

# Current status of Geo-KOMPSAT-2A Cloud Detection Algorithm in NMSC/KMA

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# Algorithm Overview

## ❖ Product

- > Discriminate cloudy pixels from clear ones
- > 3 Categories  
( 0 : Cloud, 1 : Probably cloud, 2 : Clear )
- > Intermediate products (17 Tests)

## ❖ Data

- > Proxy : Himawari-8/AHI
- > Ancillary :
  - Surface emissivity
  - Clear sky reflectance (VIS, 15-days composite)
  - Simulated TBB (IR, from RTTOV 12.1)
  - Land/Sea mask, Angles ...

Num.	Central wavelength ( $\mu\text{m}$ )	AMI					
		Day		Twilight/Dawn		Night	
		Land	Sea	Land	Sea	Land	Sea
1	0.47 (1km)						
2	0.51 (1km)						
3	0.64 (0.5km)	●					
4	0.86 (1km)		●				
5	1.38 (2km)	●	●				
6	1.61 (2km)		●				
7	3.83 (2km)					●	●
8	6.24 (2km)	●	●	●	●	●	●
9	6.95 (2km)						
10	7.34 (2km)	●	●	●	●	●	●
11	8.59 (2km)	●	●	●	●	●	●
12	9.63 (2km)						
13	10.35 (2km)	●	●	●	●	●	●
14	11.21 (2km)						
15	12.36 (2km)						●
16	13.31 (2km)	●	●	●	●	●	●

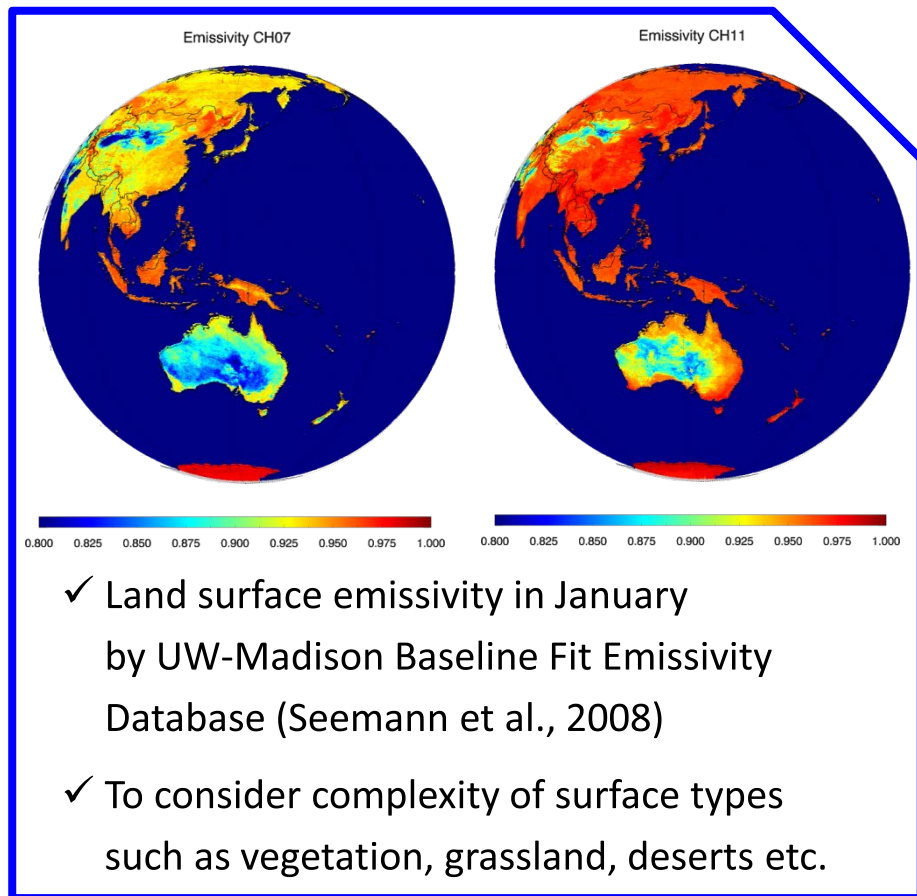
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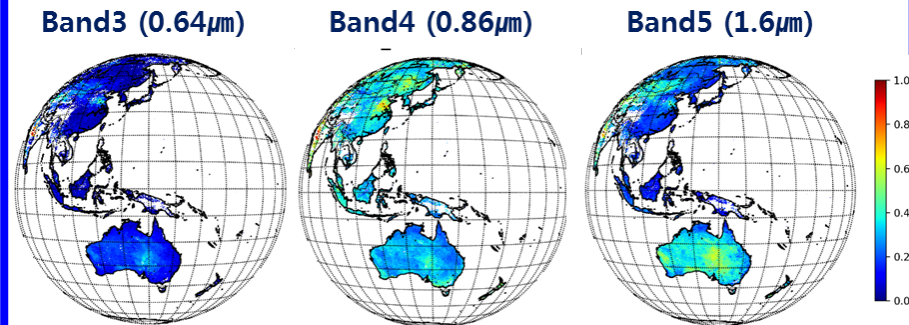
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- ✓ Background surface reflectance
- ✓ Find the minimum reflectivity of the previous 15 days ← simulated reflectivity has large uncertainty



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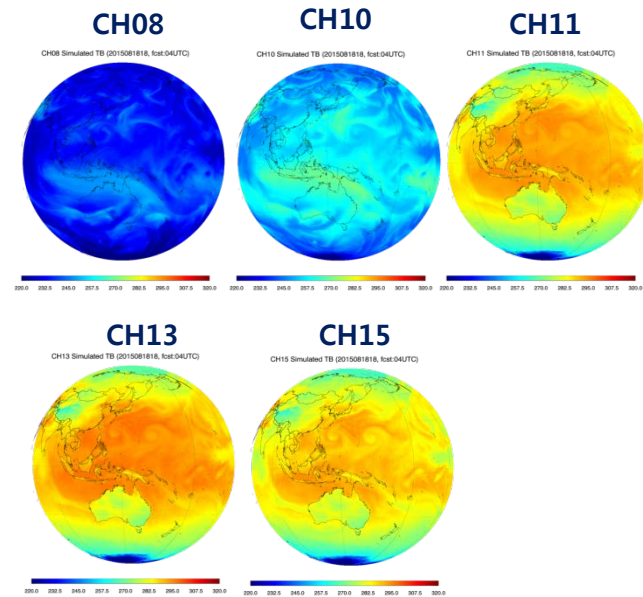
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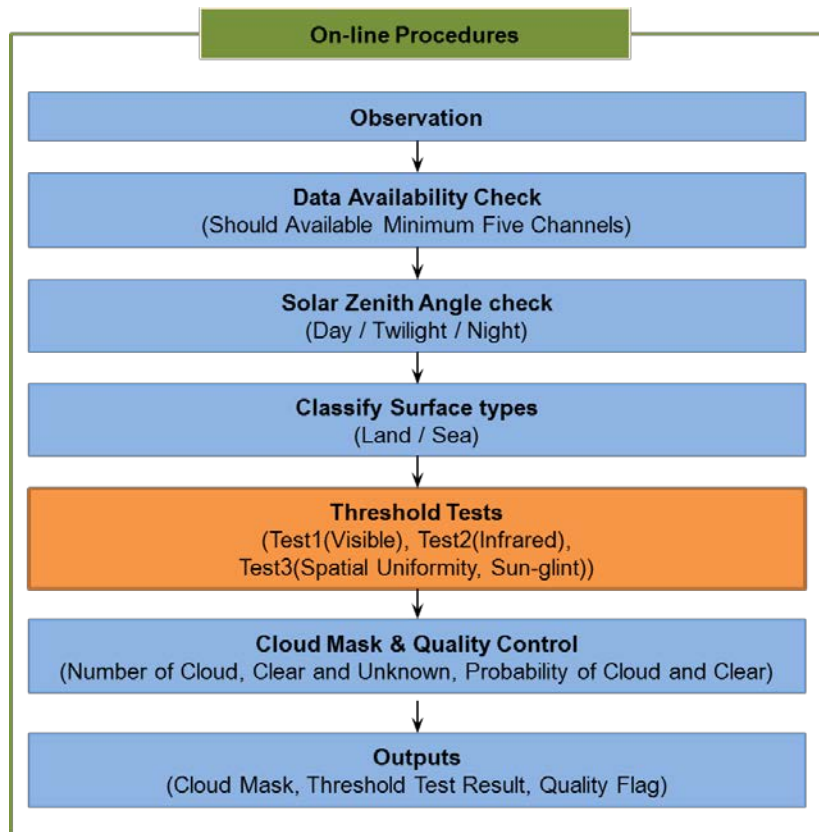
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  - Surface emissivity
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## ✓ Background brightness temperature



- ✓ Understanding of model performance
  - : limitation to reflect the influence of land type, topography, satellite viewing angles etc.

## ❖ Method



### Multi-spectral Threshold Test

#### ■ Single Channel Tests

- Ref 0.6 (0.8)
- Ref 1.6
- $BTD (10.4_{obs} - 10.4_{simu})$

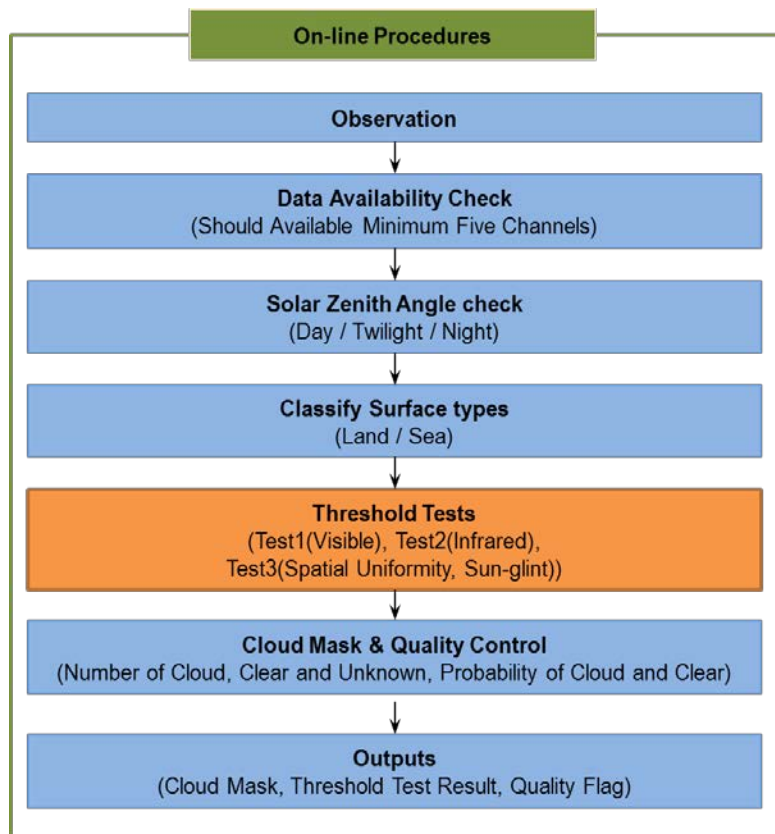
→ Most thick clouds with high accuracy

→ Partially cloudy pixel

→ Sun-glint, snow, desert region...

# Algorithm Overview

## ❖ Method



## Multi-spectral Threshold Test

### ■ Dual Channel Tests

- Ratio 0.8/0.6 : sea
- BTD (10.4 – 3.9) : low-level (at night)
- BTD (10.4 – 6.2) : middle-level
- BTD (10.4 – 7.3) : middle-level
- BTD (10.4 – 8.6) : high-level
- BTD (10.4 – 12.3) : high-level
- BTD (10.4 – 13.3) : high-level
- BTD (8.6 – 7.3) : low-level

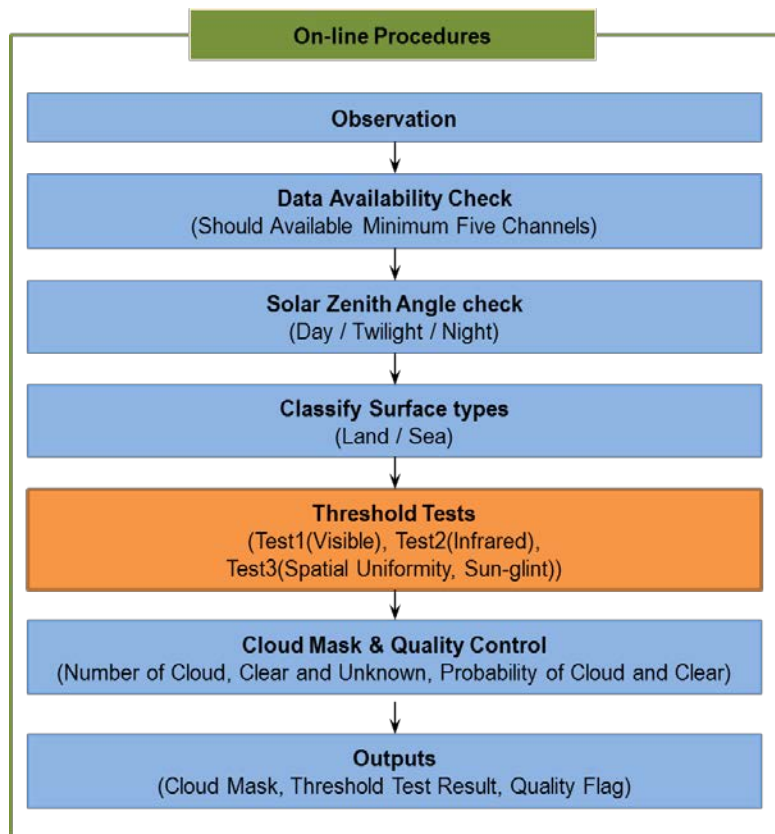
→ Cloud particles, cloud height and thickness

→ Surface emissivity, Simulated TBB



# Algorithm Overview

## ❖ Method



## Multi-spectral Threshold Test

### ▪ Spatial Uniformity Tests

- STD 0.6 (land)
- STD 0.8 (ocean)
- STD 10.4
- STD 12.3

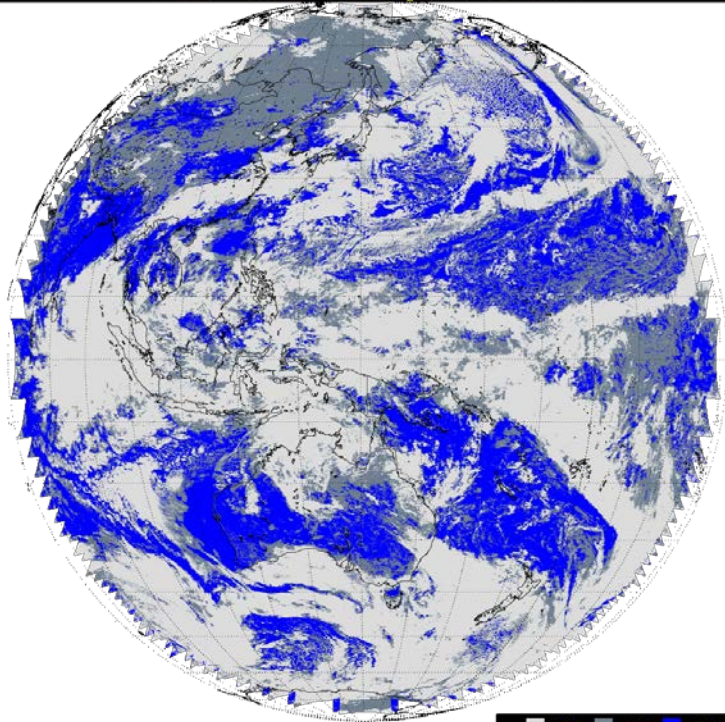
→ Cloud edge detection

→ Fractional clouds



## ❖ Outputs

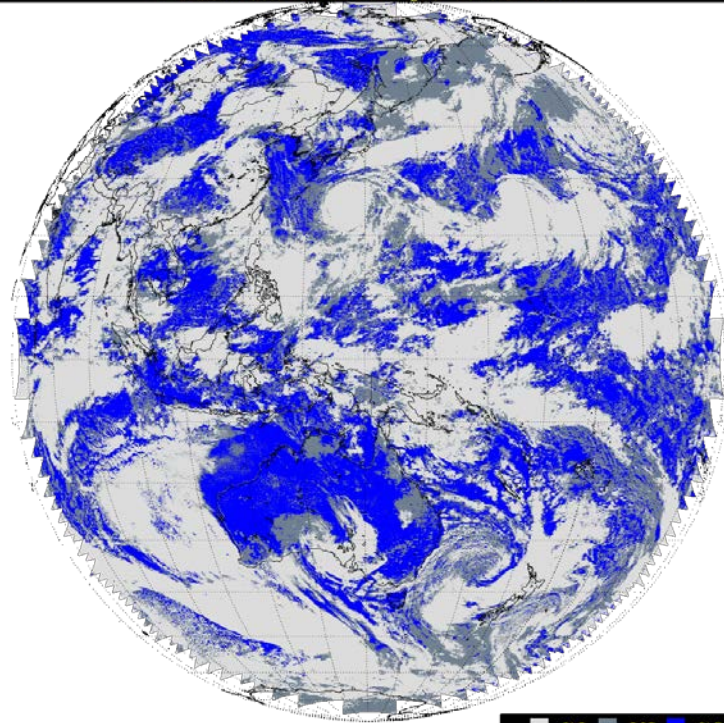
Himawari8 AHI Cloud Mask from GK-2A Algorithm 20170102 00:00 UTC



■ CLD ■ PCD ■ CLR

2017.01.02. 00 ~ 23 UTC

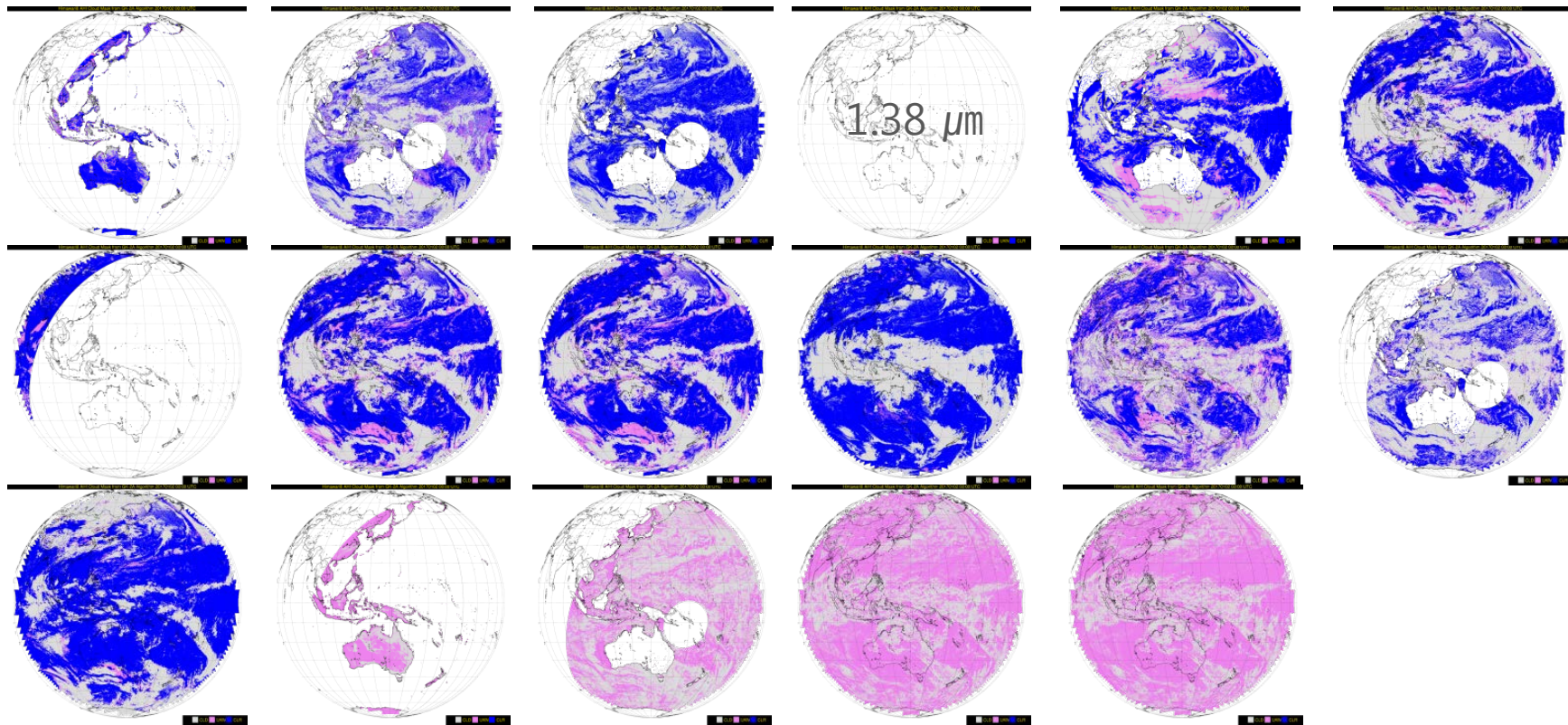
Himawari8 AHI Cloud Mask from GK-2A Algorithm 20170802 00:00 UTC



■ CLD ■ PCD ■ CLR

2017.08.02. 00 ~ 23 UTC

## ❖ Intermediate Products



# Validation

## ❖ Data

Aqua / MODIS (MYD35, MYD03)

Collocation : time gap < 5 min & distance gap < 1 km

## ❖ Period

2017.01.01. 04:00 UTC ~ 2017.01.11. 03:50 UTC (10 days)

2017. 07.24. 00:00 UTC ~ 2017.08.07. 23:50 UTC (15 days)

## ❖ Method

PC (Proportion Correct) :  $a+d / n$

POD (Probability of Detection) :  $a / a+c$

FAR (False Alarm Rate) :  $b / a+b$

MODIS GK-2A	Cloud	Clear	Total
Cloud	a	b	a+b
Clear	c	d	c+d
Total	a+c	b+d	a+b+c+d=n

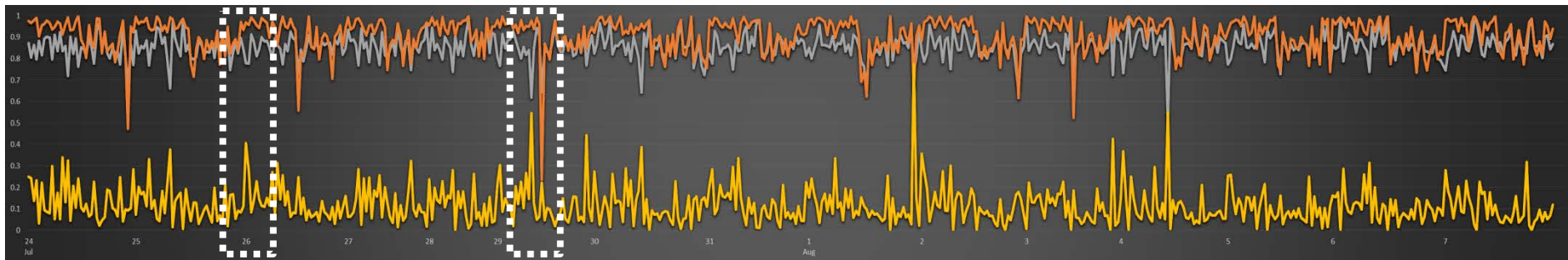


# Validation

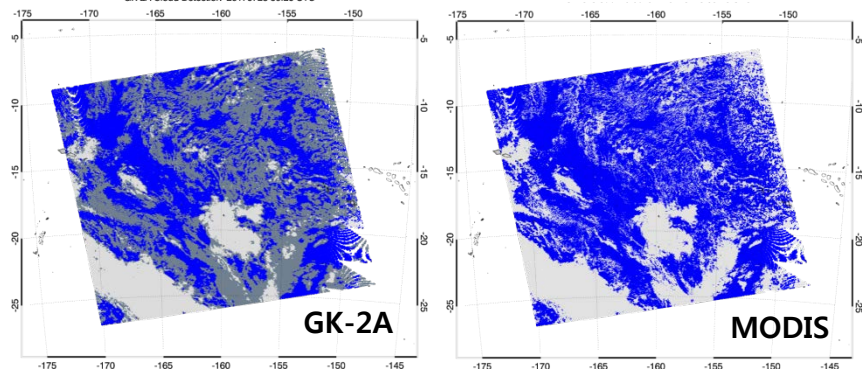
❖ 2017. 07.24 00:00 UTC ~ 2017.08.07 23:50 UTC

❖ PC : 0.85, POD : 0.91(>0.87), FAR : 0.13(<0.10)

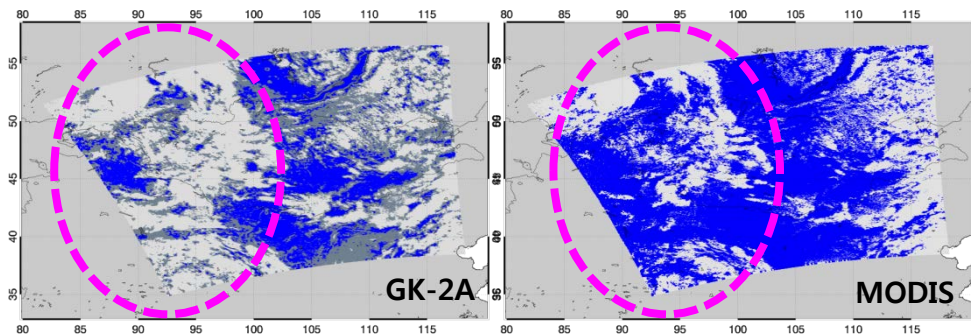
— : PC — : POD — : FAR



## Fractional clouds



## Snow

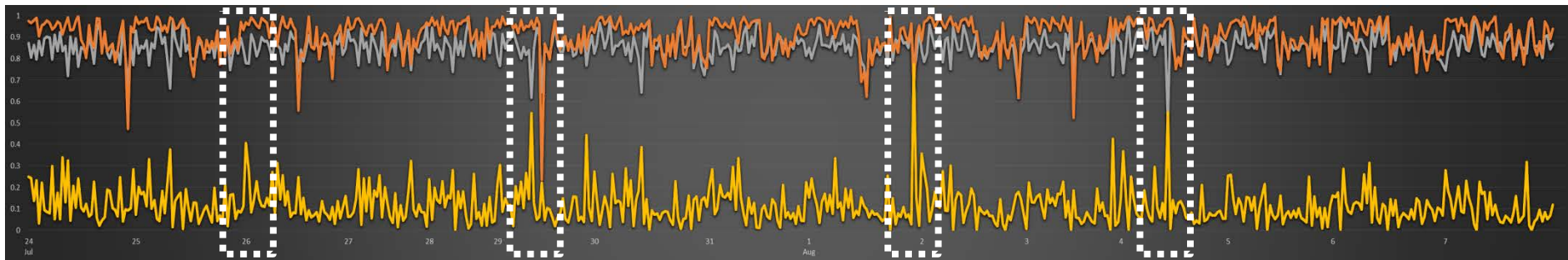


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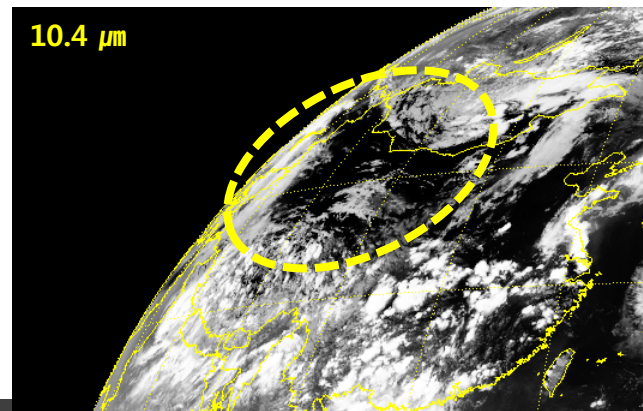
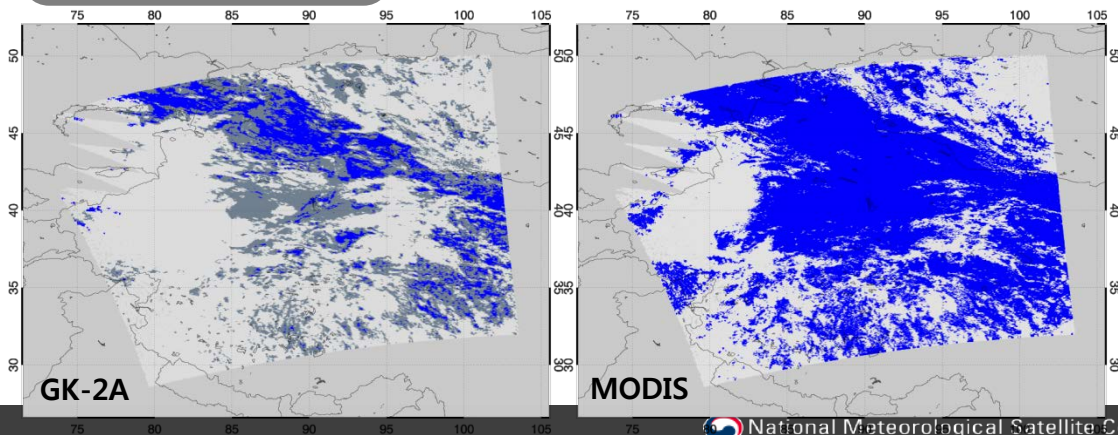
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— : PC — : POD — : FAR



## Slant view

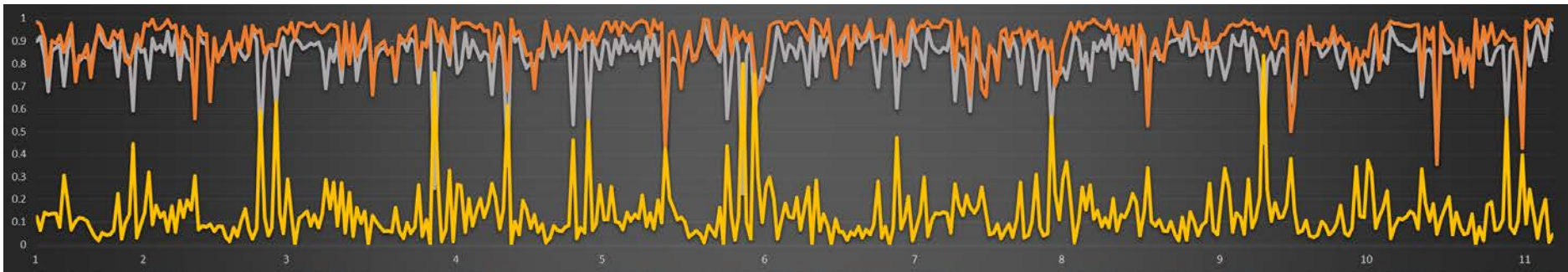


# Validation

❖ 2017. 01.01 04:00 UTC ~ 2017.01.11 03:50 UTC

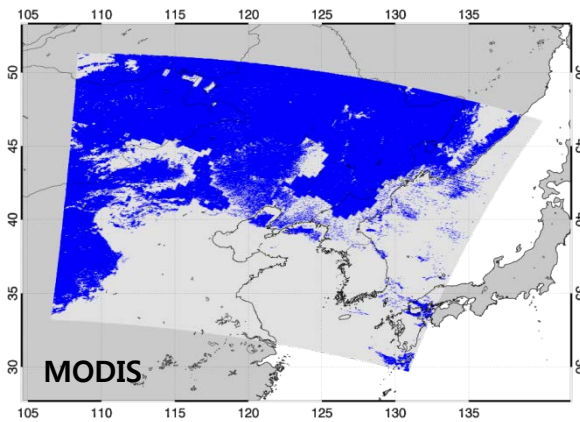
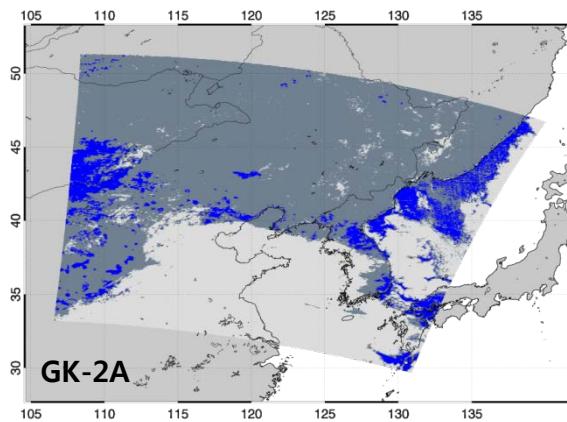
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Cloud over high elevated region or desert

- > Extremely low (or high) surface temperature
- > Snow
- \* land/sea discontinuity



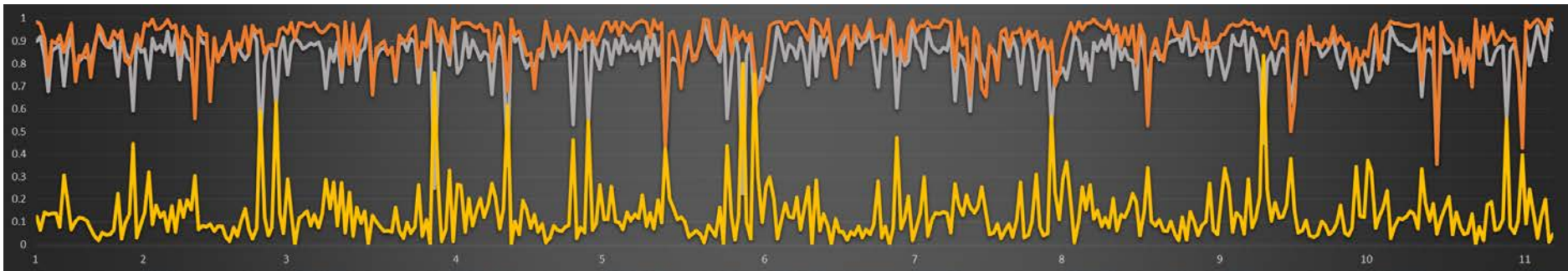


# Validation

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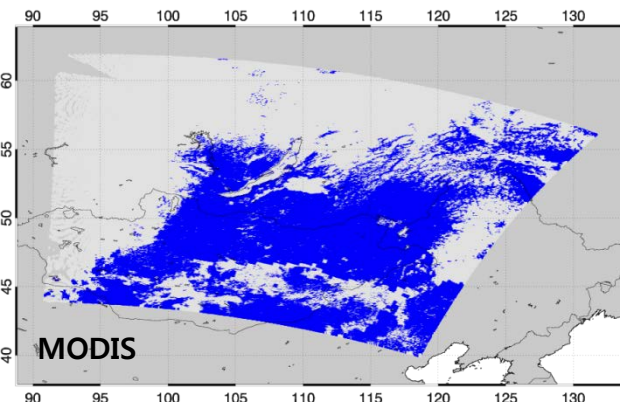
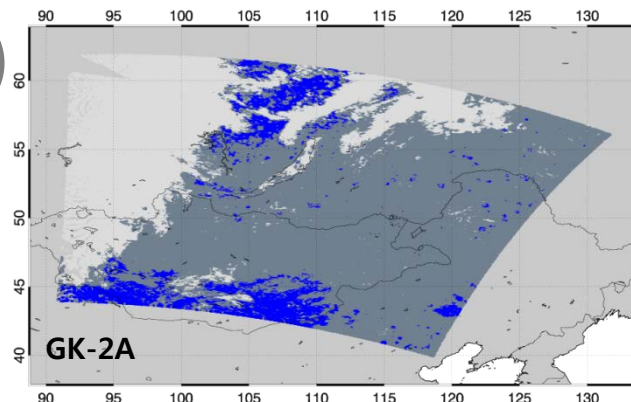
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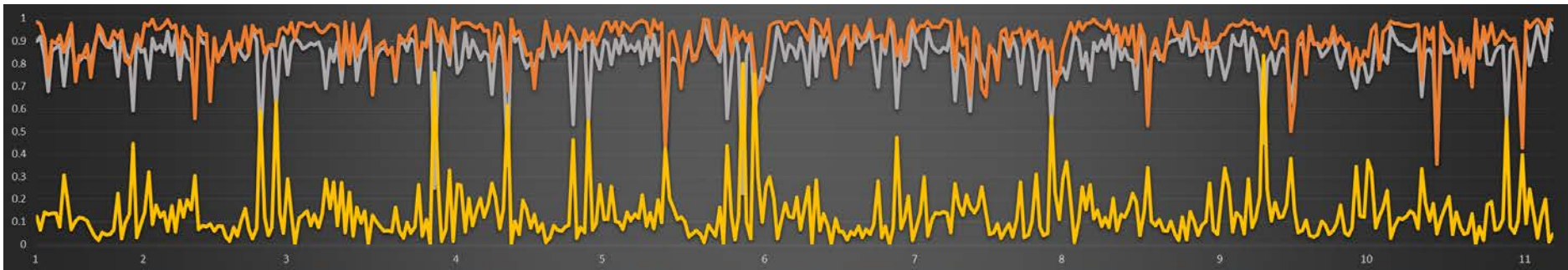


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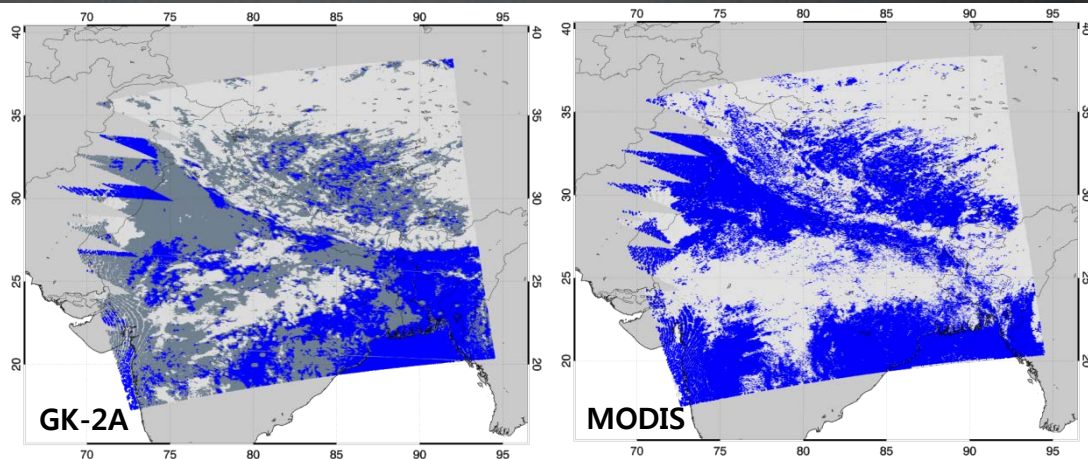
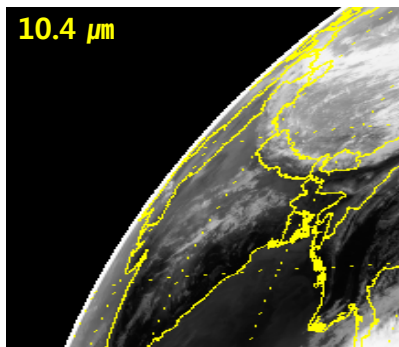
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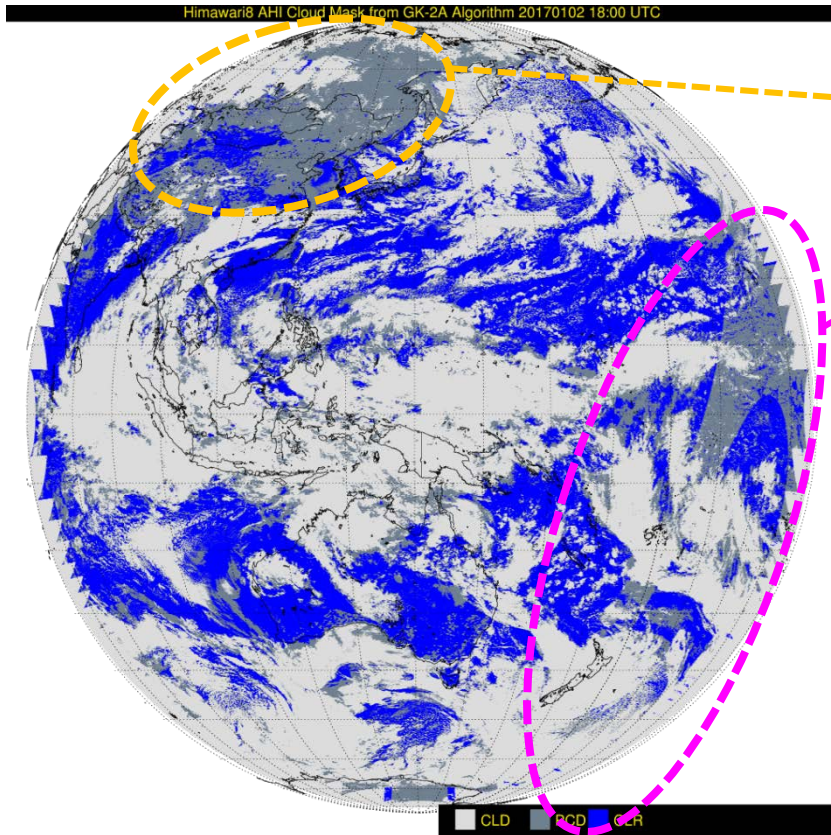


Slant view

10.4  $\mu\text{m}$



# Further Study



- Still overestimate over desert
- Day / Night transition
- Snow/Ice Test
- Low-level clouds and thin cirrus
- Slant view

# Thank you!

