

Rapidly Developing Thunderstorm Detection Using Various Satellite Products

18 May 2017

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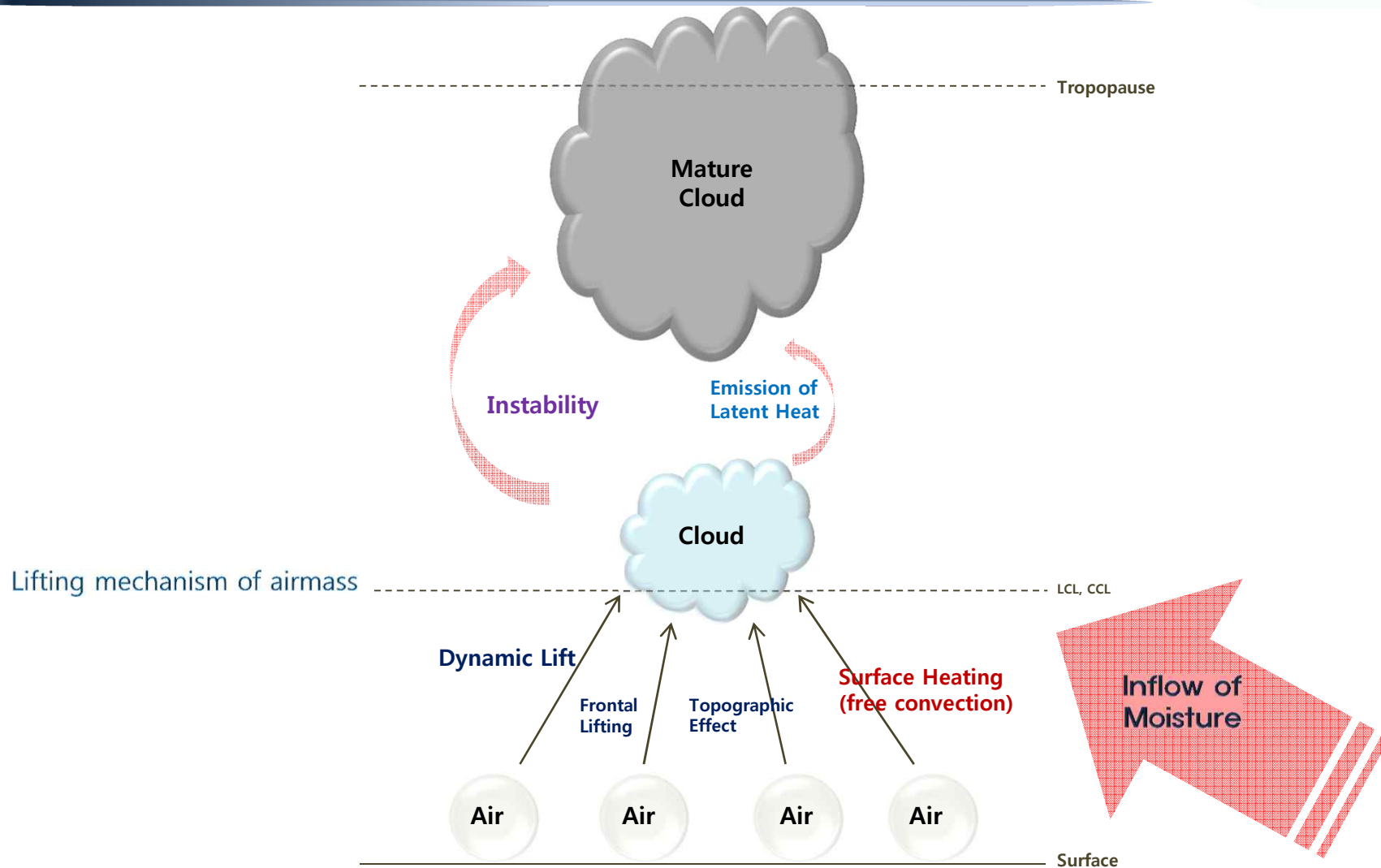
National Meteorological Satellite Center (NMSC)
Korea Meteorological Administration (KMA)



@ Precipitation : Moisture, Lift, instability

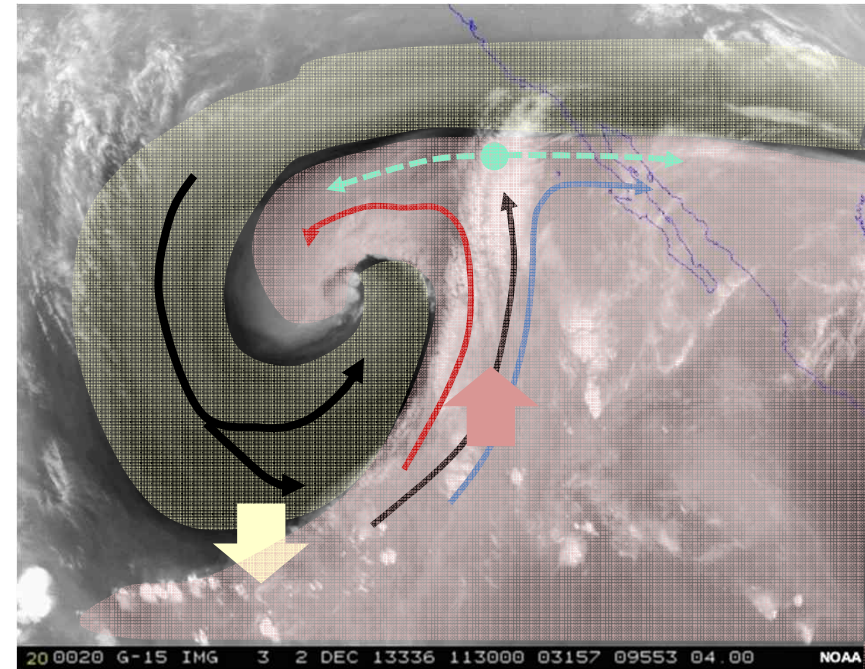
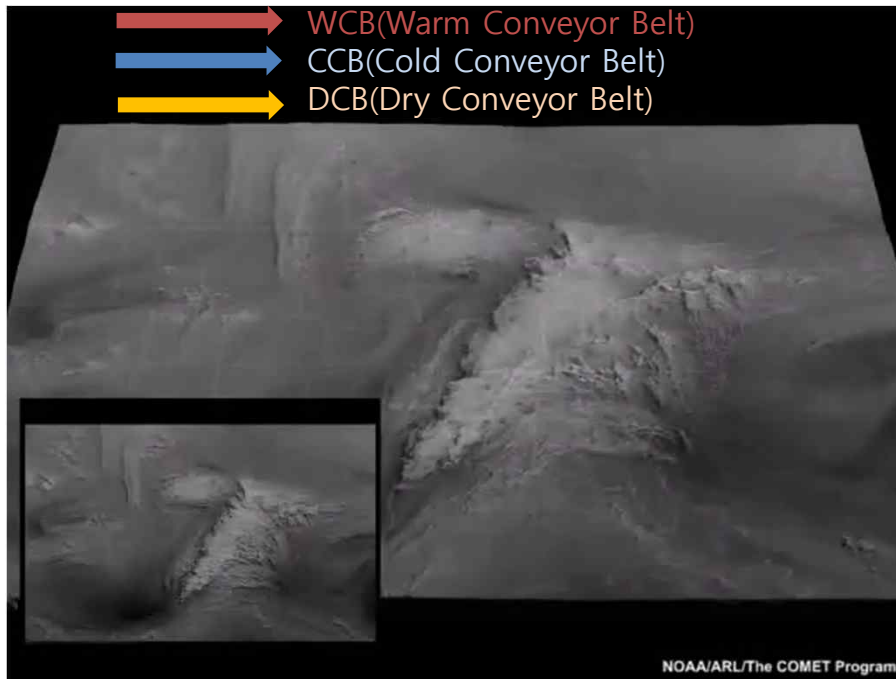


National Meteorological
Satellite Center



➔ Caused by Midlatitude Cyclone , Convective clouds

@ Midlatitude Cyclone – synoptic scale



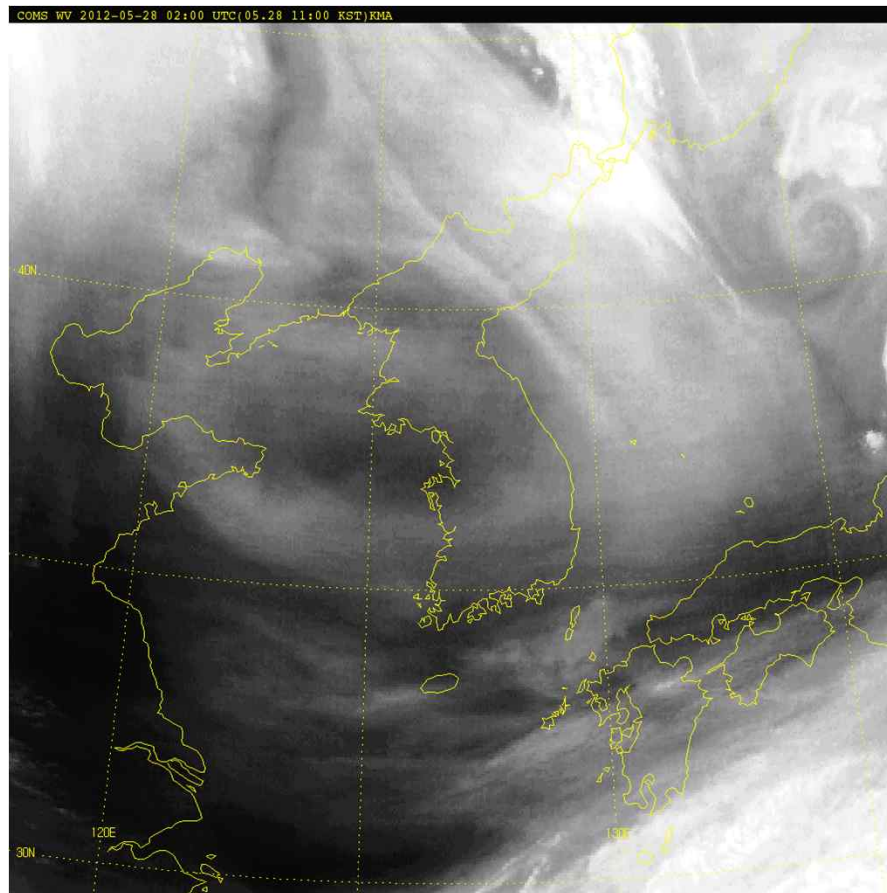
Source: The COMET Program

Identification from Water Vapour

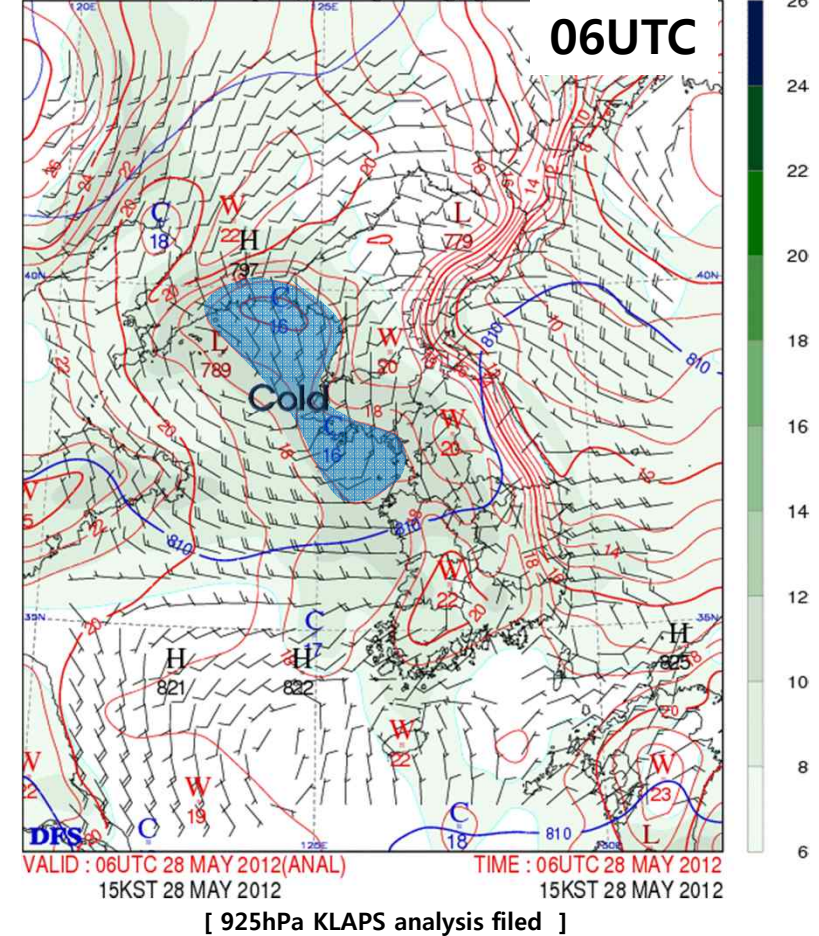
- Similar **wet-bulb potential temp(θ_w)**
- **Streamline** → defining the wind direction,
- **Vertical Motions** based on whether the streamline is pointing uphill or downhill.
 - streamline point from darker toward lighter BT → Ascending → Warm Conveyor Belt(WCBs)
 - streamline point from lighter toward darker BT → Descending → Dry Conveyor Belt(DCBs)

@ Rapidly Developing Thunderstorm (RDT)

28th May 2012



925hPa GPH(15m), Temp(1C), Mixing Ratio(g/kg) KLPS 05km(KMA)



[02:00~10:00 UTC 28th May 2012]

06UTC 28 MAY 2012 (15KST 28 MAY 2012)



06UTC 28 MAY 2012 (15KST 28 MAY 2012)



06UTC 28 MAY 2012 (15KST 28 MAY 2012)

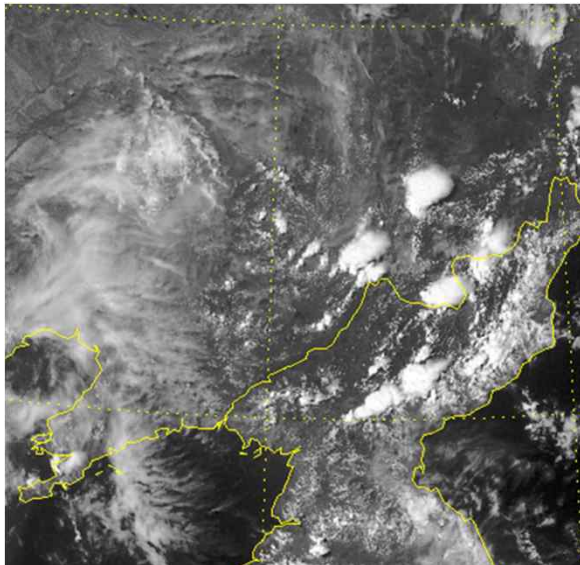
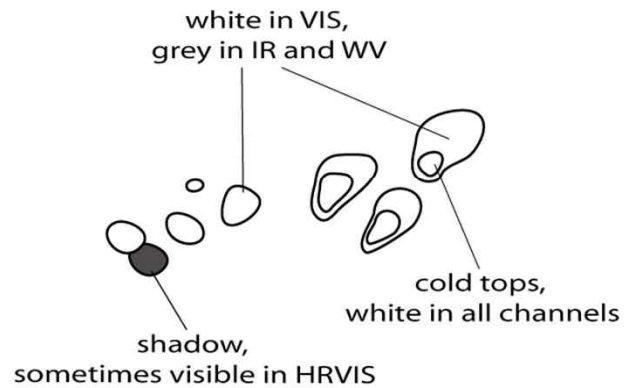
Stability Indexes

[Weather chart at 500hPa]

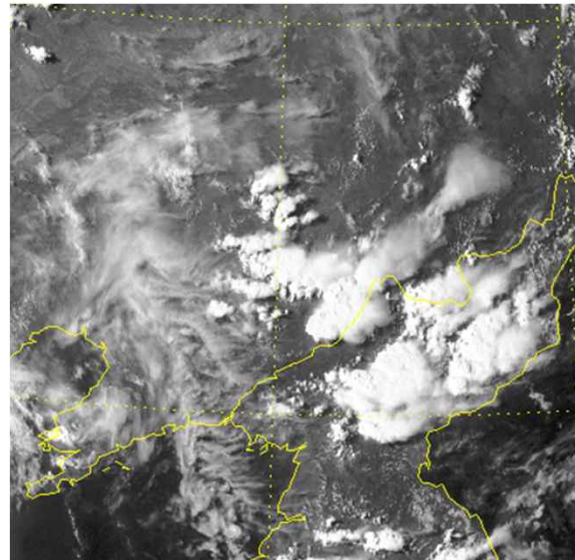
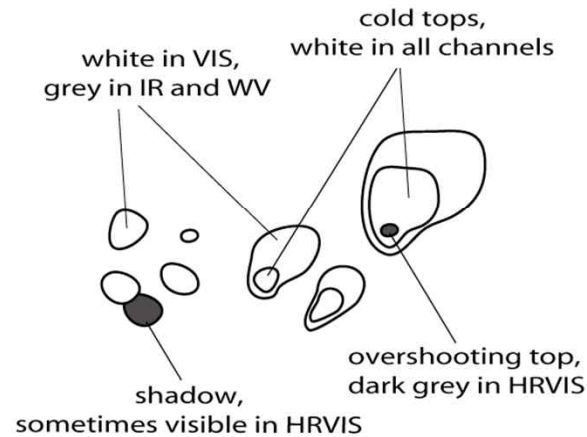


@ Features of Rapidly Developing Thunderstorm (RDT) on the single images

Developing Stage

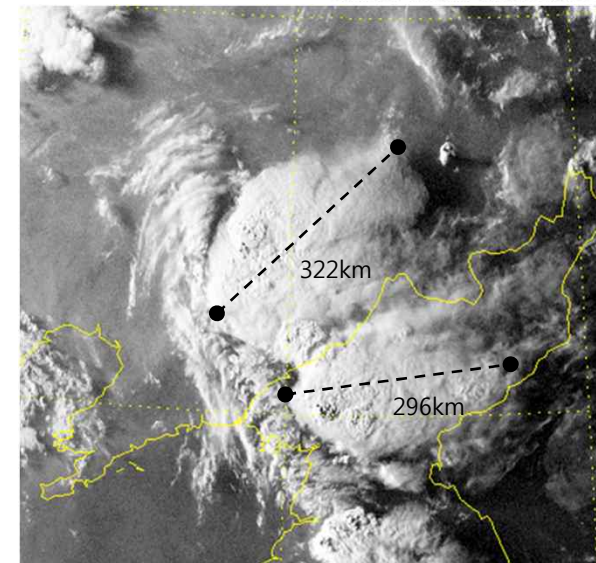
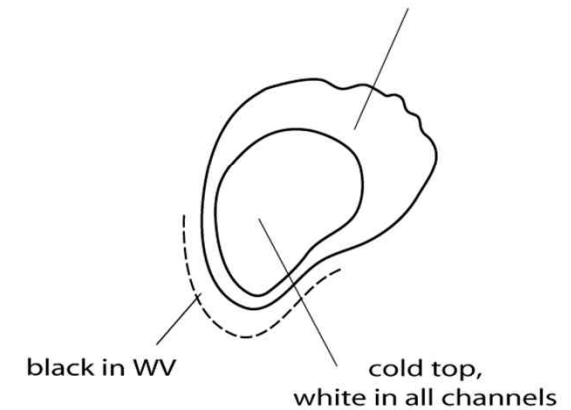


Mature Stage



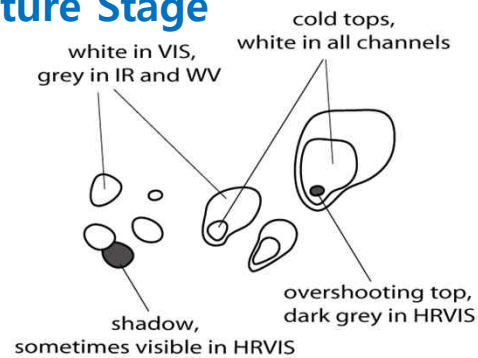
MCS

transparent, white to light grey in IR and WV, hardly visible in VIS



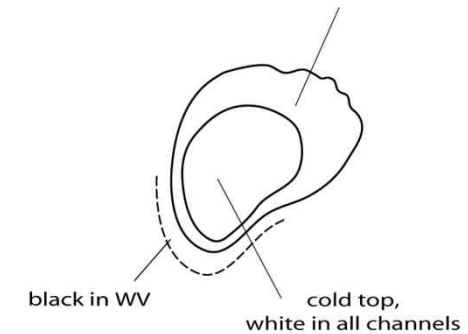
@ Features of Rapidly Developing Thunderstorm (RDT) on the single images

Mature Stage

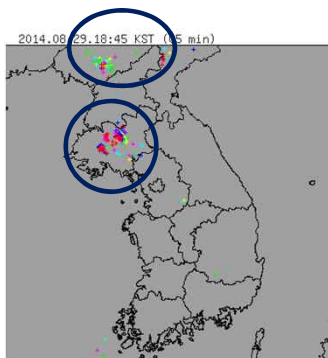


MCS

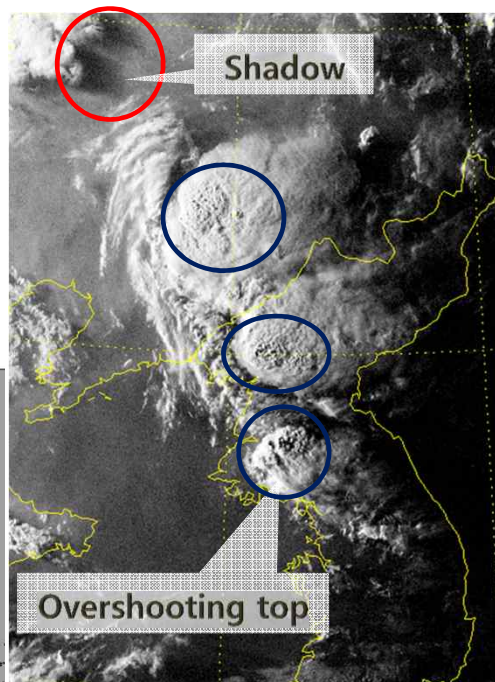
transparent, white to light grey in IR and WV, hardly visible in VIS



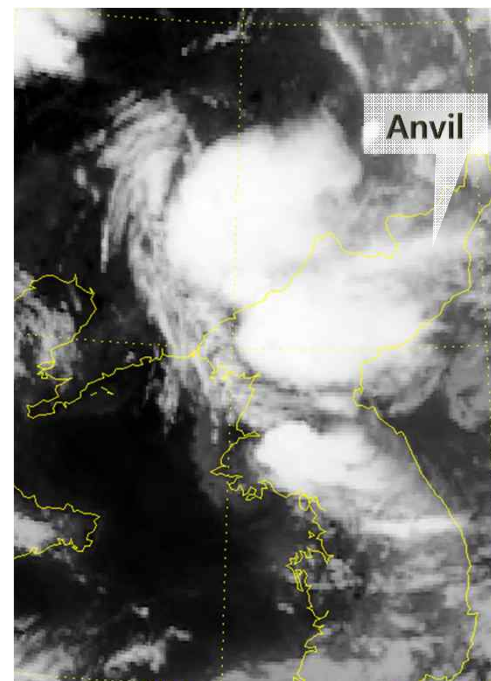
08:45 UTC
29th Aug 2014



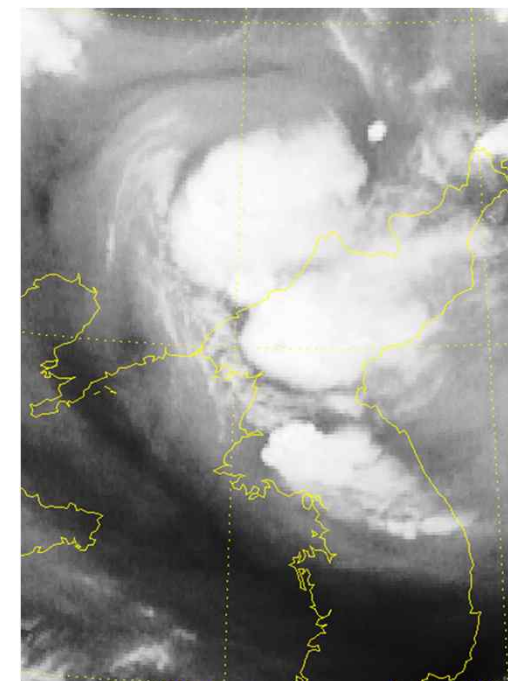
Lightning



COMS VIS

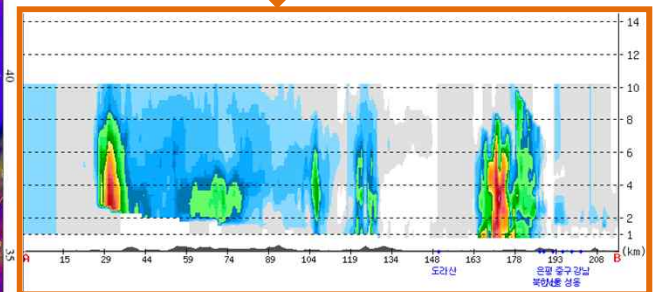
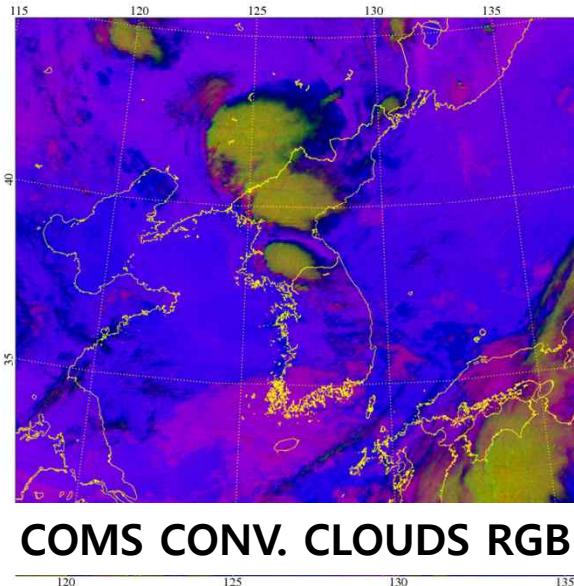
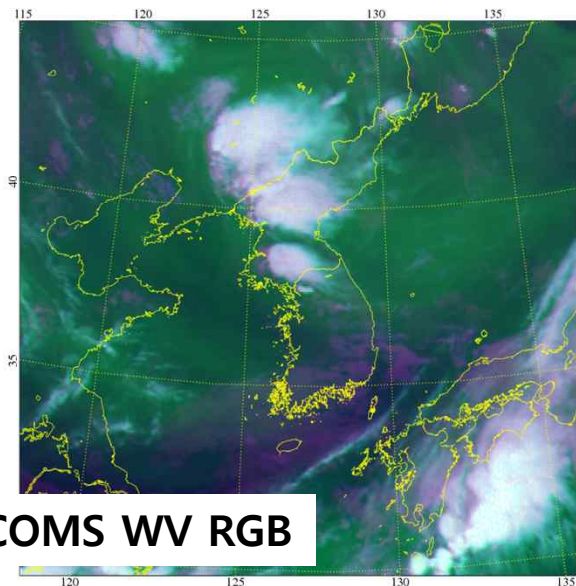
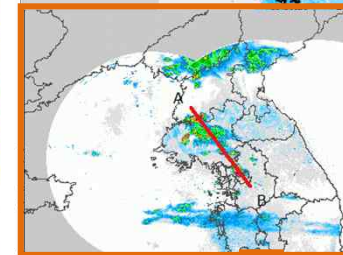
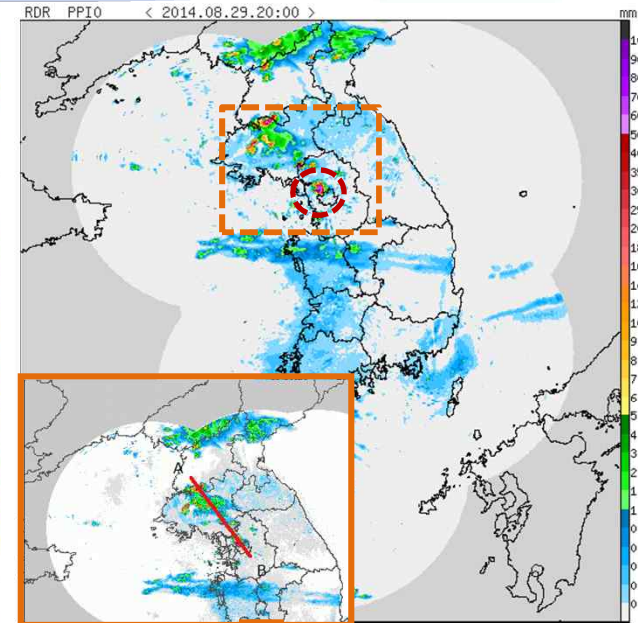
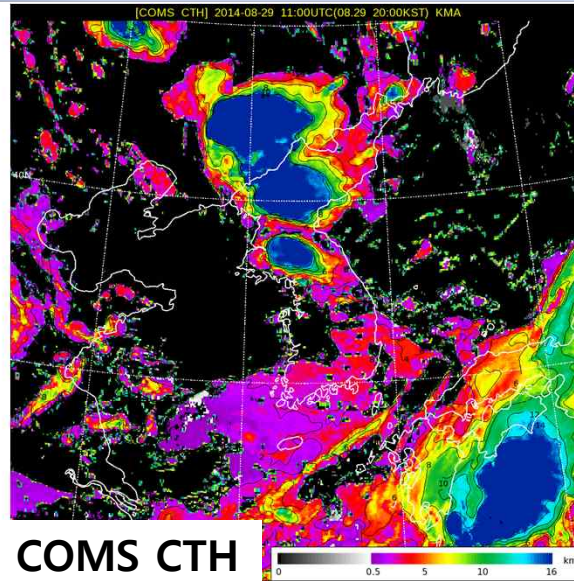
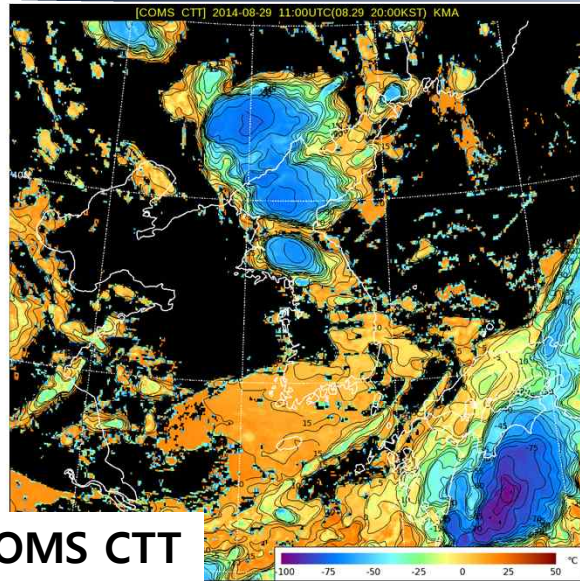


COMS IR



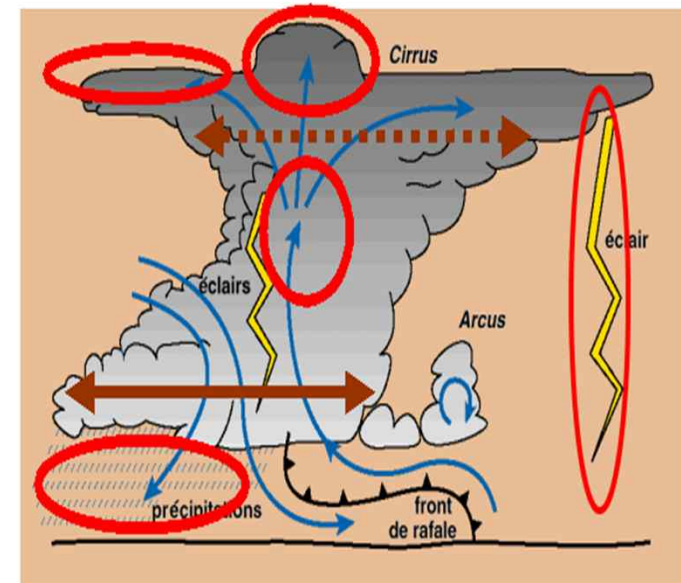
COMS WV

@ Available Satellite Products → where will the severe weather occur ?



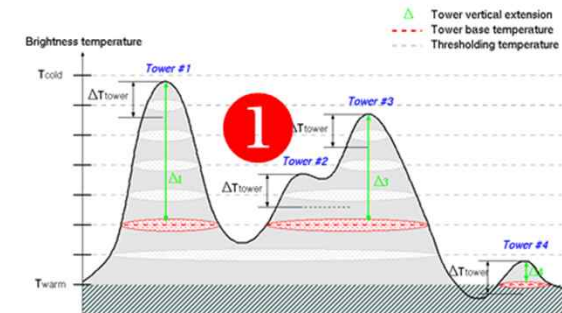
What is RDT ?

- ❖ Rapid Developing Thunderstorm has been developed by Meteo-France in the frame work of the [EUMETSAT NMCSAF in supporting to Nowcasting](#).
 - [Identification, monitoring and tracking](#) of intense convective system clouds
 - [Detection of rapidly developing convective cells](#), where IR sensor allows for
- ❖ RDT is a tool for meteorological forecasters but can also be used by research teams and end-users like aeronautical users.
- ❖ Object-oriented satellite analysis
 - Identification and tracking of cloud systems as objects: attributes (trend, morphology, etc.), motion vector, etc.
 - [from meso-alpha scale \(200-2000 km\) down to smaller scales \(few pixels\)](#)
- ❖ RDT explained with NWC SAF ATBD (RDT-PGE11 v3.0)



STEP1: Detection (in order to detect cells)

- Using vertical profile of 10.8 μ m BT
- Cells (towers) are detected at each slot
- Vertical extension: at least 6°C



STEP2: Tracking (in order to recognize each cell in the previous slot)

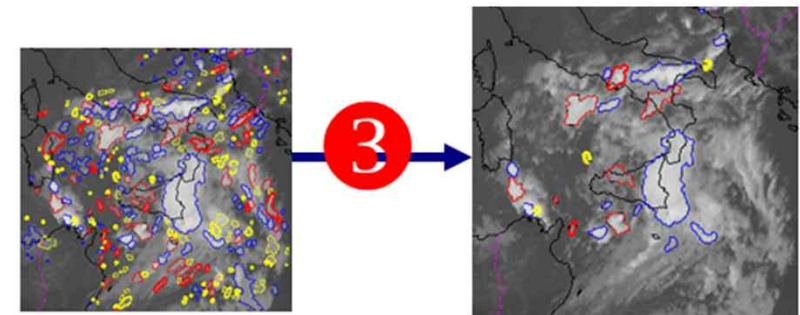
- Analysis of cloud cells overlap: each cell of the previous slot is advected
- Merges and splits are taken into account
- Trends of various parameters are calculated

6.	Max_TxTmin15
7.	Max_TxTmin30
8.	Max_TxTmin45
9.	Max_TxTmin60

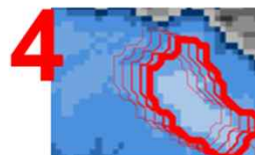


STEP3: Discrimination (in order to identify convective cells). Statistical process

- Made complex by the unbalanced populations, the wide variety of scales and evolution-phases of systems
- Highly improved by the use of a set of 5 IR-channels as predictors, by the use of NWP data
- Very highly improved by the use of lightning data

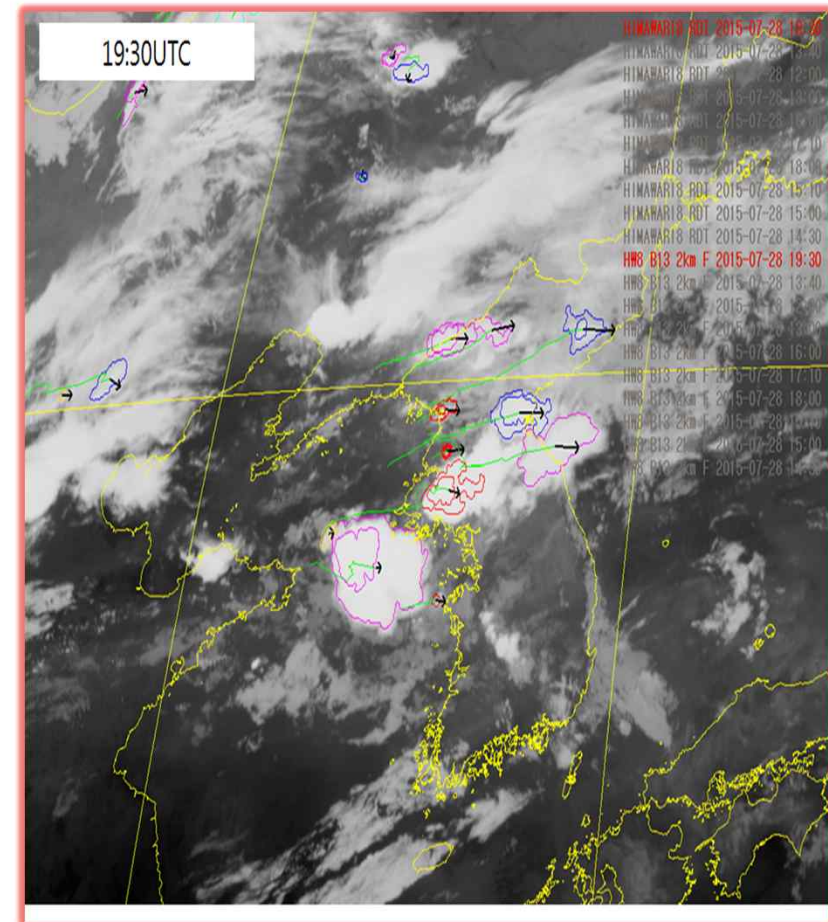
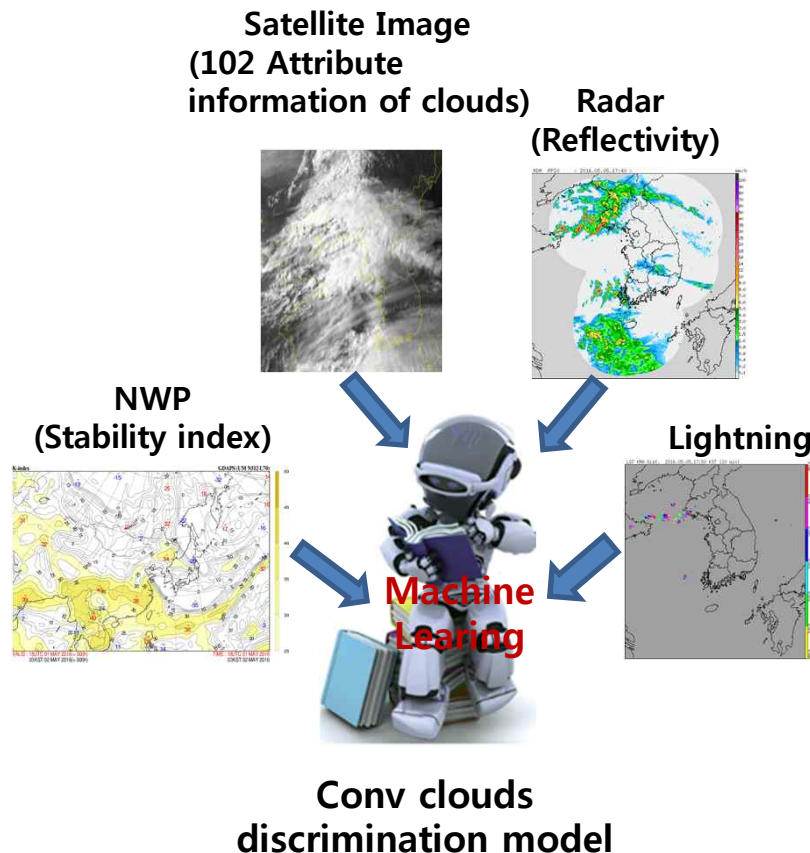


STEP4: Forecast



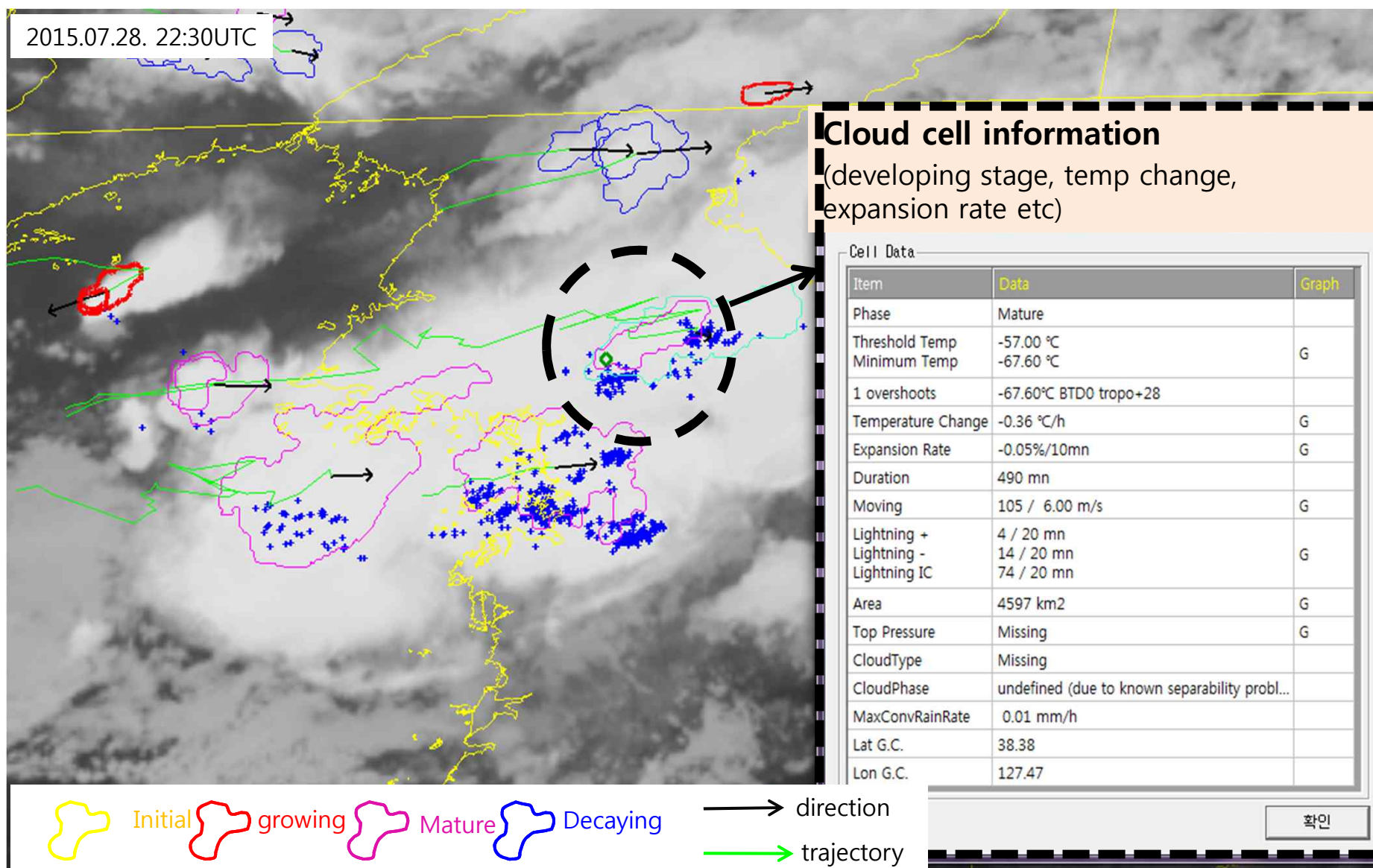
@New products_ Rapidly Developing Thunderstorm(RDT) Detection & Tracking using next generation satellites

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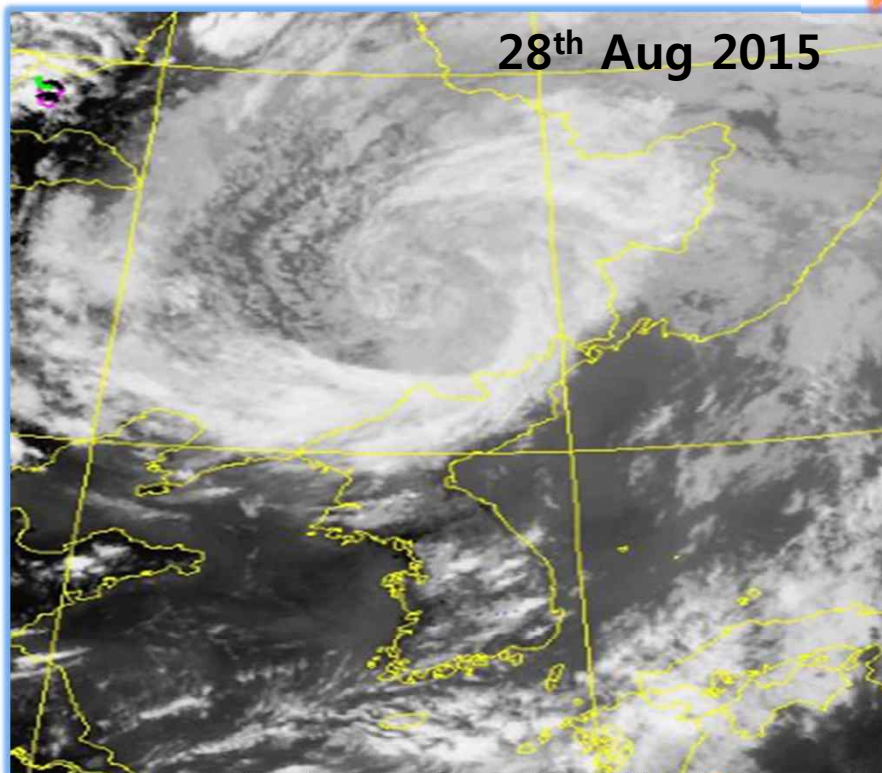
Detect convective clouds with lightning or
can be accompanied by lightning within
1hour

@RDT Outputs (Developing & testing)



COMS (07:00UTC)

(IR 10.8 μ m, IR 12 μ m, WV 6.7 μ m)

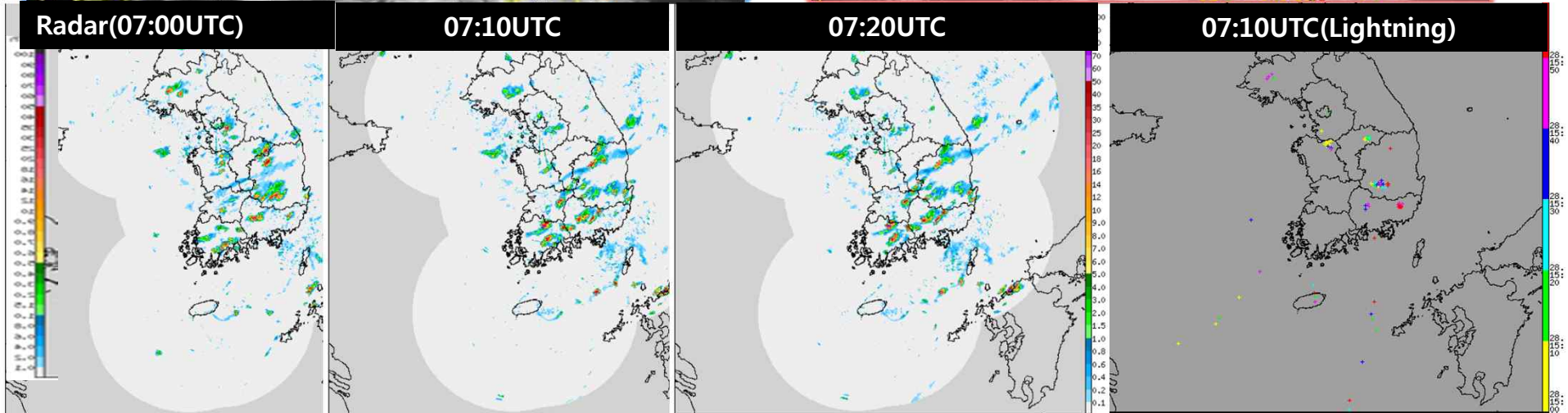
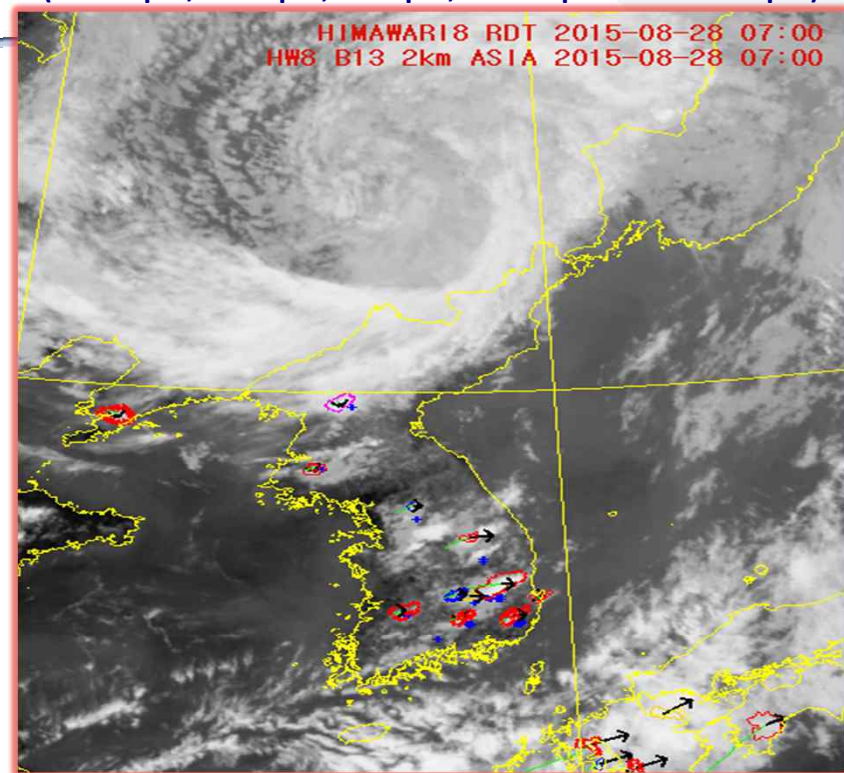


Himawari-8 (07:00UTC)

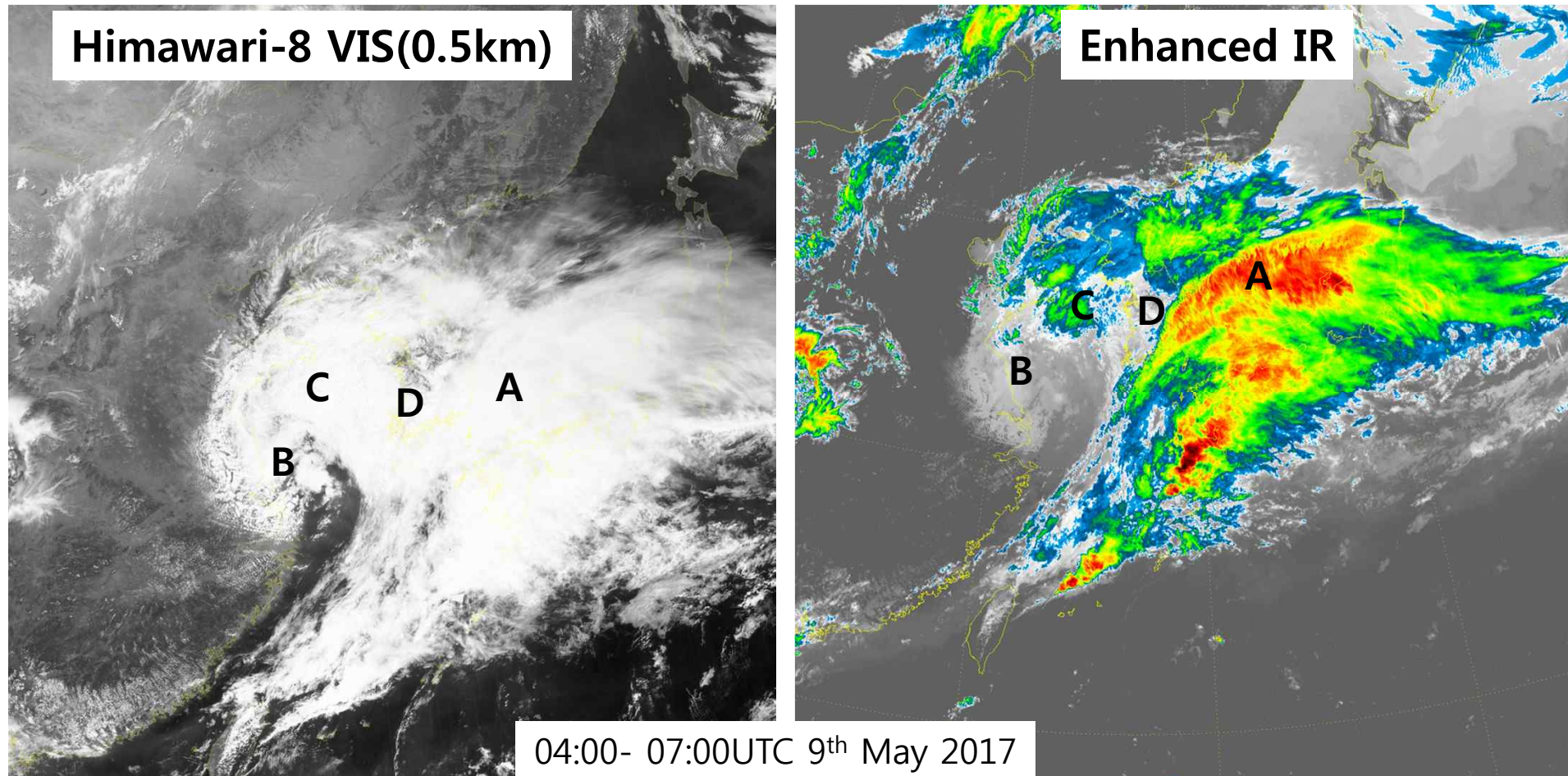
(IR 10.8 μ m, IR 8.7 μ m, IR 12 μ m, WV 6.2 μ m and WV 7.3 μ m)



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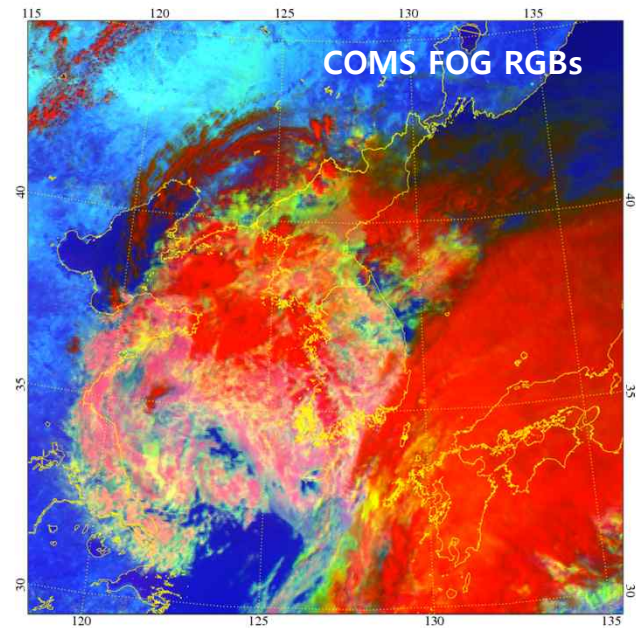
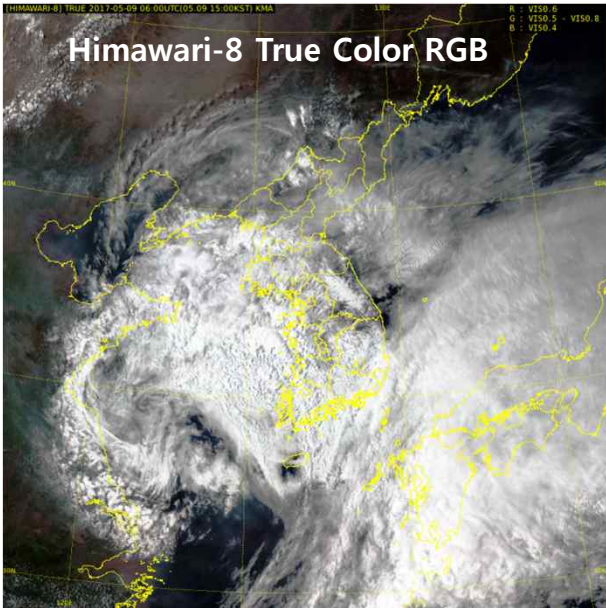
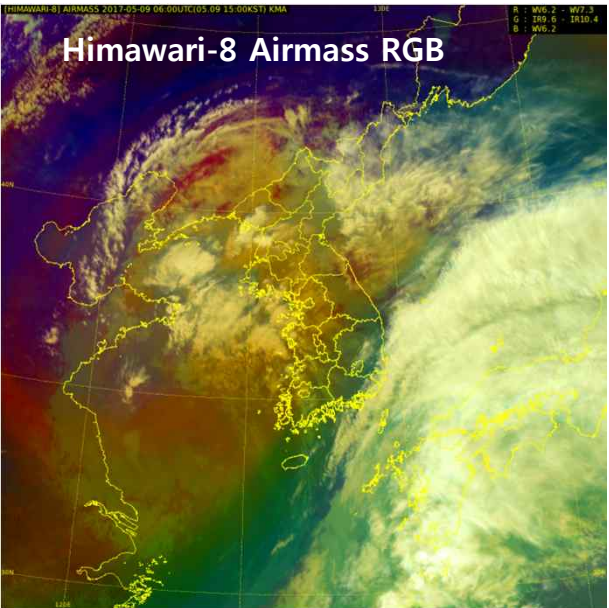
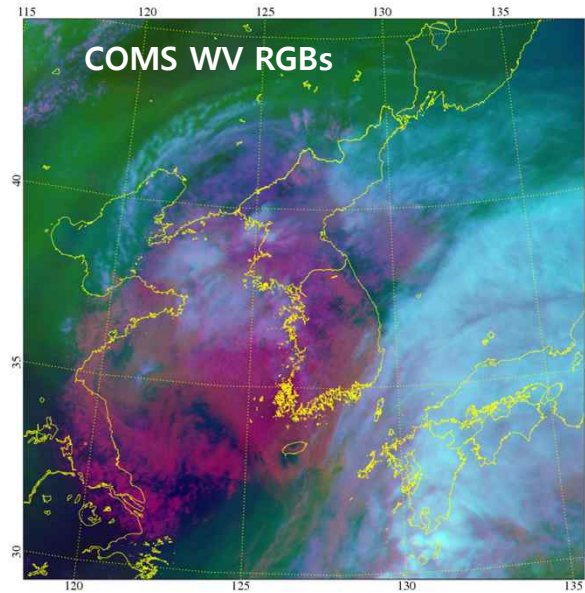
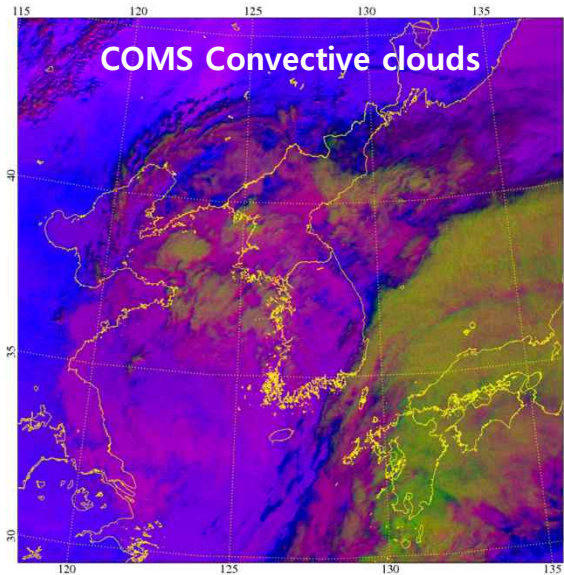
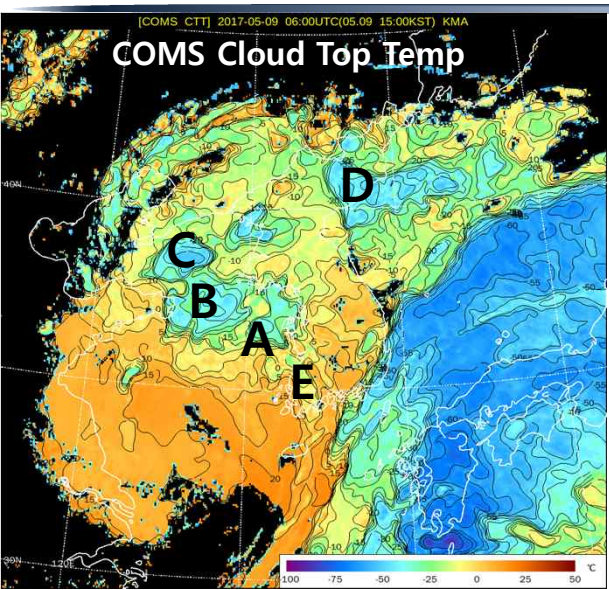


@ RDT in the Midlatitude cyclone system

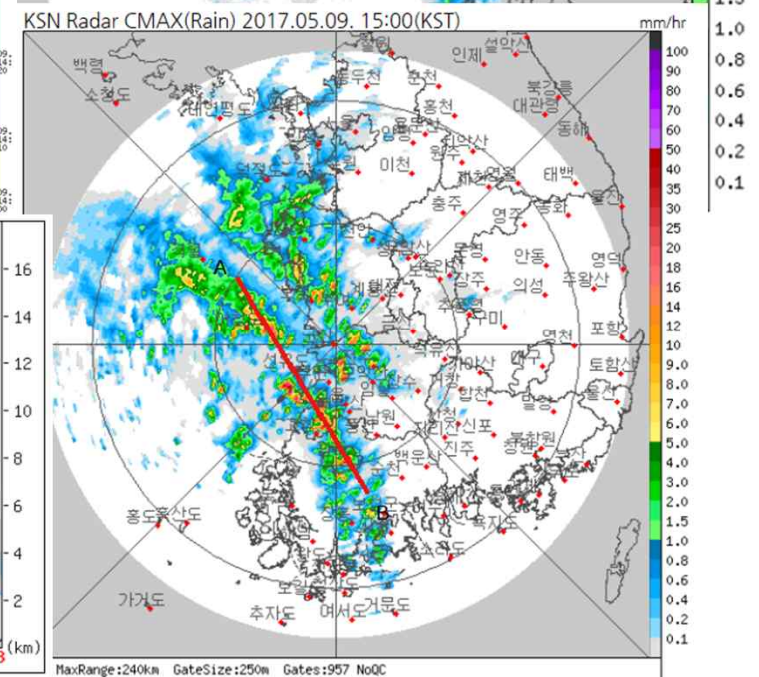
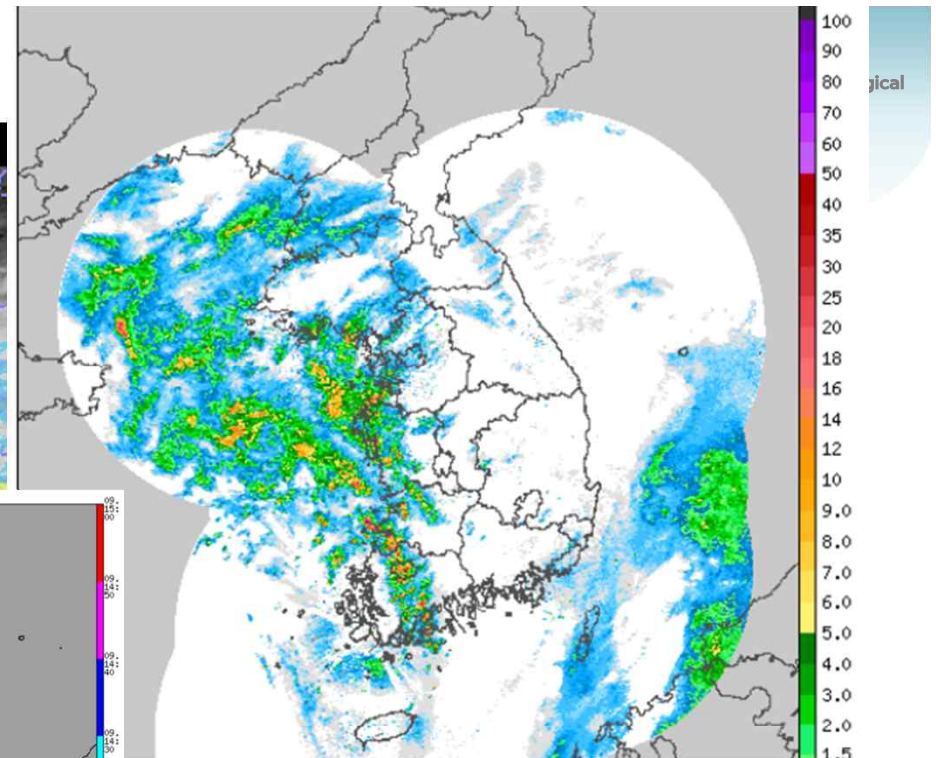
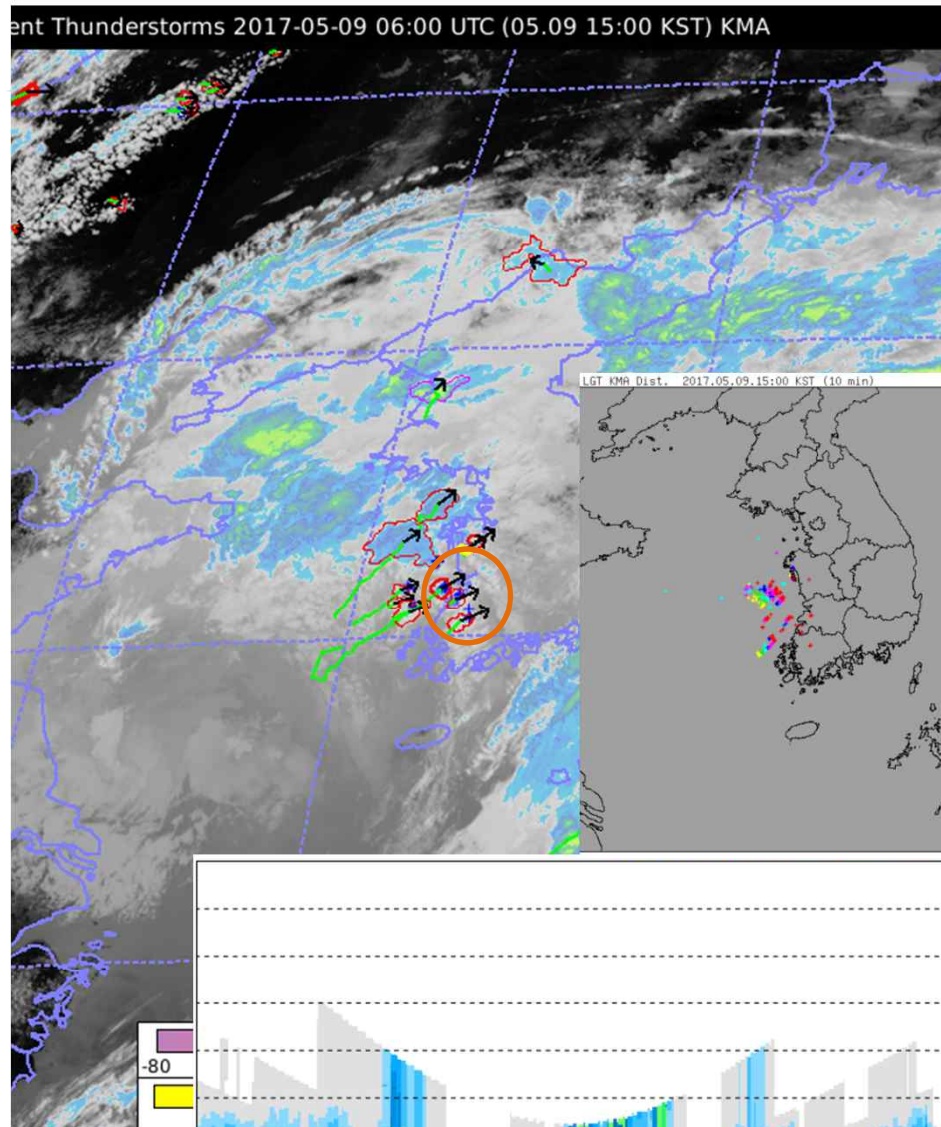


Guess the rapidly developing thunderstorm areas at the last time ?

Various RGBs → Guess the rapidly developing thunderstorm areas ?



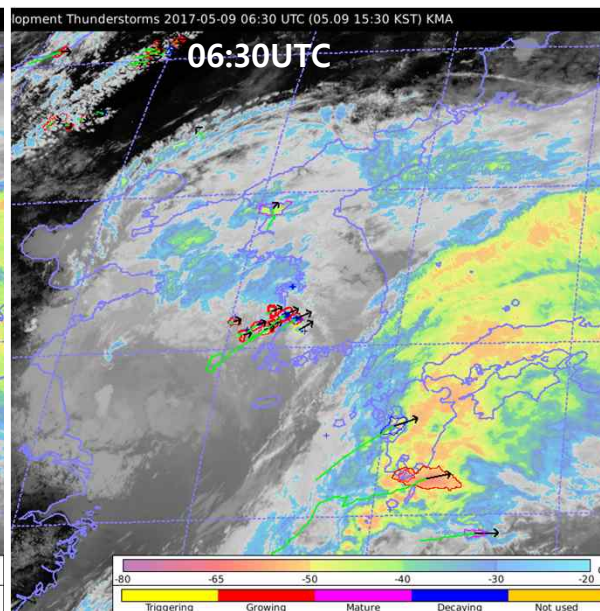
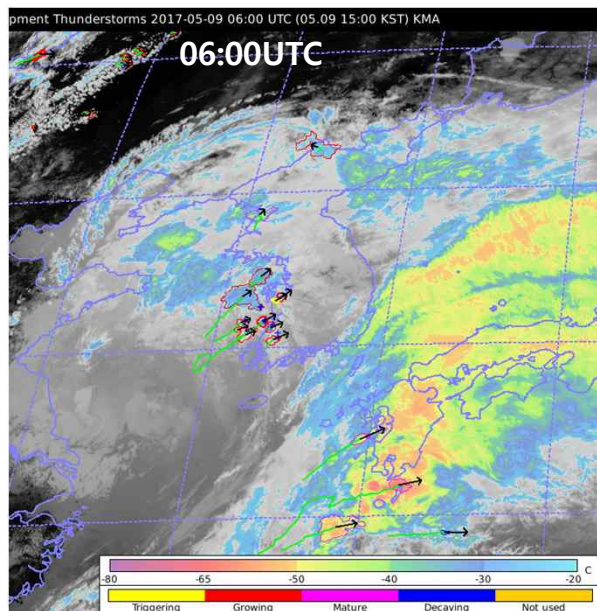
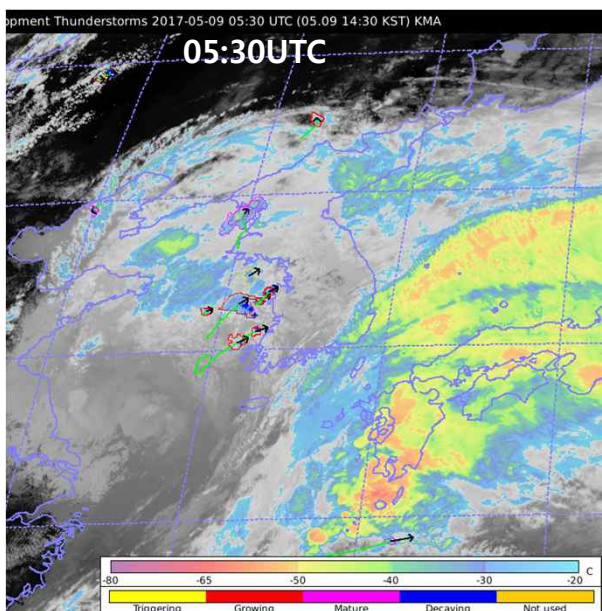
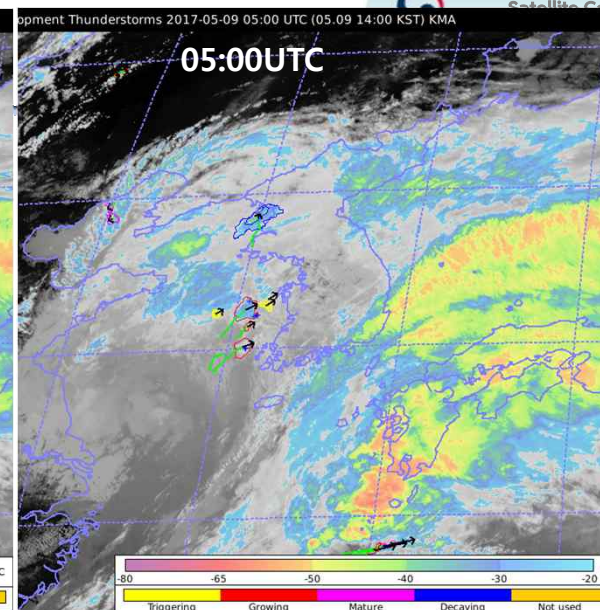
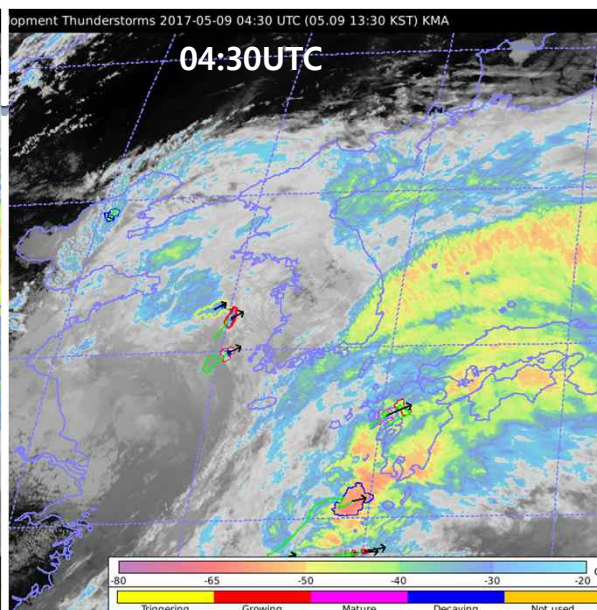
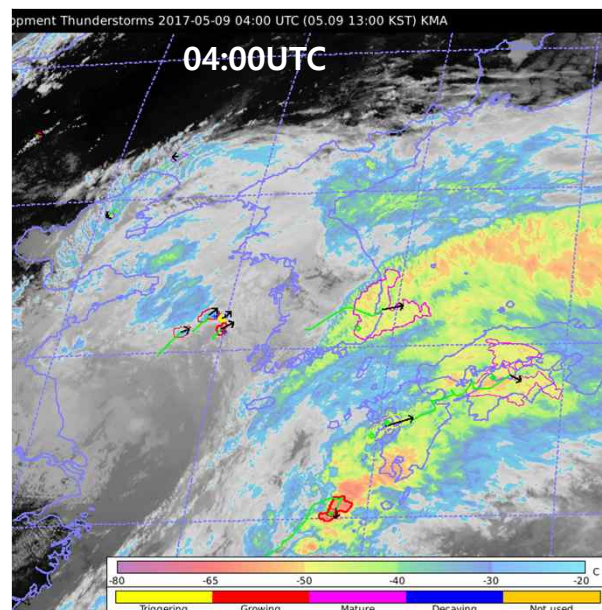
06:00UTC 9th May 2017



Tracking of Rapidly Developing Thunderstorm

9th May 2017

National Meteorological
Satellite Center



THANK YOU

