ICWG 2018, Wisconsin, USA, 31/10/2018

Assessment of cloud parameter retrievals from Himawari-8 geostationary imagery

Leads: Yong-Sang Choi (Ewha W. Univ.), Andrew Heidinger (NOAA/NESDIS@CIMSS), Andy Walther (CIMSS)

Thanks to Data Providers and Contributors: JMA, KMA, NWCSAF, and UK-METOFFICE

Participated cloud products

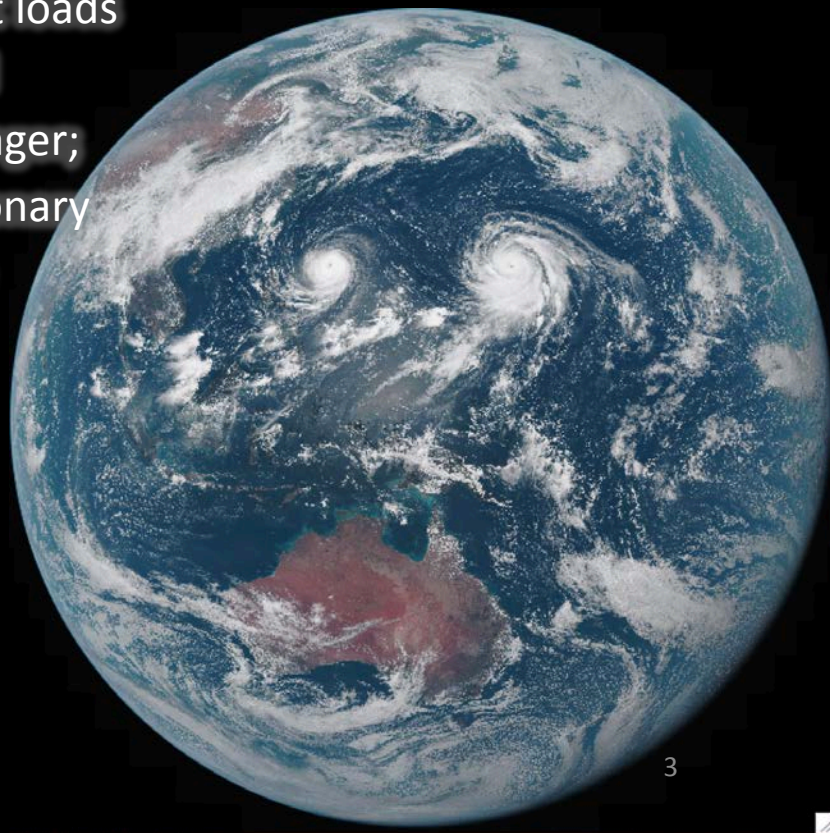
Participants	CLD	CPH	CTT	COT	EPR	LWP	Comment
NWCSAF	o	o	o	o	o	o	
JMA	o	o	o	-	-	-	
KMA	o	o	o	o	o	o	
UK METOFFICE	o	o	o	o	o	o	

- ✓ ***CLD*** cloud detection
- ✓ ***CPH*** cloud phase
- ✓ ***CTT*** cloud top temperature
  (height or pressure in case that CTT is unavailable)
- ✓ ***COT*** cloud optical thickness
- ✓ ***EPR*** effective particle radius
- ✓ ***LWP*** liquid water path

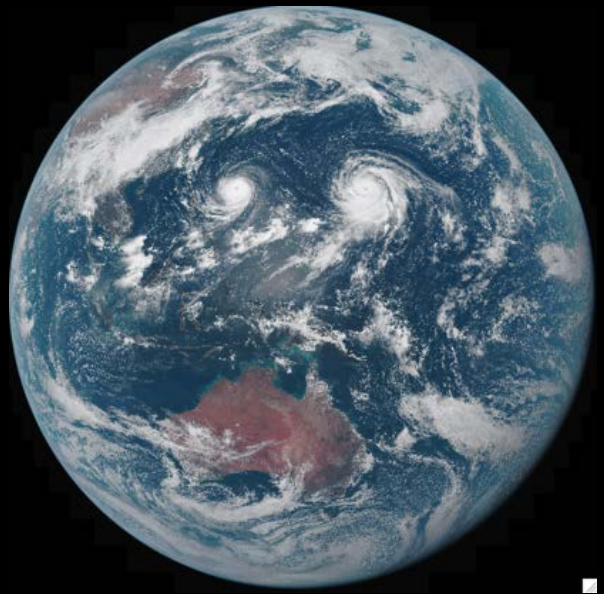
Himawari-8 (AHI) input

For a consistent comparison, all providers of cloud parameter retrievals used the same input, i.e., Himawari-8 radiance for 19 August 2015, at the full temporal resolution of 10 minutes.

There are good reasons to choose the Himawari-8. It loads the advanced imager with 16 channels in visible and infrared wavelengths (the Advanced Himawari-8 Imager; AHI), which are much more than any other geostationary imagers ever. The multi-channel radiances allow the uppermost advanced cloud retrieval algorithms.



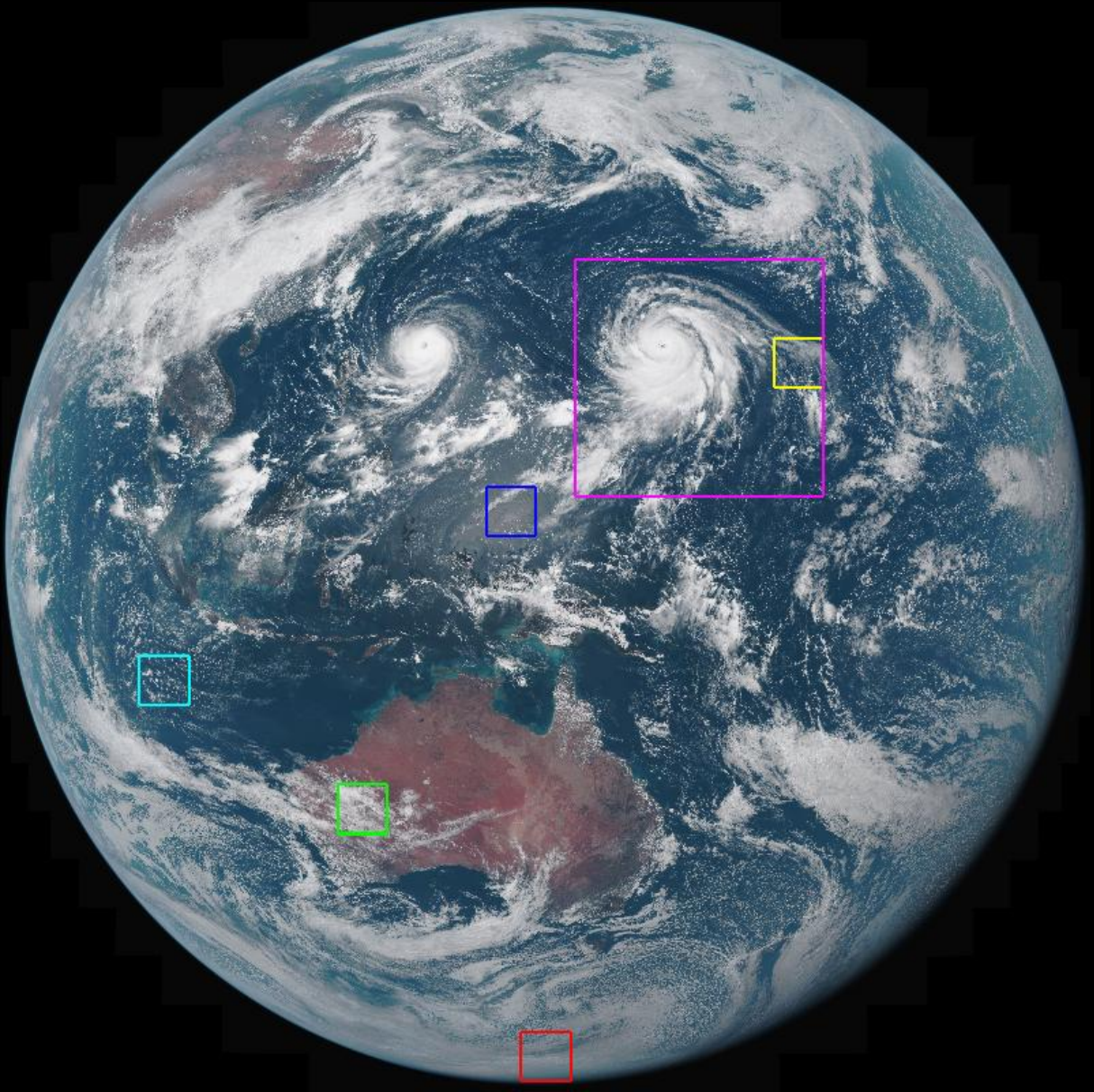
Himawari-8 (AHI) input



The Himawari-8 data covers the Asian Pacific domain centering on the tropical western Pacific. On the date particularly, the data clearly captures two northward moving Typhoons and several developing storms along with intertropical convergence zone. Thus a variety of clouds in diverse conditions can be tested.

Among the radiances every 10 minutes (0000-2350 UTC), the full-disk Himawari Standard Data (HSD) named 0240 (observed during 0240-0250 UTC) does not exist due to a scheduled satellite event (i.e. unloading) (personal communications with Mrs. Daisaku Uesawa and Ryo Yoshida in the cloud team of JMA). Similarly, full-disk HSD named 1440 (observed during 1440-1450 UTC) also lacks.

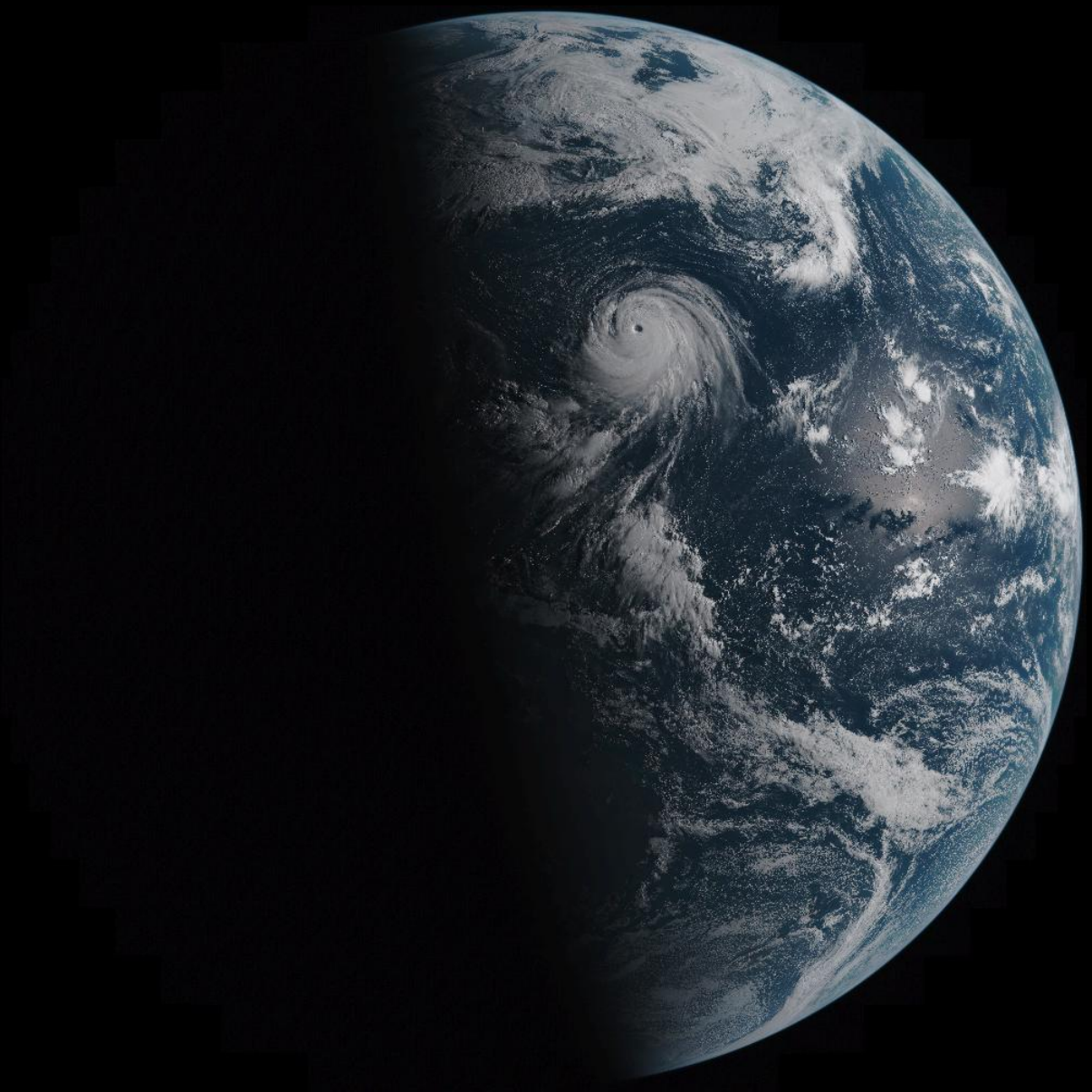
AHI RGB image samples - 2015/08/19 03:30 UTC



5 sample regions

1. Slant view
2. Cirrus
3. Clouds over desert
4. Fractional clouds
5. Sun glint
6. Typhoon, “GONI”

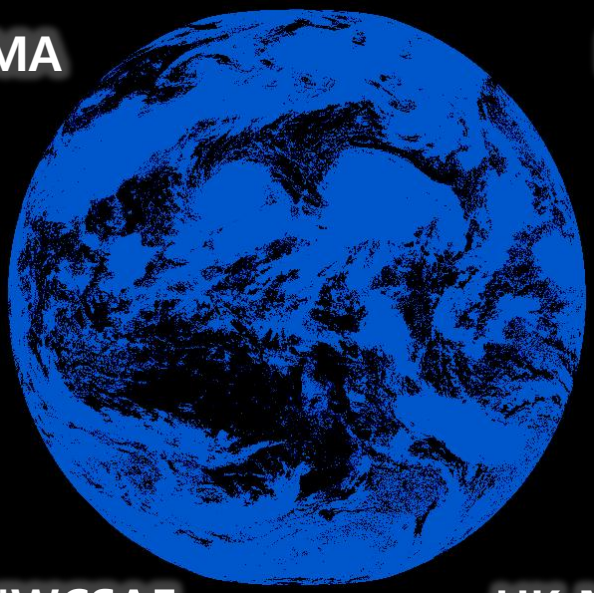
AHI RGB image samples - 2015/08/18 21:00 UTC



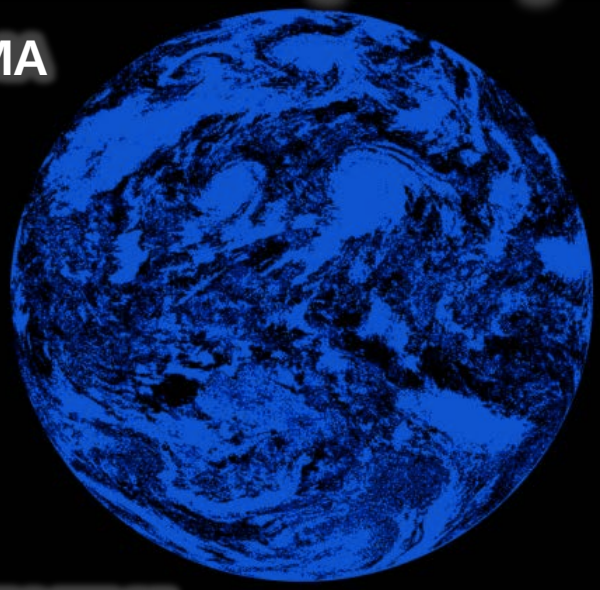
Day/night transition

Cloud detection (CLD)

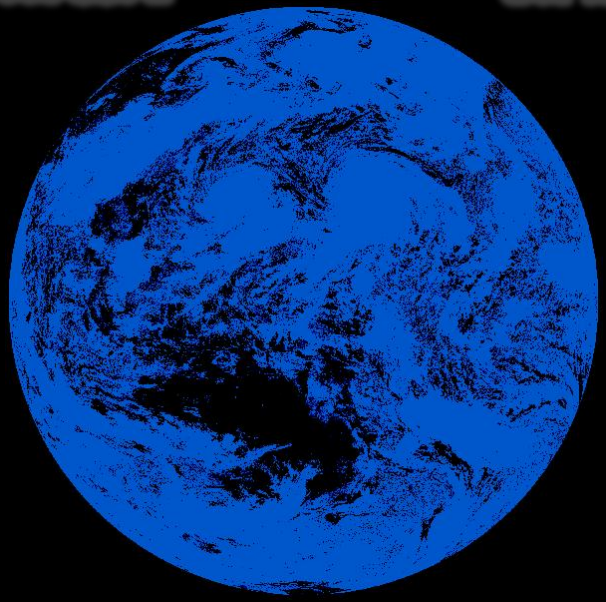
JMA



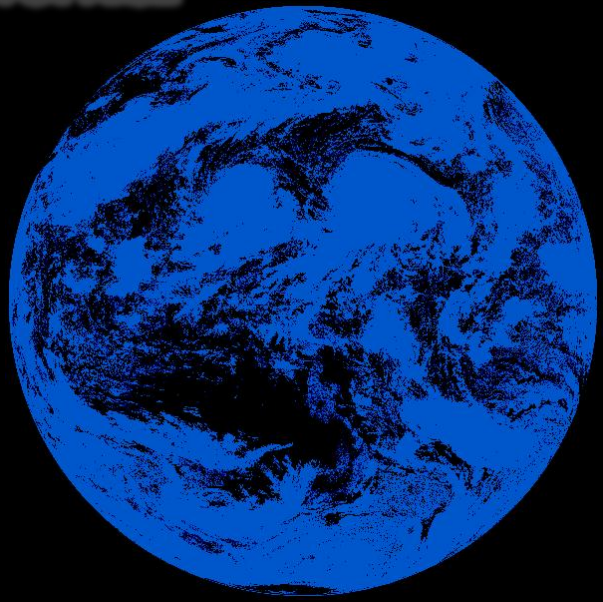
KMA



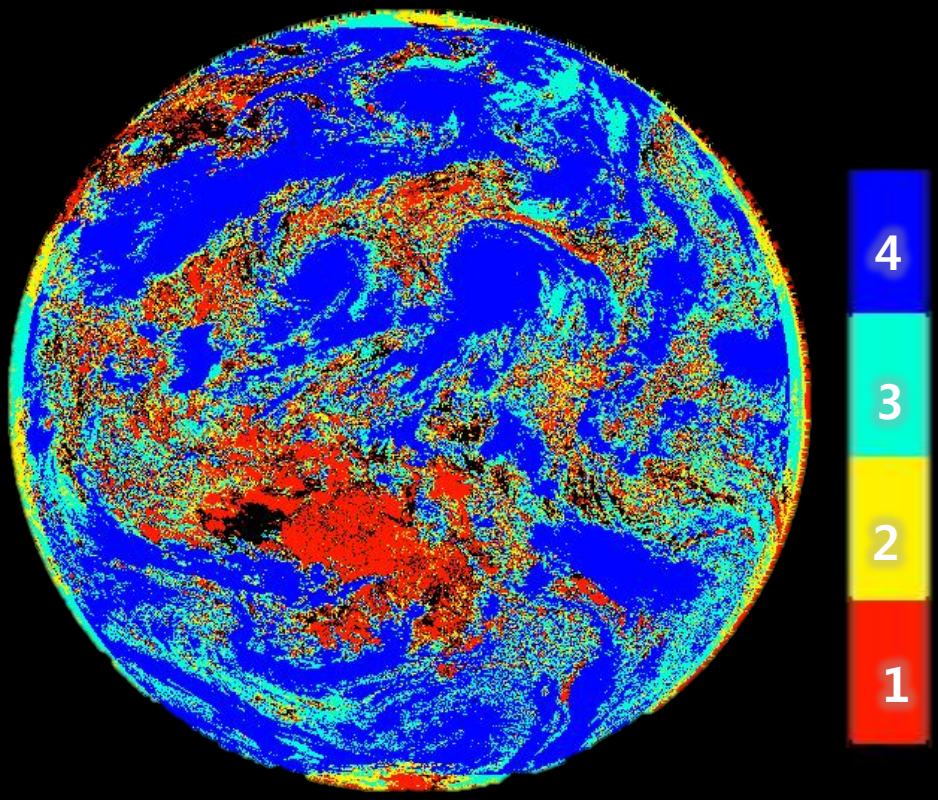
NWCSAF

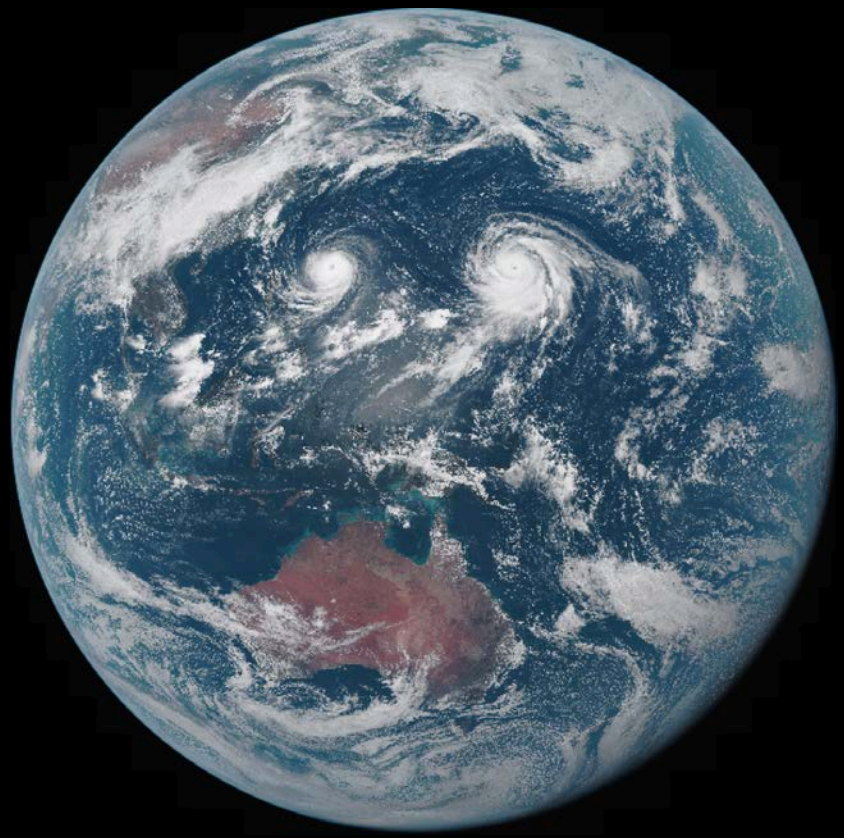


UK METOFFICE



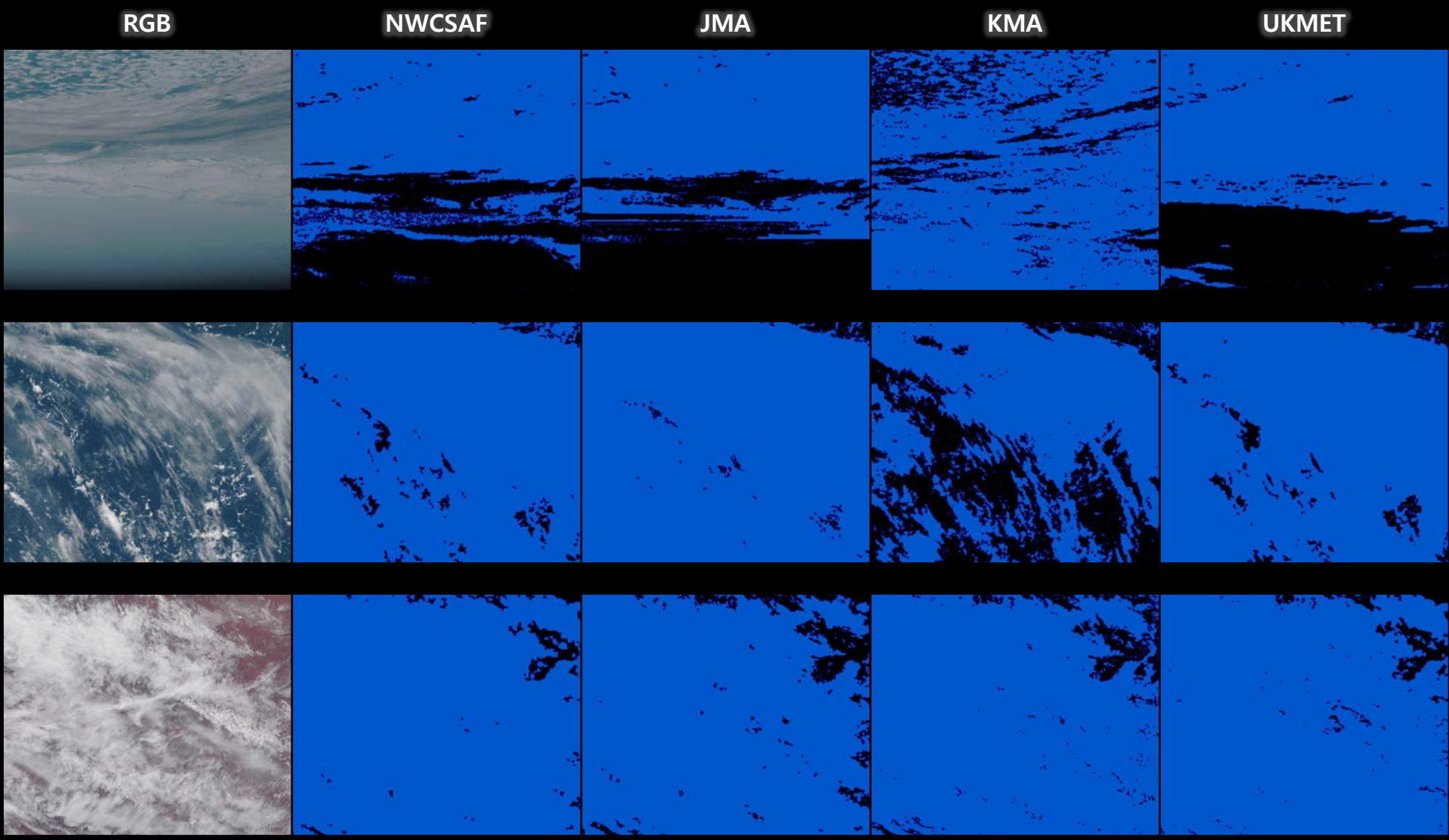
Cloud detection (CLD) Agreement rate



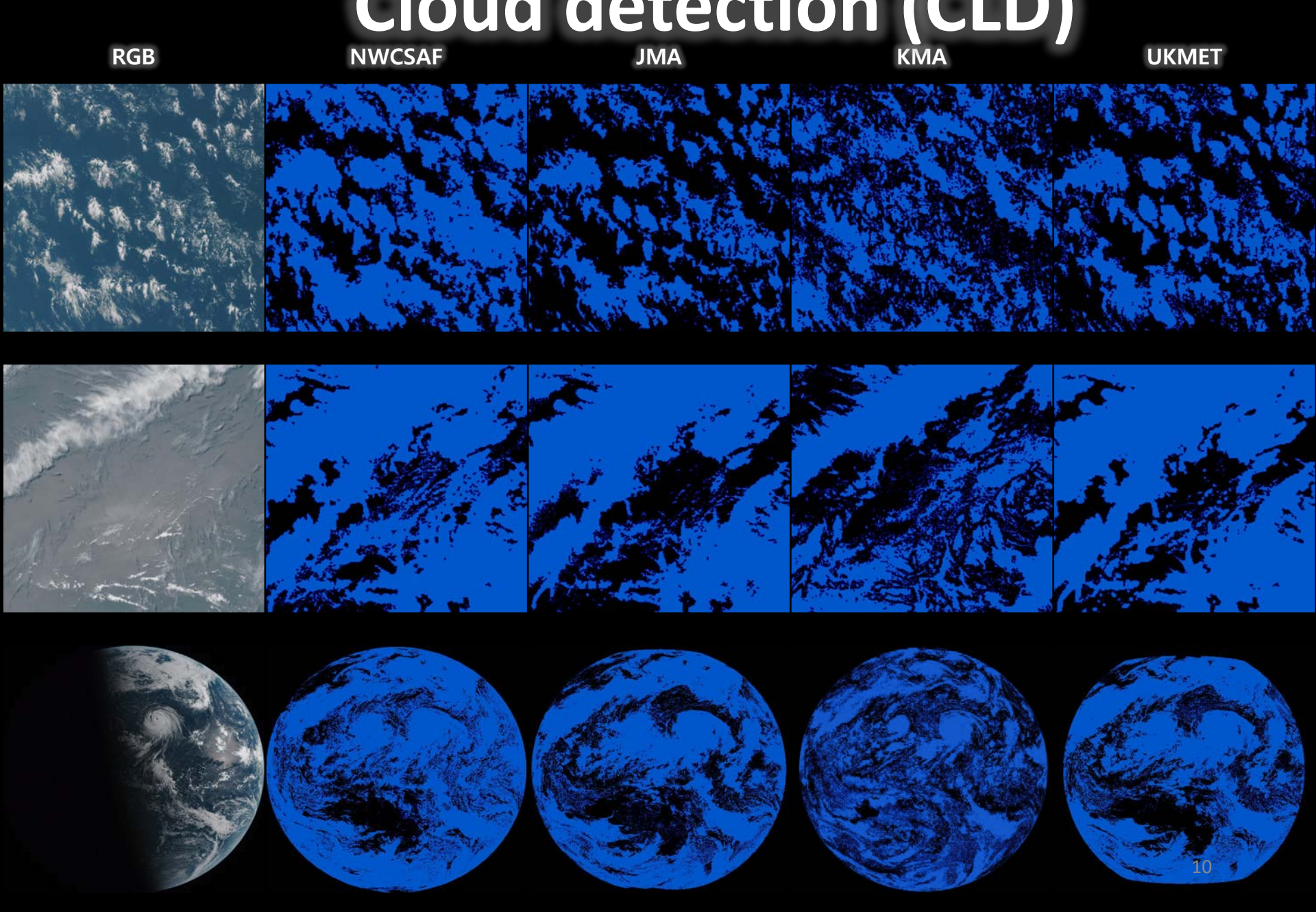


0330 UTC

Cloud detection (CLD)



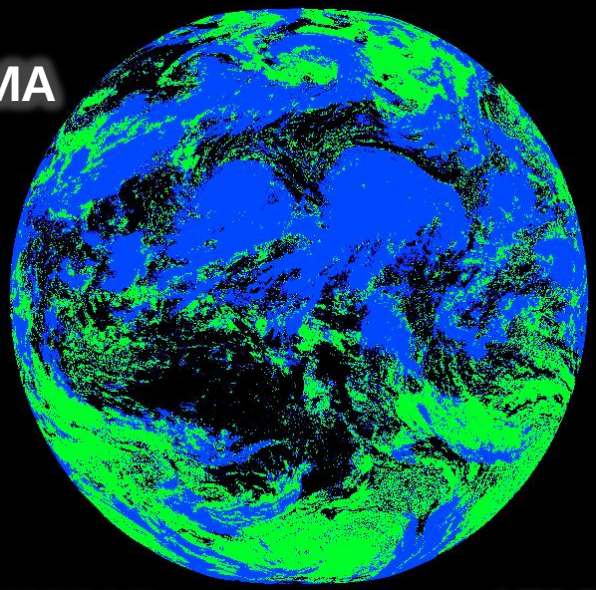
Cloud detection (CLD)



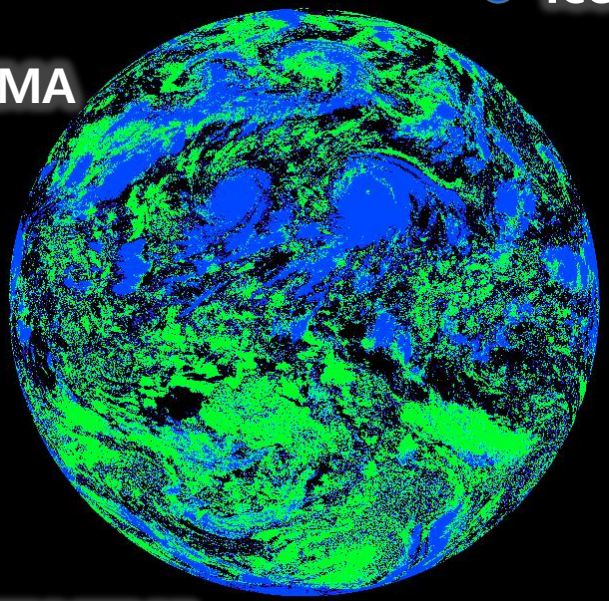
Cloud phase (CPH)

ice water

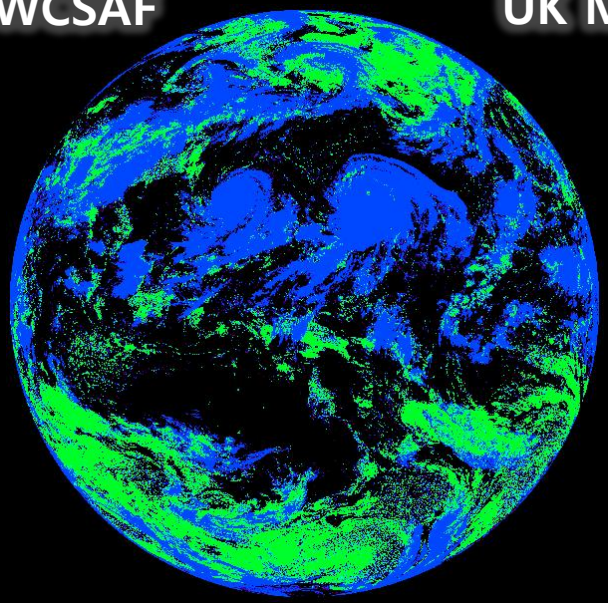
JMA



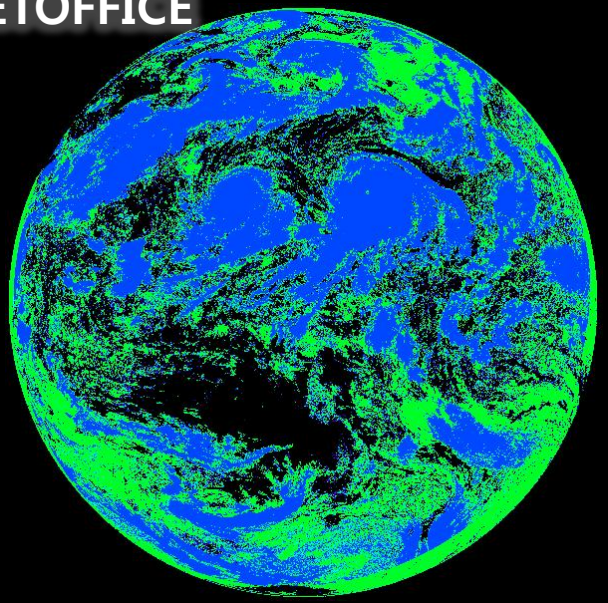
KMA



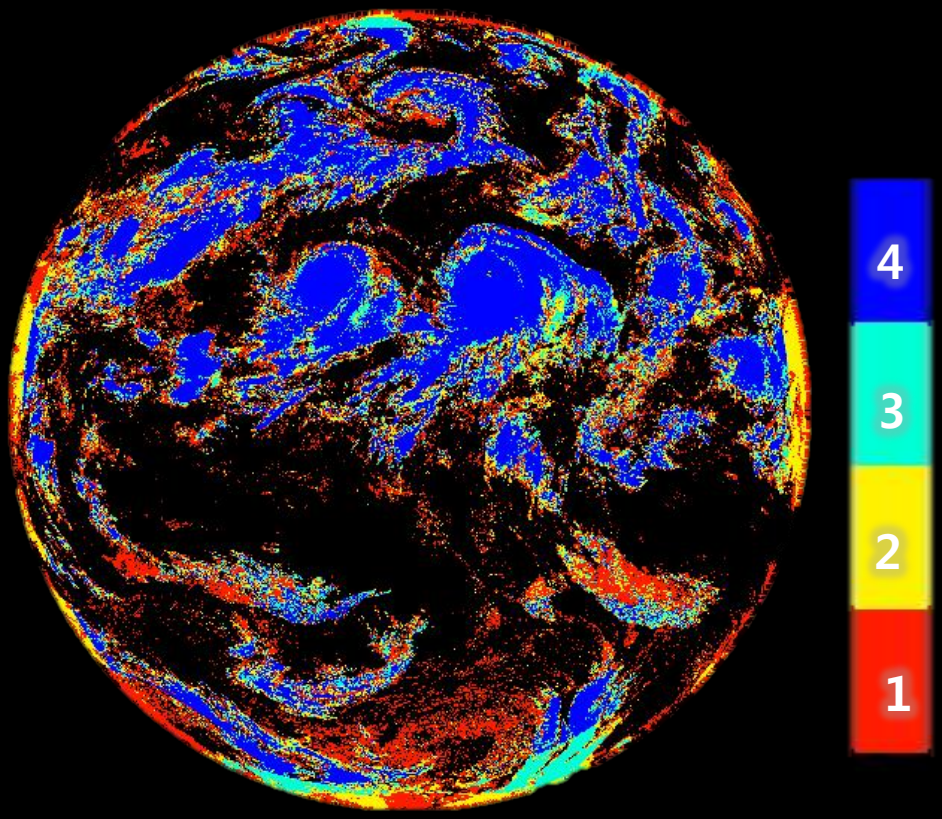
NWCSAF

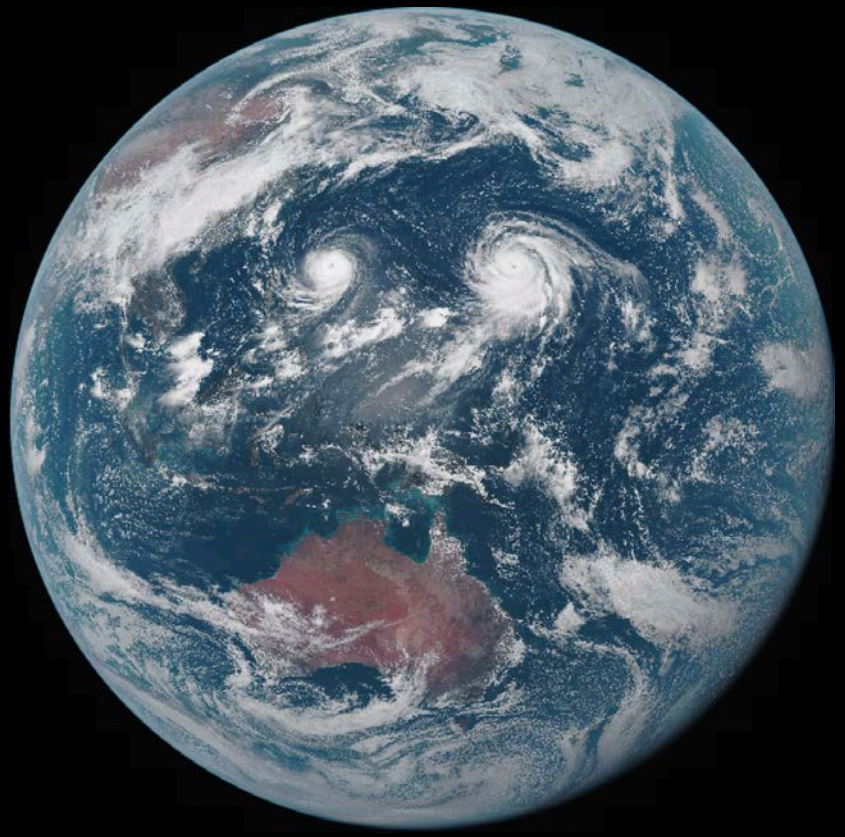


UK METOFFICE



Cloud phase (CPH) Agreement rate - ice



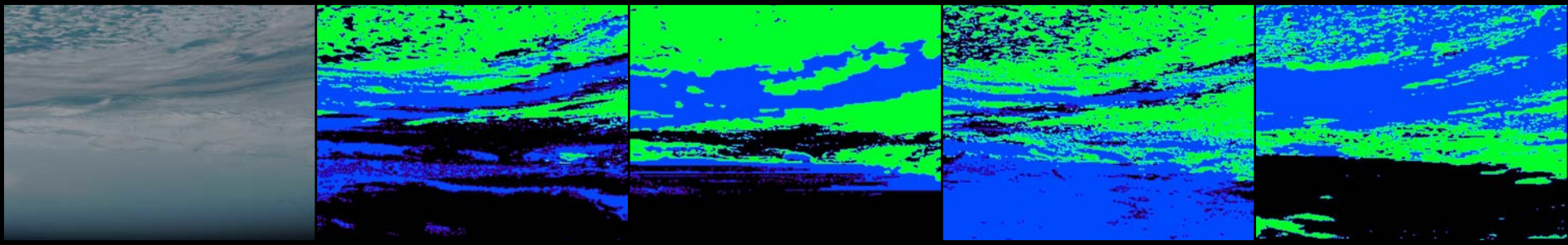


0330 UTC

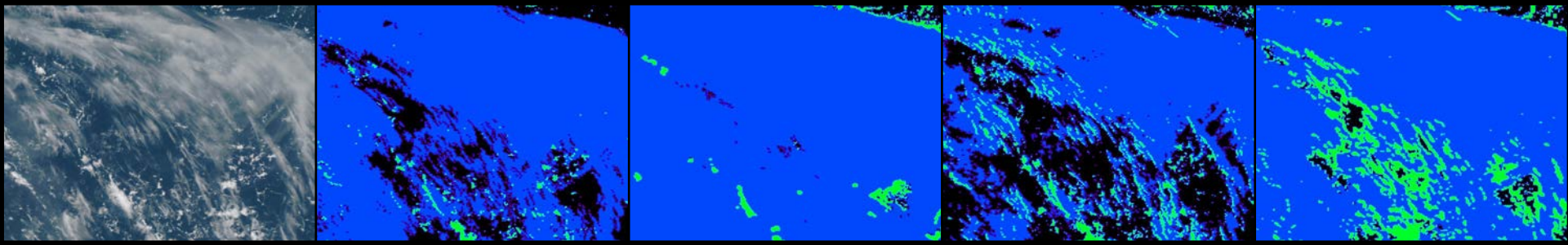
Cloud phase (CPH)

RGB | NWCSAF | JMA | KMA | UKMET

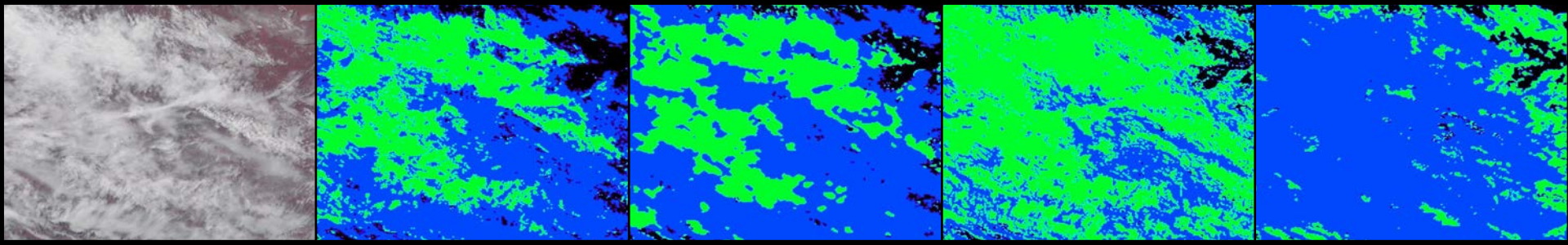
1. Slant View



2. Cirrus



3. Cloud Over Desert

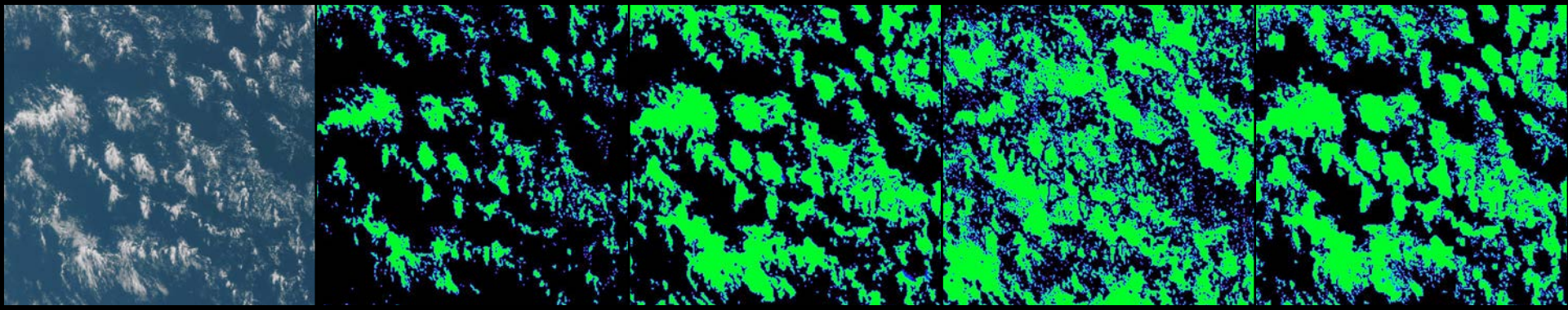


Ice Water or mixed

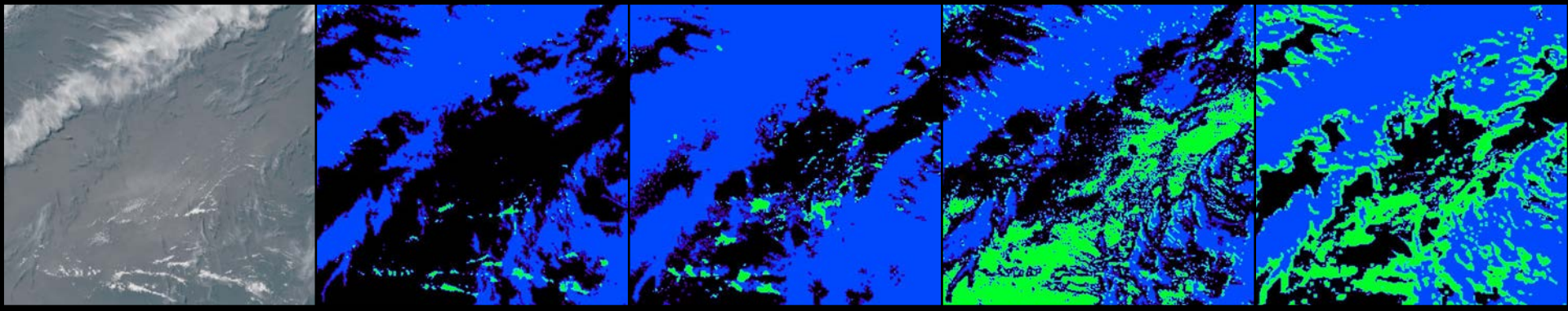
Cloud phase (CPH)

RGB NWCSAF JMA KMA UKMET

4. Fractional Cloud

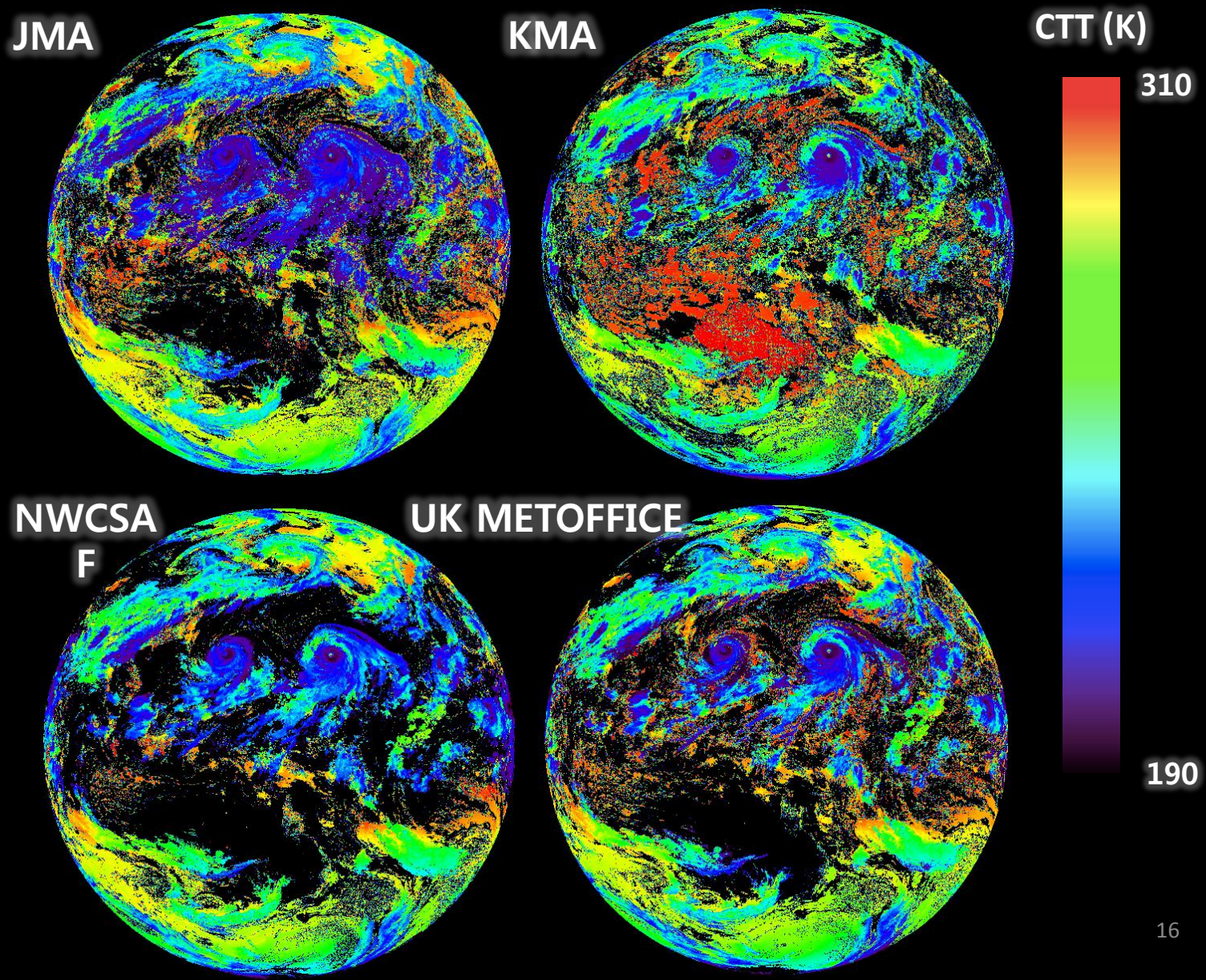


5. Sun Glint

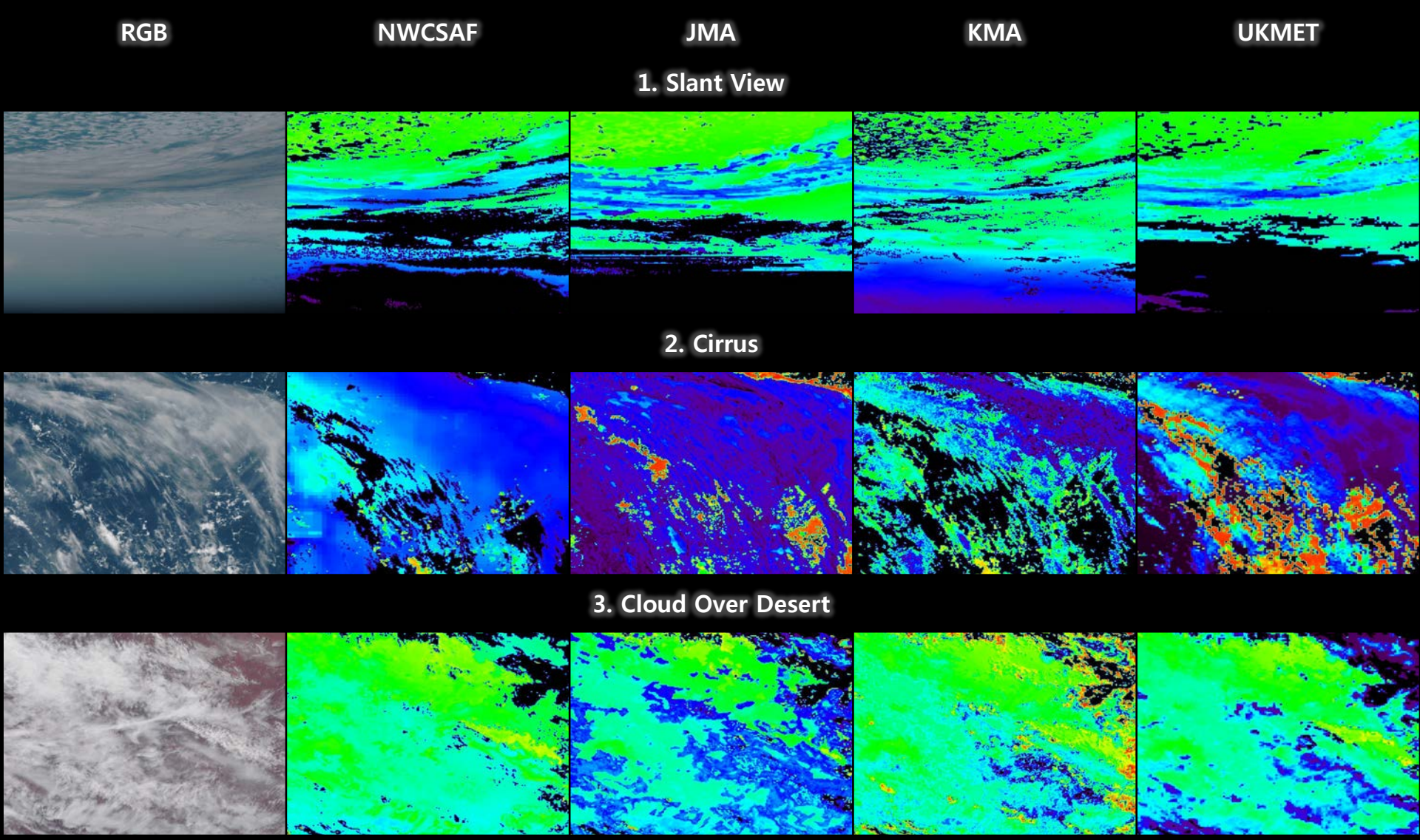


Ice Water or mixed

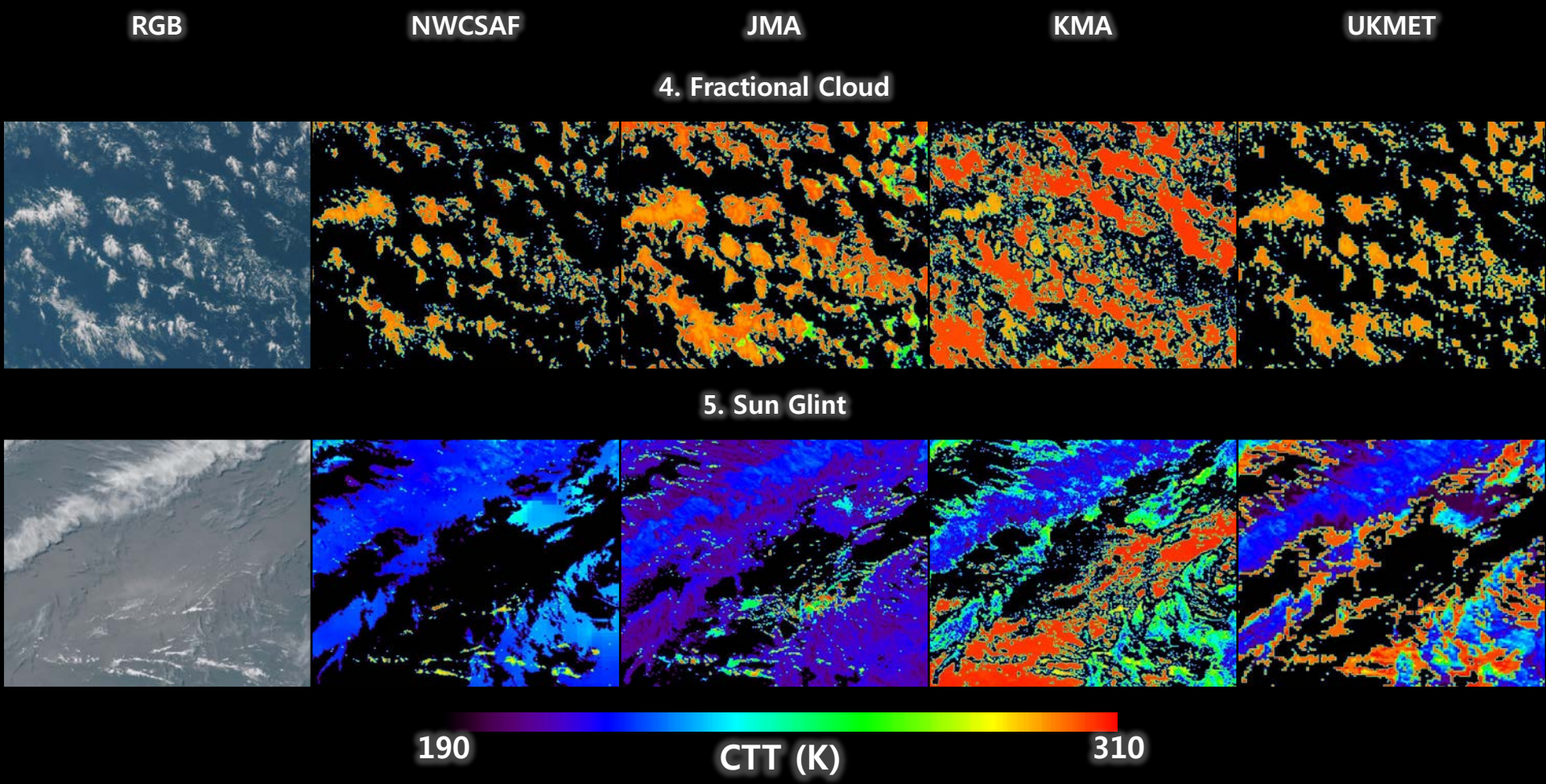
Cloud top temperature (CTT)



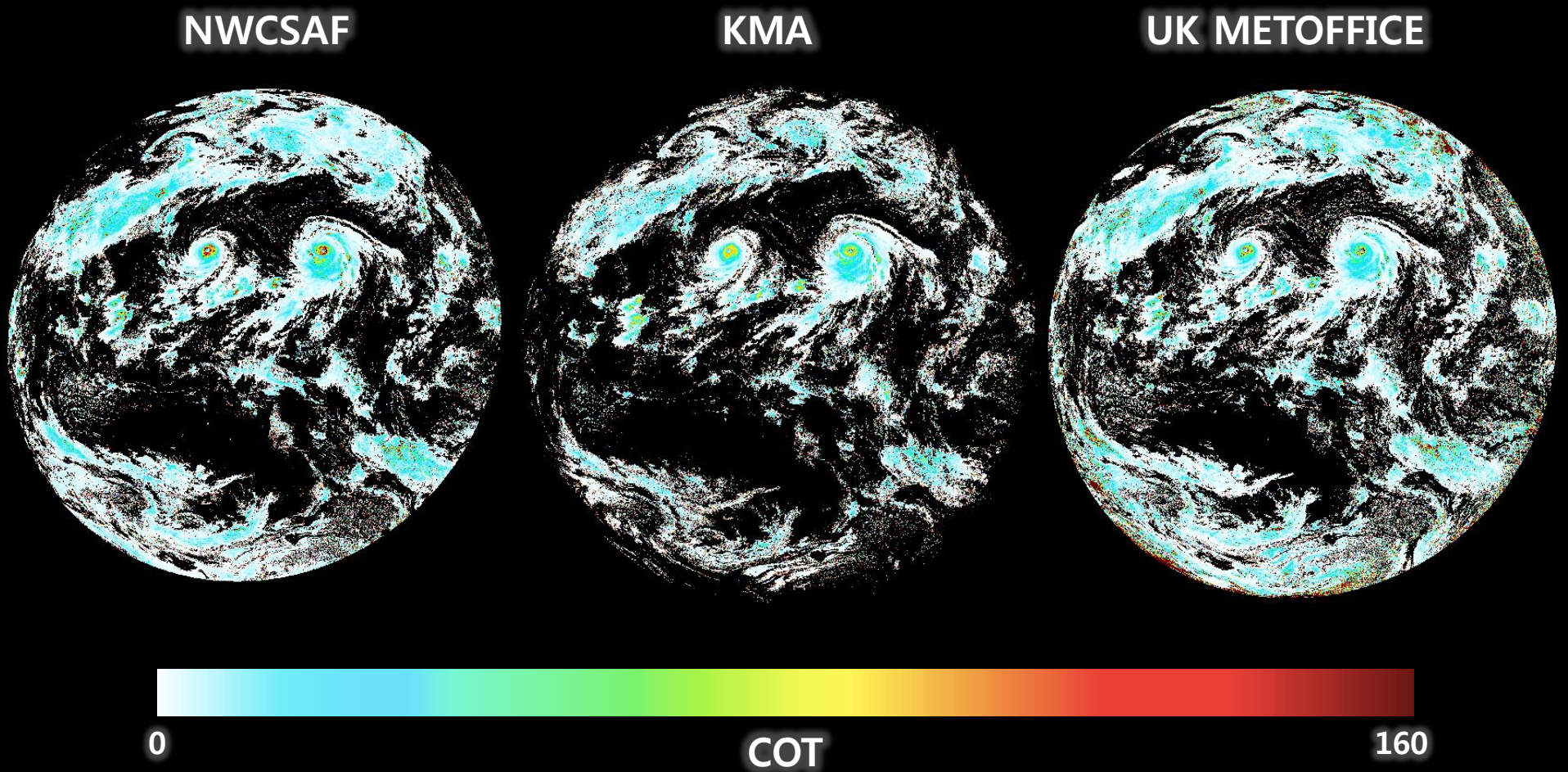
Cloud top temperature (CTT)



Cloud top temperature (CTT)



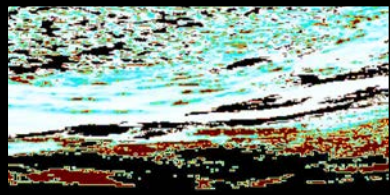
Cloud optical thickness (COT)



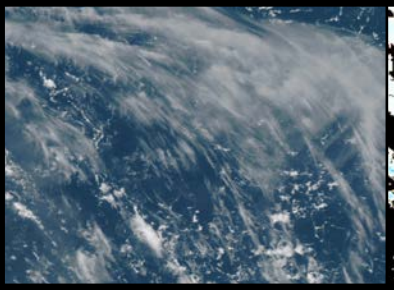
Cloud optical thickness (COT)

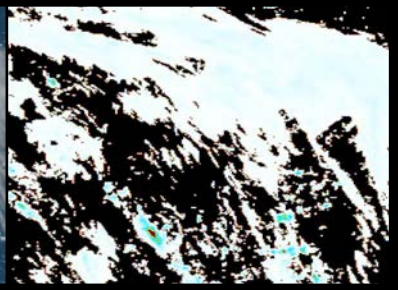
RGB NWCSAF JMA KMA UKMET

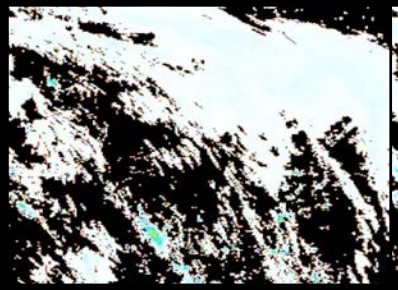
1. Slant View

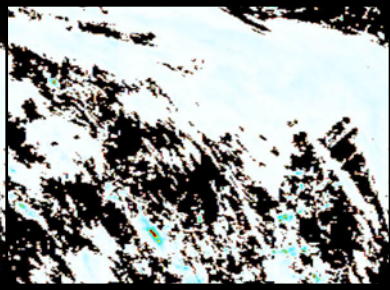


2. Cirrus

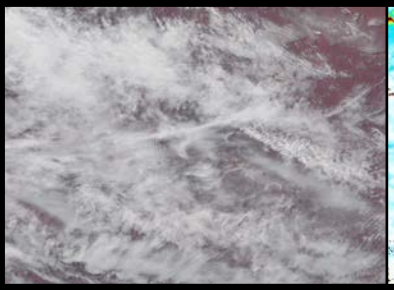


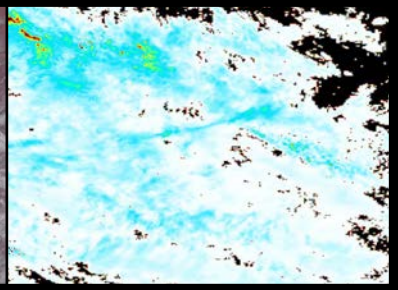


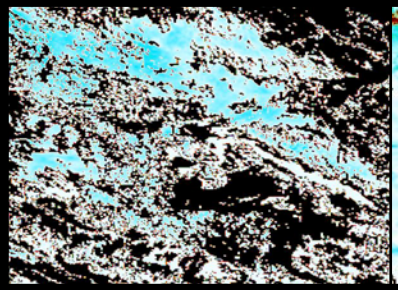


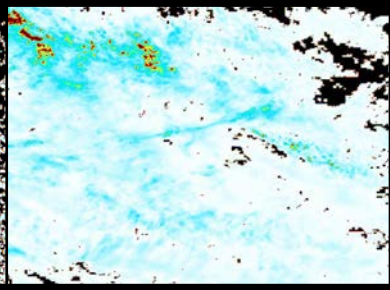


3. Cloud Over Desert







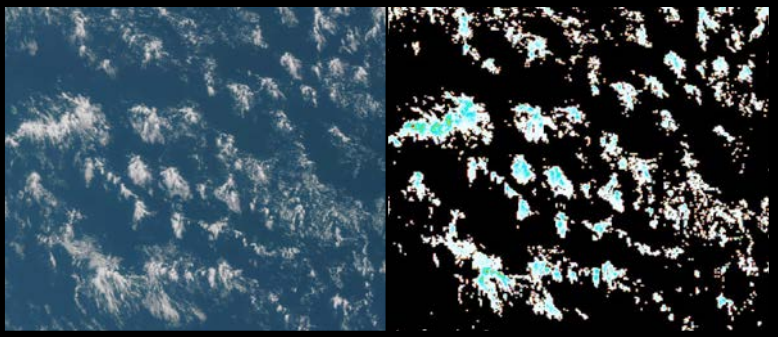
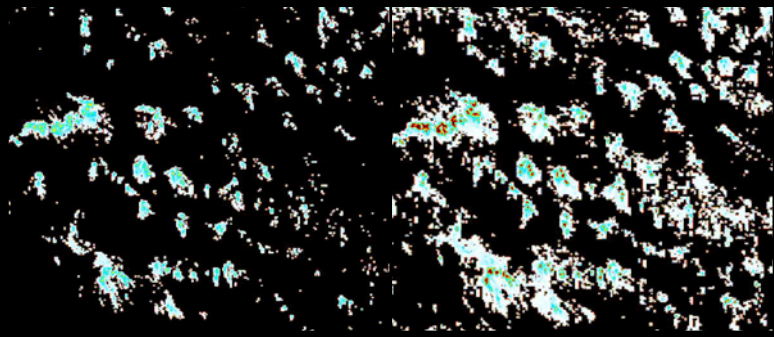


0 COT 160

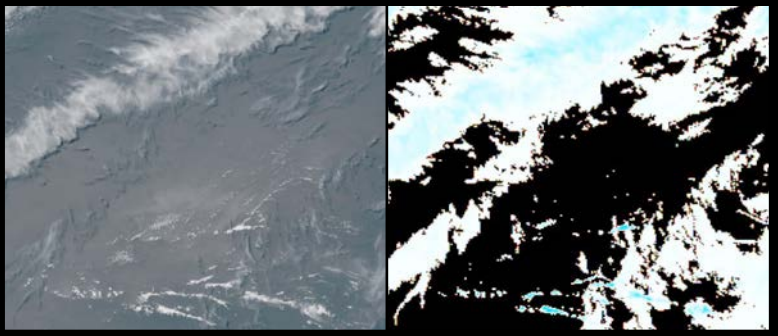
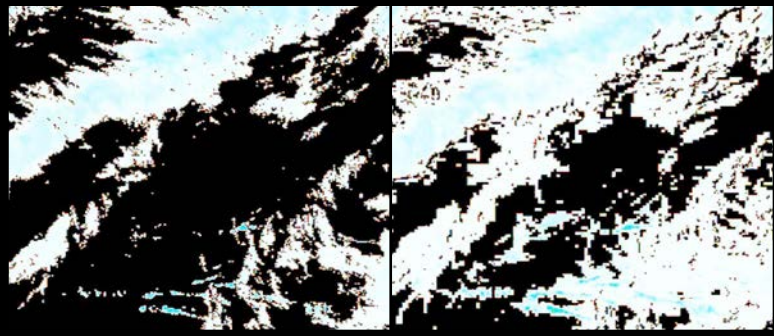
Cloud optical thickness (COT)

RGB NWCSAF JMA KMA UKMET

4. Fractional Cloud

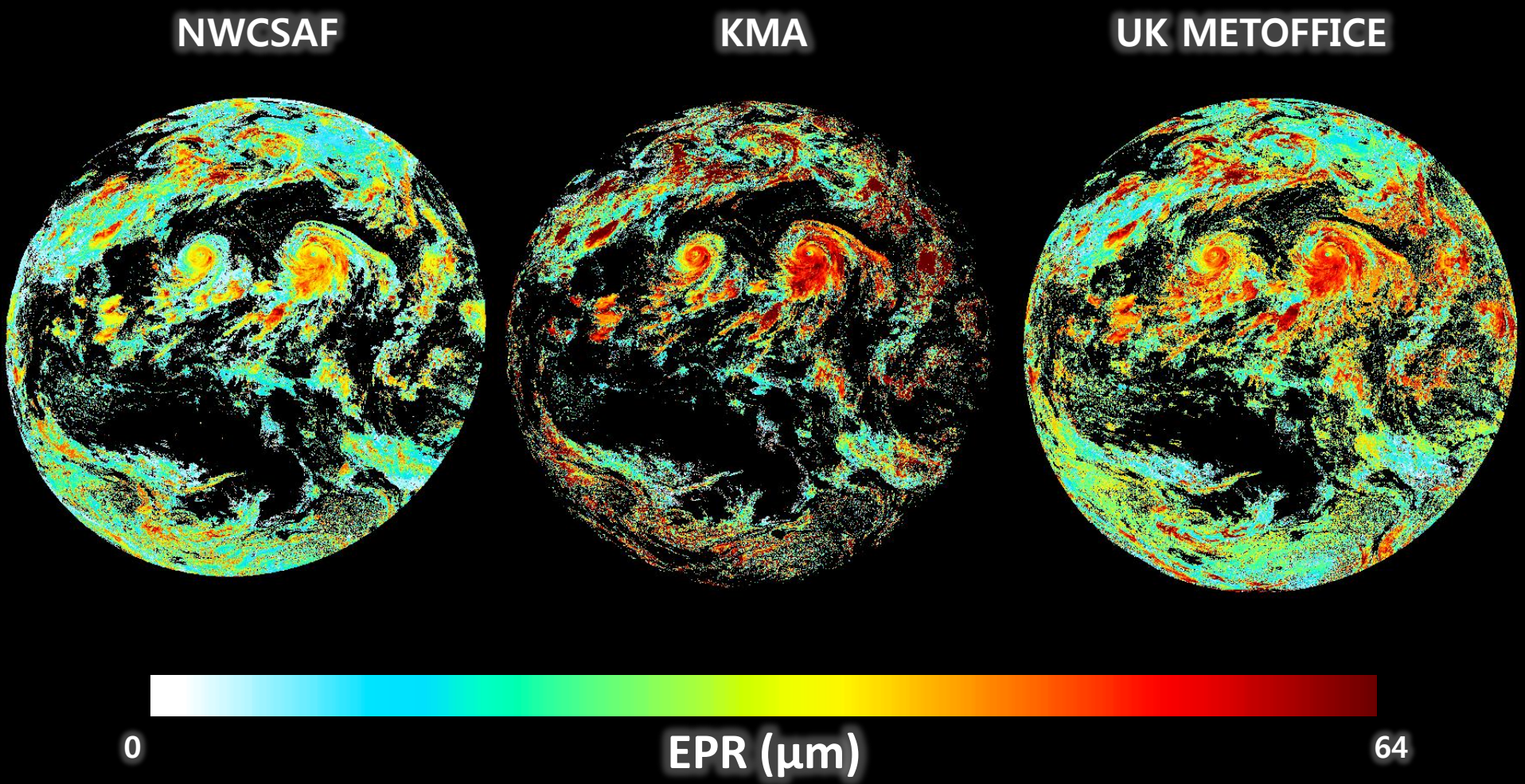



5. Sun Glint

0 COT 160

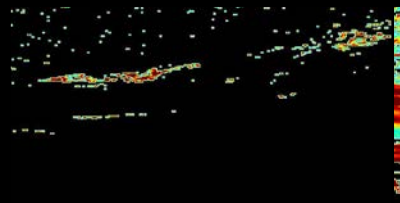
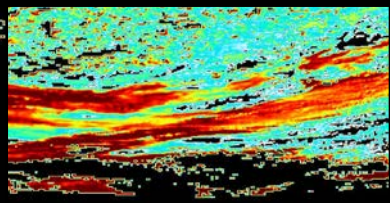
Effective particle radius (EPR)



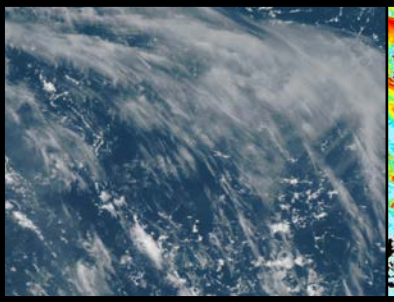
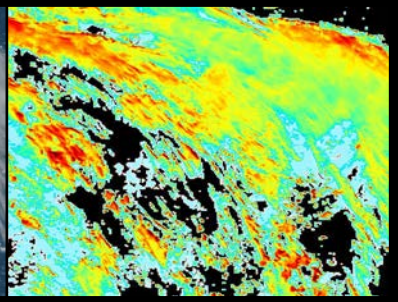
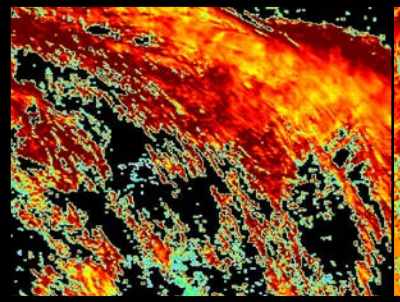
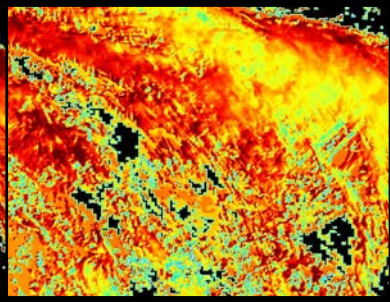
Effective particle radius (EPR)

RGB NWCSAF JMA KMA UKMET

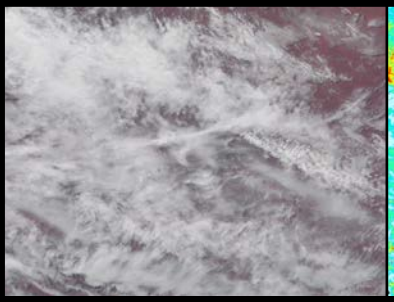
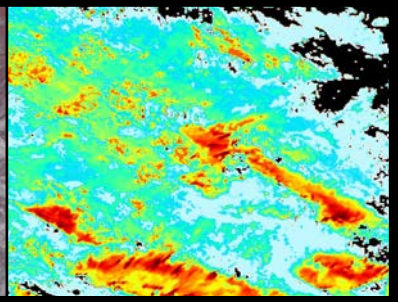
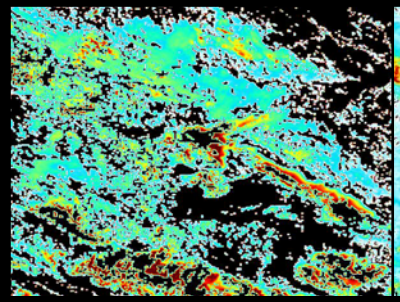
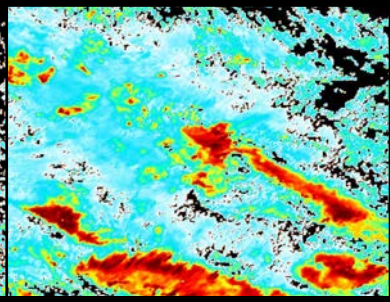
1. Slant View

2. Cirrus

3. Cloud Over Desert

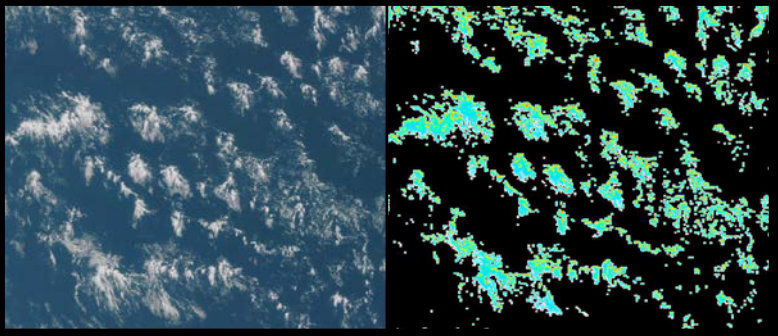
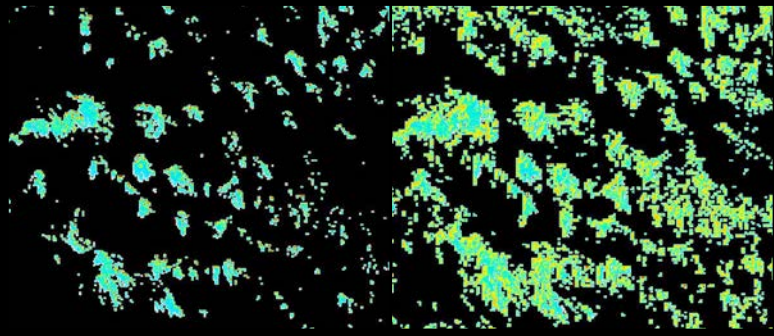





0 EPR (μm) 160

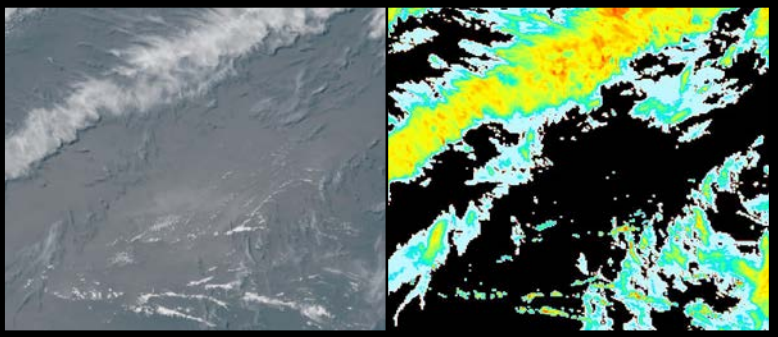
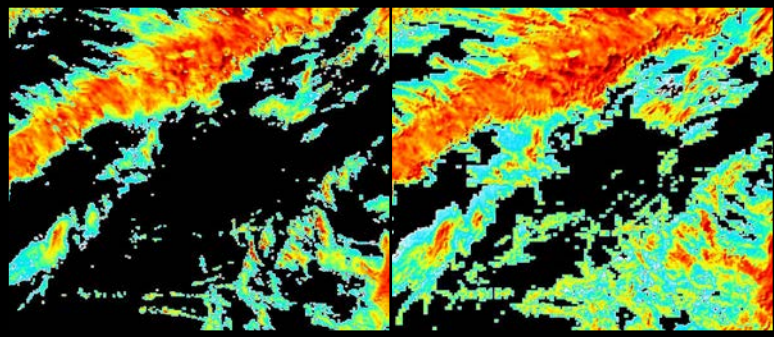
Effective particle radius (EPR)

RGB NWCSAF JMA KMA UKMET

4. Fractional Cloud

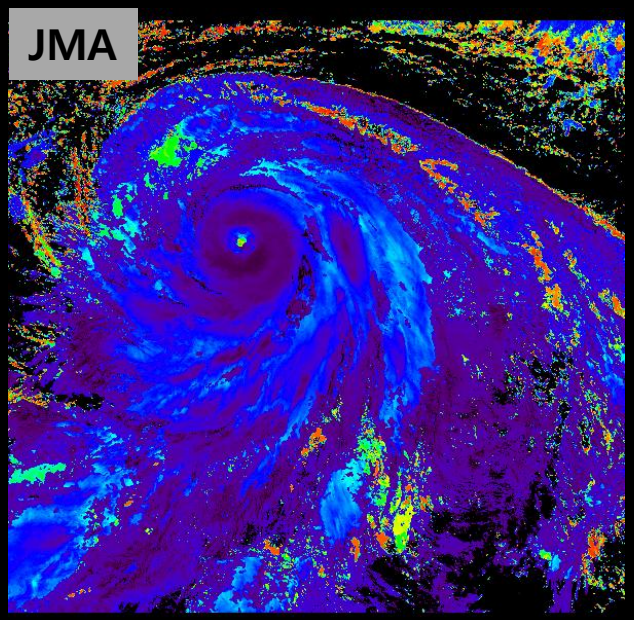
5. Sun Glint

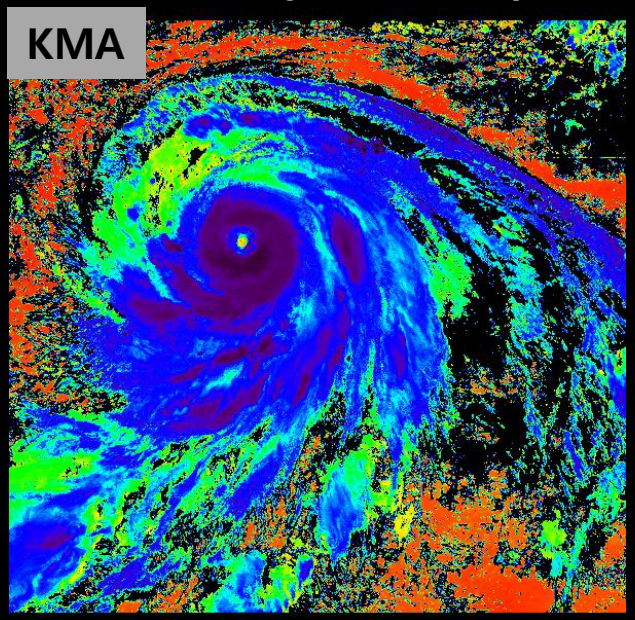



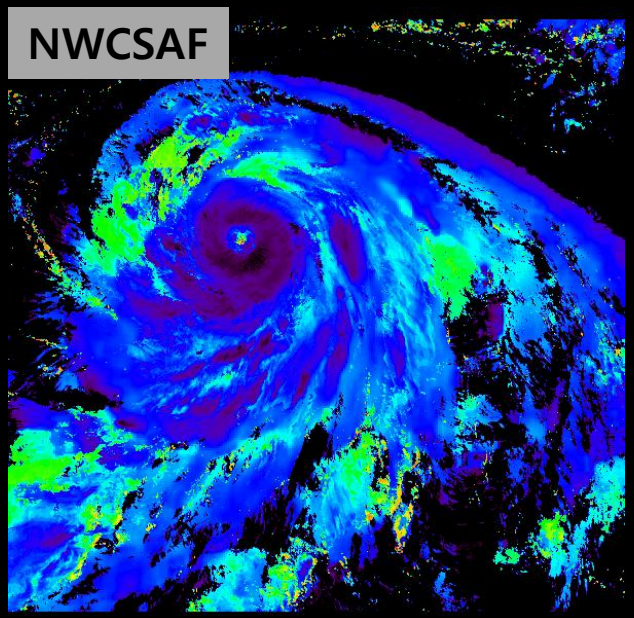
0 EPR (μm) 160

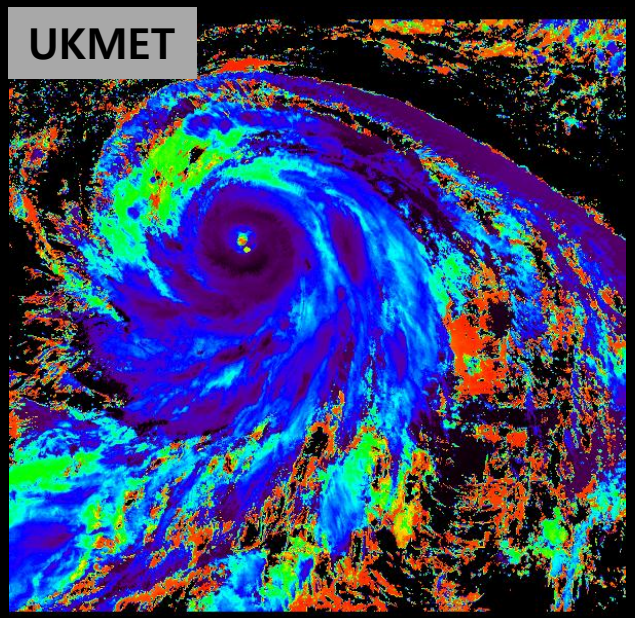
Typhoon Analysis - CTT

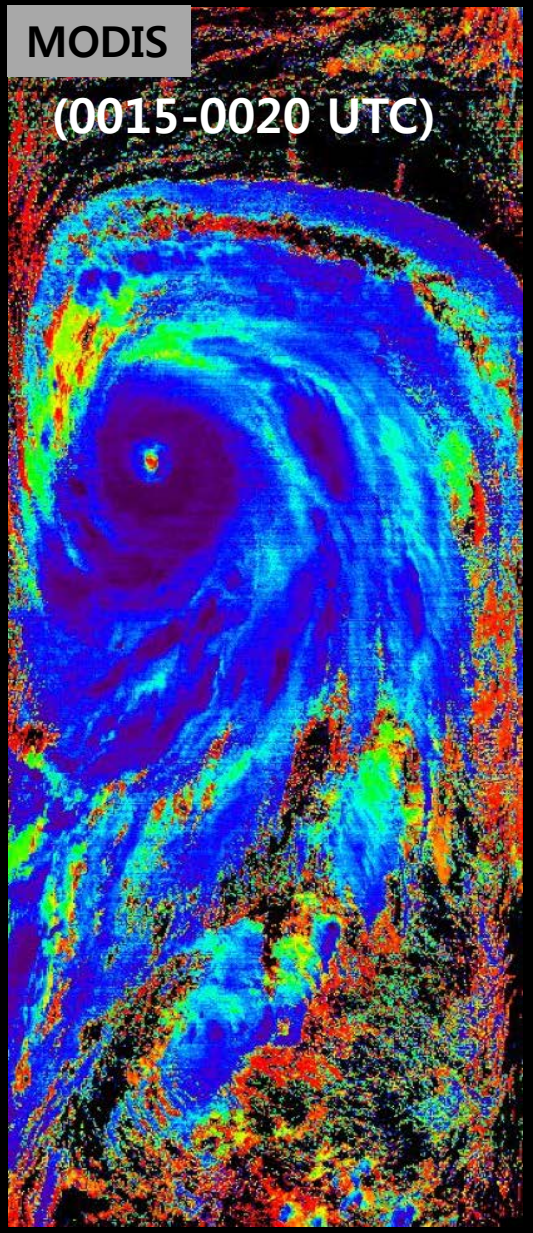
(0010 UTC)







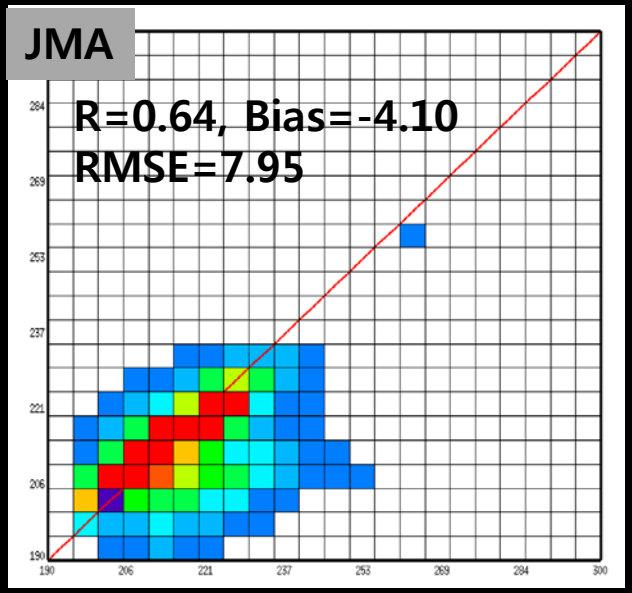


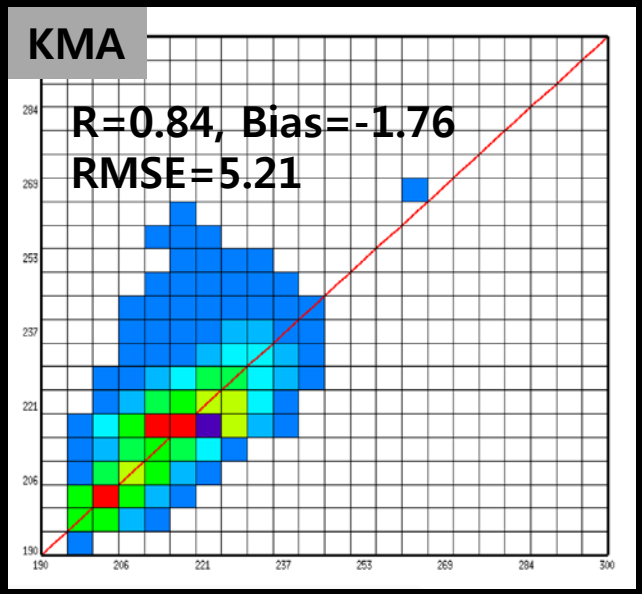


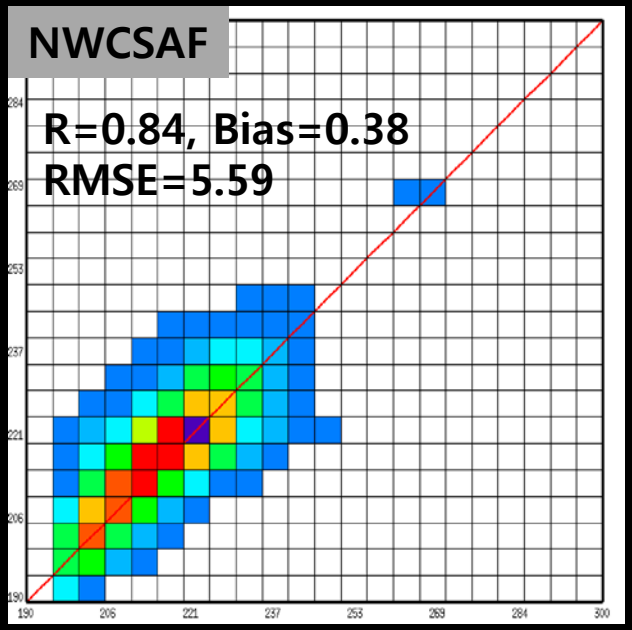
190 CTT (K) 310

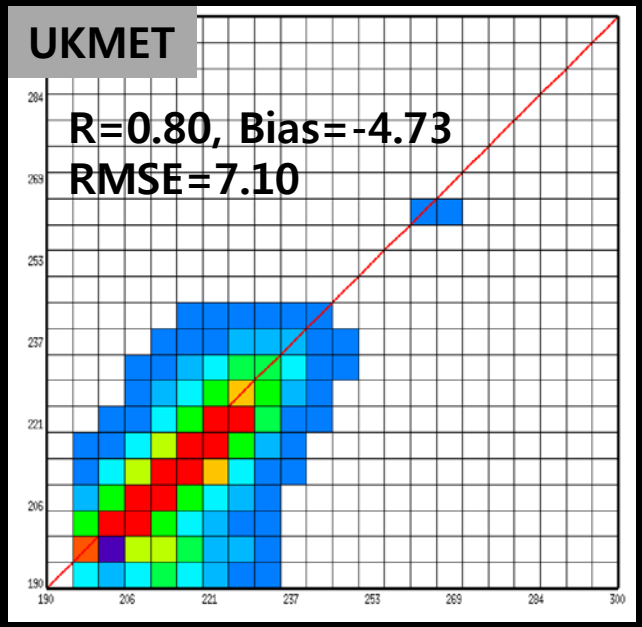
Typhoon Analysis - CTT

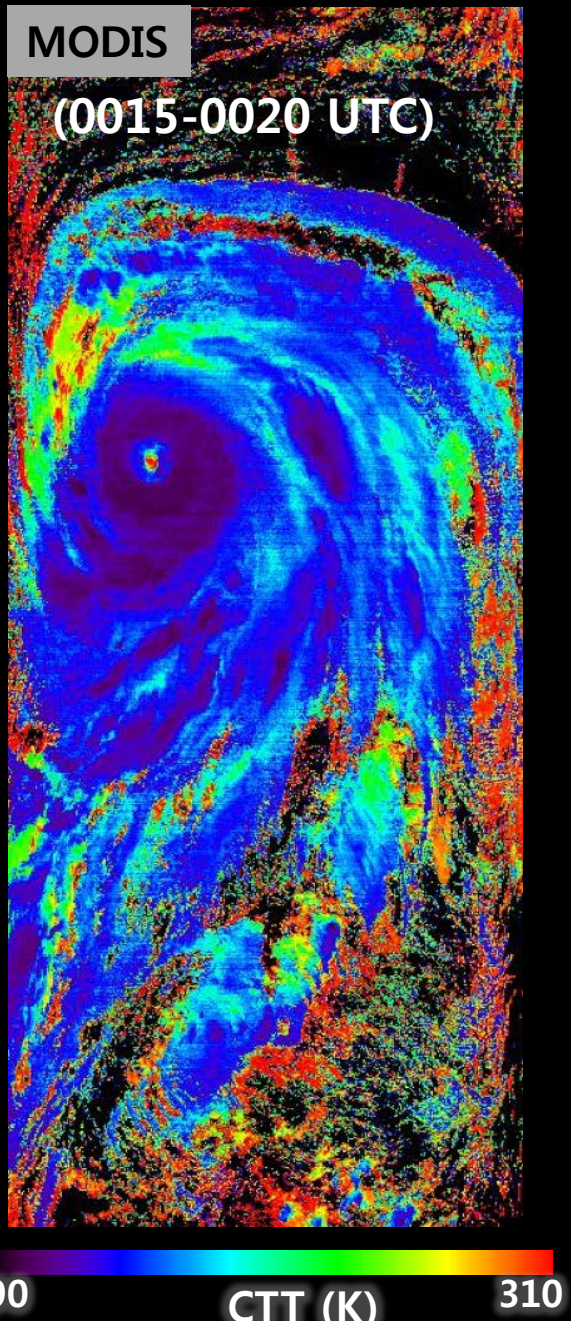
(0010 UTC)









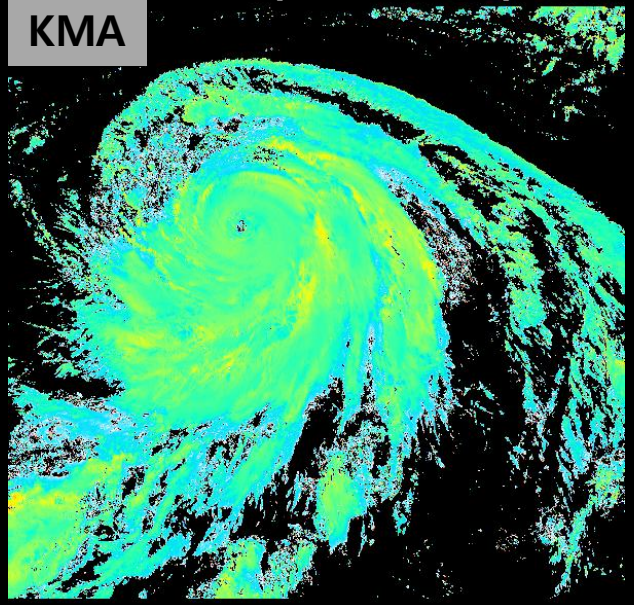


Typhoon Analysis – COT

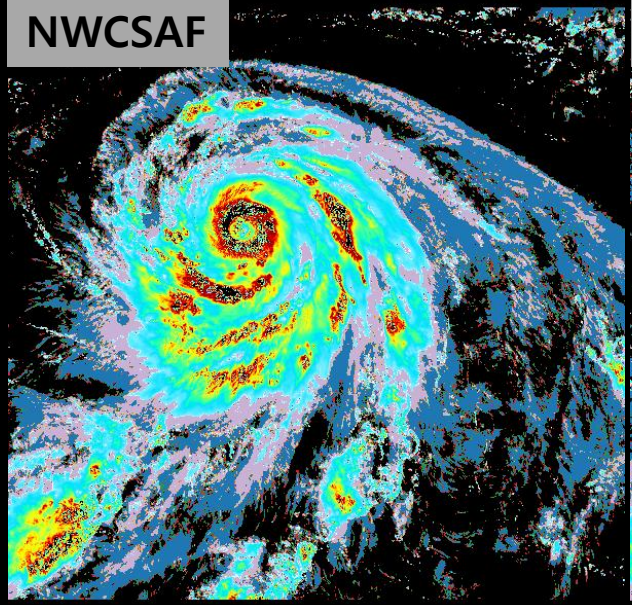
(0010 UTC)

JMA

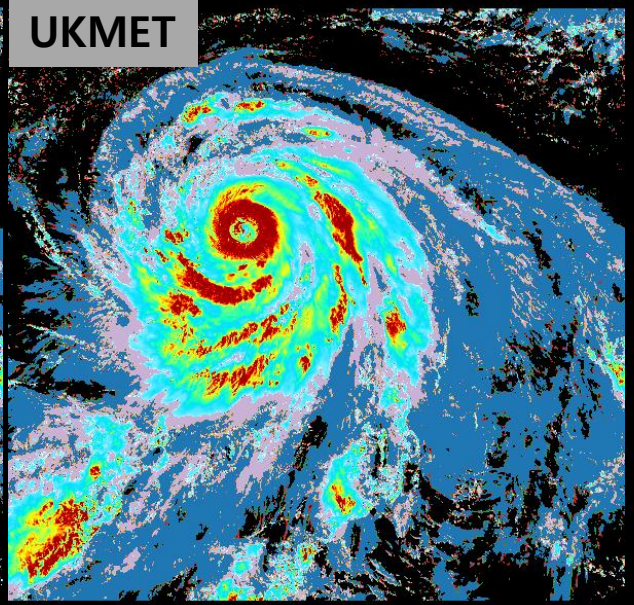
KMA



NWCSAF

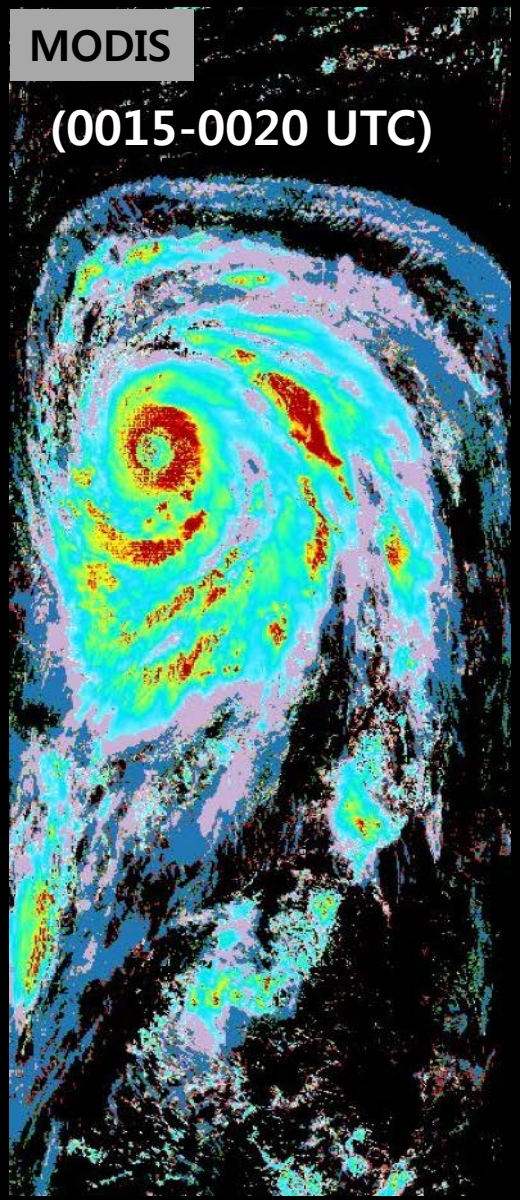


UKMET



MODIS

(0015-0020 UTC)

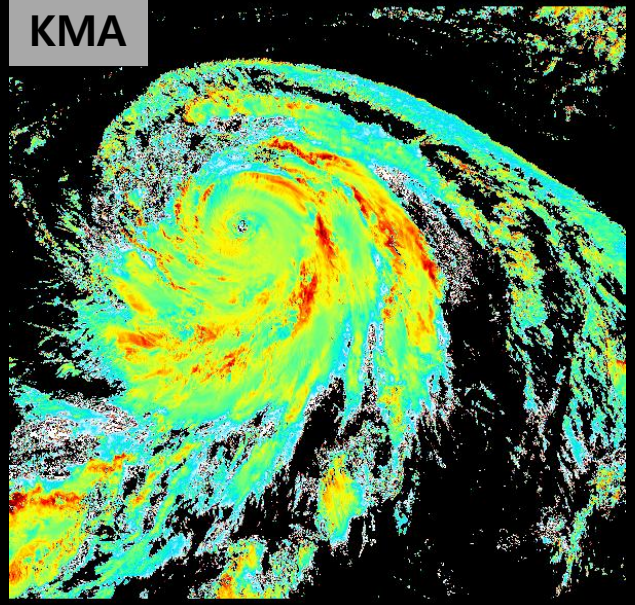


Typhoon Analysis – EPR

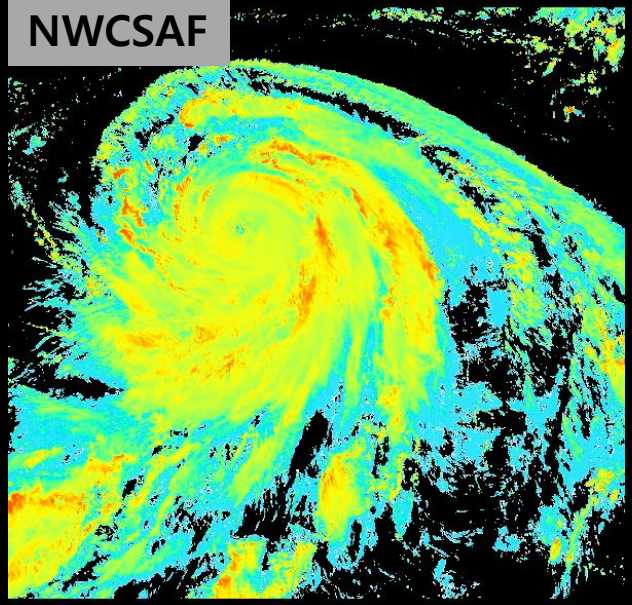
(0010 UTC)

JMA

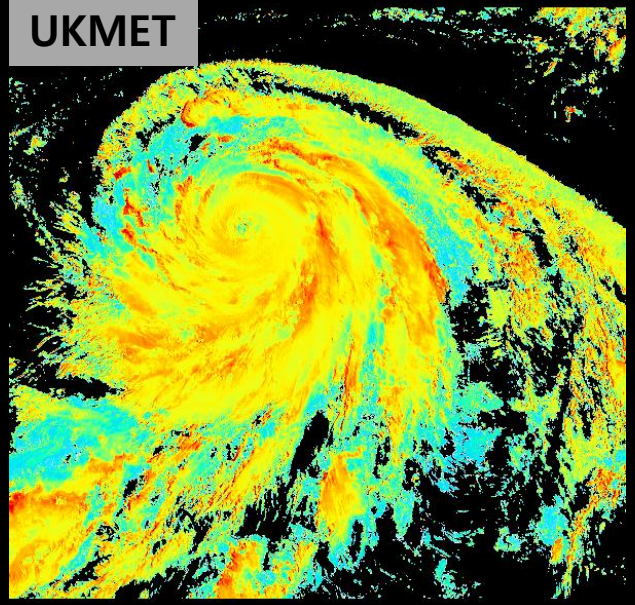
KMA



NWCSAF

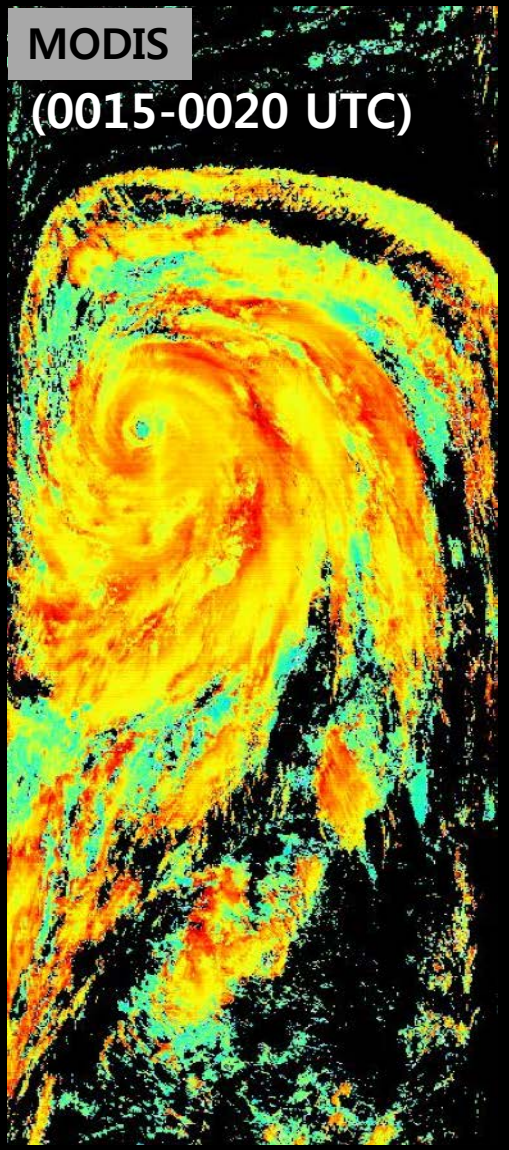


UKMET



MODIS

(0015-0020 UTC)



0 EPR (µm) 64

Summary

- The results are merely suggestive of where we stand.
- CLD: Large differences are shown in the fractional cloud scene.
- CPH: Disagreements of cloud phase are apparently shown over the bright surface, the desert scene.
- CTT: Differences in cirrus cloud top temperature ranges between agencies are large. This is also shown in the analysis of typhoon 'GONI'.
- COT: The features of cloud optical thickness retrievals over five vulnerable scenes are quite similar. However, cloud optical thickness of typhoon 'GONI' have discrepancies.
- EPR: The retrievals of effective particle radius for cirrus clouds and clouds over the desert show large differences.

Future plans

- Include more cloud algorithms if possible.
- Interpret the results based on the algorithm physics.
- Update the results once the algorithms are updated.
- Identify advantaged algorithm physics more clearly and suggest benchmarking them to all participants.
- Identify common limits to algorithms more clearly and encourage all participants to study them with focus.