Nowcasting Applications using spectral data and RGB Composites of GEO-KOMPSAT-2A

2nd December 2019

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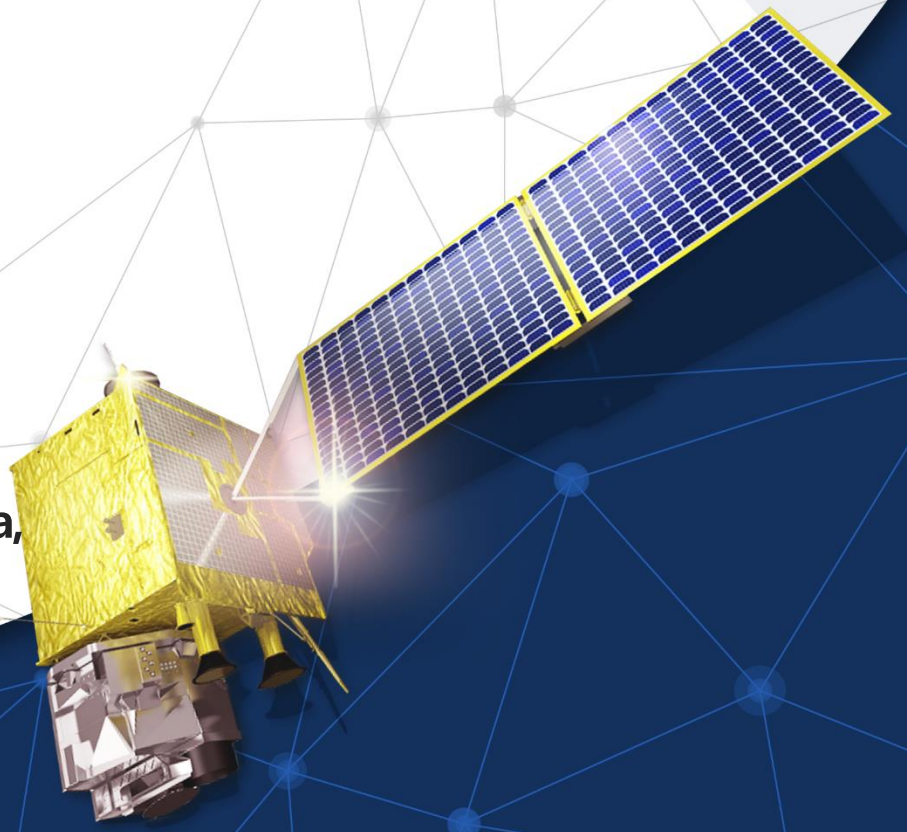

National Meteorological Satellite Center

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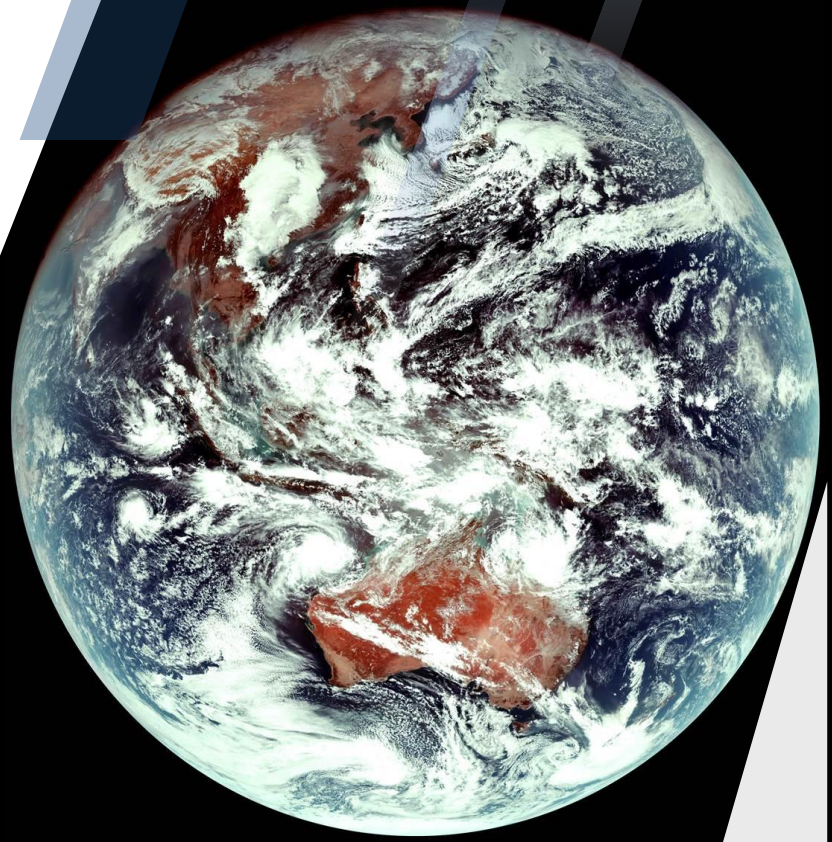
How to monitoring, detection and analysis of weather phenomena using GEO-KOMPSAT-2A(GK2A) data and RGB composites

RGB Composites by GK2A



The 1st image of GEO-KOMPSAT-
03:10UTC 26th Jan. 2019

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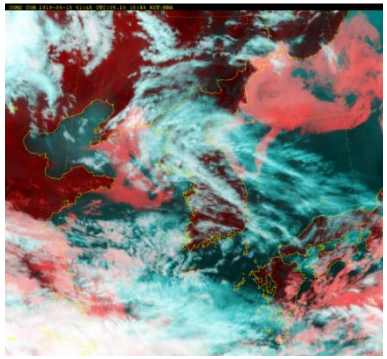
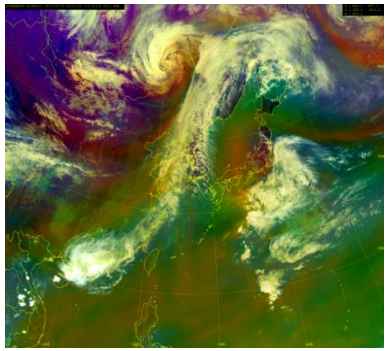
RGB Composites from GK2A

24hours RGBs

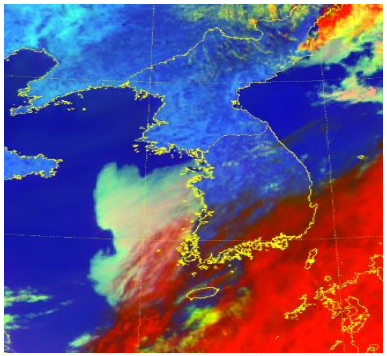
[IR+VIS composite]



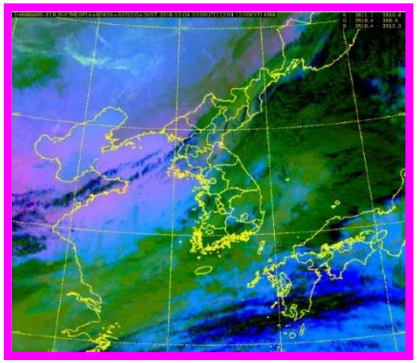
[Airmass]



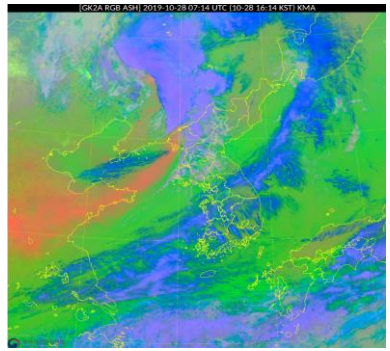
[Day/nighttime fog]



[Dusts]

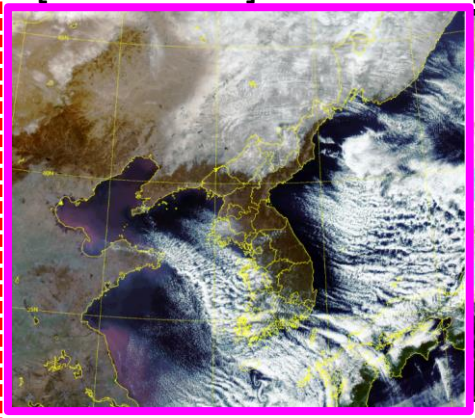


[Ash clouds]

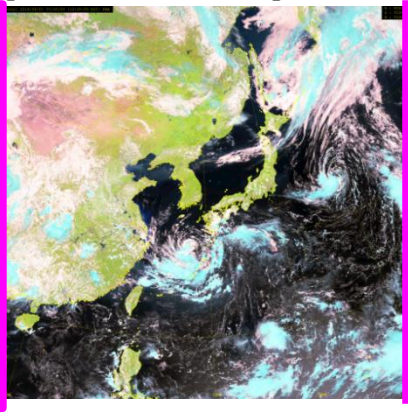


Daytime RGBs

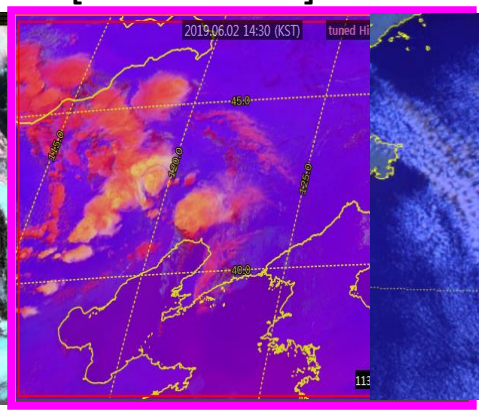
[True color]



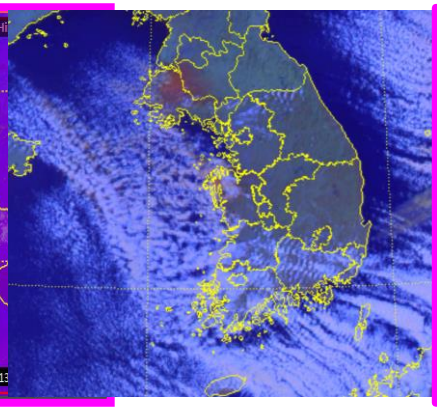
[Natural color]



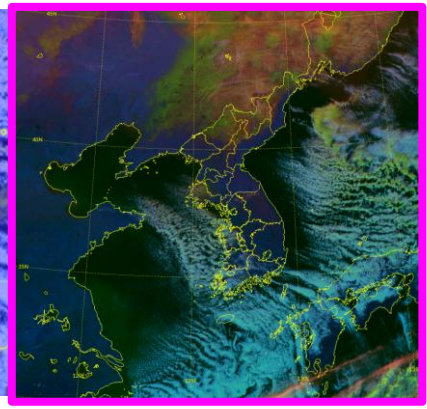
[Convection]



[Snow/fog]

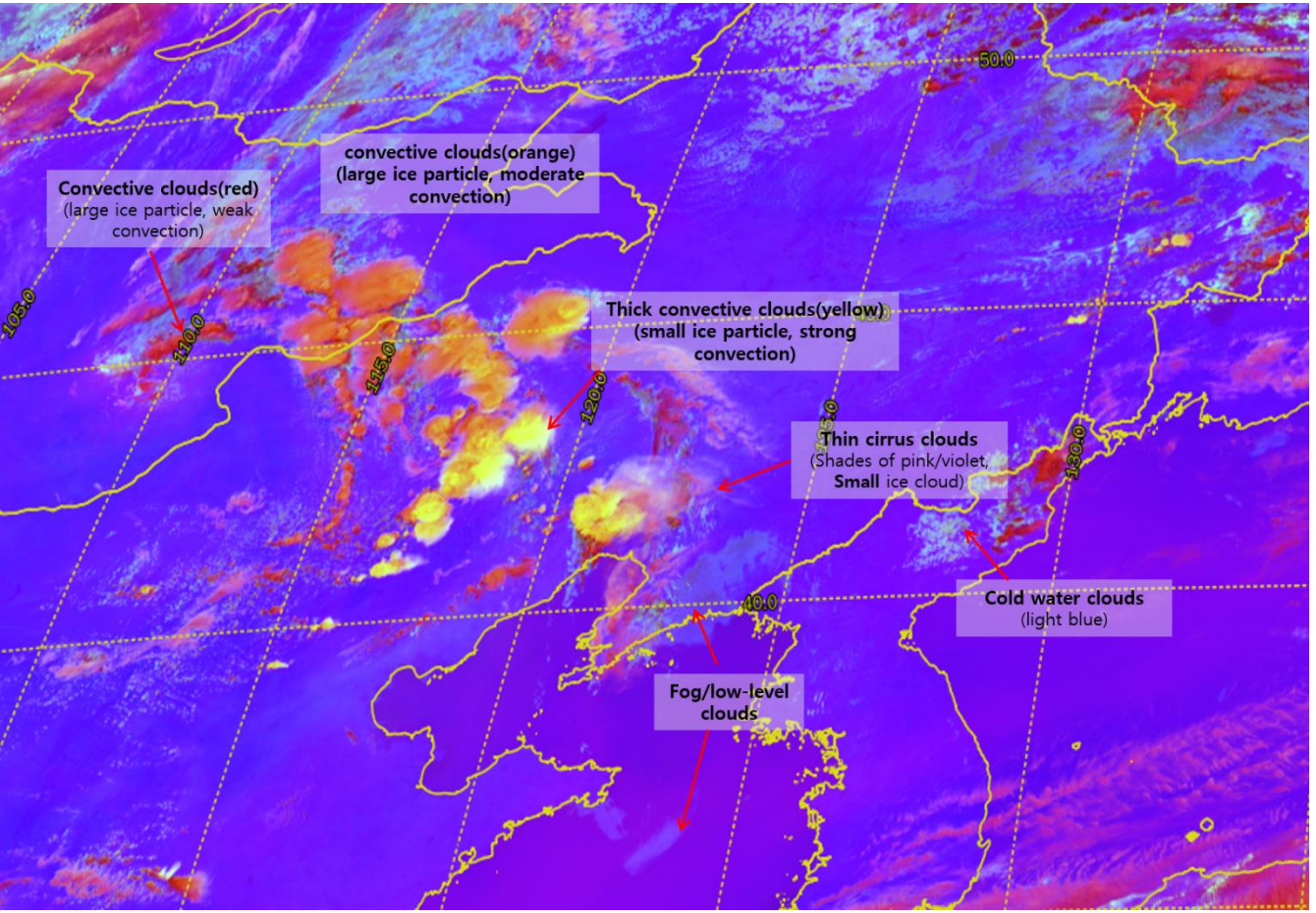


[cloud phase]



Convection RGB image produce by GK2A

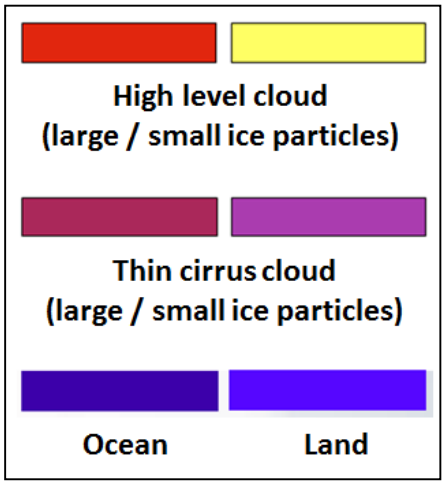
Color interpretation



Channel Combination

Day Convection RGB (KMA recipe)	Range	Gamma
WV6.3 - WV7.3 BTD (Normalization)	-8 to 1	0.5
IR3.8 - IR10.4 BTD	-5 to 60	0.3
NIR1.6 - VIS0.6 REFL	-50 to 25(%)	1.0

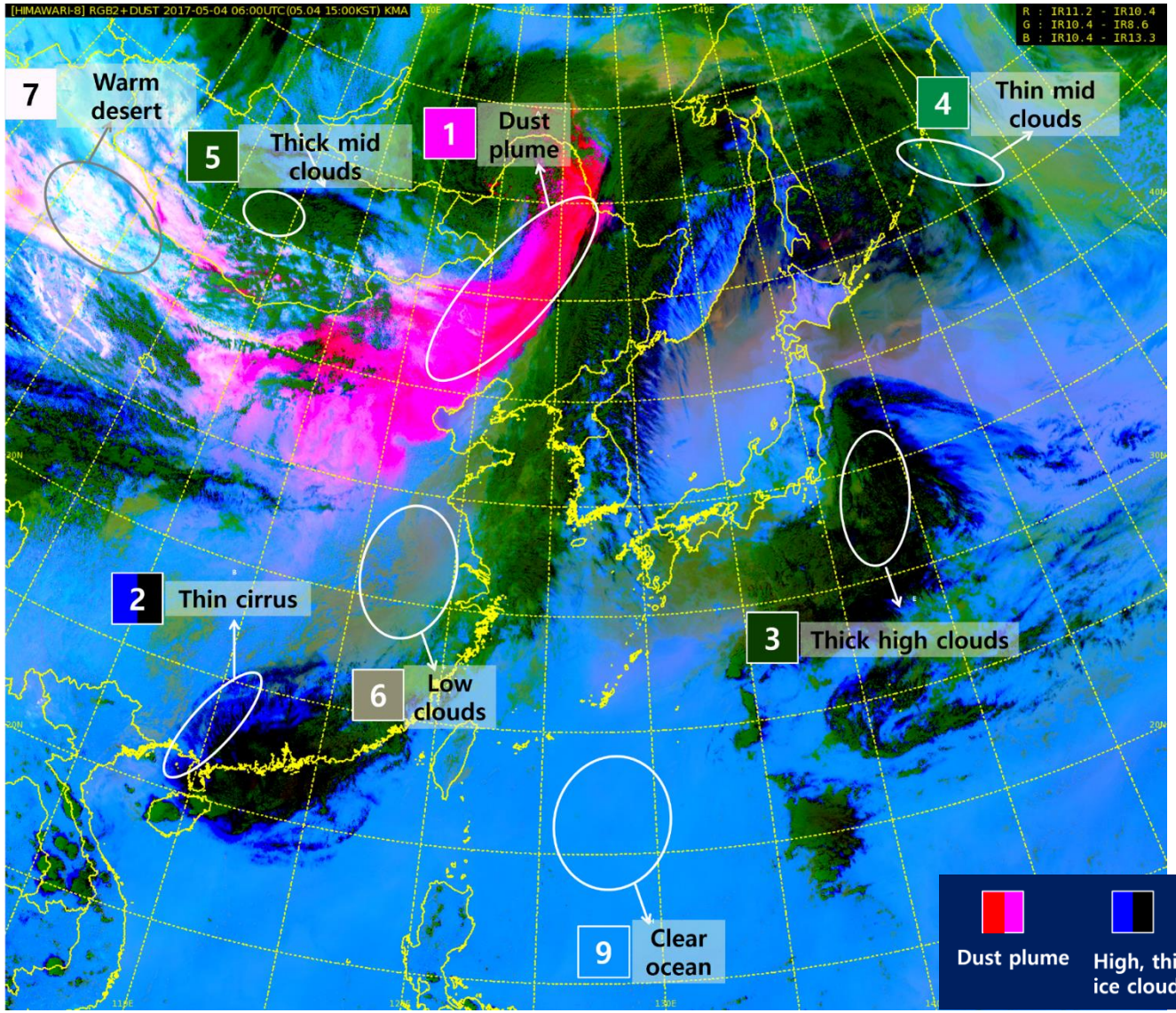
Day Convection RGB (Mid-latitude)	Range	Gamma
WV6.2 - WV7.3 BTD	-35 to 5	1.0
IR3.9 - IR10.8 BTD	-5 to 60	0.5
NIR1.6 - VIS0.6 REFL	-75 to 25%	1.0



Color interpretation palette

Dust RGB image produce by GK2A

Color interpretation

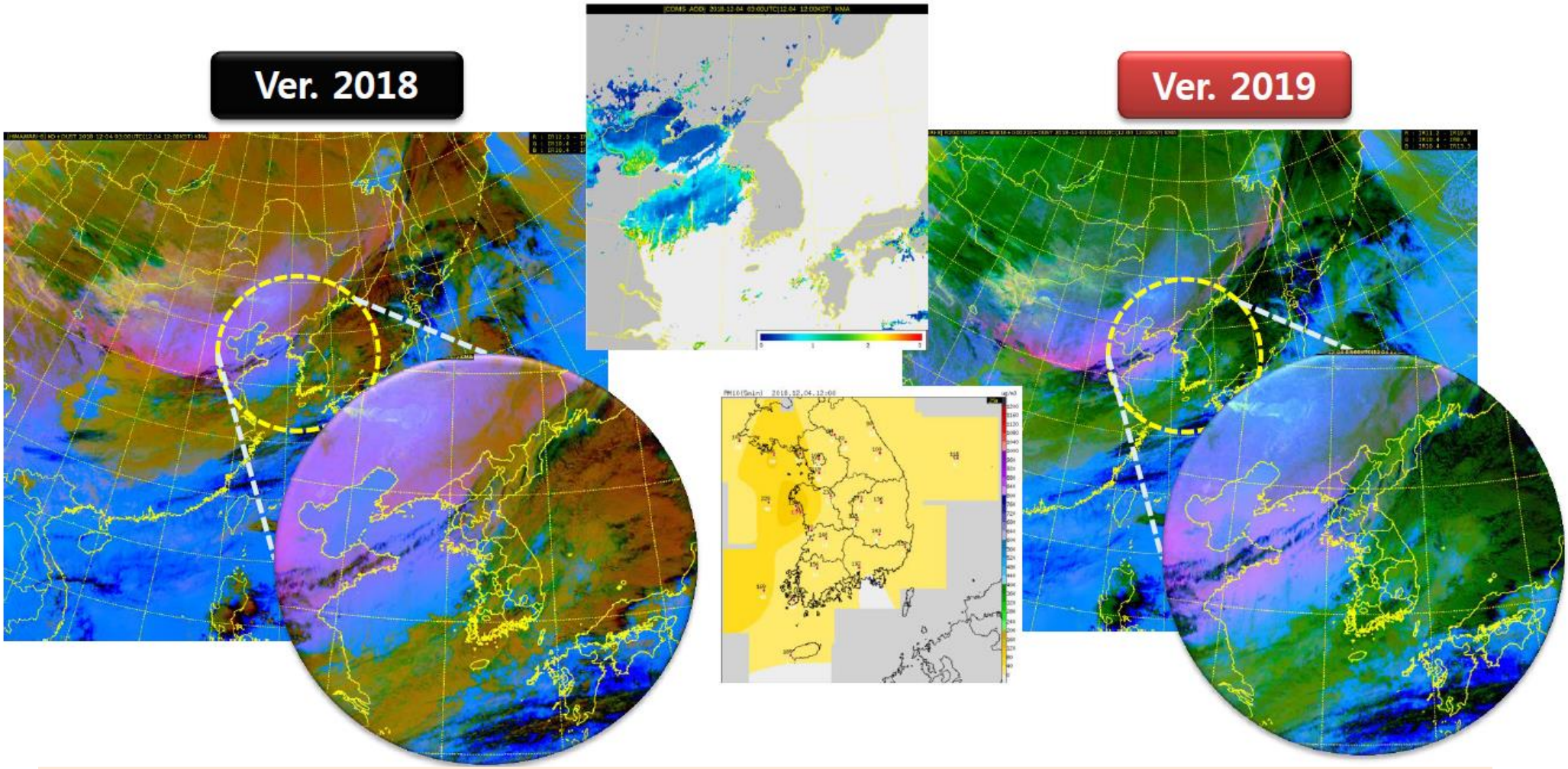


Channel Combination

Dust RGB (KMA recipe)	Range	Gamma
IR11.2 - IR10.4 BTD	-1 to 1.6	0.7
IR10.4 – IR 8.6 BTD	0.2 to 10	2.5
IR10.4 – IR 13.3 BTD	8 to 16	1.0

Dust RGB (JMA recipe)	Range	Gamma
IR12.4 - IR10.4 BTD	-6.7 to 2.6	1.0
IR11.2 – IR 8.7 BTD	-0.5 to 20	2.5
IR10.4	261.2 to 288.7	1.0

Improvement of dust RGB using GK2A

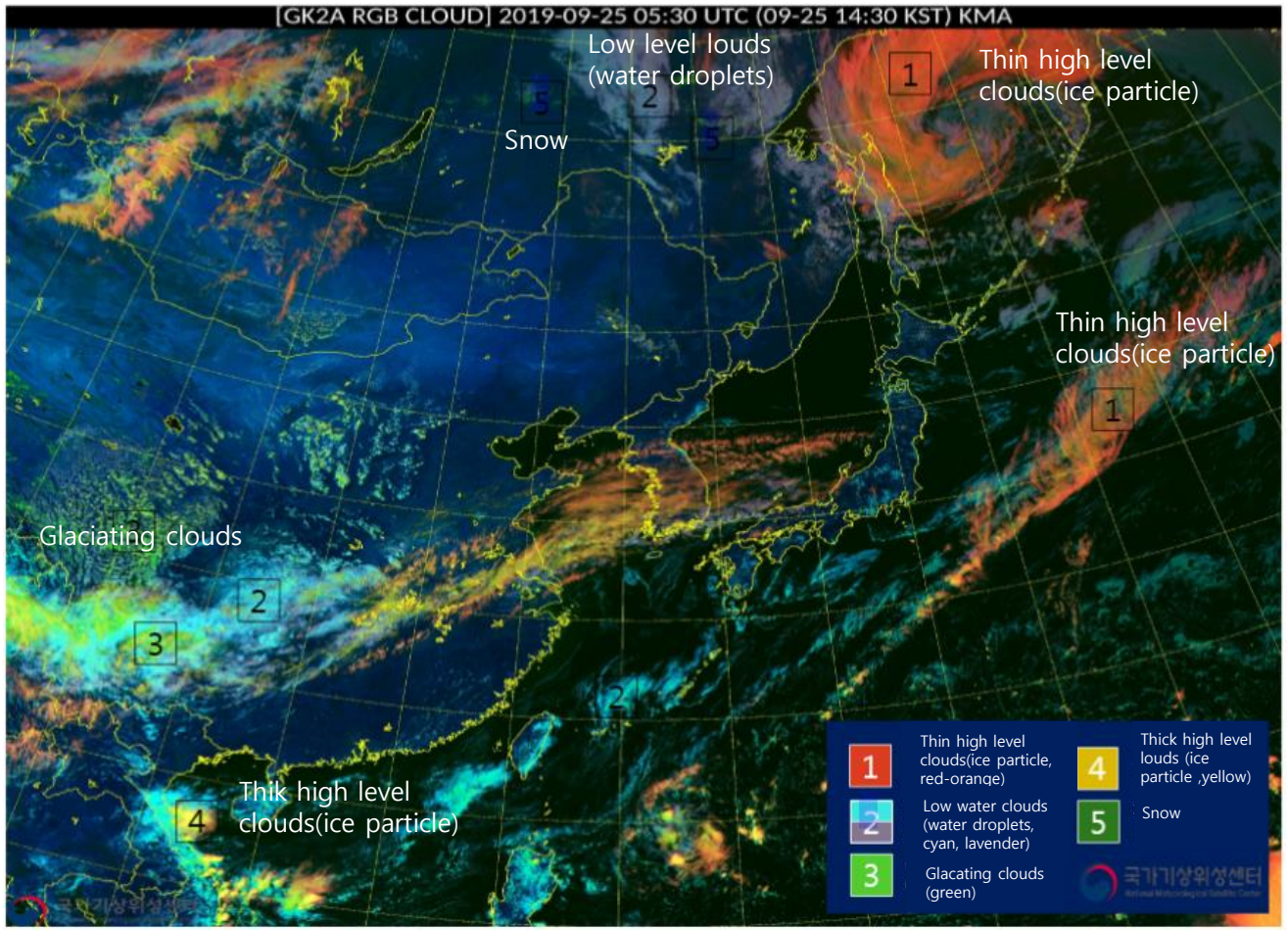


➔ Distinguish dust signals distinctly from surrounding phenomena
by displaying complementary colors (Dusts : pinkish, clouds: greenish, land/ocean : bluish colors)

➔ Weak dust signals over marine are also well detected continuously

Cloud phase RGB image produce by GK2A

Color interpretation

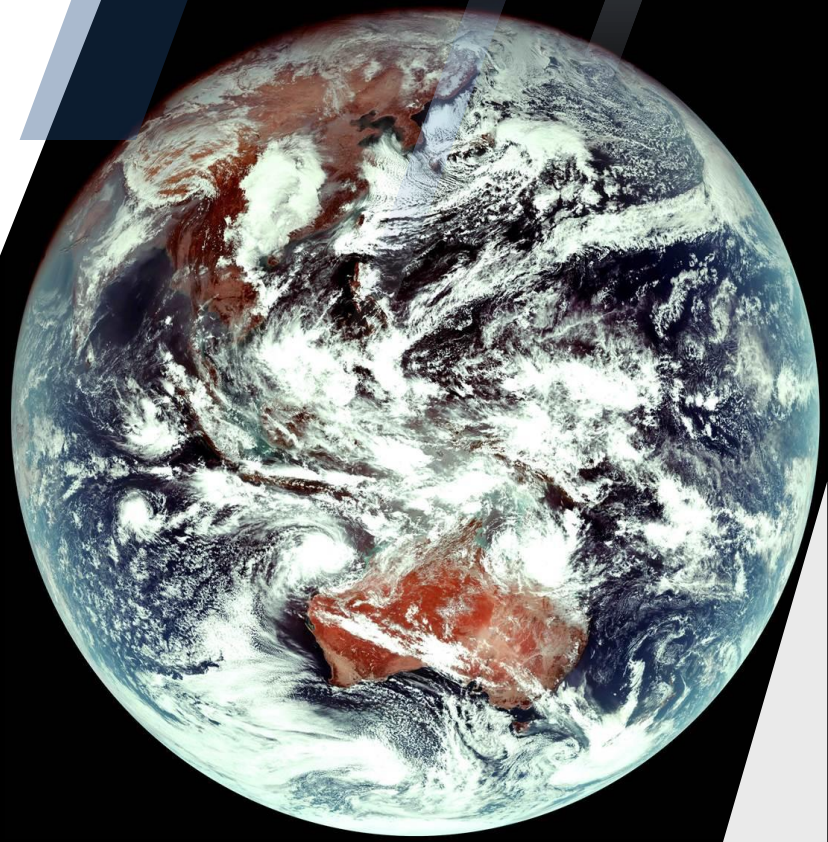


Channel Combination

Cloud phase RGB (KMA recipe)	Range	Gamma
IR10.4	216.62 to 280.67	1.0
VIS0.6 REFL	-3.46 to 77.92(%)	1.0
NIR1.6 REFL	1.19 to 59.32(%)	1.0

Cloud phase RGB (JMA recipe)	Range	Gamma 1/2
IR10.4	216.62 to 280.67	0.5/1.5
VIS0.6 REFL	-3.46 to 77.92(%)	0.5/0.5
NIR1.6 REFL	1.19 to 59.32(%)	0.5/0.5

Convective Storms



The 1st image of GEO-KOMPSAT-
03:10UTC 26th Jan. 2019

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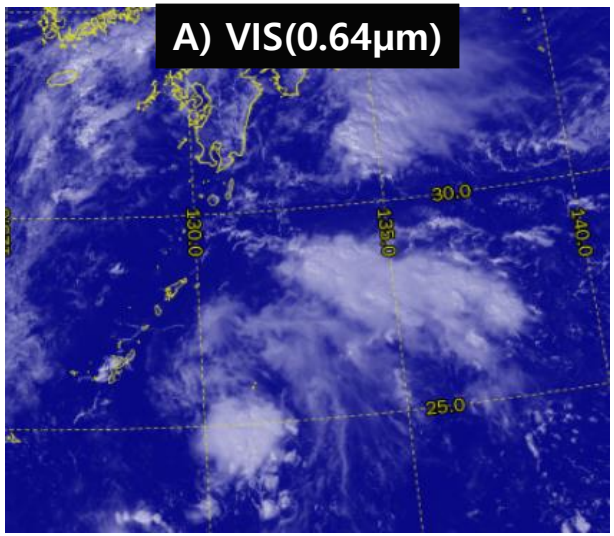
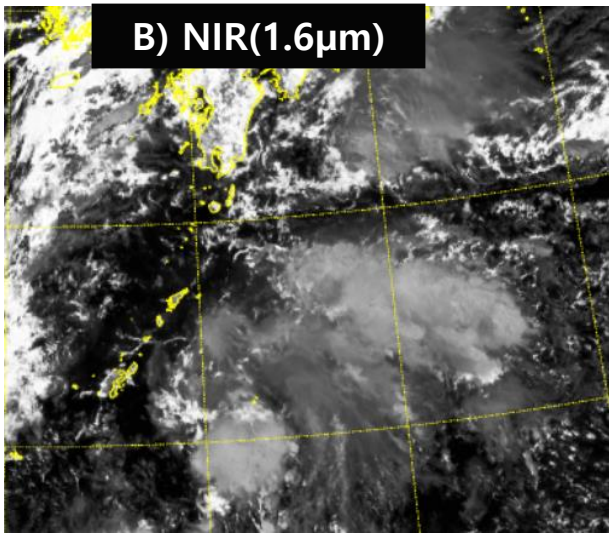
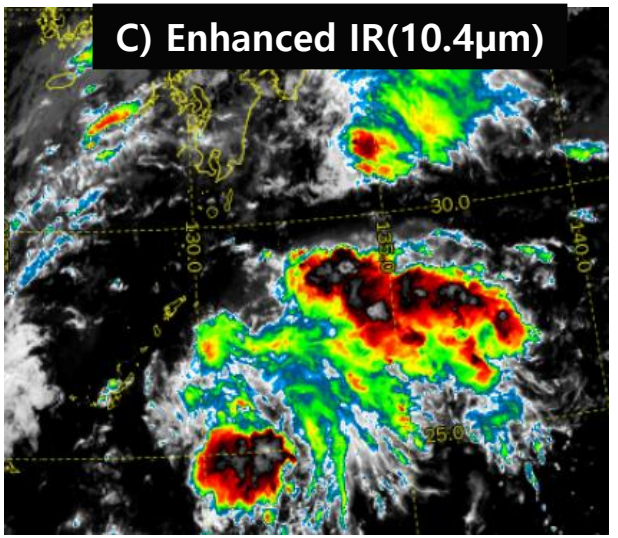
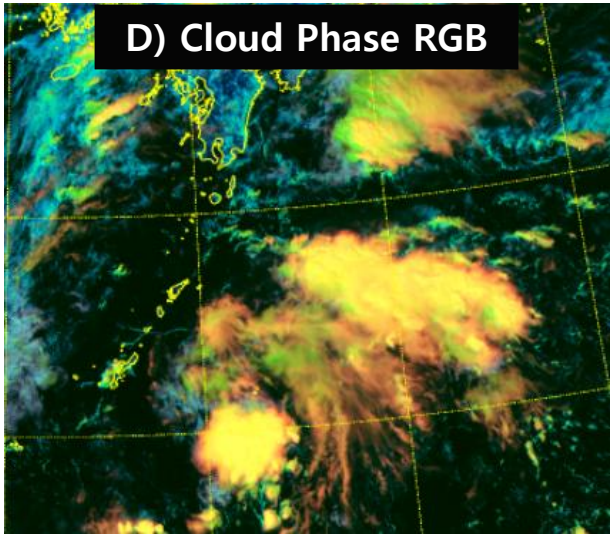
Socrative Question 1 (Choose your favorite 2 answers)

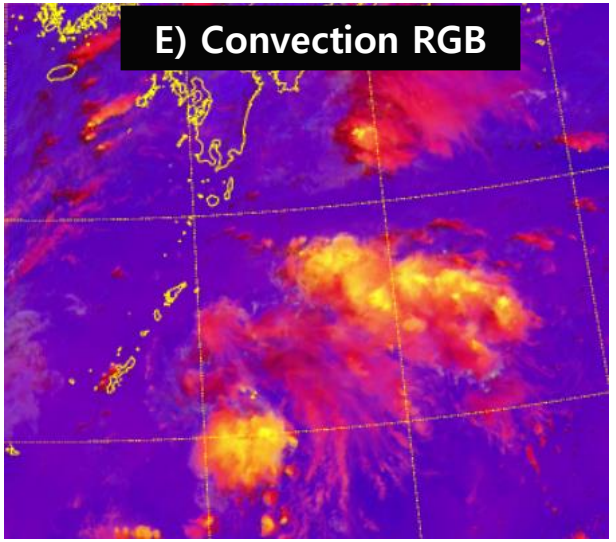
Have you use GEO-KOMPSAT-2A satellite data?

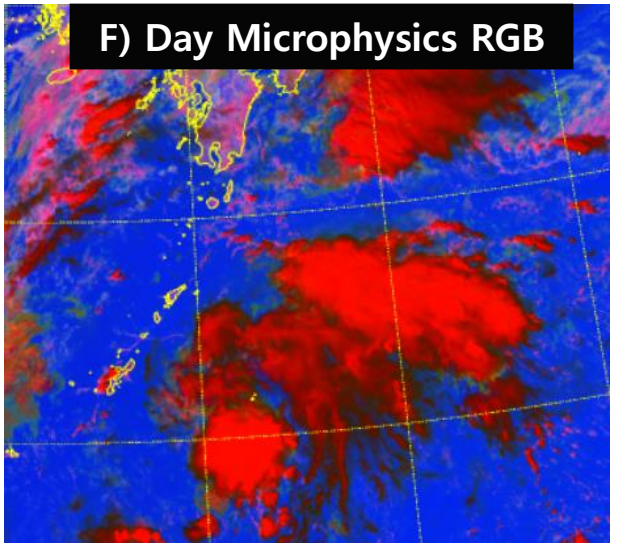






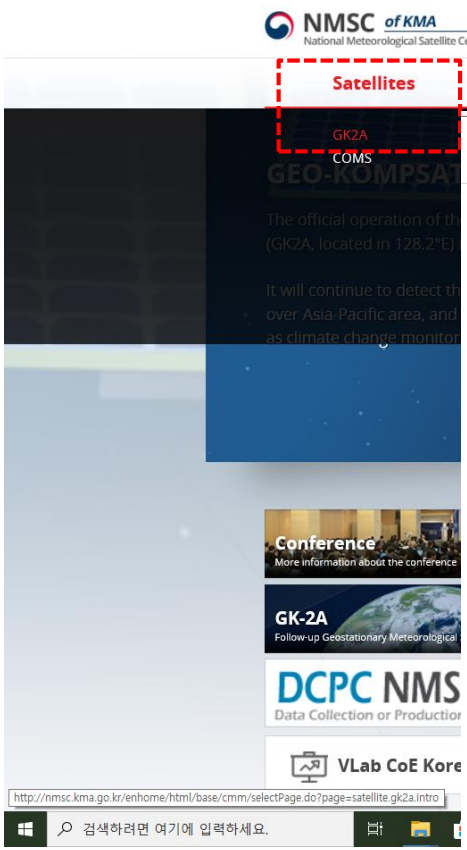


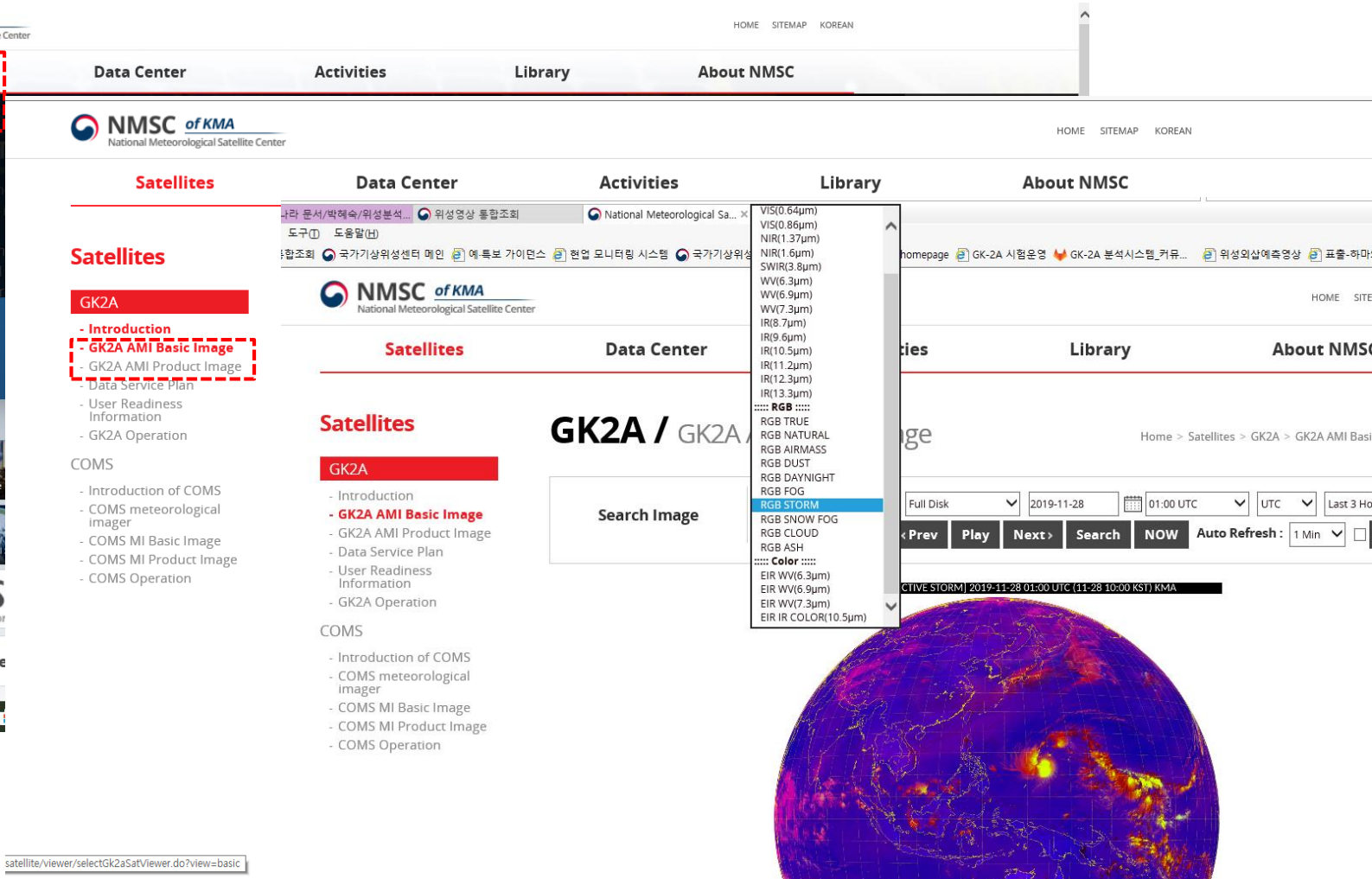




GK2A data services

How to access the GK2A images ? ➔ NMSC website (http://nmsc.kma.go.kr/enhome/html/main/main.do)



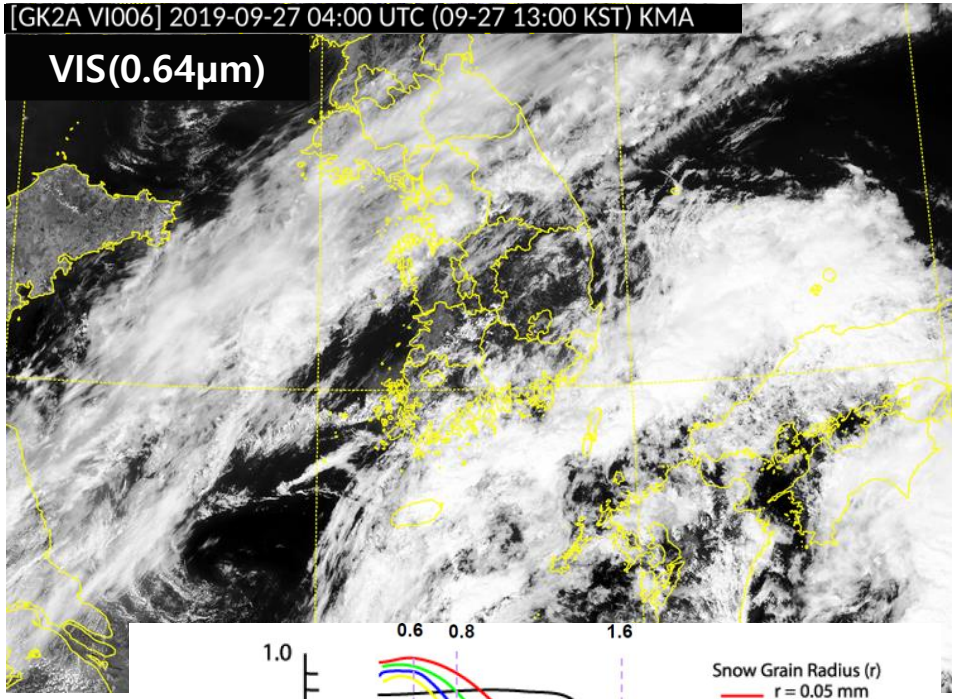


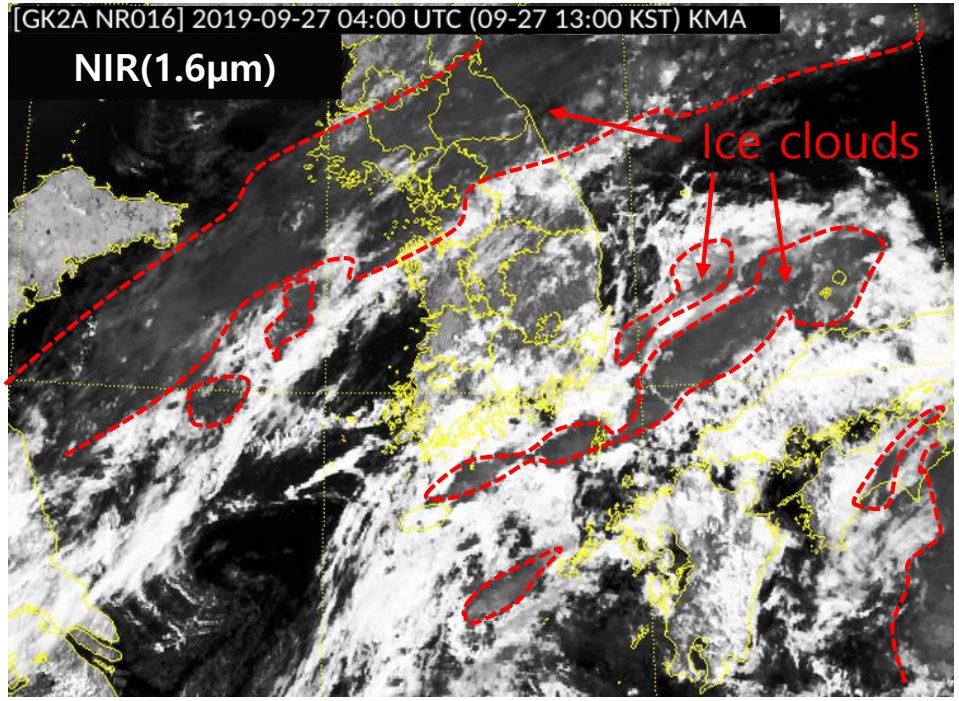
Comparing VIS and NIR single channel image

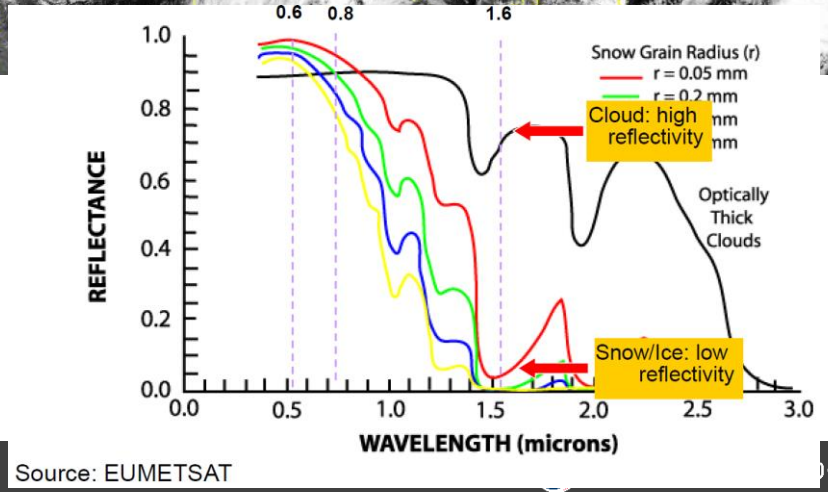
(Animation : 04~06:00UTC, 27 SEP 2010, 2min)

What make the difference between VIS(0.64μm) and NIR (1.6μm) images?

- Different reflectivity of ice/snow and water clouds between VIS and NIR







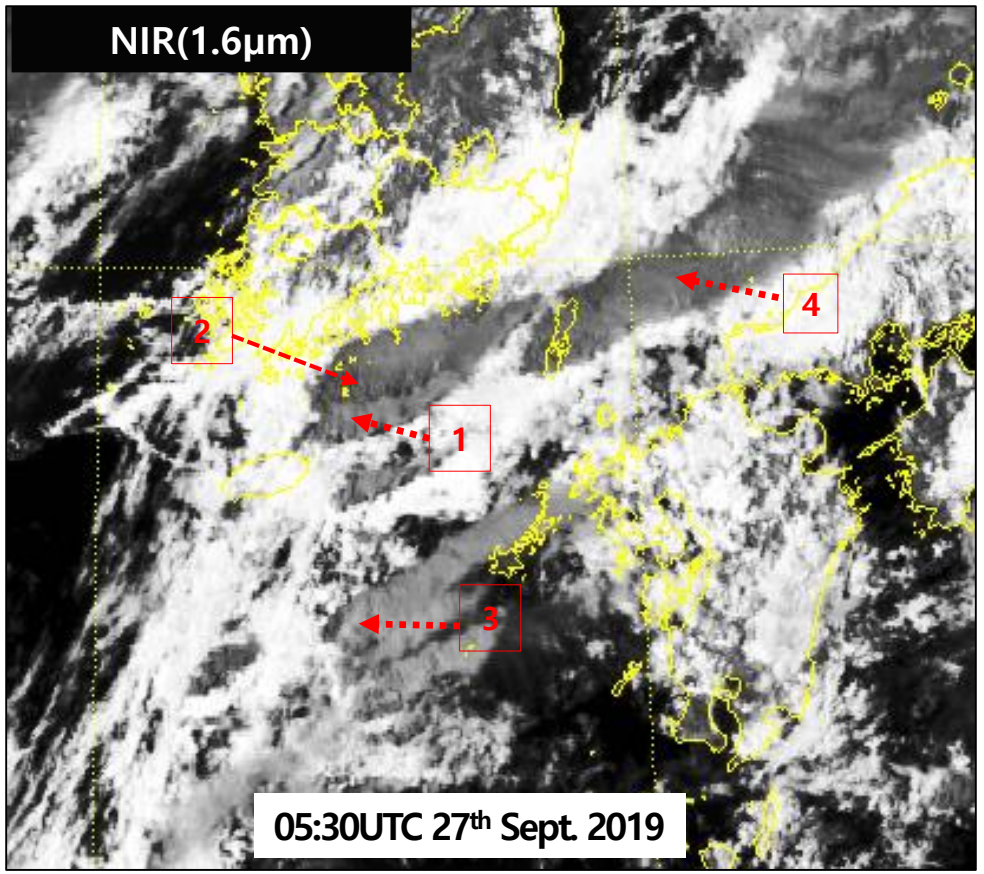
Source: EUMETSAT

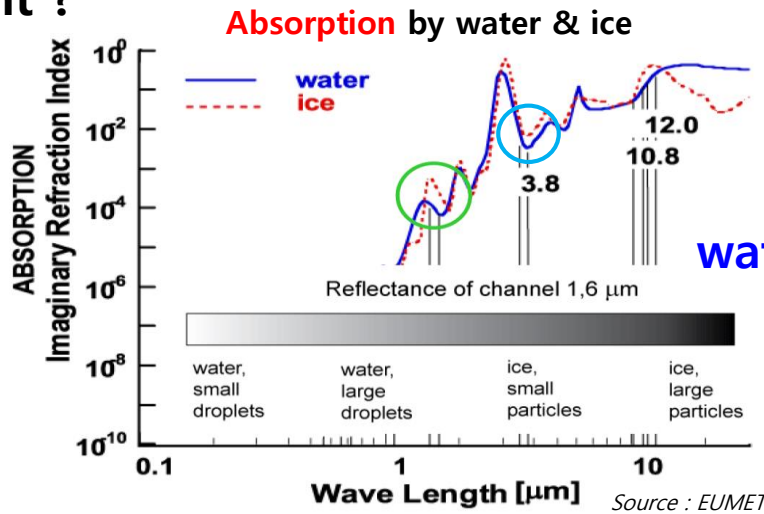
- Stronger absorption by ice than water
- Ice cloud appears darker than water clouds

➔ These properties are exploited in the creation of some RGB images

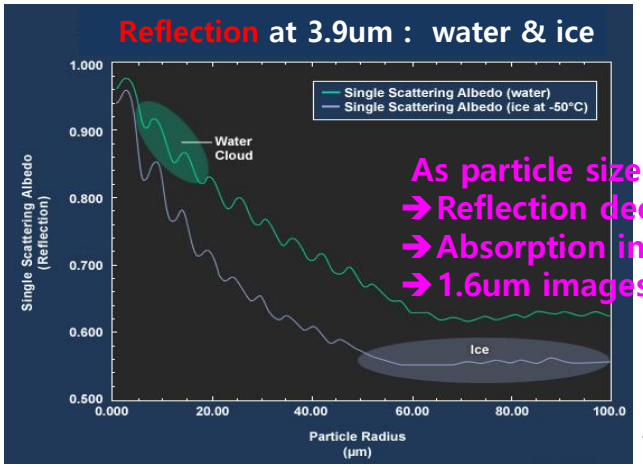
Analysis the microphysics of clouds : particle size

Why the brightness of ice clouds are different ?





Source : EUMETSAT



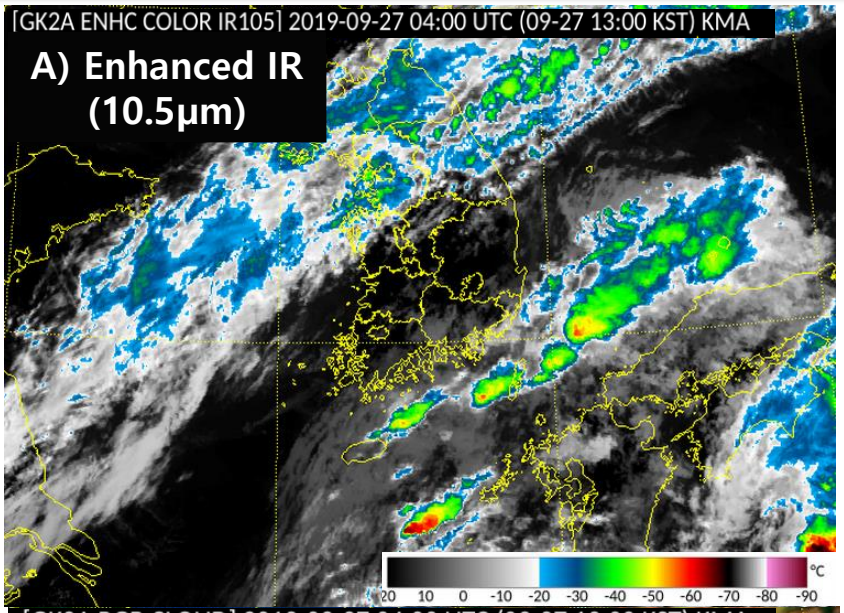
Source : COMET Program

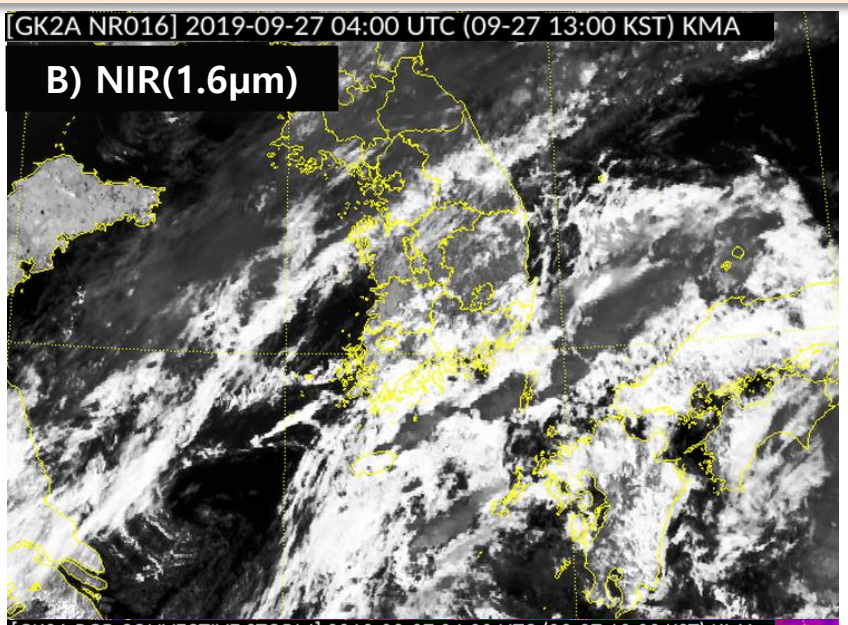
Socrative Question 2. Where is the smallest ice particles present ?

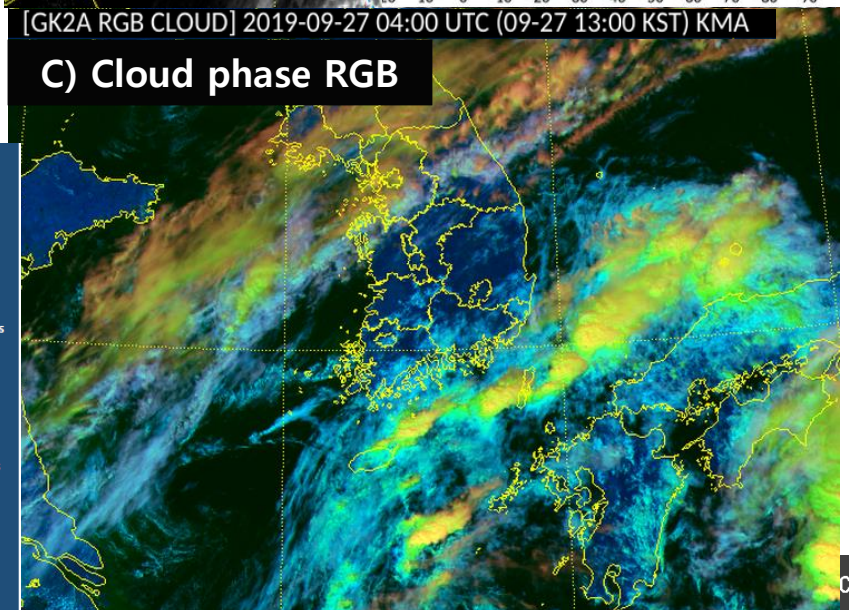
A. 1 **B.** 2 **C.** 3 **D.** 4

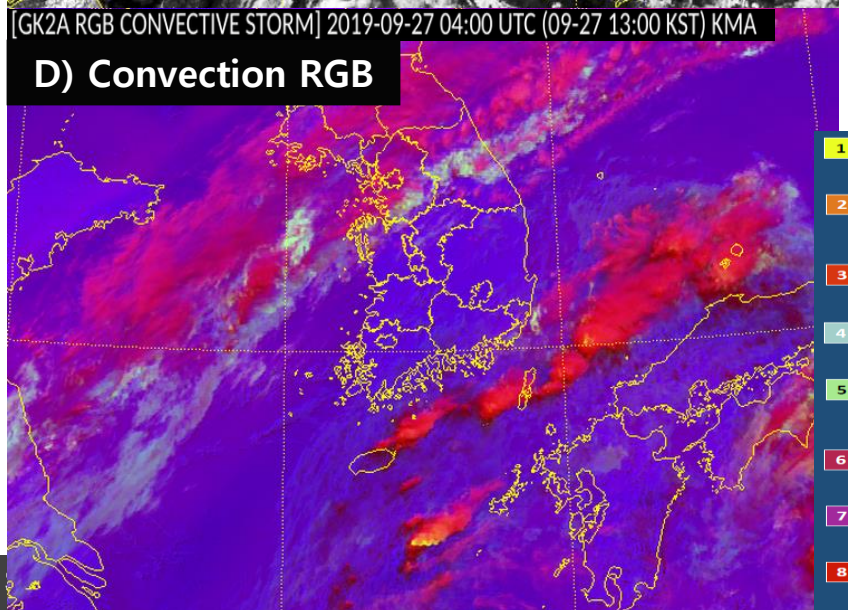
Comparing single channel images with RGB images
(Animation : 04:00~16:00UTC, 27th Sept. 2019, 2min)

Socrative Question 3. Which products give you more microphysical information of clouds?



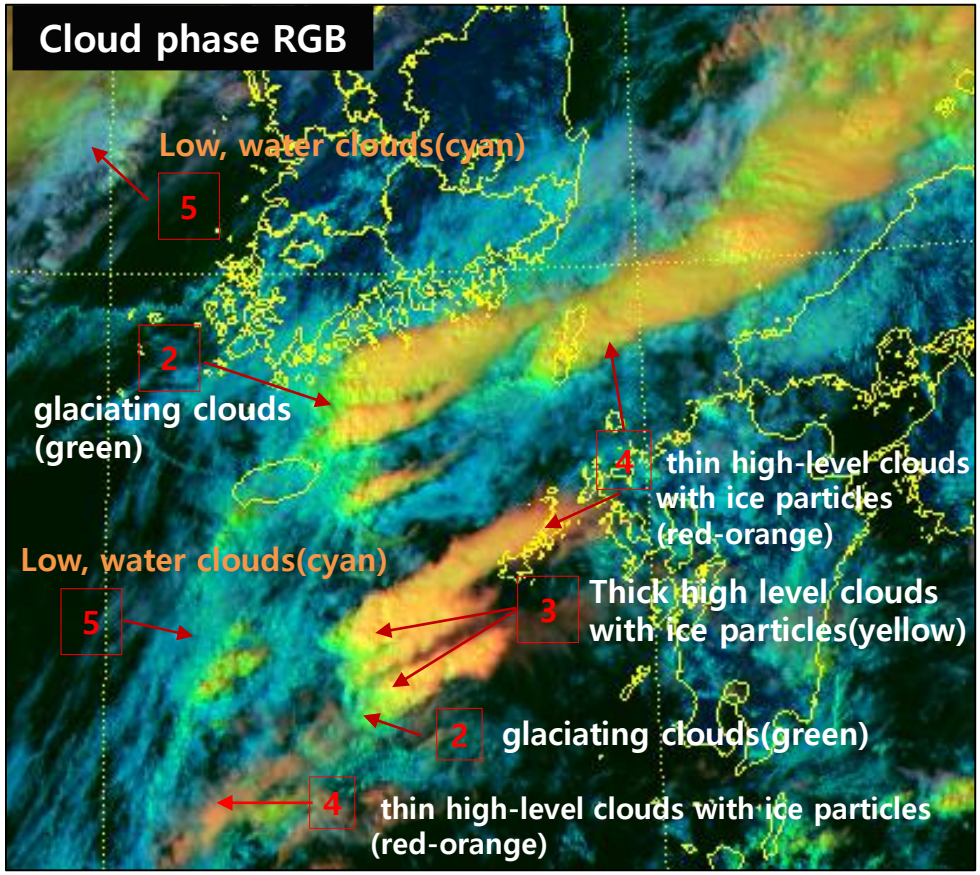


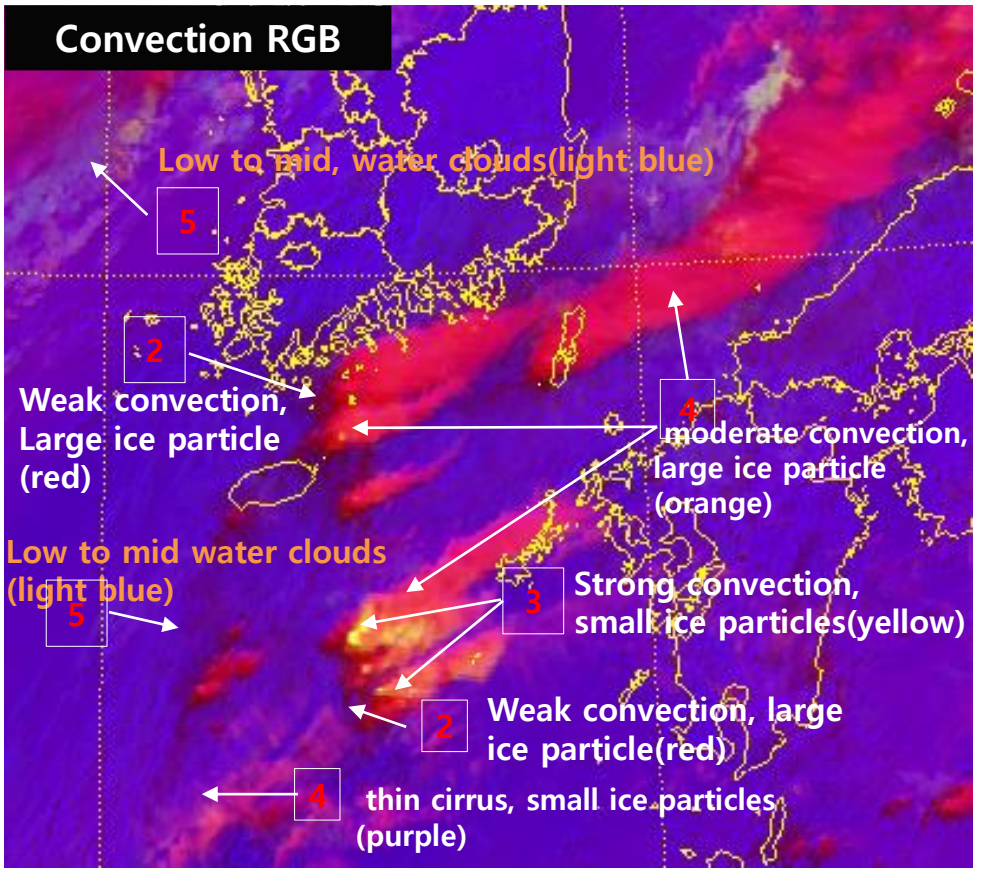




Comparing cloud phase and convection RGB image(04:30UTC, 27 SEP 2019)

- ☞ Cloud phase RGB differentiate water and ice clouds
- ☞ Convection RGB give information of ice/water, small/large particle size and intensity of convection



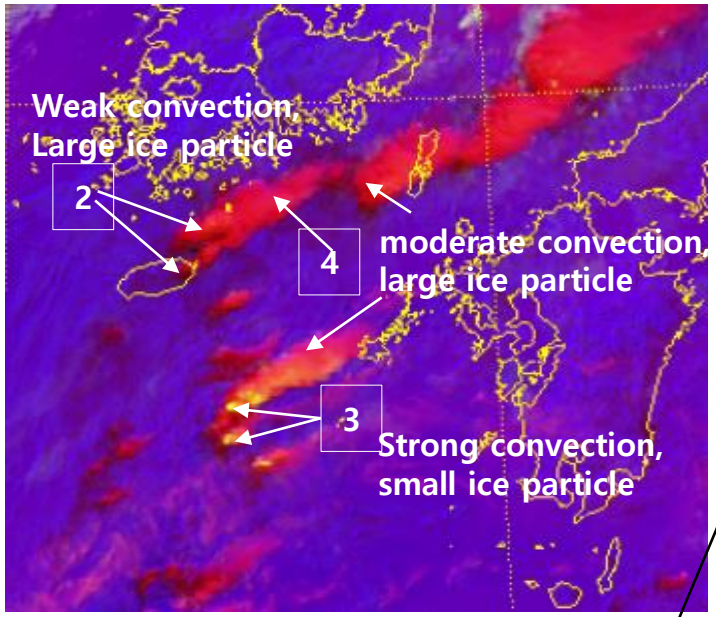


Cloud phase RGB (KMA recipe)	Range	Gamma
IR10.4	216.62 to 280.67	1.0
VIS0.6 REFL	-3.46 to 77.92(%)	1.0
NIR1.6 REFL	1.19 to 59.32(%)	1.0

Day Convection RGB (KMA recipe)	Range	Gamma
WV6.3 - WV7.3 BTD (Normalization)	-8 to 1	0.5
IR3.8 - IR10.4 BTD	-5 to 60	0.3
NIR1.6 - VIS0.6 REFL	-50 to 25(%)	1.0

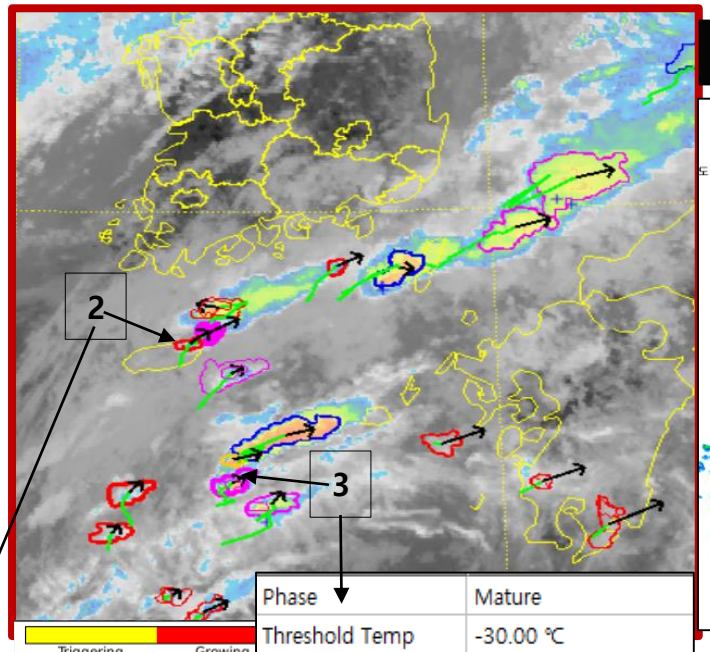
Determine the high impact weather area : Quantitative analysis

Convection RGB

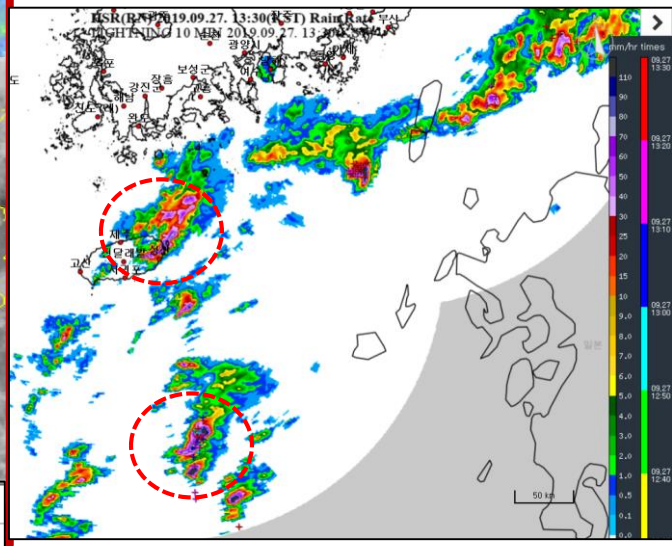


Rapidly developing thunderstorm(RDT)

(04:30UTC, 27 SEP 2019)

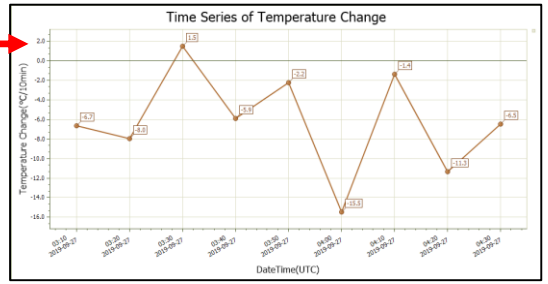


KMA radar rainrate(mm/hr)



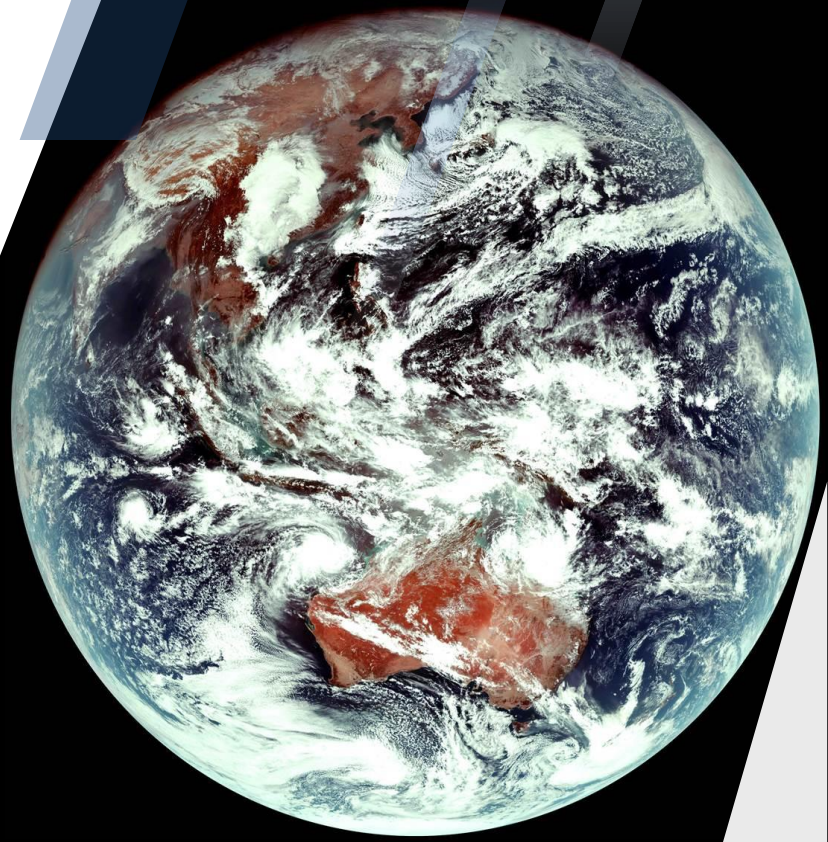
Phase	Growing
Threshold Temp Minimum Temp	-24.00 ℃ -33.40 ℃
Temperature Change	-3.90 ℃/10min
Expansion Rate	5.51%/10mn
Duration	50 mn
Moving	49 / 14.00 m/s

Phase	Mature
Threshold Temp Minimum Temp	-30.00 ℃ -58.40 ℃
Temperature Change	-6.48 ℃/10min
Expansion Rate	0.31%/10mn
Duration	90 mn
Moving	57 / 8.00 m/s
Lightning + Lightning - Lightning IC	0 / 20 mn 2 / 20 mn 1 / 20 mn



☞ **RDT identify, monitor and tracking intense convective clouds based on the training data over the Korean Peninsular using high spatio-temporal resolution satellite data, radar reflectivity, lightening and model stability data .**

Dust storms



The 1st image of GEO-KOMPSAT-
03:10UTC 26th Jan. 2019

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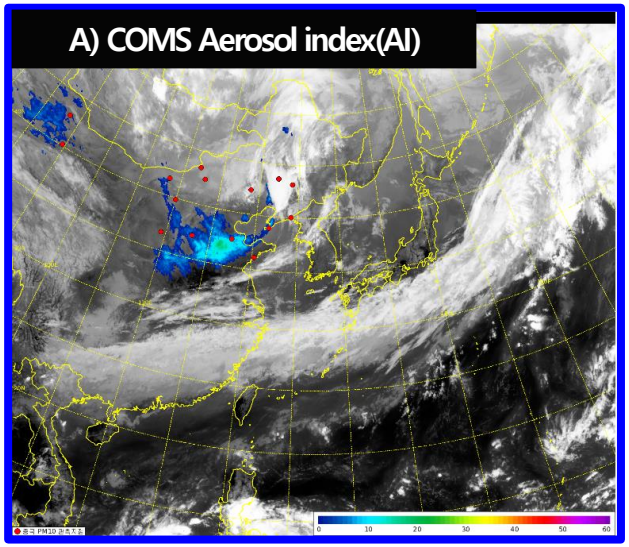
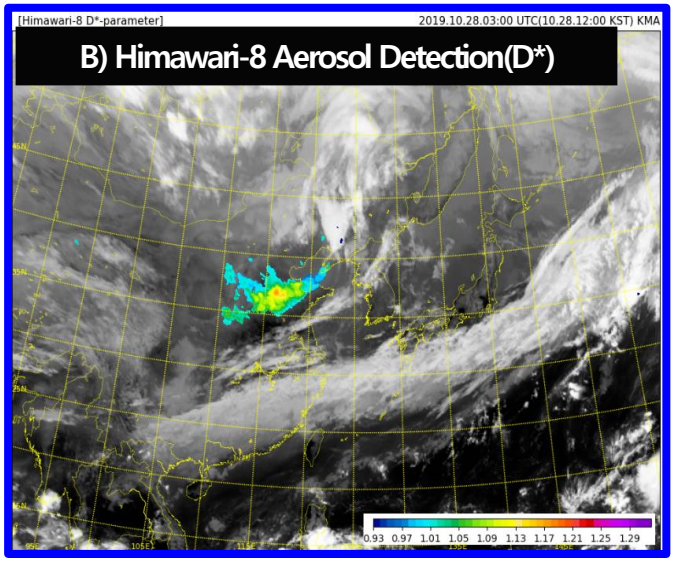
Various GEO products used for dust detection and monitoring

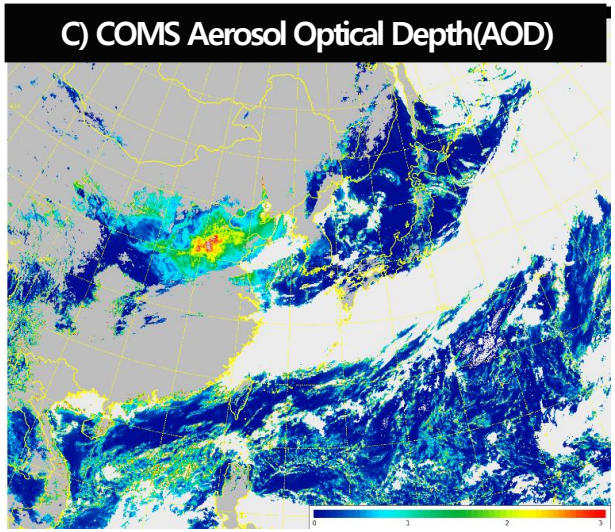
A) COMS Aerosol index(AI)



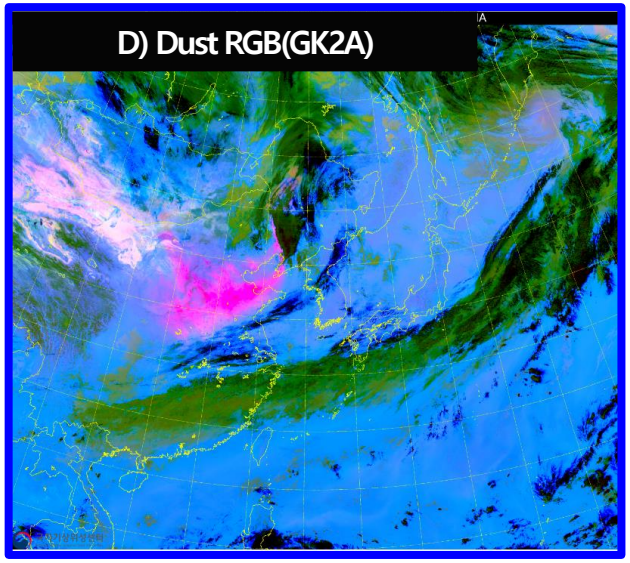
B) Himawari-8 Aerosol Detection(D*)



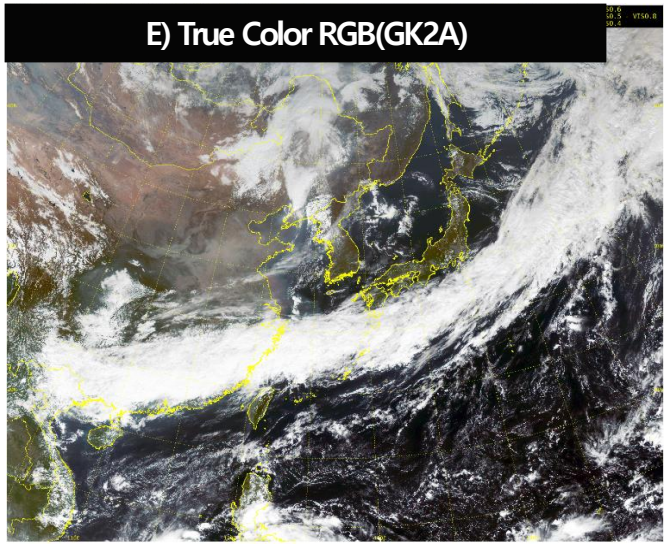
C) COMS Aerosol Optical Depth(AOD)



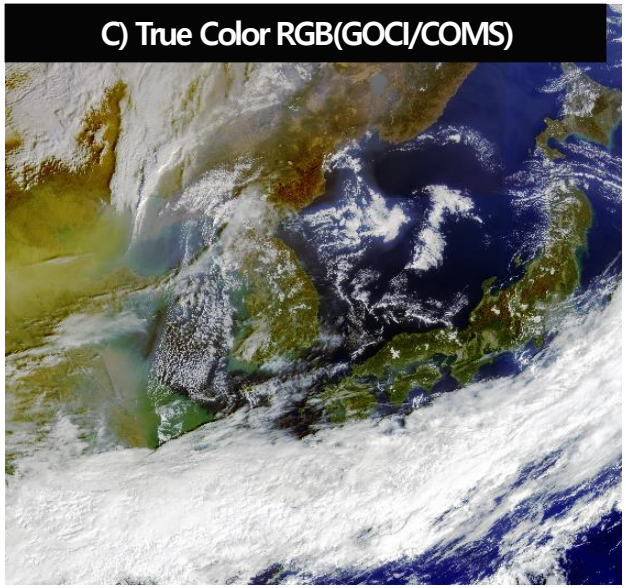
D) Dust RGB(GK2A)



E) True Color RGB(GK2A)

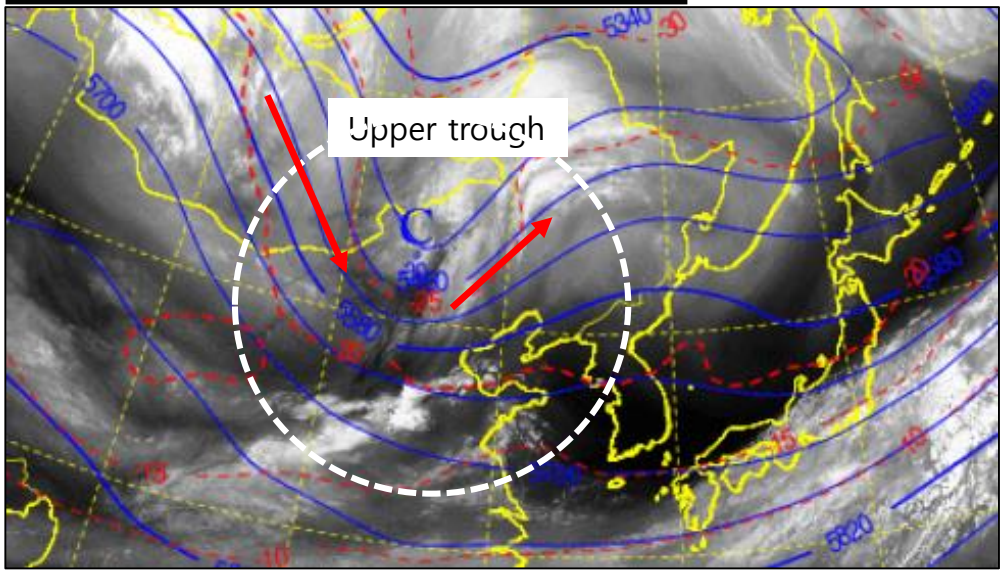


C) True Color RGB(GOCI/COMS)

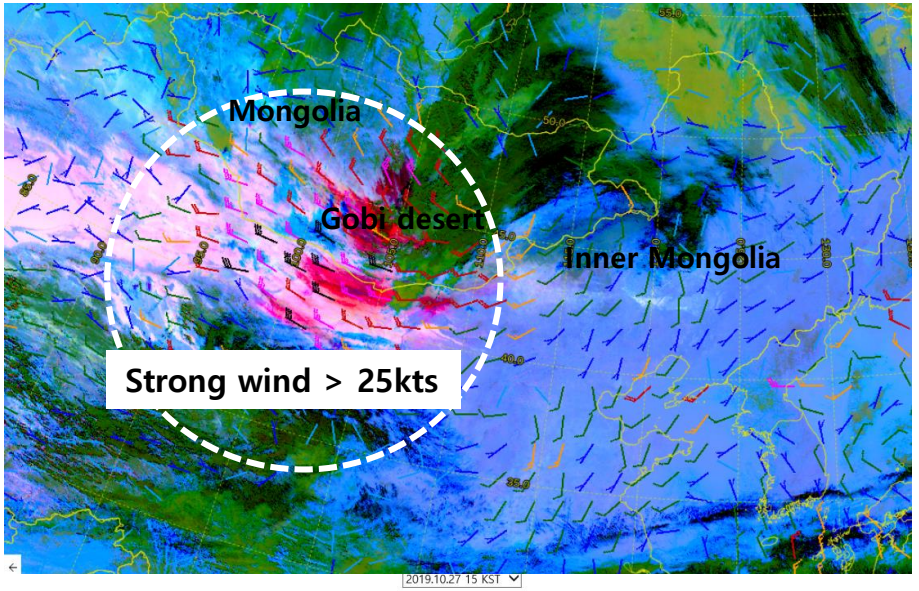


Dust Storm outbreaks (07:00UTC 27th Oct. 2019)

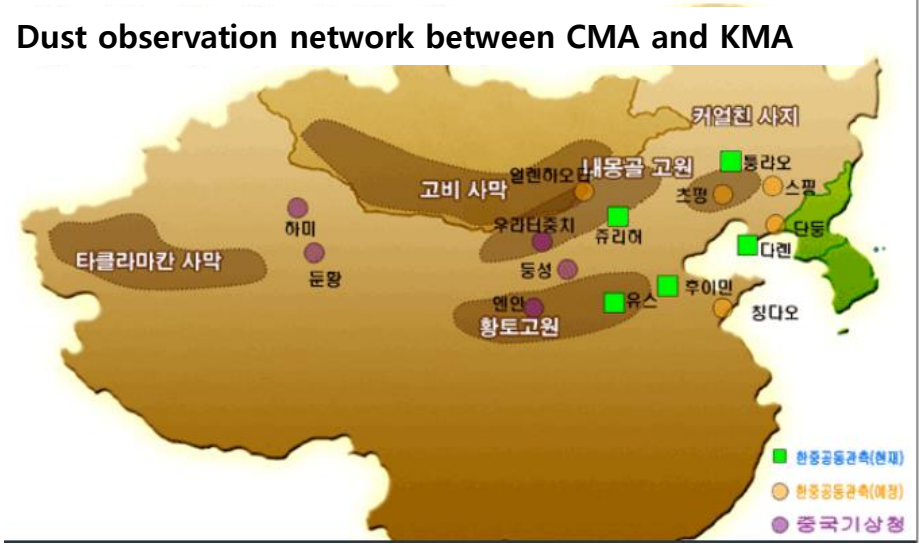
500hPa pressure field(18UTC, 26th Oct. 2019)



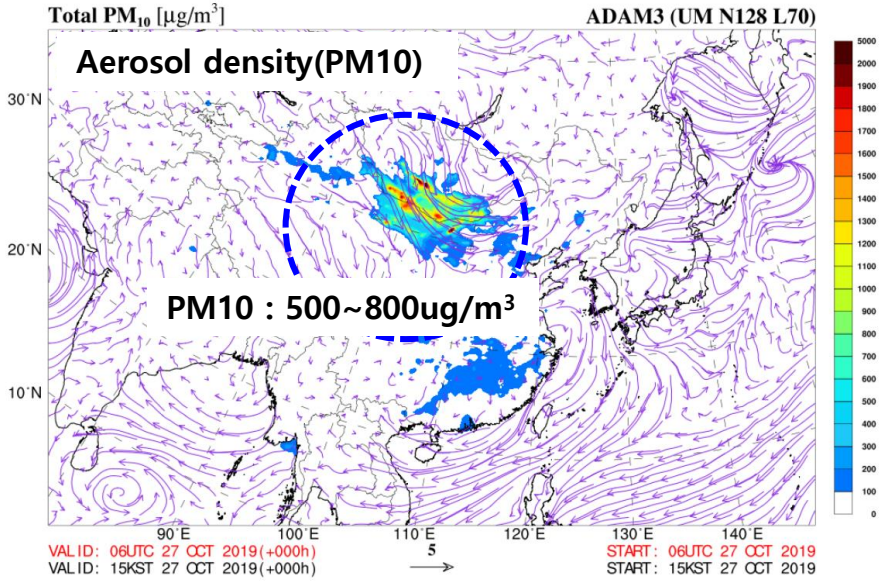
GK2A DUST RGB with wind at 1000hPa(07UTC, 27th Oct. 2019)



Dust observation network between CMA and KMA

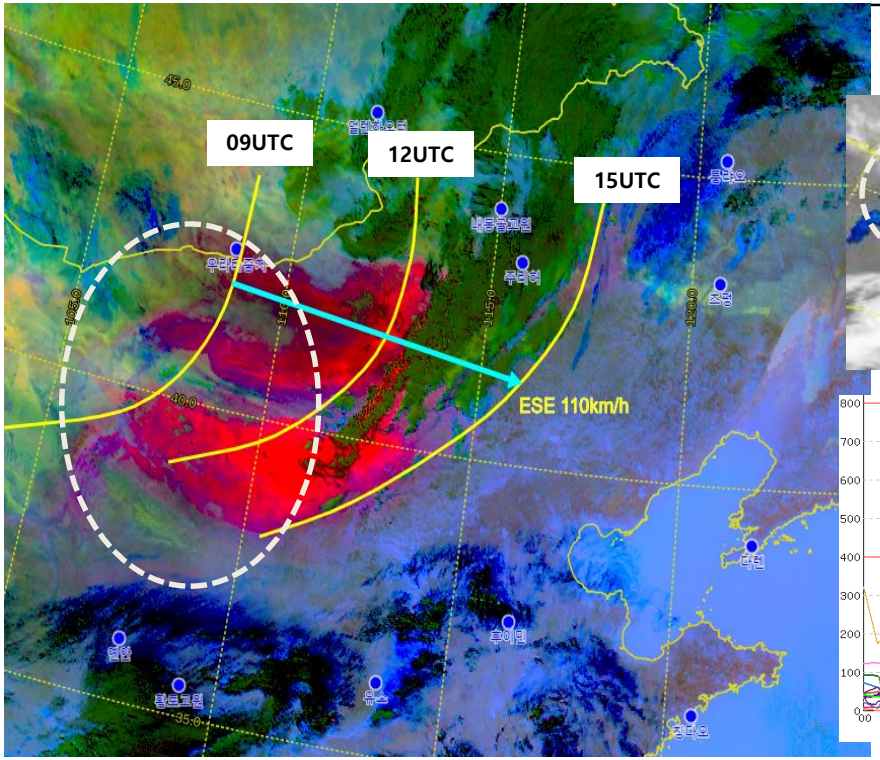


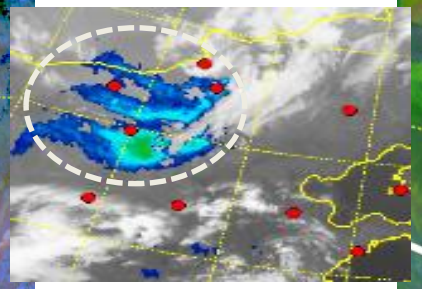
Aerosol density(PM10)

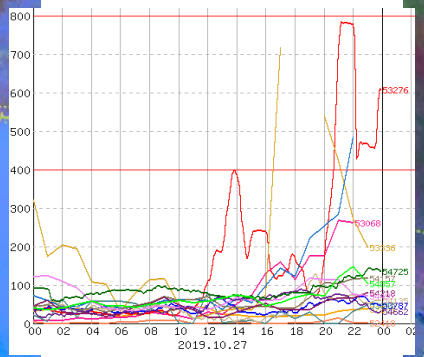


Dust analysis : movement, dispersion

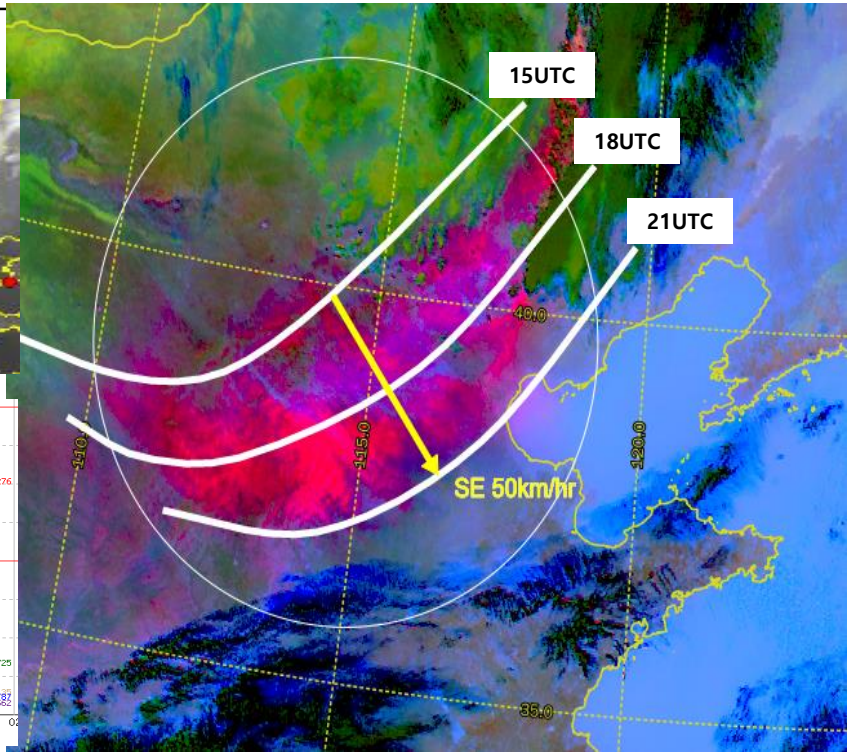
15:00UTC 27th Oct. 2019







21:00 UTC 27th Oct. 2019

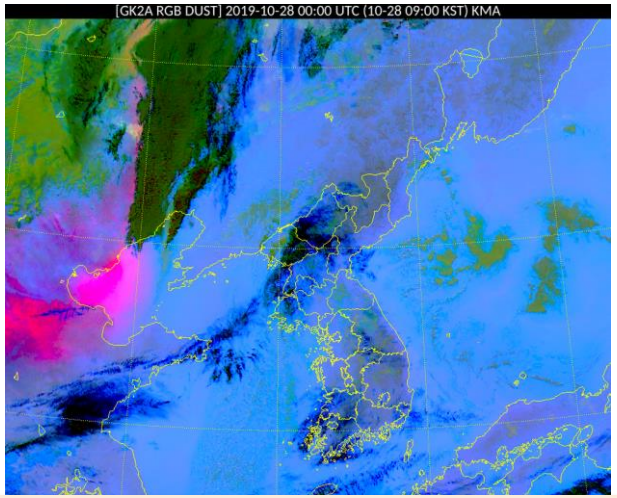


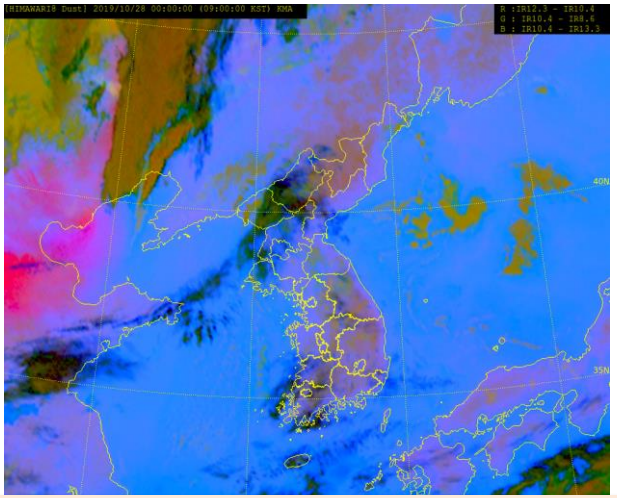
- (15:00UTC) After the outbreak of dust storm at the Gobi deserts, PM10 densities over the north China increased rapidly by 800ug/m^3 and moving ESE direction with 110km/hr.
- (21:00UTC) PM10 density over the inner Mongolia are also steadily increasing and moving speed slowed down as 50km/hr, moving direction changed to SE from ESE

Dust analysis : possibility of influence on our country
(Animation : 09:00UTC 28th ~09:00UTC 29th Oct. 2019)

Socrative Question 4. Which product do you prefer for monitoring dust areas ?

A) DUST RGB (KMA recipe)

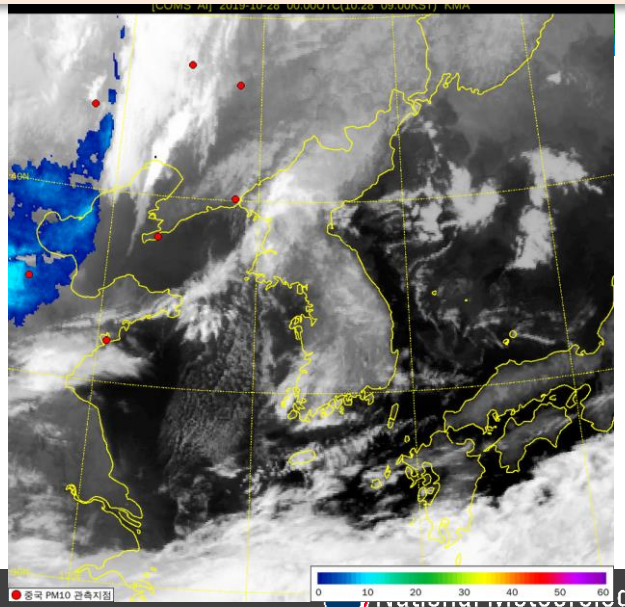


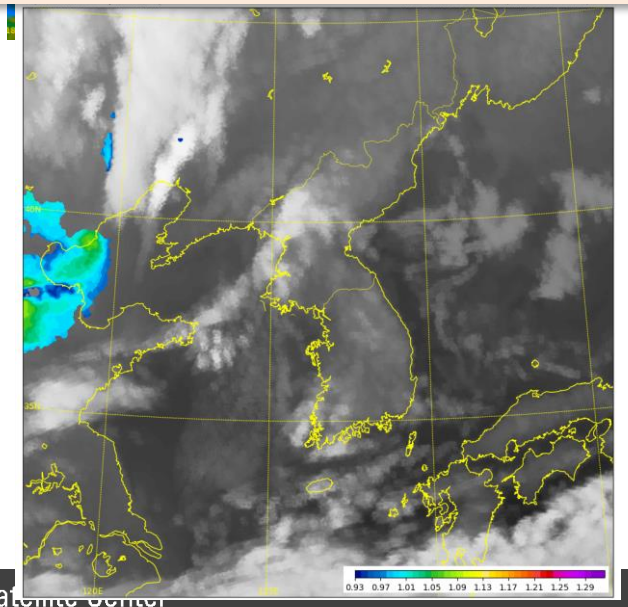


B) Dust RGB (JMA recipe)

Socrative Question 5 : What's the advantage of dust RGB compared to dust products ? (choose all)

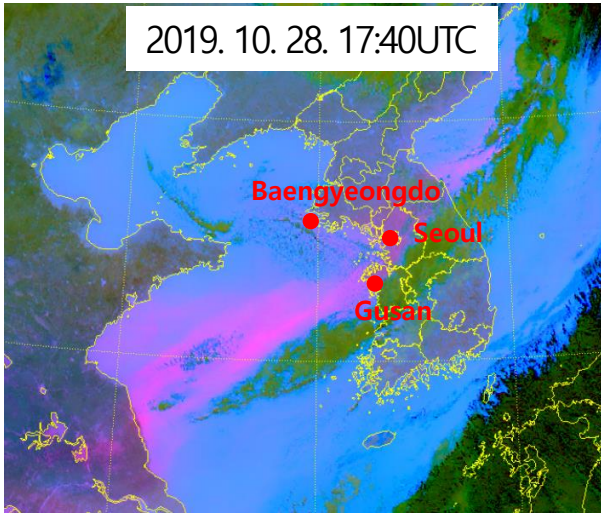
C) COMS Aerosol Index

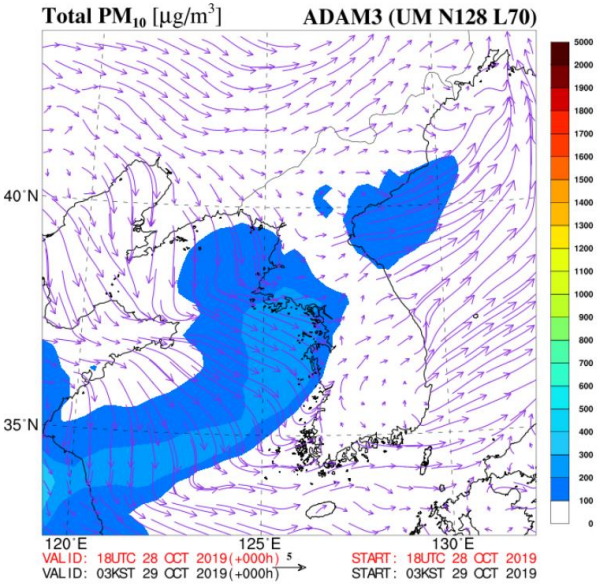


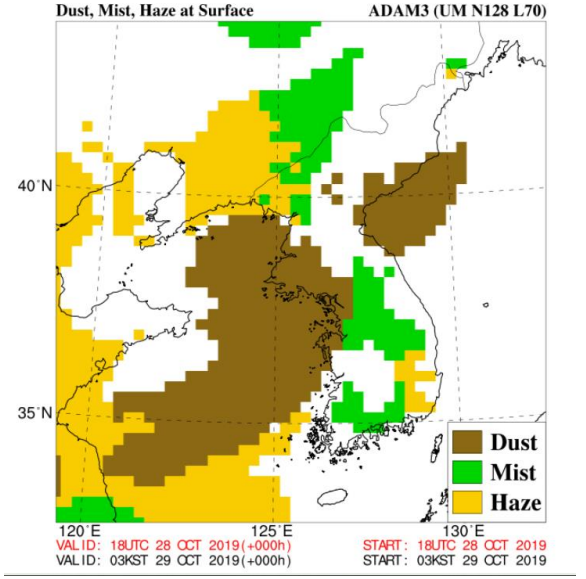


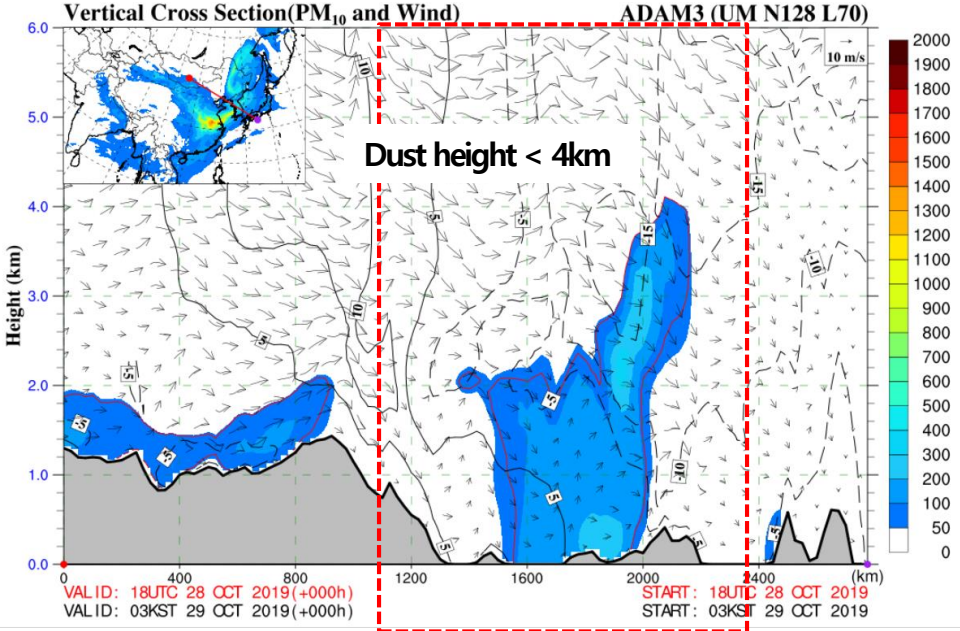
D) Dust Detection(D*)

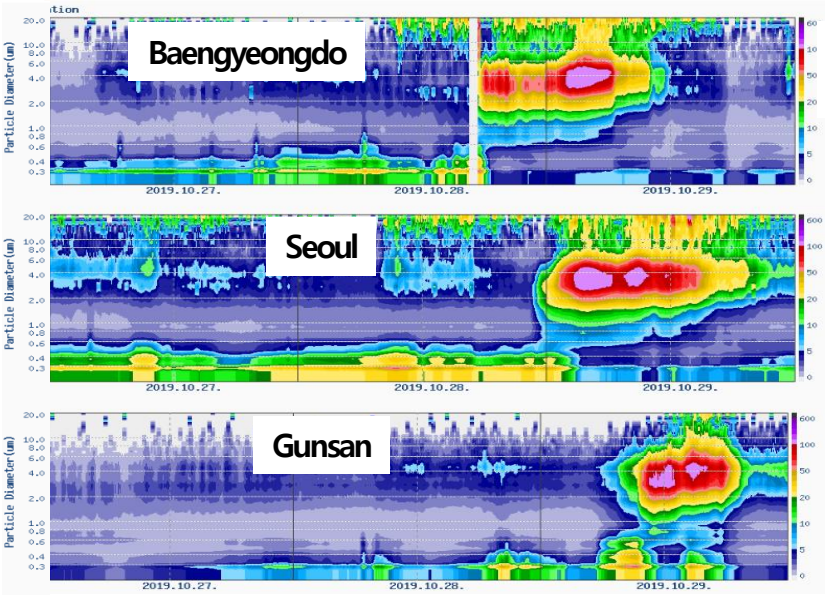
Dust analysis : comparison with model estimation & surface observation









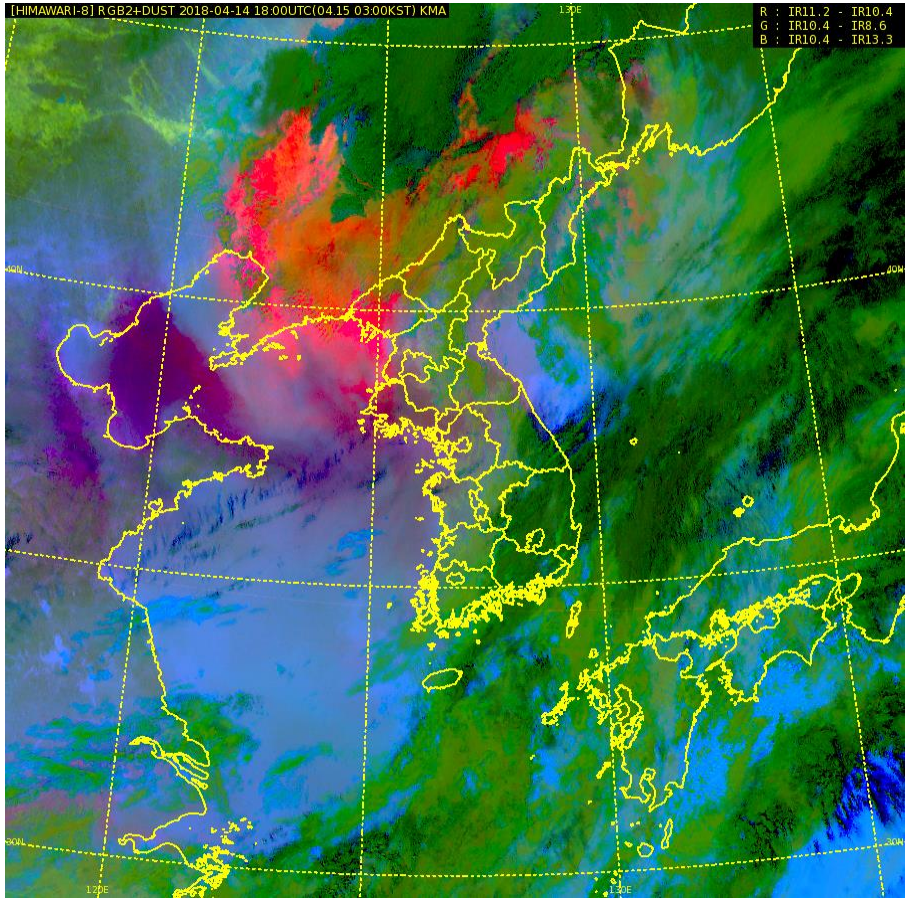


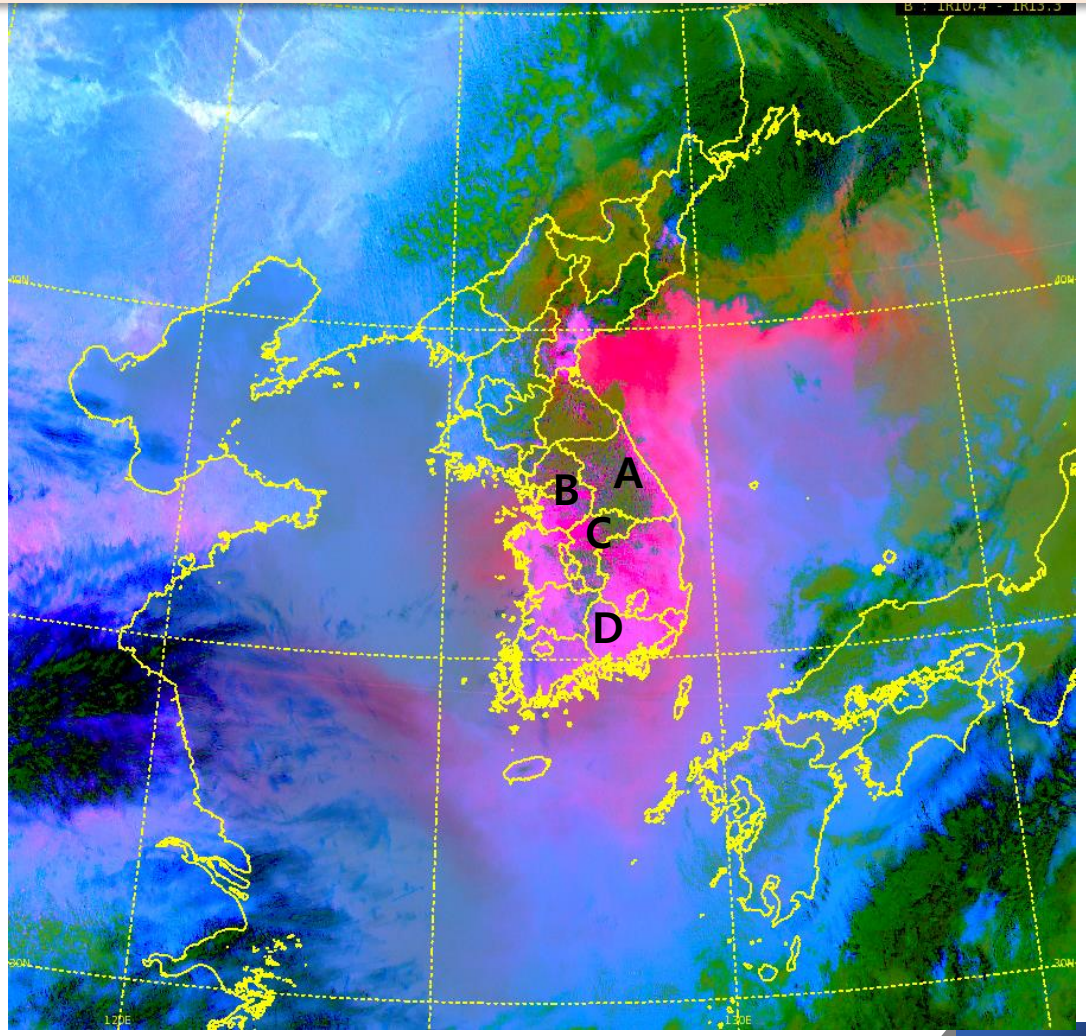
Particle size : 2~4 μm

Dust analysis : comparison with surface observation
(animation : 18:00UTC ~06:00UTC 15th April, 2018)

Socrative Question 6 : Looking at the animation, Where is most likely to be affected by dust on the ground at 06:00UTC 15 April 2018(right image) ?

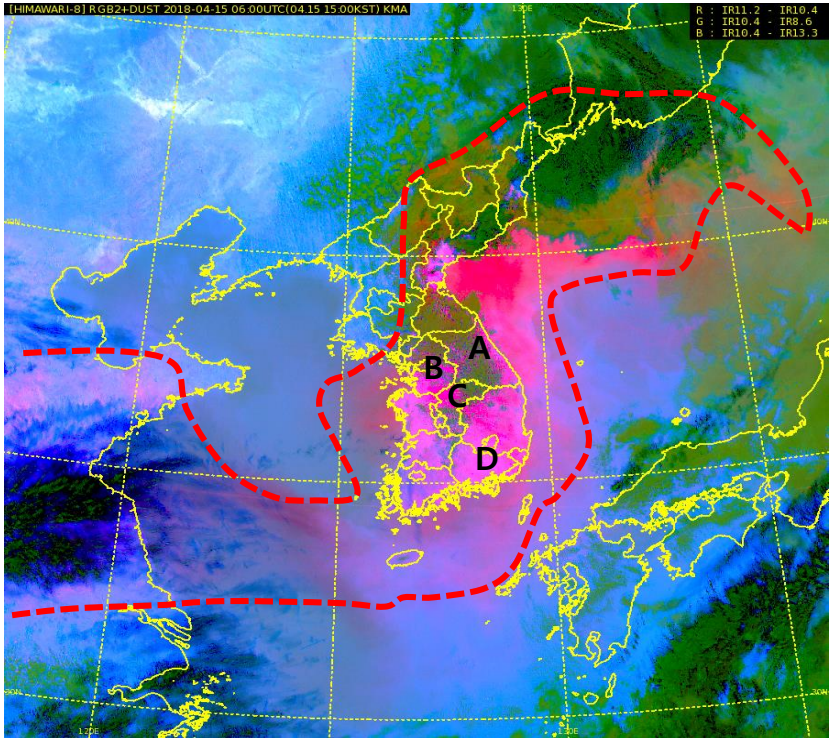
A. Gwangwon-do **B. Capital area** **C. Chungcheong-do** **D. Gyeongsang-do**



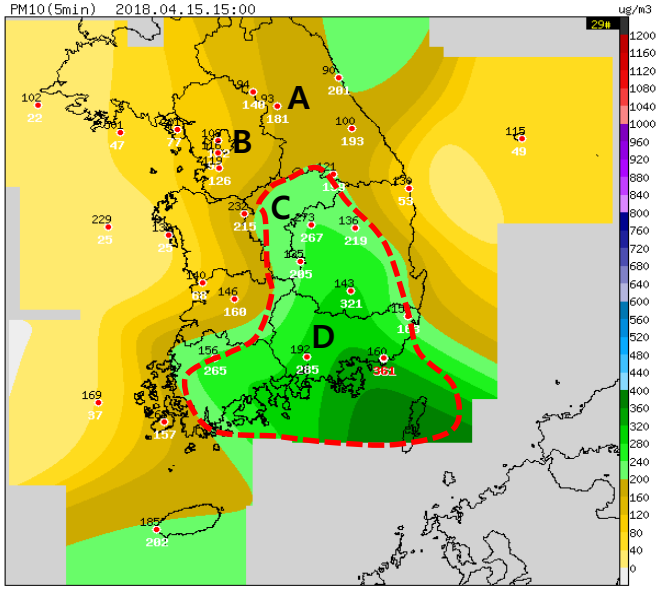


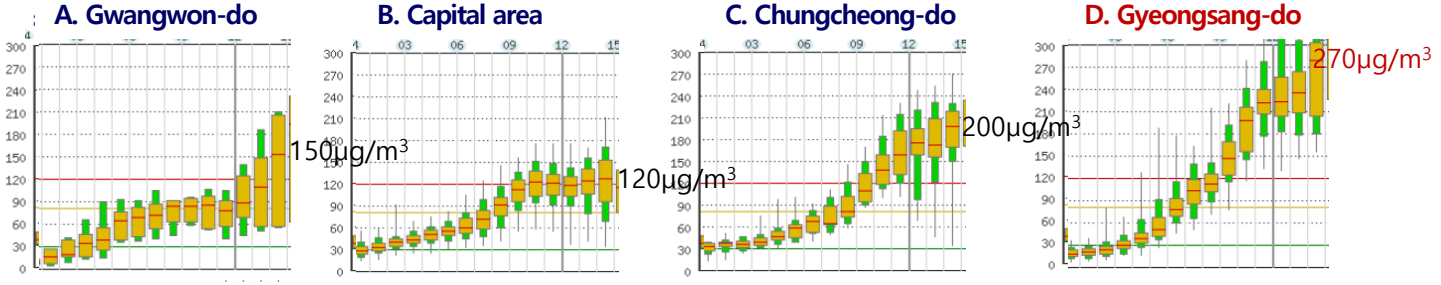
Dust analysis : comparison with surface observation
(Dust event : 06:00UTC 15th April, 2018)

- Dust RGB and products by satellite detect the floating dusts around 3~4km well
- Surface instrument observe the dusts or aerosols density near the surface.



PM10 density on the ground



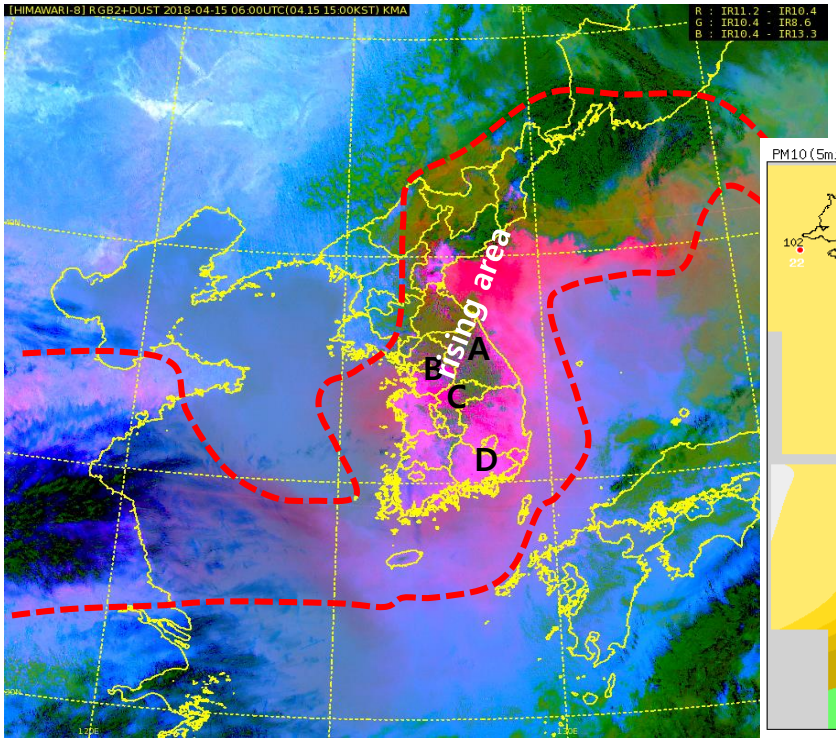


Time series of 1hr average PM10 density over the Korean Peninsula(15th April 2018)

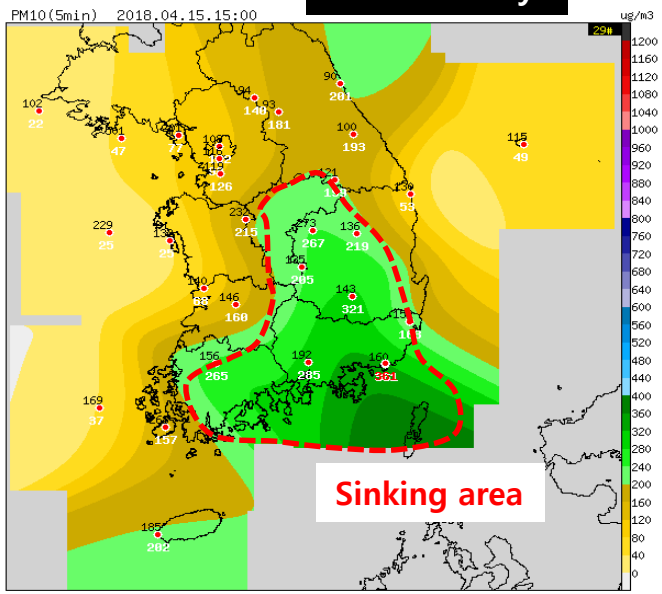
Dust analysis : comparison with surface observation
(Dust event : 06:00UTC 15th April, 2018)

What make different distribution of dust areas between satellite and surface observation

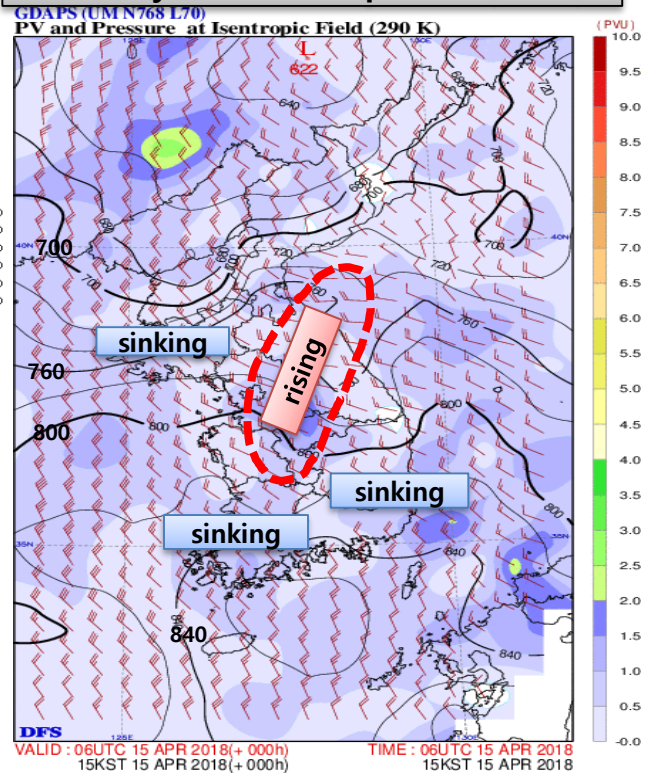
- ➔ **Mainly depend on the vertical motion and density of floating dusts**
- ➔ **Satellite detect floating dusts at the rising motion area, while surface instrument observes dusts concentrated on the ground**
- ➔ **Therefore, forecasters should consider vertical motion by referring to the satellite detection when forecasting dust affected areas on the grounds.**



PM10 density



PV analysis at isentropic field(290K)



Summary of the Session

- Discussed useful GK2A spectral band and products for monitoring, detection, analysis of convection clouds
  - Introduced various RGB and spectral images to monitor convective clouds
  - How to analyse the microphysical properties of convective clouds using RGB and products of GK2A

- Examined the Dust RGBs to forecast dust affected areas
  - Detection of dust areas using dust RGBs and products from GK2A
  - Comparing different observation data : satellite & surface instrument
  - Introduce how to forecast dust affected areas on the ground

THANK YOU!!