Australian Government
Bureau of Meteorology

Himawari-8 RGB product use and development amongst Australian / RAV / RAII stakeholders: the Australian VLab Centre of Excellence perspective

EUMeTrain 'Event Week on MTG-I satellite'

7-11 November 2016

Bodo Zeschke

Australian VLab Centre of Excellence Point of Contact

Content

- Introducing the Australian VLab Centre of Excellence
- The seven EUMETSAT/WMO endorsed RGB products
- Engaging stakeholders to permit effective use and development of the RGB products
- Tuning of the WMO endorsed RGB products in order to adapt these to Himawari-8 data and to RAV and RAII regions.
- Evidence of the effective stakeholder use of the data
- Stakeholders developing Himawari-8 RGB products

More information: CALMET 2016 presentation

Australian Government
Bureau of Meteorology

PAST SESSION: A REVIEW OF THE AUSTRALIAN VLAB CENTRE OF EXCELLENCE NATIONAL HIMAW CHALLENGES

Period: 23 July- 9 September 2016

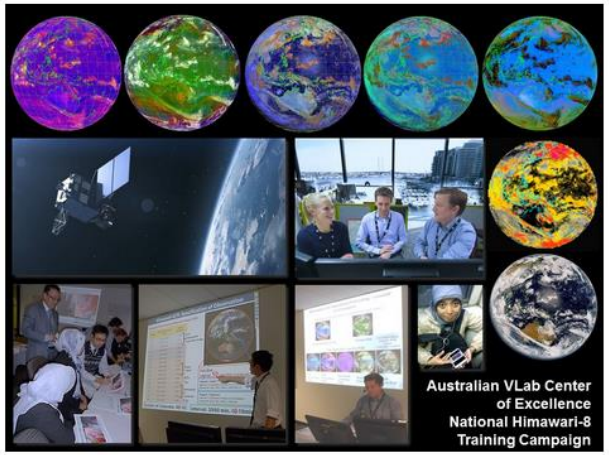
Bodo Zeschke,

Bureau of Meteorology Training Centre,

Australian Bureau of Meteorology

"I was involved in developing training resources and conducting Satellite data and data products. This advanced Japanese sate monitor our hemisphere in 16 channels and at 10 minute interv

Preparations commenced in 2009 and included topic familiariz and other stakeholders (you can read more about this backgro resources and conducting prior training. The Bureau's National



What you can expect from this session

In this CALMet Online session I will share my experiences regarding how the Himawari-8 training was conducted, including classroom and remote sessions.
I will also tell about the important collaboration with Satellite Champions and other stakeholders, including JMA, KMA, CMA, BMKG Indonesia, EUMETSAT. In addition, I will discuss the impact of the training on the effective use of Himawari-8 data by RAV and RAII stakeholders.

Finally, this session will also give you, the CALMet participants an opportunity to participate in a Regional Focus Group meeting which will demonstrate the training in practice.

2. View recorded sessions & join the forum discussion

Below are short recorded sessions where I review the experiences of the Australian VLab Centre of Excellence in preparing for conducting training pertaining to the effective Forecaster use of Himawari-8 data and data products. Please listen to the recordings:

- **TOPIC 1: How the Himawari-8 training was conducted**
  - **Introduction** (5:30 min) **.wmv** (5Mb) or **.mp4** (10Mb)
  - **Preparing the Training Resources** (7 min) **.wmv** (12Mb) or **.mp4** (20Mb)
  - **Summary** (6:30 min) **.wmv** (12Mb) or **.mp4** (20Mb)
  - **Training** (13:27 min) **.wmv** (13Mb) or **.mp4** (31Mb)
- **TOPIC 2: Collaboration with Satellite Champions and other stakeholders, including JMA, KMA, CMA, BMKG Indonesia, EUMETSAT etc.**
  - **Introduction** (8:30 min) **.wmv** (8Mb) or **.mp4** (18Mb)
  - **Collaboration in Training** (7 min) **.wmv** (7Mb) or **.mp4** (16Mb)
  - **Collaboration in Conferences** (5:30 min) **.wmv** (6Mb) or **.mp4** (14Mb)
  - **Collaboration with Operational Staff** (9:30 min) **.wmv** (10Mb) or **.mp4**(27Mb)
  - **Summary** (6:30 min) **.wmv** (7Mb) or **.mp4** (15Mb)
- **TOPIC 3: Evaluation of the impact of the training on the effective use of Himawari-8 data by RAV and RAII stakeholders.**
  - **Part 1** (11 min) **.wmv** (16Mb) or **.mp4** (27Mb)
  - **Part 2** (8 min) **.wmv** (15Mb) or **.mp4** (25Mb)

Next, post any questions that you may have into the **Himawari Training Forum**. Your comments would also be very appreciated!

3. Listen to the online session

The final online session was conducted during the Australian VLab Centre of Excellence Regional Focus Group meeting conducted online on the 6th September 2016. There were 40 online connections with attendees from Australia, Indonesia, Japan, China and Singapore. The recordings of the sessions are given below.

- **Part 1: A Weather and Forecast Discussion incorporating audience interaction methods outlined during my CALMET 2016 presentations** (32 min) **.wmv** (40Mb) or **.mp4** (86Mb)
- **Part 2: Introducing the Cloud Phase RGB product with a case study** (22 min) **.wmv** (37Mb) or **.mp4** (65Mb)

http://training.eumetsat.int/course/view.php?id=259#section-1

More information: CALMET 2016 presentation

Australian Government
Bureau of Meteorology

PAST SESSION: A REVIEW OF THE AUST
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Period: 23 July- 9 September 2016

Bodo Zeschke,

Bureau of Meteorol
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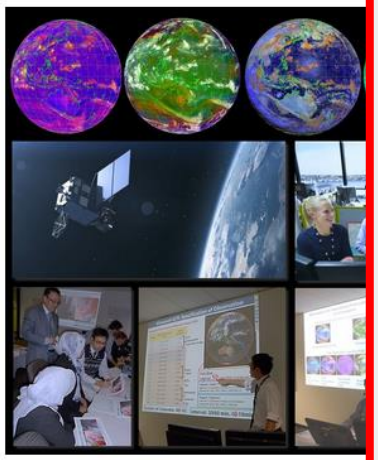

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oduct with a case study (22

http://training.eumetsat.int/course/view.php?id=259#section-1

Australian VLab Centre of Excellence and RAV contacts (from September 2013)

Australian Government
Bureau of Meteorology

Peter Davidson
(Head of CoE)

Bodo Zeschke
(Main Point of Contact)

RAV

Philippines

Singapore

Indonesia

PNG

Solomon Islands

Fiji

Vanuatu

Samoa

Melbourne

New Zealand

Other important contacts:

- JMA
- EUMETSAT
- CMA
- KMA

Satellite Champions

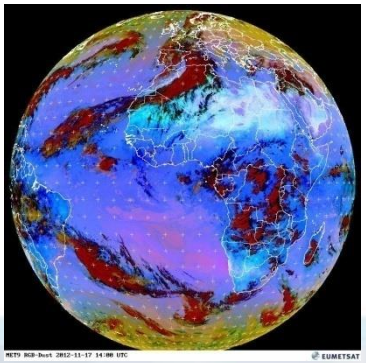
RAV contacts frequently attending our training

Other RAV contacts

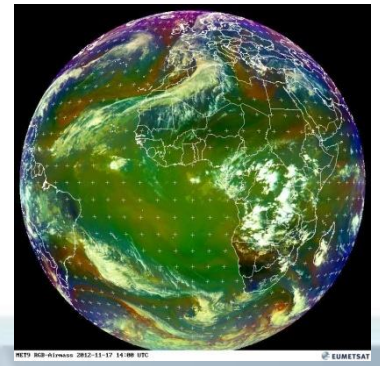
RGB products for Operational Forecasting – WMO / EUMETSAT recommendation

Australian Government
Bureau of Meteorology

Two RGB composites which complement each other



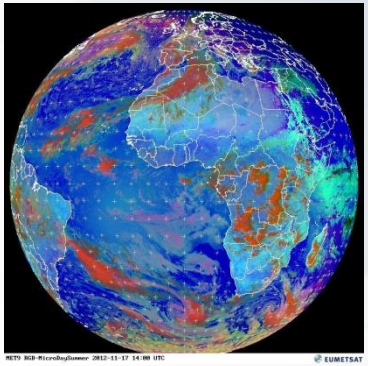
24 hour Microphysical RGB



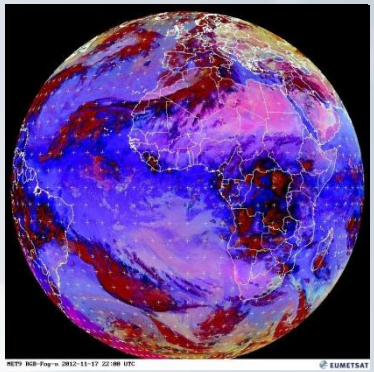
Airmass RGB

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

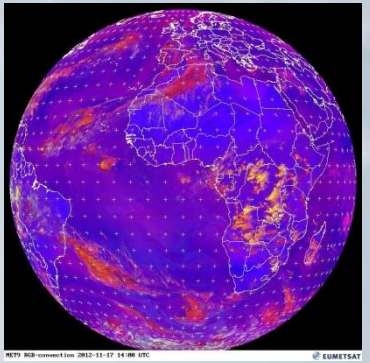
Five application specific RGBs



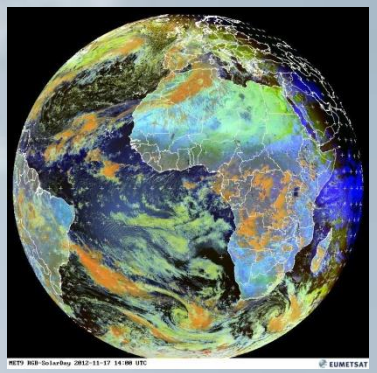
Day Microphysical RGB



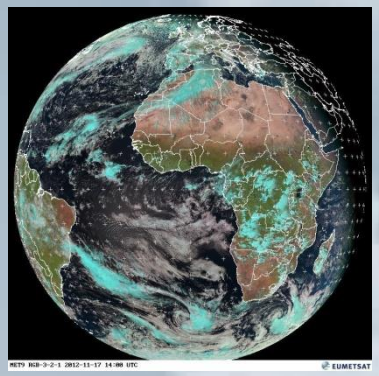
Night Microphysical RGB



Day Convection RGB

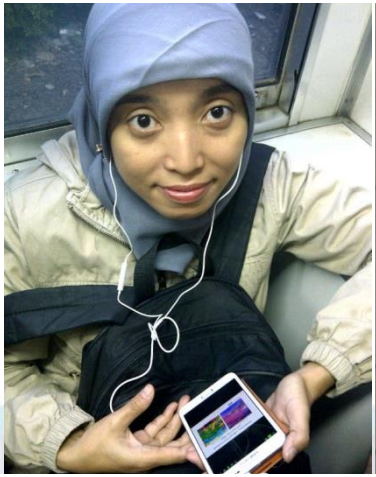


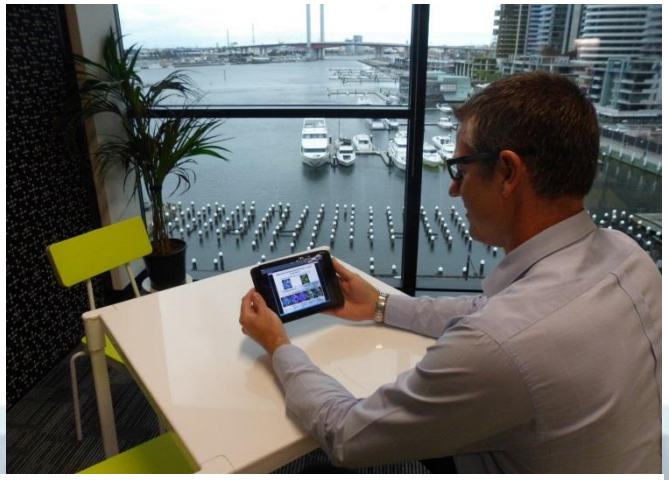
Snow / fog RGB



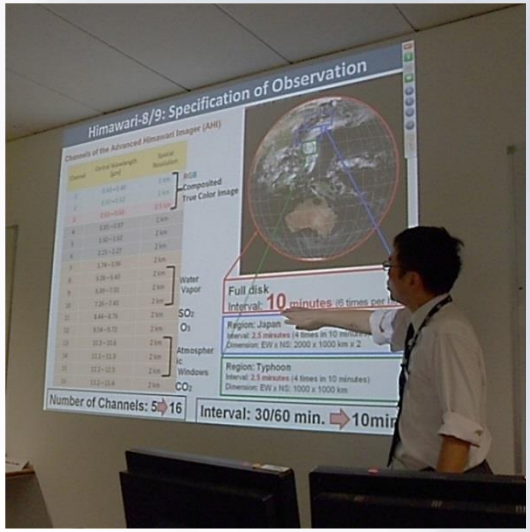
Natural Colours RGB

Collaboration with and gaining stakeholder engagement (prior to the availability of the Himawari-8 data)

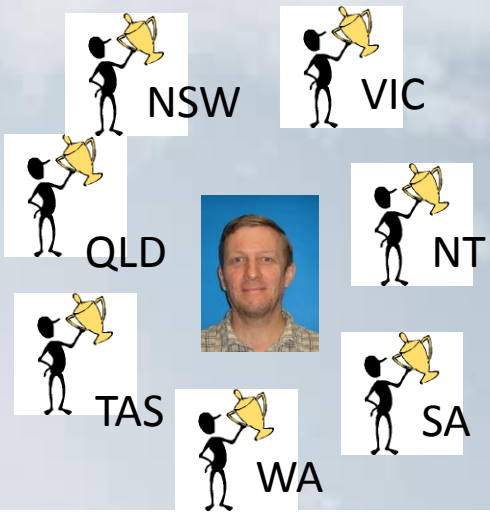




1: Classroom and remote training (AFC, AOMSUC-4, RFG meetings)



2: Guest Experts

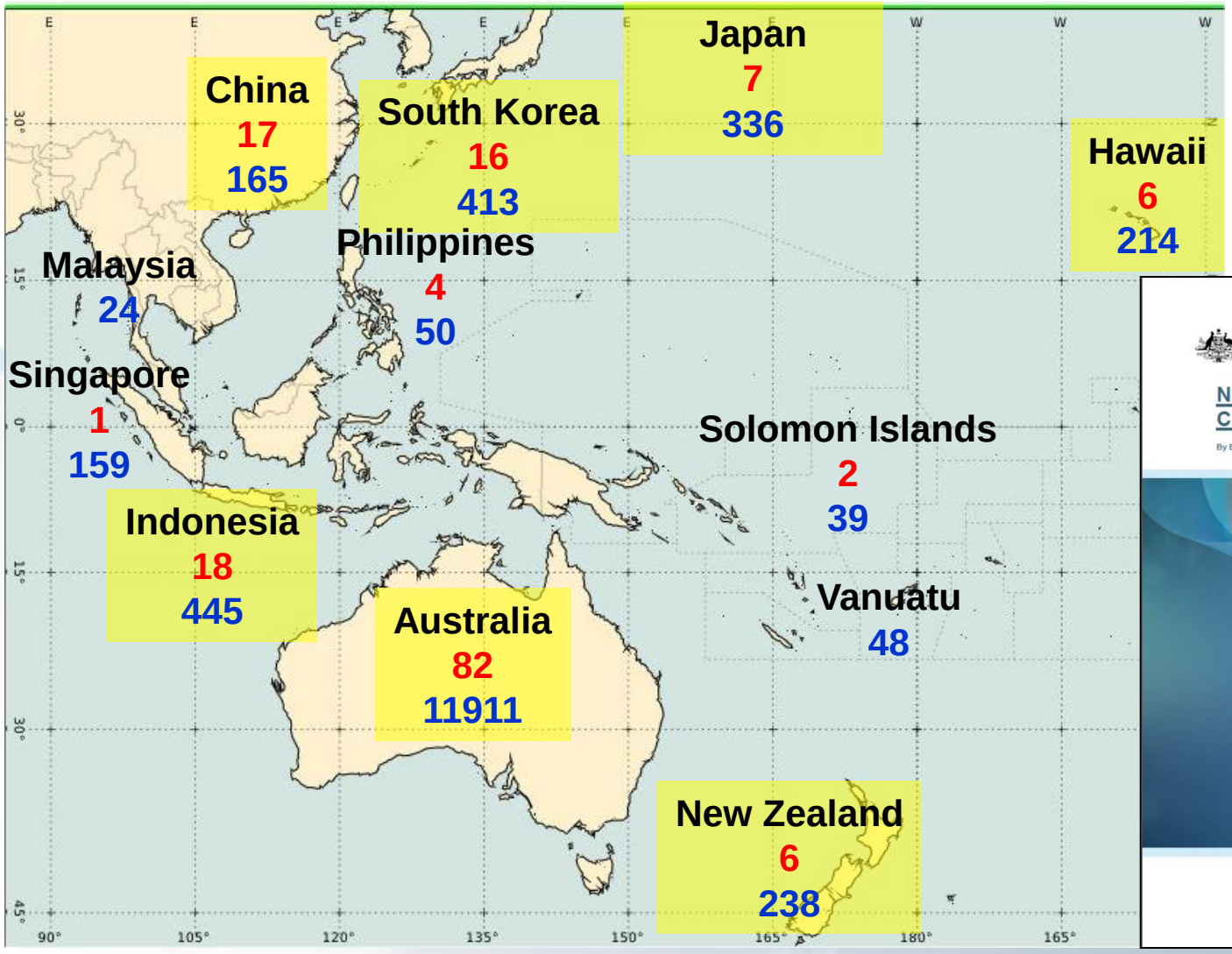


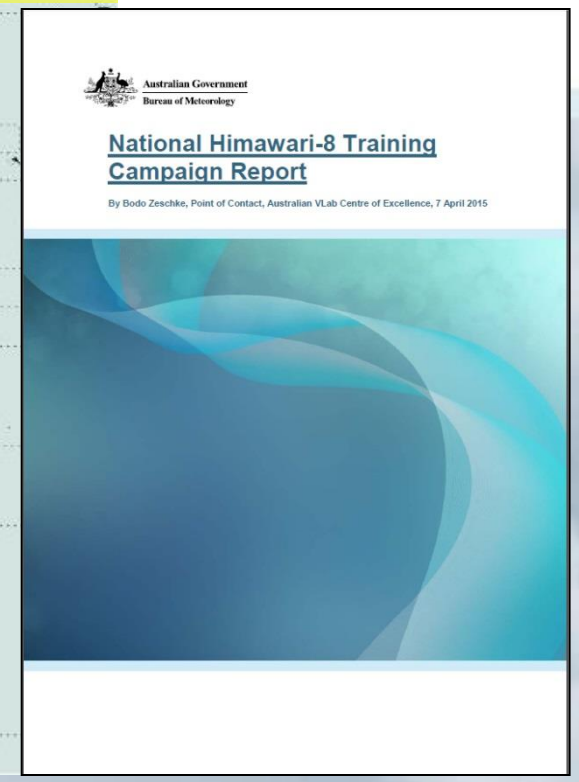
3: Communication with Champions/stakeholders

4: Presentations by stakeholders

National Himawari-8 Training Campaign summary

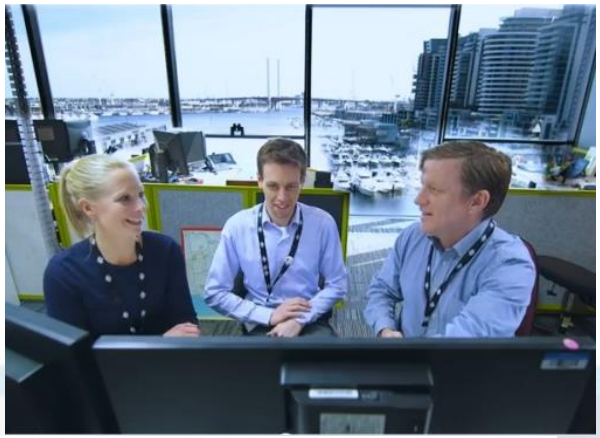
(January to 27th October 2015 – Google Analytics)



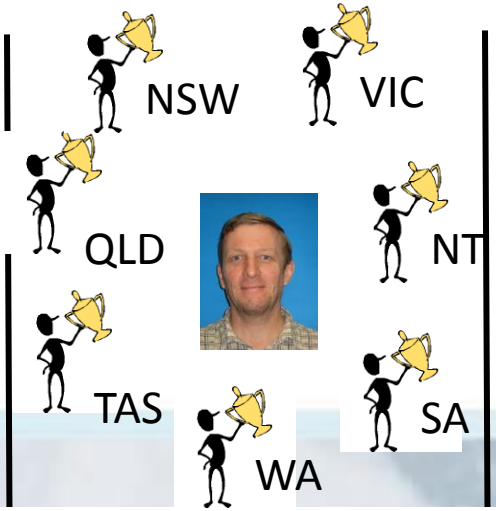


- Attendees to the 15 Tutorial Sessions
- Hits on the National Himawari-8 Training Campaign web page

Ongoing liaison and collaboration with stakeholders once the data is operationally available.



2: Talking to Forecasters



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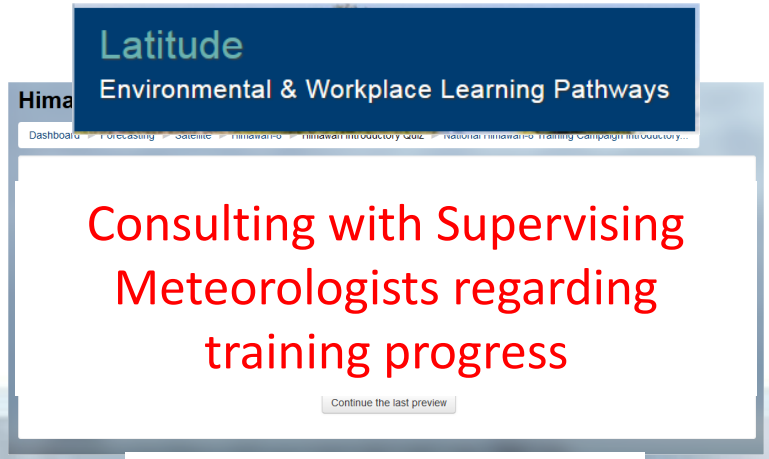
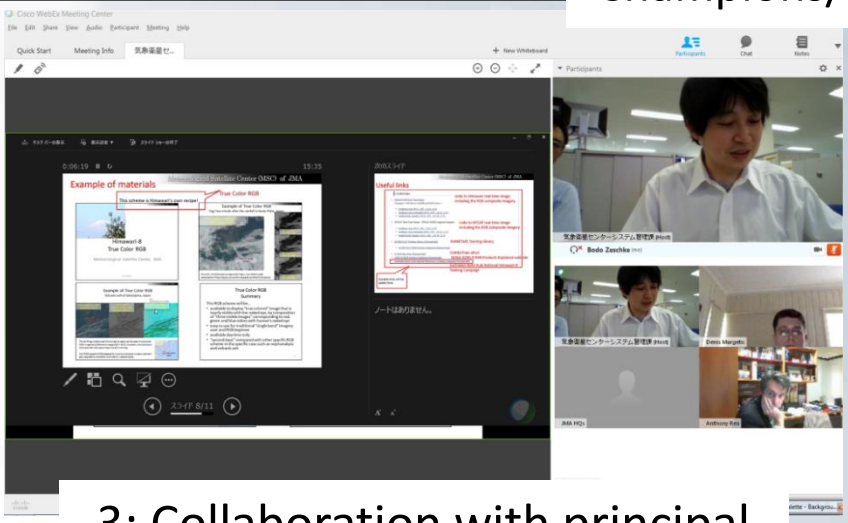
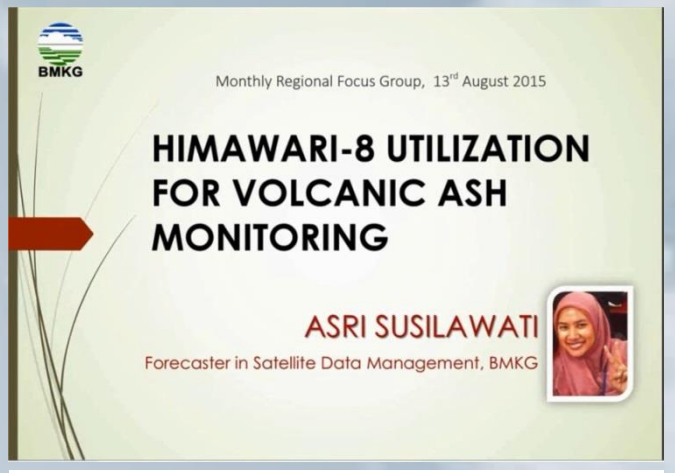


6: Internal Bureau Quiz



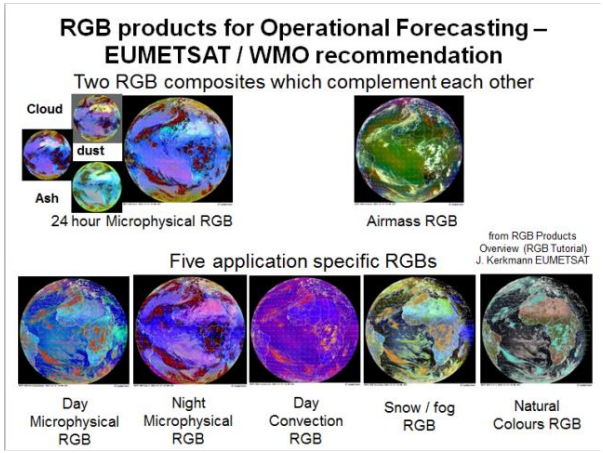
3: Collaboration with principal Satellite Operator (JMA)

4: Ongoing Tutorial Sessions

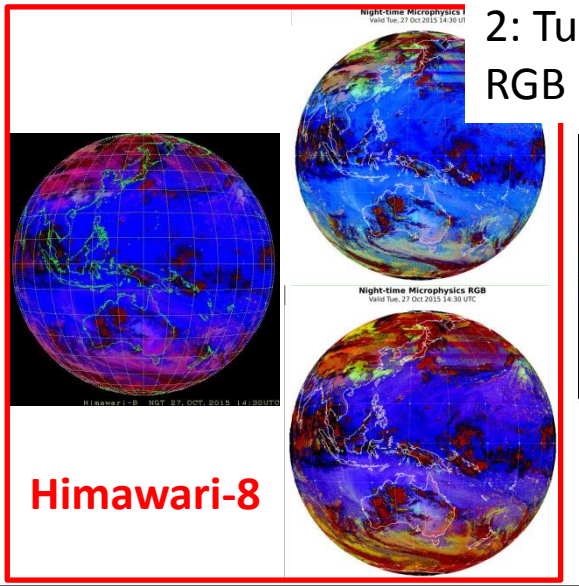


5: Himawari-8 presentations by stakeholders

Tuning the RGB products to Himawari-8 and to local RAV and RAII conditions

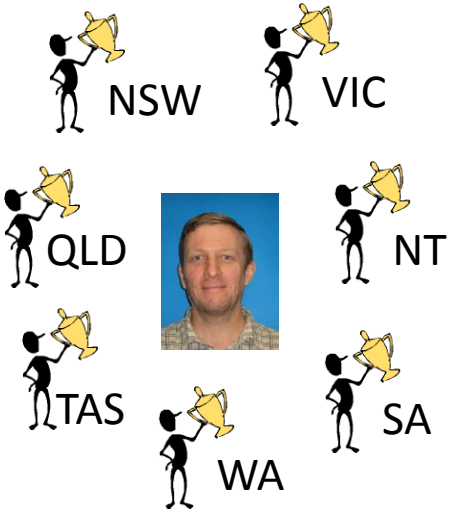


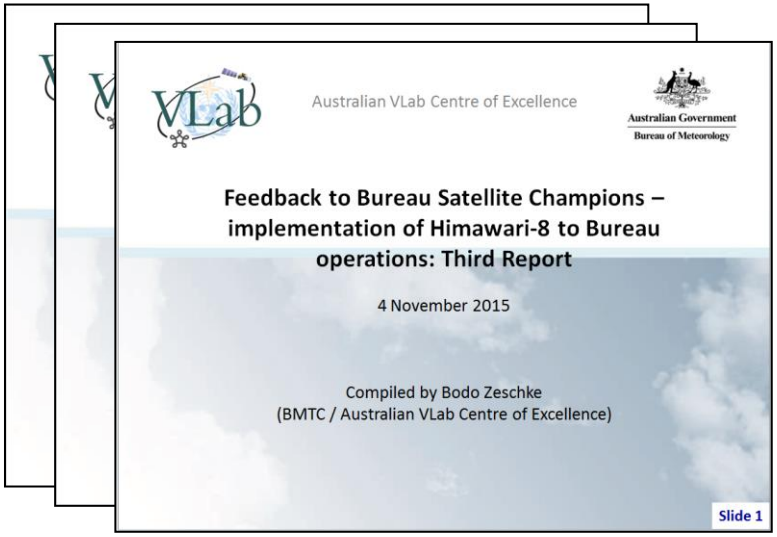
1: WMO/EUMETSAT endorsed products



2: Tuning Himawari-8 RGB products

3: Assistance from EUMETSAT and JMA experts and Satellite Champions



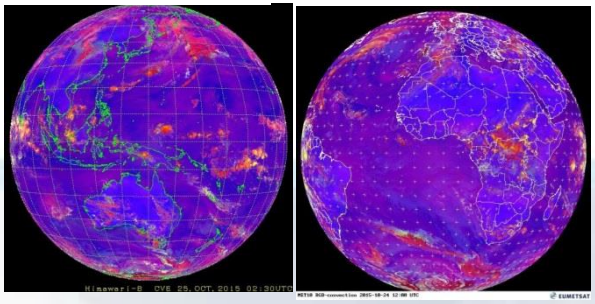


4: Providing Feedback to Stakeholders

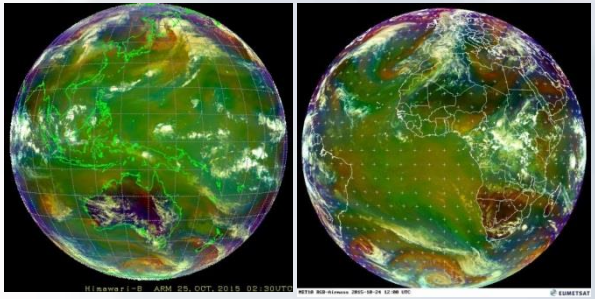
Comparing Himawari-8 vs METEOSAT-10 RGB products

Quiz – annotate which products require the greatest adjustment

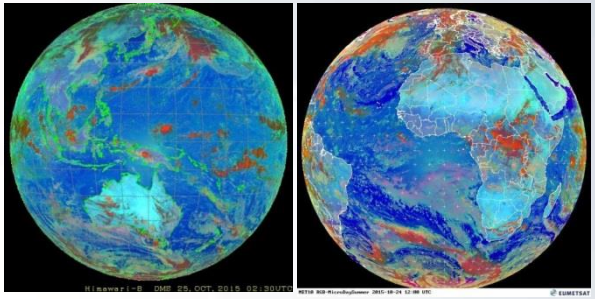
Himawari-8 METEOSAT-10



Day Convection RGB

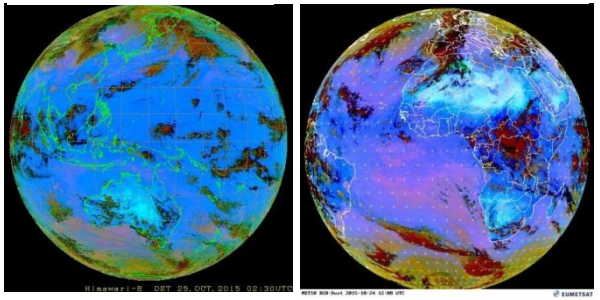


Airmass RGB

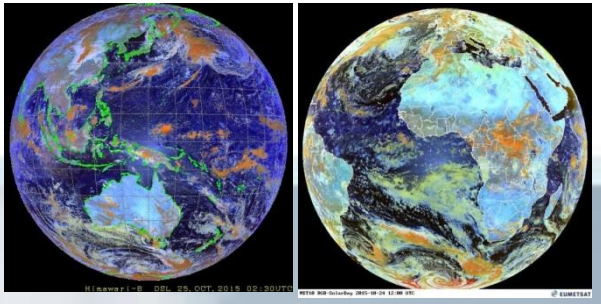


Day Microphysics RGB

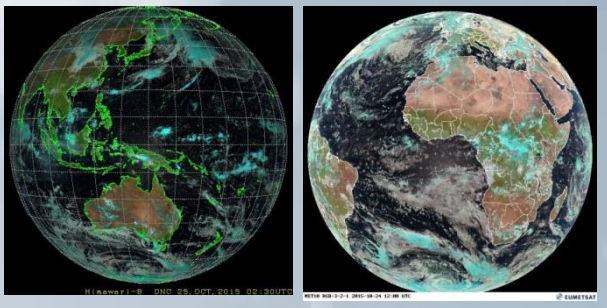
Himawari-8 METEOSAT-10



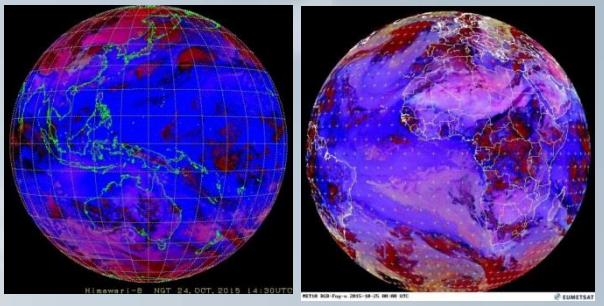
Dust RGB



Snow/Fog RGB



Natural Colour RGB



Night Microphysics RGB

images courtesy JMA images courtesy EUMETSAT

Tentative adjusted recipe by (linear) regression coefficients

AIR MASS

RGB	band(MSG)	min(MSG)	max(MSG)	gamma	band(H8)	min(H8)	max(H8)	gamma
R	6.2-7.3	-25	0	1.0	6.2-7.3	-26.2	0.6	1.0
G	9.7-10.8	-40	5	1.0	11.2-9.6	-43.2	6.7	1.0
B	6.2(inv)	243	208	1.0	6.2(inv)	243.9	208.5	1.0

DUST

RGB	band(MSG)	min(MSG)	max(MSG)	gamma	band(H8)	min(H8)	max(H8)	gamma
R	12.0-10.8	-4	2	1.0	12.4-10.4	-6.7	2.6	1.0
G	10.8-8.7	0	15	2.5	11.2-8.6	-0.5	20.0	2.5
B	10.8	261	289	1.0	10.4	261.2	288.7	1.0

Night Microphysics #1

RGB	band(MSG)	min(MSG)	max(MSG)	gamma	band(H8)	min(H8)	max(H8)	gamma
R	12.0-10.8	-4	2	1.0	12.4-10.4	-6.7	2.6	1.0
G	10.8-3.9	0	10	1.0	11.2-3.9	-3.5	6.9	1.0
B	10.8	243	293	1.0	10.4	243.6	292.6	1.0

Night Microphysics #2

RGB	band(MSG)	min(MSG)	max(MSG)	gamma	band(H8)	min(H8)	max(H8)	gamma
R	12.0-10.8	-4	2	1.0	12.4-10.4	-6.7	2.6	1.0
G	10.8-3.9	0	10	1.0	10.4-3.9	-3.1	5.2	1.0
B	10.8	243	293	1.0	10.4	243.6	292.6	1.0

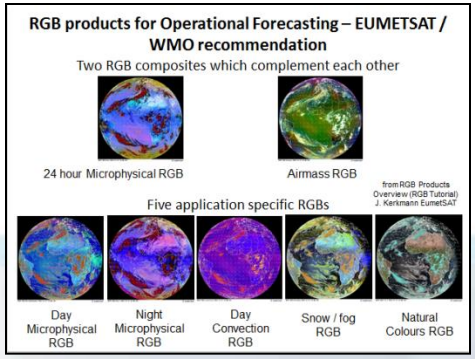
NaturalColors

RGB	band(MSG)	min(MSG)	max(MSG)	gamma	band(H8)	min(H8)	max(H8)	gamma
R	1.6	0	100	1.0	1.6	0.0	97.5	1.0
G	0.8	0	100	1.0	0.86	0.0	108.6	1.0
B	0.6	0	100	1.0	0.64	0.0	100.0	1.0

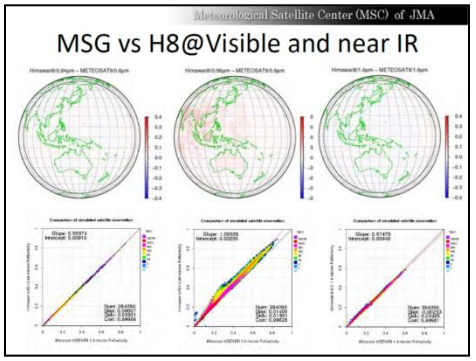
from: "Introduction of JMA Vlab Support Site on RGB Composite Imagery and tentative RGBs". AOMSUC-6 presentation by Akihiro Shimizu (JMA)

Summary: the process of "tuning" RGB products

1: The WMO/EUMETSAT endorsed 7 RGB products and their recipes

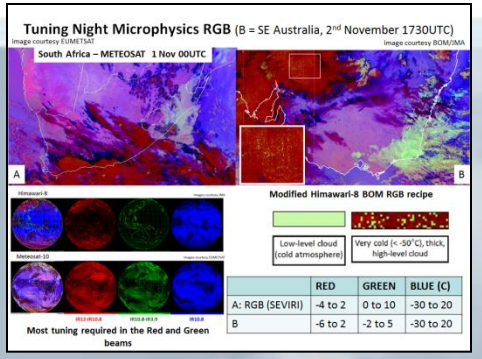


2: Tuning the original RGB products for Himawari-8 data using the JMA correlation / regression analysis (MSG vs H8) as guide.



3: Development of RGB products by Forecasters and stakeholders to suit local conditions:

- **Using the new channels of Himawari-8**
- **Creation of new RGB products**

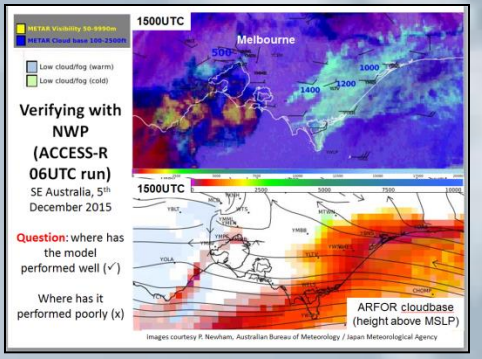


Liaison with:

- **Principal Sponsoring Satellite Operator**
- **VLab Contacts**
- **EUMETSAT experts**
- **Researchers (CAWCR etc.)**
- **Other stakeholders**

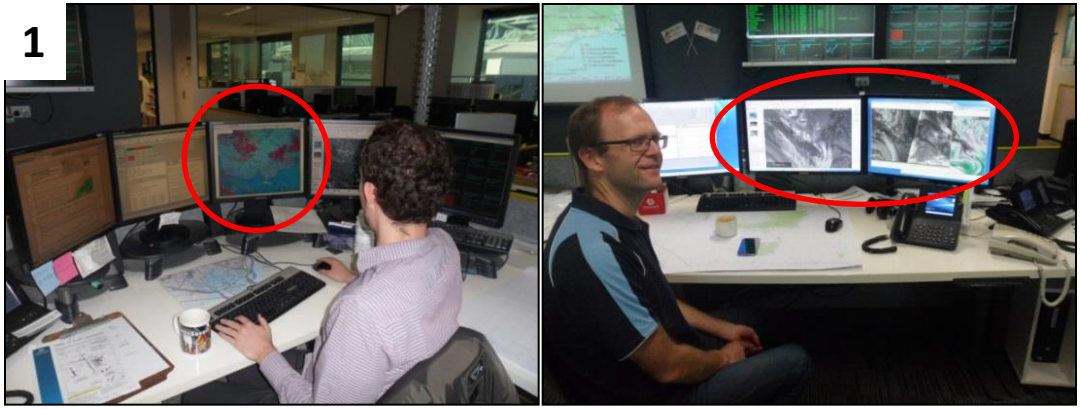
4: Creation of RGB case studies

- **Summer / winter, tropical / mid latitude.**
- **Using other observations, NWP to verify the tuned RGB product**



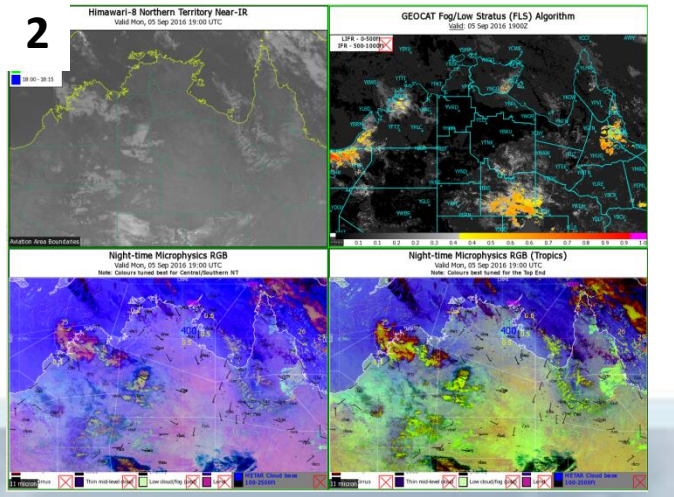
Effective use of the RGB products by stakeholders

1



Operational Forecasters using the products "on the job"

2



Forecaster evaluation of new products in case studies (via email)

3

Forecaster feedback regarding the use of Himawari-8 products for thunderstorm monitoring (part 1)

Tropical Forecasters have found that the Day Convection RGB shows the yellow stormtop enhancement for many storms. There is a perception that this product has too many "false alarms" and requires tuning. This can be seen in the Java convection example of 19th April 2016, as shown previously.

Forecasters do not like the Day Convection RGB product as it takes a long time to load, due to the large size of the data contained in the reflective (solar) channels.

The Sandwich product and the storm-top enhancement on single channel imagery is popular with Forecasters. This data also loads quickly into the visualisation software. Forecasters have found it useful to scale the colour palette within the Sandwich product to temperatures ranging from -10 to -20C to colder temperatures. Colour enhancements corresponding to -10C usually indicates areas of increased potential for storms. Colour enhancements corresponding to -20C usually corresponds to formed thunderstorms.

Forecaster feedback regarding improved use of data (via surveys)

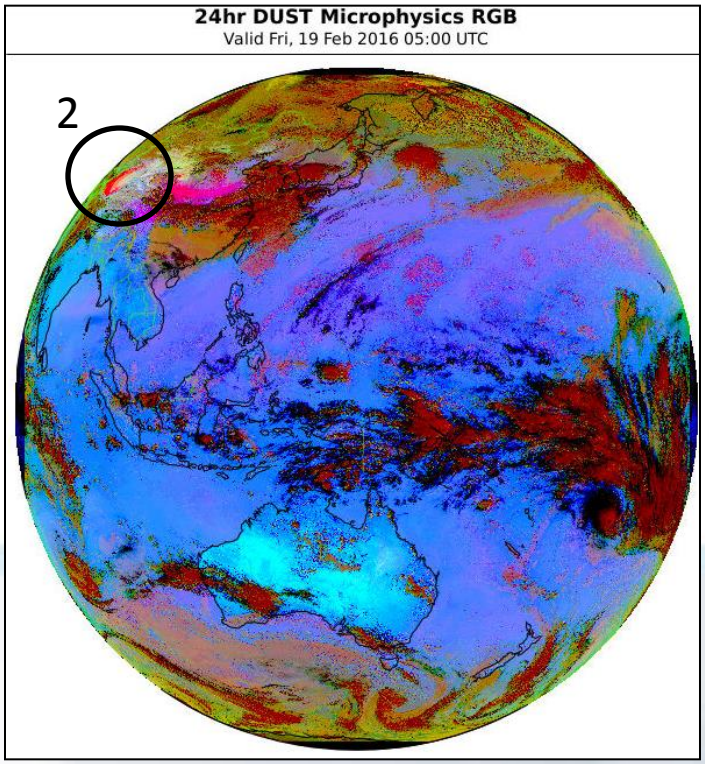
4

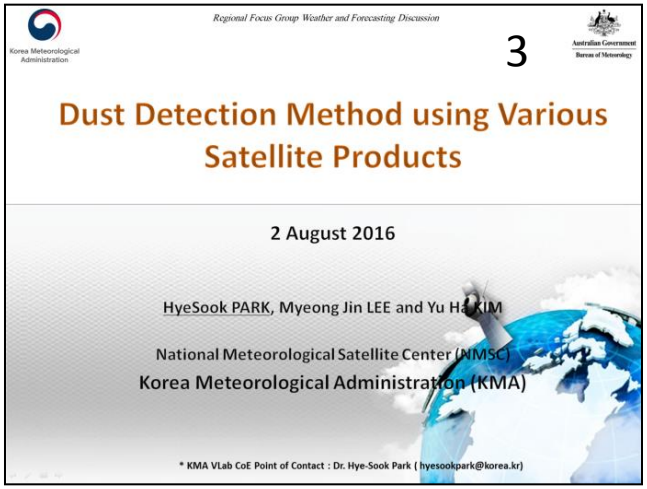
Dissemination of stakeholder feedback

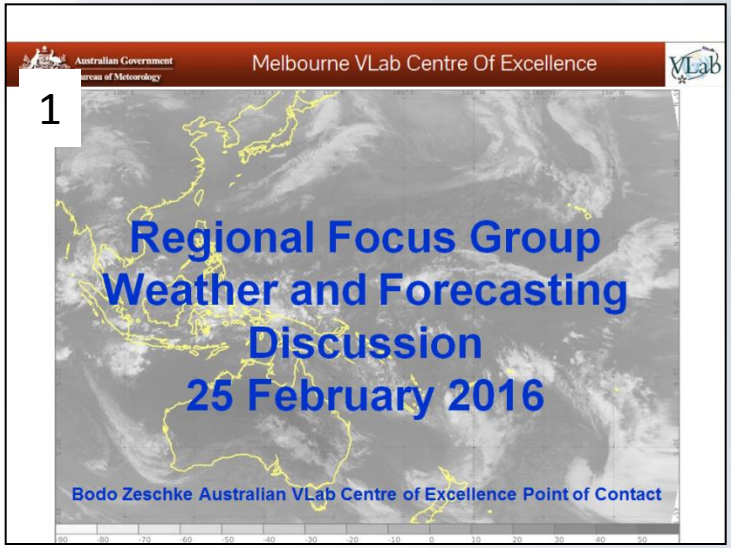
image courtesy JMA

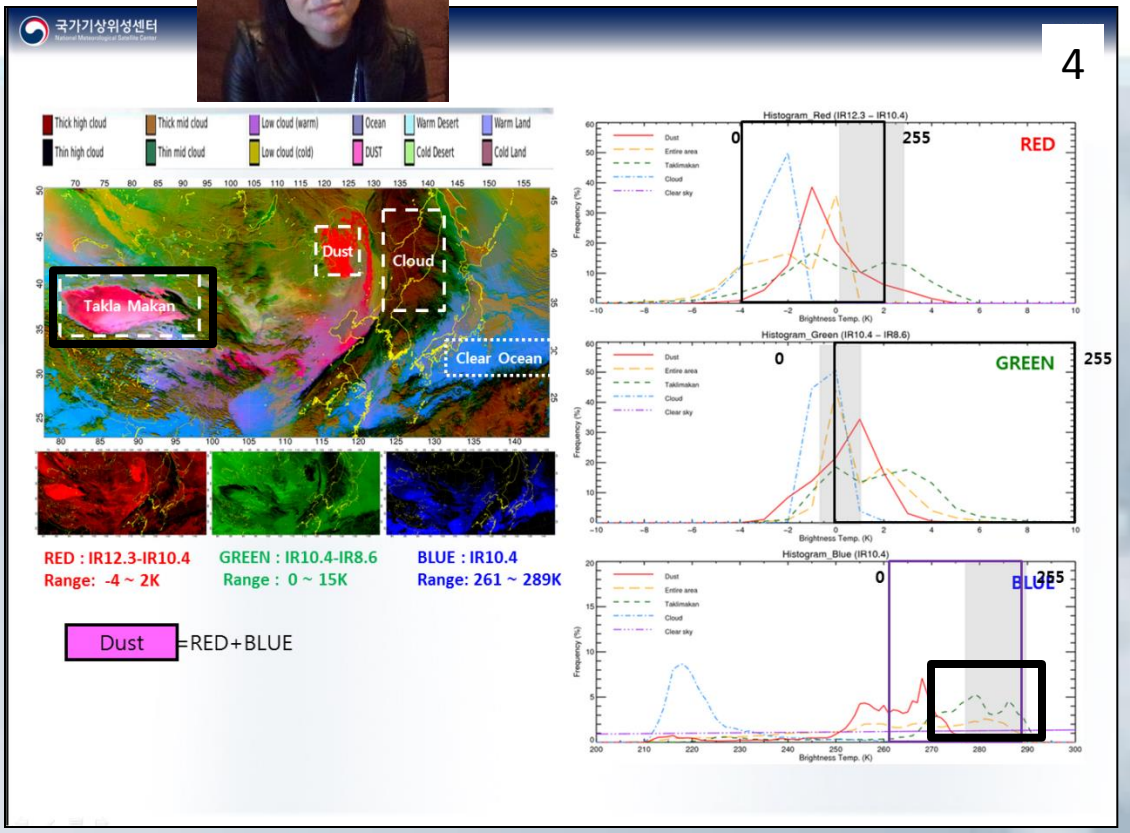
presentation courtesy Korea Meteorological Administration

Detailed interrogation of the data by stakeholders









Reference resource pages developed by stakeholders

1

collaborate with TWiki

Search

Edit | Attach | Printable

You are here: TWiki > Main Web > TWikiUsers > NaomiBenger > RGBU... > ...ightMicro

r9 - 10 Aug 2016 - 05:03:28 - NaomiBenger

Night Microphysical RGB

- Channel Scale Breakdown
- Feature Colour Guide
- More Channel Details
- Even more for the enthusiastic!
- References

- Uses
  - **Distinguish low cloud/fog at night.**
  - Detection/monitoring of fires at night.
  - Classifying clouds, snow, low-level moisture boundaries.
  - Distinguish high and thick cloud, Cb at night.

When using the night microphysical RGB images it is important to be aware of how temperature effects the images. The blue channel is sensitive to temperature, this means that fog and stratus events may look different depending on the surface temperature. **It is important to be flexible with your interpretation of the images and always use them in conjunction with other observations.** This is particularly true in winter when, for example, comparing images of an event on a night with average minimum temperature with images of an event on a night which is particularly cold. To take into account the temperature difference between summer and winter there are two variations of the night microphysical RGB images available. The following examples and case studies can be used as a guide of the range of colours to look for, and illustrate how temperature effects the RGB images.

- Examples and Case Studies
  - Example (Summer)
  - Winter Case Studies
    - 16-17 July 2016 (Temperature Effect Notes/Introduction) Start here!
    - Case Study: 21 July 2016 Fog and stratus over Vic/NSW/Qld: RGB/Temp analysis/Sondes
    - Case Study: 22 July 2016 Fog and stratus over Vic/NSW/Qld: RGB/Temp analysis/Sondes/Cielo-vis/NWP
    - Case Study: 02 Aug 2016 Stratus over area 51: RGB/Temp analysis/Td analysis/SPECIs/NWP
    - Case Study: 03 Aug 2016 Fog and stratus in Areas 51, 52, 53: RGB/Temp analysis/Td analysis/AIREPs/NWP
    - Case Study: 10 Aug 2016 Fog and stratus in Areas 60, 61, 63: RGB/Temp analysis/Td analysis/RGB loop/Sondes/Cielo-vis/NWP

- Channels

R	IR15 (12.3) - IR13 (10.35)	-4 to 2 K
G	IR13 (10.35) - IR07 (3.9)	0 to 10 K
B	IR13 (10.35)	243 to 293 K

2

Night Microphysics

Description

Beam	Channels	Range (mid-lat)	Range (Tropics)
Red	IR 12.4 - IR 10.4	-6.7 to +2.6K	-6.7 to 2.6K
Green	IR 10.4 - NIR 3.9	-3.1 to 5.2K	-3.1 to 2.6K
Blue	IR 10.4	-29.4 to 19.6	0.6 to 26.4

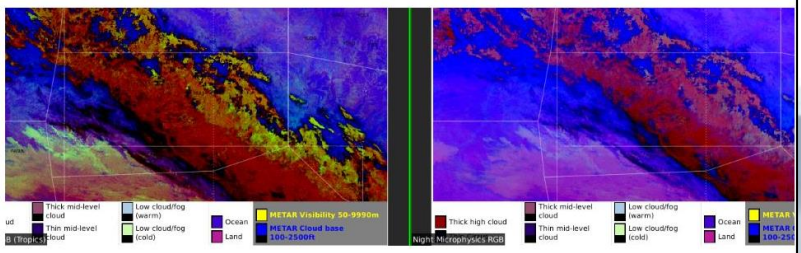
In the RED beam: The channel differencing gives an indication of optical depth. There is a strong signal in this beam for thick clouds. For thin meteorological cloud there is greater absorption by the "dirty window" 12micron channel. In addition the 12 micron radiation is absorbed more strongly in ice phase cloud compared to water phase clouds.

In the GREEN beam: This channel differencing is used in The Night-time Fog/Low Cloud Enhancement. The 3.9 micron radiation has lower emissivity compared to the 10.8 micron radiation for small water droplet clouds. Therefore there is a large contribution to the green beam in this RGB product for water clouds with small droplets. There is also a significant contribution from desert surfaces.

In the BLUE beam: The 10.8 µm infrared brightness temperature is a function of surface and cloud top temperatures. The scaling for this beam results in a strong blue beam component for warm surfaces.

More info: http://www.virtuallab.bom.gov.au/index.php/download_file/view/700/261/

Examples



Night Microphysics imagery (Tropics on left, Mid-lat on right) showing low cloud over the southwest of Area 85. 1700UTC 28 March 2016

3

Aviation Forecasters Satellite Quick Reference (3/4)

DRAFT

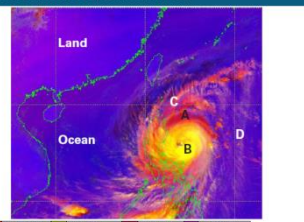
Day Convection RGB - Himawari 8

Product Use: Detection of deep convection, especially distinguishing between severe and non-severe storms. To be used as a guide only.

Channel combination - aka: The Recipe.

Beam	Channel (µm)	Equates to Band (you can select this in VW)	Range	Gamma
Red	WV 6.2 - WV 7.3	WV 8 - WV 10	-36.9 to 5.9 (K)	1.0
Green	IR 3.9 - IR 10.4	IR 7 - IR 13	-1.7 to 66.1 (K)	1.0
Blue	NIR 1.6 - VIS 0.6	NIR 5 - VIS 3	-71 to +24 (%)	1.0

The breakdown of the Day Convection RGB:



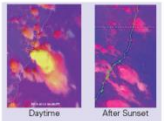
A	B	C	D	
Thick high cloud. Large ice particles.	Cb cloud with strong updrafts. Small ice particles.	Thin cirrus cloud. Large ice particles.	Thin cirrus cloud. Small ice particles.	Ocean / Land

Information courtesy JMA, Bodo Zeschke (b.zeschke@bom.gov.au).
Contact James Lannan for corrections (j.lannan@bom.gov.au)
Aviation Weather Services

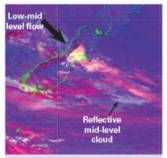
Aviation Forecasters Satellite Quick Reference (2/2)

DRAFT

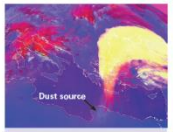
Day Convection RGB - Examples



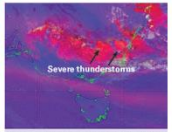
At night, the green component drops out due to absence of the reflective component in the 3.9 micron channel and so stormtops show up as pink/red and with no yellow colour.



Lee cloud evident on the SE side of the NZ Southern Alps. Large number of small ice crystals generated due to rapid ascent.



Dust changes the cloud microphysics due to the addition of a great number of CCN (the dust particles). For example in this case, dust has been ingested into the baroclinic system on the southern edge (NH-Hemisphere). The large number of small ice crystals present result in a yellow colour though this is not related to storm severity. (eg: small ice crystals associated with overshooting tops..



Severe winter storms in the mid-latitudes over SE Australia.The Day Convection RGB product is of limited use due to warmer storm top temperatures, leading to a reduced temperature difference in the green (IR component). The red beam then dominates and the yellow component (strong red and green contribution) is missing.

Aviation Forecasters Satellite Quick Reference (1/2)

GEOCAT FLS Algorithm Background

The following information is to be used as a guide only. GEOCAT is still under development and has known limitations, it should not be used in isolation.

GEOCAT uses both satellite and model data to form each image:

Himawari-8 data:
- Daytime: 0.65, 3.9 and 11 micron.
- Nighttime: 3.9 and 11 micron.

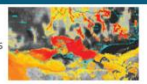
Static data:
- Digital Elevation Model
- Surface type and emmisivity.
- SST data

Model data:
- Uses NWP profile to determine the highest relative humidity in the 1000/3000ft layer.
- Textural & spectral information
- Difference between cloud radiative temperature and surface temperature
- Cloud object based filtering technique

This results in three Visual Weather fields:

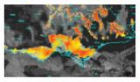
Marginal Visual Flight Rules (MVFR)

Ceiling (BKN or OVC) of 1000-3000 feet and/or a 3-5 mile (5-8km) visibility.



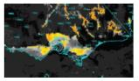
Instrument Flight Rules (IFR)

Ceiling of 500-1000 feet and/or a 1-3 mile (1.6-5km) visibility.



Low Instrument Flight Rules (LIFR)

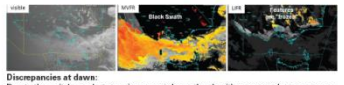
Ceiling of less than 500 feet and/or a visibility of less than 1 mile (<1.6 km)



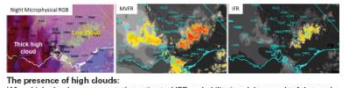
Content courtesy Bodo Zeschke and Chris Lucas.
Please contact James Lannan for corrections jlannan@bom.gov.au.
AviationWeather Services

Aviation Forecasters Satellite Quick Reference (2/2)

GEOCAT FLS Algorithm Limitations

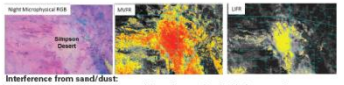


Discrepancies at dawn:
Due to the switch over between imagery at dawn, the algorithm may produce erroneous results. You will notice this if you view it spatially, such as the imagery above.



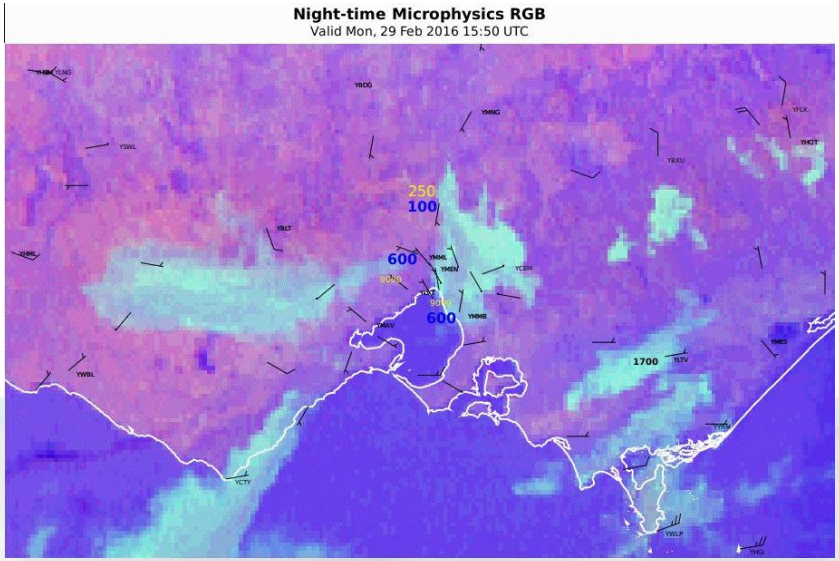
The presence of high clouds:
When high clouds are present, the estimated IFR probability is solely a result of the model predictors. The end result tends to be more smooth and the probabilities will be lower relative to surrounding areas where both satellite and model predictors were used.
See example above over Victoria, 11 August 2016 13UTC.

Land/Sea boundary discontinuities:
There are probability discontinuities at the land/sea boundary for some cases.
See example above over southern Victoria, 15th July 2016 20UTC.

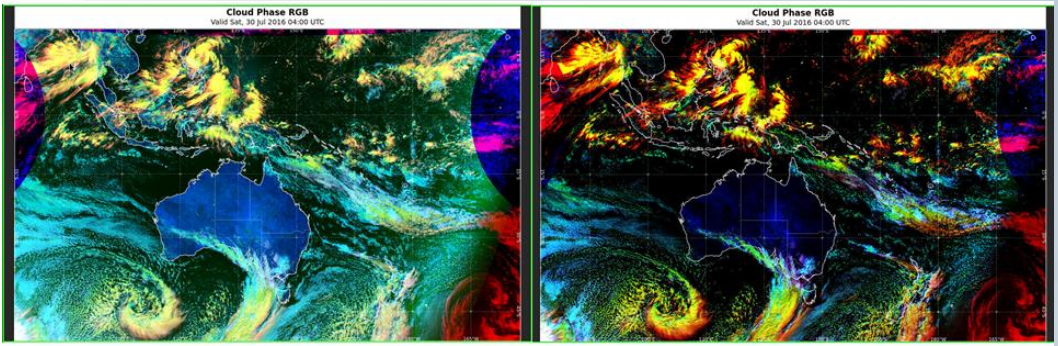


Interference from sand/dust:
There is also a false signal over central Australia associated with desert sand.
See example above over Central Australia, 16th August 2016 20UTC.

Stakeholders developing Himawari-8 RGB products (1)



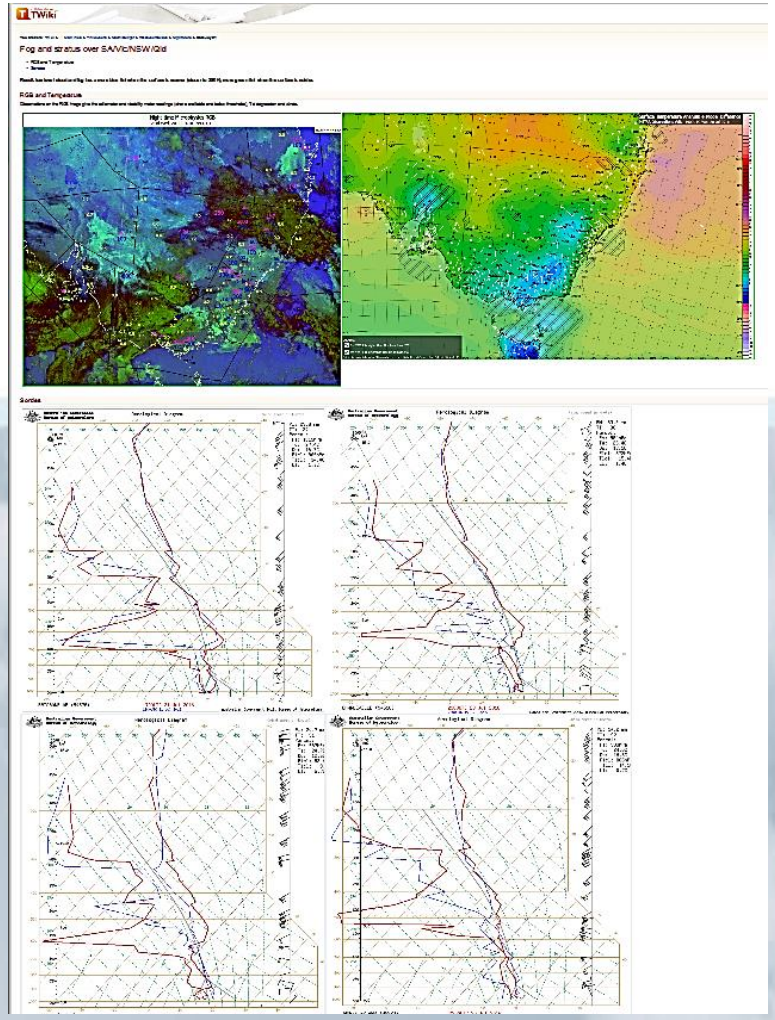
Developing effective methods of viewing the RGB data



Original JMA recipe of the Cloud Phase RGB, 04UTC, 30th July 2016

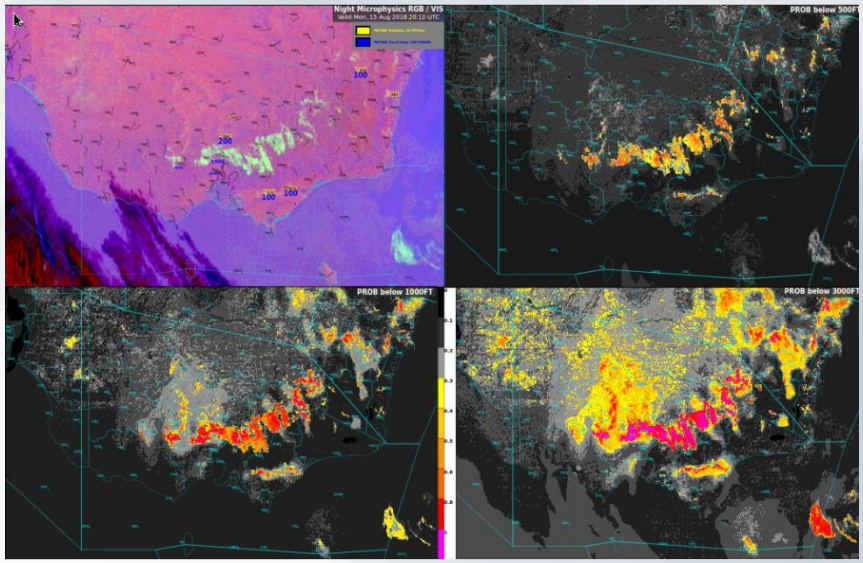
Naomi version (with GAMMA corrections applied)

Images and animations courtesy JMA/BOM

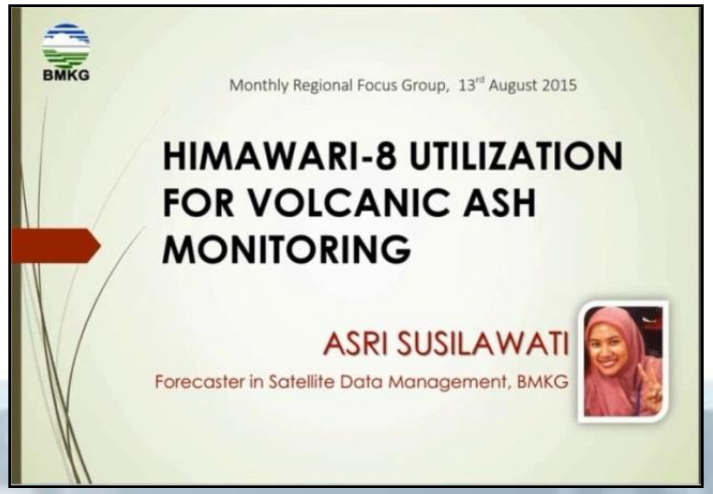


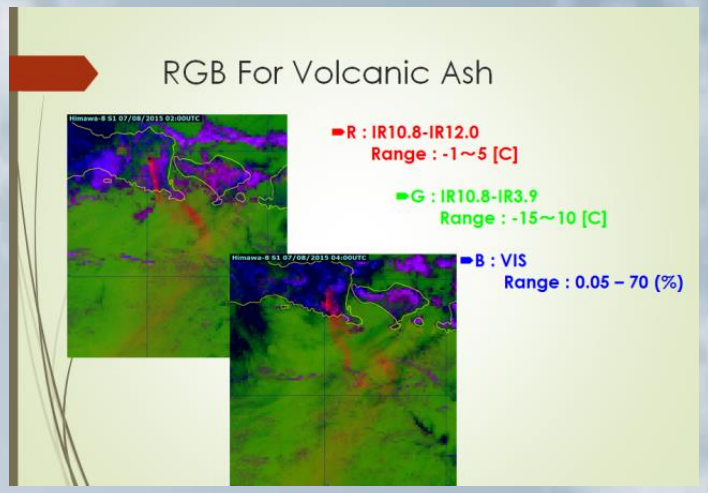
Tuning RGB products in combination with other data

Stakeholders developing Himawari-8 RGB products (2)



Developing Derived Products in conjunction with RGB products





New RGB products developed by BMKG Indonesia

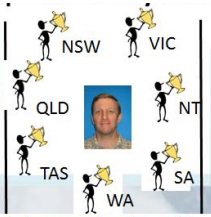
images and animations courtesy JMA/BOM

presentation courtesy BMKG Indonesia

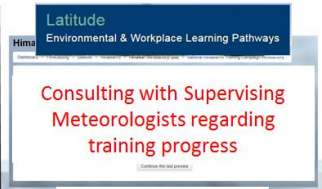
Summary: RGB product use and development amongst Australian / RAV / RAII stakeholders

1: Engaging stakeholders

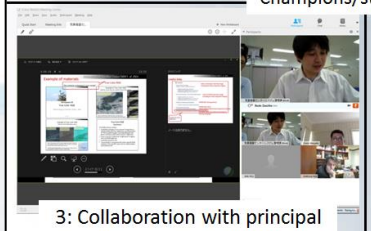
2: Talking to Forecasters



1: Communication with Champions/stakeholders



6: Internal Bureau Quiz

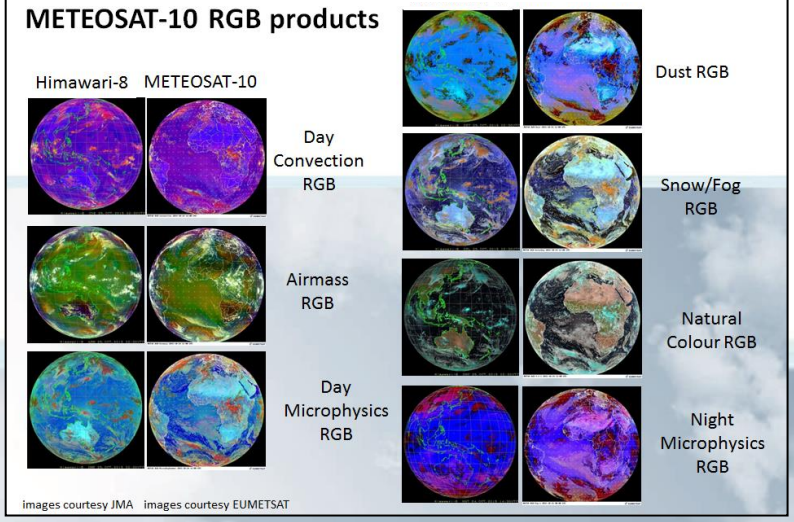


3: Collaboration with principal Satellite Operator (JMA)

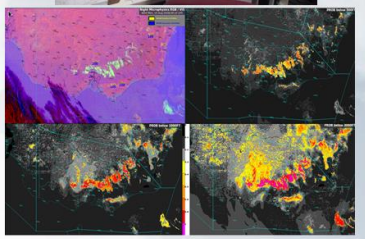
4: Ongoing Tutorial Sessions

5: Himawari-8 presentations by stakeholders

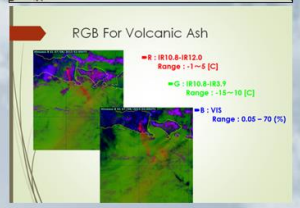
2: Tuning RGB products



4: Stakeholders developing the data



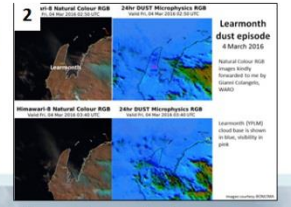
Developing Derived Products in conjunction with RGB products



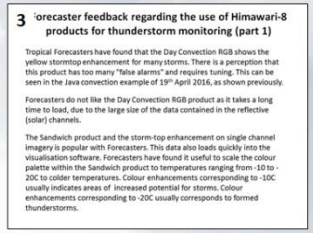
New RGB products developed by BMKG Indonesia

3: Stakeholders effectively using data

Direct communication with Operational Forecasters



Forecaster evaluation of new products in case studies (via email)



Forecaster feedback regarding improved use of data (via surveys)

Dissemination of stakeholder feedback