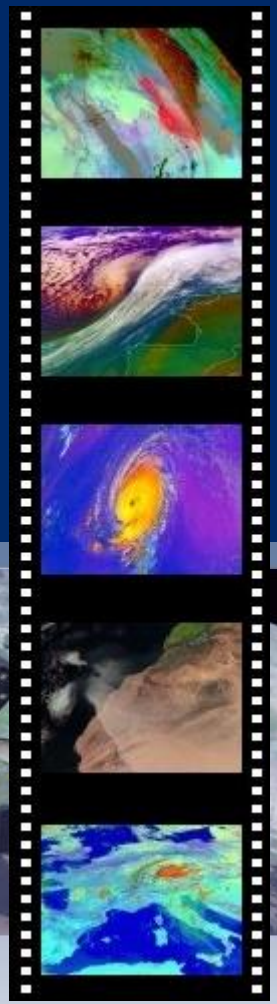
New RGB products from MTG FCI

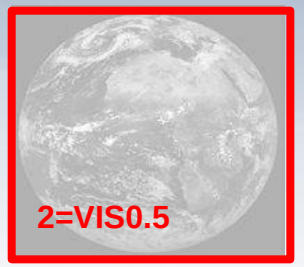


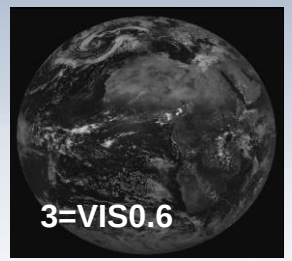
Jochen Kerkmann

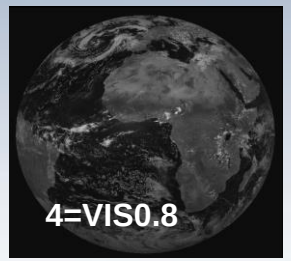
jochen.kerkmann@eumetsat.int

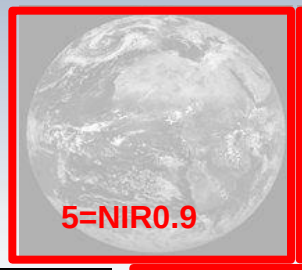
EUMETSAT

FCI on Meteosat Third Generation (MTG)

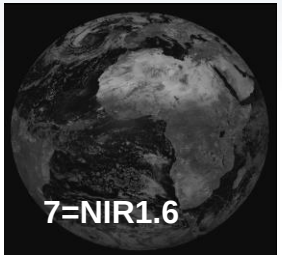


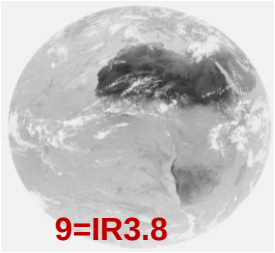


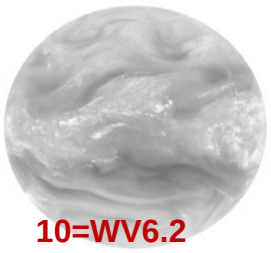


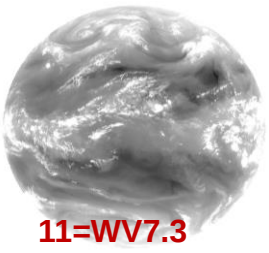


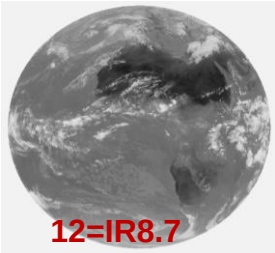
Solar
1.0 km



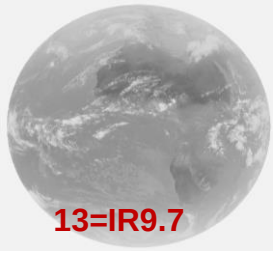


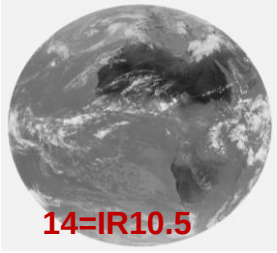


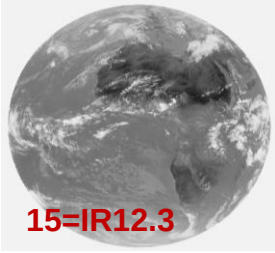


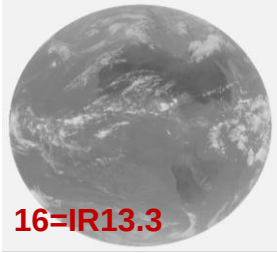


Thermal
2.0 km









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FCI Optical Design

Spectral Channel	Central Wavelength, λ_0 (µm)	Spectral Width, $\Delta\lambda_0$ (µm)	On-ground spatial sampling distance (km)
VIS 0.4	0.444	0.060	1.0
VIS 0.5	0.510	0.040	1.0
VIS 0.6	0.640	0.050	1.0 / 0.5
VIS 0.8	0.865	0.050	1.0
VIS 0.9	0.914	0.020	1.0
NIR 1.3	1.380	0.030	1.0
NIR 1.6	1.610	0.050	1.0
NIR 2.2	2.250	0.050	1.0 / 0.5
IR1 3.8	3.800	0.400	2.0 / 1.0
IR1 6.3	6.300	1.000	2.0
IR1 7.3	7.350	0.500	2.0
IR2 8.7	8.700	0.400	2.0
IR2 9.7	9.660	0.300	2.0
IR3 10.5	10.500	0.700	2.0 / 1.0
IR3 12.3	12.300	0.500	2.0
IR3 13.3	13.300	0.600	2.0

- AHI, ABI, VIIRS, MODIS
- AHI
- MODIS
- MODIS, VIIRS, ABI
- AHI, ABI, VIIRS (not MODIS)

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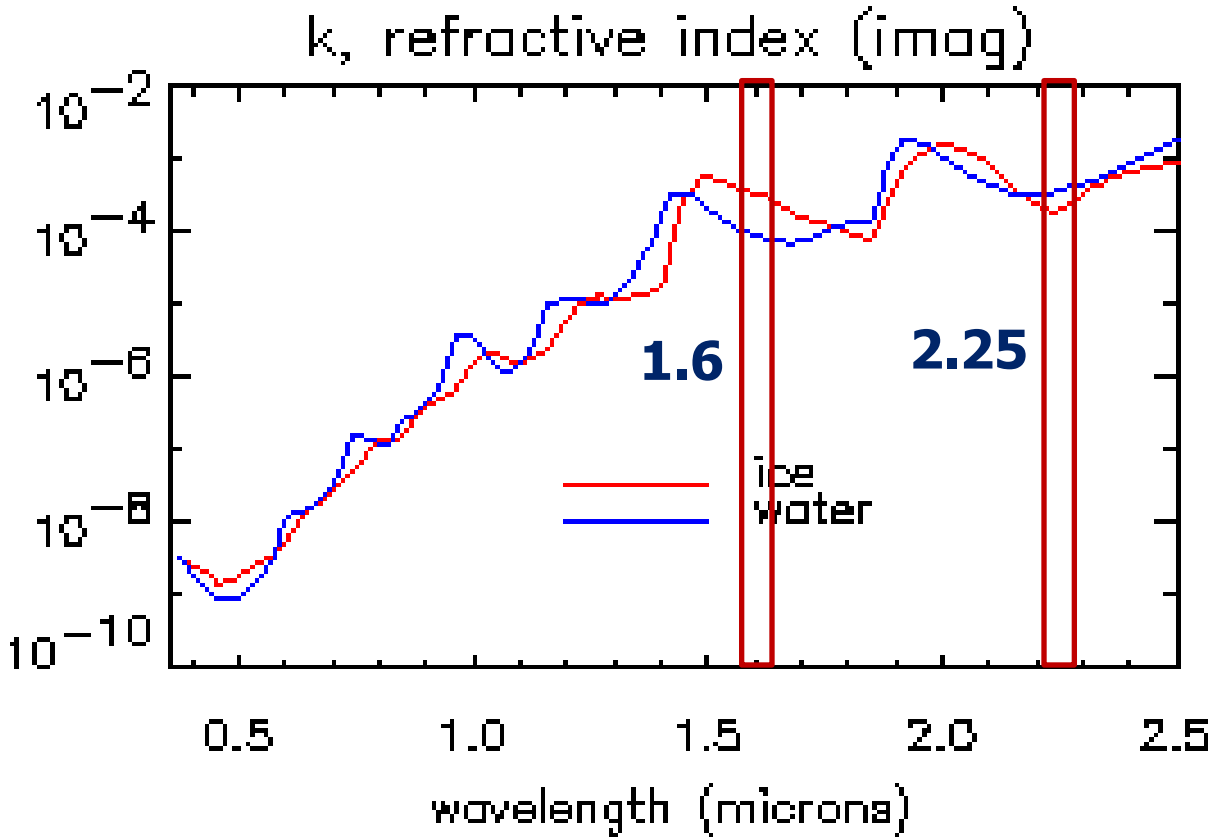
Cloud Phase RGB from FCI

	Range
R NIR1.6	0 to 50 %
G NIR2.3	0 to 50 %
B VIS0.5/VIS0.6	0 to 100 %

Attention: if the VIS0.6 channel has higher resolution, up- or down-scaling is needed!

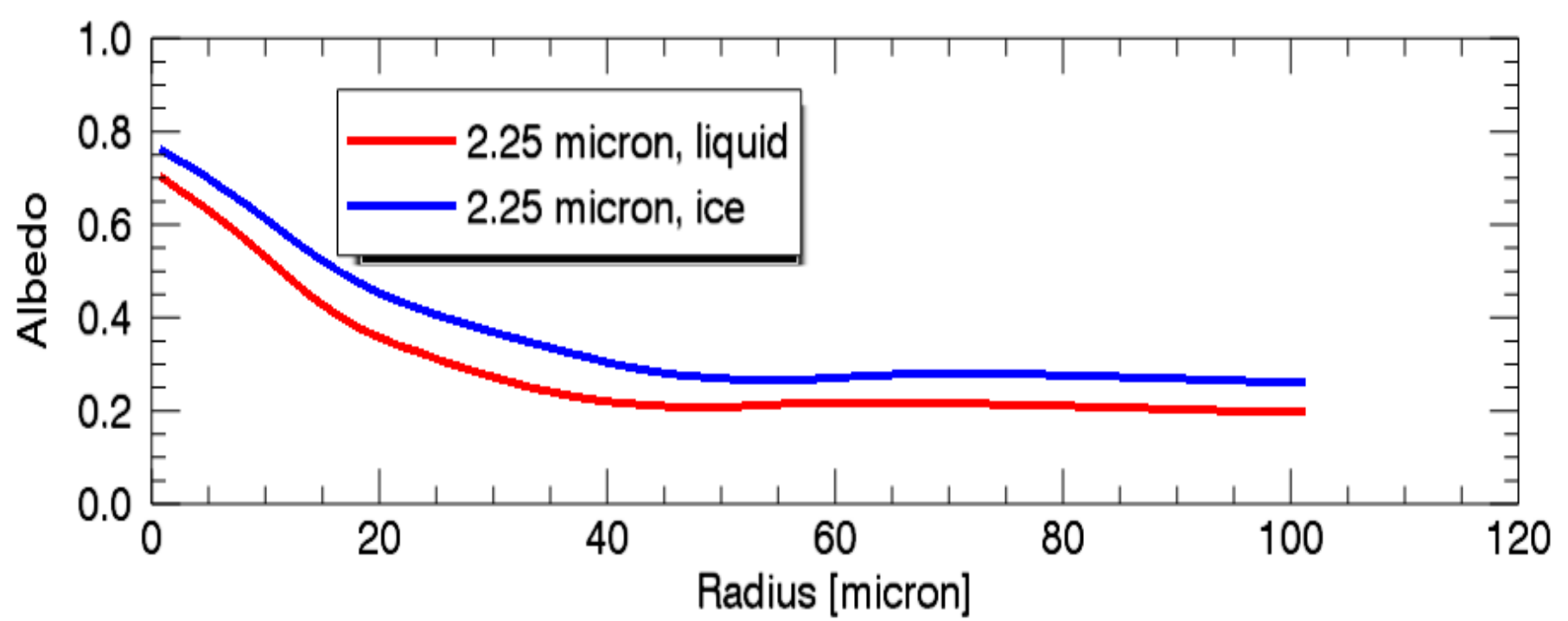
NIR2.25: Cloud Microphysical Channel



- MODIS 2.1 band has a central wavelength at 2.13 micron to be compared to the 2.25 micron for VIIRS, FCI, AHI/ABI
- Ice absorption changes a lot between 2.13 and 2.25

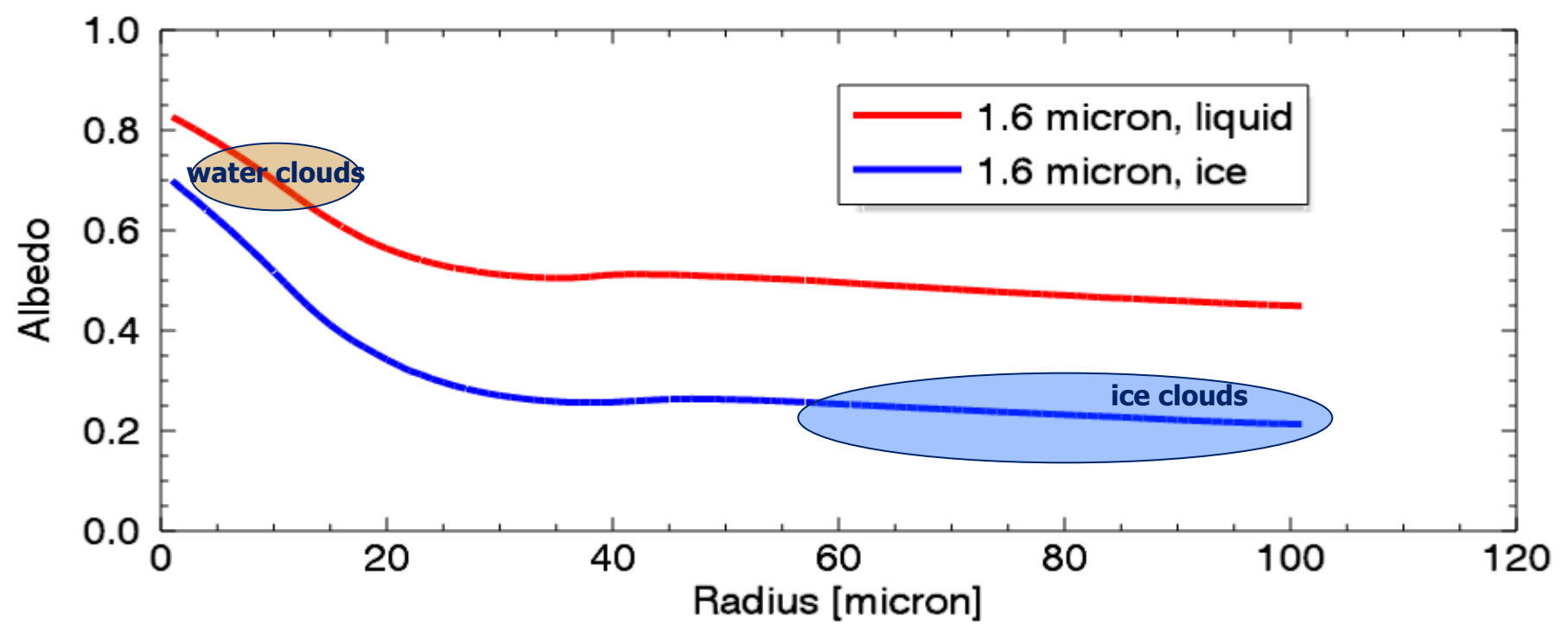
EUMETSAT

Cloud optical properties at 2.25 microns



EUMETSAT

Cloud optical properties at 1.6 microns



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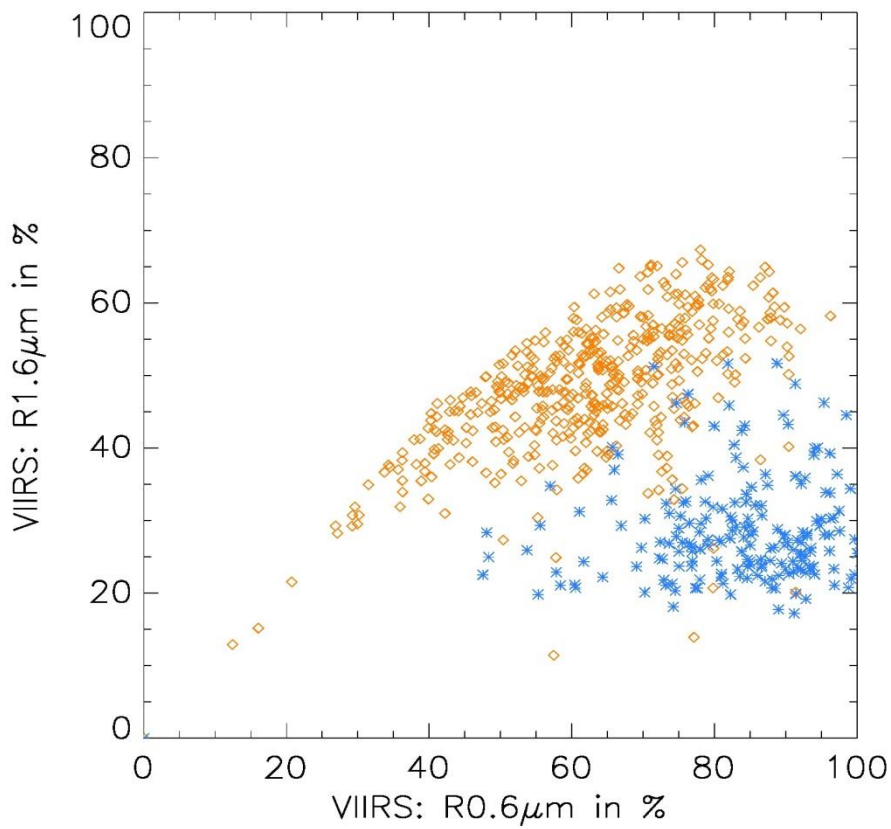
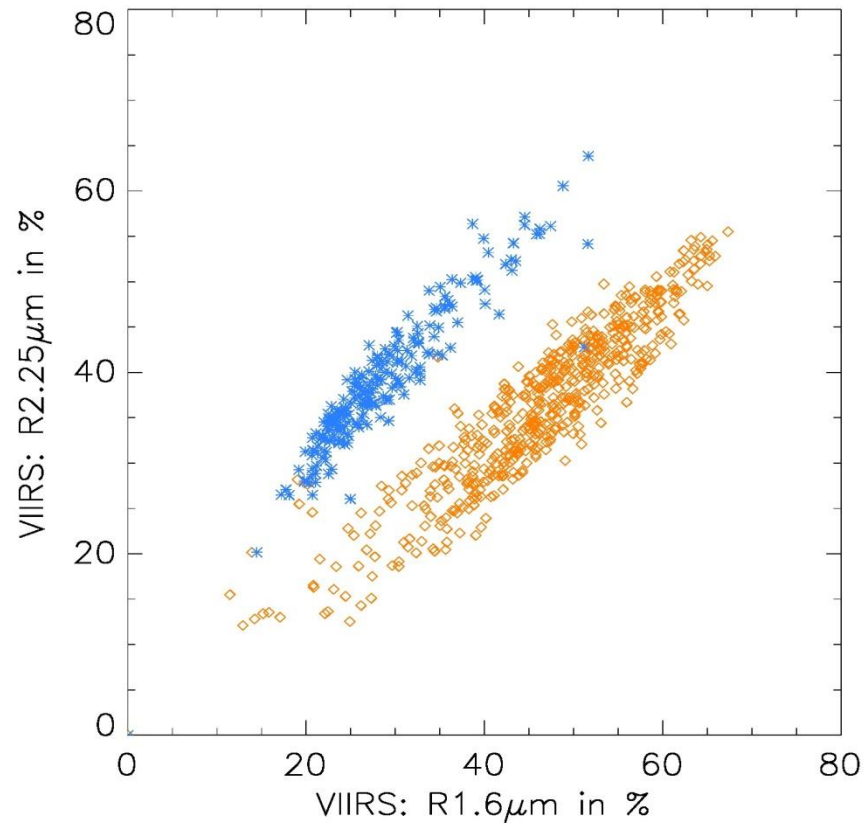
2.25µm to improve cloud phase on future GEO





Blue: ice clouds (Cb/Cs)

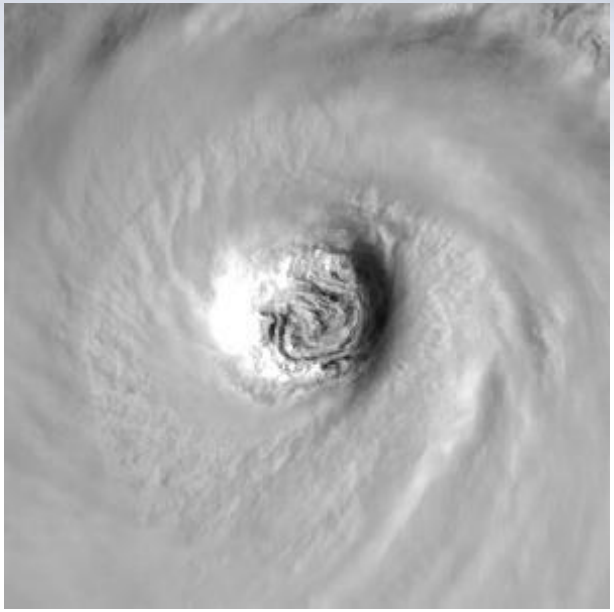
Orange: water clouds (St/SC)

Credits: Meteo France

EUMETSAT

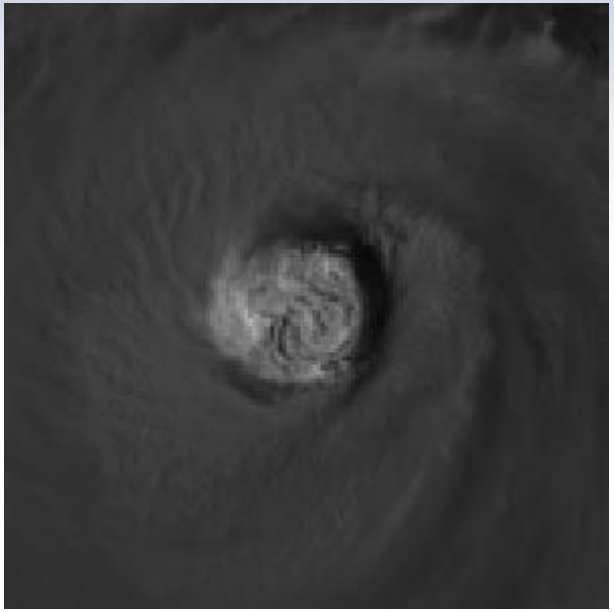
AHI Solar Bands - zoom

Band 4 (VIS0.8)



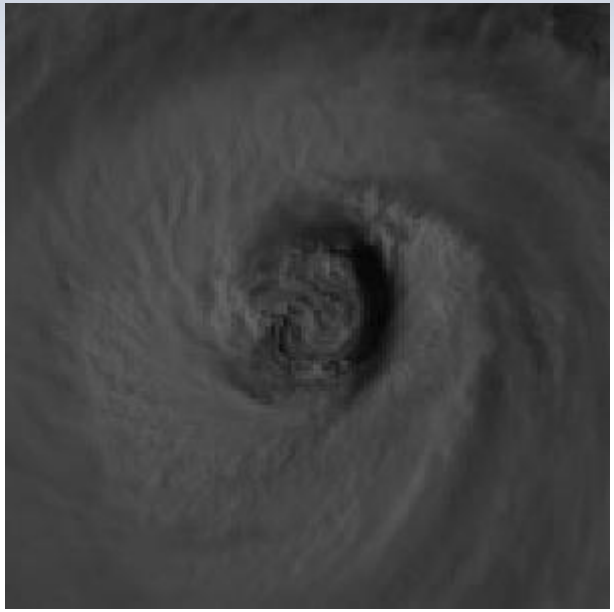
1 km

Band 5 (NIR1.6)



2 km

Band 6 (NIR2.3)



2 km

20 August 2015, 00:00 UTC
Typhoon Atsani, Pacific Ocean

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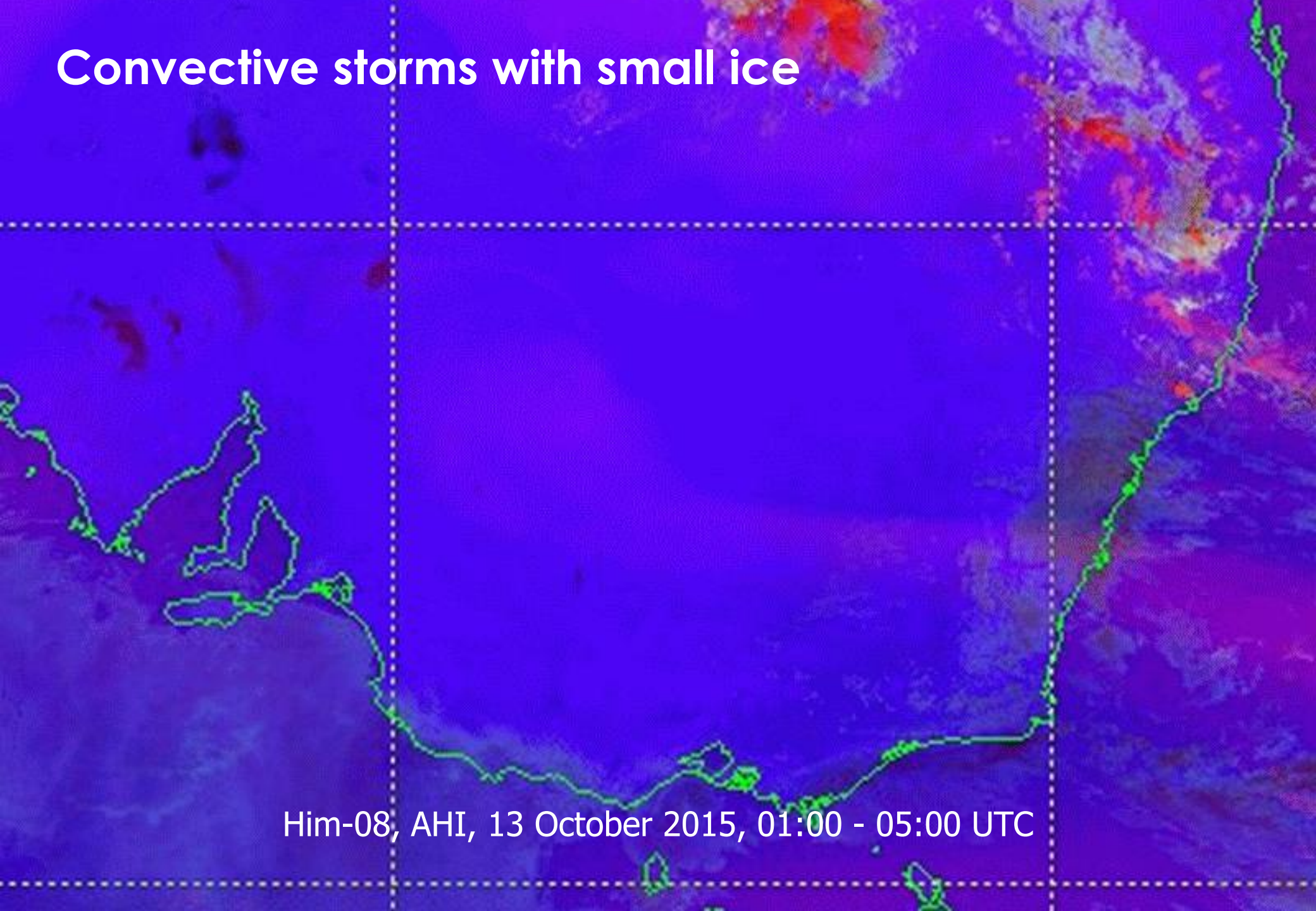
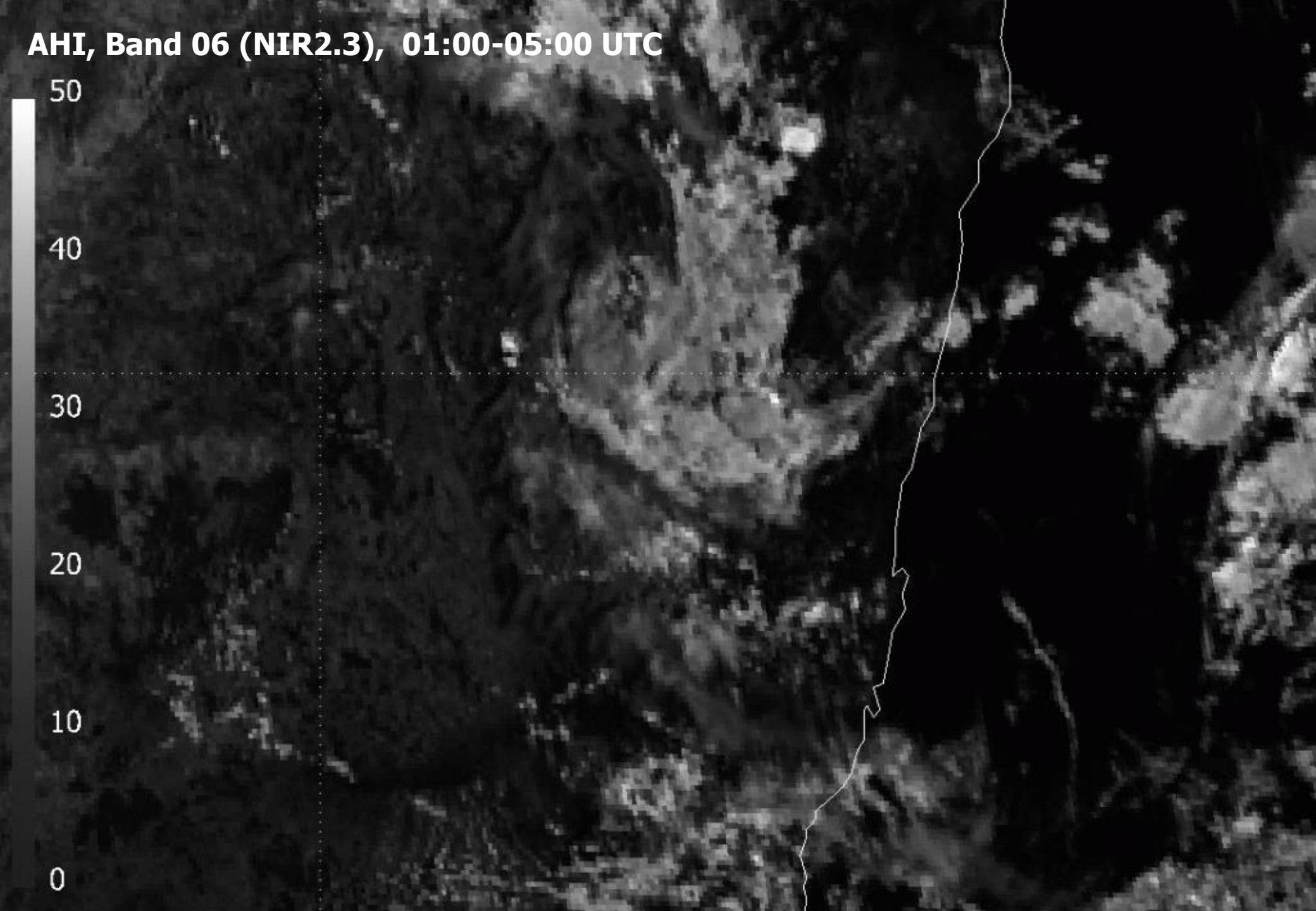
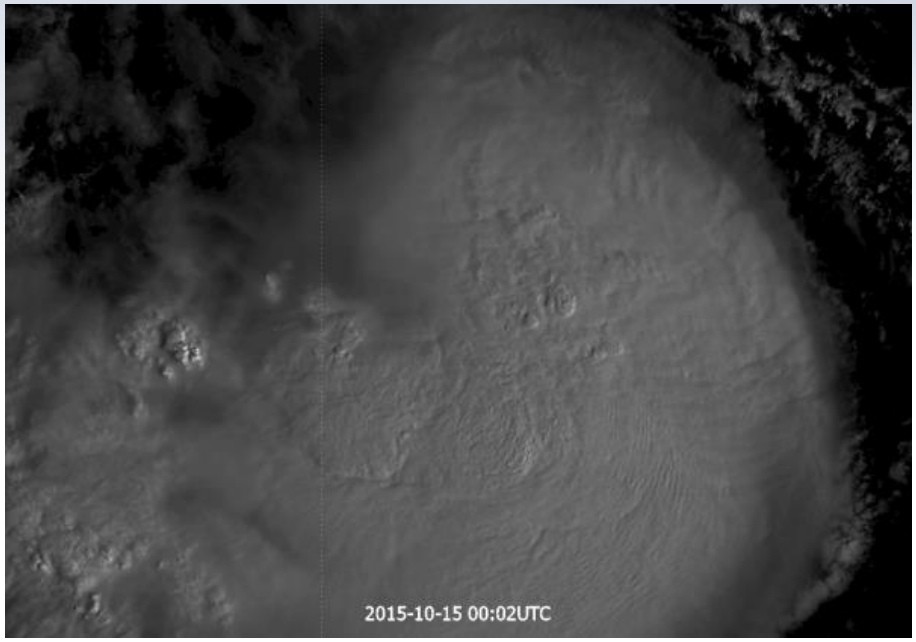
Convective storms with small ice

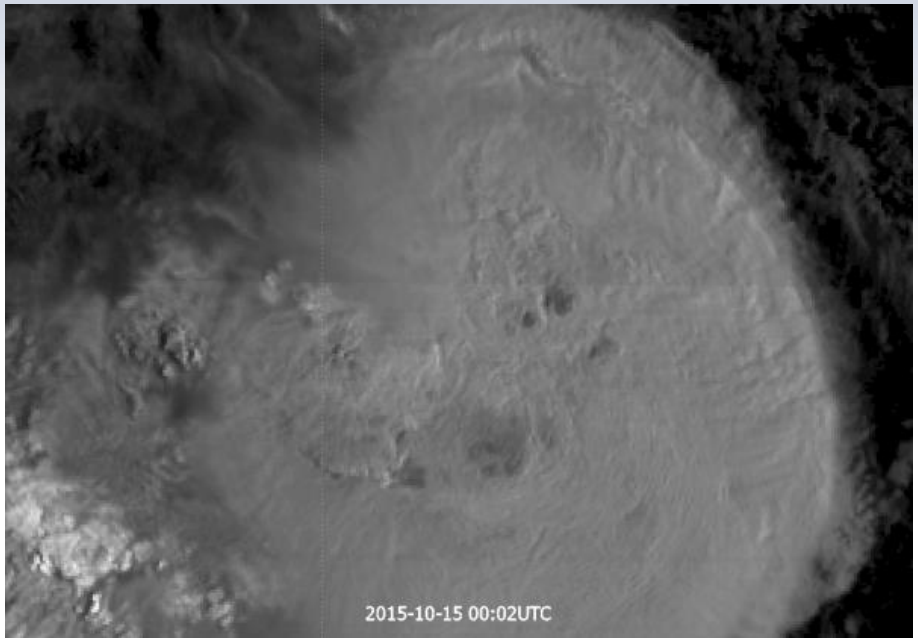



AHI, Band 06 (NIR2.3), 01:00-05:00 UTC
50
40
30
20
10
0

Overshooting Tops in Typhoon Koppu (Him-08)



Band 03 (VIS0.6)



Band 06 (NIR2.25)

Rapid Scans: 2.0 km / 2.5 minutes

CLICK HERE

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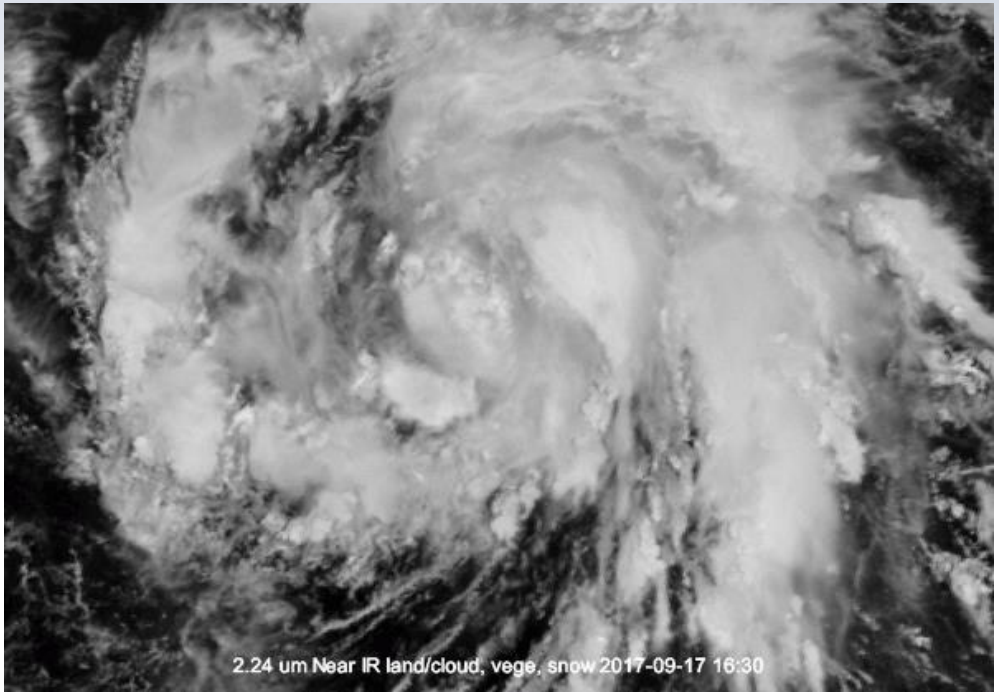
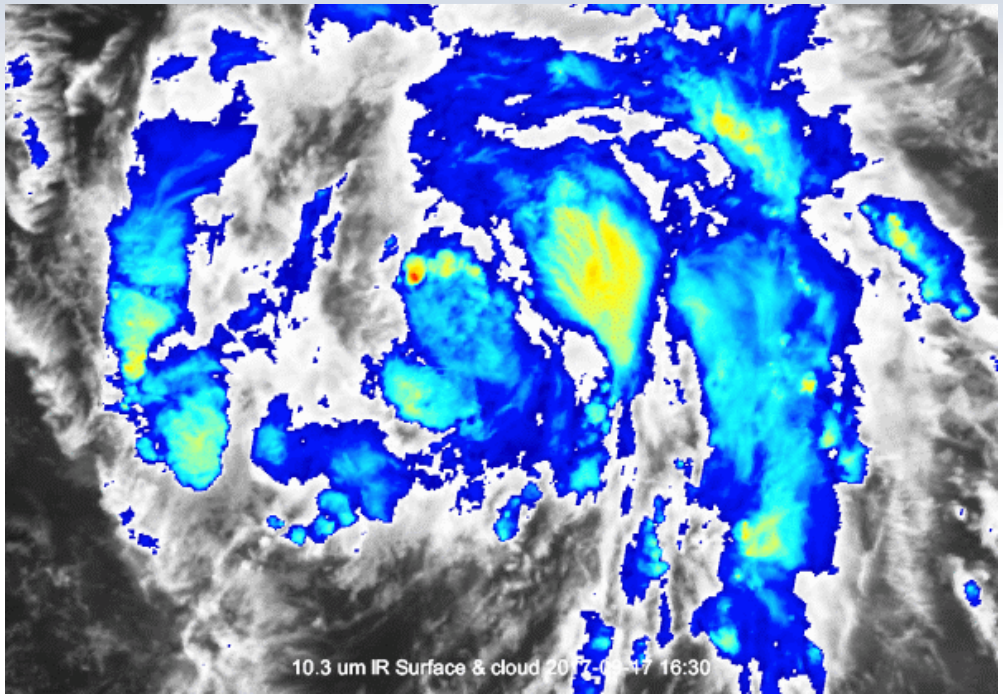
NIR2.25 for Particle Size (GOES-16)

Band 6 (NIR2.3)

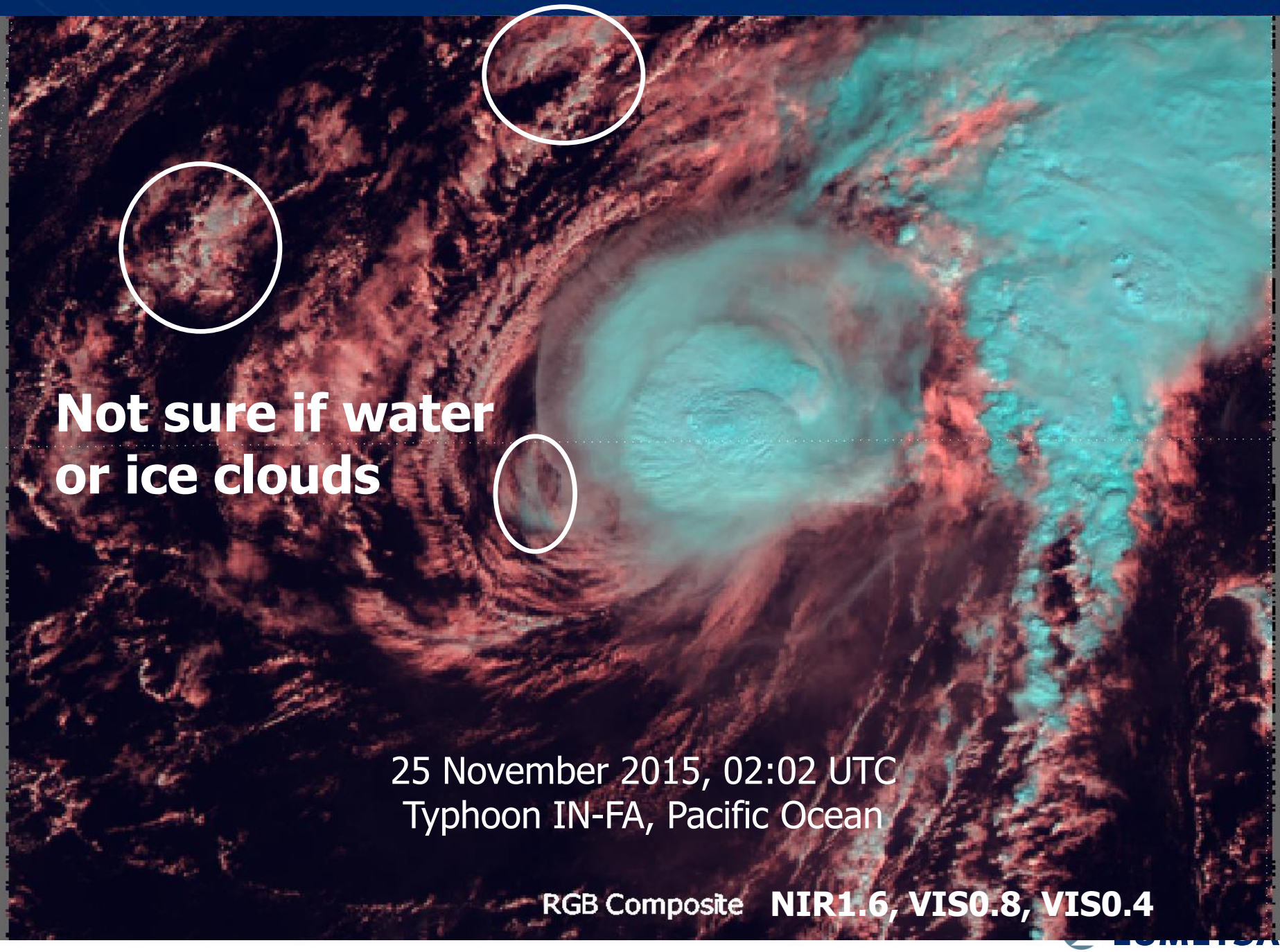


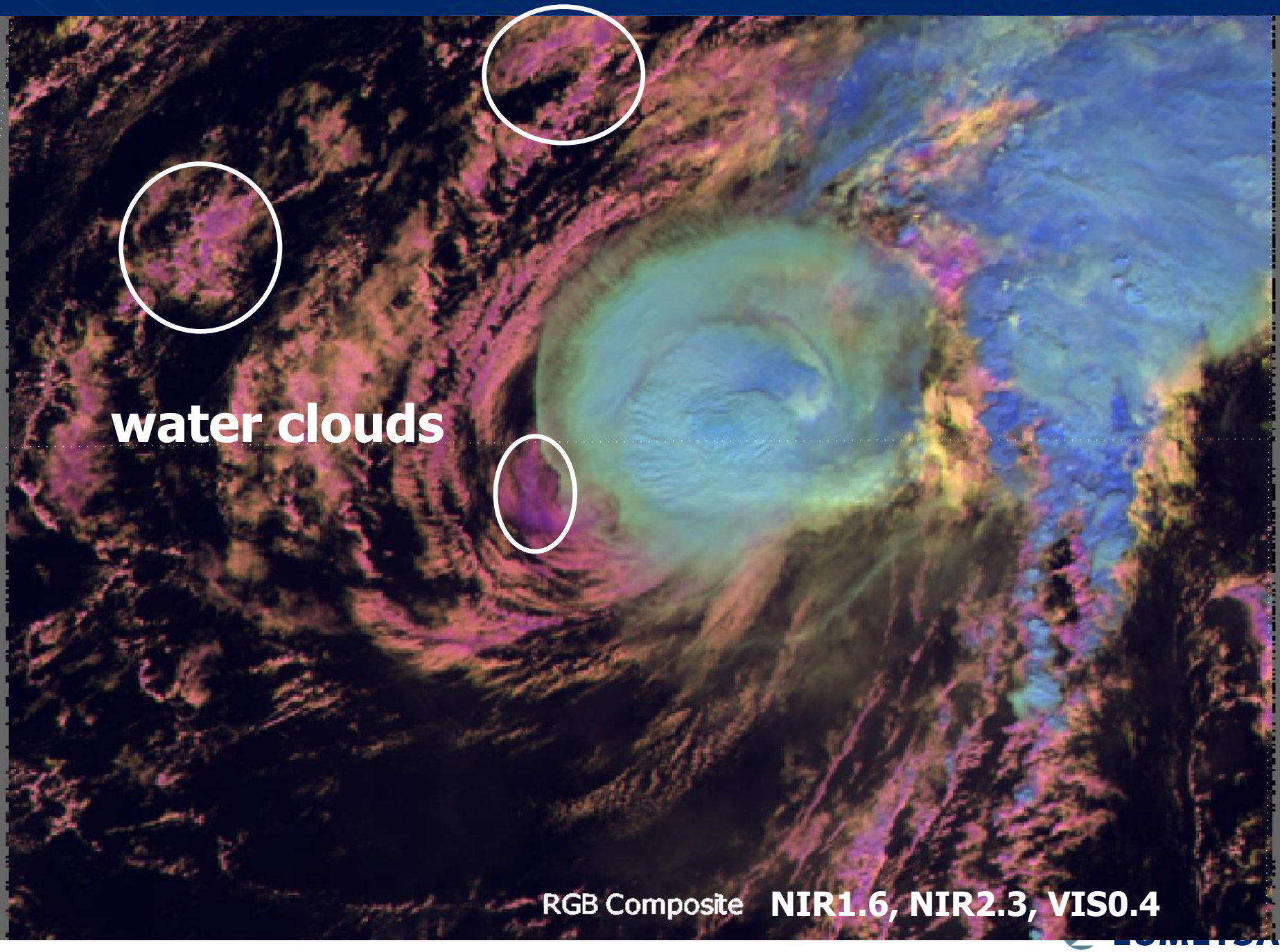
Band 13 (IR10.4)



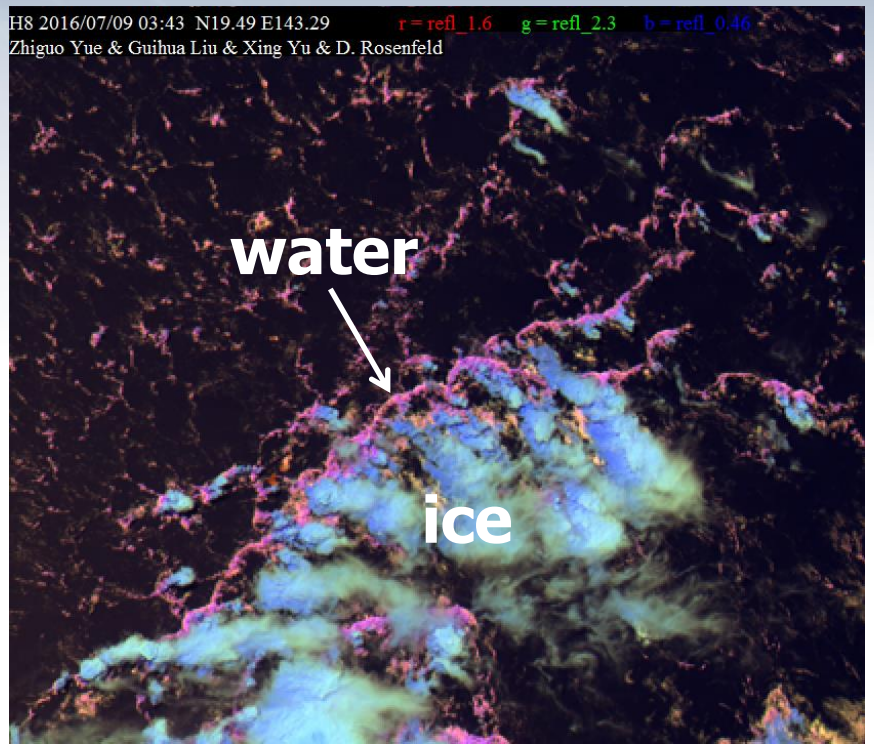
17 September 2017, 16:30 - 17:30 UTC
Hurricane Maria

EUMETSAT

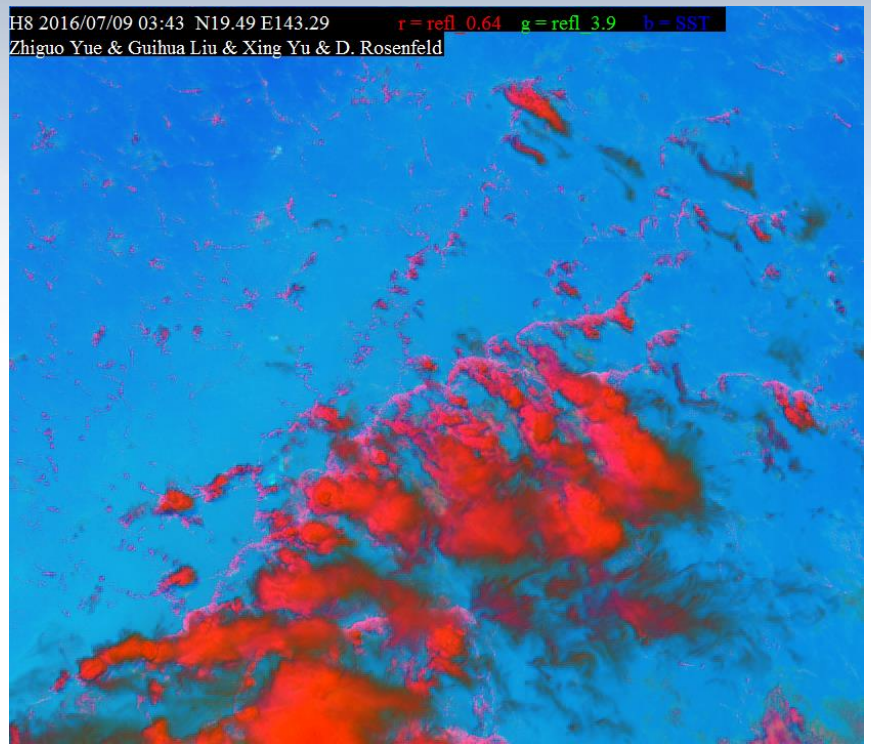

Not sure if water
or ice clouds
25 November 2015, 02:02 UTC
Typhoon IN-FA, Pacific Ocean
RGB Composite NIR1.6, VIS0.8, VIS0.4


water clouds
RGB Composite NIR1.6, NIR2.3, VIS0.4

Him-08 Cloud Phase RGB



RGB Cloud Phase
(with NIR1.6 & NIR2.3)

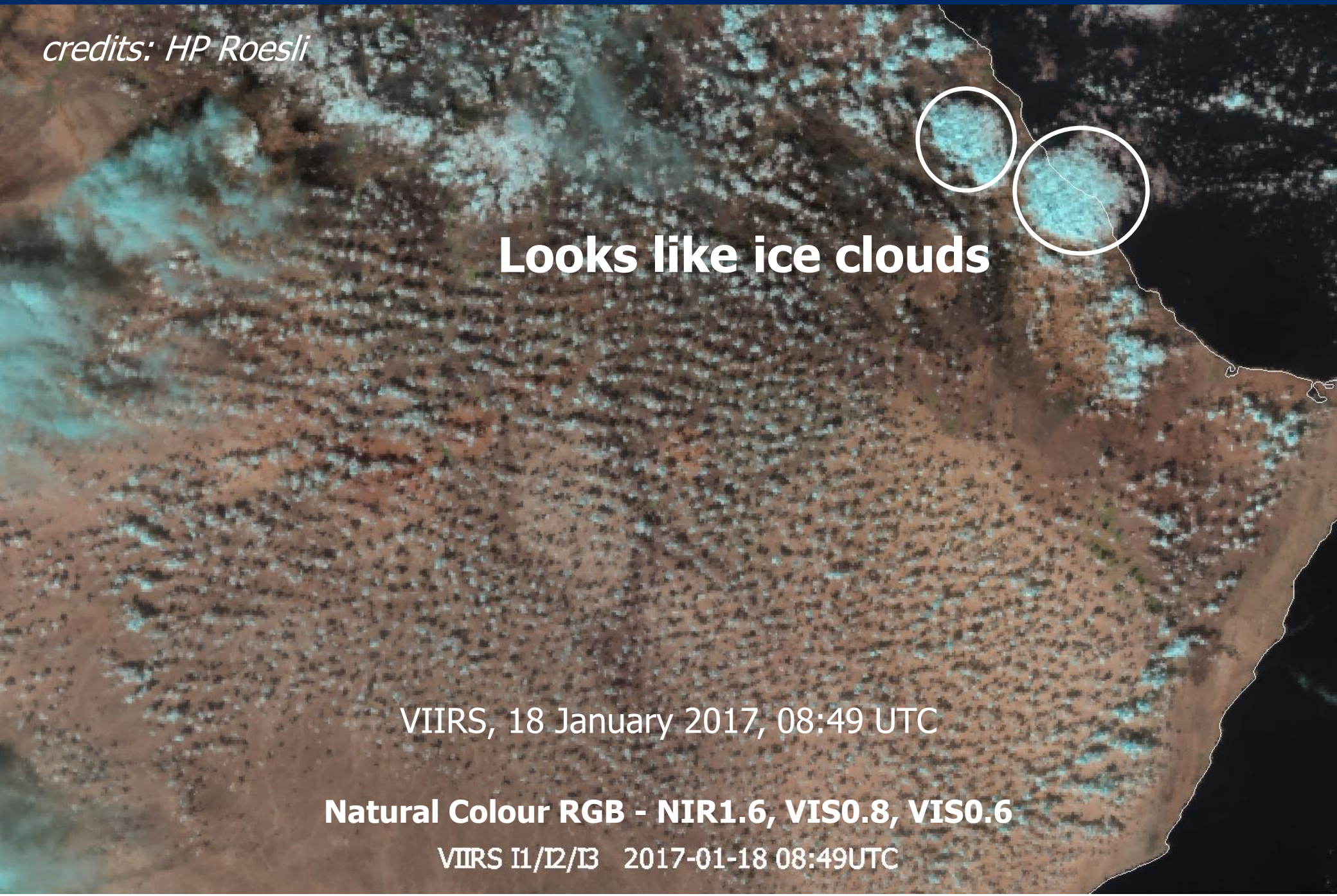


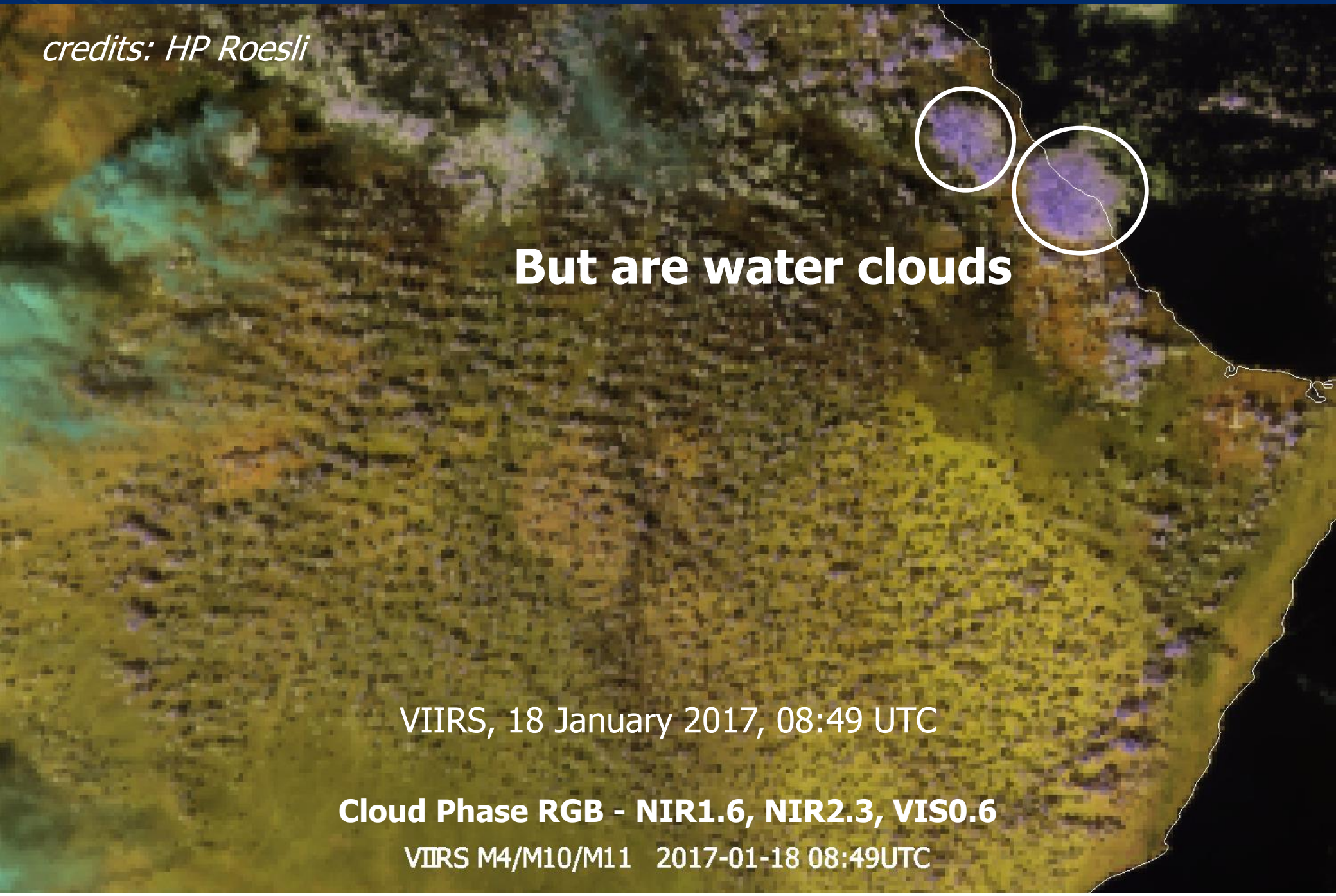
RGB Day Microphysics
(with IR3.9)

9 September 2016, 03:40 UTC

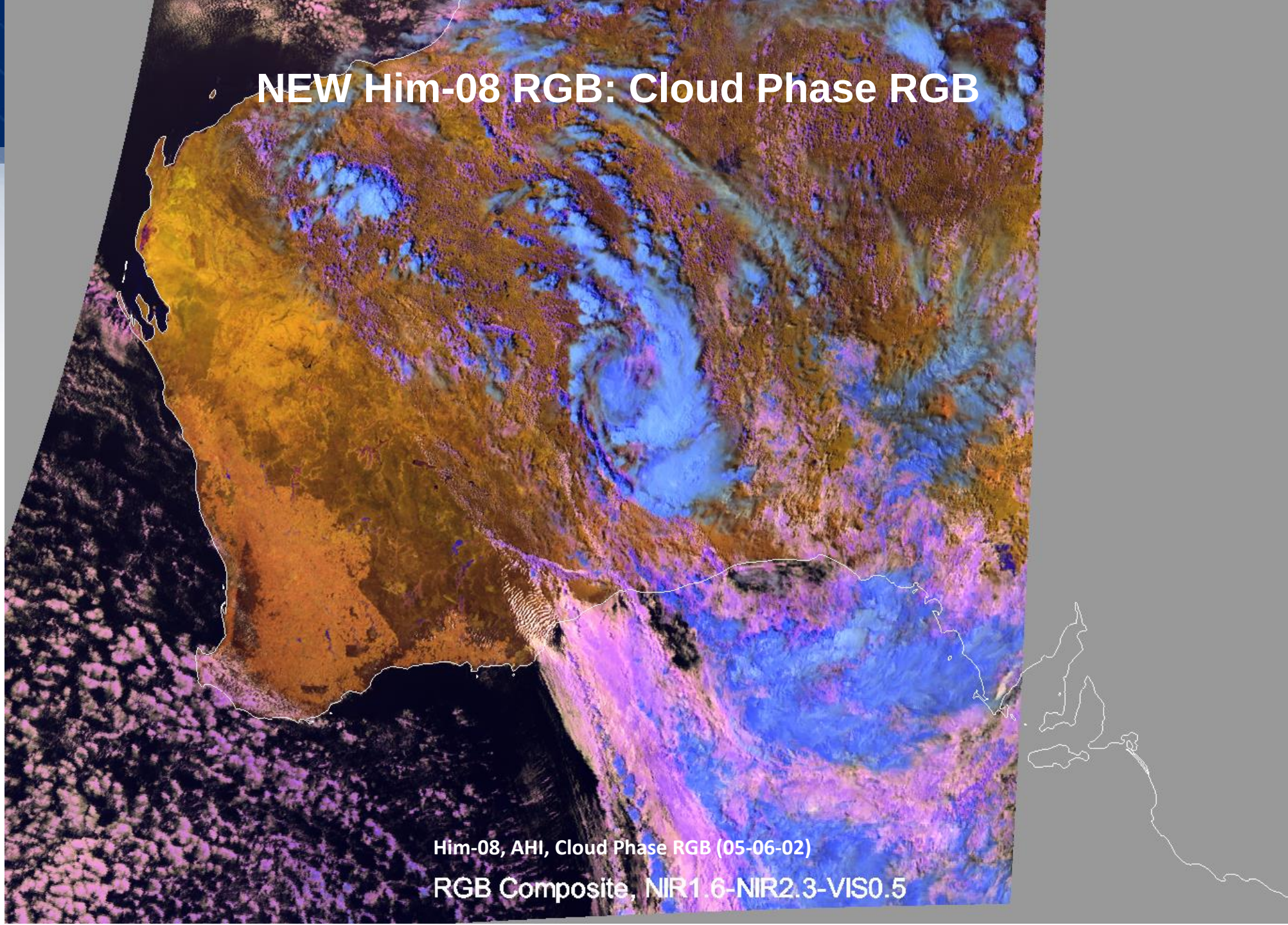
Credits: Danny Rosenfeld

EUMETSAT

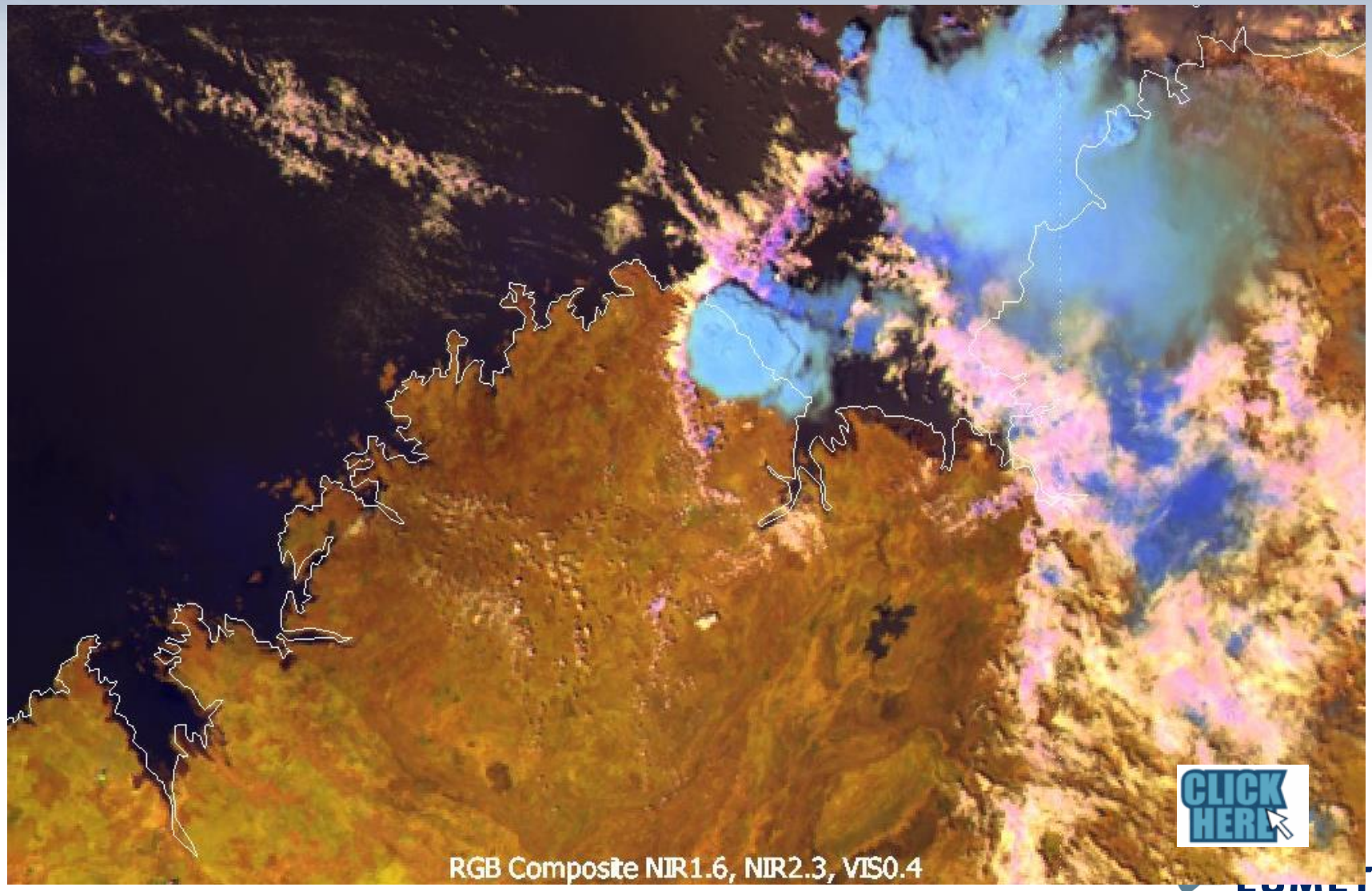

credits: HP Roesli
Looks like ice clouds
VIIRS, 18 January 2017, 08:49 UTC
Natural Colour RGB - NIR1.6, VIS0.8, VIS0.6
VIIRS I1/I2/I3 2017-01-18 08:49UTC


credits: HP Roesli
But are water clouds
VIIRS, 18 January 2017, 08:49 UTC
Cloud Phase RGB - NIR1.6, NIR2.3, VIS0.6
VIIRS M4/M10/M11 2017-01-18 08:49UTC

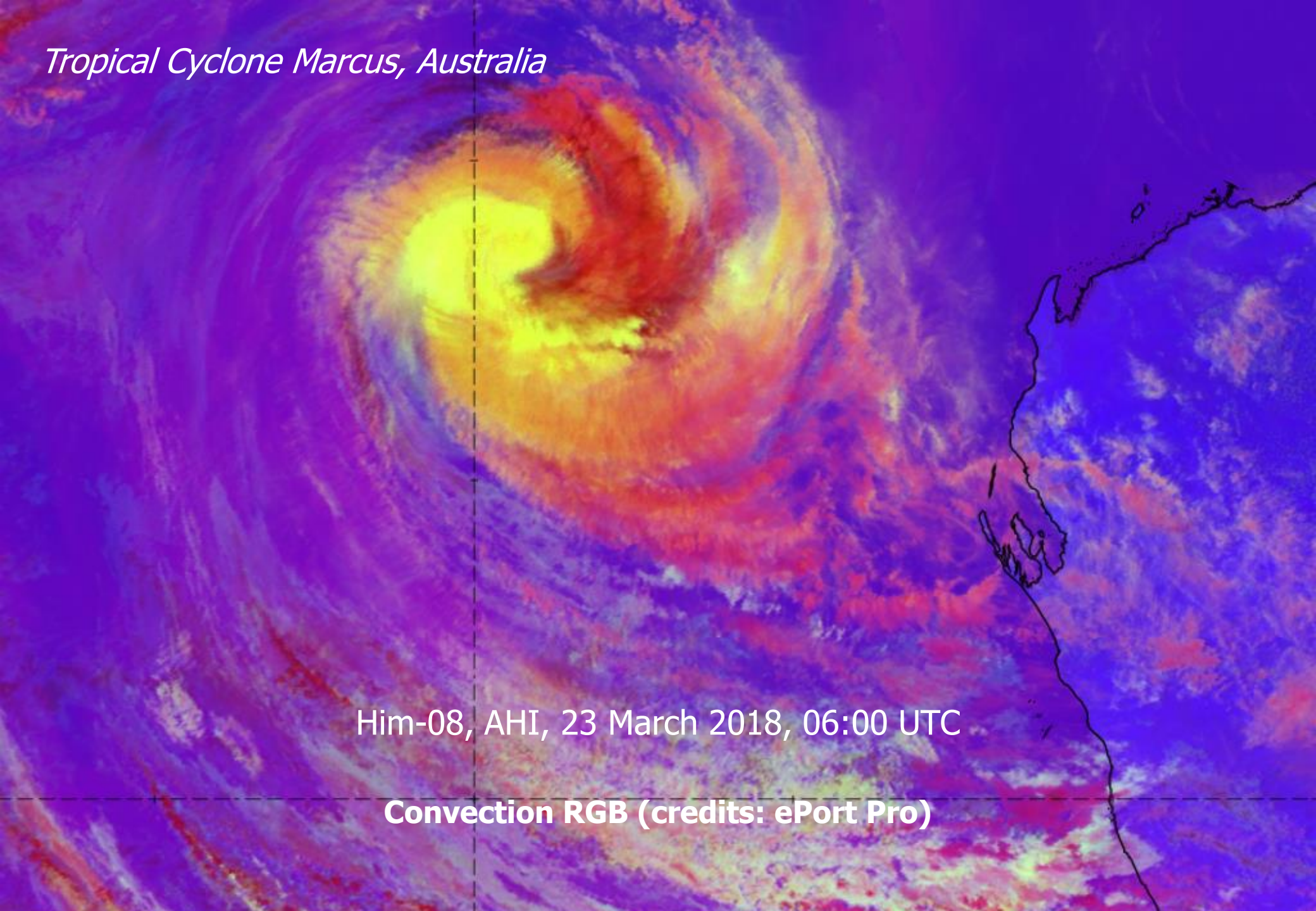
NEW Him-08 RGB: Cloud Phase RGB

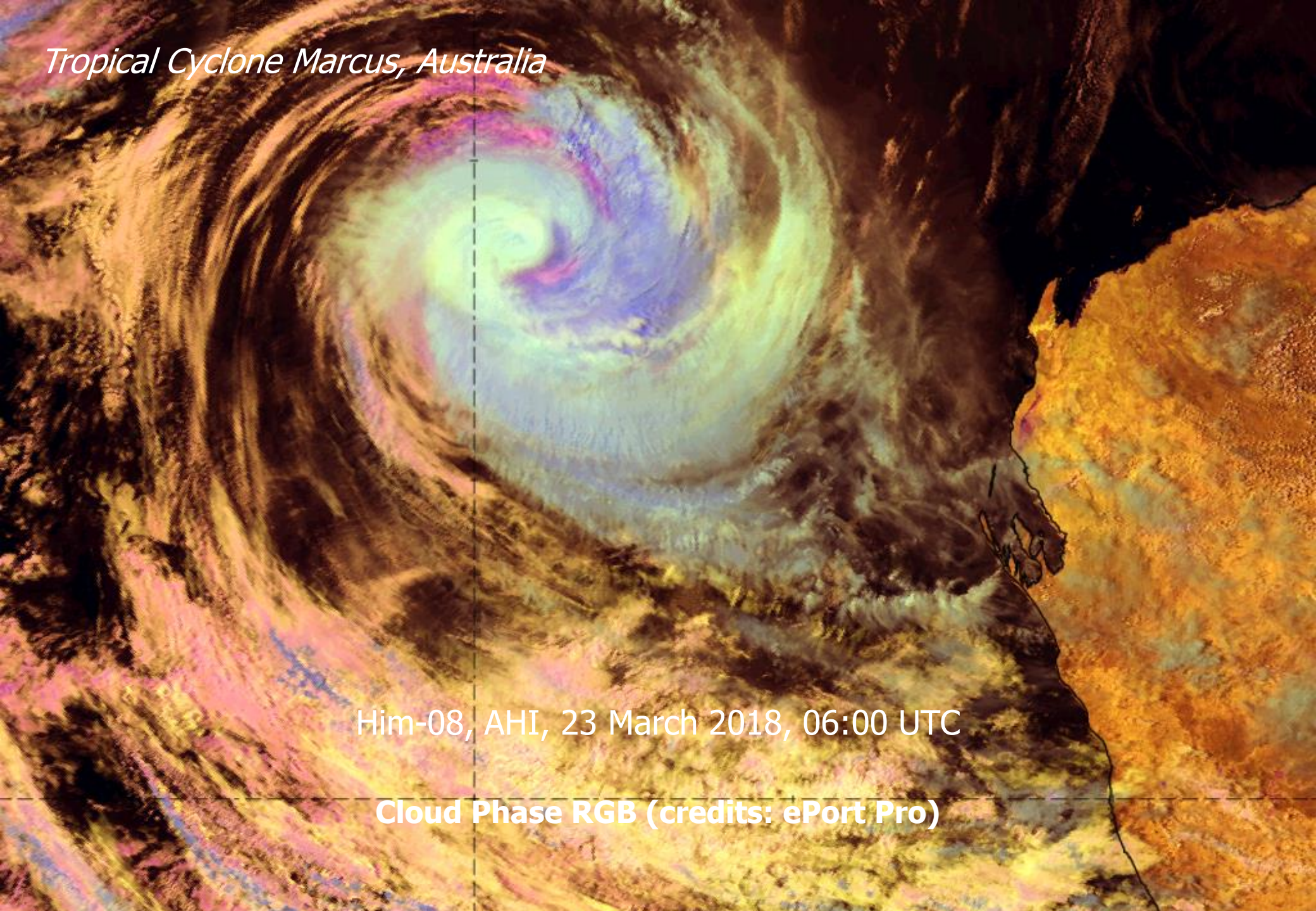


Animation Cloud Phase RGB, Australia

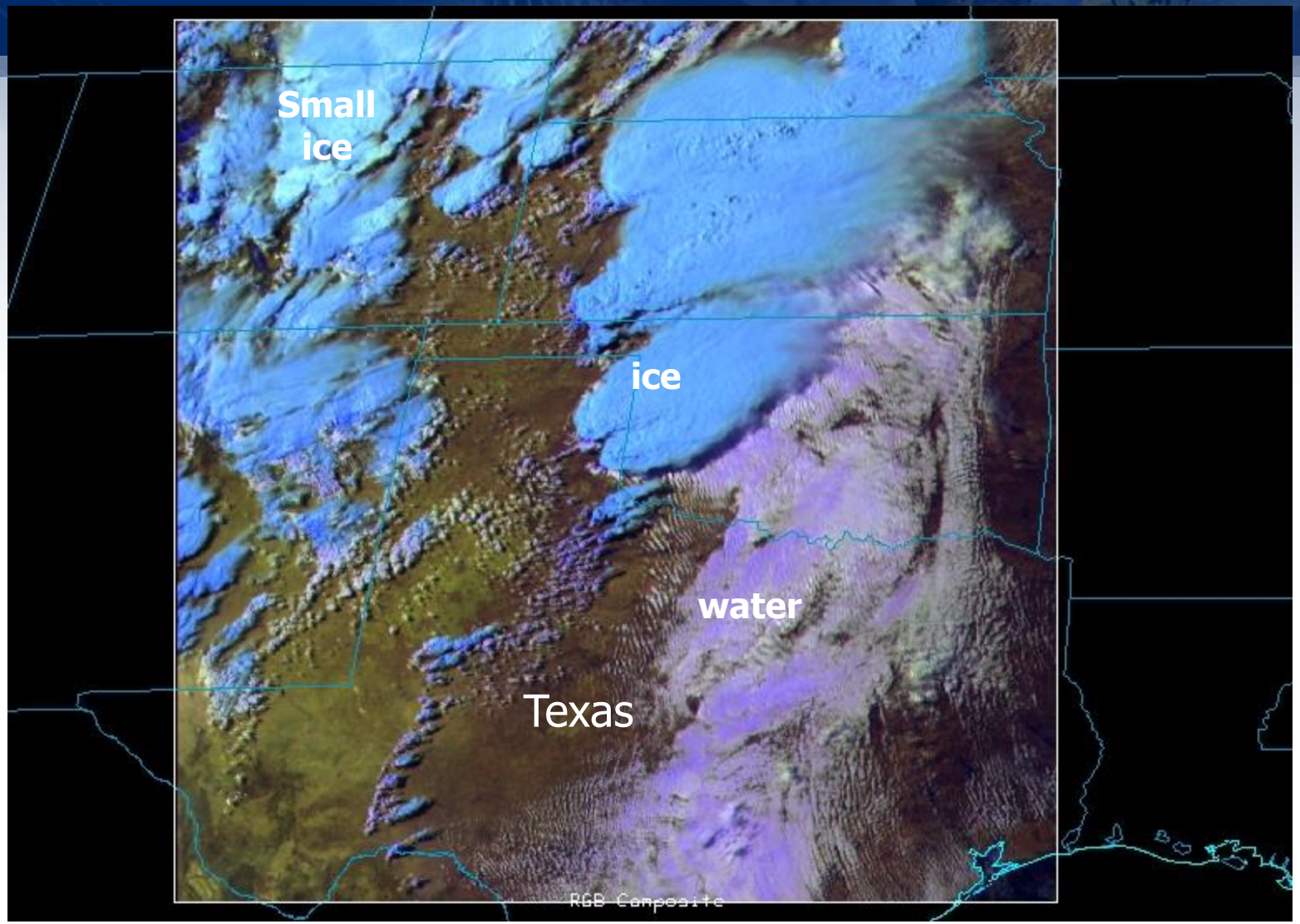


EUMETSAT


Tropical Cyclone Marcus, Australia
Him-08, AHI, 23 March 2018, 06:00 UTC
Convection RGB (credits: ePort Pro)


Tropical Cyclone Marcus, Australia
Him-08, AHI, 23 March 2018, 06:00 UTC
Cloud Phase RGB (credits: ePort Pro)

GOES-16 Cloud Phase RGB (non-operational data)

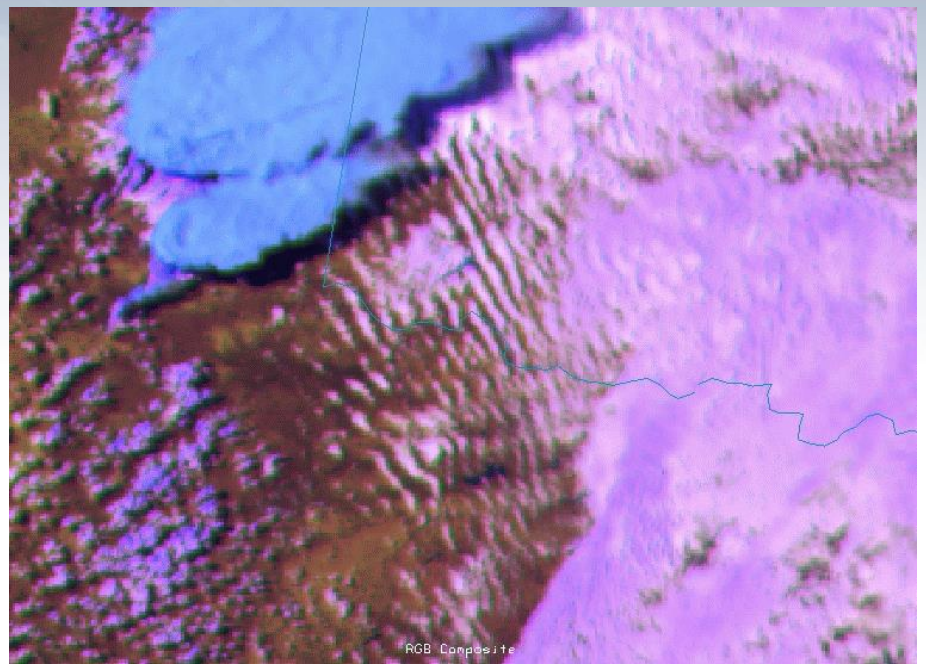


Credits: D. Gencic

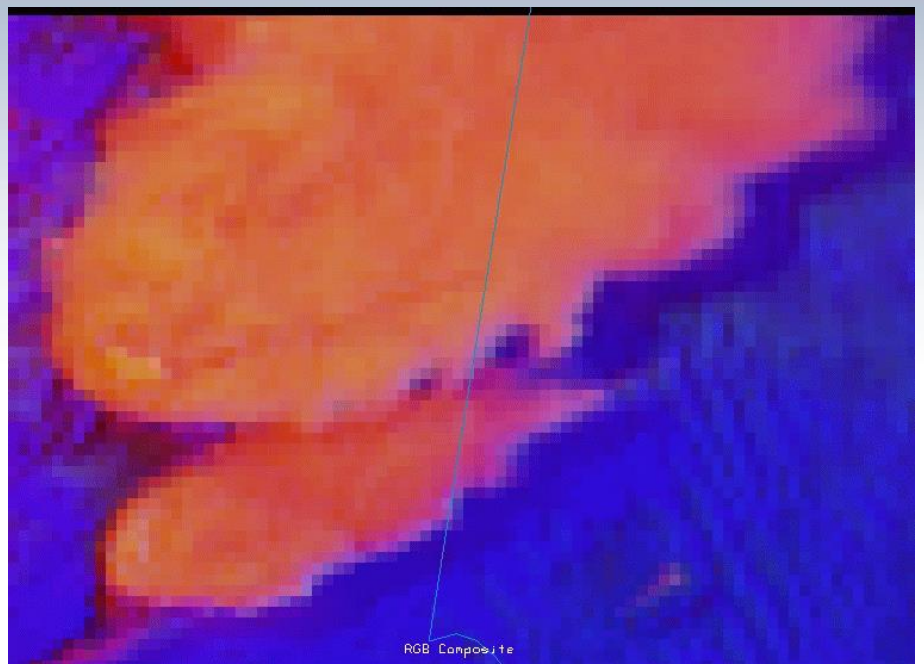
16 May 2017

EUMETSAT

GOES-16 Cloud Phase RGB (non-operational data)



Cloud Phase RGB



Convection RGB

Supercell, Texas, 16 May 2017, 21:27 – 23:02 UTC (5 min intervals)

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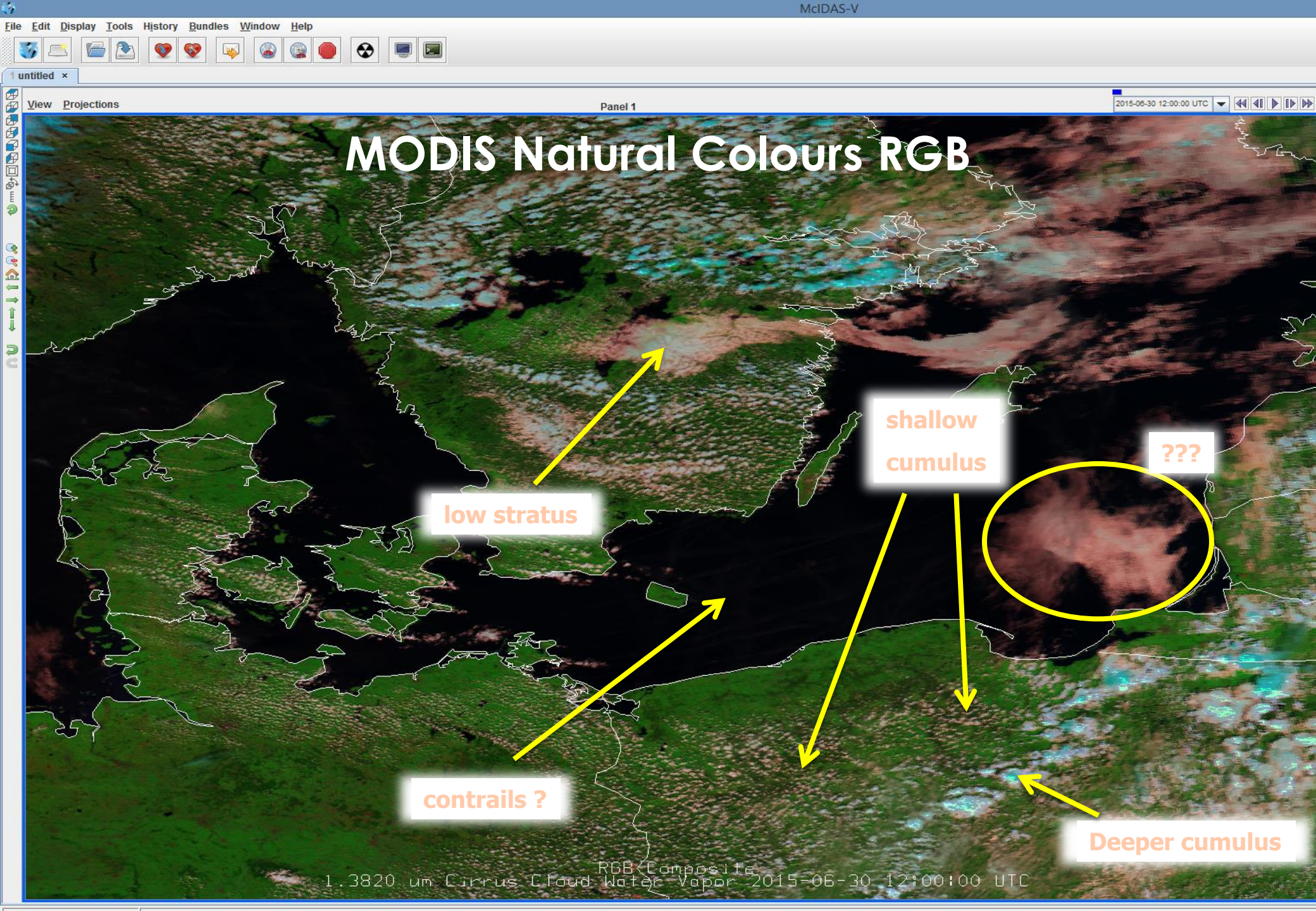
New RGB with NIR1.3 ?

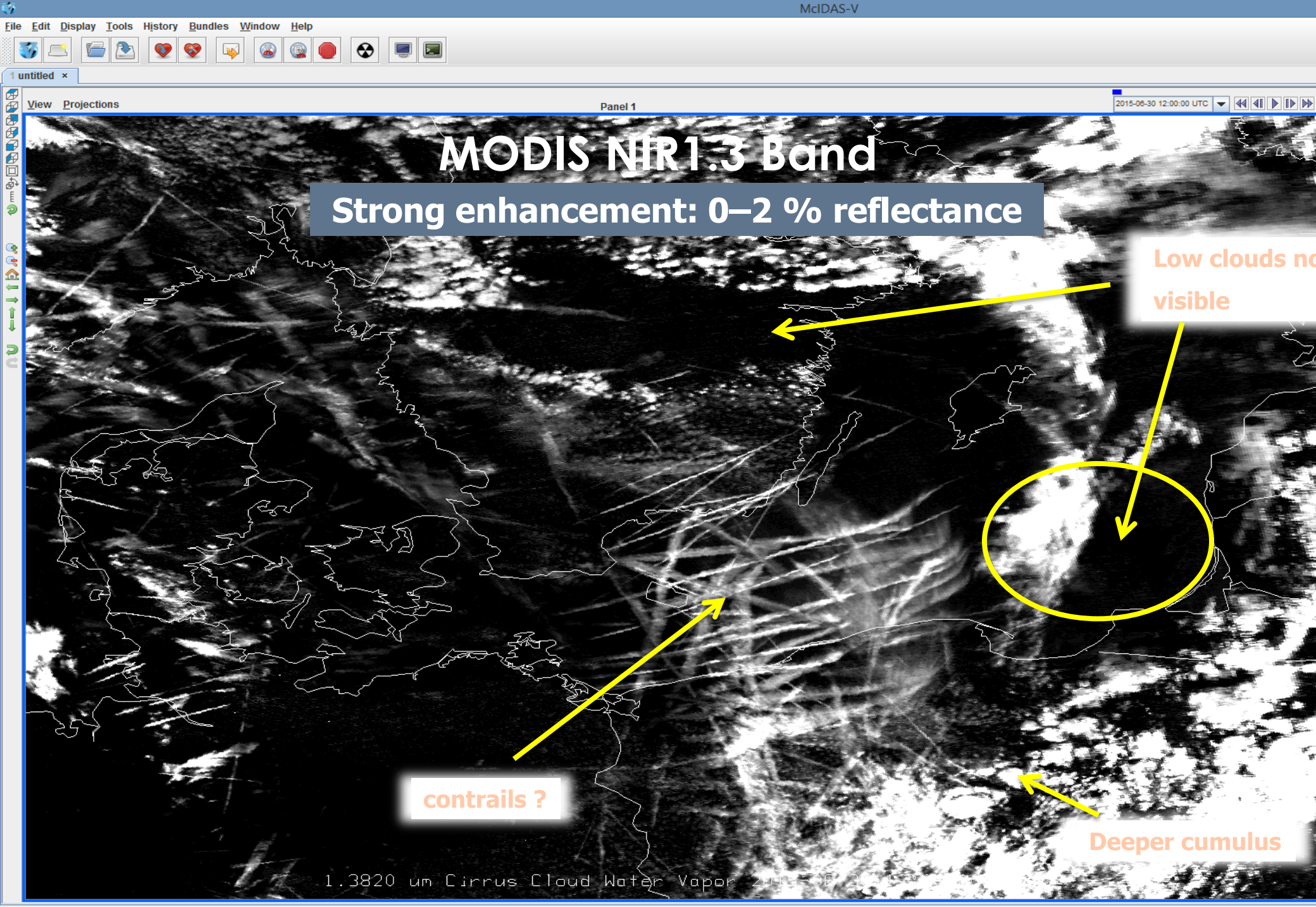
	Range
R ?	?
G ?	?
B ?	?

Possible inputs:

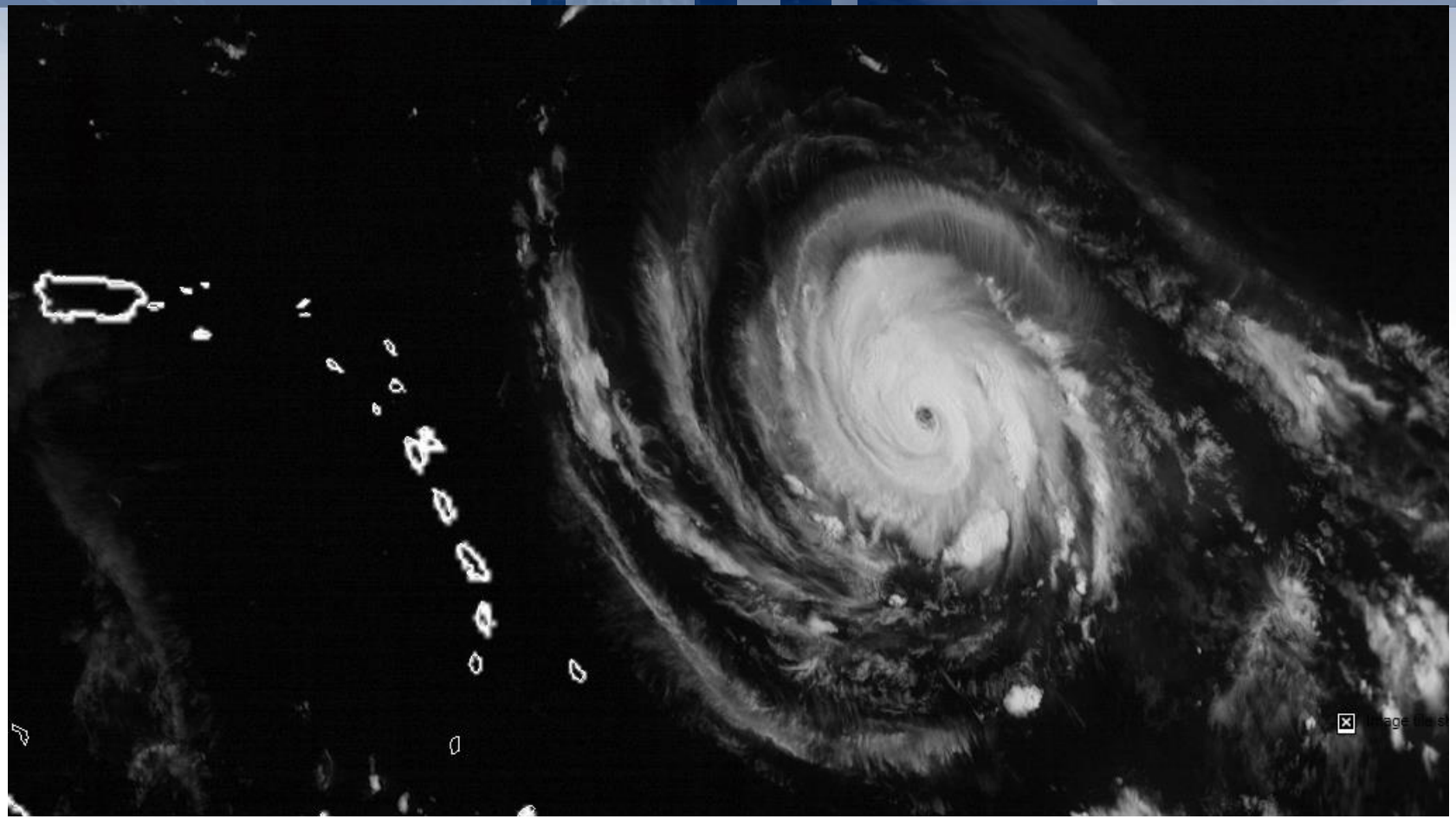
VIS0.6 (cloud thickness), NIR1.3 (high clouds), NIR1.6 (cloud phase), NIR2.3 (particle size)

IR12.3-IR10.5 (cloud thickness), IR IR10.5-IR3.9 (particle size), IR10.5 (cloud temperature)


McIDAS-V
File Edit Display Tools History Bundles Window Help
untitled
View Projections
Panel 1
2015-06-30 12:00:00 UTC
MODIS Natural Colours RGB
low stratus
shallow cumulus
???
contrails ?
Deeper cumulus
RGB Composite
1.3820 um Cirrus Cloud Water Vapor 2015-06-30 12:00:00 UTC


McIDAS-V
File Edit Display Tools History Bundles Window Help
1 untitled
View Projections
Panel 1
2015-06-30 12:00:00 UTC
MODIS NIR1.3 Band
Strong enhancement: 0–2 % reflectance
Low clouds no visible
contrails ?
Deeper cumulus
1.3820 um Cirrus Cloud Water Vapor

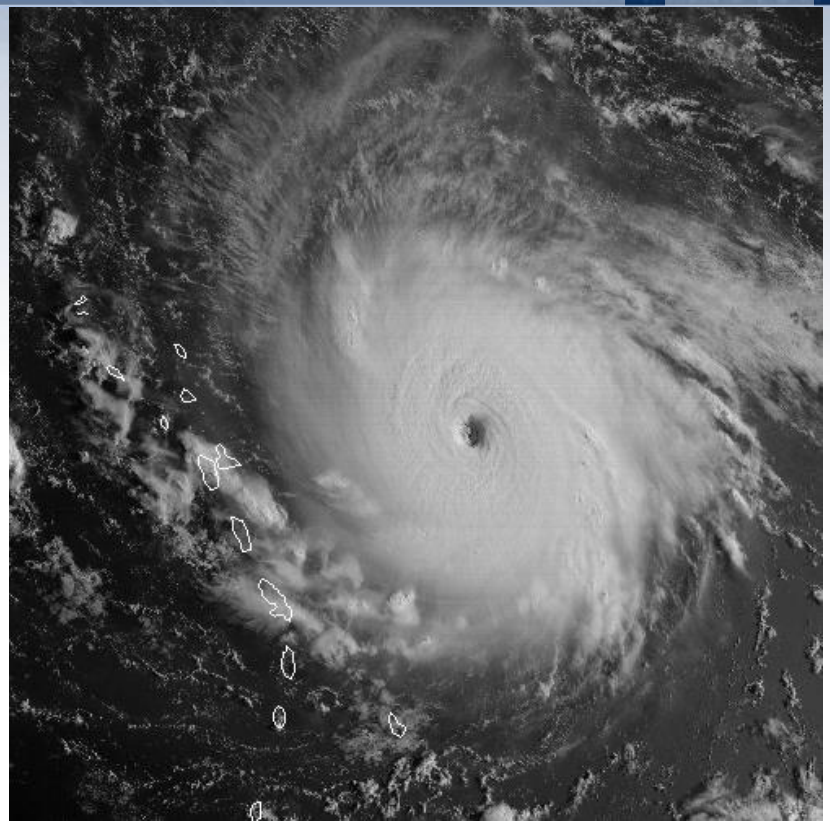
4 September 2017, 12:00 – 21:15 UTC (source: CIRA)



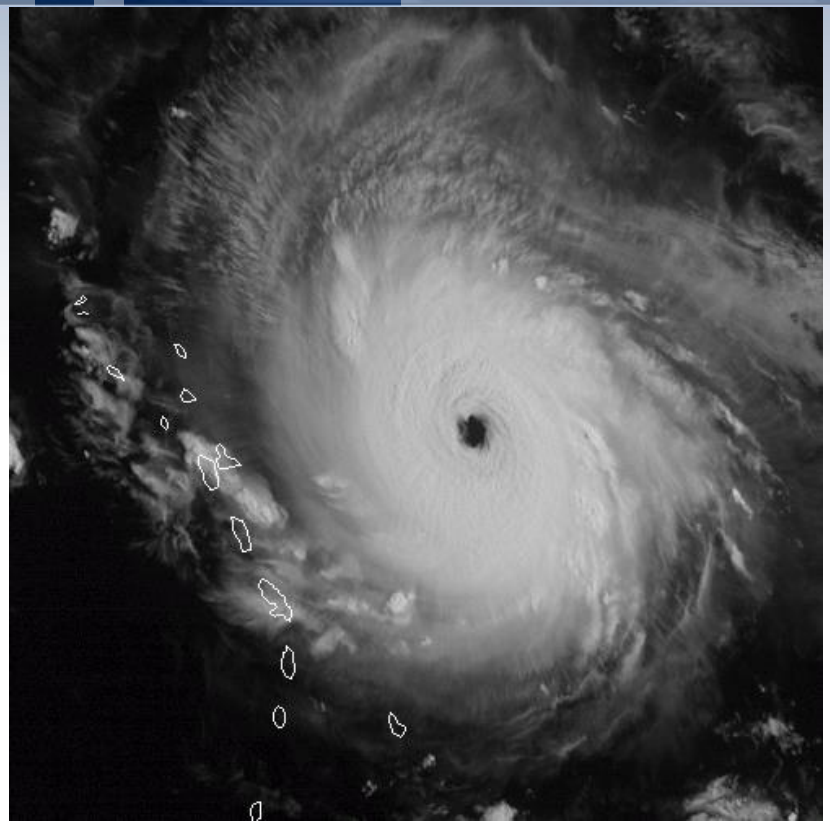
ABI Band 04 (NIR1.3)

EUMETSAT

5 September 2017, 12:00 – 20:00 UTC (source: CIRA)



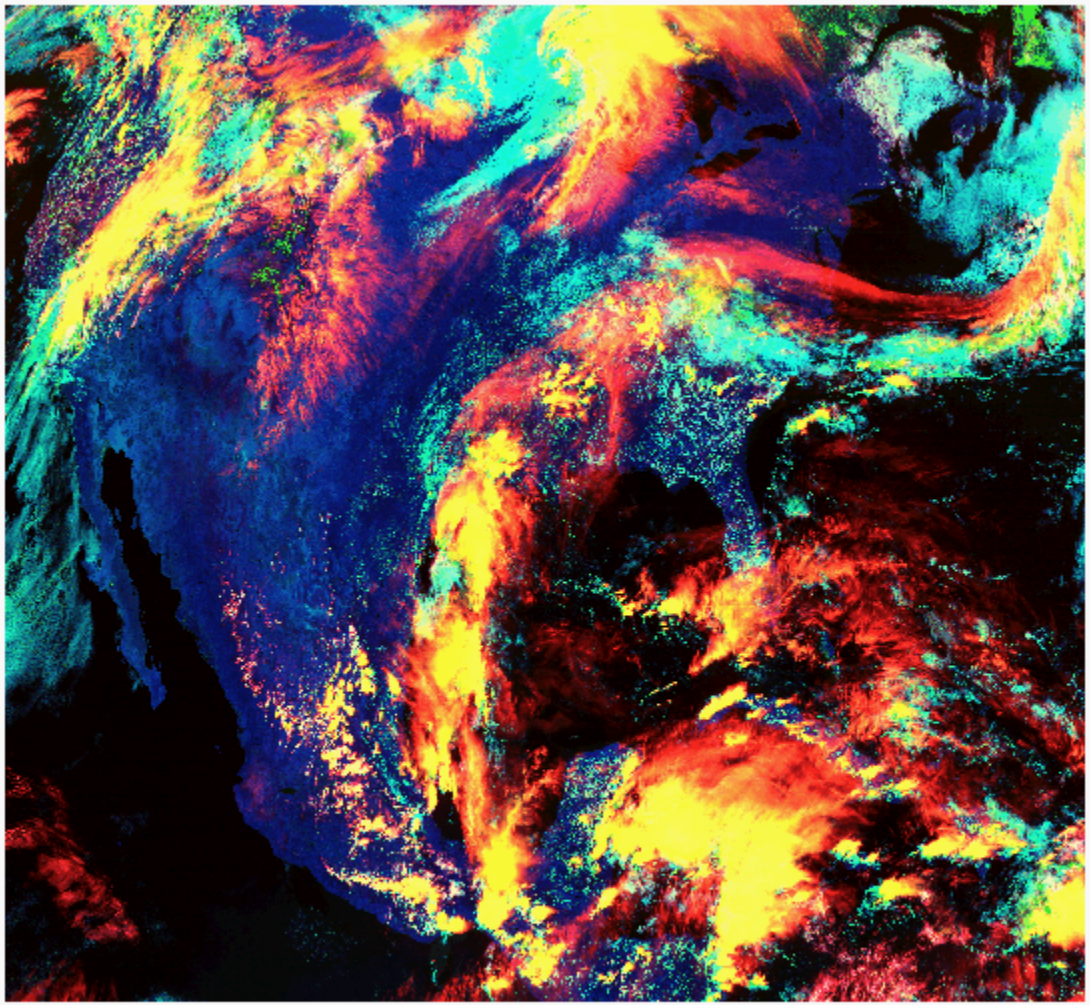
Band 02 (VIS0.6)



Band 04 (NIR1.3)

EUMETSAT

Cloud Type RGB from Andrew Heidinger (CIMSS)

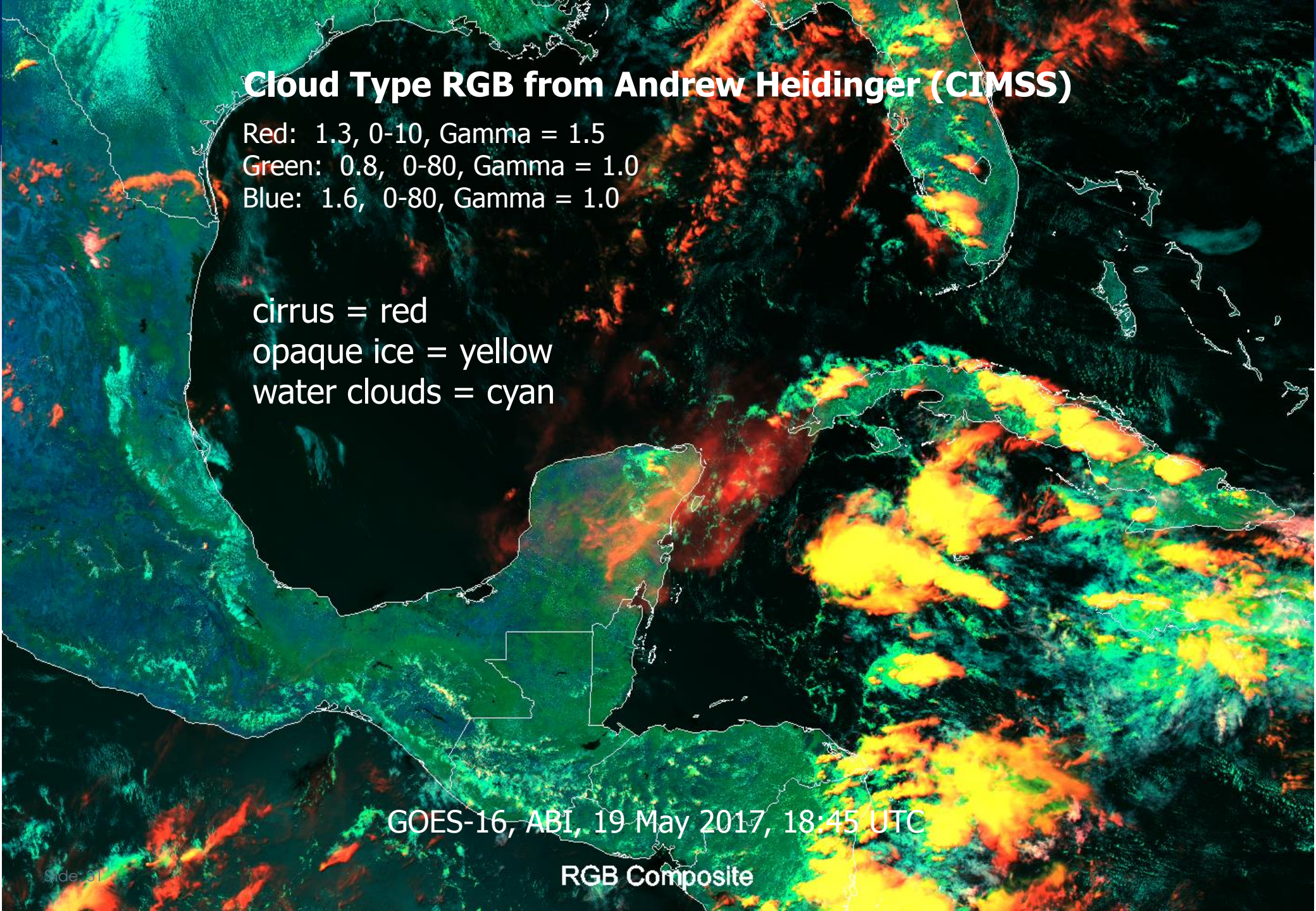


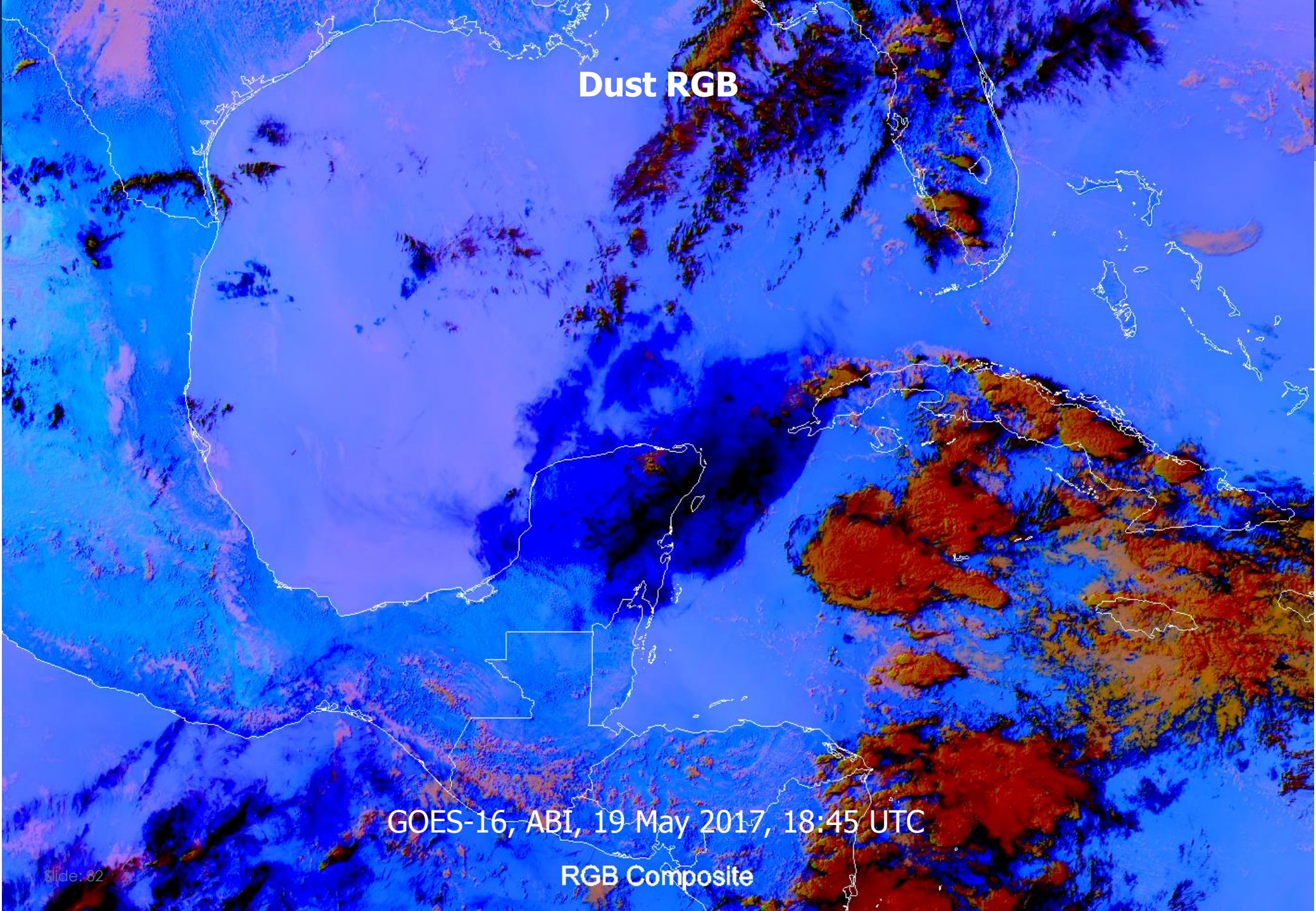
Red: 1.38, 0-10, Gamma = 1.5
Green: 0.64: 0-80, Gamma = .75
Blue: 1.6: 0-80, Gamma = 1.0

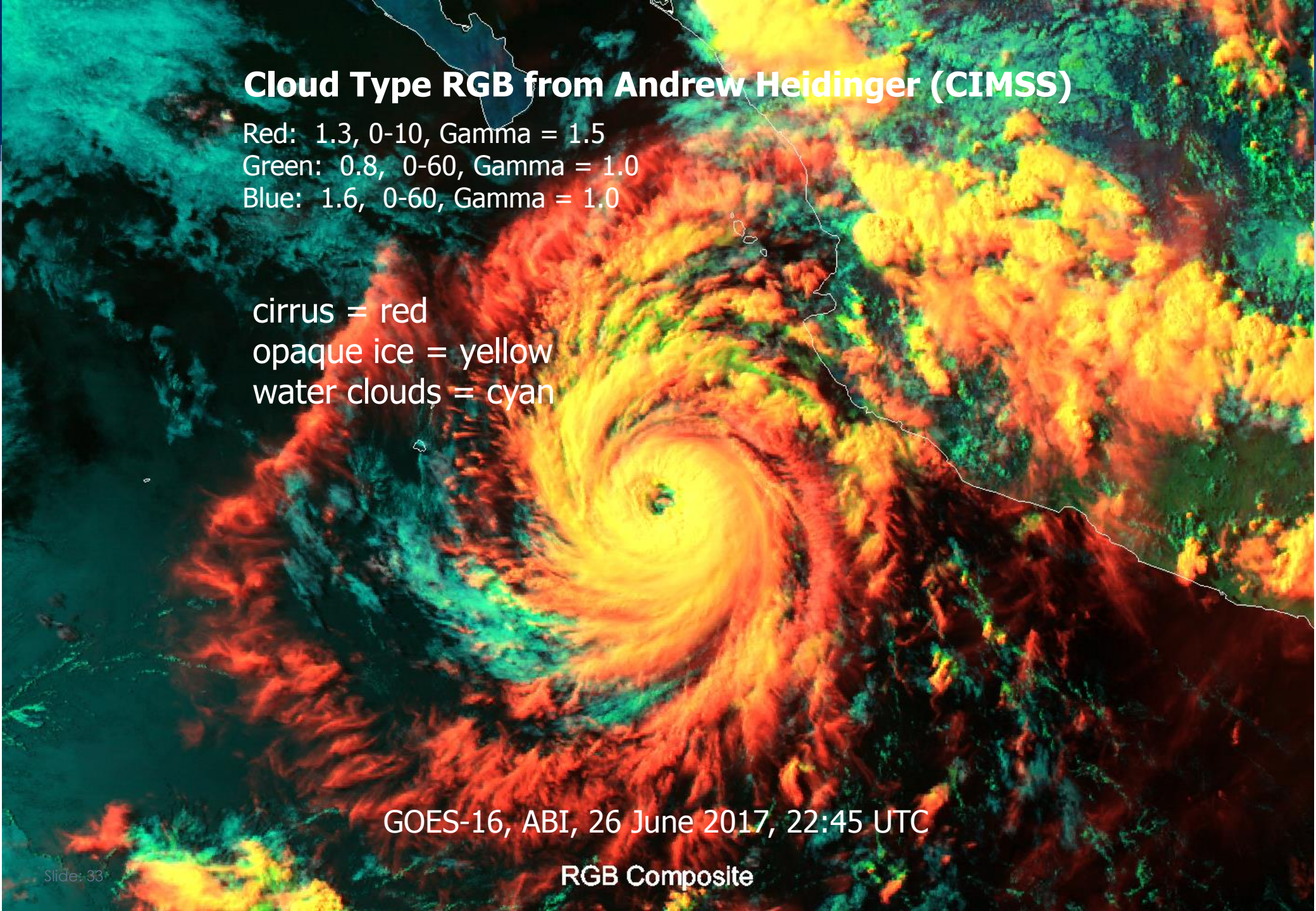
So this makes:

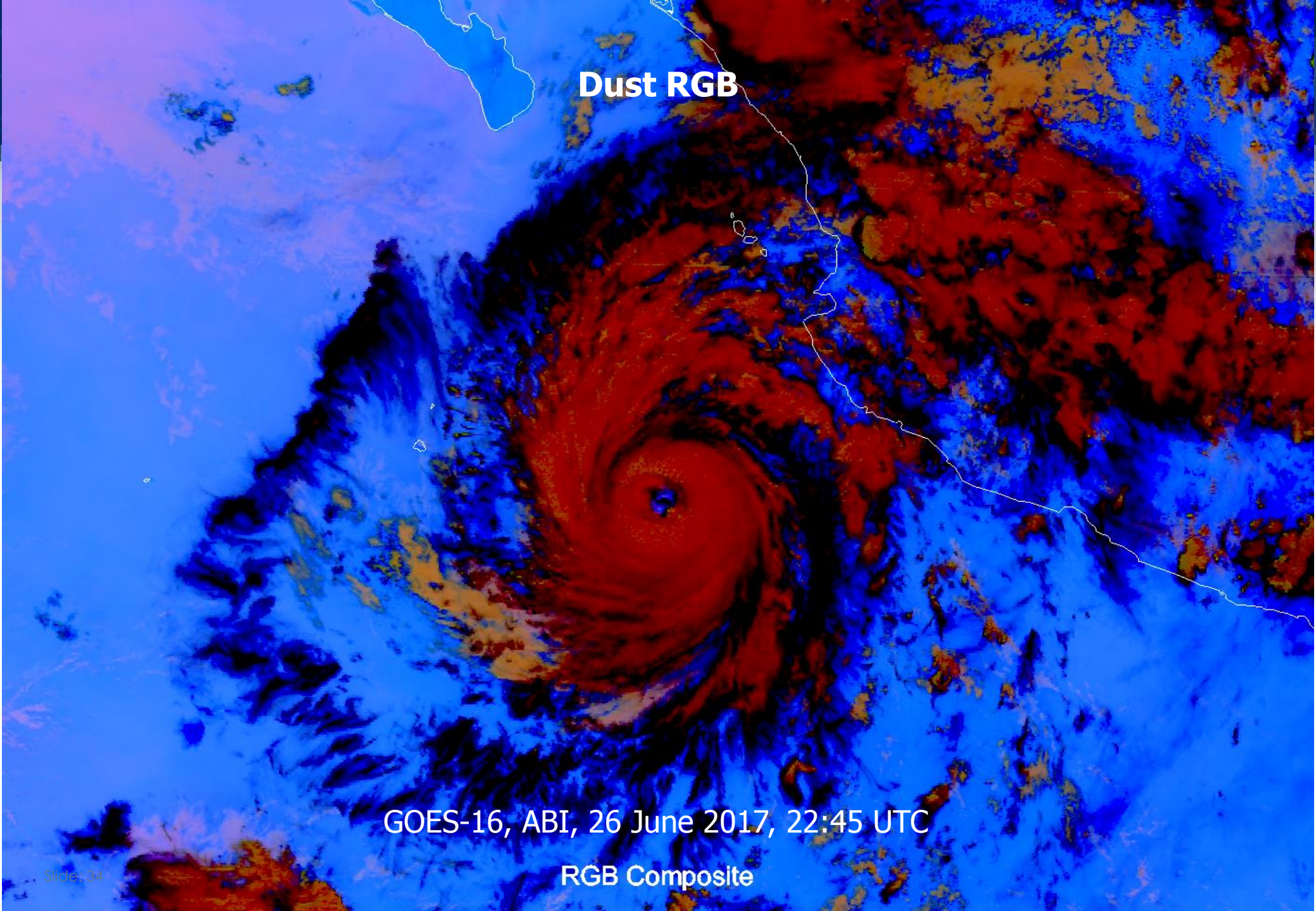
cirrus = red
opaque ice = yellow
water clouds = cyan
snow = green
white = lofted water cloud

EUMETSAT


Cloud Type RGB from Andrew Heidinger (CIMSS)
Red: 1.3, 0-10, Gamma = 1.5
Green: 0.8, 0-80, Gamma = 1.0
Blue: 1.6, 0-80, Gamma = 1.0
cirrus = red
opaque ice = yellow
water clouds = cyan
GOES-16, ABI, 19 May 2017, 18:45 UTC
RGB Composite

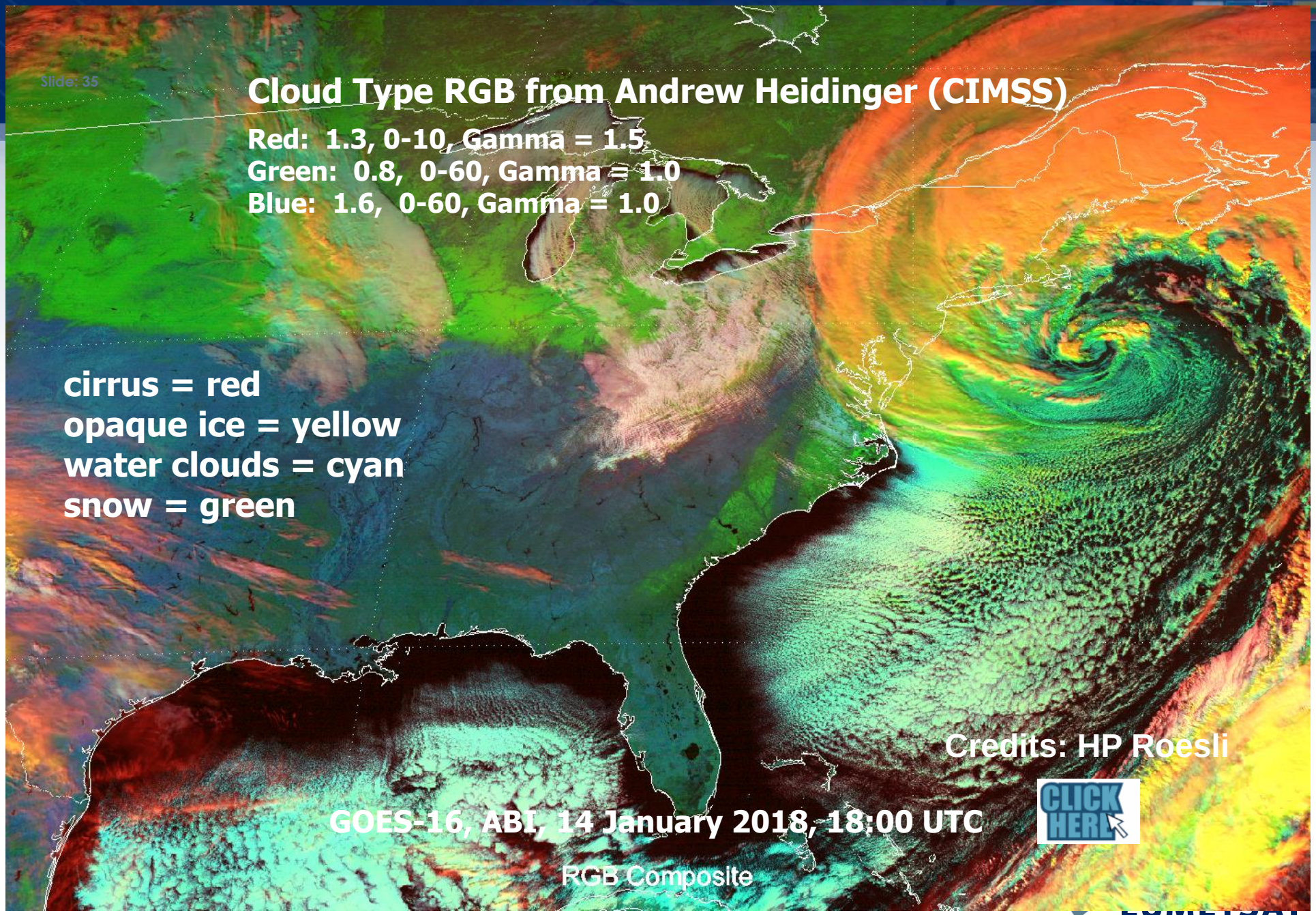

Dust RGB
GOES-16, ABI, 19 May 2017, 18:45 UTC
RGB Composite

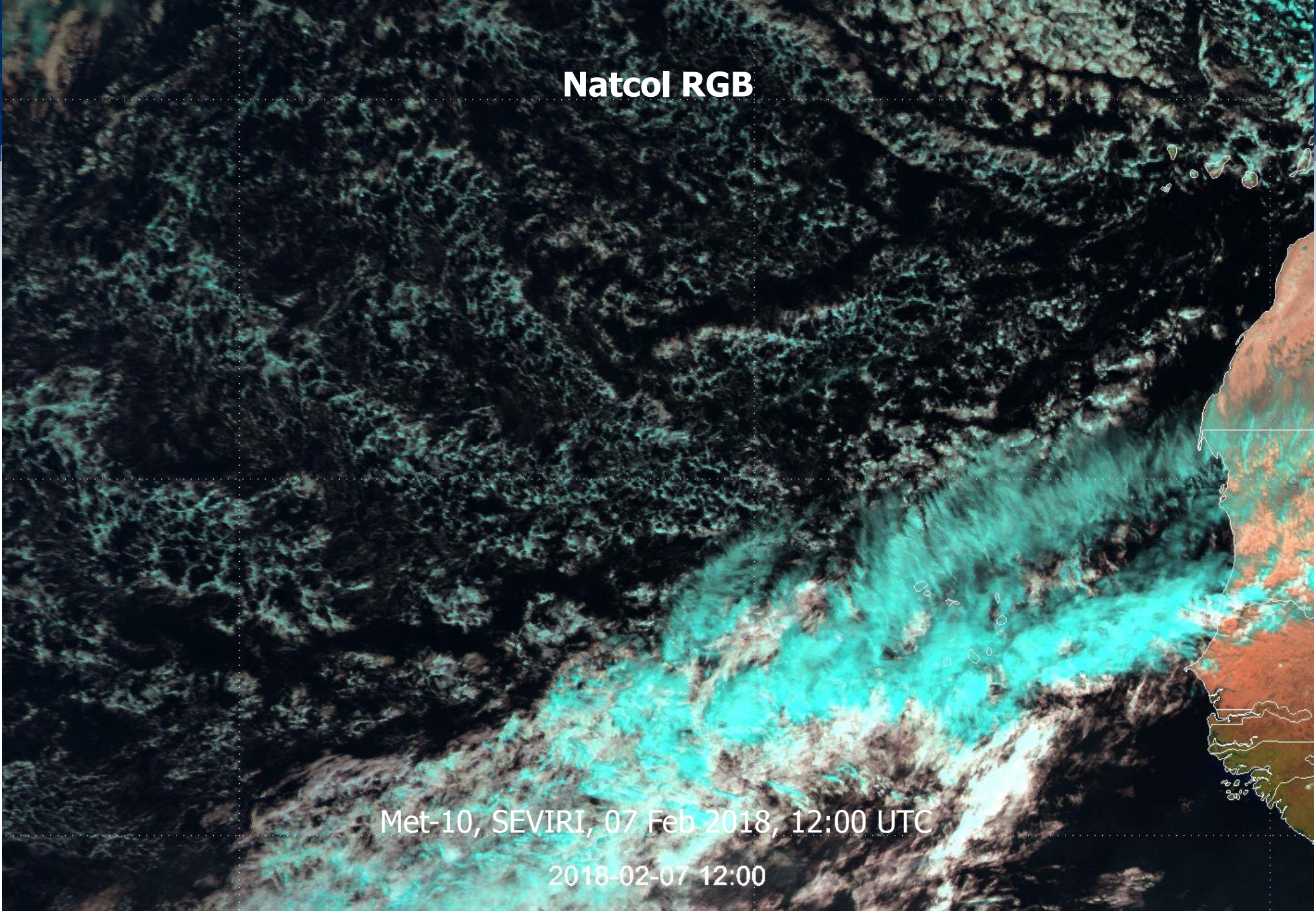

Cloud Type RGB from Andrew Heidinger (CIMSS)
Red: 1.3, 0-10, Gamma = 1.5
Green: 0.8, 0-60, Gamma = 1.0
Blue: 1.6, 0-60, Gamma = 1.0
cirrus = red
opaque ice = yellow
water clouds = cyan
GOES-16, ABI, 26 June 2017, 22:45 UTC
RGB Composite

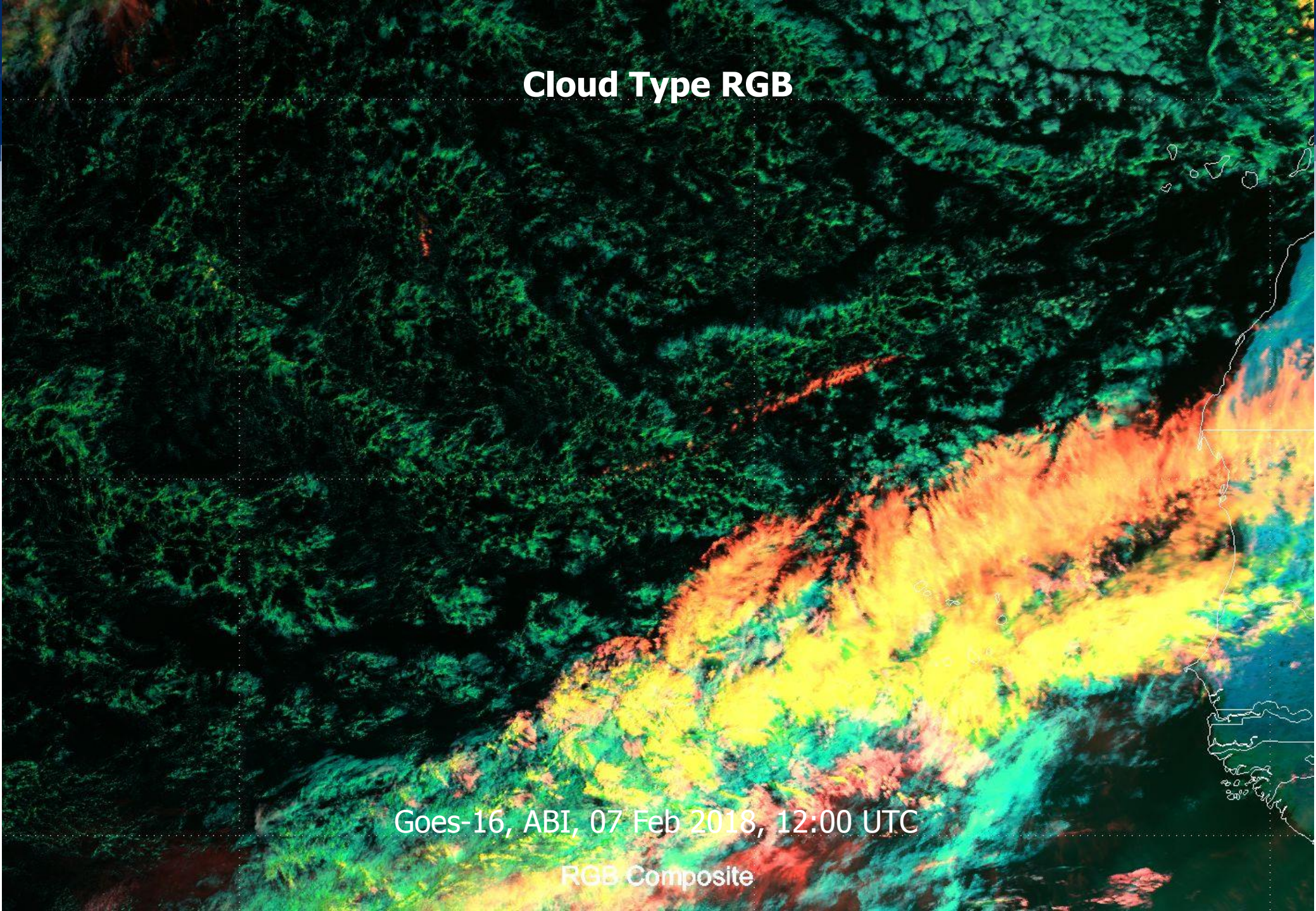

Dust RGB
GOES-16, ABI, 26 June 2017, 22:45 UTC
RGB Composite

Cloud Type RGB from Andrew Heidinger (CIMSS)

Red: 1.3, 0-10, Gamma = 1.5
Green: 0.8, 0-60, Gamma = 1.0
Blue: 1.6, 0-60, Gamma = 1.0




Natcol RGB
Met-10, SEVIRI, 07 Feb 2018, 12:00 UTC
2018-02-07 12:00


Cloud Type RGB
Goes-16, ABI, 07 Feb 2018, 12:00 UTC
RGB Composite

Sentinel-3 (launched on 16 Feb 2016)

Instruments:

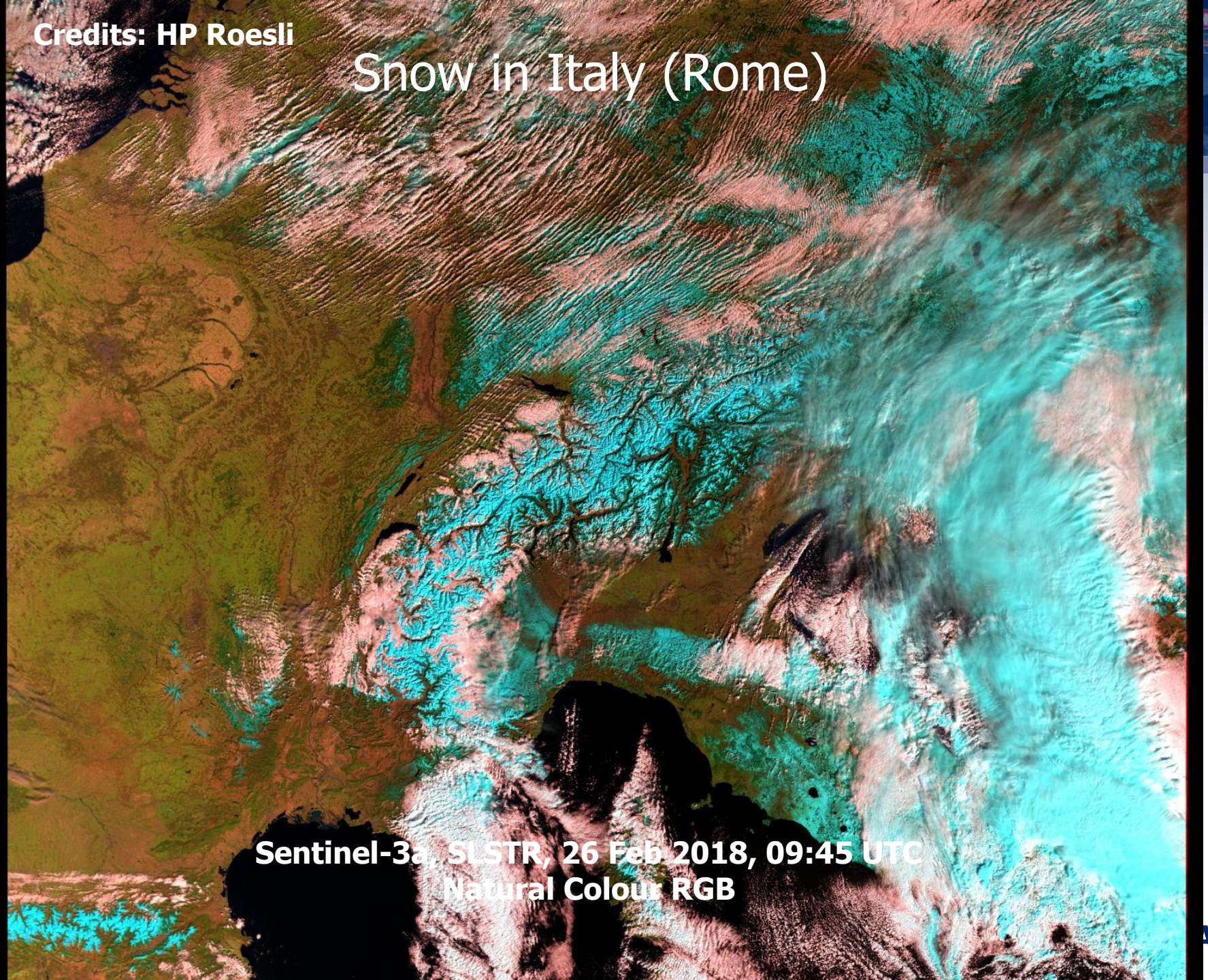
- Ocean and Land Color Instrument (OLCI)
- Sea and Land Surface Temperature Radiometer (SLSTR)
- SAR Radar Altimeter (SRAL)
- Microwave Radiometer (MWR)
- Precise Orbit Determination Package (consisting 3 instruments)

SLSTR Bands

Band	λ centre (µm)	Width (µm)	Function	Comments		Res. (m)
S1	0.555	0.02	Cloud screening, vegetation monitoring, aerosol	Visible Near IR	Solar reflectance bands	500
S2	0.659	0.02	NDVI, vegetation monitoring, aerosol			
S3	0.865	0.02	NDVI, cloud flagging, Pixel co-registration			
S4	1.375	0.015	Cirrus detection over land	Short-Wave IR		
S5	1.61	0.06	Cloud clearing, ice, snow, vegetation monitoring			
S6	2.25	0.05	Vegetation state and cloud clearing			
S7	3.74	0.38	SST, LST, Active fire	Thermal infra-red Ambient bands (200 K - 320 K)		1000
S8	10.85	0.9	SST, LST, Active fire			
S9	12	1	SST, LST			
F1	3.74	0.38	Active fire	Thermal infra-red fire emission bands		
F2	10.85	0.9	Active fire			

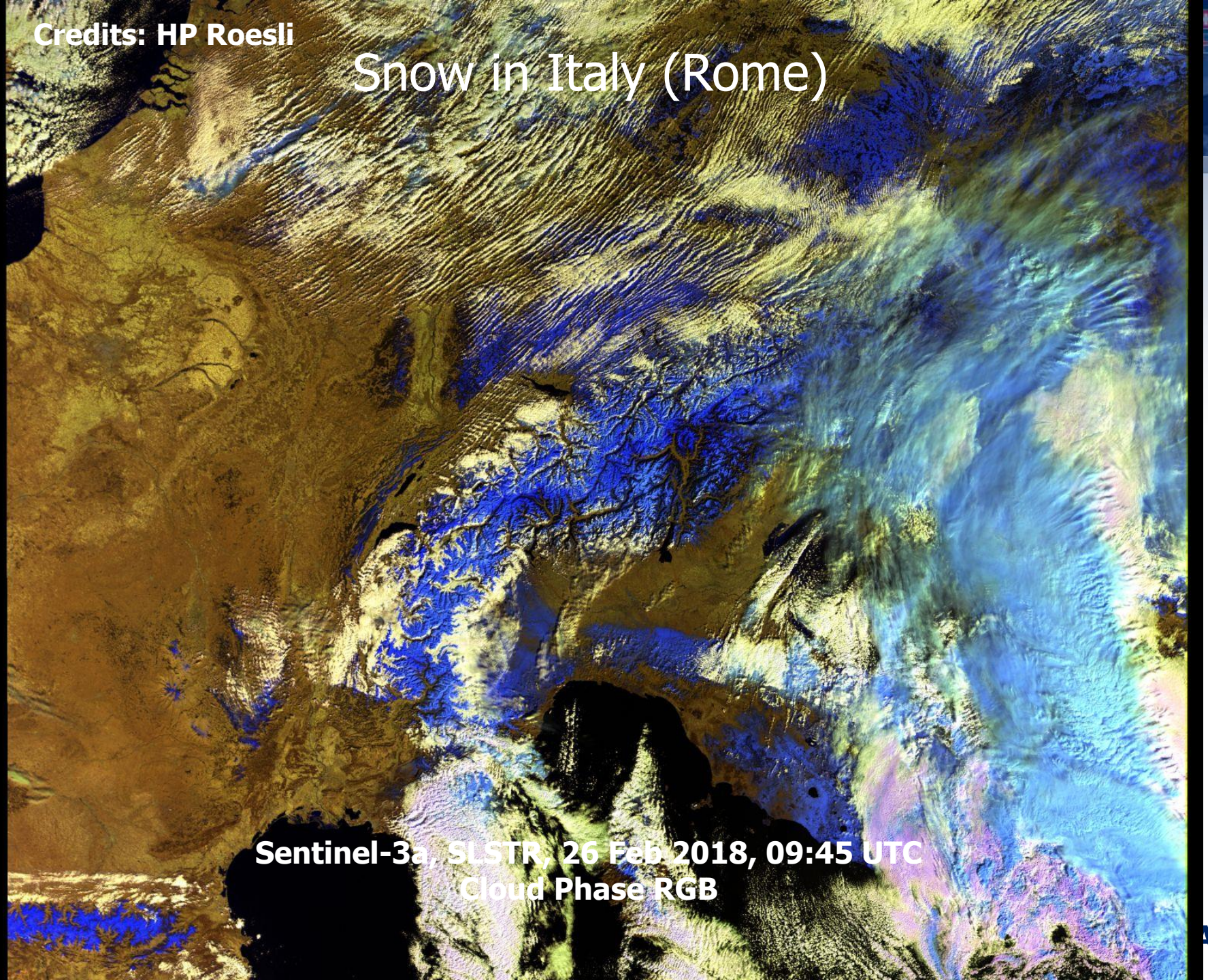
Credits: HP Roesli

Snow in Italy (Rome)



Credits: HP Roesli

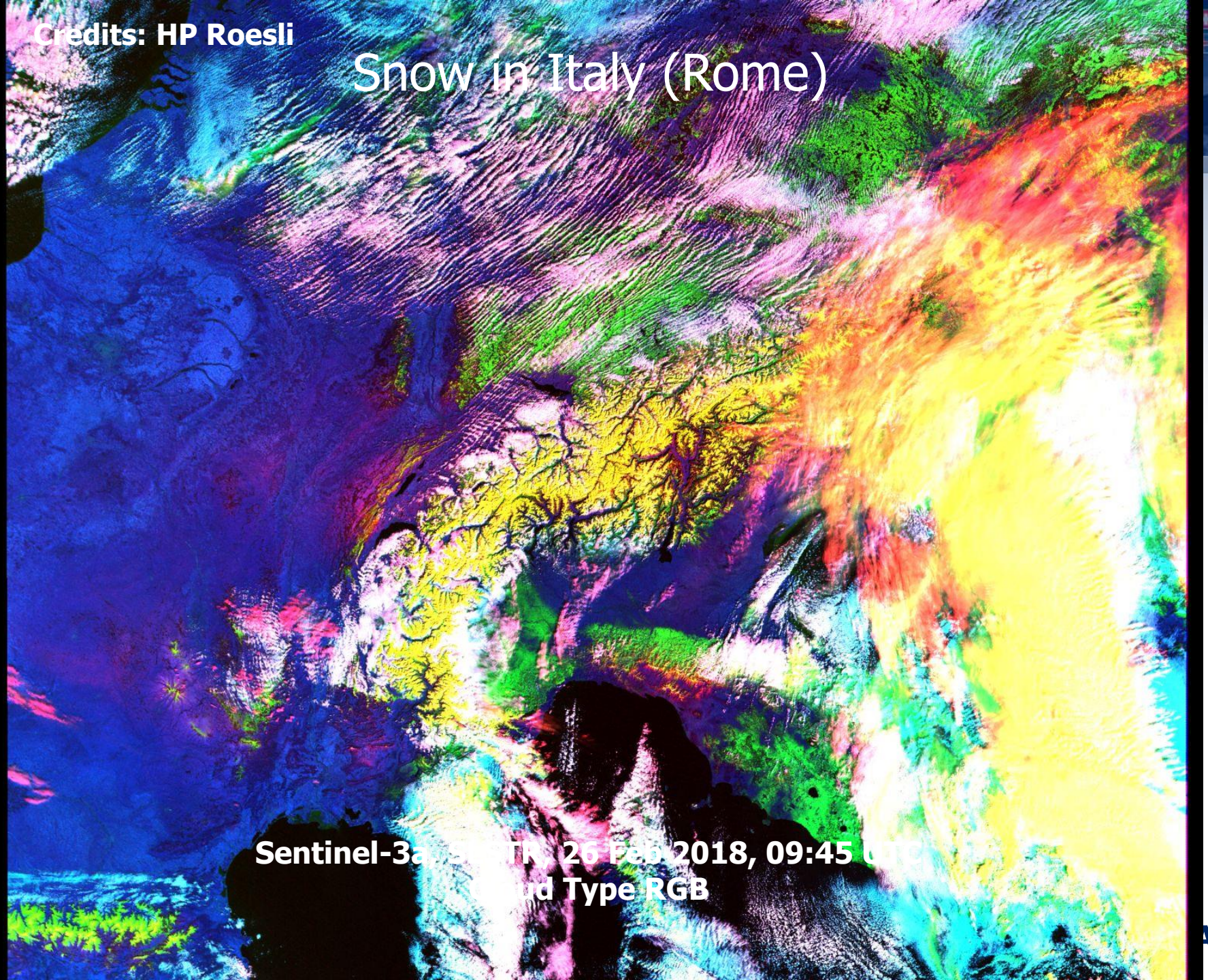
Snow in Italy (Rome)



Sentinel-3a, SLSTR, 26 Feb 2018, 09:45 UTC
Cloud Phase RGB

Credits: HP Roesli

Snow in Italy (Rome)



Sentinel-3a, OLCI, 26 Feb 2018, 09:45 UTC
False Type RGB

Summary

New RGBs for FCI:

Already tested / implemented:

True Colour RGB, Cloud Phase RGB, Fire Temperature RGB

Proposed:

Cloud Type RGB (with NIR1.3), Day Micro RGB (with NIR2.25)

To be devised:

Moisture RGB