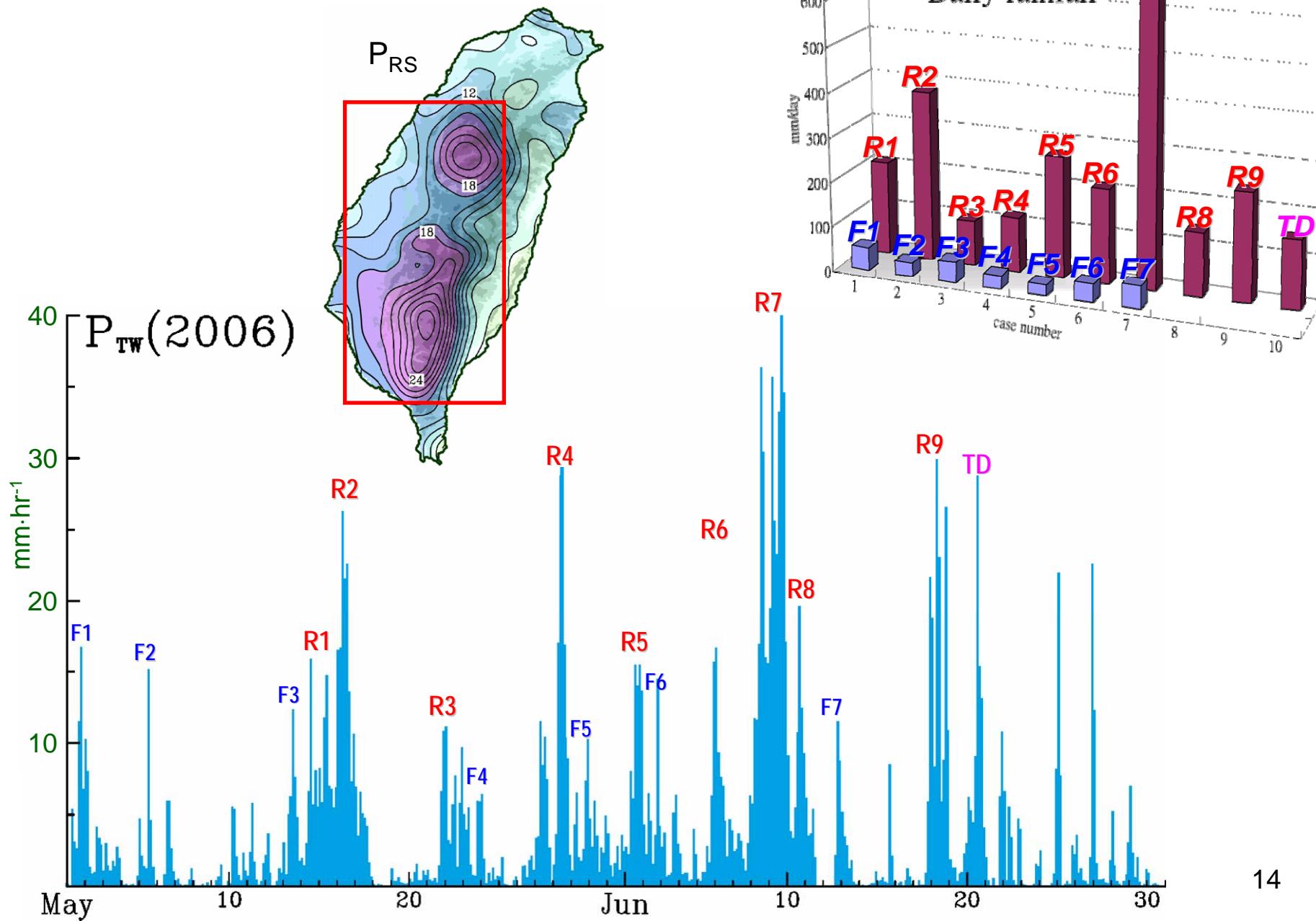


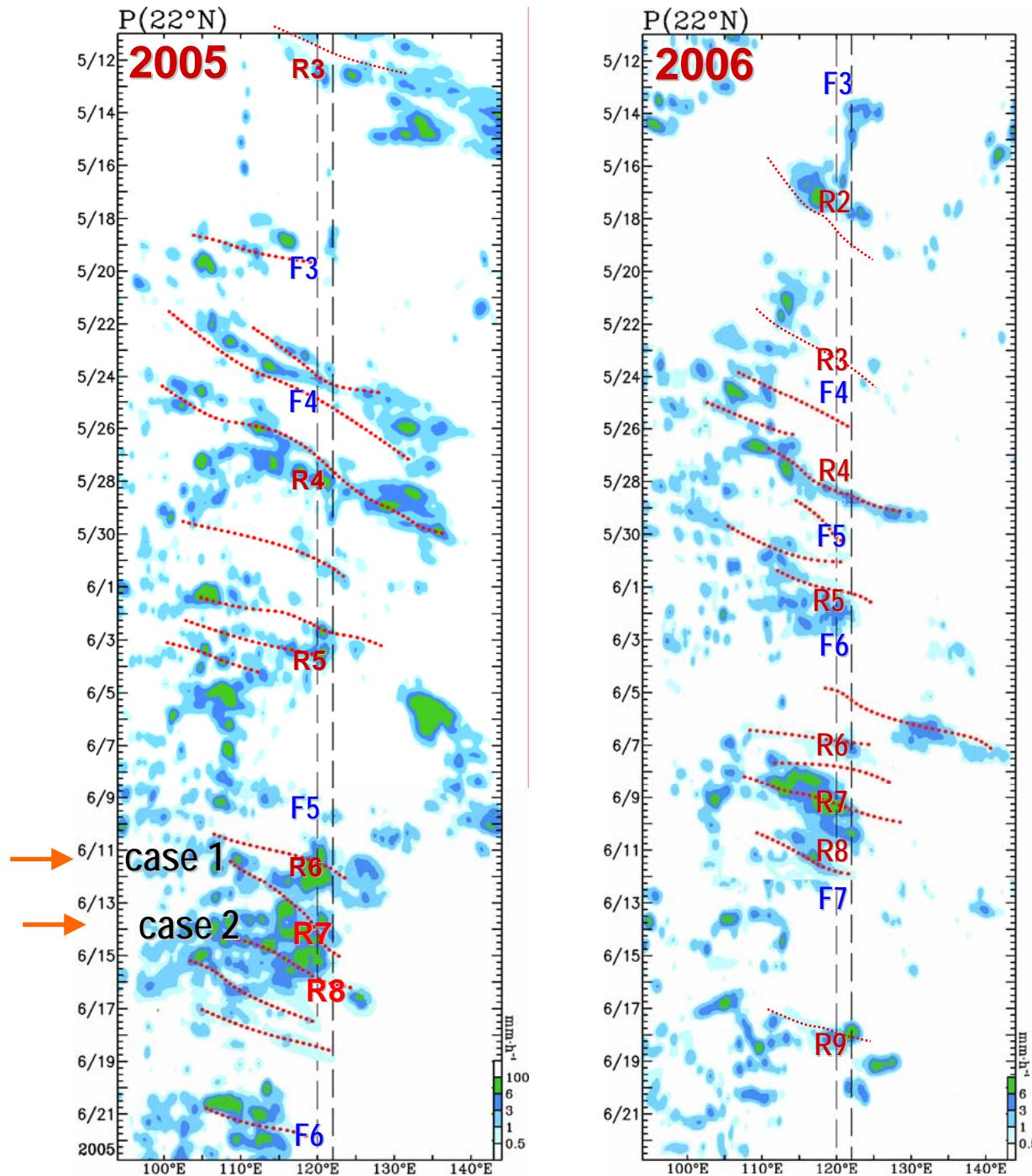
## d. Downstream Development

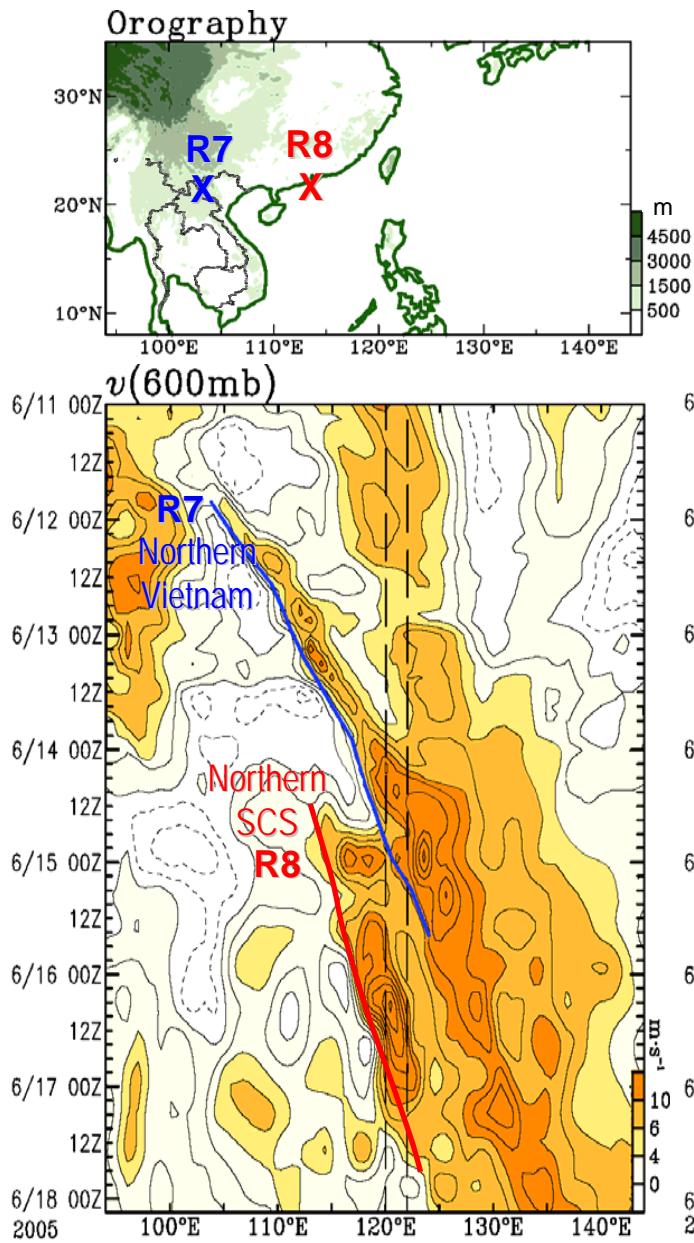
### Rainstorms in 2005



# Rainstorms in 2006

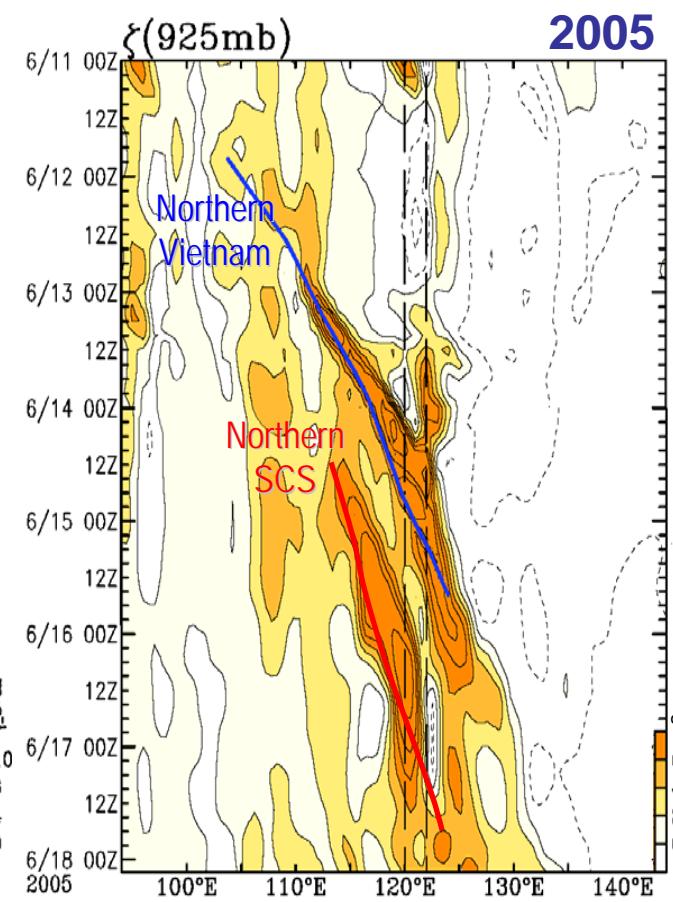






## Examples: 2 types of genesis

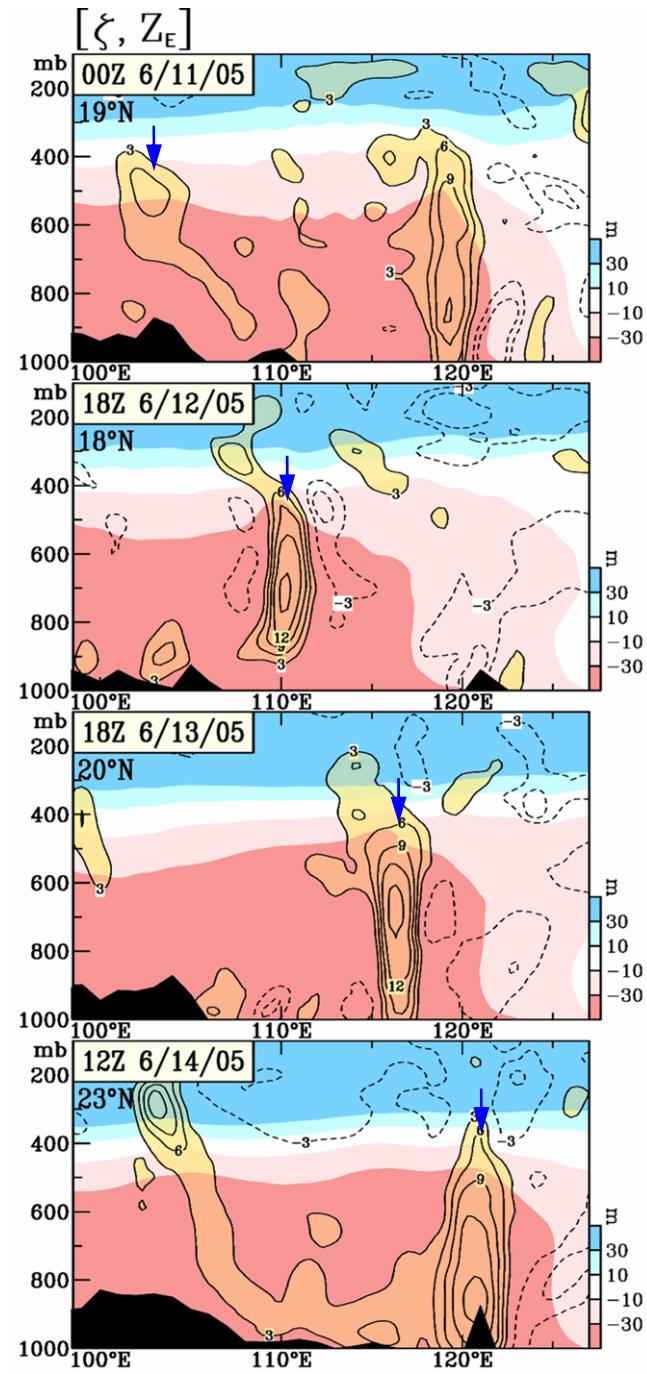
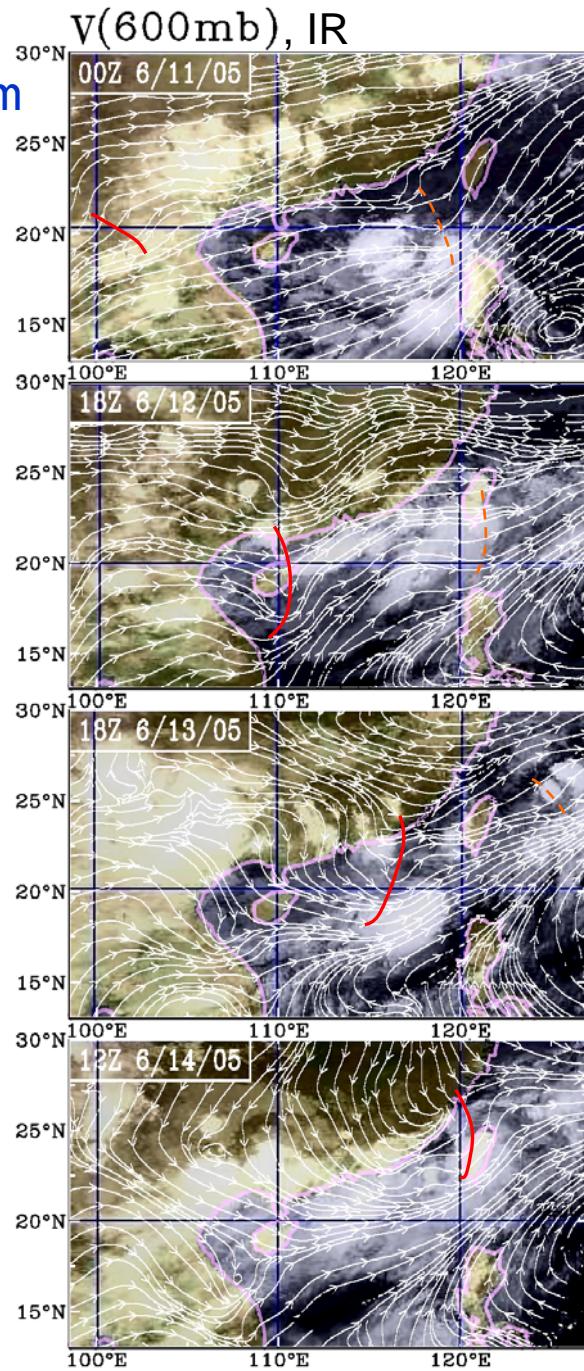
Latitude varies with time  
following the RS

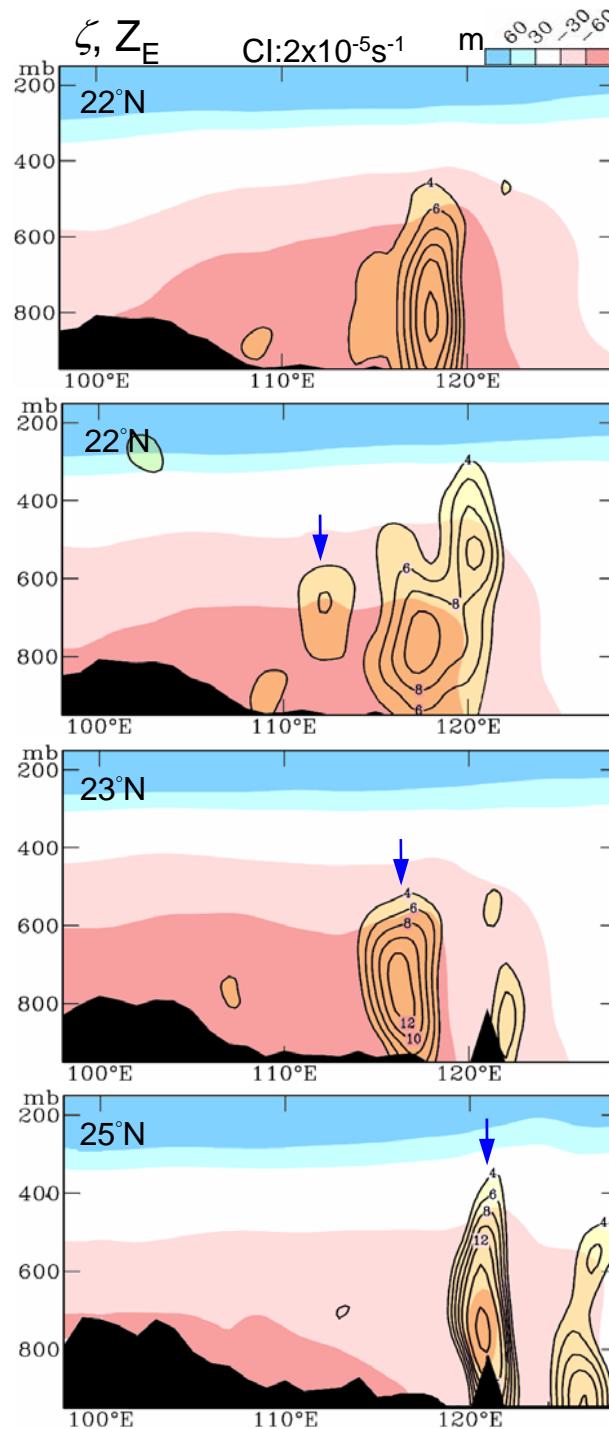
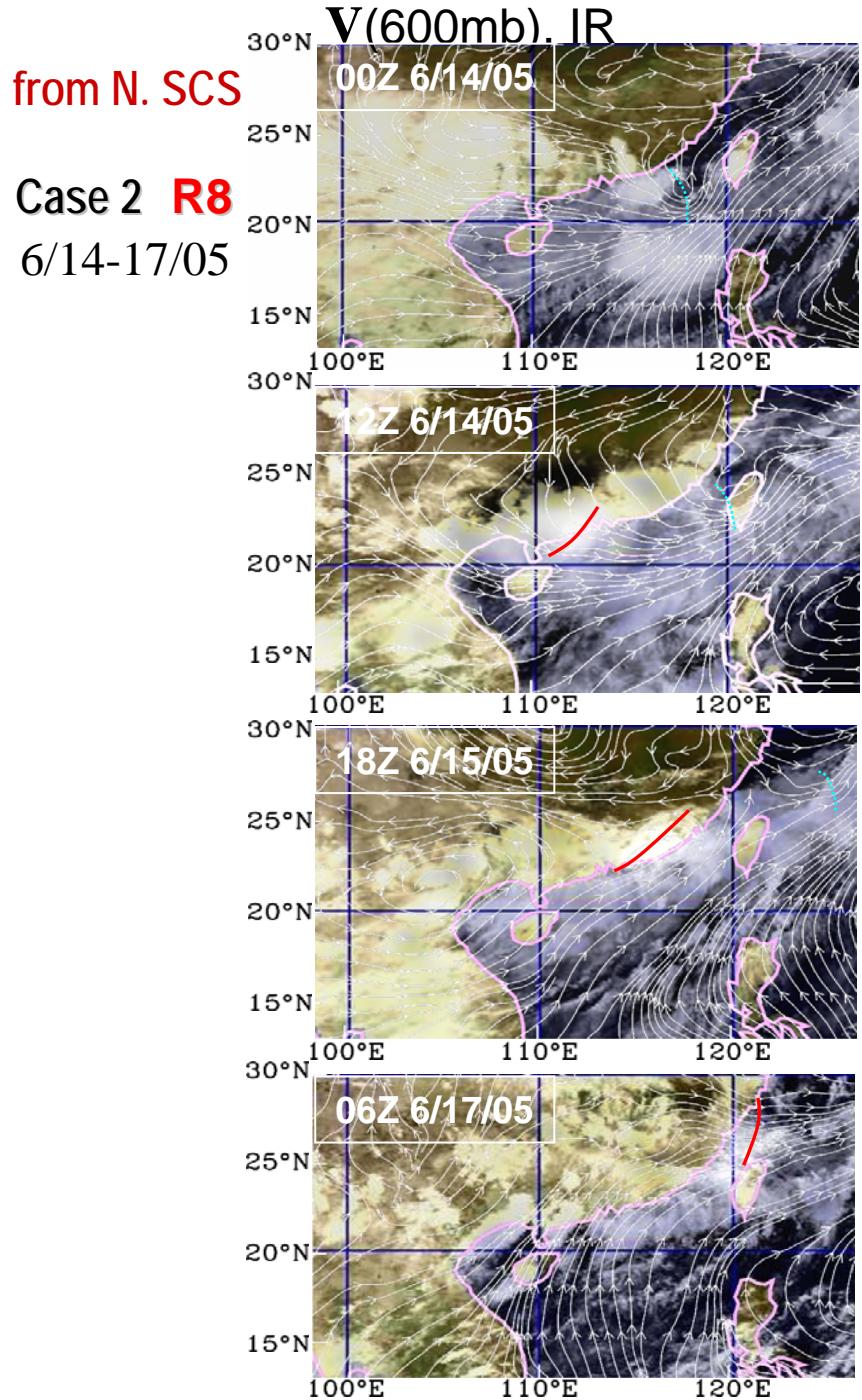


GFS initial analysis

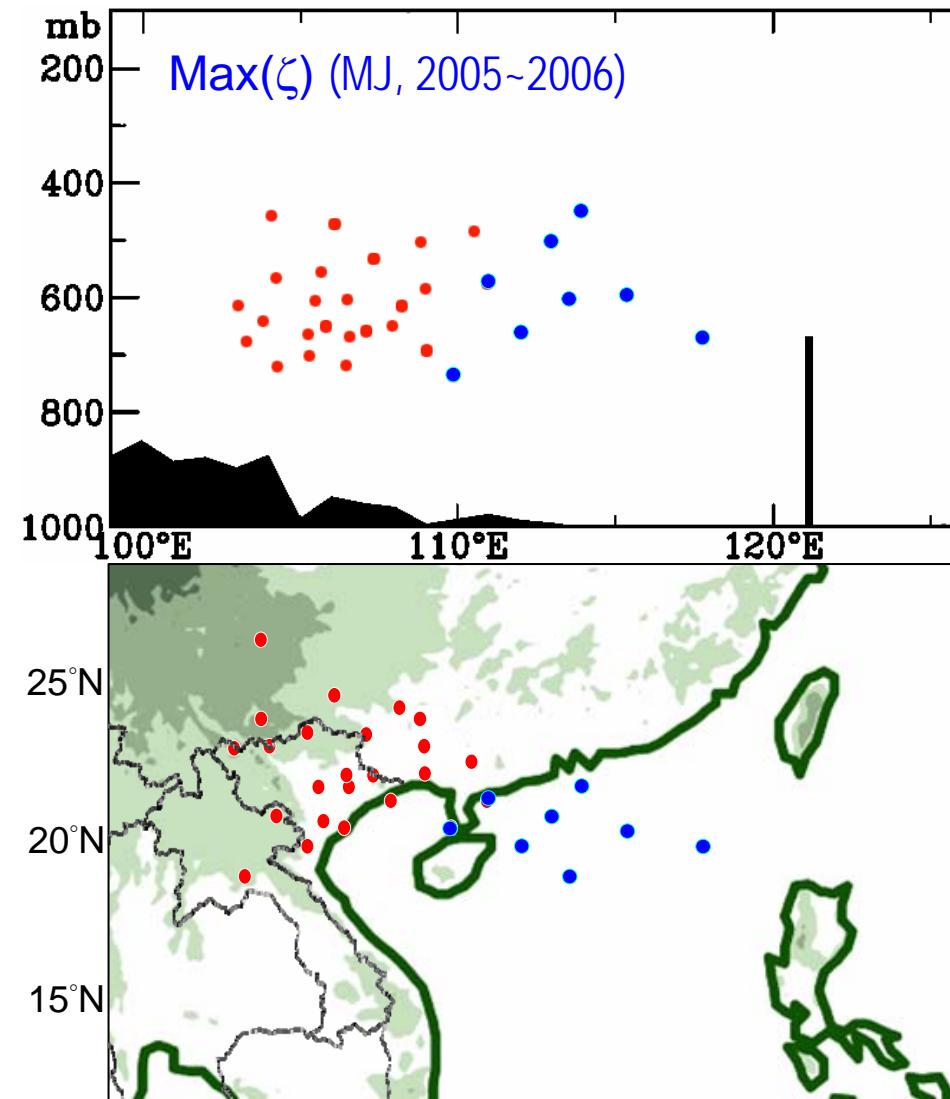
from N. Vietnam

Case 1 R7  
6/11-15/05



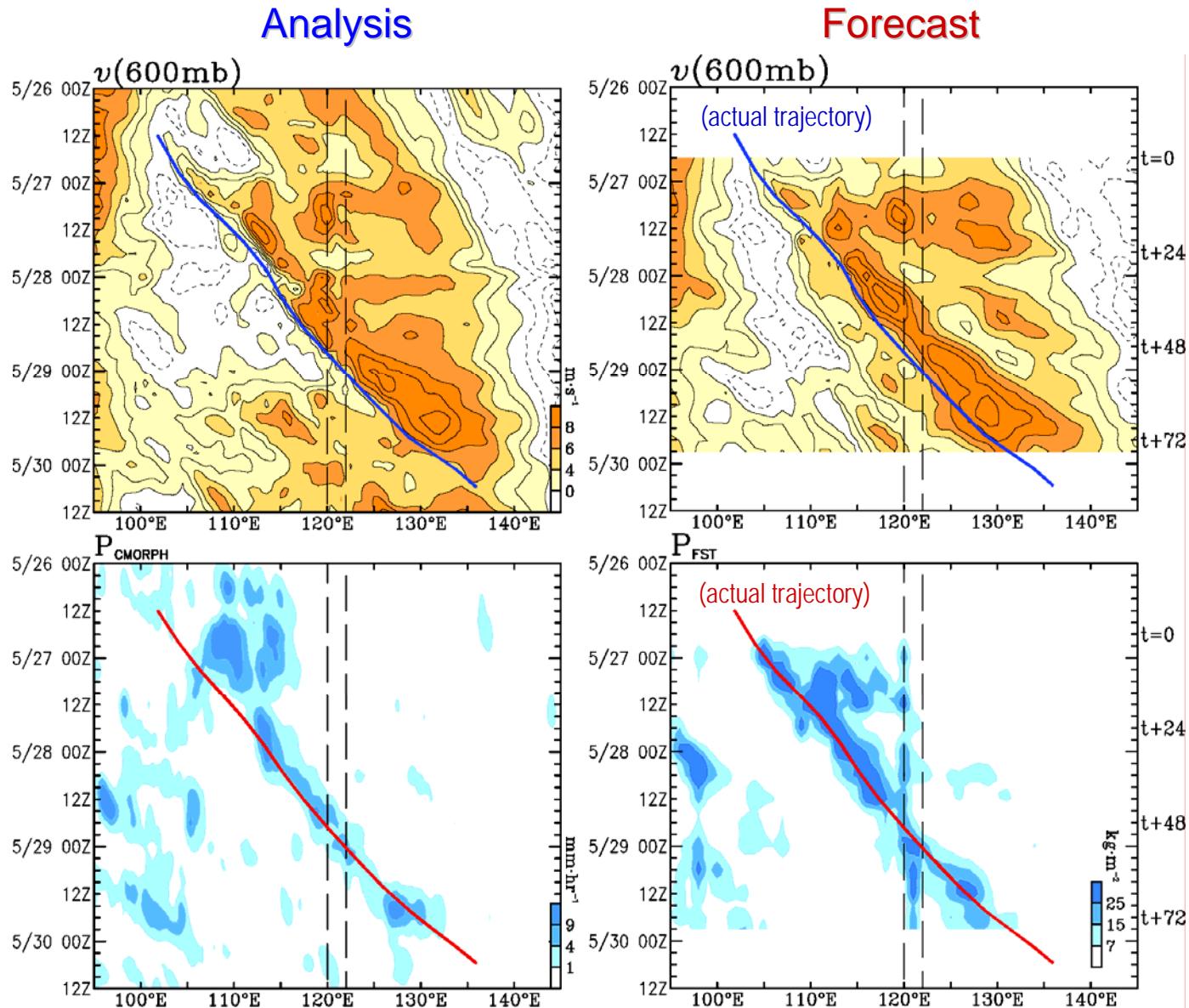


## Distribution of genesis location

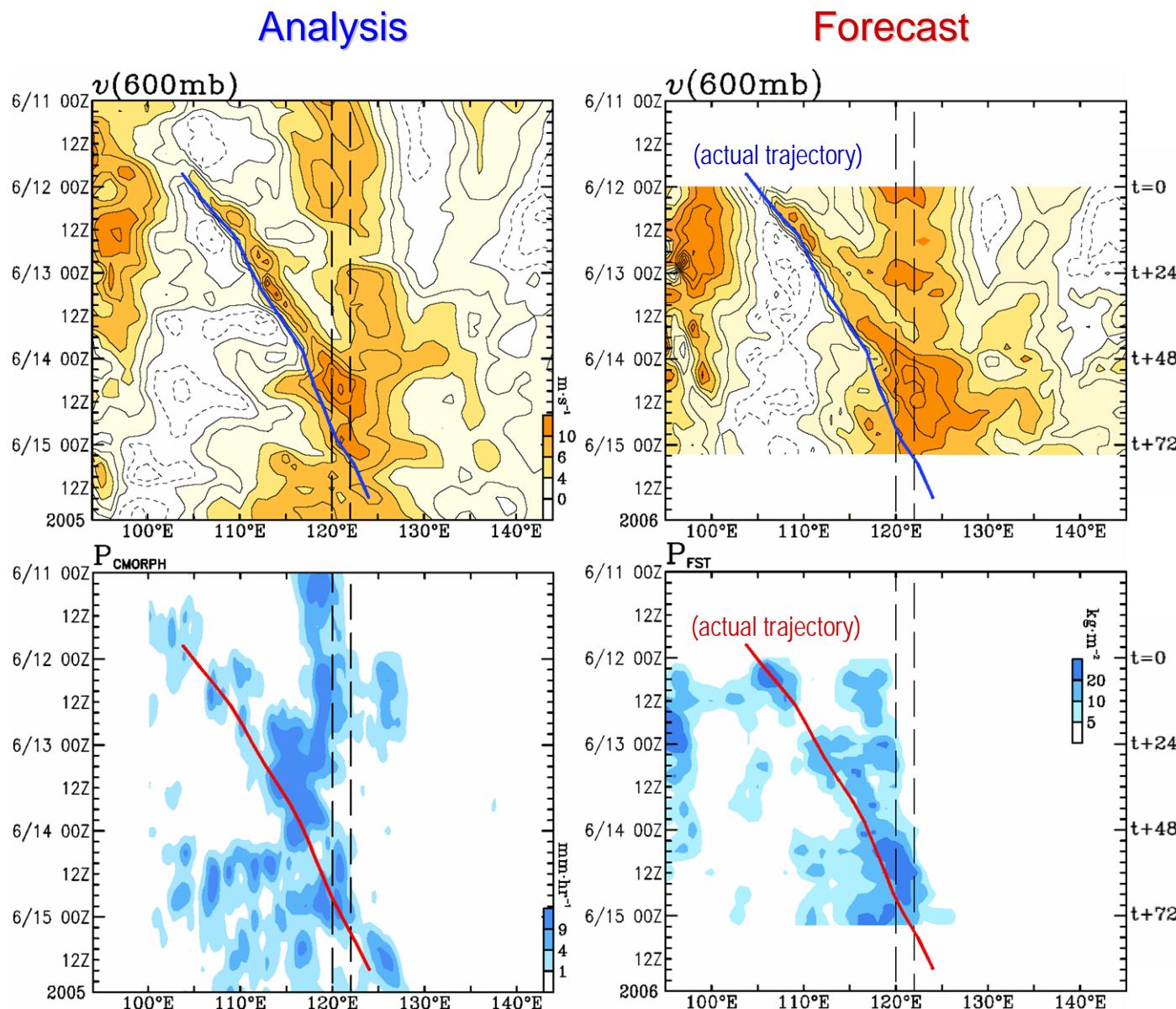


### 3. Rainstorm Forecastability by GFS

Case (May 26-30, 2006)



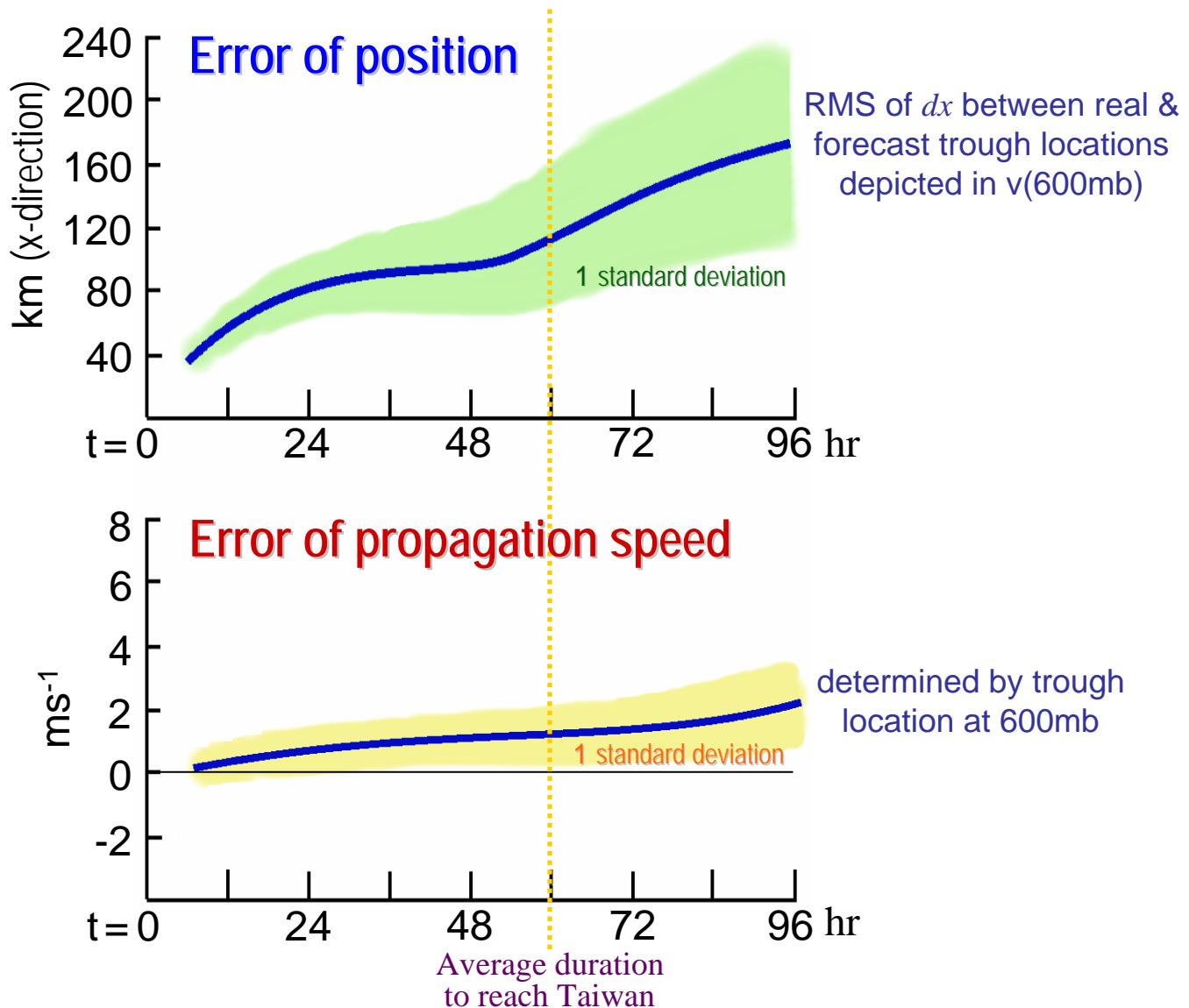
## Case (June 11-15, 2005)



# GFS forecast performance

(MJ, 2005-2006)

For the mid-tropospheric perturbation: (actual – forecasted)

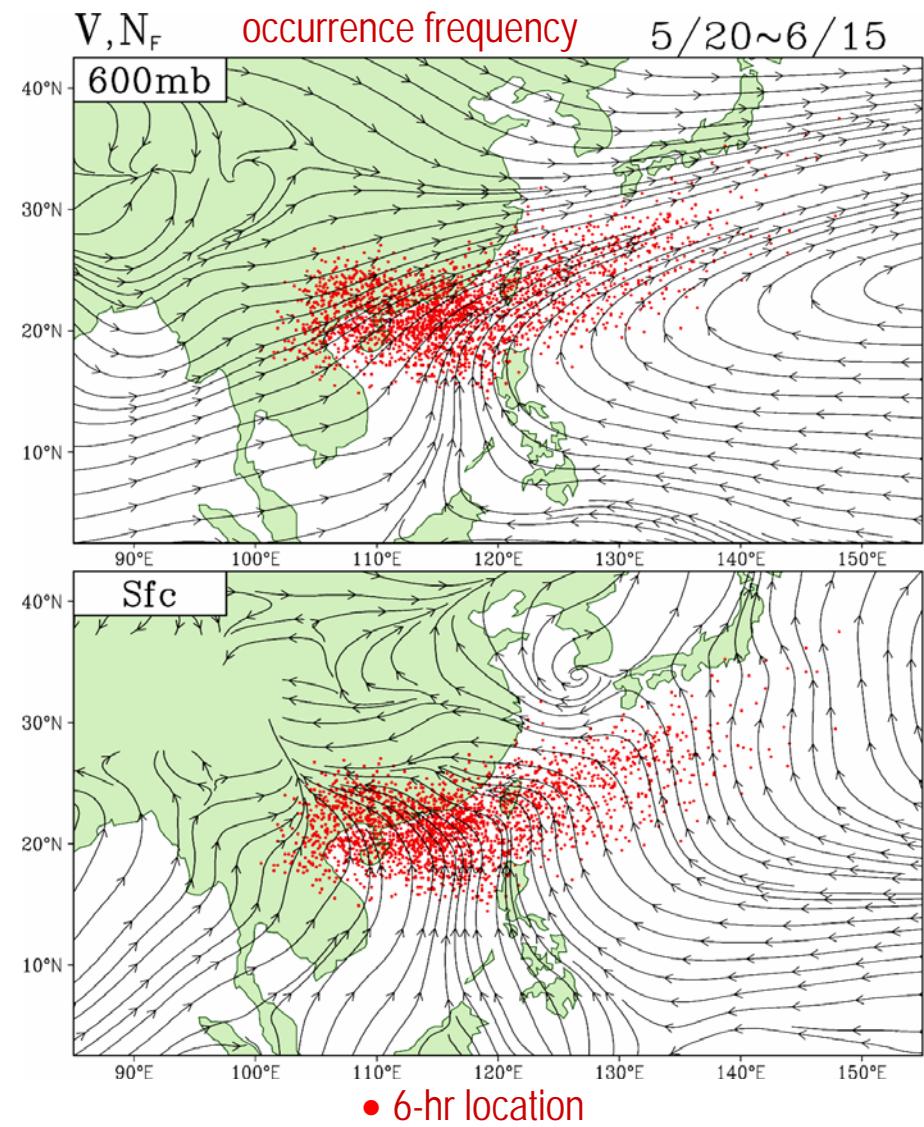
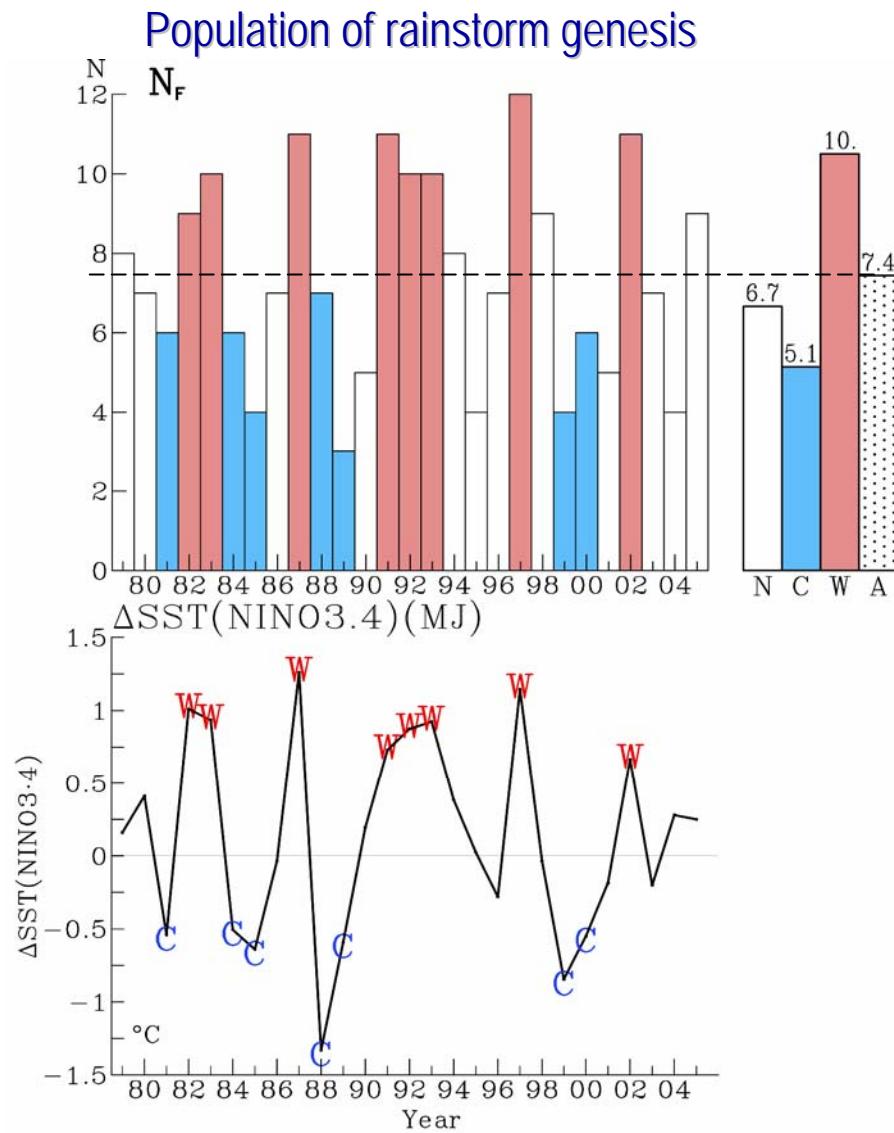


## Performance of current GFS forecasting:

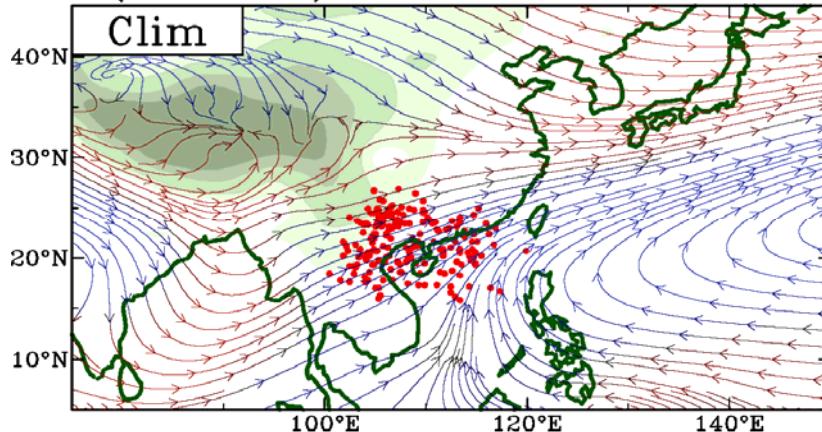
Position error: within 50 km in E-W direction for 4 days  
within 50 km in E-W direction over 1,600 km  
from genesis location

Speed error: within  $2 \text{ ms}^{-1}$  zonal speed for 4 days  
within  $2 \text{ ms}^{-1}$  zonal speed over 1,600 km  
from genesis location

## 4. Interannual variation



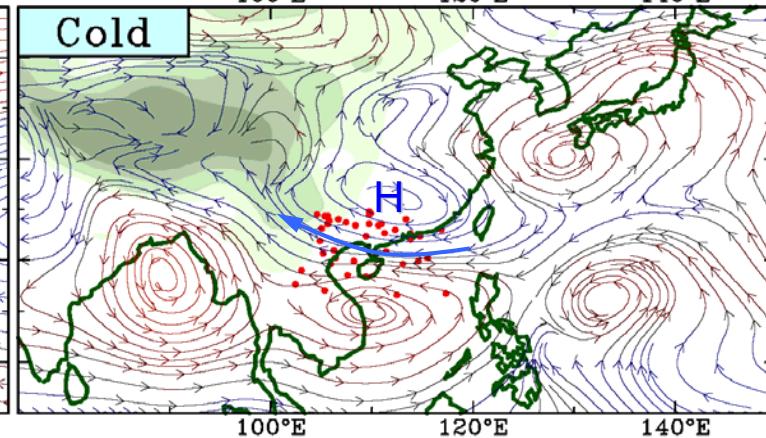
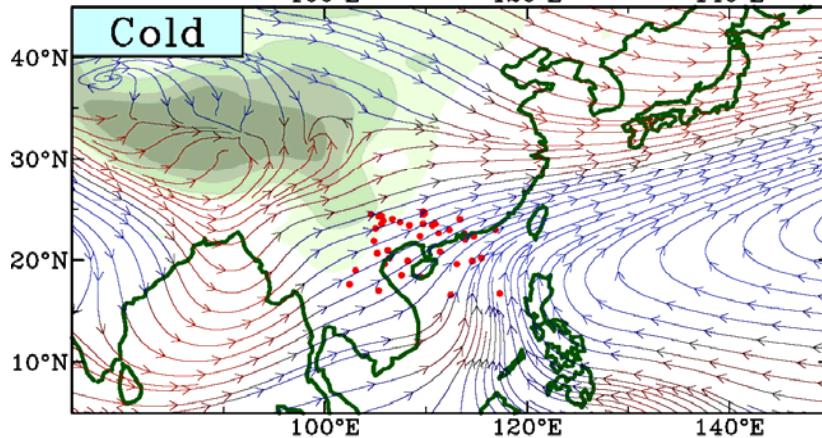
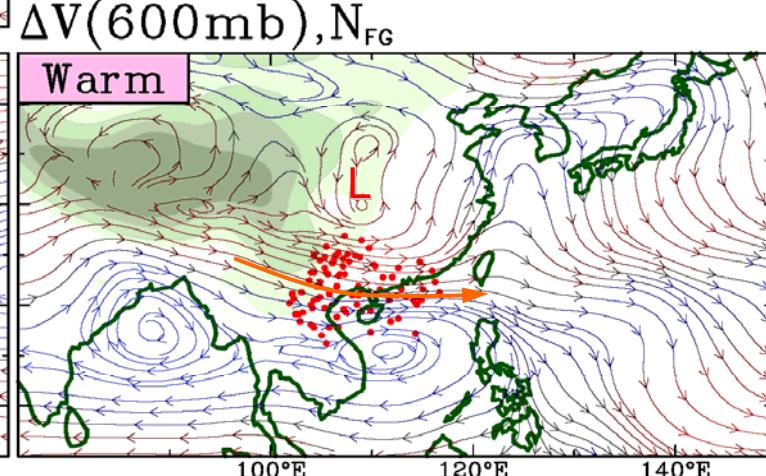
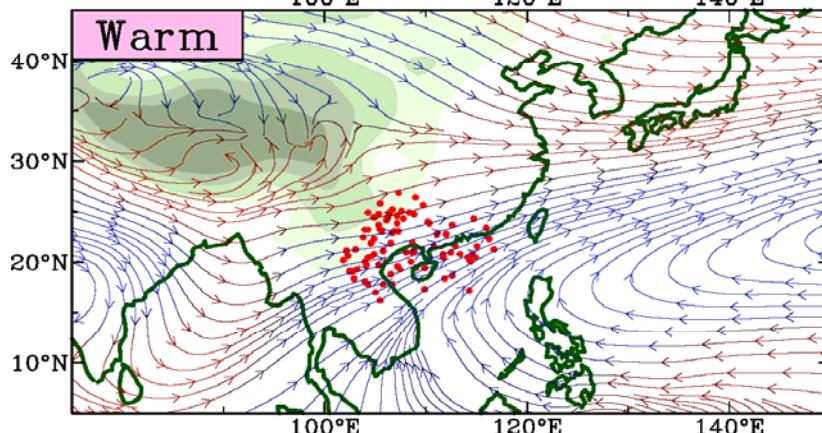
$V(600\text{mb}), N_{FG}$



• Genesis location of RS

5/10-6/20

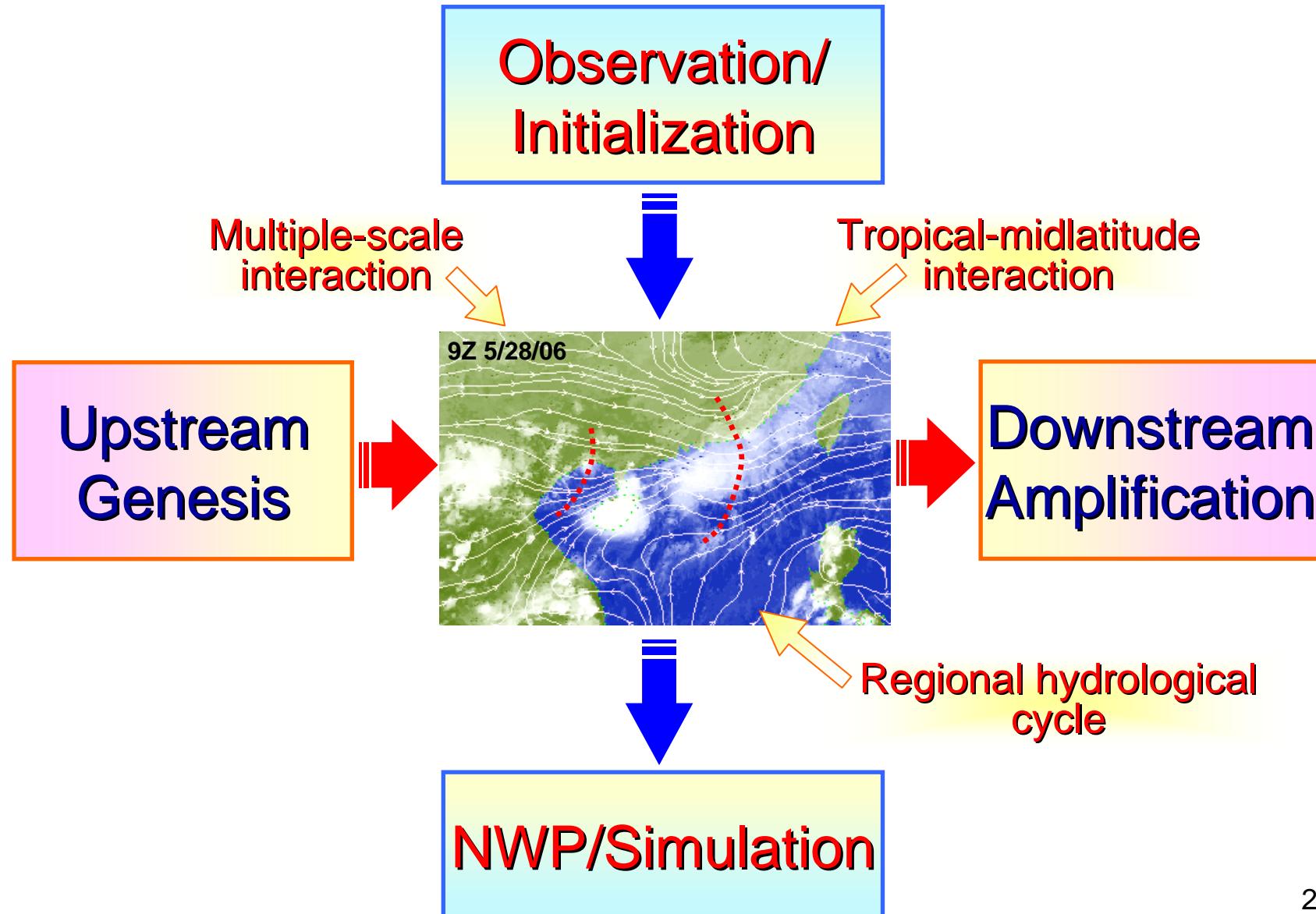
Difference



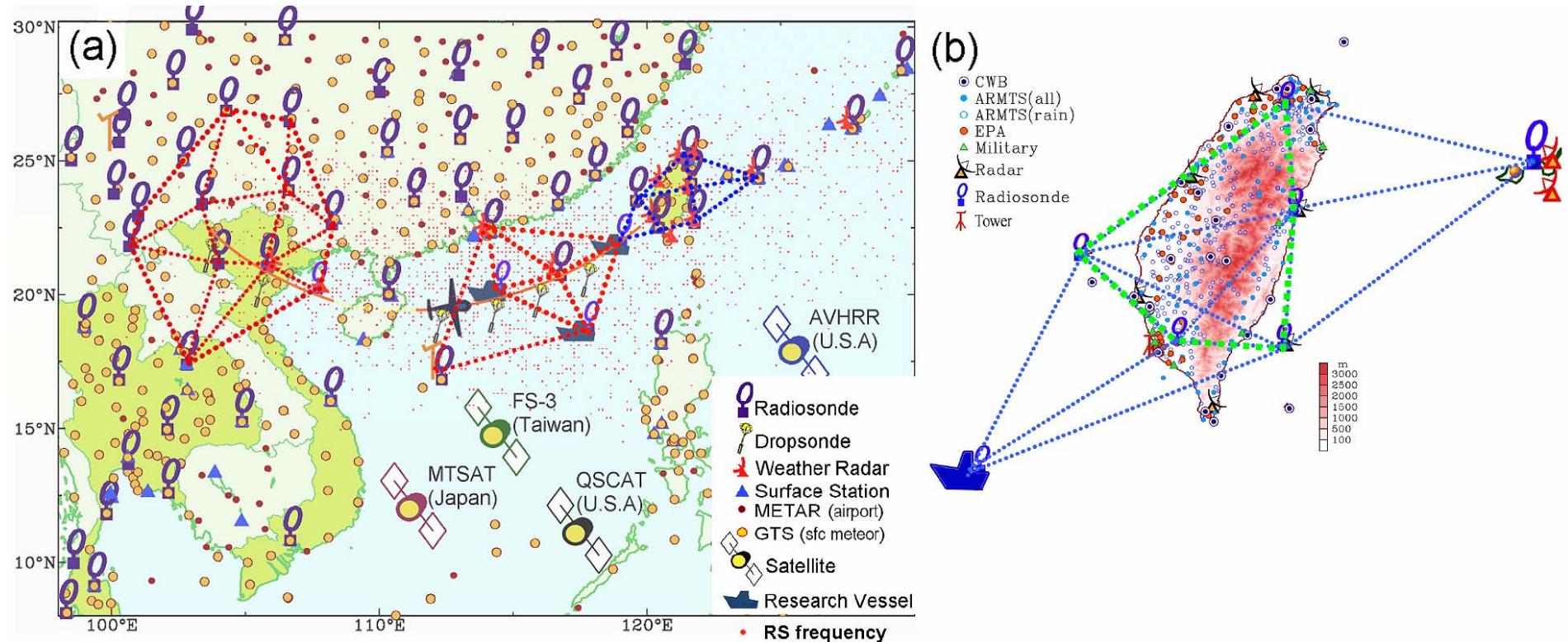
## **II. Scientific objectives**

- 1. Late spring/early summer rainstorms**
- 2. Hydrological processes**
- 3. Impact of multiple-scale process on  
rainstorm activity**
- 4. Effect of the midlatitude-tropical interaction  
on rainstorm activity**

### III. Science plan

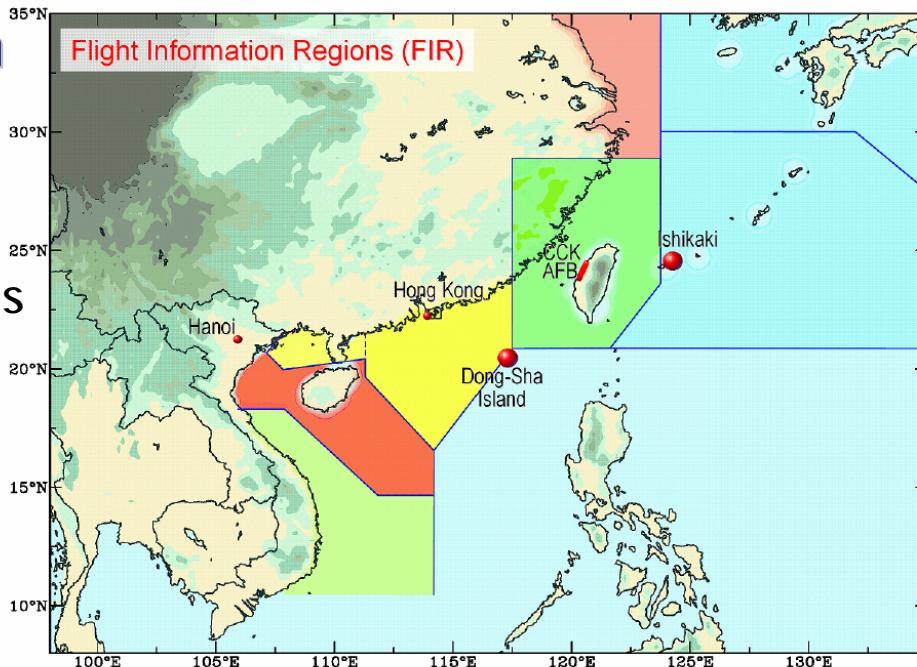


## IV. Summer Rainstorm Experiment

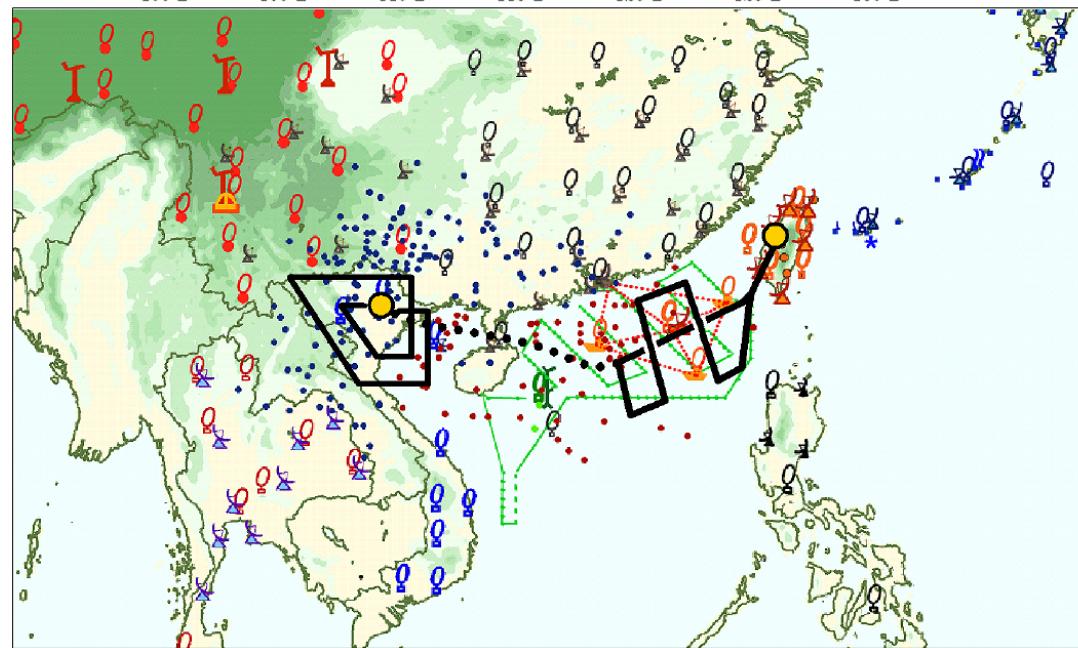


## Dropsonde observation

### Flight information Regions

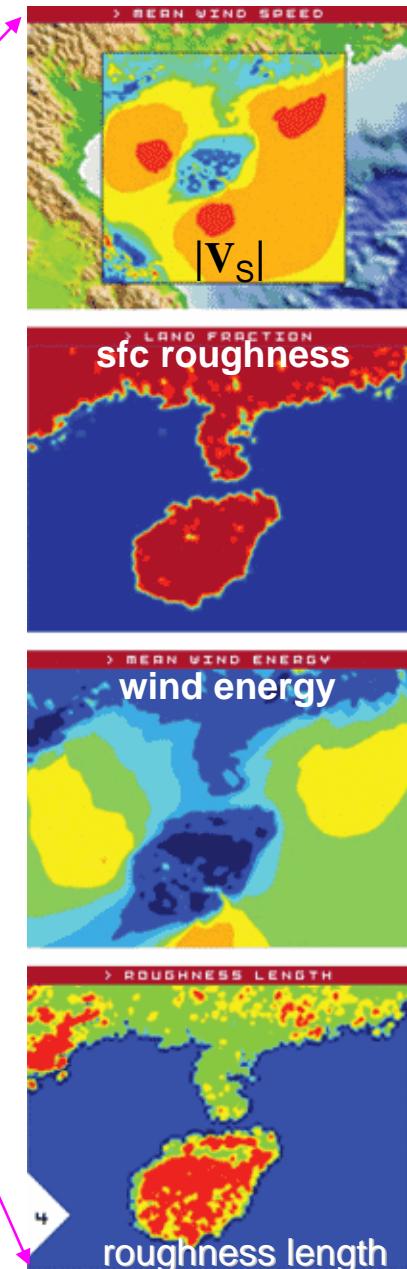
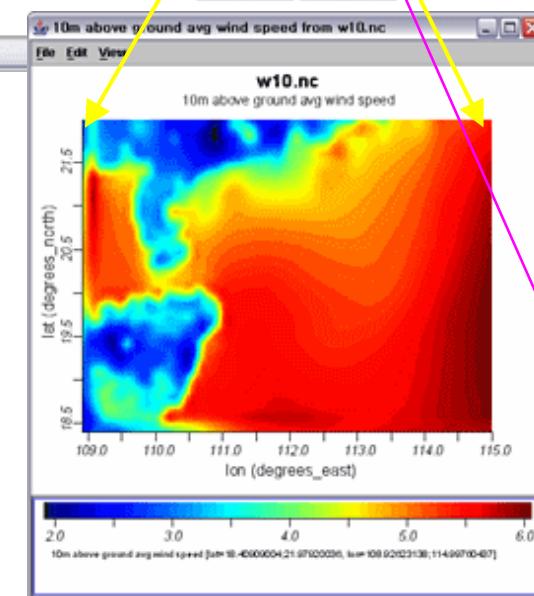
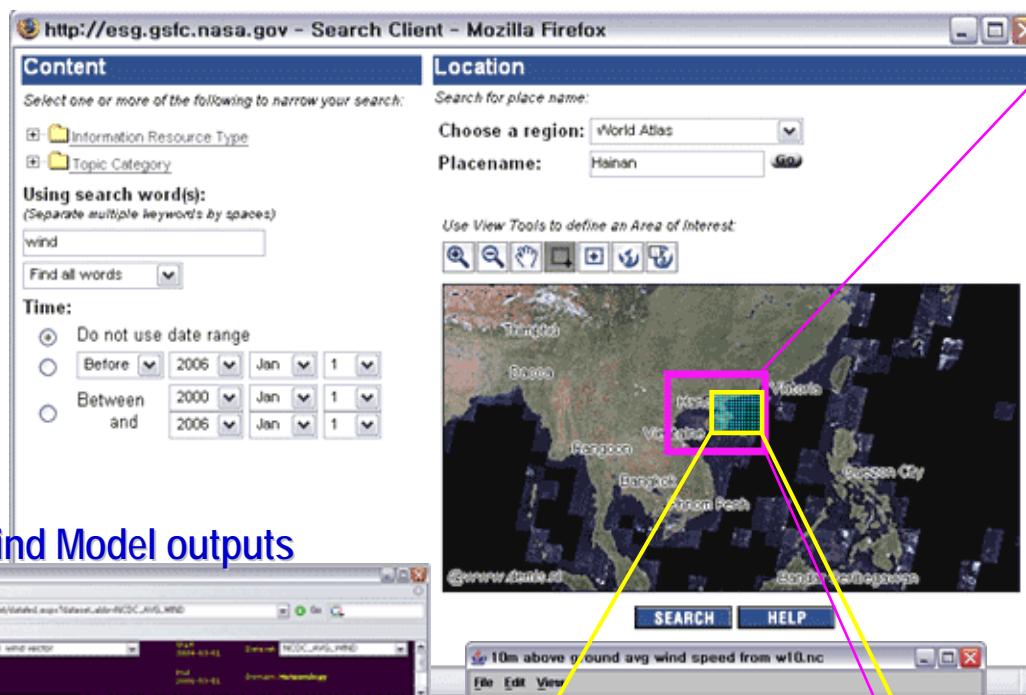
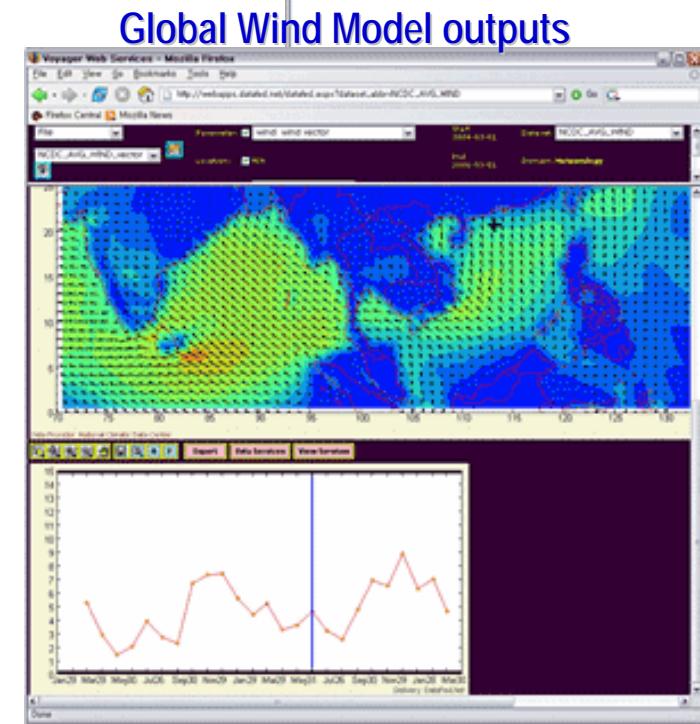


- Proposed flight route
- Base



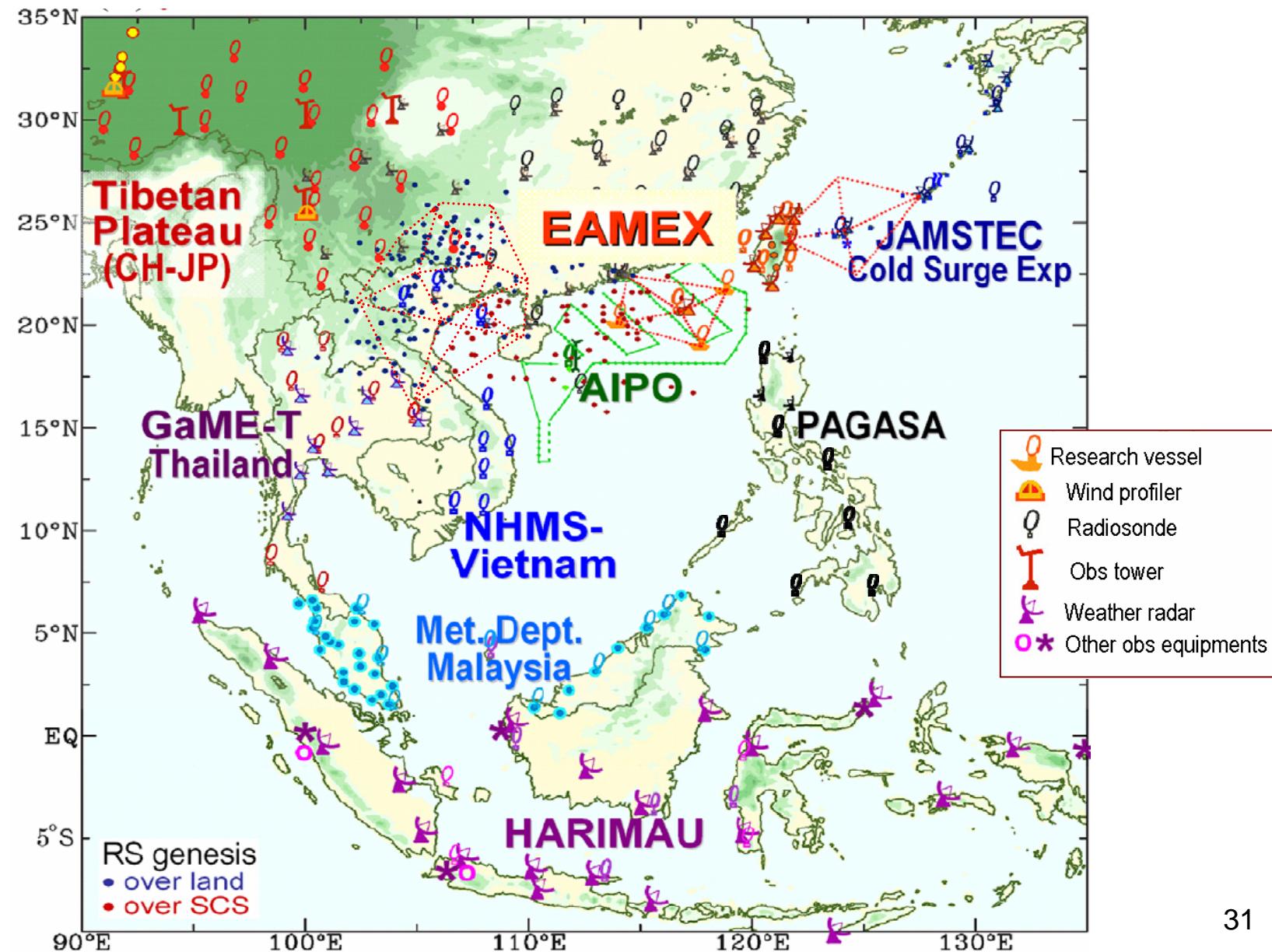
# GOESS Global Earth Observation System of Systems (U.S. EPA/NASA) Realtime observation derived from satellites and NWP models

Direct access  
via web-based  
interface

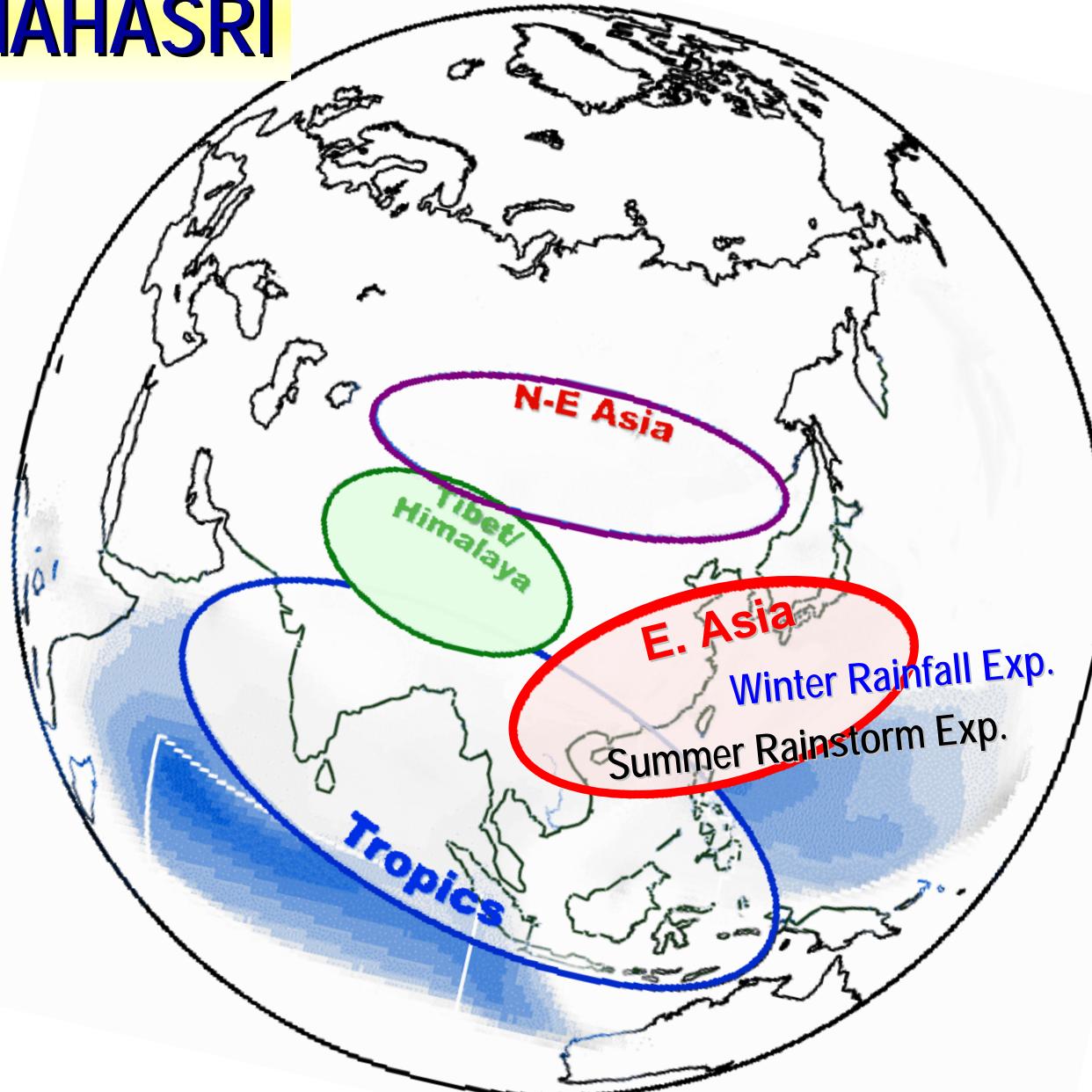


## V. International Collaboration

## Facilities



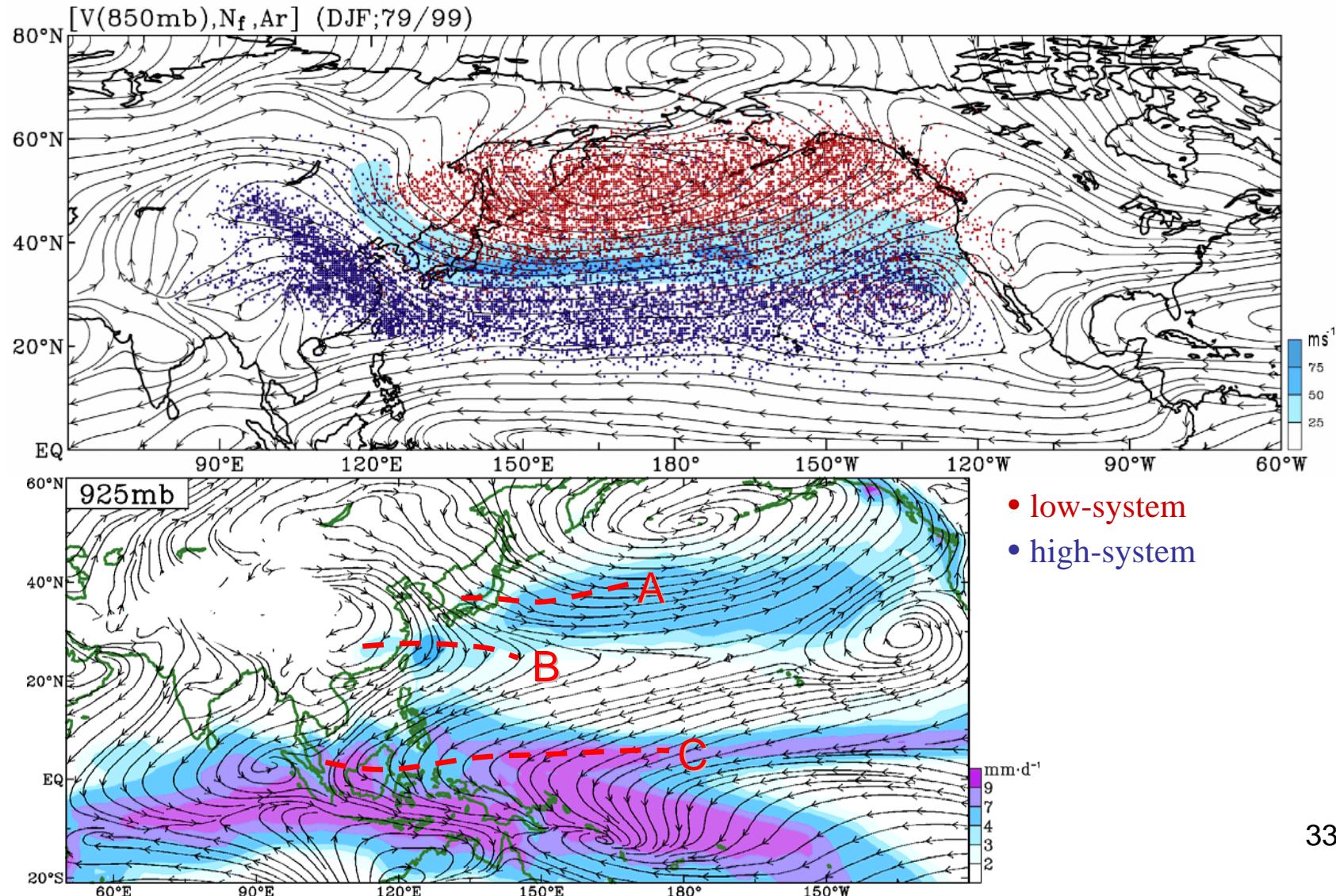
# MAHASRI

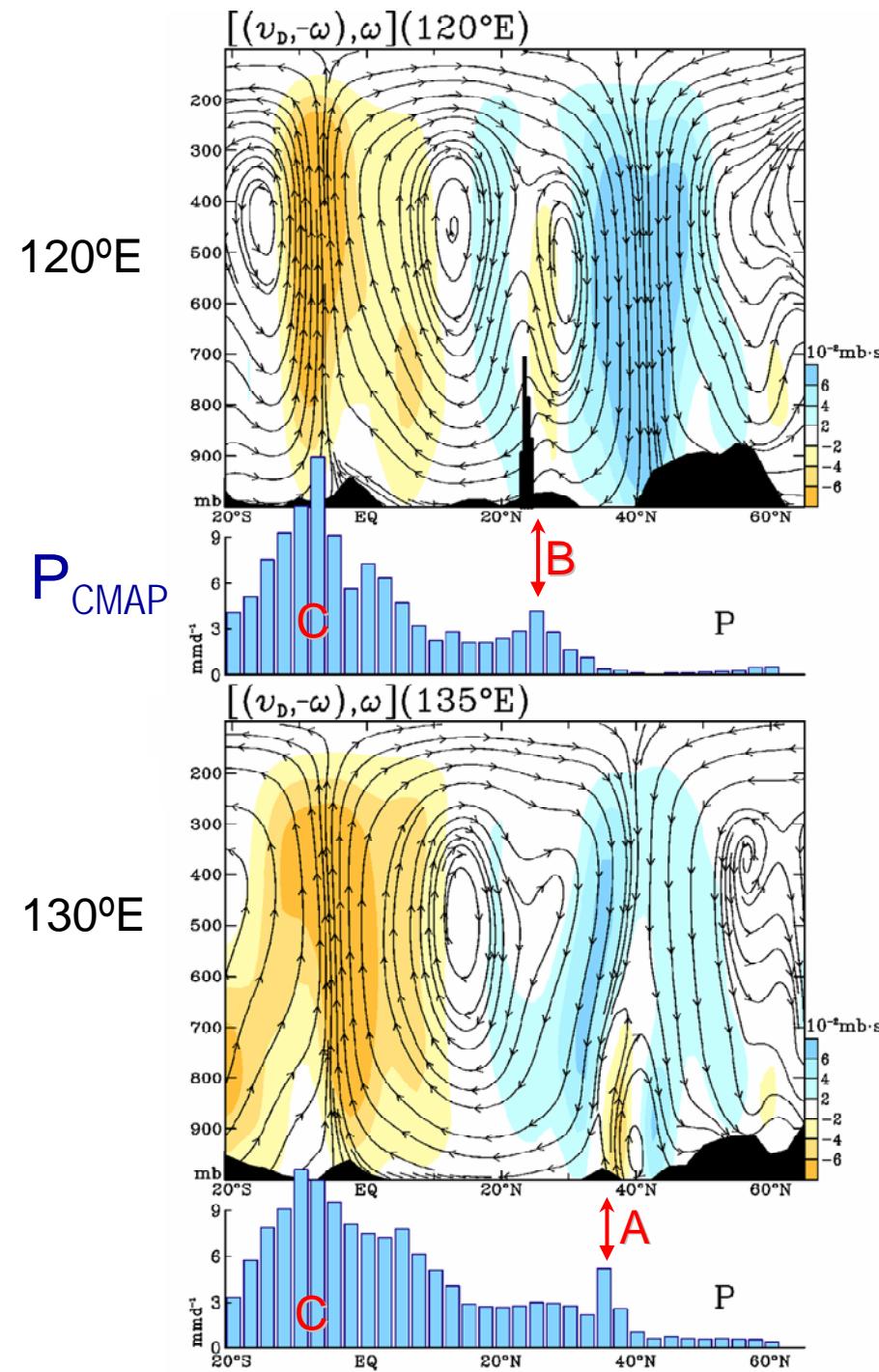


# Winter

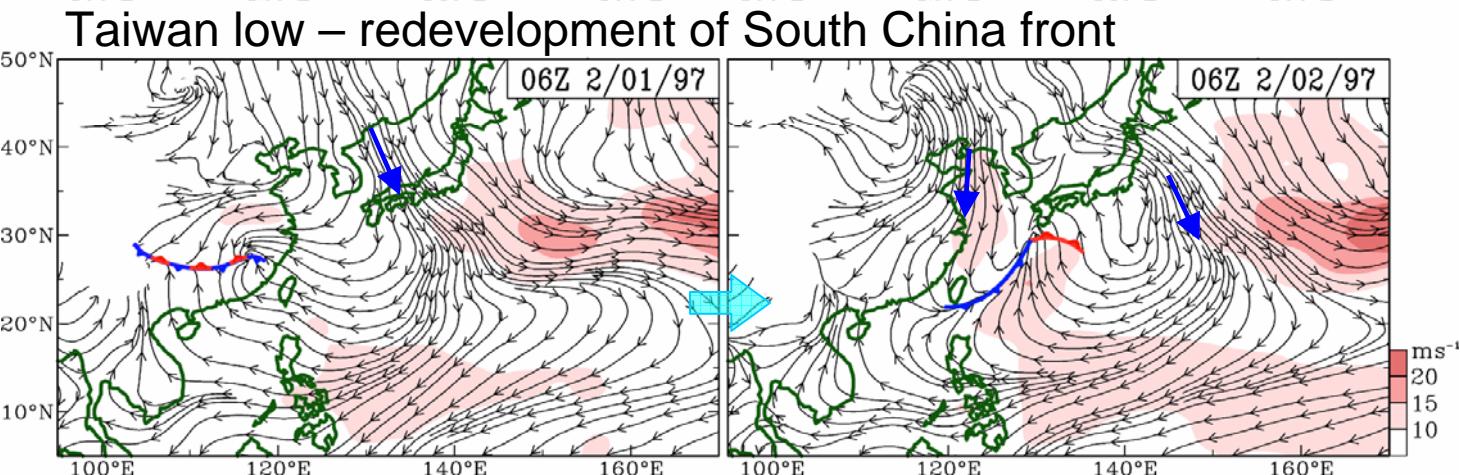
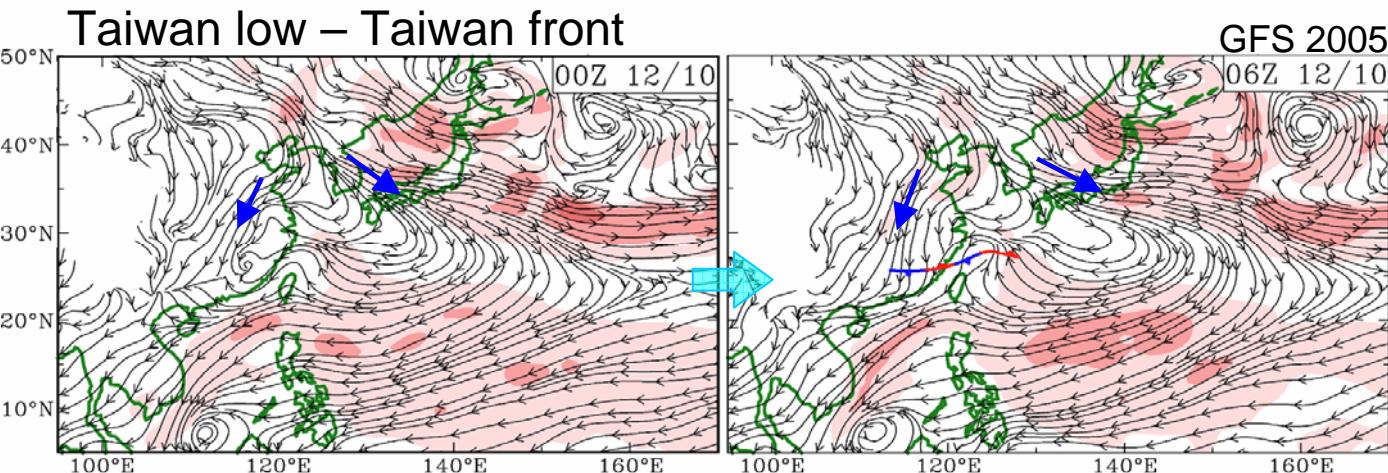
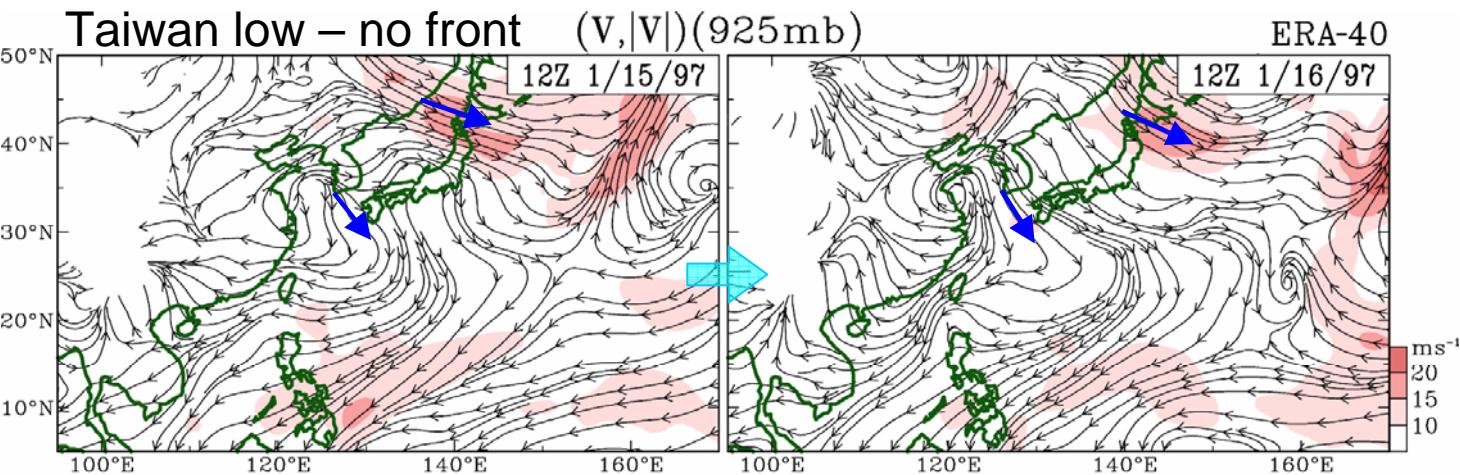
## I. Scientific issues

### 1. Importance of synoptic disturbances in winter rainfall





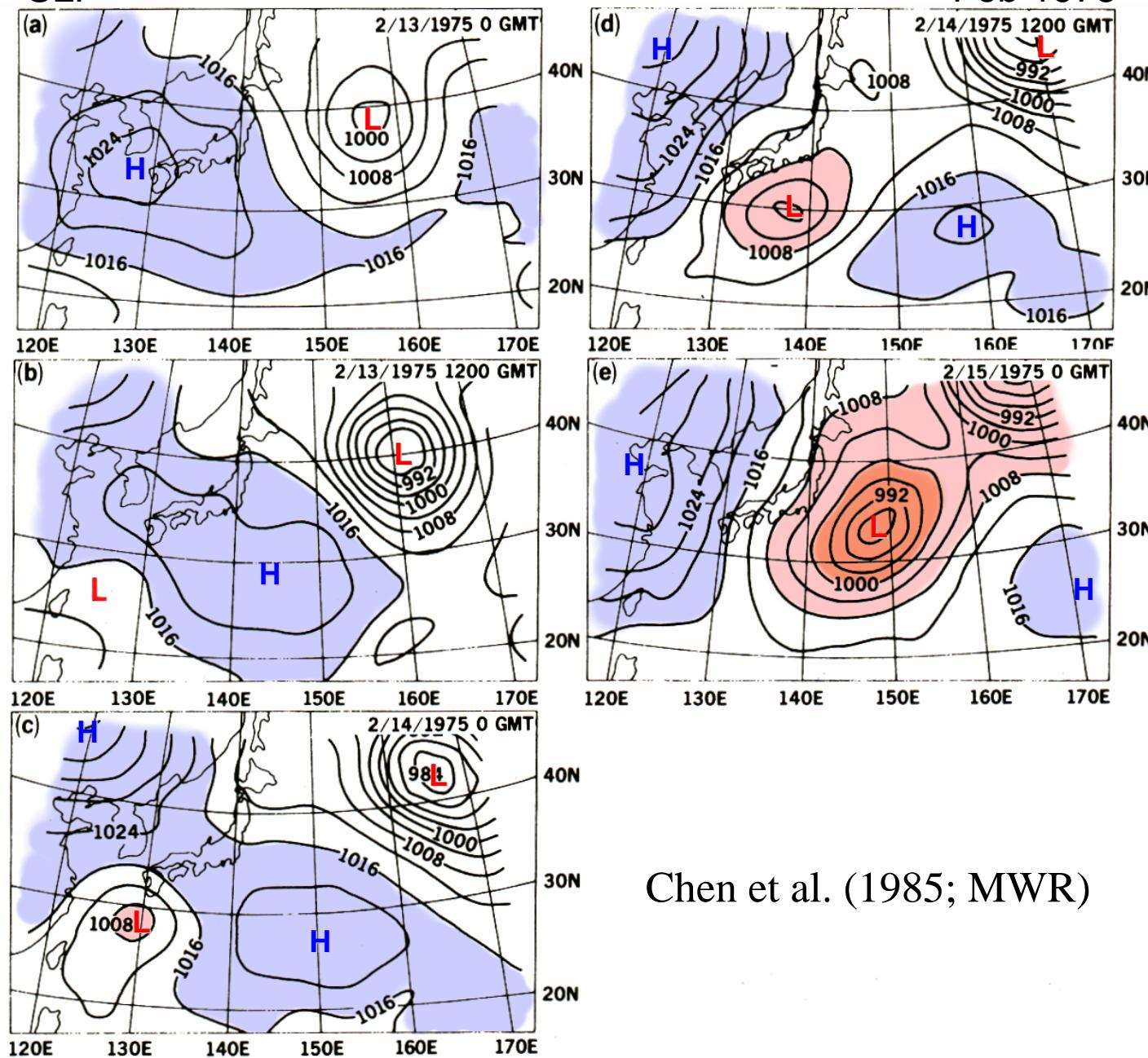
Example



SLP

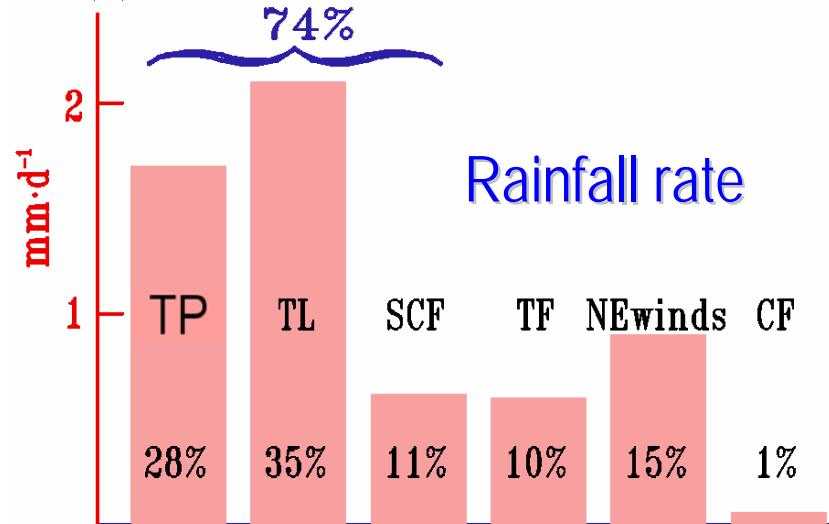
# The AMTEX storm

Feb 1975

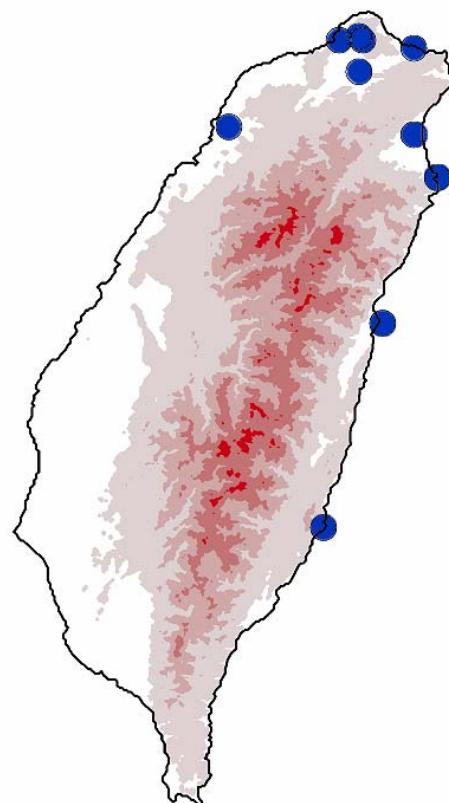


Chen et al. (1985; MWR)

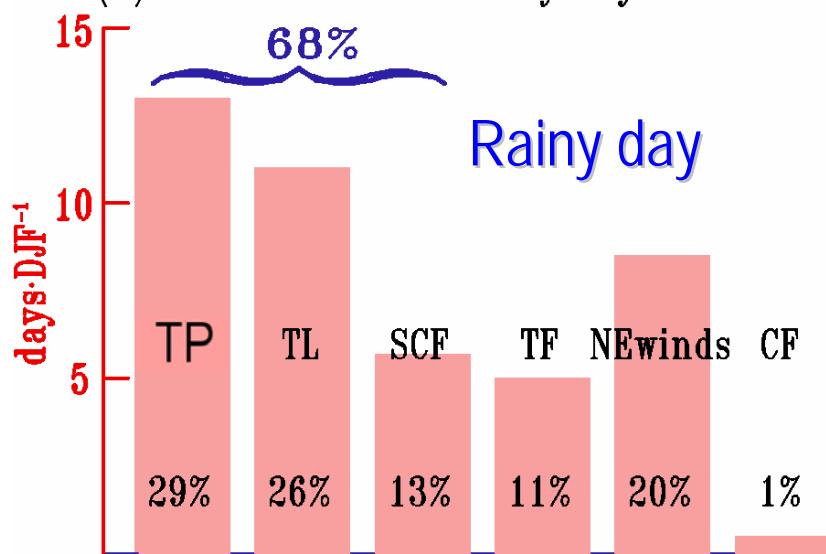
(A) Contribution of rainfall from different types of perturbation



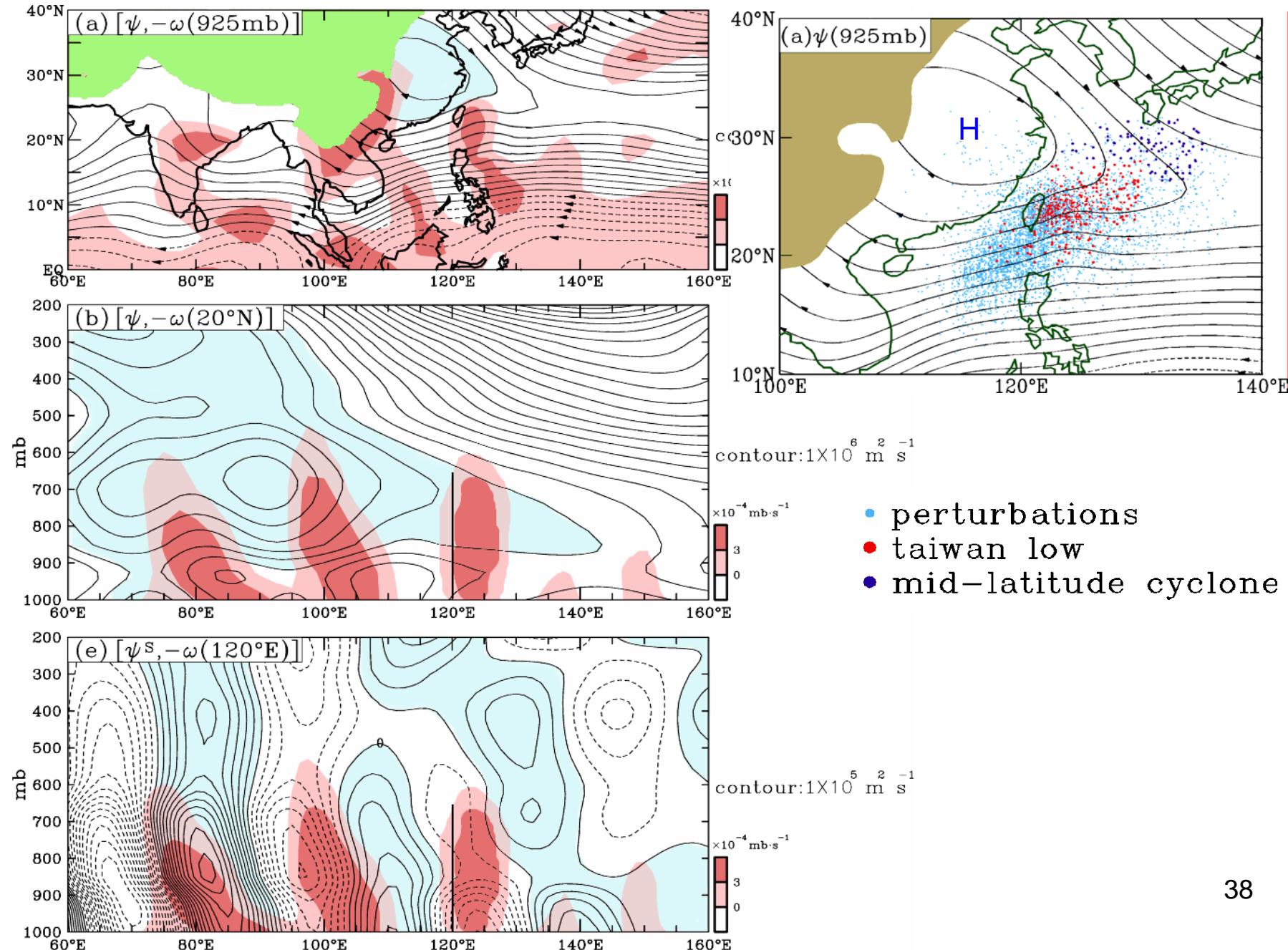
CWB stations



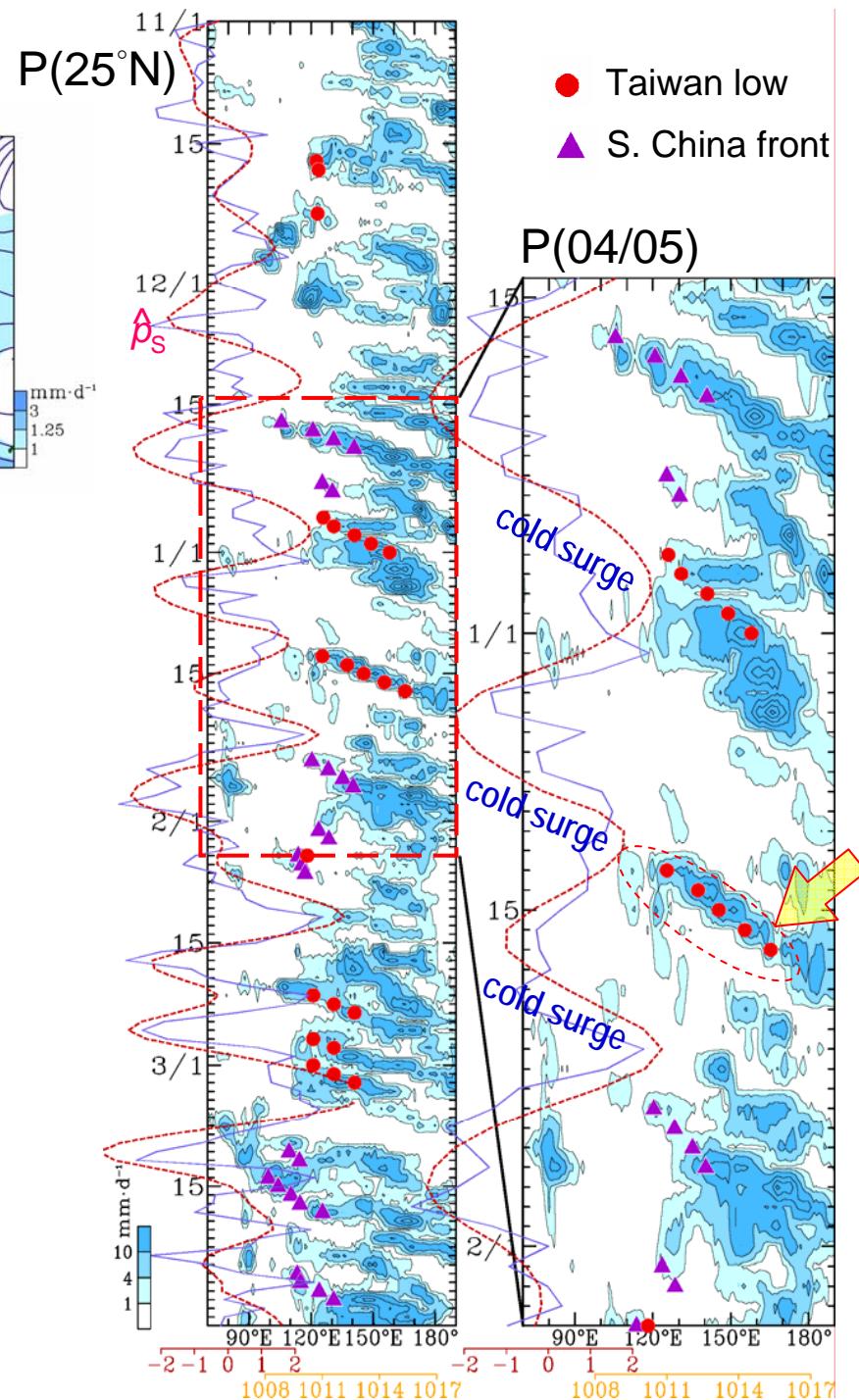
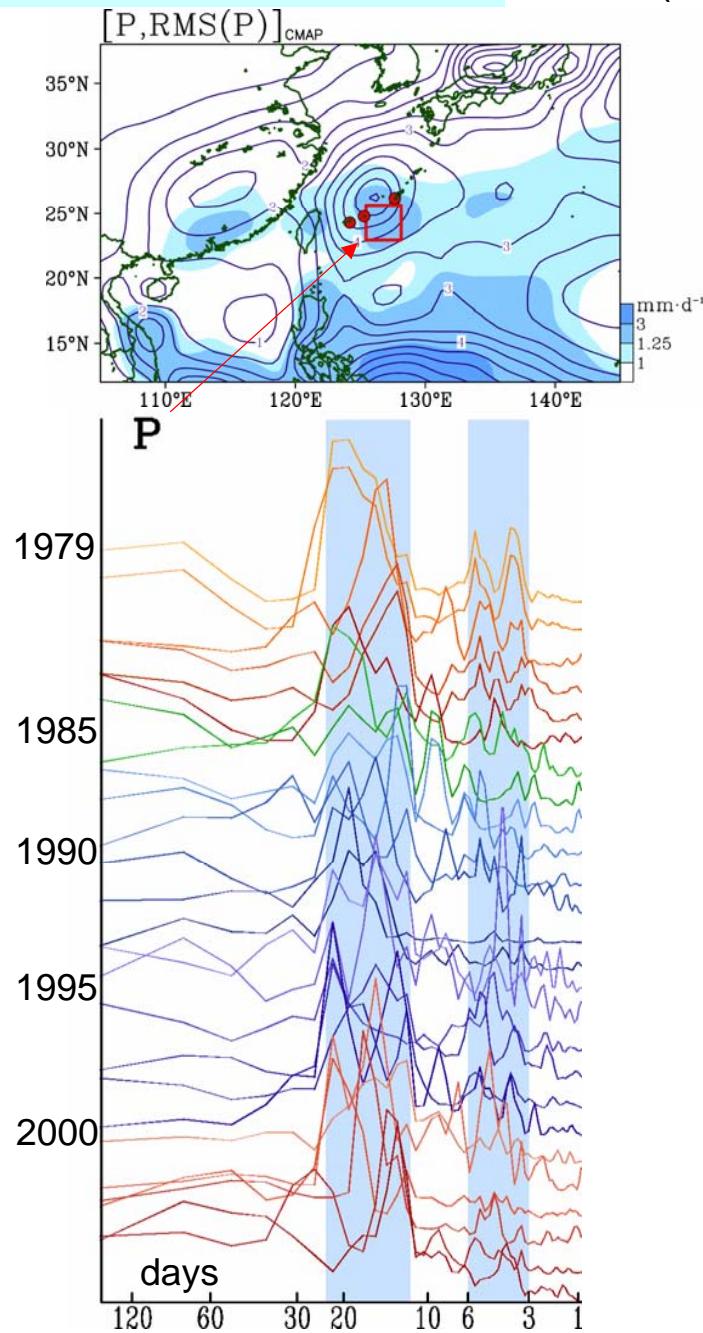
(B) Classification of rainy days



## 2. Taiwan low: Genesis mechanism

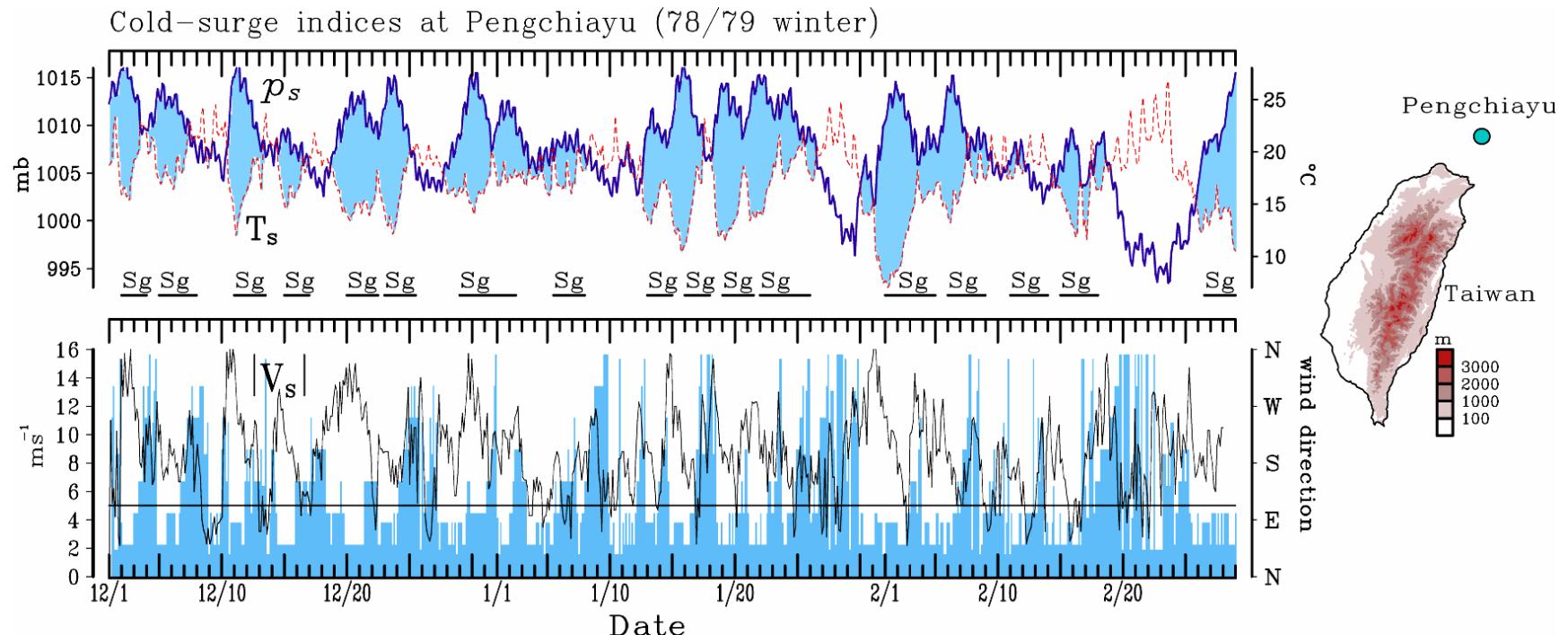


### 3. Multiple-scale process

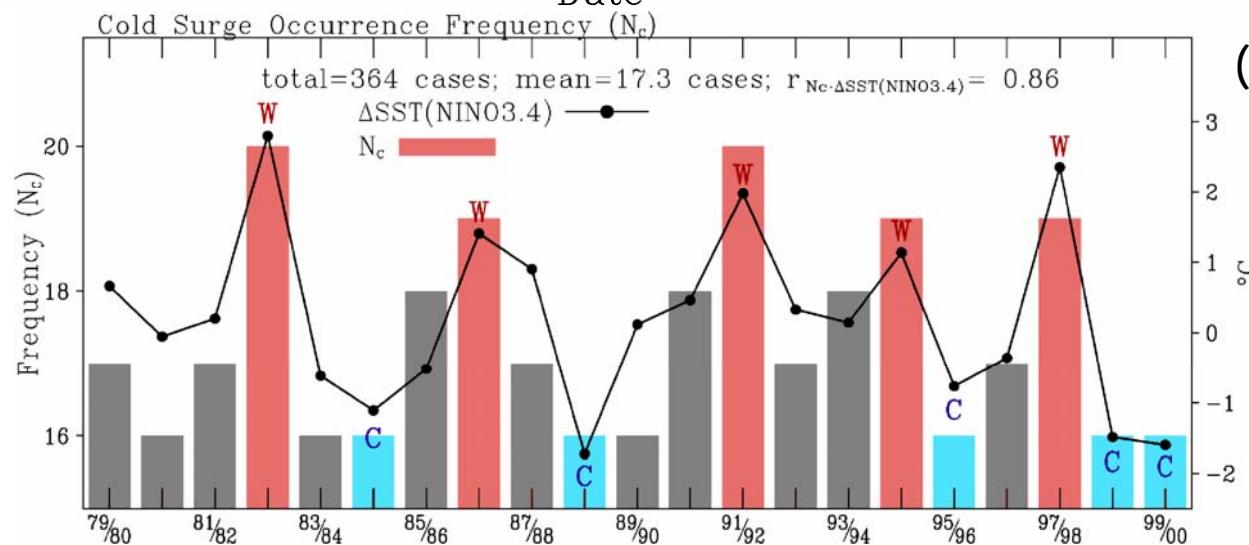


## 4. Interannual variation

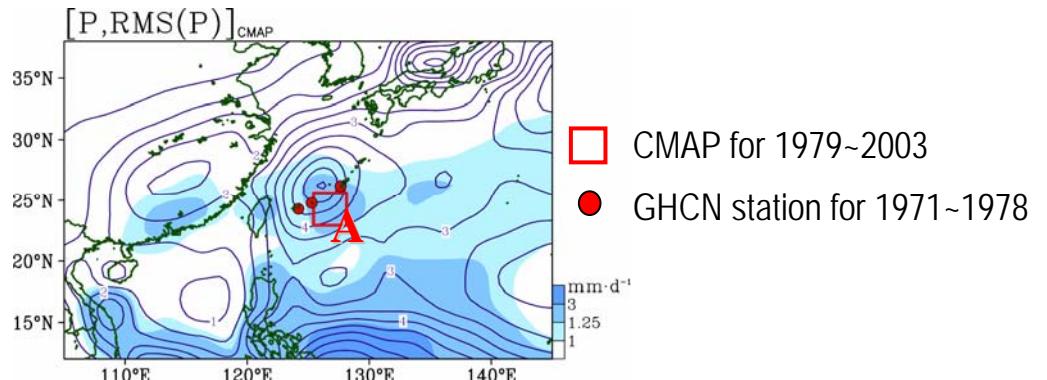
# Cold surge



(Chen et al. 2004; JCLI)



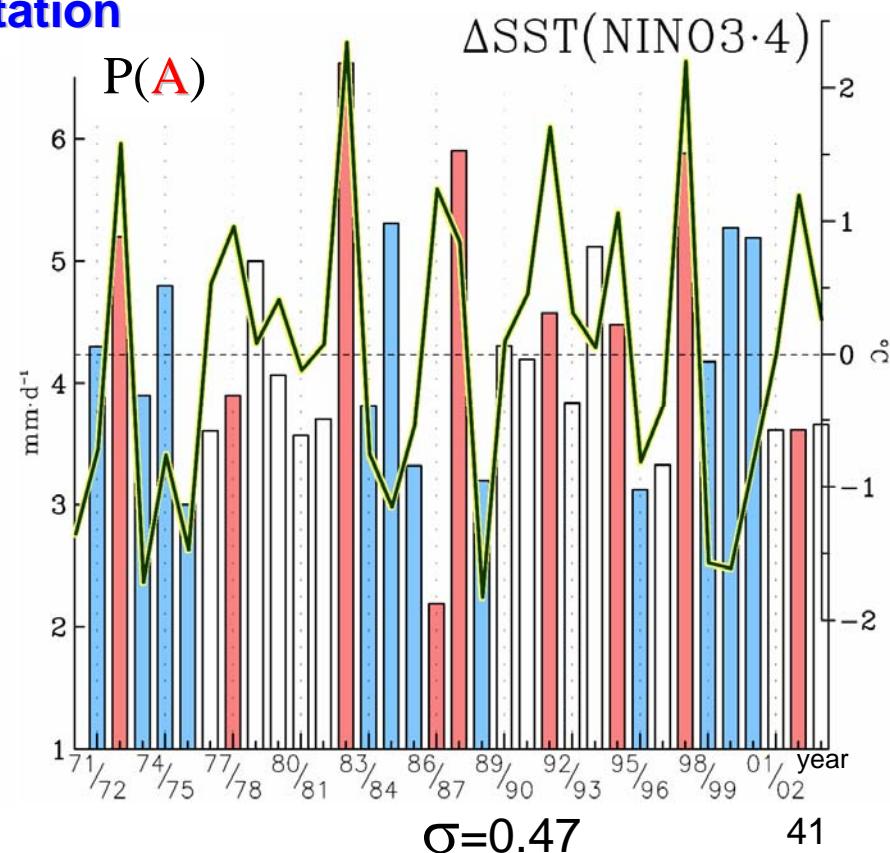
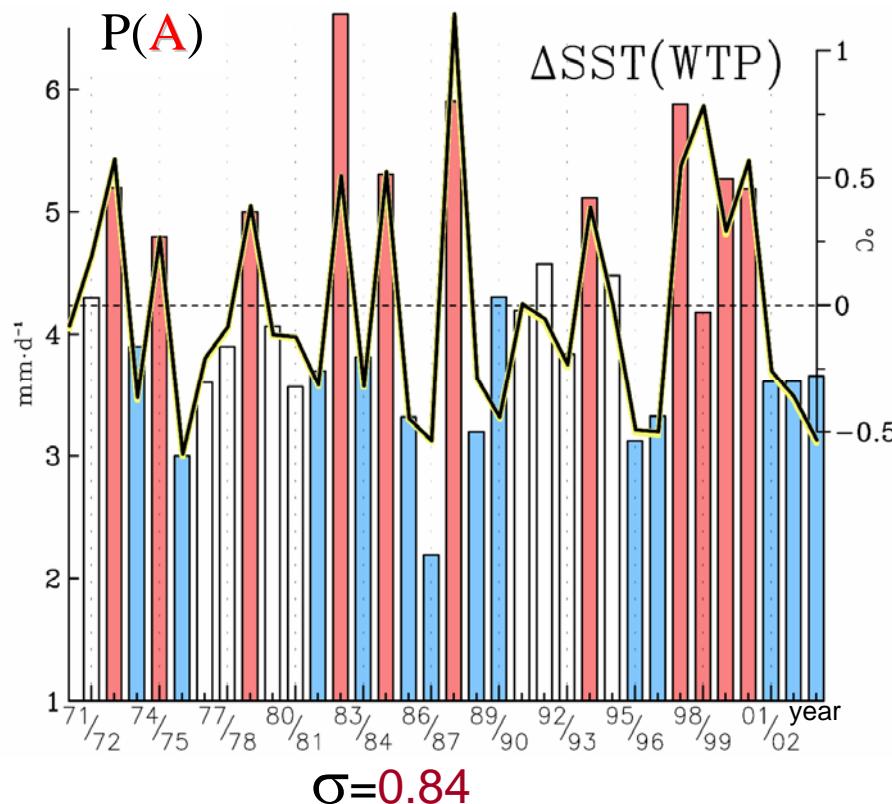
## Taiwan low



Warm/Cold subjected to  $\Delta$ SST[WTP(A)]

Warm/Cold subjected to  $\Delta$ SST(NINO3.4)

### Precipitation

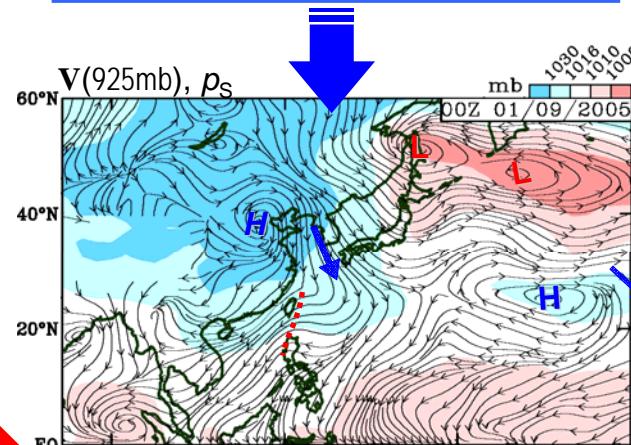


## **II. Scientific objectives**

- 1. Taiwan lows**
- 2. AMTEX storm**
- 3. Impact of multiple-scale process on genesis  
of Taiwan low**
- 4. Regional hydrological cycle**

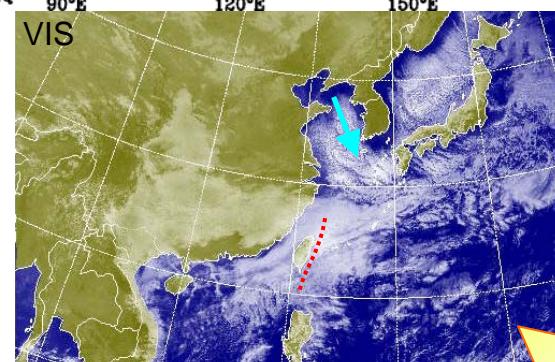
### III. Science Plan

#### Observation/ Initialization



Multiple-scale  
interaction

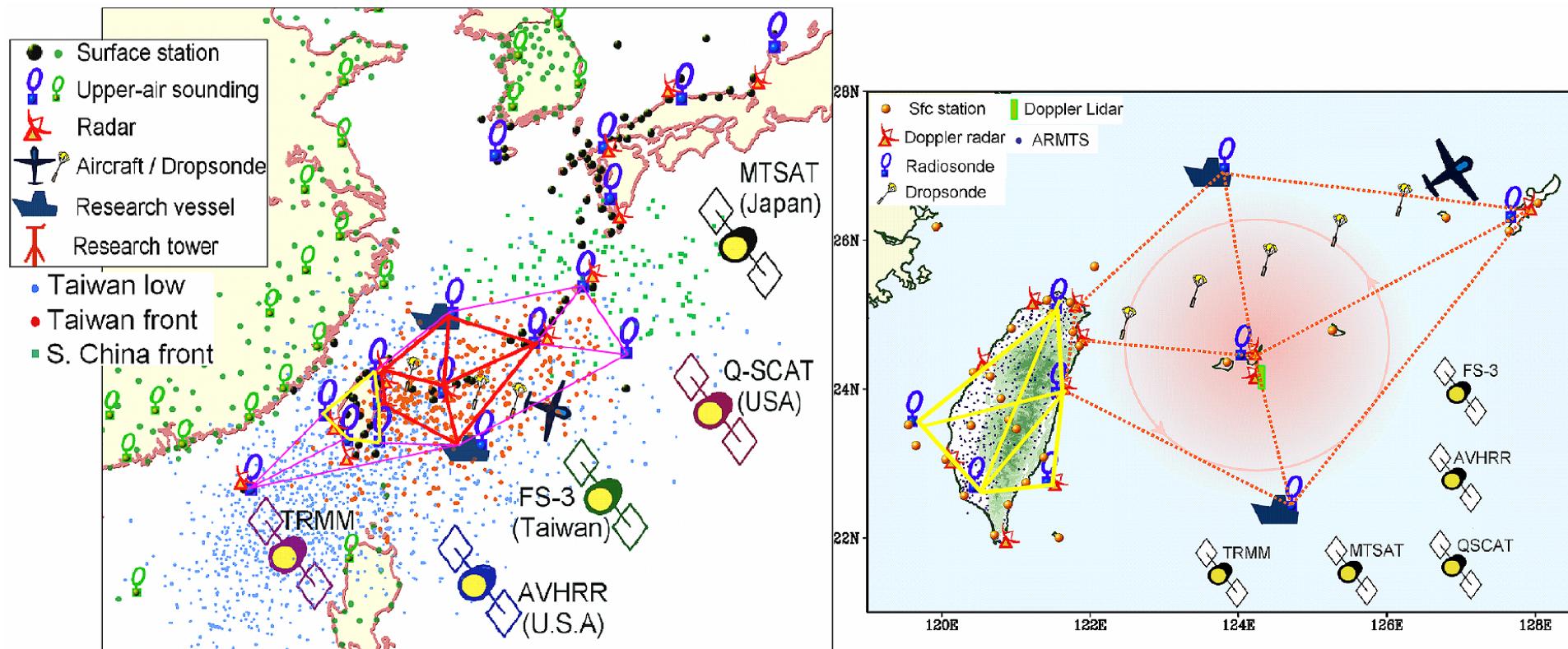
Tropics-midlatitude  
interaction



Regional hydrological  
cycle

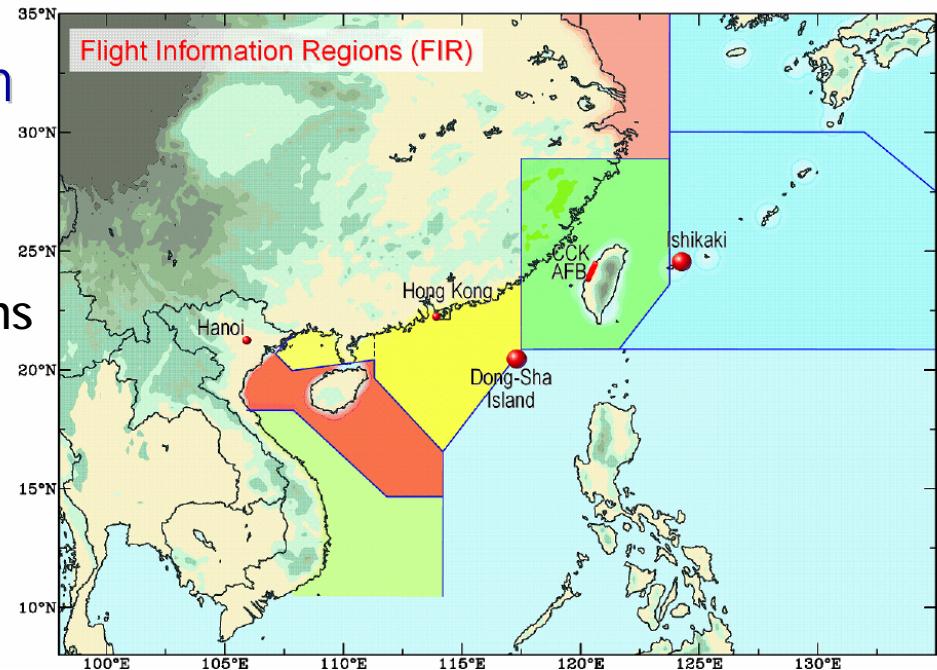
NWP/Simulation

## IV. Winter Rainfall Experiment

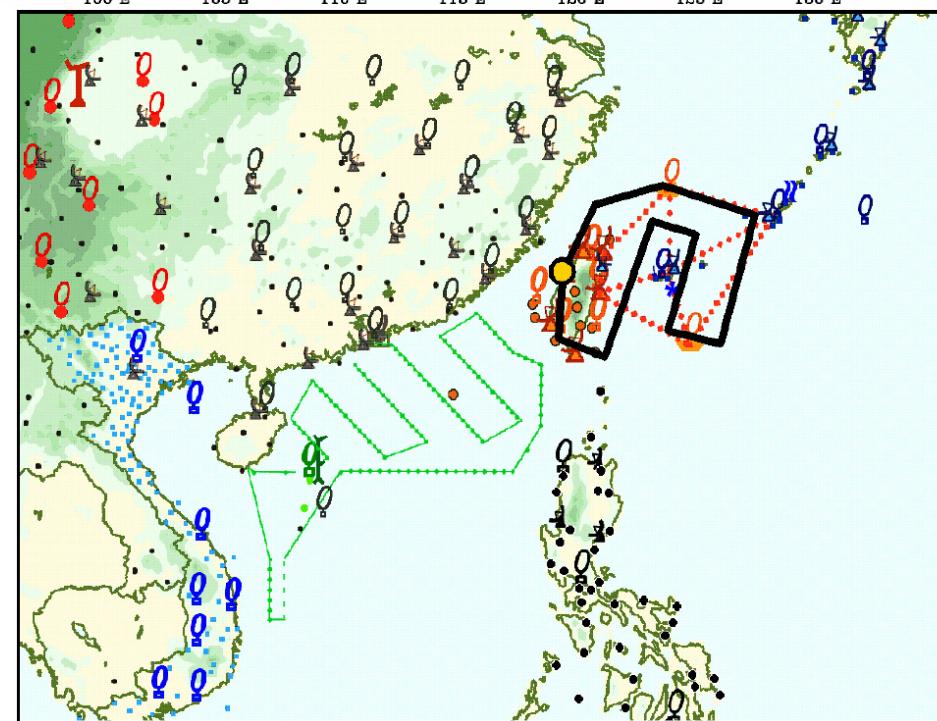


## Dropsonde observation

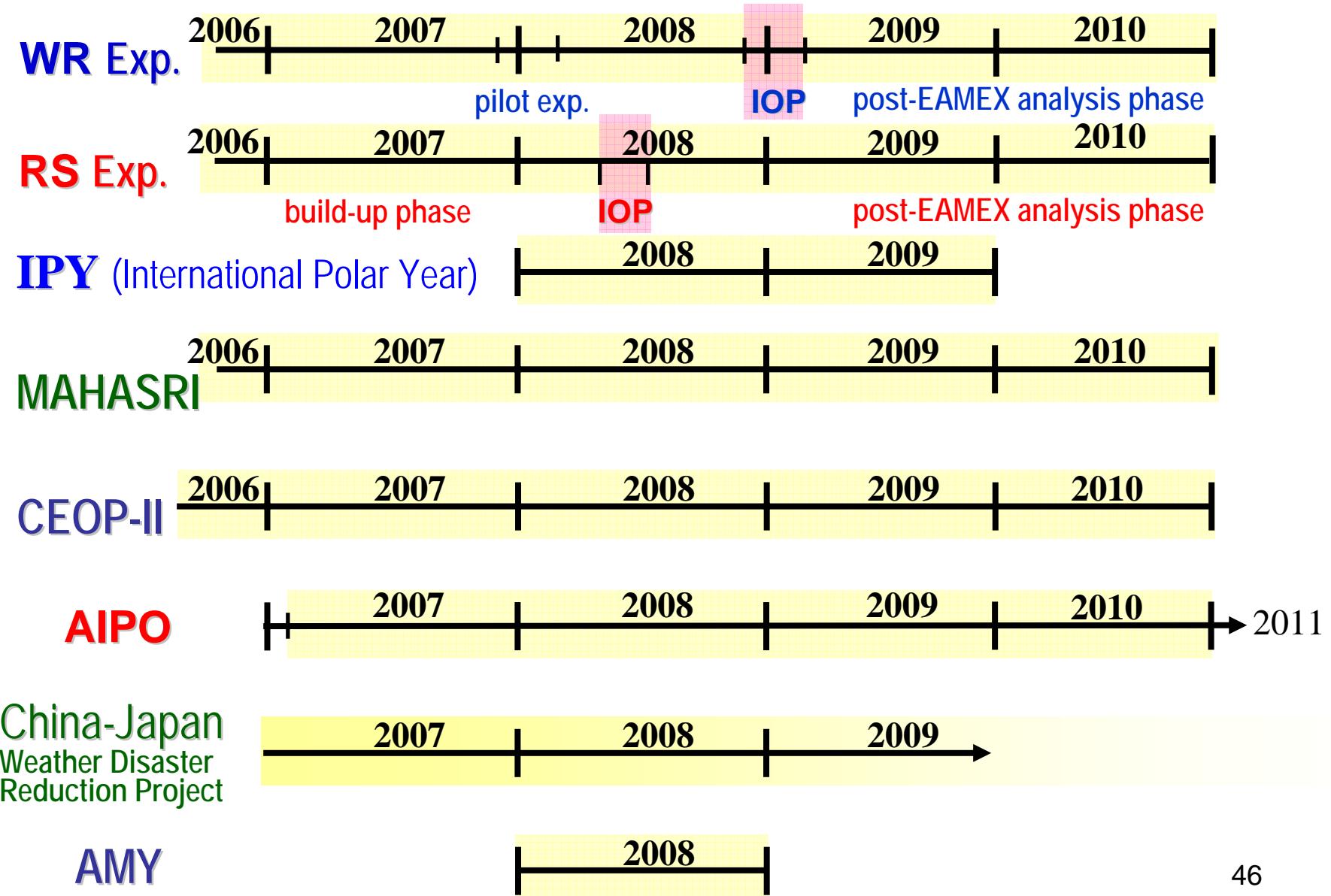
### Flight information Regions



- Proposed flight route
- Base

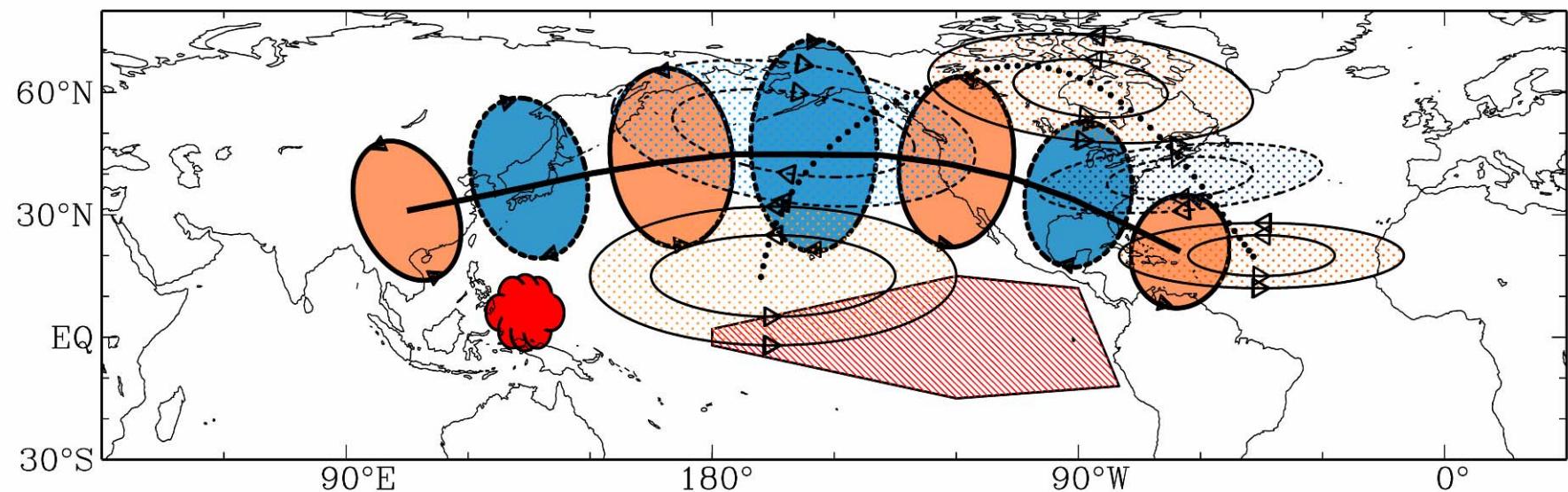


# Time Table



# Thank you

## North Pacific Short-Wave Train during the Extreme Phase of ENSO



( Chen 2002; JCLI)

