



기상청

Korea Meteorological  
Administration

# A Study on the Characteristics of Extratropical Cyclones on the Korean Peninsula through the Analysis of Heavy Rain in Summer

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## I. Introduction

### □ Purpose

- I. Characterization of Extratropical Cyclones on the Korean Peninsula
- II. Analysis & Verification of skills to forecast heavy rain caused by the Extratropical Cyclones

### □ Methodology

#### Case Study ( Date : August 25<sup>th</sup> 2014 )

Data :

- Synoptic Charts
- Numerical Models
  1. KLAPS(Korea Local Area Prediction System), UM(Unified Model by KMA)
  2. FAS(Forecasters Analysis System), GloView
- Observation Data(AWS, radar, satellite)

## II. Background Study

### □ Summer in the Korean Peninsula



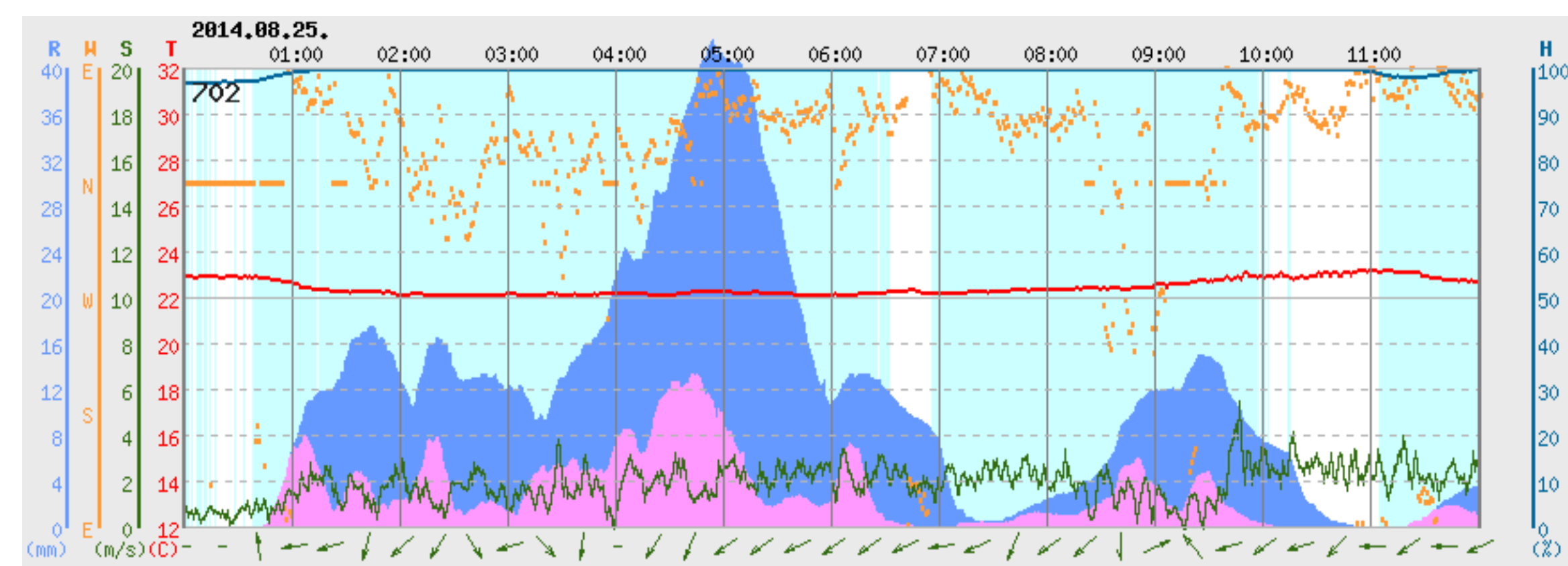
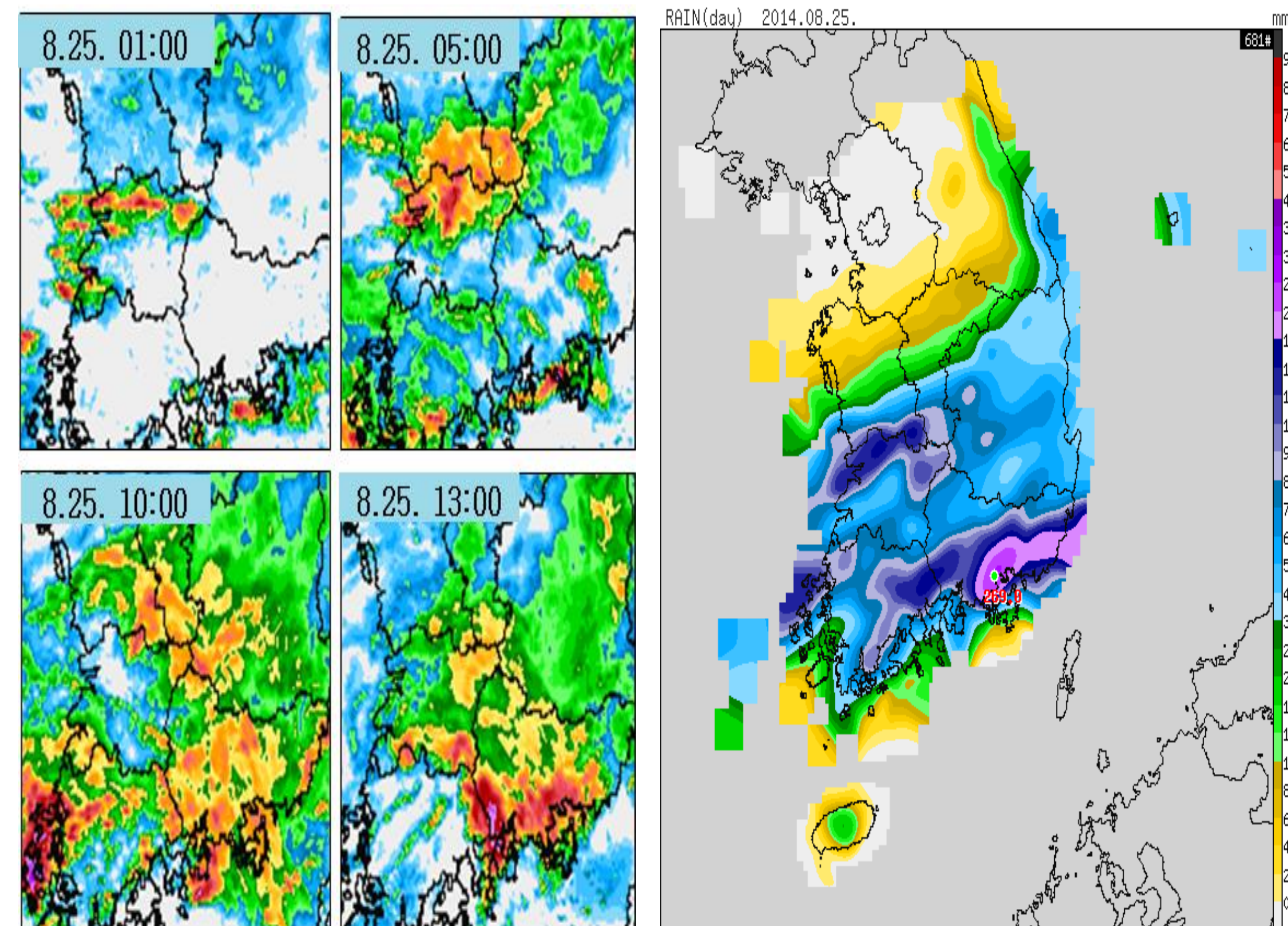
- ❖ North Pacific High
- ❖ Monsoon period(Jangma)
- ❖ Sweltering Heat(Heat wave), Tropical nights
  - Minimum temperature above 25°C(77°F)
- ❖ Heavy Rain or Showers with high equivalent temperature
- ❖ Typhoons

### □ Events of the Summer of 2014

July	Weather	August	Weather
2 <sup>nd</sup>	Start of Jangma	10 <sup>th</sup>	Typhoon 'HALONG'
13 <sup>th</sup>	Jangma on southern region	14 <sup>th</sup>	Blistering heat
24 <sup>th</sup>	Jangma on central region	23 <sup>th</sup> ~25 <sup>th</sup>	Heavy rain
28 <sup>th</sup>	End of Jangma	28 <sup>th</sup>	Autumn season

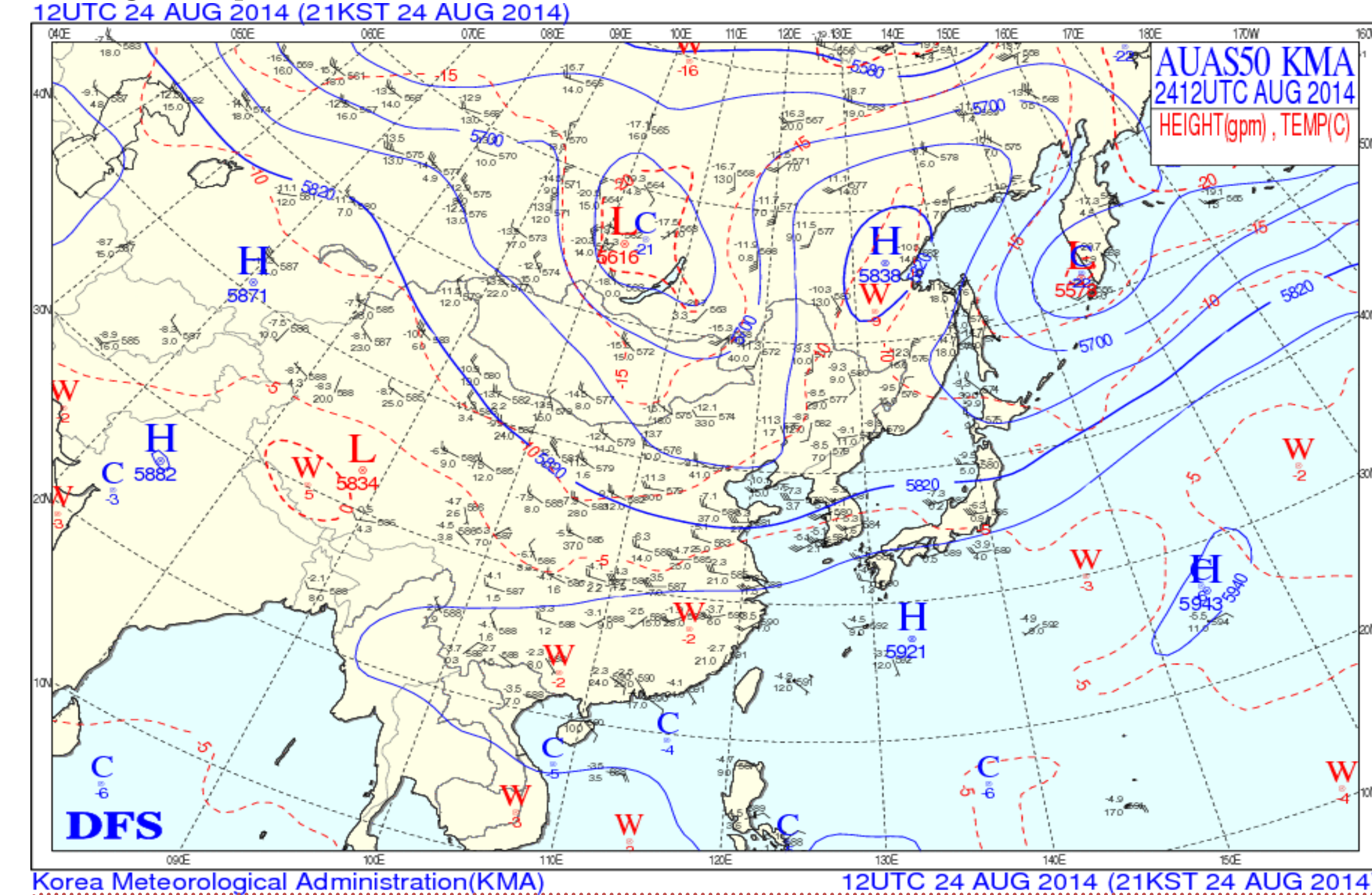
## III. Case Study of August 25<sup>th</sup> 2014

### □ The weather of August 25<sup>th</sup>

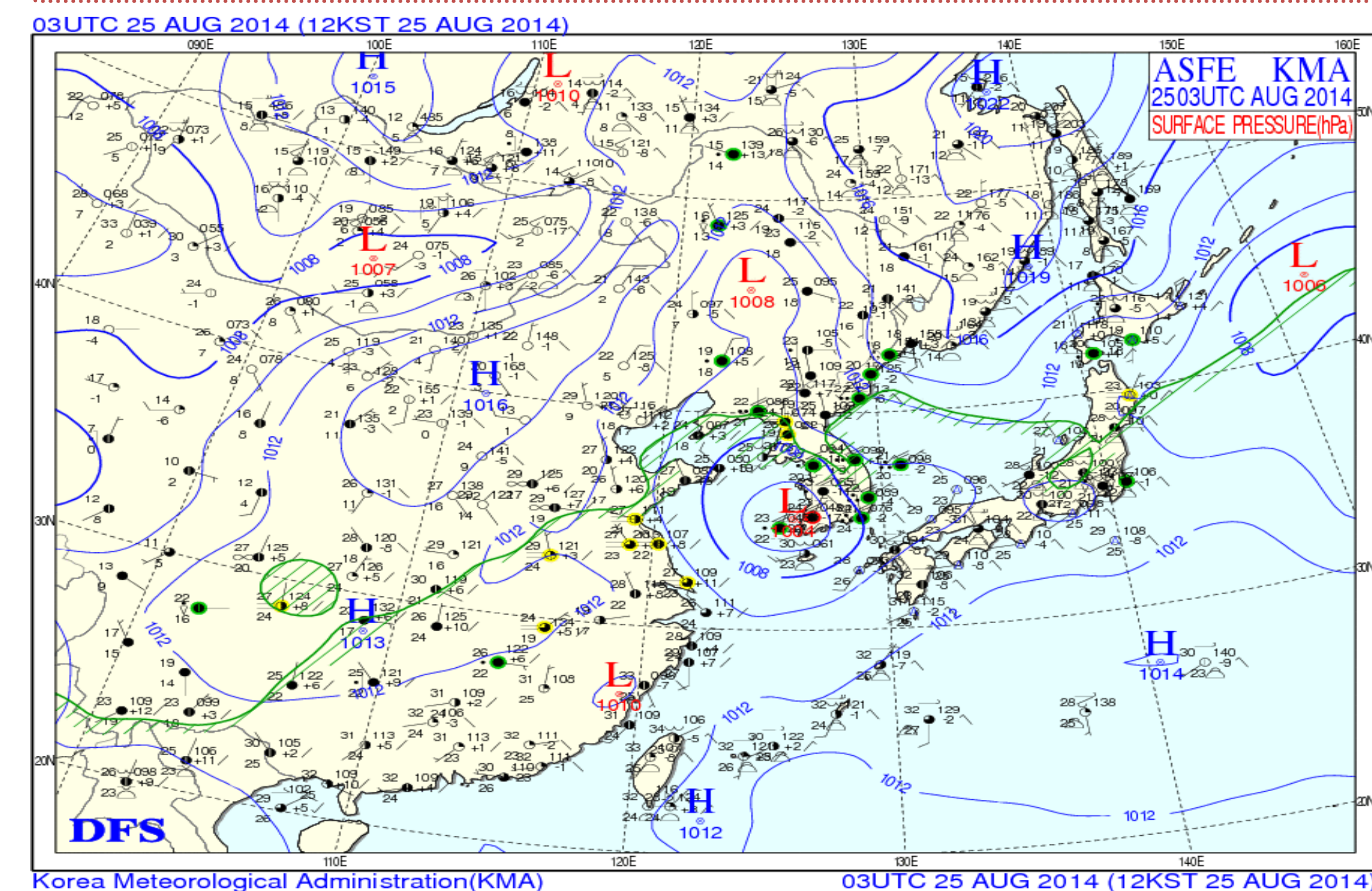


- ❖ 1<sup>st</sup> phase started by 1 a.m. on Northern Jeollabuk-do & West-coastal area
- ❖ 2<sup>nd</sup> phase started by 10 a.m. in the whole Jeollabuk-do
- ❖ Short duration but high/strong precipitation(not rain shower or Jangma)
- ❖ Total precipitation : 157.5mm(max), 38.mm(min)

### □ Synoptic weather charts

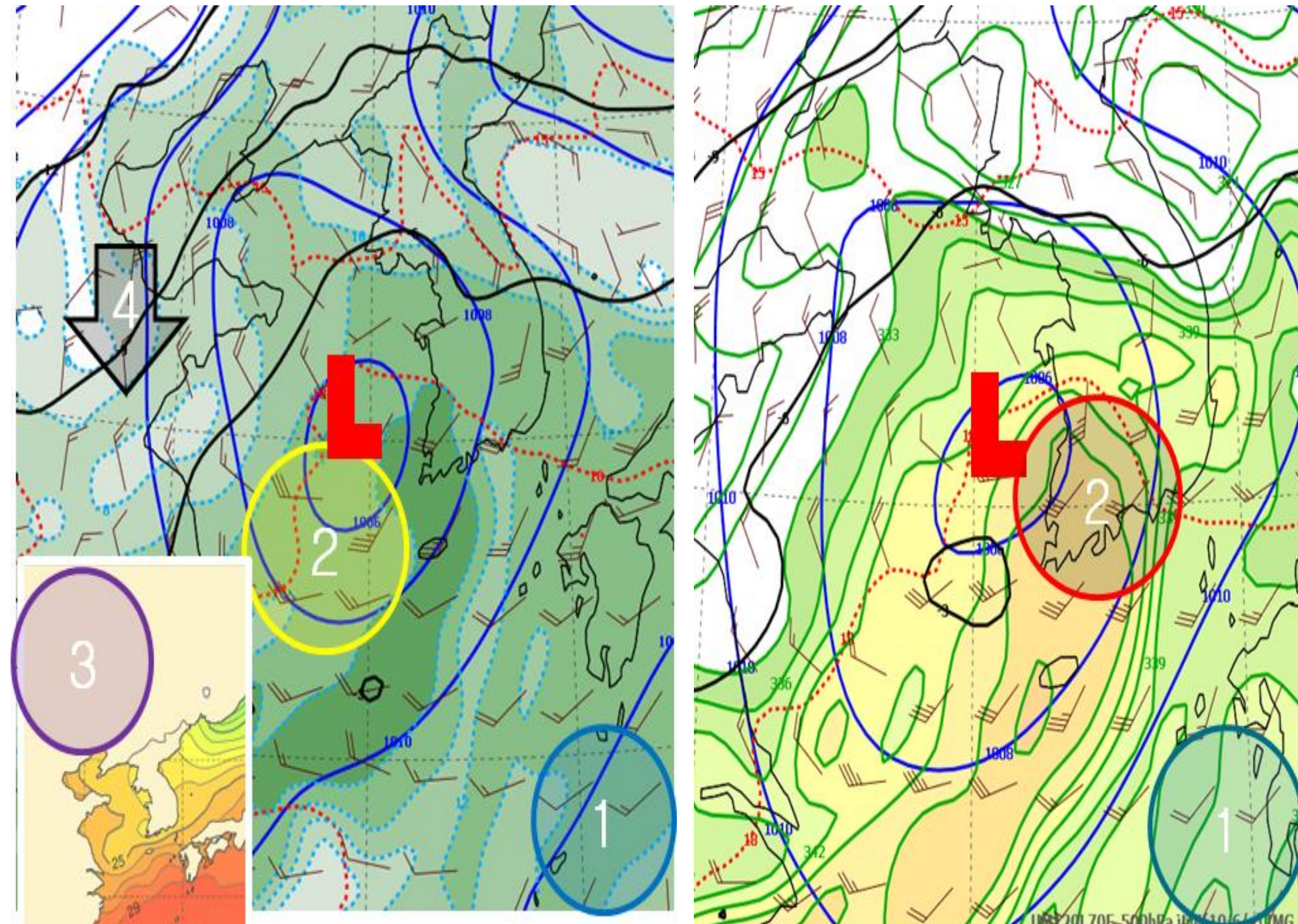


- ❖ Cold trough centered on Lake Baikal
- ❖ Cut-off High and Cut-off Low blocks the flow
- ❖ Upper level cold air increases low level instability



- ❖ Cyclone generated inland of china, moving toward West sea
- ❖ SW-ly enhanced on the boundary of North Pacific High
- ❖ Heavy rain on the southern regions of Korea

### □ Web FAS charts



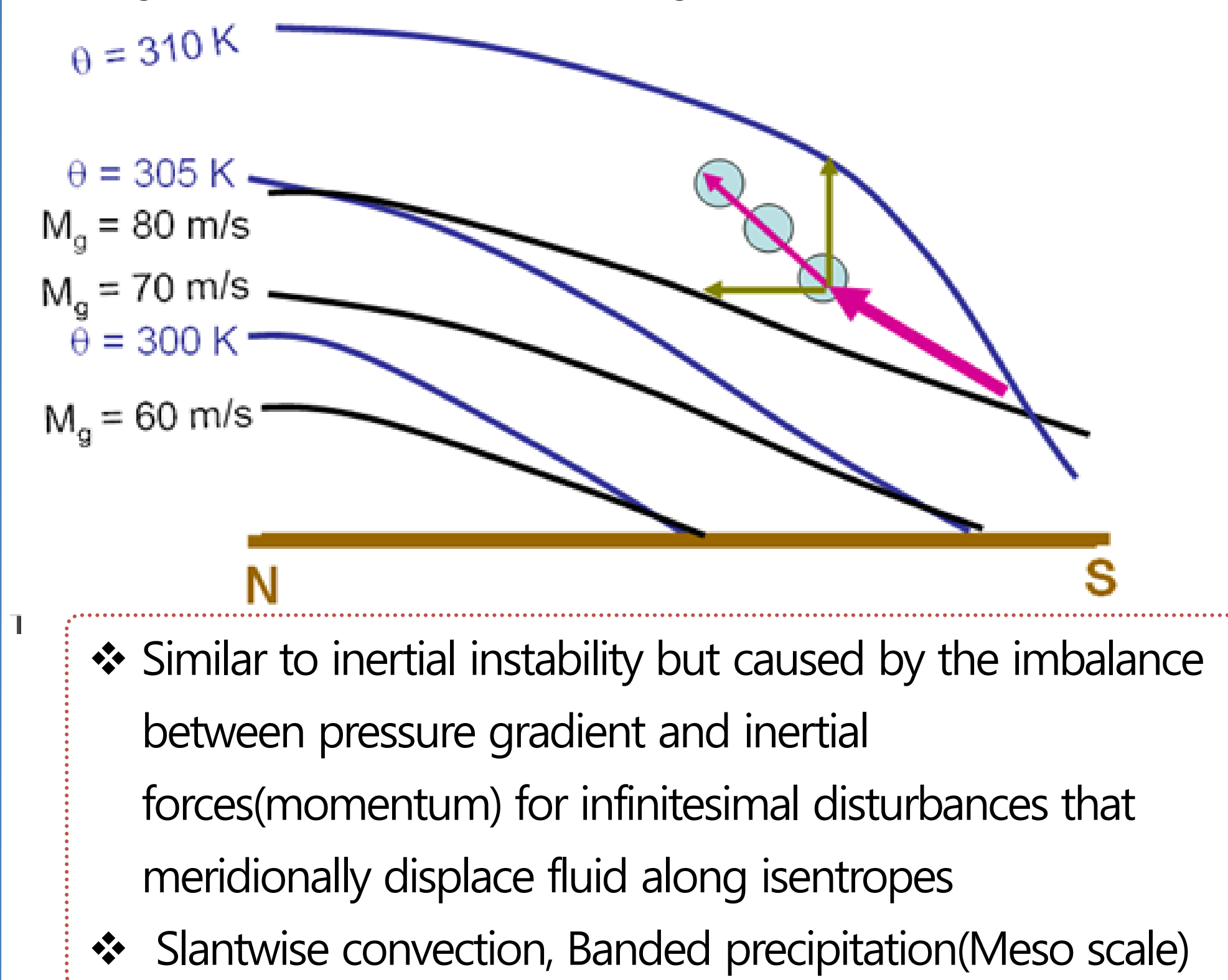
- ① Expansion of North Pacific High
  - ② SW-ly(over 30knots) with moisture
  - ③ Warm West sea
  - ④ Descending cold upper level air
- ① Blocking of North Pacific High
  - ② High equivalent temperature with symmetric instability

### □ GloView



- ❖ Count-clockwise flow on West sea due to the cyclone
- ❖ Strong SW-ly(Low level Jet) blow in to southern regions
- ❖ Vertical ascending flow in warm Equivalent core(352K)
- ❖ Strong Symmetric Instability cause heavy rain(more than 100mm) in Jellobuk-do

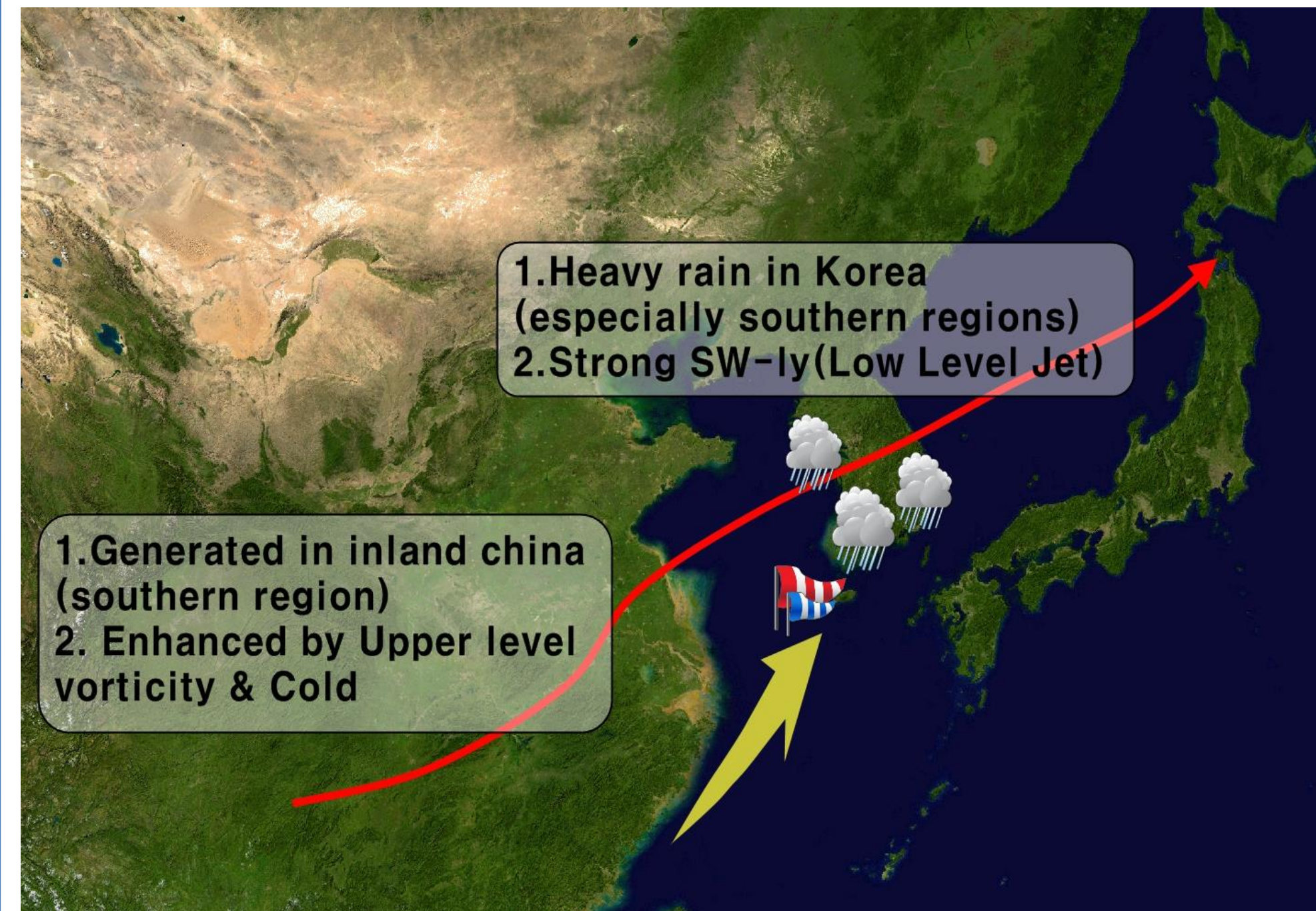
### □ Symmetric Instability



- ❖ Similar to inertial instability but caused by the imbalance between pressure gradient and inertial forces(momentum) for infinitesimal disturbances that meridionally displace fluid along isentropes
- ❖ Slantwise convection, Banded precipitation(Meso scale)

## Summary & Conclusion

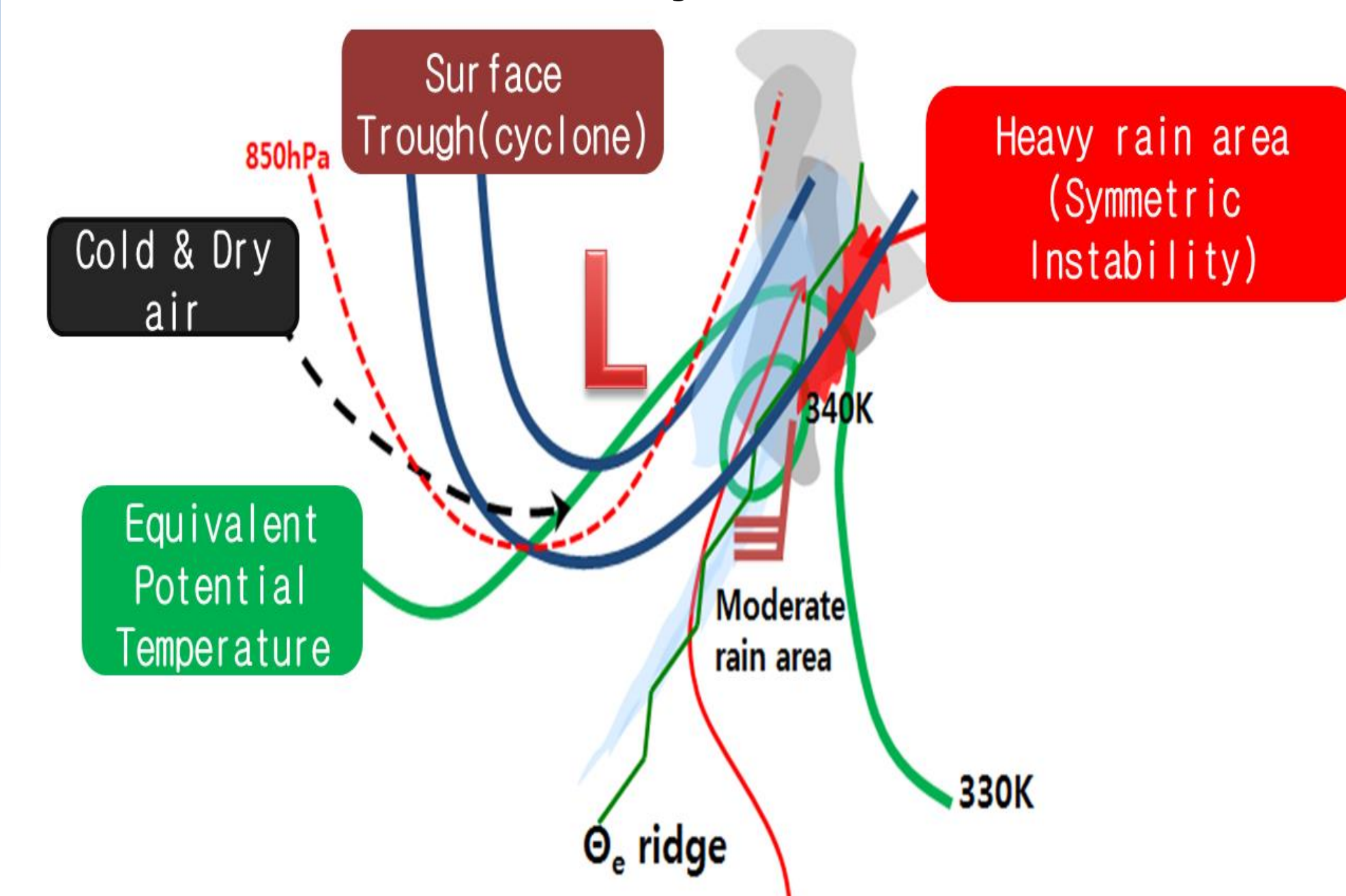
### □ Track of the Extratropical cyclone



### □ Features of the Extratropical cyclones

1. The cyclones are meso-alpha scale(precipitation)  
Extratropical Cyclones at the edge of the synoptic scale
2. The cyclones are generated by upper level through(cold core, divergence etc.)
3. SW-ly(or Low Level Jet) enhanced by the cyclones provided abundant moisture for heavy rain
4. It rained heavily in areas with symmetric instability

### □ Forecast for Heavy rain



1. Moderate rain in warm equivalent potential temperature core
2. Heavy rain in right side of the direction of the wind(by SI)

## Future Plan

- ❖ Statistical analysis of annual heavy rain events by cyclones
- ❖ Study of features of the seasonal cyclones on Korea
- ❖ Developing severe weather Forecast / Advisory / Warning operation skill

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