Australian VLab Centre of Excellence Regional Focus Group meeting

29th September 2022

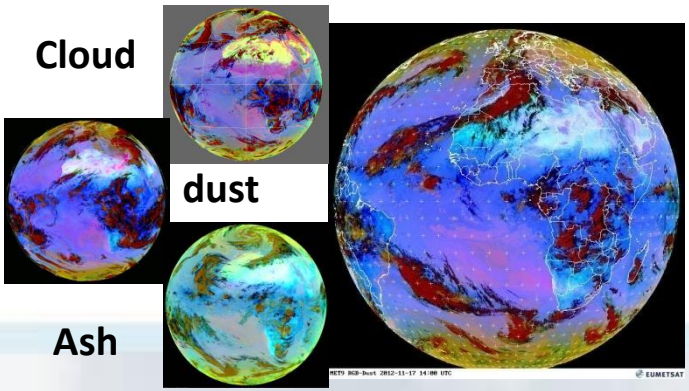
RGB composite examples adapted to low latitude tropical areas and to high latitude winter times, with a focus on the Australasia Pacific region

Bodo Zeschke Australian VLab Centre of Excellence Point of Contact

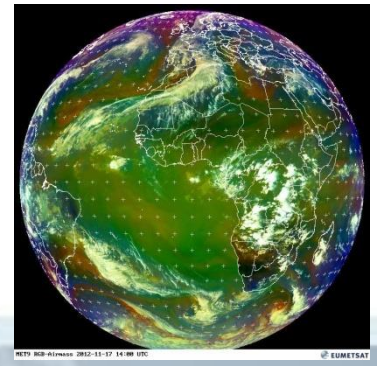
…some slides not shown…

RGB products for Operational Forecasting – EumetSAT recommendation

Two RGB composites which complement each other



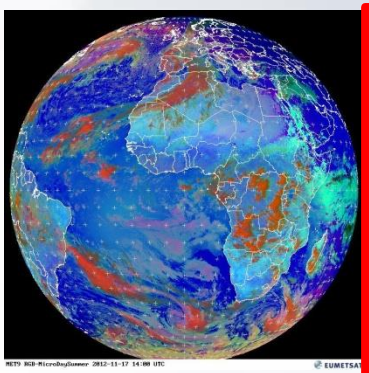
24 hour Microphysical RGB



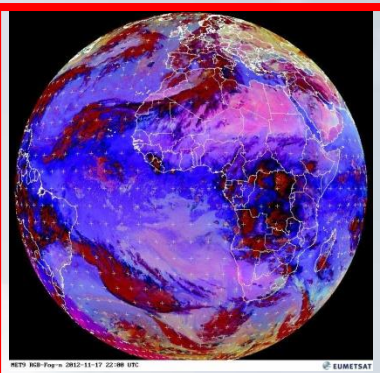
Airmass RGB

from RGB Products Overview (RGB Tutorial) J. Kerkmann EumetSAT

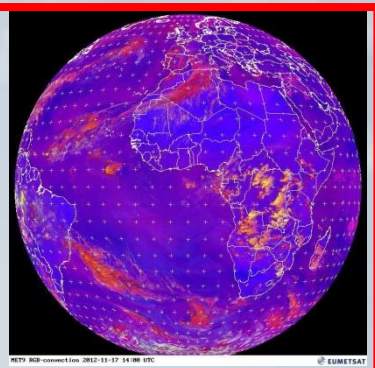
Five application specific RGBs



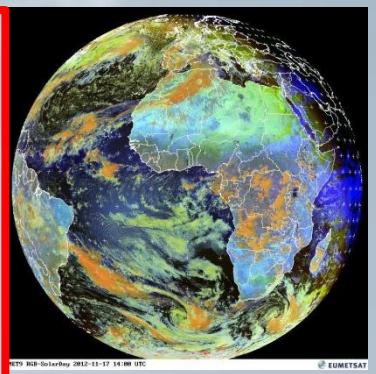
Day Microphysical RGB



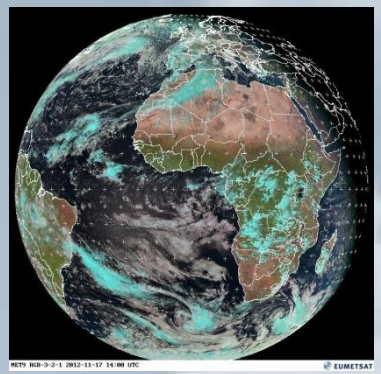
Night Microphysical RGB



Day Convection RGB



Snow / fog RGB

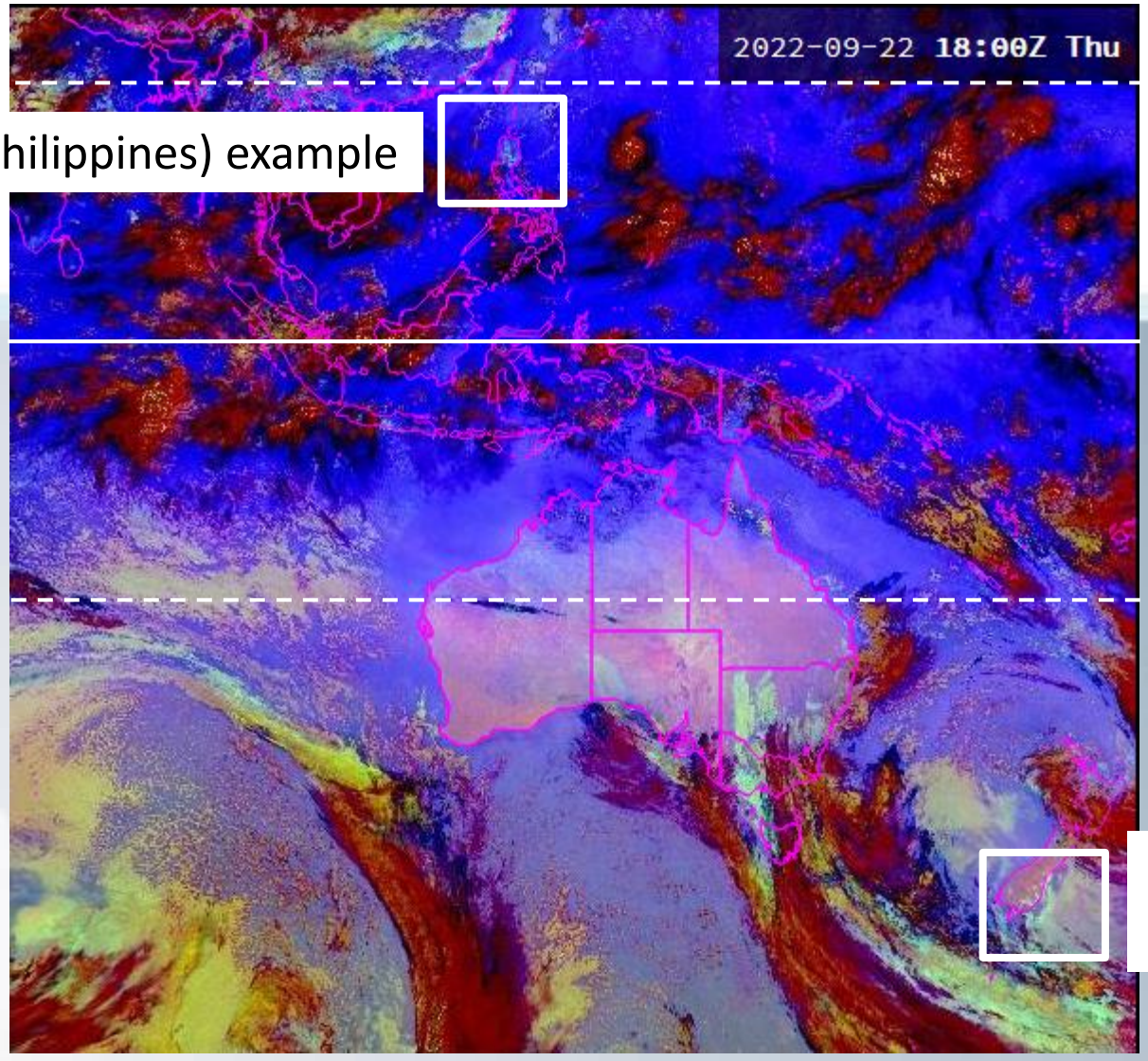


Natural Colours RGB

…some slides not shown…

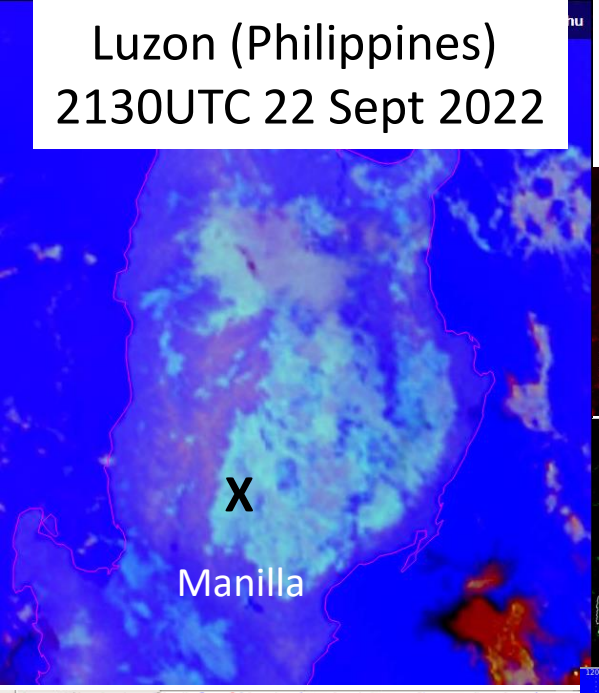
image courtesy JMA/BOM

Exploring the fog/low cloud signal in the Night Microphysics RGB for tropical and midlatitude locations



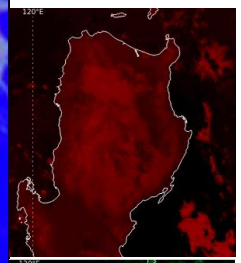
satellite images courtesy JMA/BOM

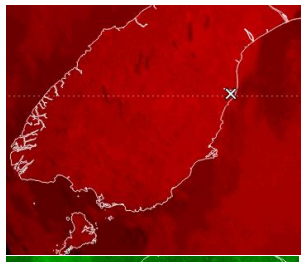
Luzon (Philippines)
2130UTC 22 Sept 2022



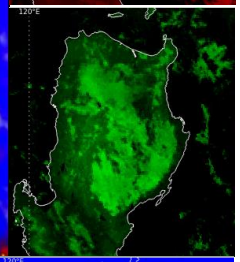
Beams

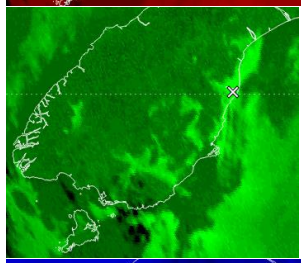
Red



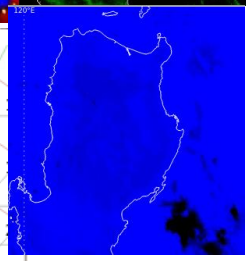


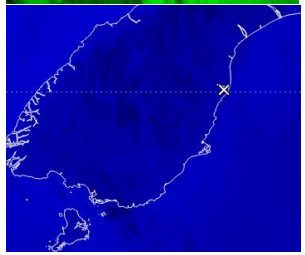
Green



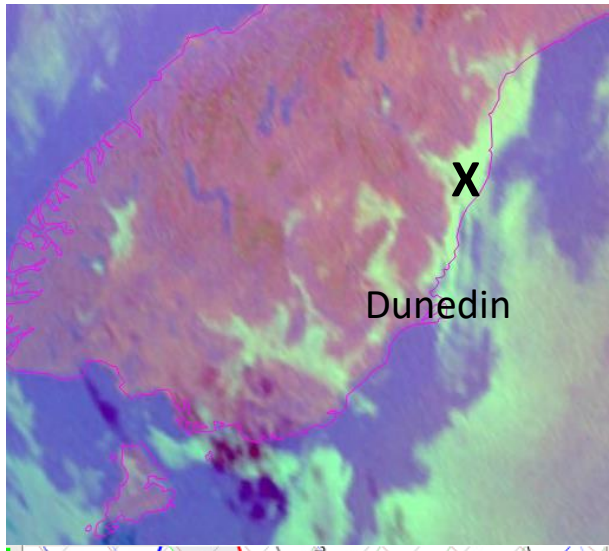


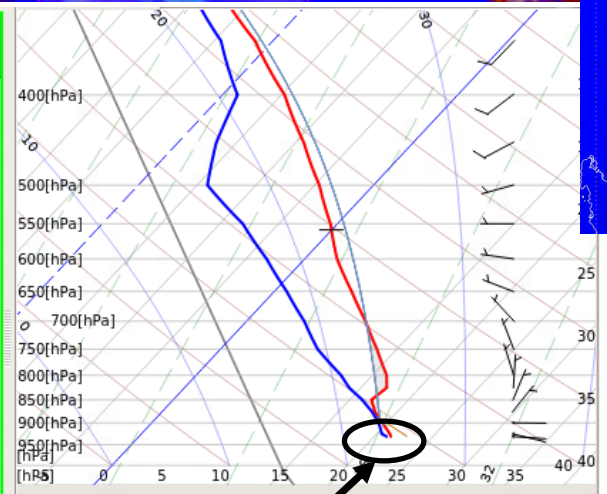
Blue

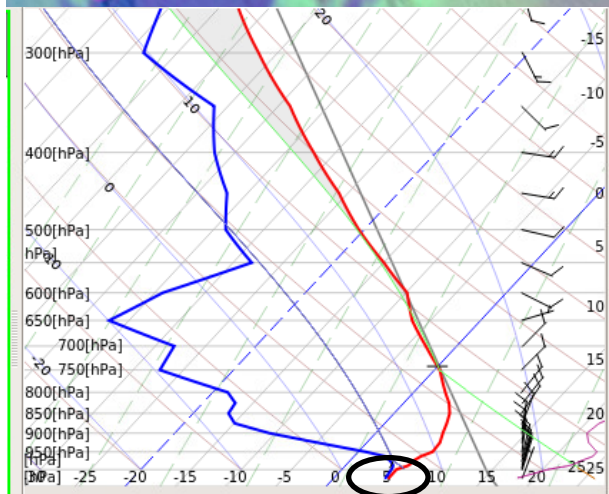




South Island of New Zealand
18UTC 22 Sept 2022





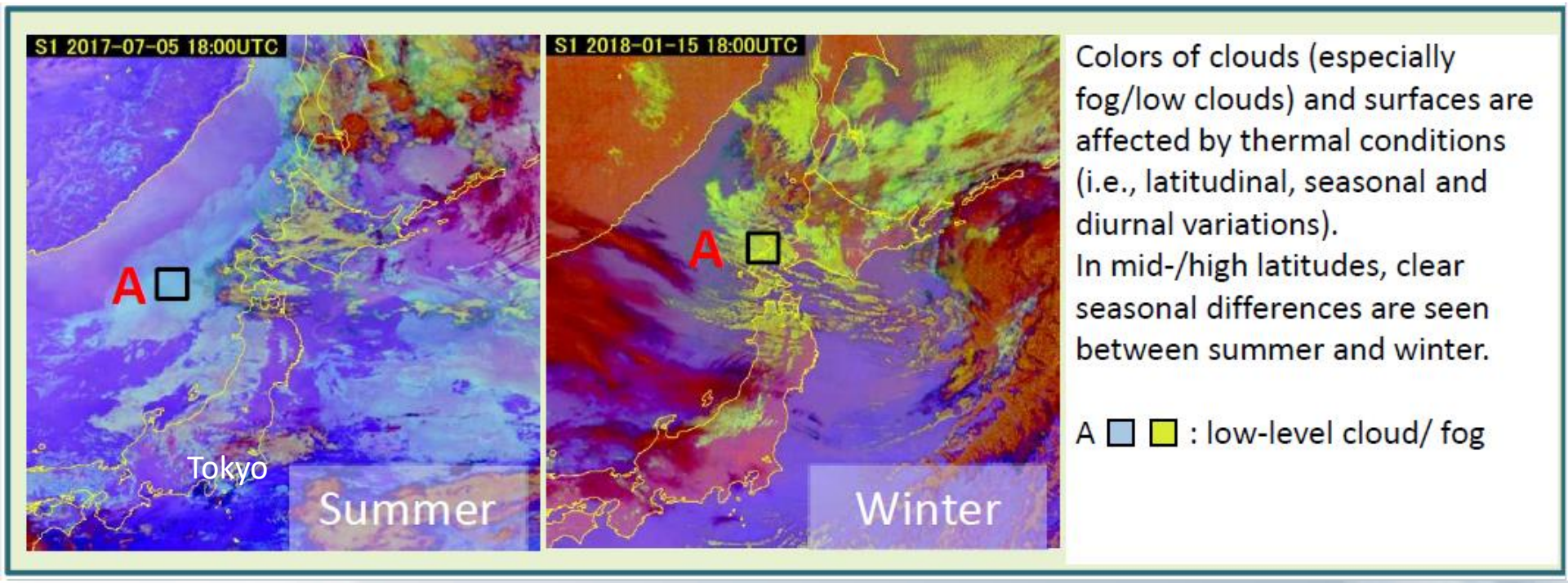


Investigation of the cold and warm atmosphere response of the Night Microphysics RGB

…some slides not shown…

Seasonal variations in the Night Microphysics fog / low cloud signal for high latitude locations

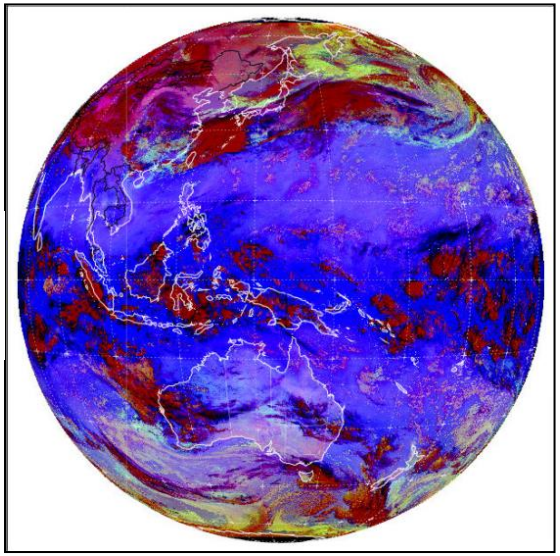
from the JMA Himawari RGB Quick Guides at
https://www.jma.go.jp/jma/jma-eng/satellite/VLab/RGB_QG.html

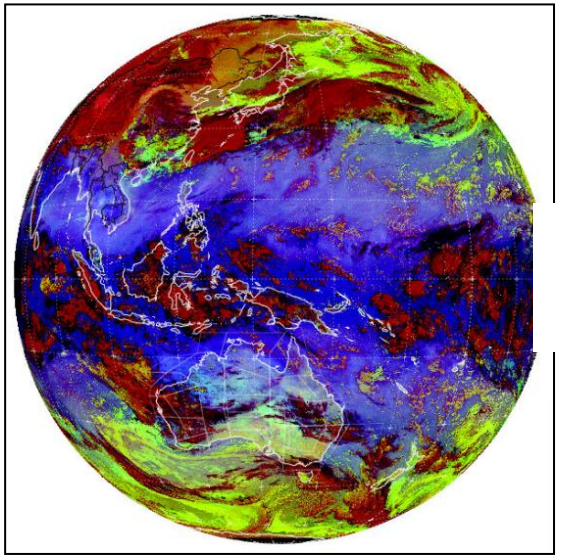


Summer and wintertime images of the Japan area

Tropical and Mid-latitude versions of the Night Microphysics RGB

Mid-latitude version





Tropical version

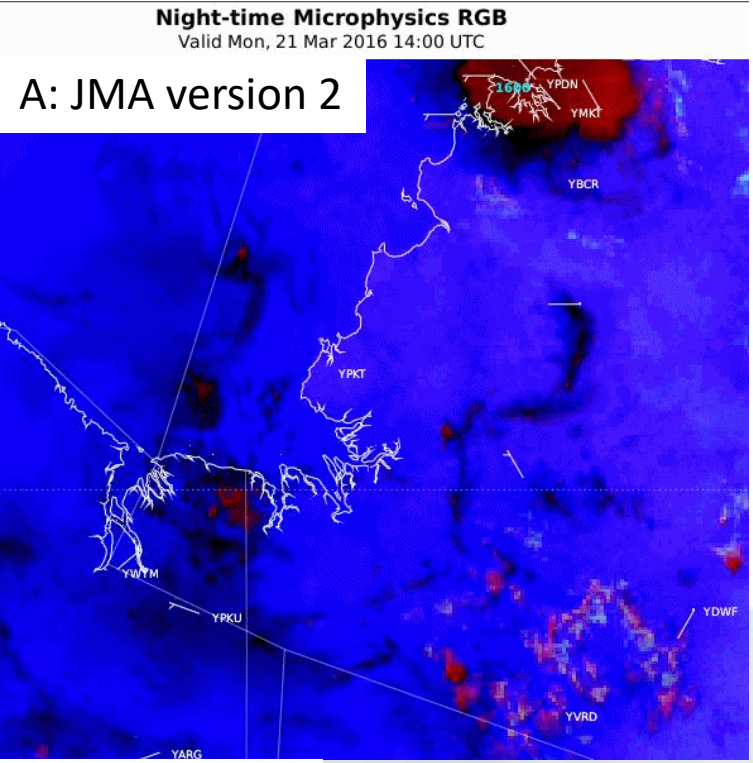
Night-time Microphysics RGB

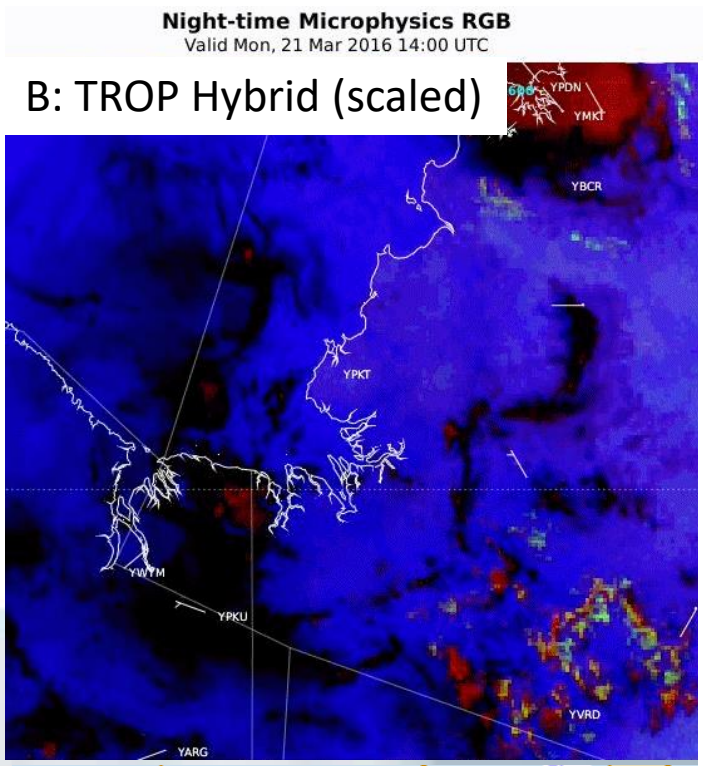
Valid Sun, 10 Apr 2016 14:00 UTC

Thick high cloud	Thick mid-level cloud	Low cloud/fog (warm)	Ocean
Thin Cirrus	Thin mid-level cloud	Low cloud/fog (cold)	Land

	RED (IR12.0 – IR10.4)	GREEN (IR10.4-NIR3.9)	BLUE (IR10.4)
Midlatitude version (JMA version 2)	-6.7 to 2.6	-3.1 to 5.2	-29.4 to 19.4
Tropical version	-6.7 to 2.6	-3.1 to 2.6	0.6 to 26.4

…some slides not shown…

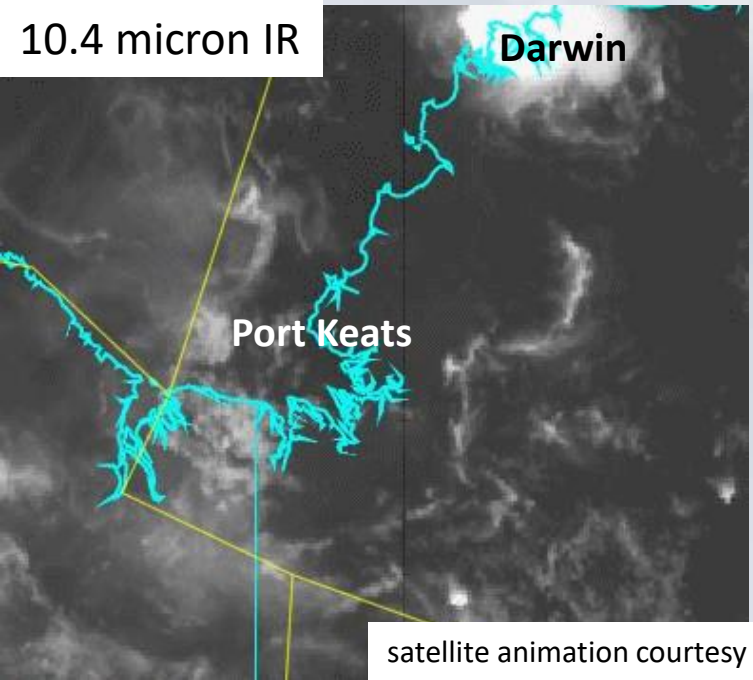




Animation

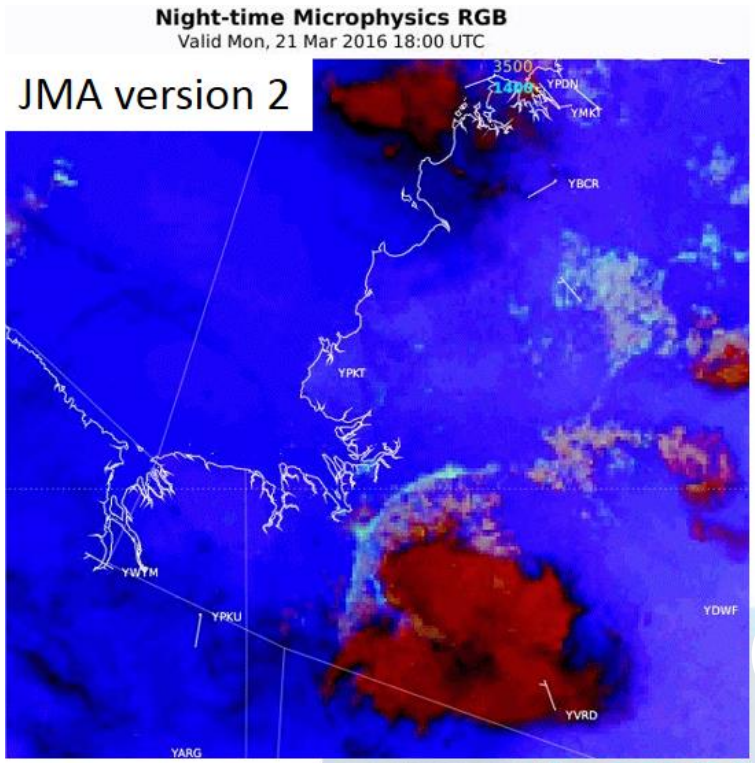
Tropical and Midlatitude versions of the Night Microphysics RGB product. Northern Territory,

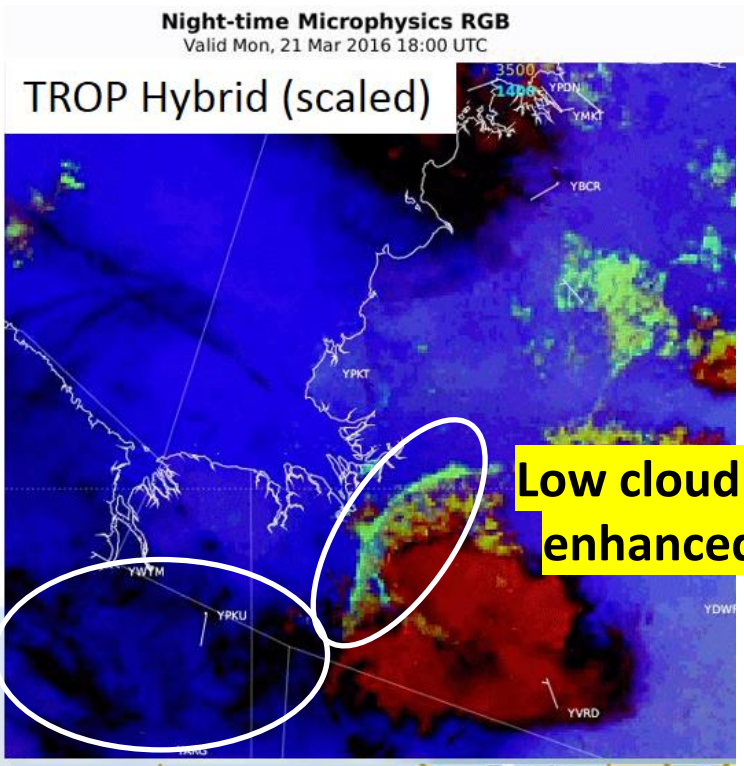
21st March 2016, 14 – 22UTC



satellite animation courtesy BOM/JMA

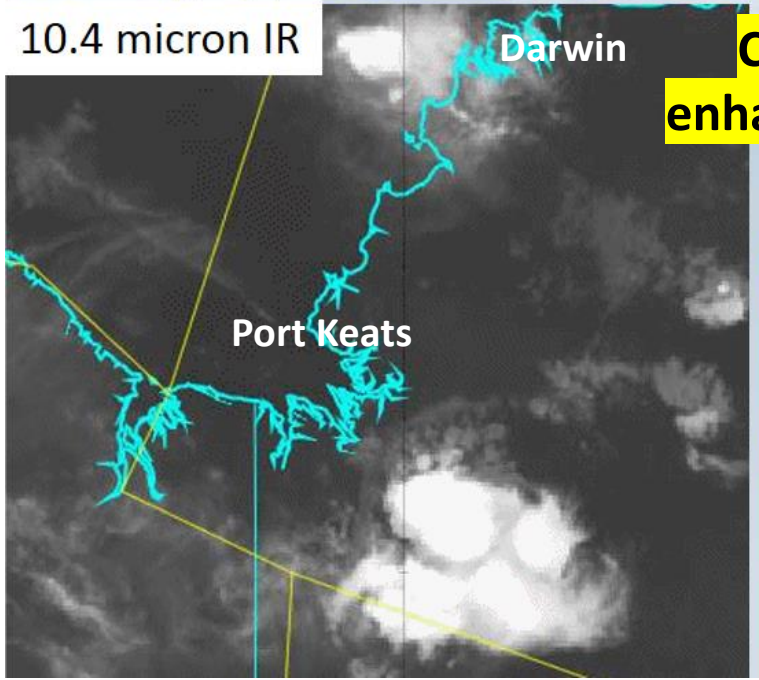
radar animation courtesy BOM



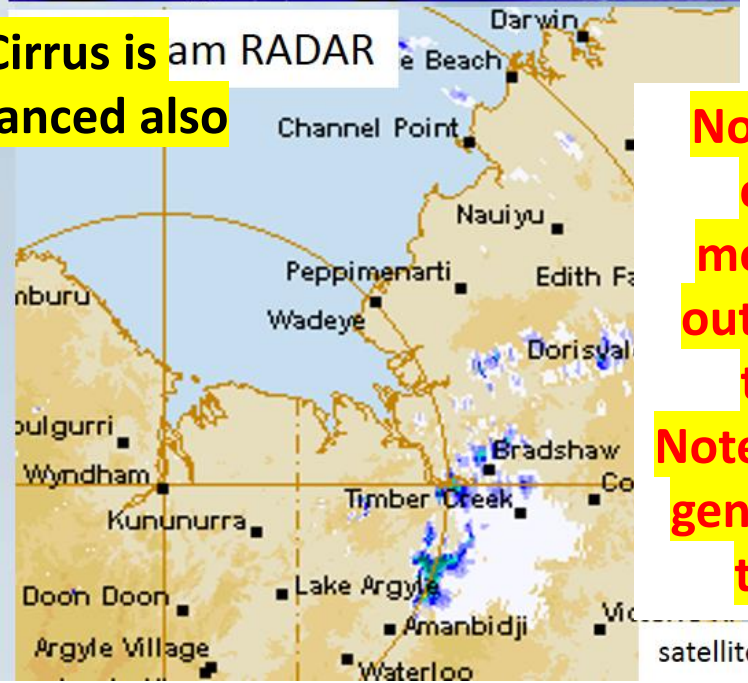


Low cloud is enhanced

Tropical and Midlatitude versions of the Night Microphysics RGB product. Northern Territory, 21st March 2016, 18UTC



Cirrus is enhanced also



Note how this RGB composite can monitor the storm outflow better than the other data

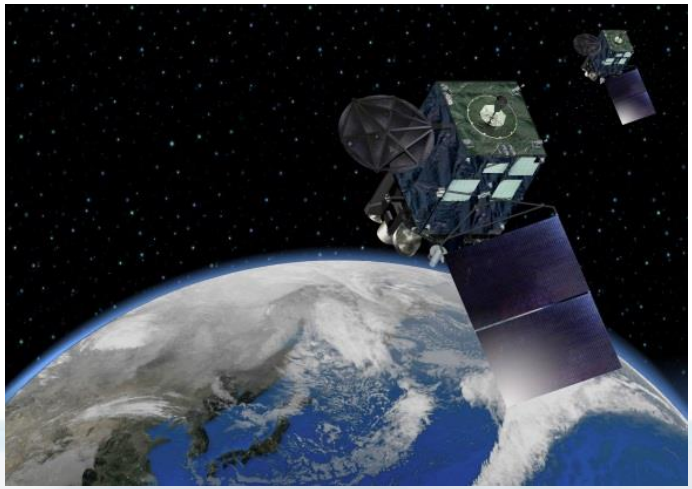
Note how the outflow generates secondary thunderstorms

satellite images courtesy BOM/JMA

…some slides not shown…

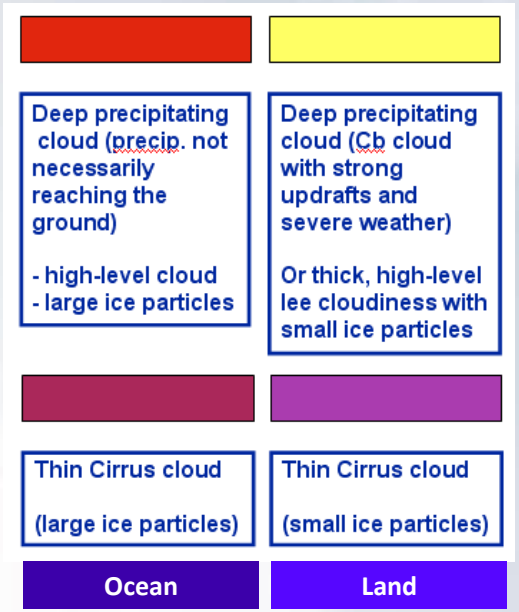
images courtesy JMA

The Day Convection RGB composite

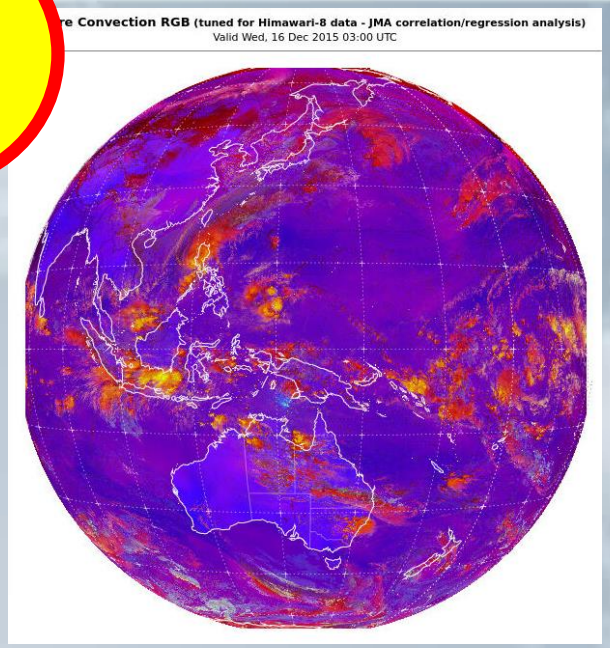


Day Convection RGB	Range	Gamma
6.2 – 7.3 micron	-36.9 to 5.9	1.0
3.9-10.4 micron	-1.7 to 66.1	0.5
1.6-0.6 micron	-71 to +24%	1.0

CHANNEL COMBINATION



Colour Interpretation Palette

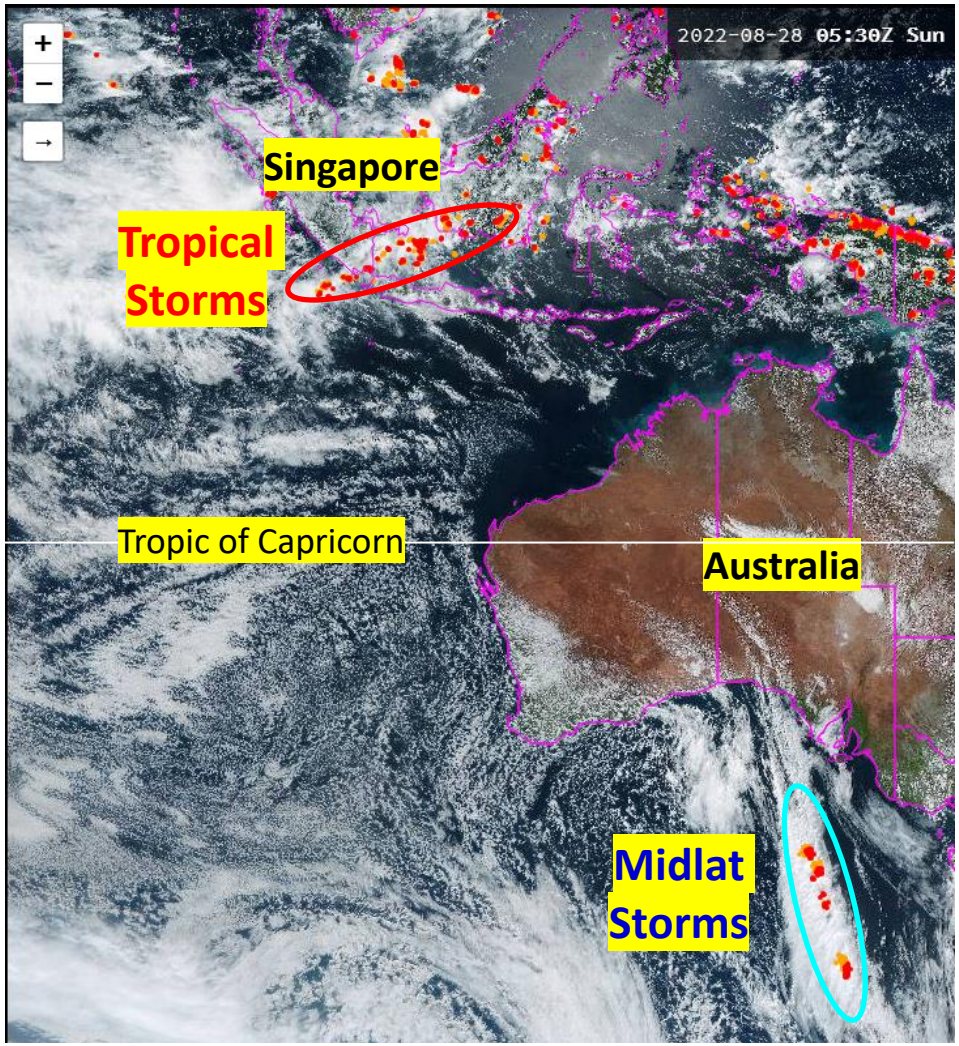


Himawari-8 RGB Composite

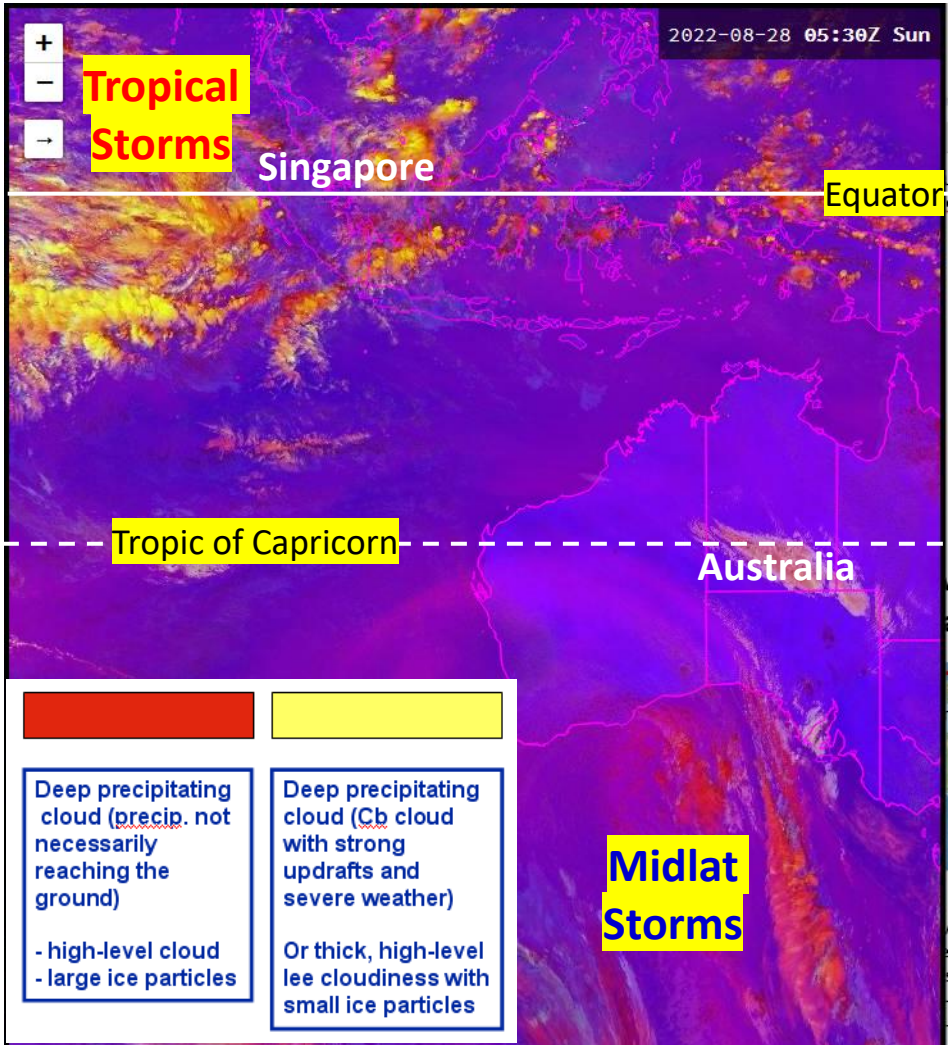
…some slides not shown…

Tropical and Midlatitude storms in satellite imagery

0530UTC 28th August 2022



True Colour RGB

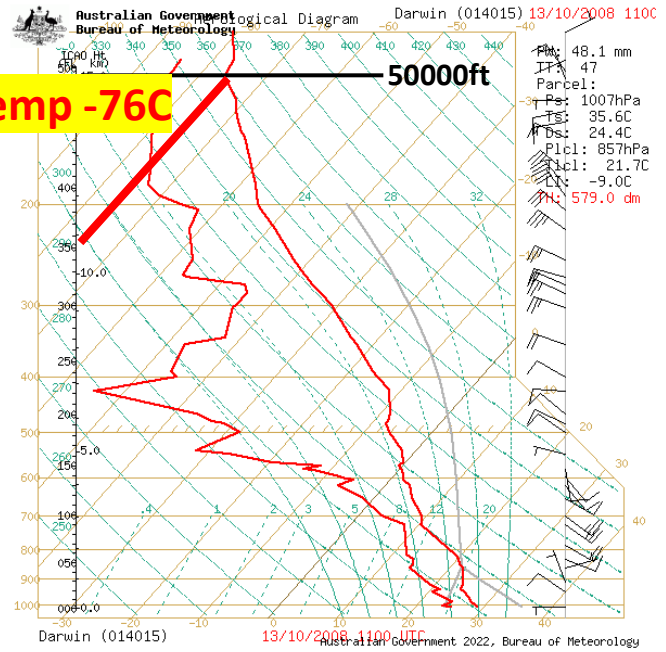


Day Convection RGB (midlat tuned)

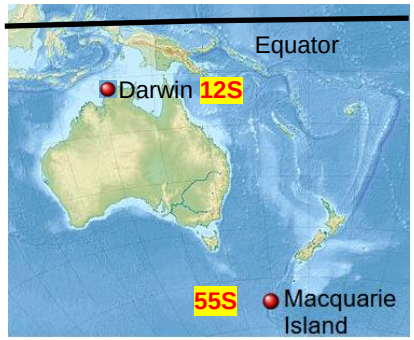
images courtesy BOM/JMA

image courtesy Rowland Beardsell BOM

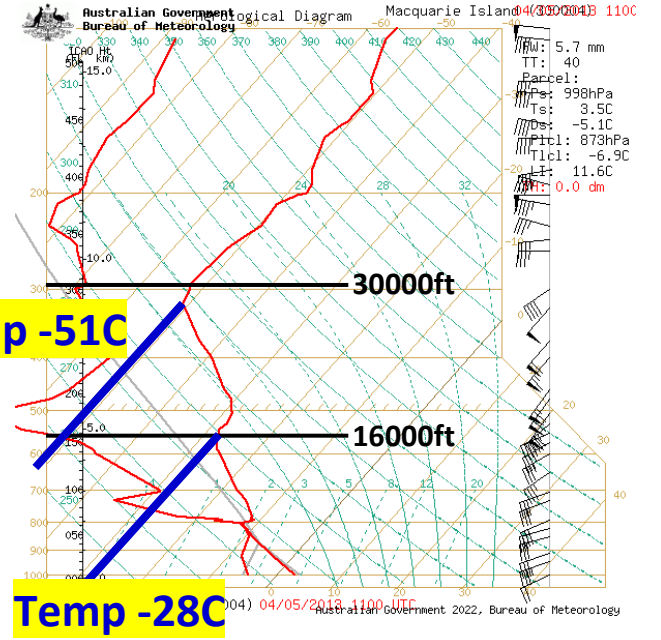
Comparing tropical and midlatitude storms



Darwin thunderstorm (above) 13th October 2008
Macquarie Island thunderstorm (below) 4th May 2013



https://www.antarctica.gov.au/news/stations/macquarie-island/2013/this-week-at-macquarie-island-10-may-2013/



1: For Tropical Storms:

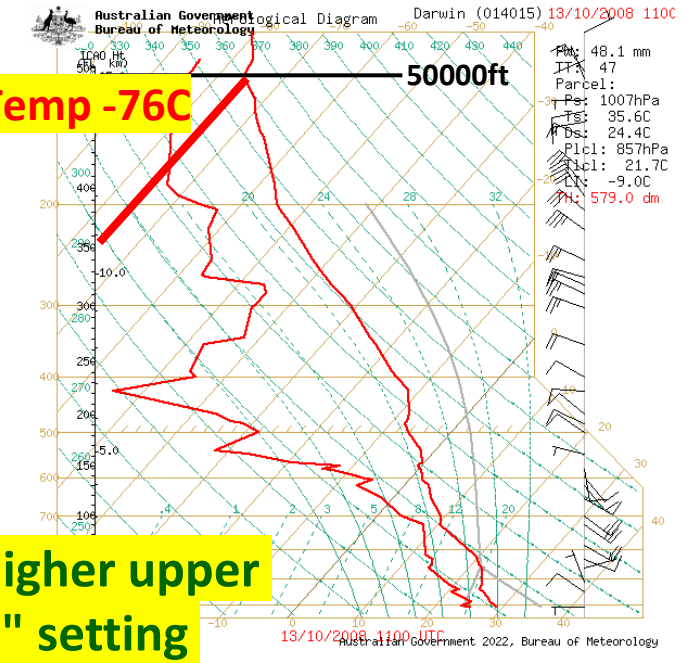
Very cold stormtop temperatures in the IR

3.9 – 10.4 micron temp always large.

Often have strong green component

TROPICAL Day Convection RGB	Range	Gamma
6.2 – 7.3 micron	-35 to 5	1.0
3.9-10.4 micron	-5 to 75	0.33
1.6-0.6 micron	-75 to +20%	1.0
MIDLATITUDE Day Convection RGB	**Range**	**Gamma**
6.2 – 7.3 micron	-36.9 to 5.9	1.0
3.9-10.4 micron	-1.7 to 66.1	0.5
1.6-0.6 micron	-71 to +24%	1.0

3:..so higher upper "Range" setting and lower Gamma required

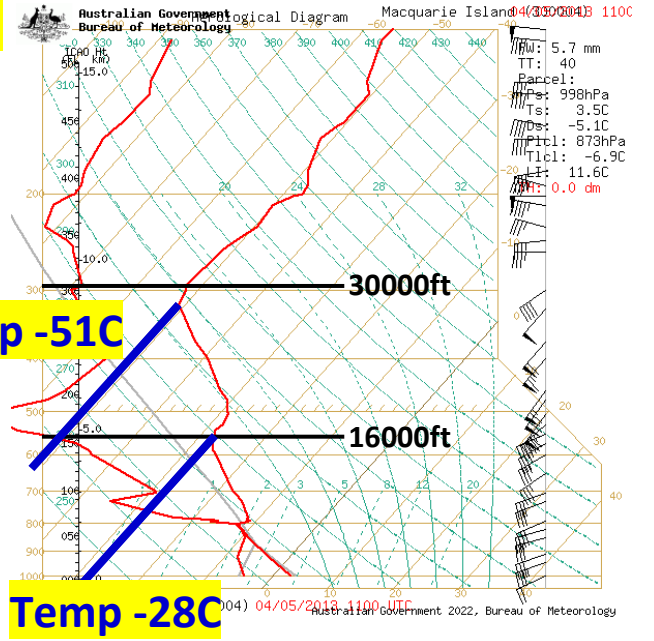


2: For Midlat Storms:

Warmer stormtop temperatures in the IR

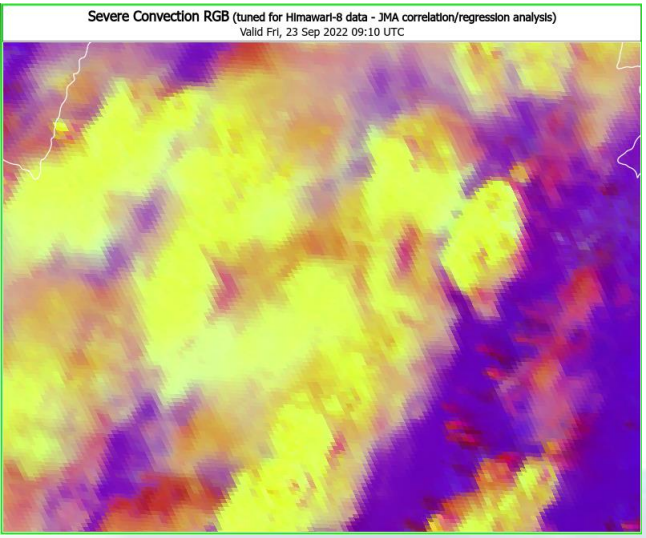
3.9 – 10.4 micron temp always small or negative.

Often have little green component

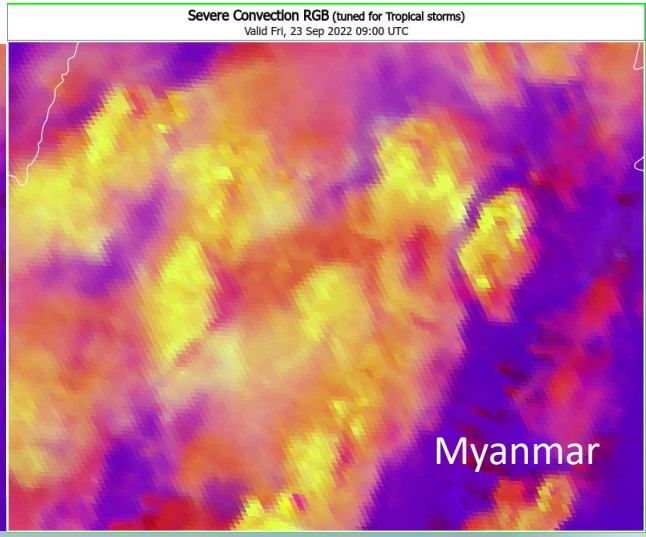


images courtesy BOM/JMA, lightning data courtesy WeatherZone

Case study over Myanmar, 09UTC 23rd September 2022

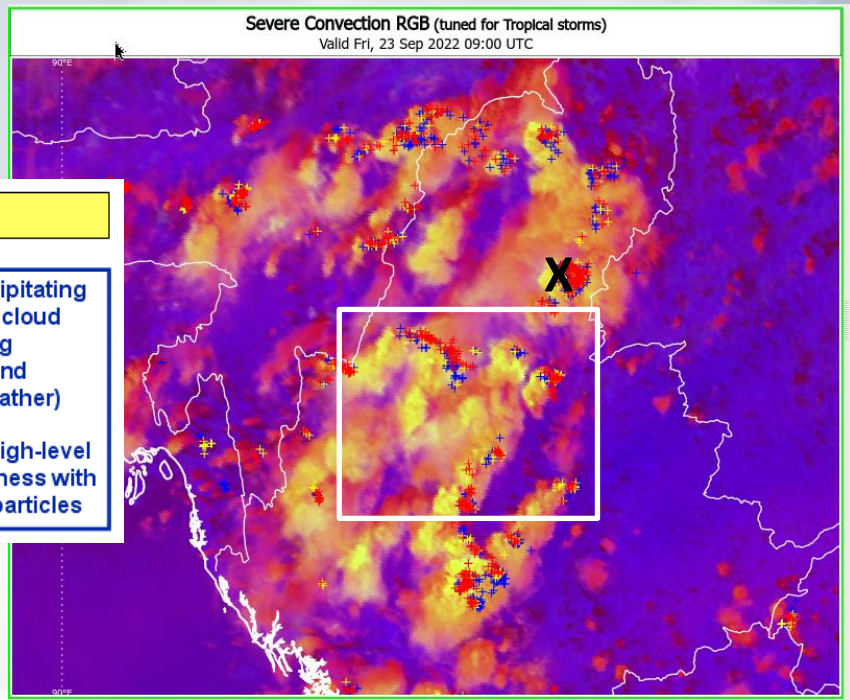


10 minute lightning



Mid-lat Day Convection RGB

Tropical tuned Day Convection RGB

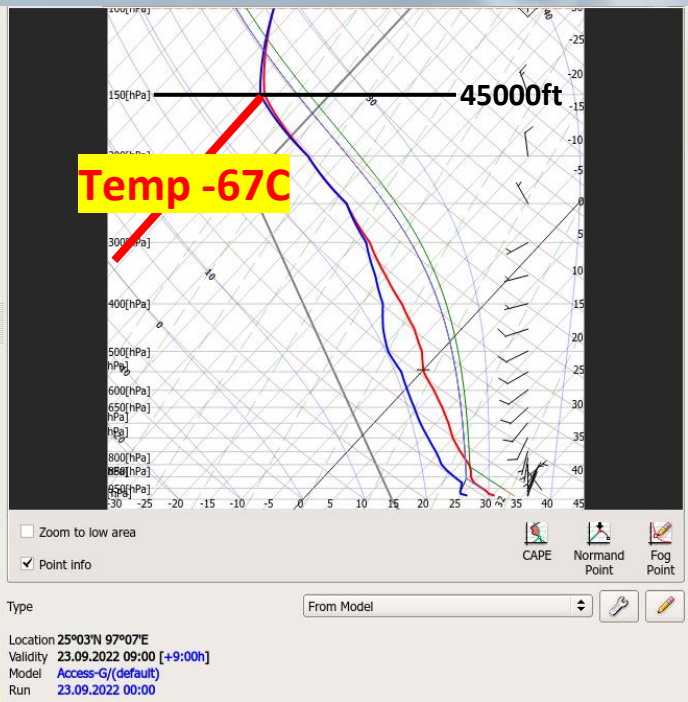


Deep precipitating cloud (precip. not necessarily reaching the ground)

- high-level cloud
- large ice particles

Deep precipitating cloud (Cb cloud with strong updrafts and severe weather)

Or thick, high-level lee cloudiness with small ice particles

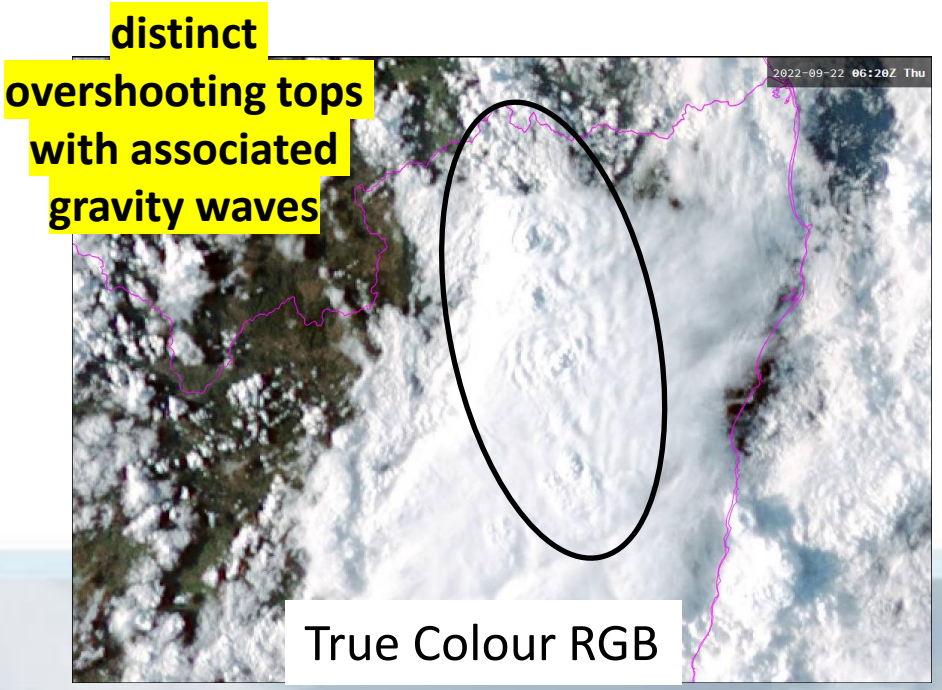


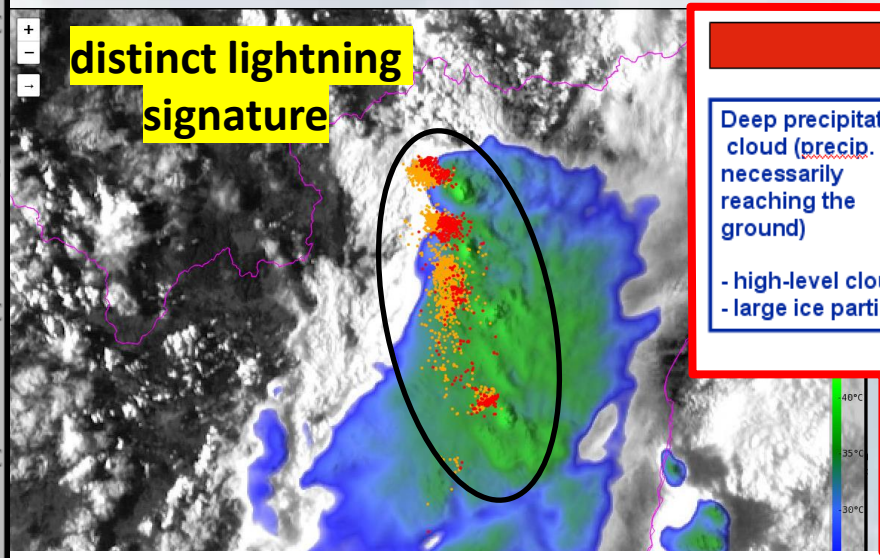
…some slides not shown…

images courtesy JMA / BOM, lightning data WeatherZone

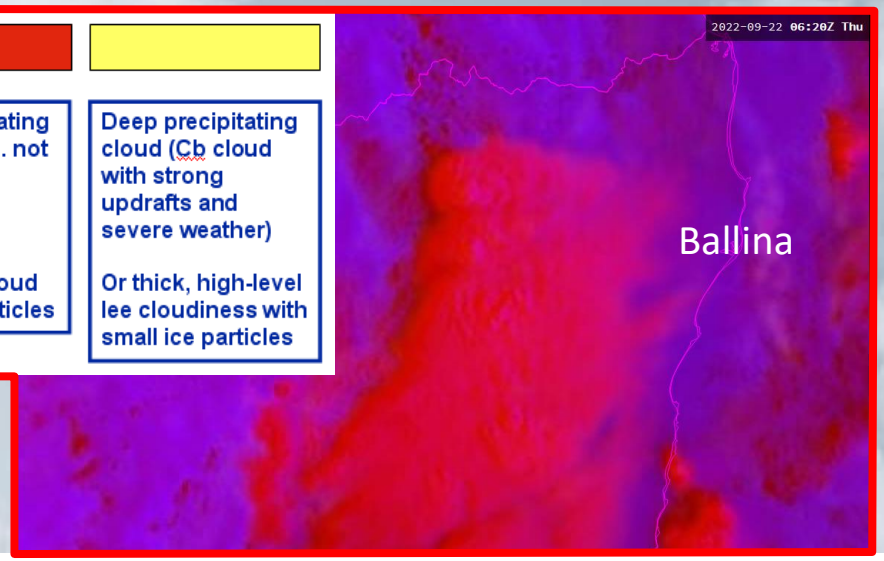
The convection over northeastern NSW

0620UTC 22nd September 2022





Sandwich Product and Lightning



Day Convection RGB (midlatitude version)

images courtesy JMA / BOM, lightning data WeatherZone

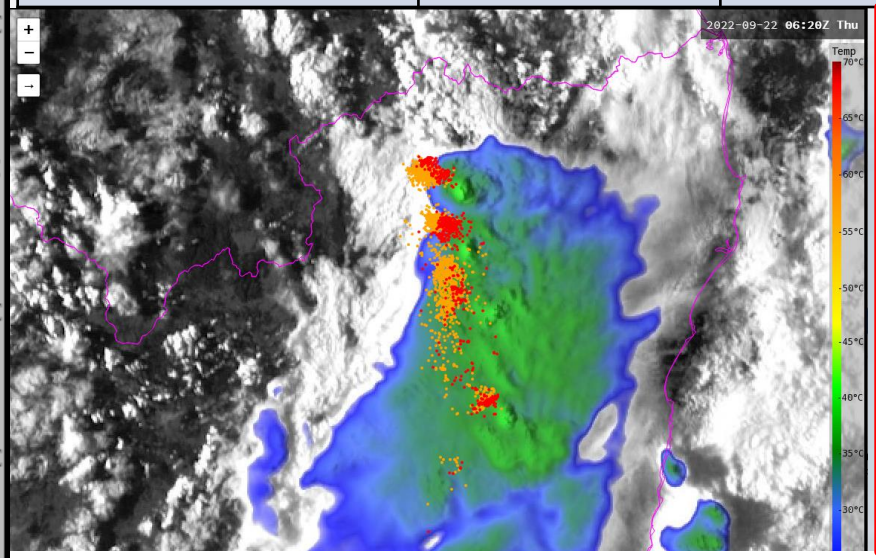
The convection over northeastern NSW

0620UTC 22nd September 2022

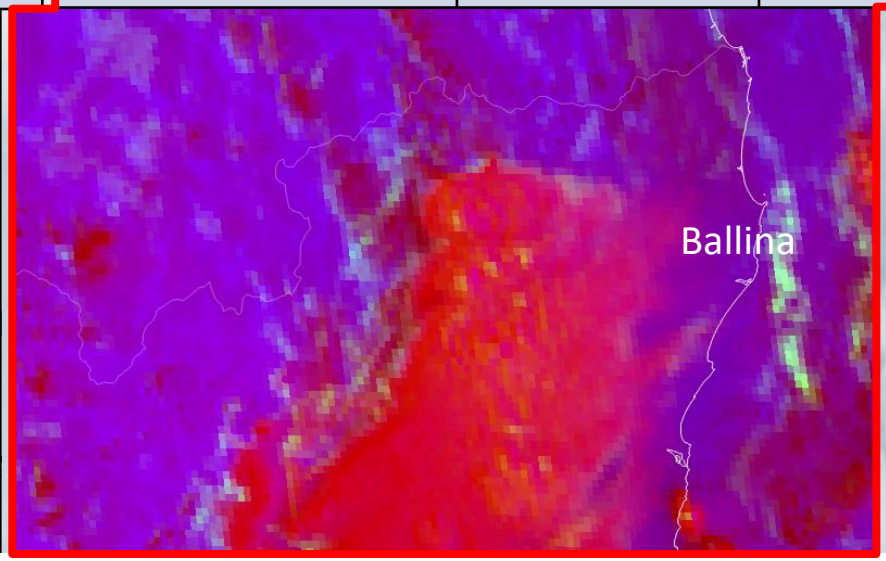
MIDLATITUDE Day Convection RGB	Range	Gamma
6.2 – 7.3 micron	-36.9 to 5.9	1.0
3.9-10.4 micron	-1.7 to 66.1	0.5
1.6-0.6 micron	-71 to +24%	1.0

TROPICAL Day Convection RGB	Range	Gamma
6.2 – 7.3 micron	-35 to 5	1.0
3.9-10.4 micron	-5 to 75	0.33
1.6-0.6 micron	-75 to +20%	1.0

WINTER Day Convection RGB	Range	Gamma
6.2 – 7.3 micron	-36.9 to 5.9	1.0
3.9-10.4 micron	5 to 20	0.8
1.6-0.6 micron	-71 to +24%	1.0



Sandwich Product and Lightning

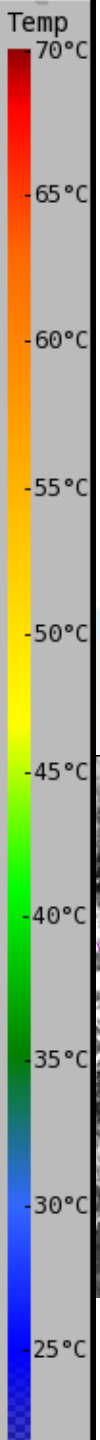


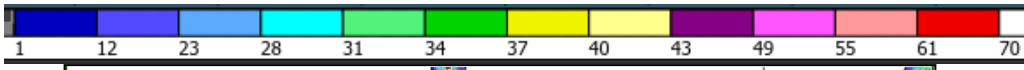
Day Convection RGB (winter version)

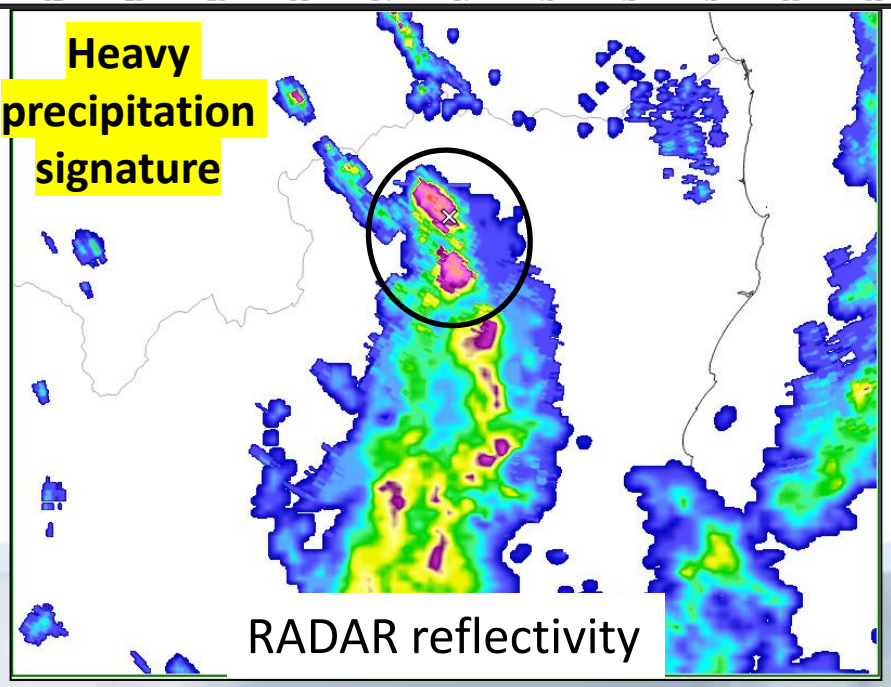
images courtesy JMA / BOM, lightning data WeatherZone, RADAR data BOM

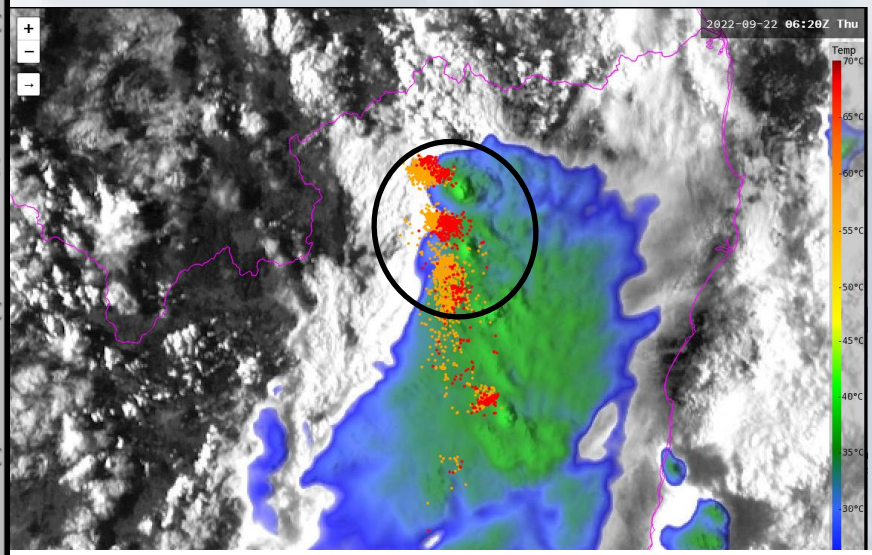
The convection over northeastern NSW

0620UTC 22nd September 2022

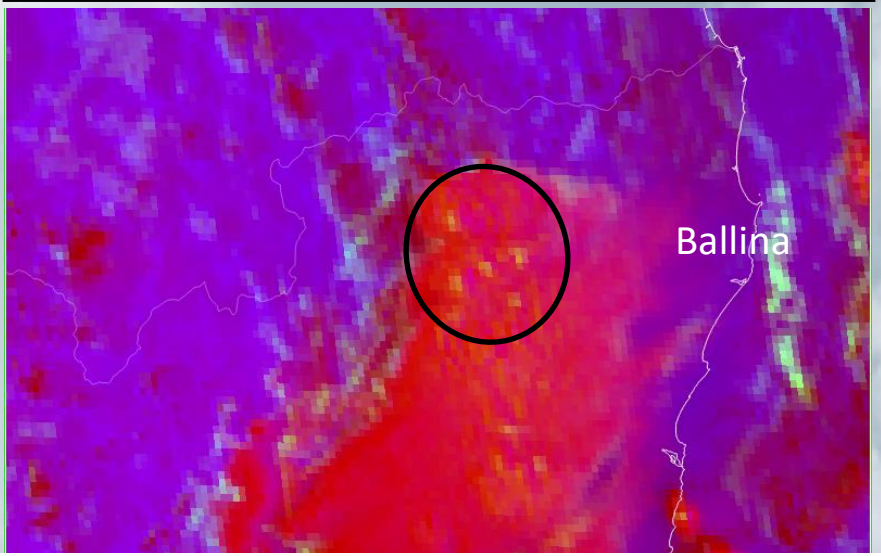








Sandwich Product and Lightning



Day Convection RGB (winter version)

…some slides not shown…

Korea Meteorological Administration

Australian Government
Bureau of Meteorology

Introducing KMA's modified Dust RGB composite for improved detection of weak dust events

30 April 2019

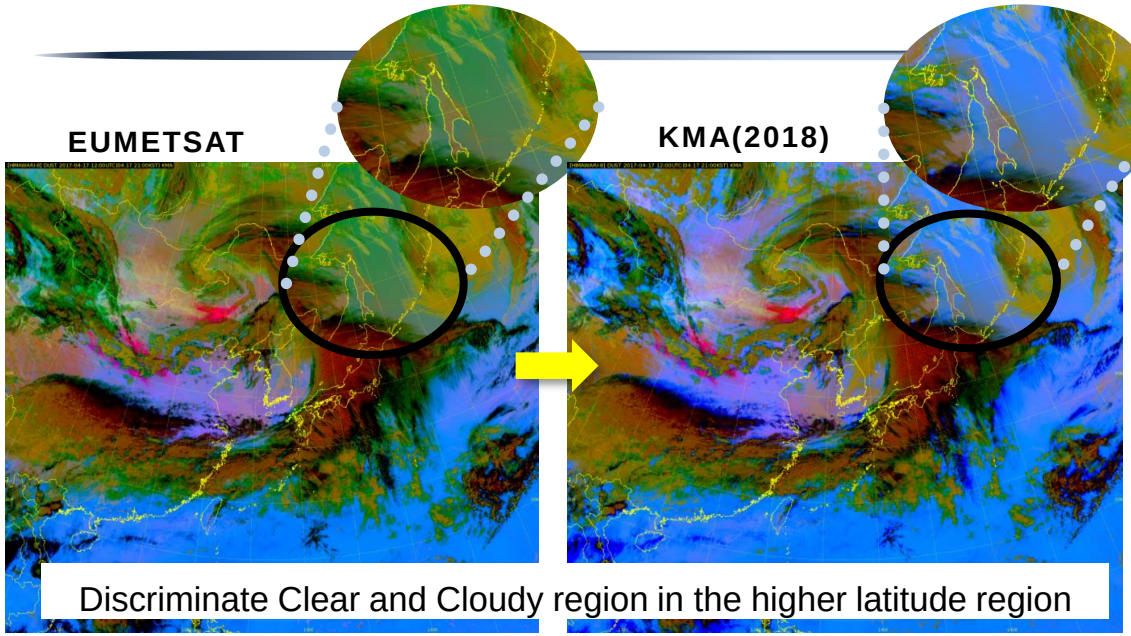
Dr. Hye-Sook PARK

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

*** KMA VLab CoE Point of Contact : Dr. Hye-Sook Park (hyesookpark@korea.kr)**

…some slides not shown…

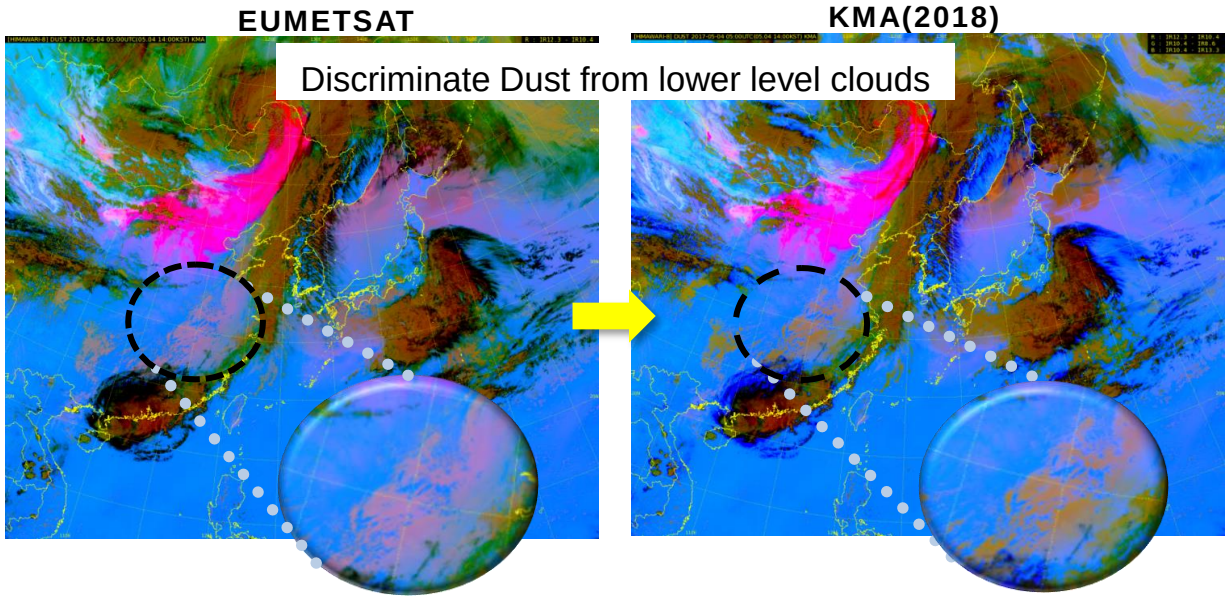
1st improvement of Dust RGB in KMA(2018)



	EUMETSAT	**KMA(2018)**
Red	IR12.4 – IR10.4	IR12.4 – IR10.4
Green	IR10.4 – IR8.6	IR10.4 – IR8.6
Blue	IR10.4	**IR10.4 – IR13.3**

Range: 10~16K
Gamma: 1.0

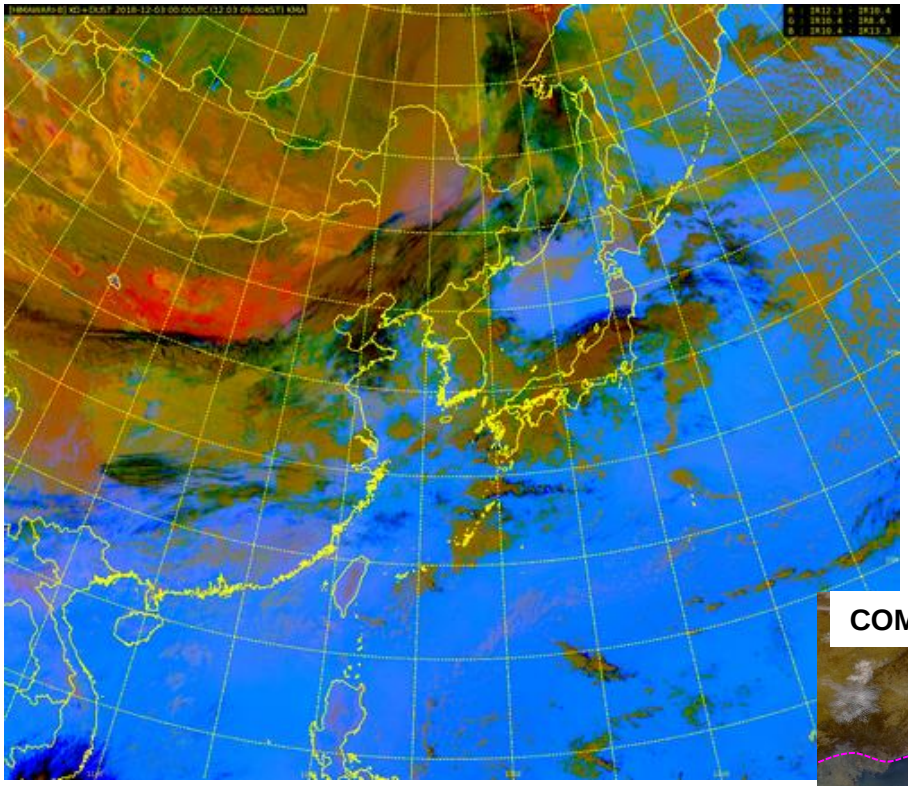
Improve ambiguous colors shown on the original dust RGB Provided by EUMETSAT recipe



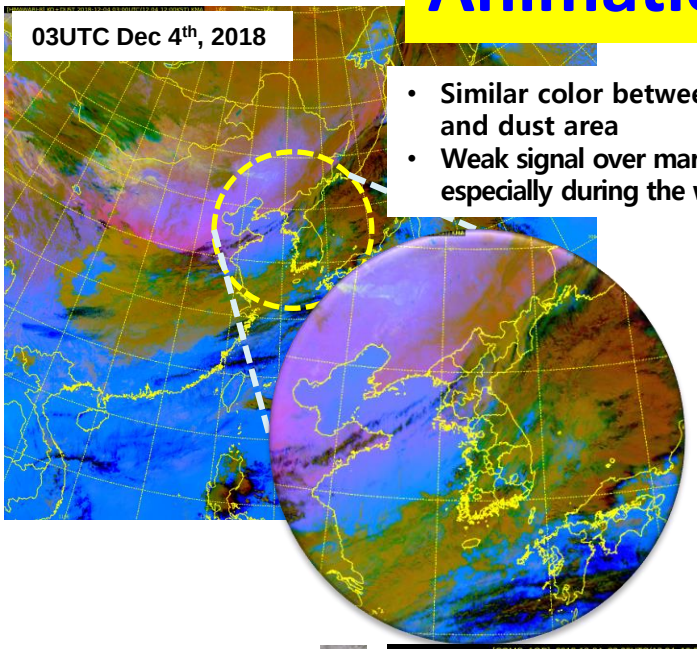
Motivation) Variations in Dust RGB – diurnal cycle, height and thickness

Animation K2

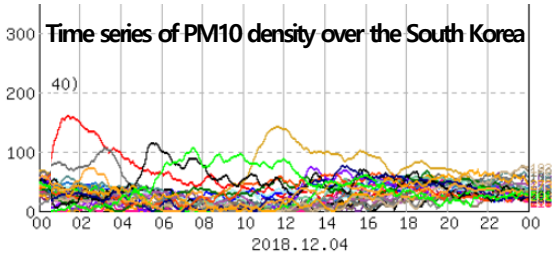
Loop3 (00UTC Dec. 03rd - 23UTC Dec. 4th, 2018)



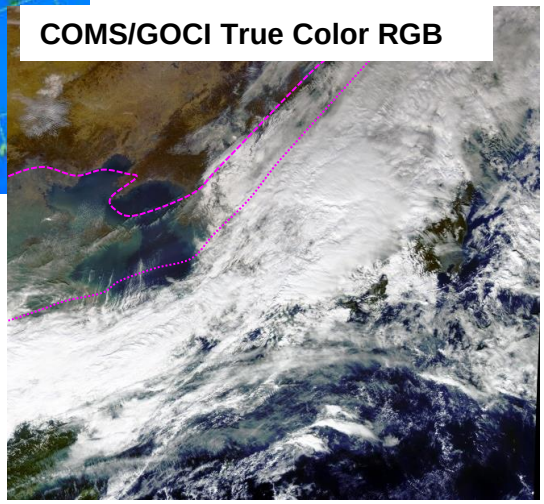
Dust RGB(ver.2018)

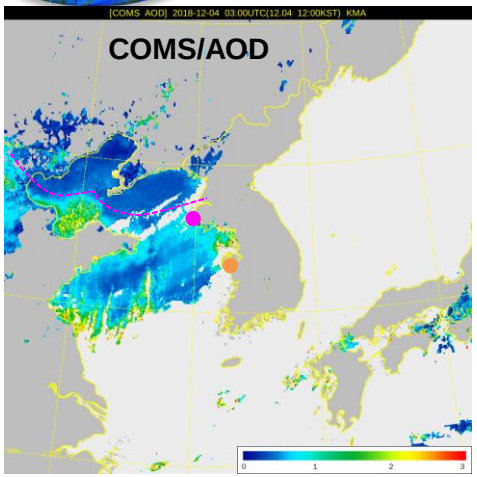


- Similar color between surface and dust area
- Weak signal over marine areas, especially during the winter season



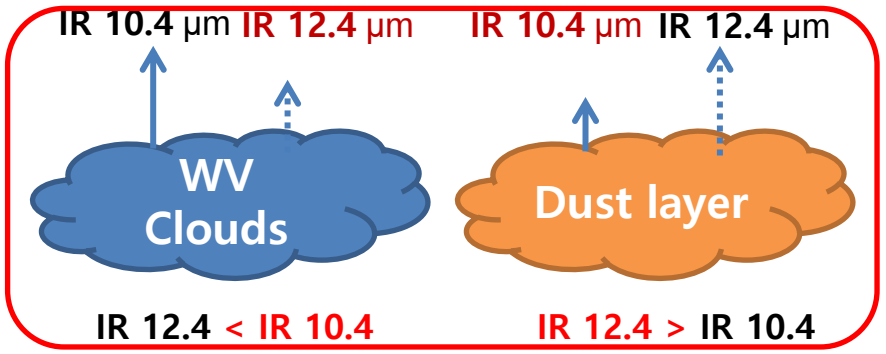
COMS/GOCI True Color RGB



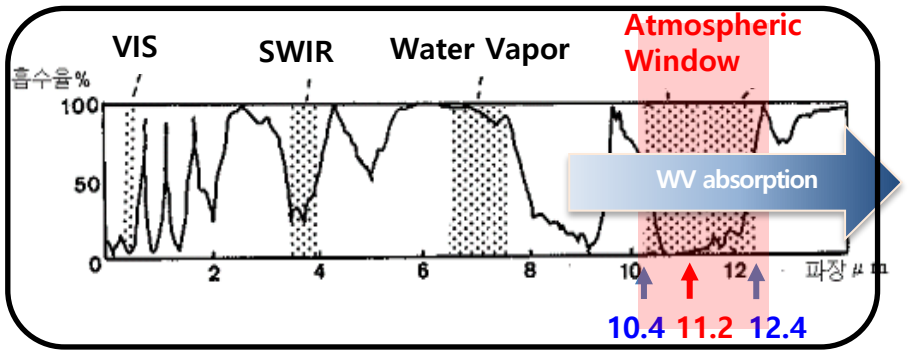


Cause Analysis) Properties in the Red Channel

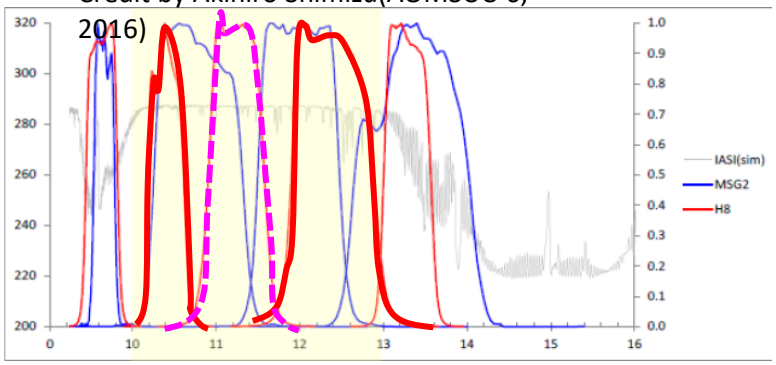
Transmitted radiation



WV absorption at the Window bands



Credit by Akihiro Shimizu(AOMSUC-6, 2016)



10.4
Clean window

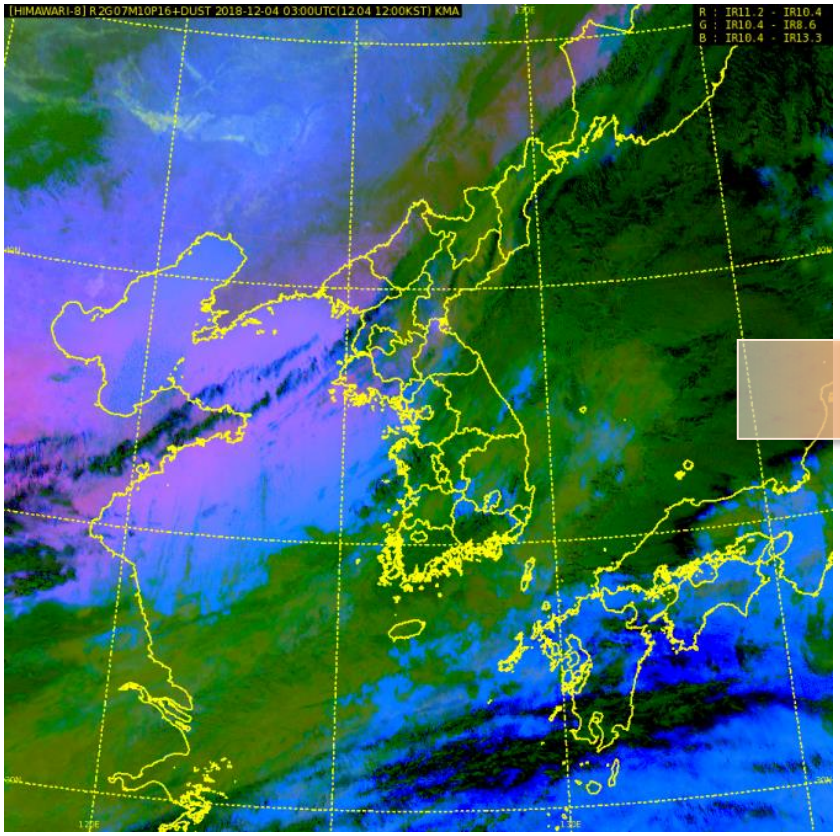
12.4
dirty window

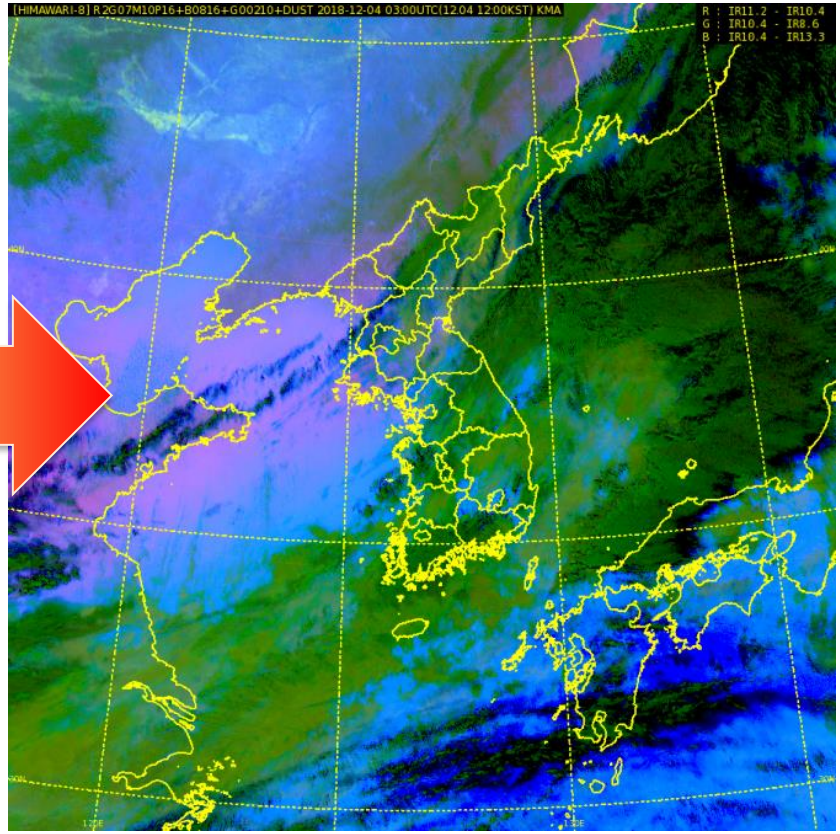
	EUMETSAT	**KMA(2018)**
Red	IR12.4 – IR10.4	IR12.4 – IR10.4
Green	IR10.4 – IR8.6	IR10.4 – IR8.6
Blue	IR10.4	**IR10.4 – IR13.3**

Is it possible to use the 11.2 μm band instead of 12.4 μm ?
to reduce the impact of WV absorption

…some slides not shown…

Test 4) Fine tuning of threshold values for B and G channels





	KMA(2018)	value	gamma
R	**IR12.4** – IR10.4	-4~2	1
G	IR10.4 – IR8.6	0~15	2.5
B	IR10.4 – IR13.3	10~16	1

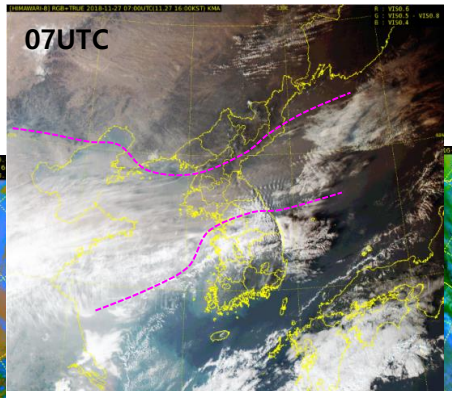
	KMA(2019)	value	gamma
R	**IR11.2** – IR10.4	**-1~1.6**	**0.7**
G	IR10.4 – IR8.6	0.2-10	2.5
B	IR10.4 – IR13.3	8-16	1

…some slides not shown…

Result 2) Improvement of Dust RGB composite

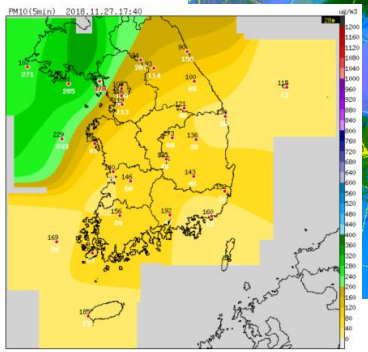
by modify the threshold value and gamma correction for red channel

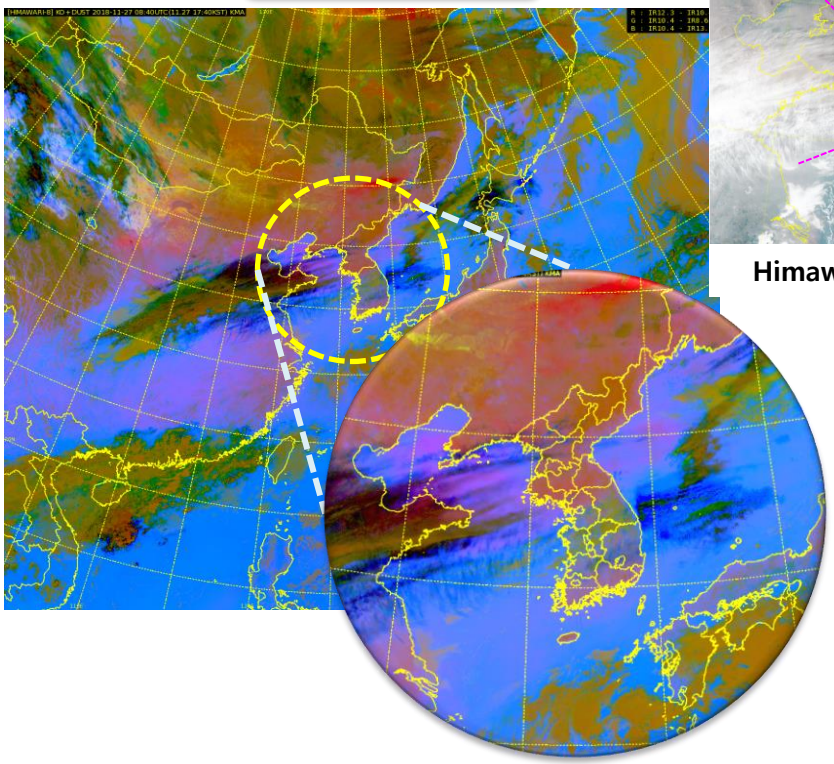
Ver. 2018

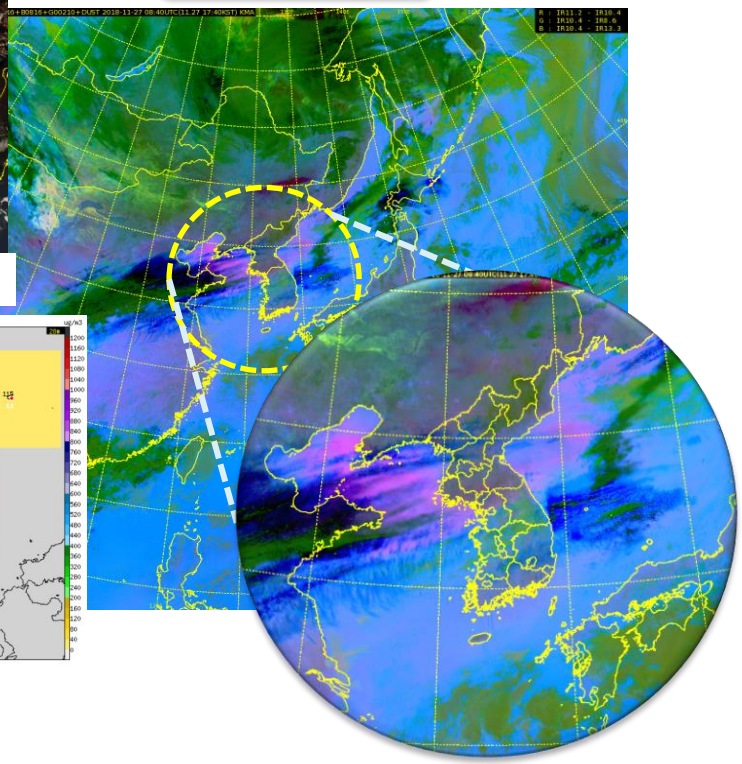


Himawari-8 True Color RGB

Ver. 2019



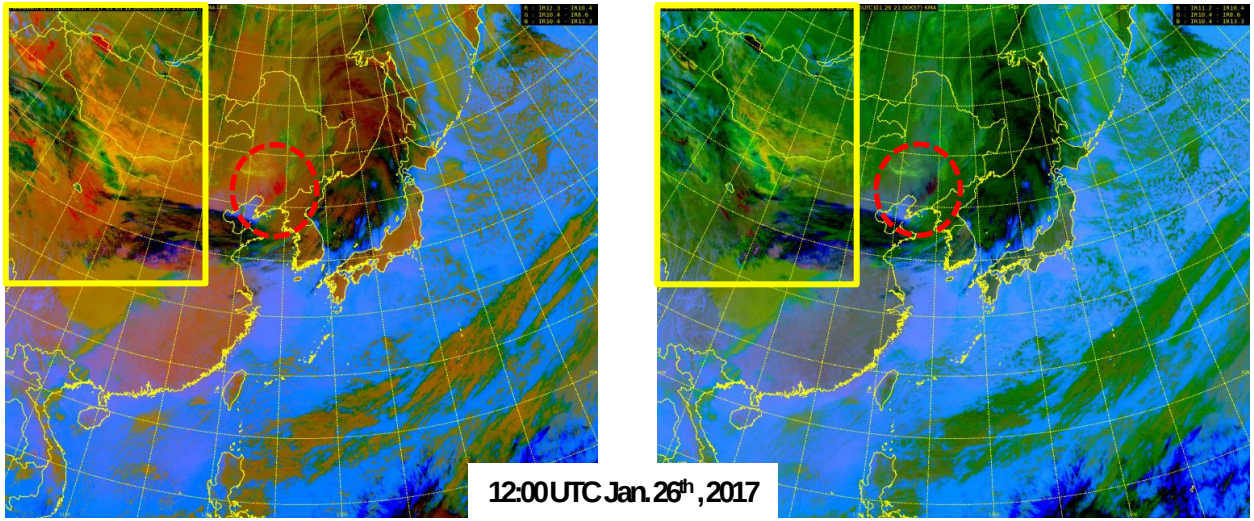




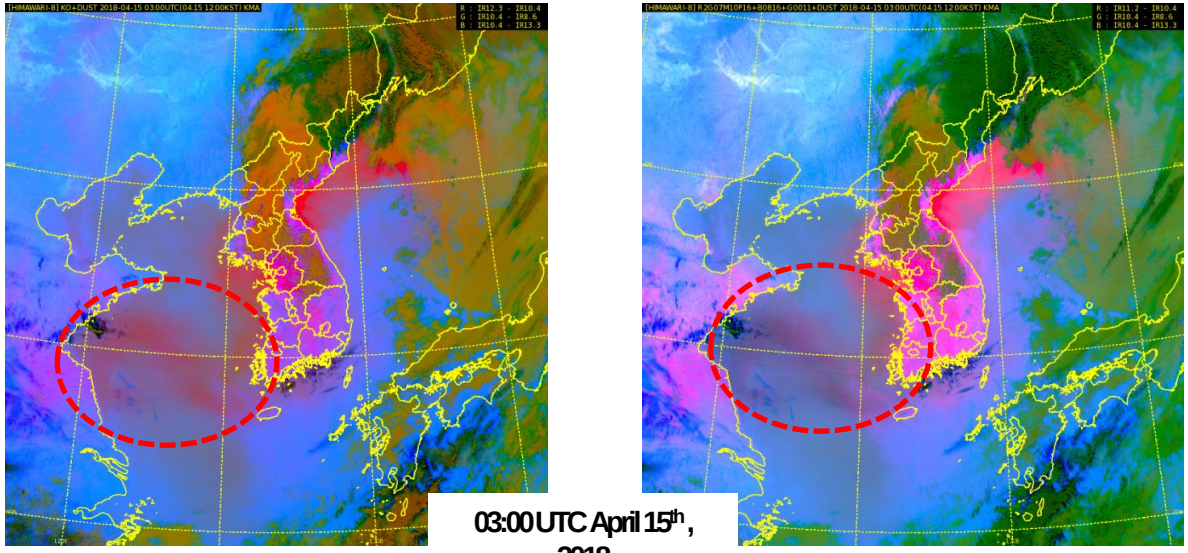
Winter/Nighttime
08:40 UTC Nov. 27th, 2018

…some slides not shown…

Limitations) Variations in dust signals



12:00 UTC Jan. 26th , 2017



03:00 UTC April 15th , 2018

- Underestimate of dust signals underneath the clouds
- Sometimes, dust signals are displayed as dark-red from redish especially nighttime in winter season
- Sometimes, the colors of dust signals are displayed as pink-violet-dark violet especially over the marine

Joint Australia - Korea VLab Centres of Excellence Regional Focus Group meeting 20 December 2017

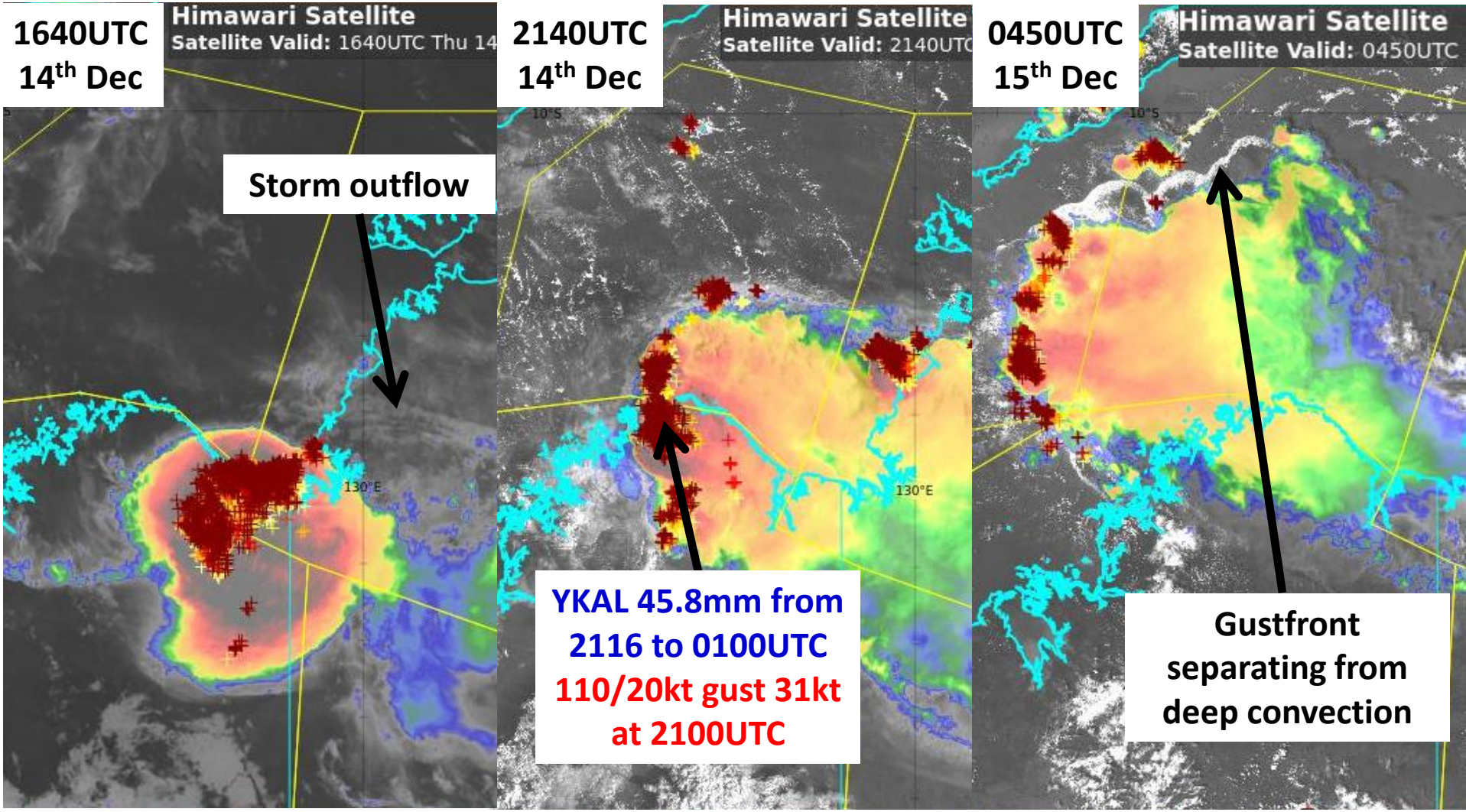
Applying some RGB Composites to an Australian Squall line

Bodo Zeschke Australian VLab Centre of Excellence Point of Contact

…some slides not shown…

Overview of the event

Enhanced Infrared / Sandwich product and 10 minute lightning data
at 1620UTC and 2140UTC, 14th December and 0450UTC 15th December

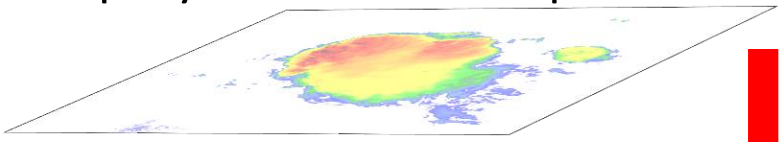


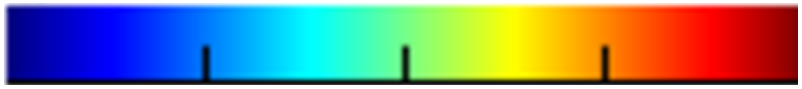
…some slides not shown…

Example 4: "Airmass RGB Sandwich Product" (HansPeter Roesli)

Modification by BOM staff, including Operational Forecasters and B.Zeschke

Top layer: IR10.4 BT tropical scale

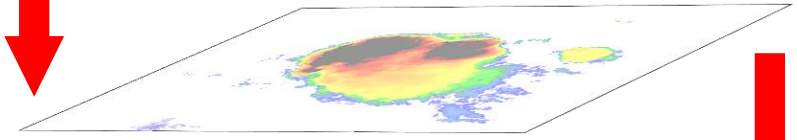


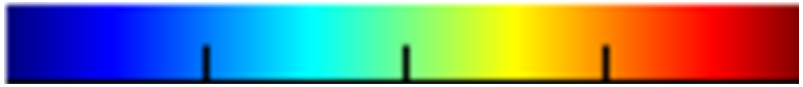


-20C Tropical -80C

scale as adapted from Australian Bureau of Meteorology forecasters

Mid layer: IR10.4 BT midlat scale

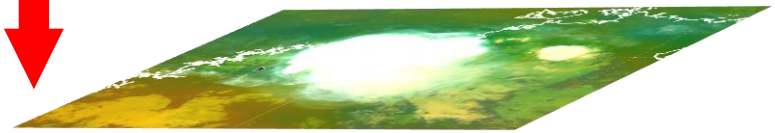




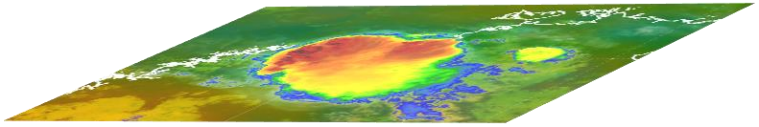
-20C Mid-latitude -70C

Upper and mid layer opacity set to 50%

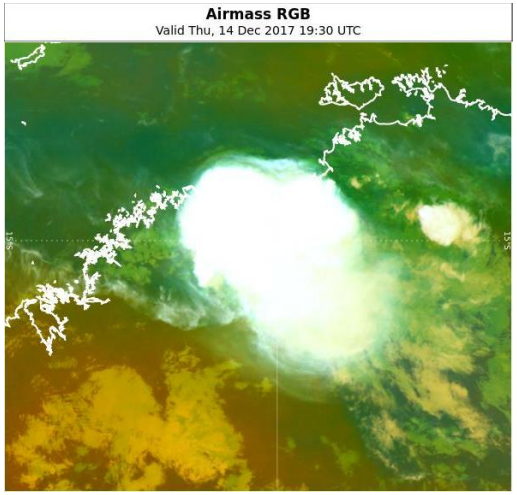
Bottom layer (“background”): Airmass RGB (midlat tuned)



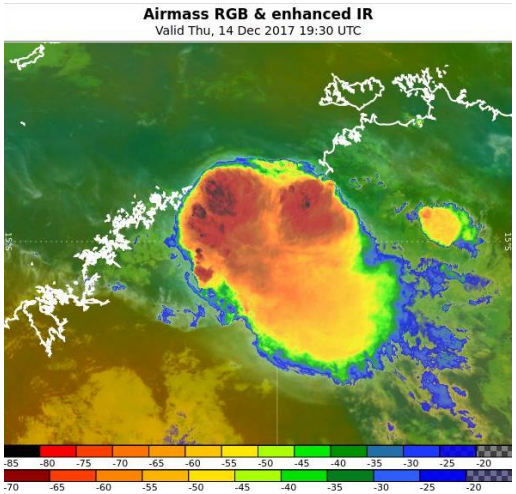
Blending options – applied to the upper layer



Before



After



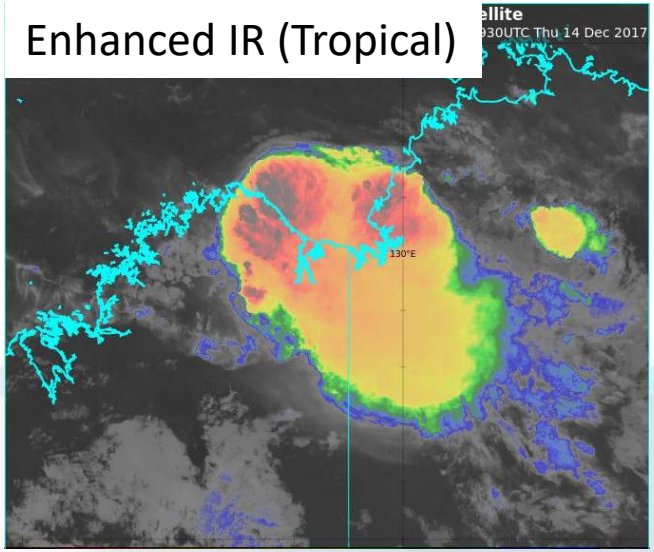
…some slides not shown…

images courtesy JMA/BOM

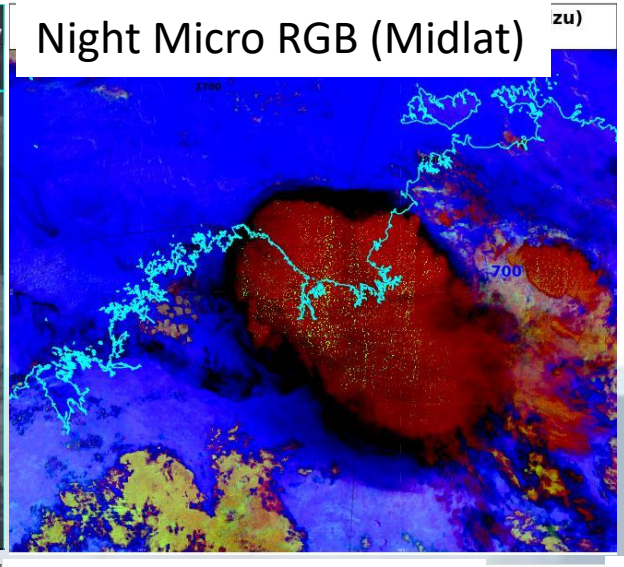
Summary: RGB products examined during the night time

(situation at 1930UTC, 14th December)

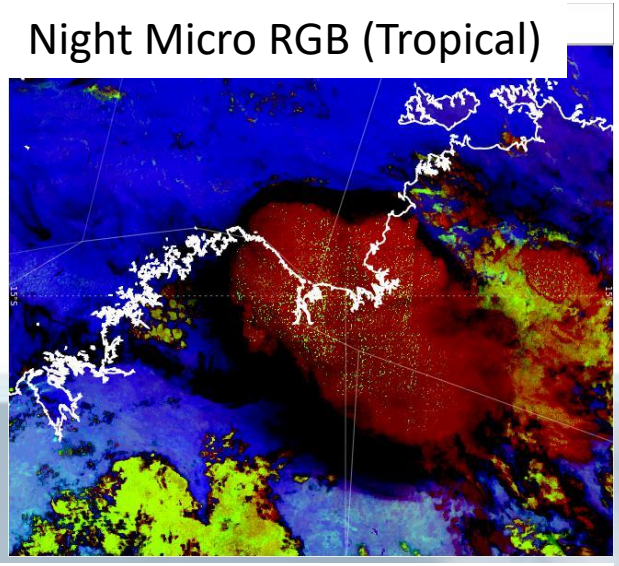
Enhanced IR (Tropical)



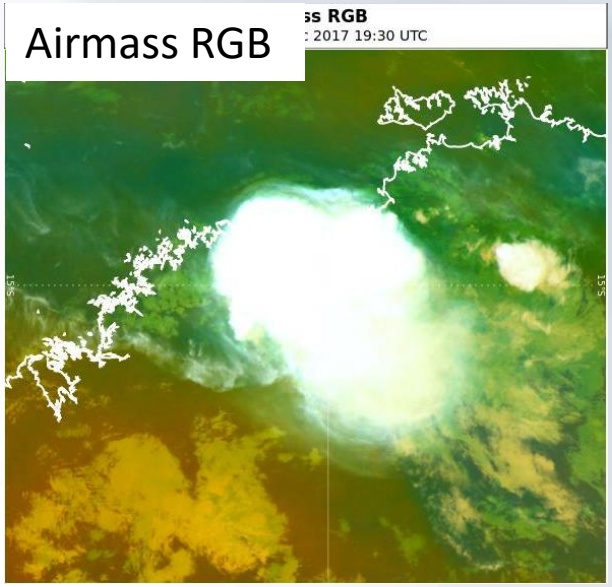
Night Micro RGB (Midlat)



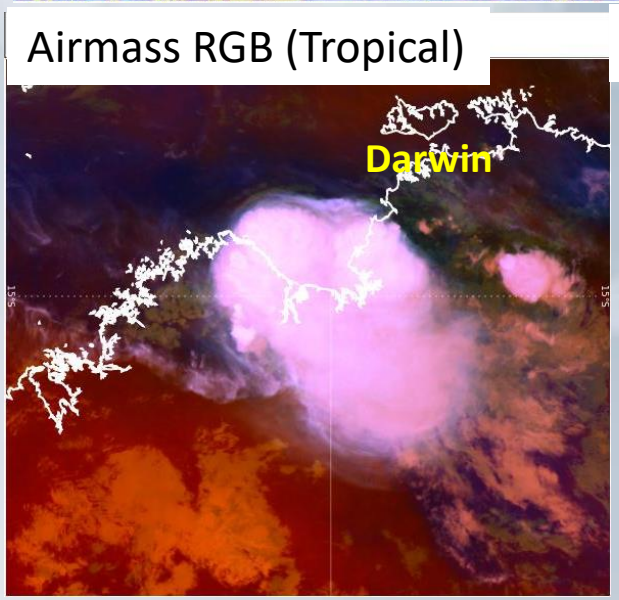
Night Micro RGB (Tropical)



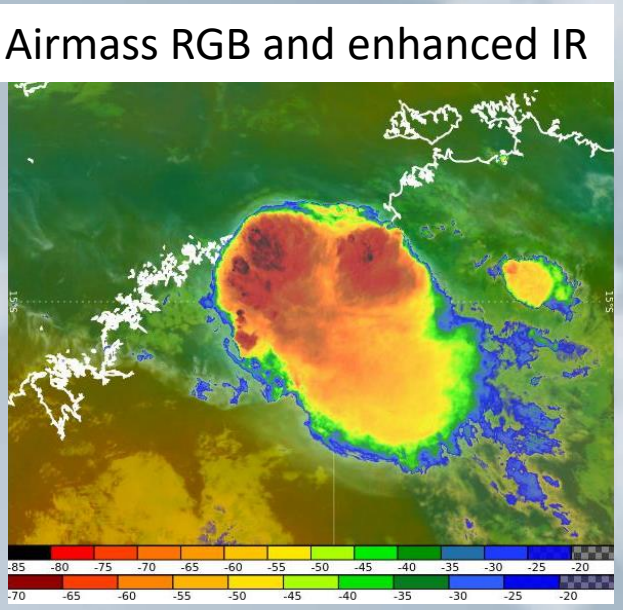
Airmass RGB



Airmass RGB (Tropical)



Airmass RGB and enhanced IR

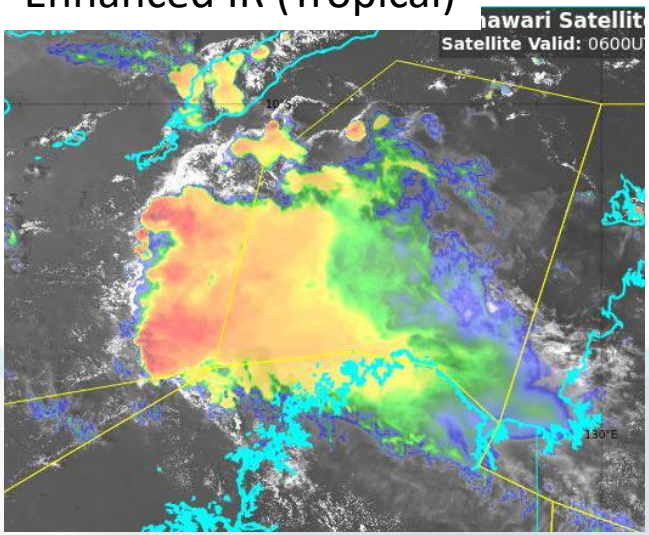


…some slides not shown…

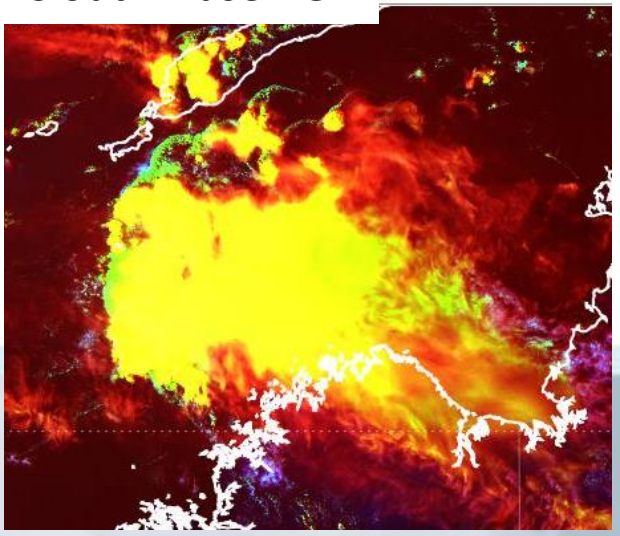
Summary: RGB products examined during the day time

(situation at 0600UTC, 15th December)

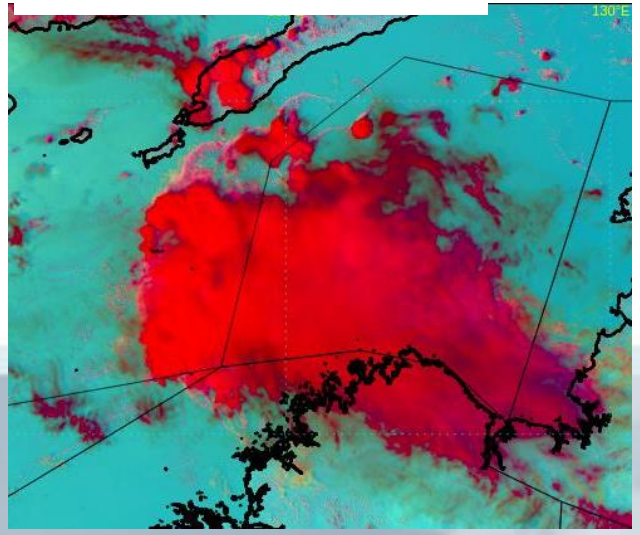
Enhanced IR (Tropical)



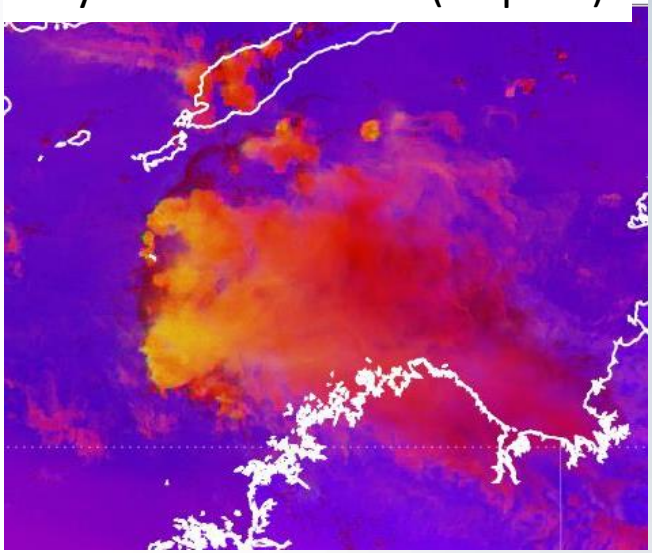
Cloud Phase RGB



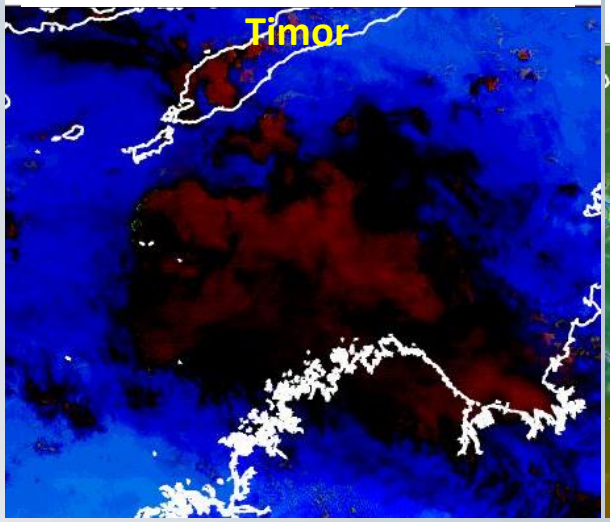
Day Microphysics RGB



Day Convection RGB (tropical)



24 hour Microphysics RGB



Airmass RGB and enhanced IR