



JMA Status Report

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Three topics

- Current status and recent progress of JMA's NWP
- Updates on Himawari-8/9
(prepared by satellite program division)
- Status report of RTH Tokyo
(prepared by RTH focal point for Tokyo)





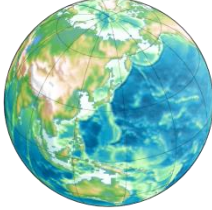



Current status and recent progress of JMA's NWP

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Current NWP models in JMA

	In Operation					On trial
	Global Spectral Model GSM	Meso-Scale Model MSM	Local Forecast Model LFM	Global Ensemble GEPS	Seasonal Ensemble CPS2	Meso-scale Ensemble MEPS
objectives	Short- and Medium-range forecast	Disaster reduction Aviation forecast	Aviation forecast Disaster reduction	One-week forecast Typhoon forecast Early warning on extreme weather One-month forecast	Seasonal forecast (three month forecast, cold/warm season outlook) El Nino outlook	
Forecast domain	Global 	Japan and its surroundings (4080km x 3300km) 	Japan and its surroundings (3160km x 2600km) 	Global 	Coupled Global Atmosphere and Ocean 	Japan and its surroundings (4080km x 3300km) 
Horizontal resolution	TL959 (0.1875 deg)	5km	2km	TL479 / TL319 (0.375 / 0.5625 deg)	Atmos.: 1.125 deg Ocean:0.3-0.5x1 deg	5km
Vertical levels / Top	100 0.01 hPa	76 21.8km	58 20.2km	100 0.01 hPa	Atmos.: 60 (~0.1 hPa) Ocean: 52 with BBL* *Bottom Boundary Layer	76 21.8km
Forecast Hours (Initial time)	132 hours (00, 06, 18 UTC) 264 hours (12 UTC)	39 hours (00, 03, 06, 09, 12, 15, 18, 21 UTC)	9 hours (00-23 UTC hourly)	264 h (00, 12 UTC) 132 h (06, 18 UTC)* 27 members Extend to 432 h (4times/week) 816 h (4times/week) 13 members	210 days (00UTC) 51 members / month	39hours (00,06,12,18 UTC) 21 members
Initial Condition	Global Analysis (4D-Var)	Meso-scale Analysis (4D-Var)	Local Analysis (3D-Var)	Global Analysis with ensemble perturbations (SV, LETKF)	JRA-55 with ensemble perturbations (BGM)	Meso-scale Analysis with ensemble perturbations (SV)

* when a TC of TS intensity or higher is present or expected in the RSMC Tokyo - Typhoon Center's area of responsibility (0°–60°N, 100°E–180°).

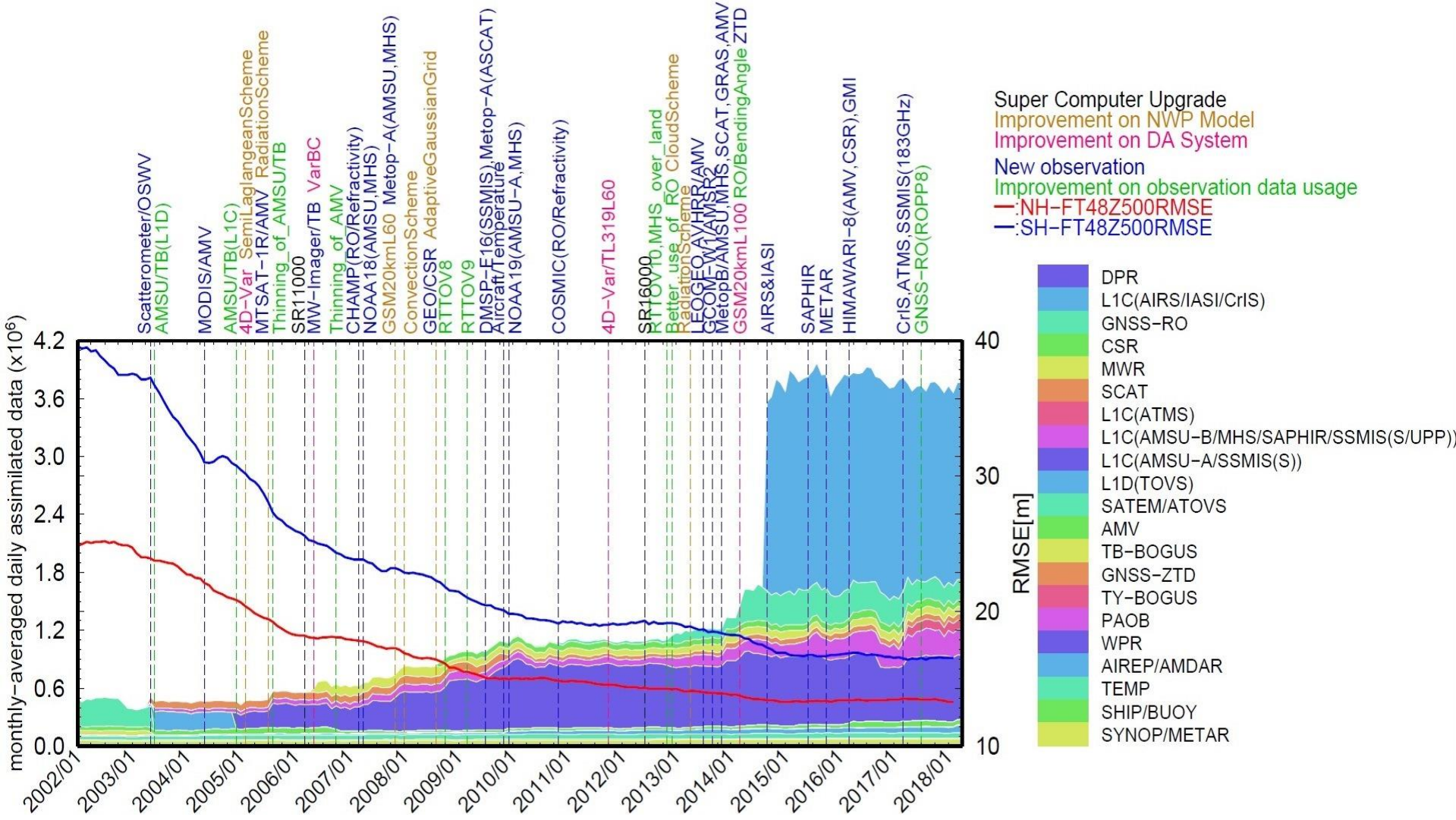
Operationally Assimilated Satellite Data

Type	Satellite/Instrument	Global Analysis	Meso Analysis	Local Analysis
1. MW Sounder	NOAA15,18,19,Metop-A,-B,Aqua/AMSU-A	Radiance	Radiance	Radiance
	NOAA18,19,Metop-A,-B/MHS	Radiance	Radiance	Radiance
	DMSP-F17,18/SSMIS	Radiance	-	-
	Suomi-NPP/ATMS	Radiance	-	-
	Megha-Tropiques/SAPHIR	Radiance	-	-
2. IR Sounder	Aqua/AIRS	Radiance	-	-
	Metop-A,B/IASI	Radiance	-	-
	Suomi-NPP/CrIS	Radiance	-	-
3. MW Imager	DMSP-F17,18/SSMIS	Radiance	Radiance, Rain Rate	Radiance
	GCOM-W/AMSR2	Radiance	Radiance, Rain Rate	Radiance
	GPM-core/GMI	Radiance	Radiance, Rain Rate	Radiance
4. VIS/IR Imager	Himawari-8	CSR, AMV	CSR, AMV	CSR, AMV
	GOES-15	CSR, AMV	-	-
	Meteosat-8,11	CSR, AMV	-	-
	NOAA15,18,19,Metop-A,-B/AVHRR	AMV	-	-
	Aqua,Terra/MODIS	AMV	-	-
	LEO GEO composite image	AMV	-	-
5. Scatterometer	Metop-A,-B/ASCAT	OSWV	OSWV	-
6. Radio Occultation	GRACE-A,-B/Blackjack	Bending Angle	Refractivity	-
	Metop-A,-B/GRAS	Bending Angle	Refractivity	-
	TerraSAR-X/IGOR	Bending Angle	Refractivity	-
	TanDEM-X/IGOR	-	Refractivity	-
	COSMIC/IGOR	Bending Angle	Refractivity	-
7. Radar	GPM/DPR	-	Relative Humidity	-
8. Soil Moisture	GCOM-W/AMSR2	-	-	Soil Moisture
	Metop-A,-B/ASCAT	-	-	Soil Moisture

CSR: Clear Sky Radiance on water vapor channels, AMV: Atmospheric Motion Vector, OSWV: Ocean Surface Wind Vectors

Assimilated Data Amount History

- Global Analysis -



Recent Progress for 2017-2018

GA: Global Analysis MA: Meso-scale Analysis LA: Local Analysis

(1) Jun. 2018: Upgrades of JMA supercomputer, Cray XC50

Updates of Observation data usage since 1st GODEX-NWP meeting

(1) May 2017: Enhancement of QC for GNSS-RO data in GA

(2) Mar. 2018: Switch-over from Meteosat-10 to Meteosat-11
AMV and CSR

(3) Jun. 2018: Use of DBNet Suomi-NPP/ATMS in GA

(4) Oct. 2018: Enhancement of surface sensitive CSR data use in GA

JMA 10th generation supercomputer system

JMA began the operation of its new supercomputer system on 5 June 2018.

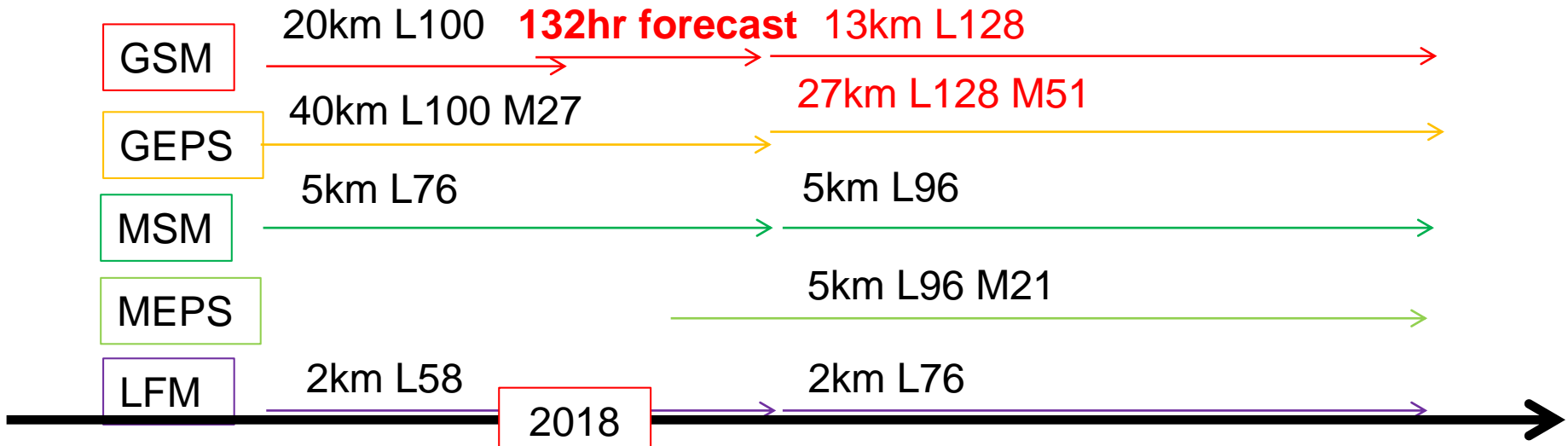
Effective computer capacity (in terms of meteorological calculation) was enhanced about 10 times.

25th and 26th rank at the Top 500 in June 2018



Comparison of Specifications

	Previous	New
Model	HITACHI SR16000/M1 (Vendor: Hitachi)	Cray XC50 (Vendor: Hitachi)
Theoretical Peak Performance	847 TFlops (*)	18,166 TFlops
Capacity of Main Memory	108 TBytes	528 TBytes
Capacity of Magnetic Disk	348 TBytes	10,608 TBytes

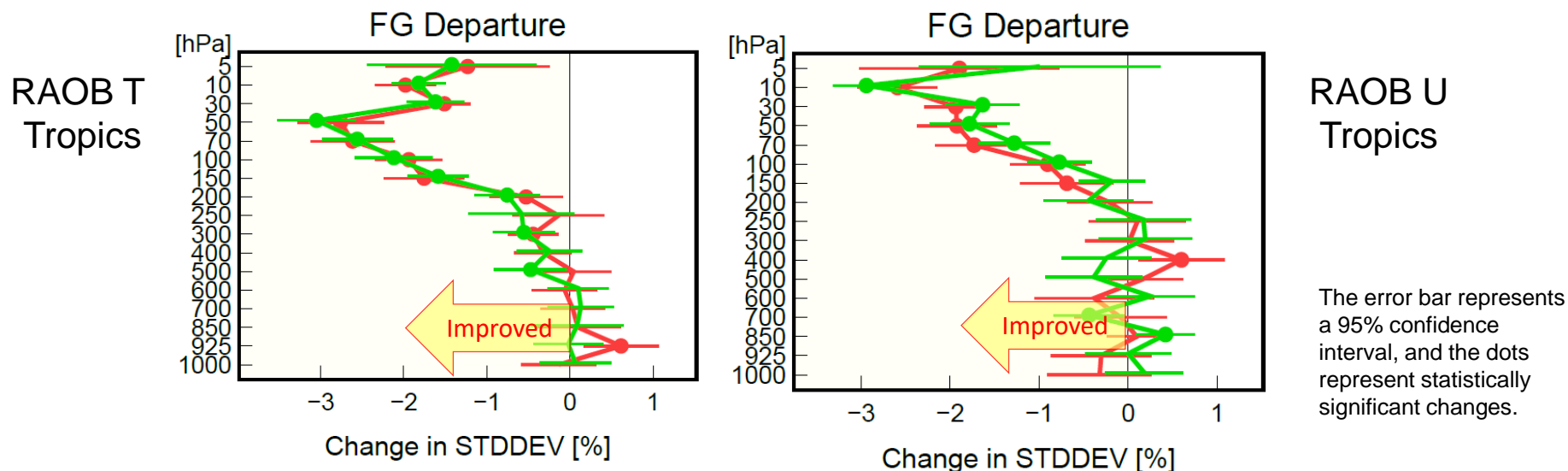


Replacement of Super Computer System (Jun 2018)

Enhancement of QC for GNSS-RO data in GA

- Changing bending angle's threshold value of the gross error check in the tropics → Increased data use
- Changing the handling of quality flag
- Setting the lower limit of altitude (2km) for assimilating bending angle
- ROPP6 to ROPP8

Normalized changes in STD of FG departure (O-B)



Control run: previous operation equivalent, Test run: current operation

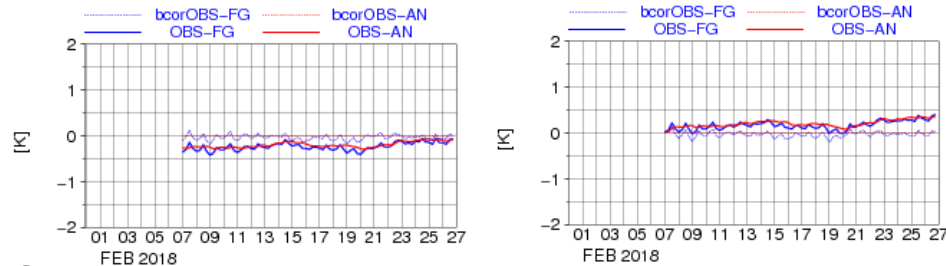
Red: 10 Jun. to 11 Oct. 2015, Green: 10 Nov. 2015-11 Mar. 2016

CSR and AMV: Switch-over from Meteosat-10 to Meteosat-11

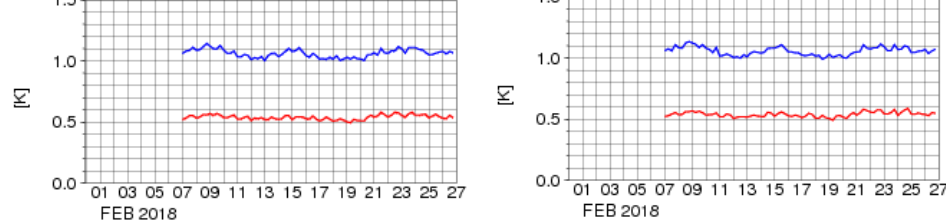
CSR data monitoring between Meteosat-10 and -11

Data counts of assimilated WV AMVs in the southern hemisphere

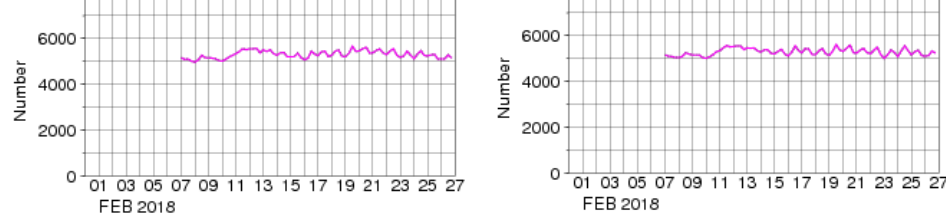
BIAS



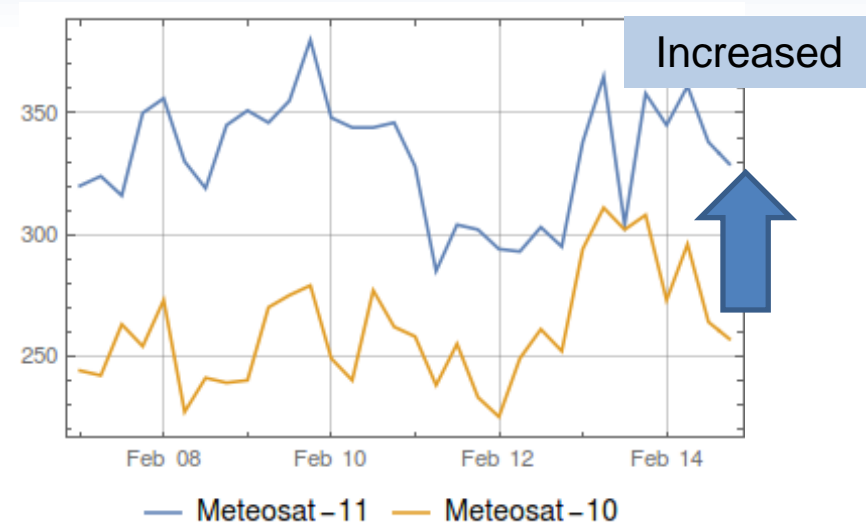
STD



Counts



After QC, quality of Meteosat-11 CSR data are comparable to Meteosat-10 CSR data.



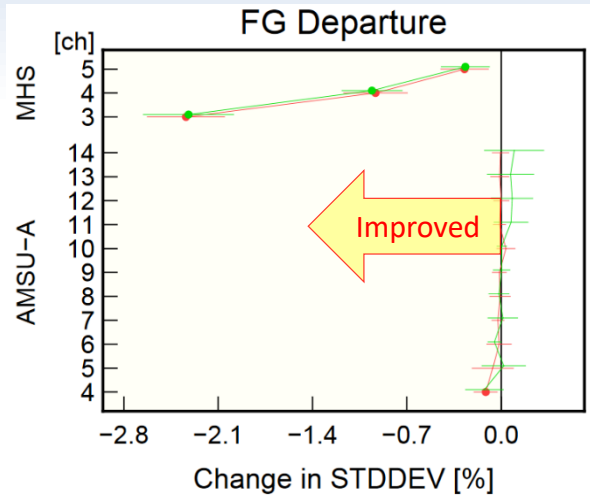
Increase of available AMV data from Meteosat-11.

Switch-over from Meteosat-10 to Meteosat-11 was 6th March 2018 at JMA

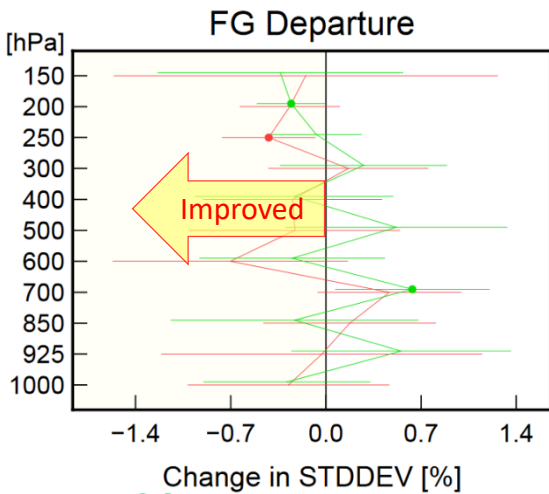
Impact on FG departure of other observations

Normalized change in FG STD
from Baseline experiment

MHS



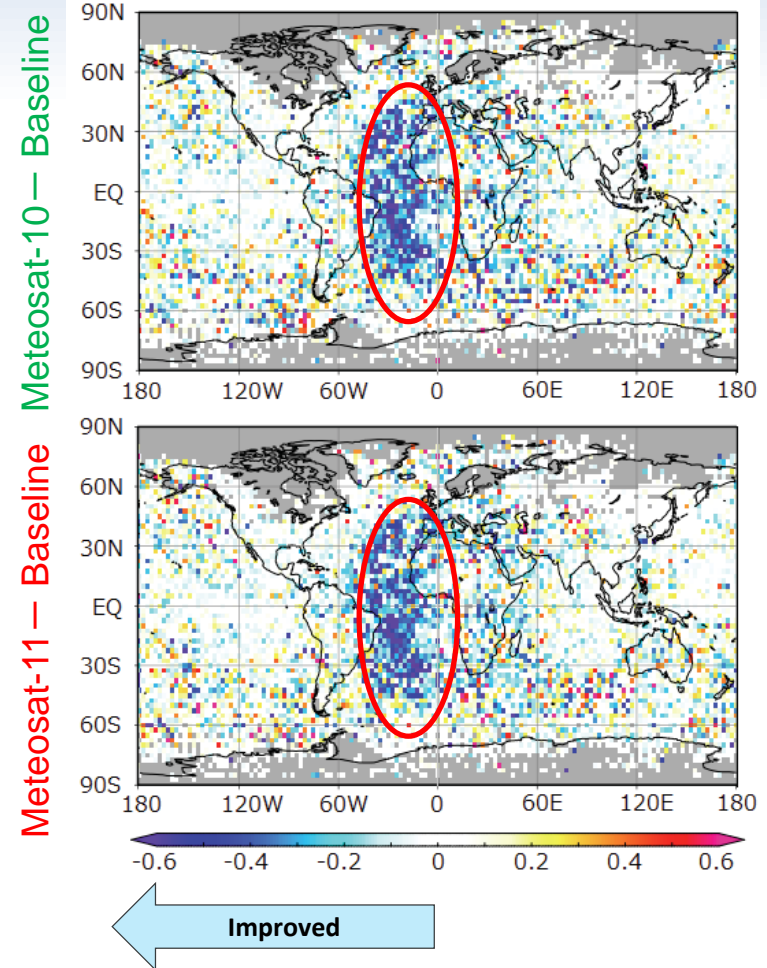
Aircrafts
(Wind)



Meteosat-10 AMV, CSR

Meteosat-11 AMV, CSR

Horizontal distribution of normalized changes
of FG departure's STD (MHS Ch. 3)



Improved FG fits to wind and humidity-sensitive observations.
Especially, in the gap areas between GOES and Meteosat-8.

Status/Plan for NOAA/Metop/JPSS Sounder data

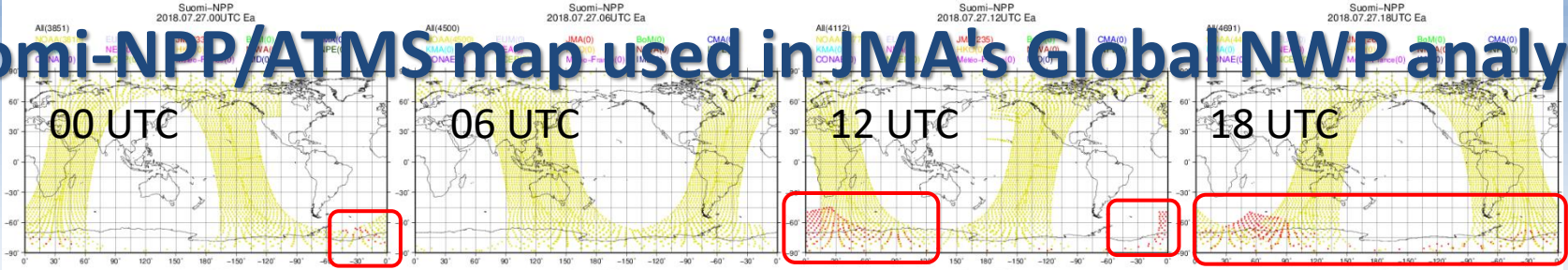
Satellite	Sensor	JMA/MSC	DBNet AP	DBNet EU	DBNet SA	DBNet DBRTN	Global data
NOAA	AMSU-A,MHS	⊙	⊙	⊙	⊙	/	⊙
Metop	AMSU-A,MHS	⊙	2	⊙	⊙	/	⊙
Suomi-NPP	ATMS	1 ⊙	△	○	—	○	⊙
NOAA-20	ATMS	—	—	—	—	○	○
Suomi-NPP	CrIS (NSR)	⊙	△	○	—	○	⊙
NOAA-20	CrIS (NSR)	/	/	/	/	/	/
Suomi-NPP	CrIS (FSR)	—	—	—	—	—	3 ⊙
NOAA-20	CrIS (FSR)	—	—	—	—	○	○
Metop	IASI (500ch)	○	△	—	—	○	○ using 616ch

⊙ : Receiving and using ○ : Receiving, but not using yet — : Not receiving yet CrIS(NSR) : Normal Spectral Mode (399ch)
 / : No data available △ : Receiving from several stations (not using) CrIS(FSR) : Full Spectral Mode (431ch)

1. JMA has started to use direct readout Suomi-NPP/ATMS and CrIS at JMA/MSC.
2. and will start to use data from DBNet soon.
3. JMA has started to use CrIS(FSR) dataset instead of CrIS(NSR) dataset.
4. JMA has started to monitor passively NOAA-20/ATMS and CrIS.

Suomi-NPP/ATMS map used in JMA's Global NWP analysis

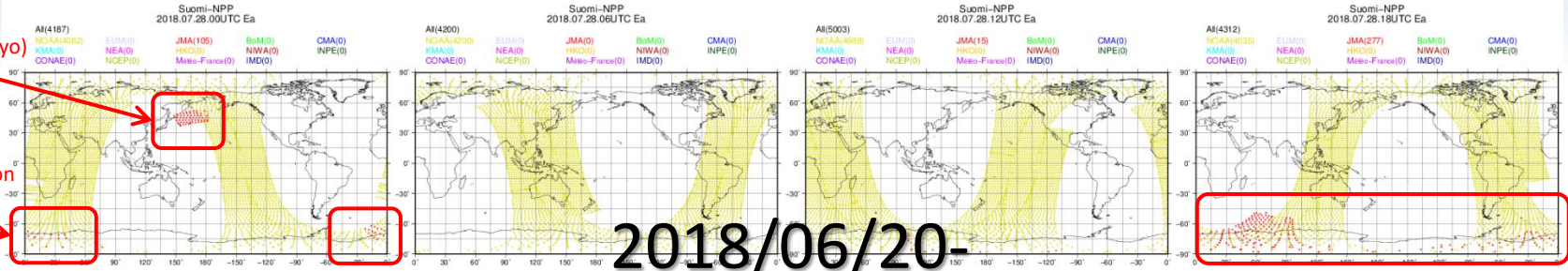
2018/
07/27



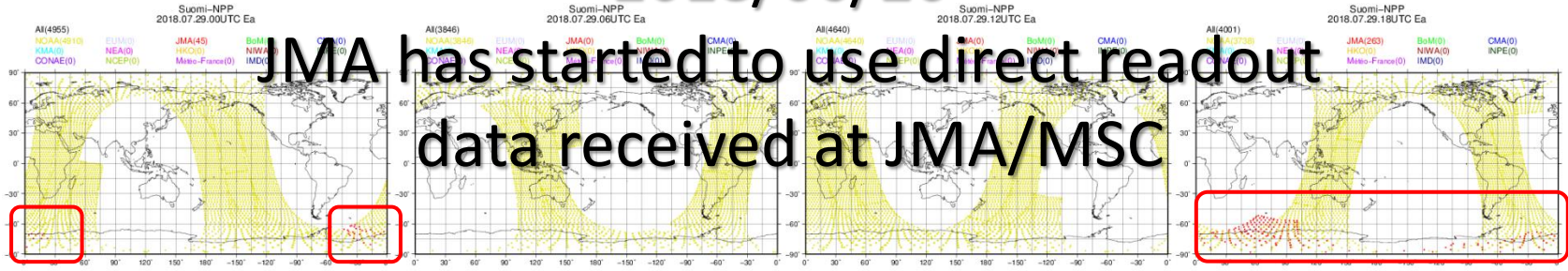
JMA/MSC
(Kiyose, Tokyo)

07/28

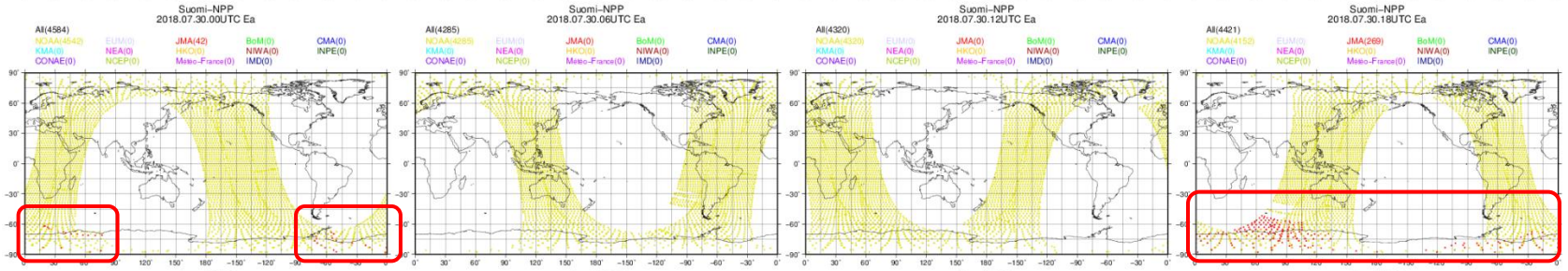
Syowa station
(Antarctica)



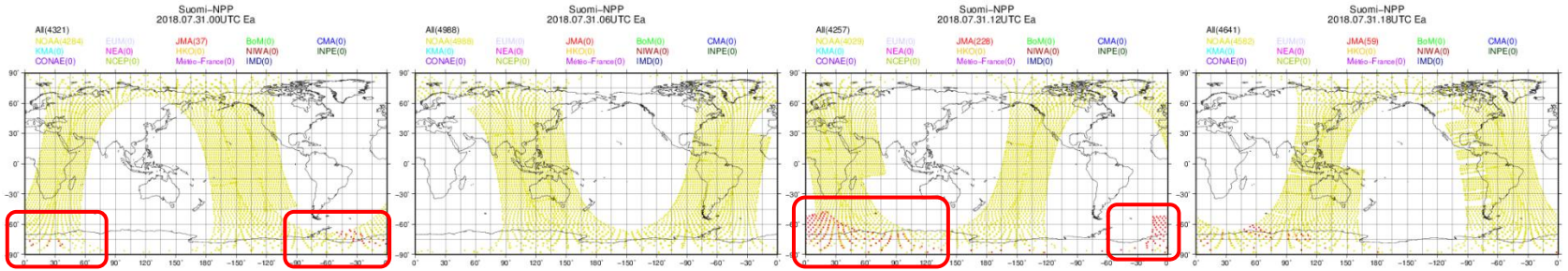
07/29



07/30



07/31



Global
JMA

Enhancement of surface sensitive CSR data use in GA

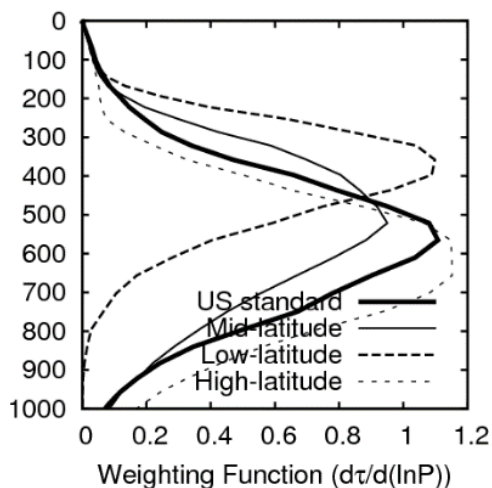
1. Himawari Band 9, 10 and MSG Ch 6 CSR data are affected by land surface
 - Use of land surface emissivity atlas and **retrieved Land Surface Temperature (LST_{ret})** from window channel observation
 - CSR data at higher altitude (**> 4,000 m**) are rejected
2. Use of hourly CSR data from GOES and MSG



90 % increase of available CSR data

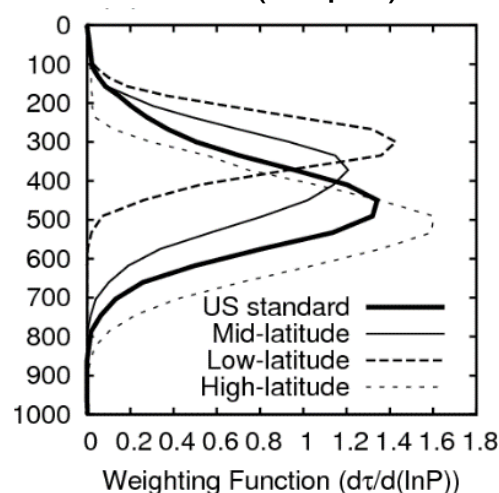
MSG (SEVIRI)

Ch 6(7.35 μ m)

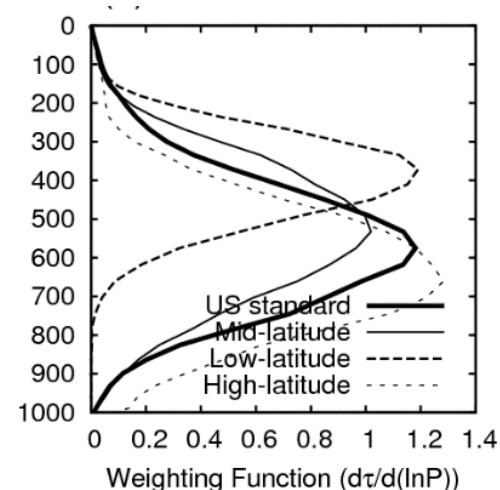


Himawari-8 (AHI)

Band 9(6.9 μ m)



Band 10(7.3 μ m)



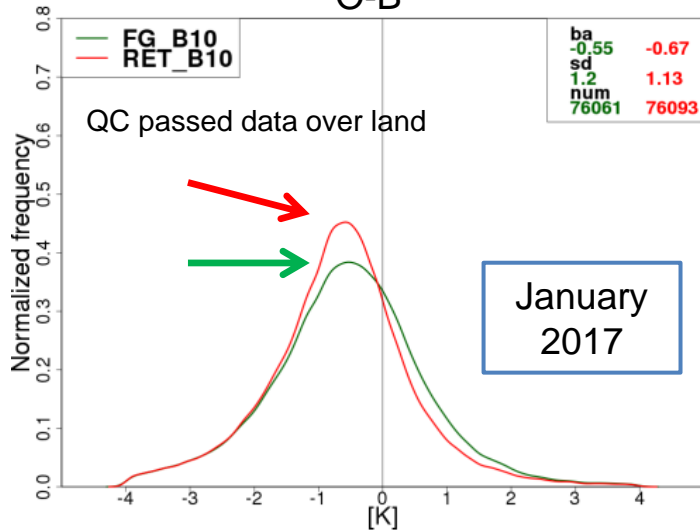
Use of LST_{ret} in RTM calculation for CSR data

Base: Operational JMA NWP system with surface-sensitive CSR over ocean

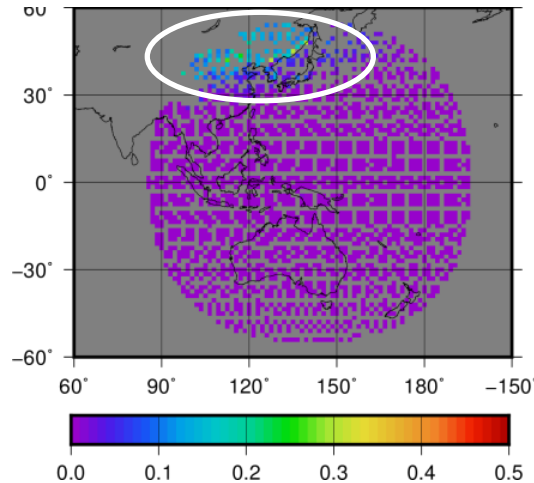
Test 1: Base + surface-sensitive CSR over land using LST_{FG} .

Test 2: As Test 1 but LST_{ret} was used over land.

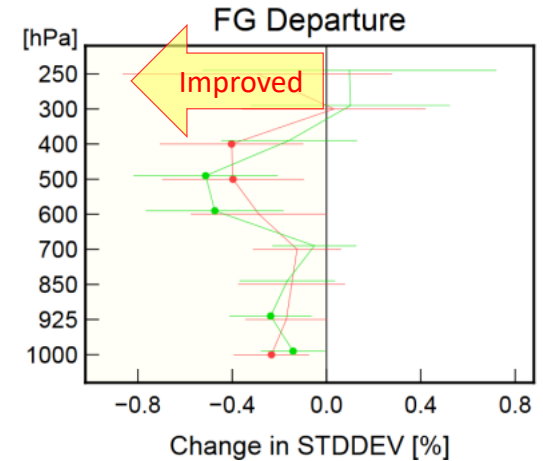
Himawari-8, B10
O-B



Transmittance of Himawari-8 B10



Normalized Change in FG
STD of RAOB RH



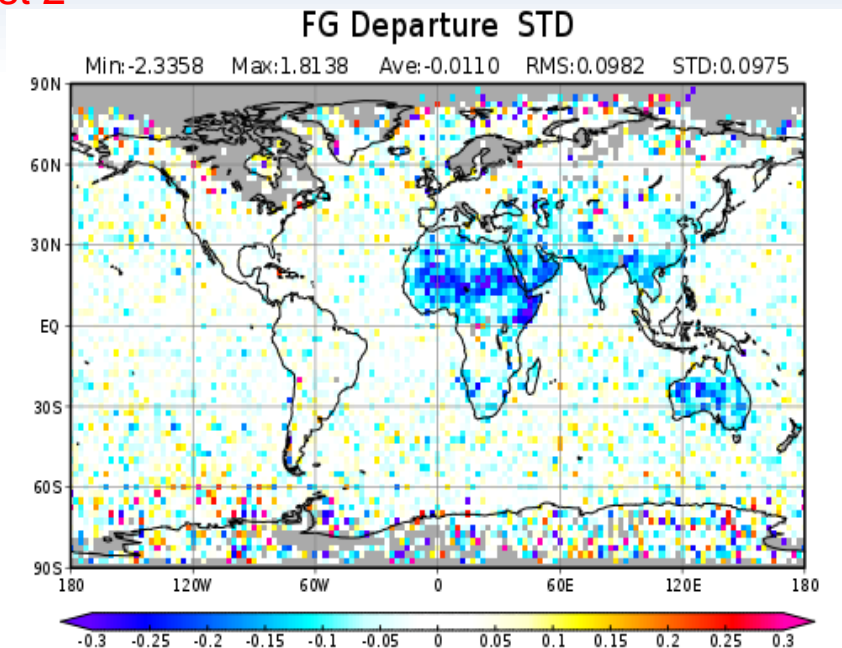
Improved O-B histogram (w/o BC) by using retrieved LST in RTM

Improved FG fits to RAOB by using surface-sensitive CSR with LST_{ret}

Impacts on NWP forecasts

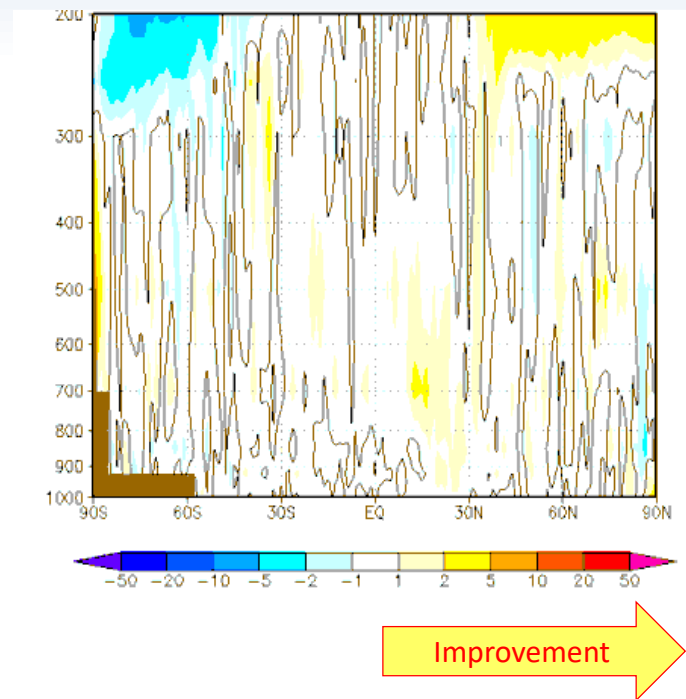
Normalized Change in FG STD of MHS Ch. 4
Dec. 2016 – Feb. 2017

Test 2



Addition of surface sensitive CSR data
(Himawari-8 B9, B10, MSG CH.6)
improved FG fits of MHS ch.4 over land

Relative improvement of
24-hr specific humidity forecast



Improvement of 24-h forecast
of specific humidity in Tropics

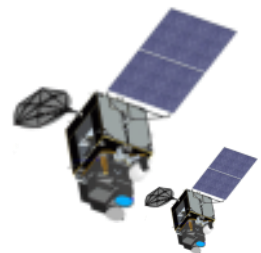
Planned updates of observation use in JMA's NWP system for 2018-2019

GA: Global Analysis MA: Meso-scale Analysis LA: Local Analysis

- (1) Enhancement of AMV QC in GA
- (2) Use of GOES-16 AMV and CSR in GA
- (3) Activation of NOAA-20 ATMS and CrIS in GA
- (4) Use of ScatSat/OSCAT ocean surface wind in GA
- (5) Use of TanDEM-X bending angle data in GA
- (6) Use of Himawari-8 Band-9, -10 in MA
- (7) Use of 12.5km ASCAT wind data in MA
- (8) Use of high density Himawari-8 AMV in MA
- (9) Activation of NOAA-20 ATMS in MA
- (10) All-sky MW radiance assimilation in GA

Updates on Himawari-8/9

Japan Meteorological Agency



History of Himawari Satellites



GMS (Geostationaly Meteorological Satellite)

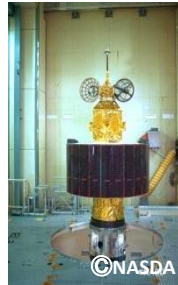
- GMS**
 (Himawari)
- GMS-2**
 (Himawari-2)
- GMS-3**
 (Himawari-3)
- GMS-4**
 (Himawari-4)
- GMS-5**
 (Himawari-5)



Launched in 1977



1981



1984



1989



1995

GOES-9

Back-up operation of GMS-5 with GOES-9 by NOAA/NESDIS from May 22, 2003 to June 28, 2005

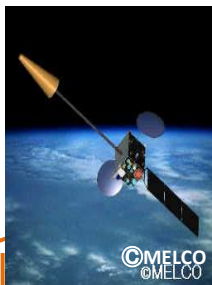


MTSAT (Multi-functional Transport SATellite) Himawari

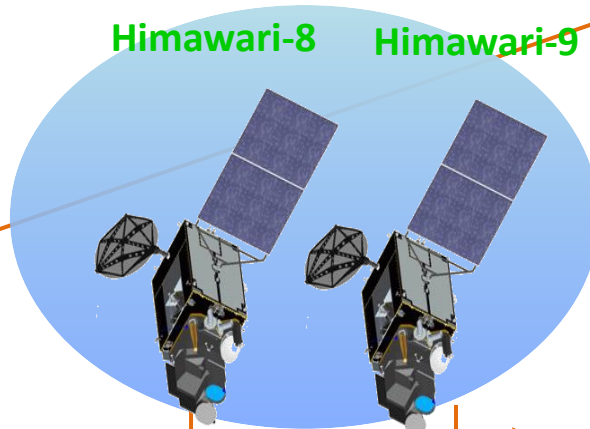
- MTSAT-1R**
 (Himawari-6)
- MTSAT-2**
 (Himawari-7)



Launched in 2005



2006

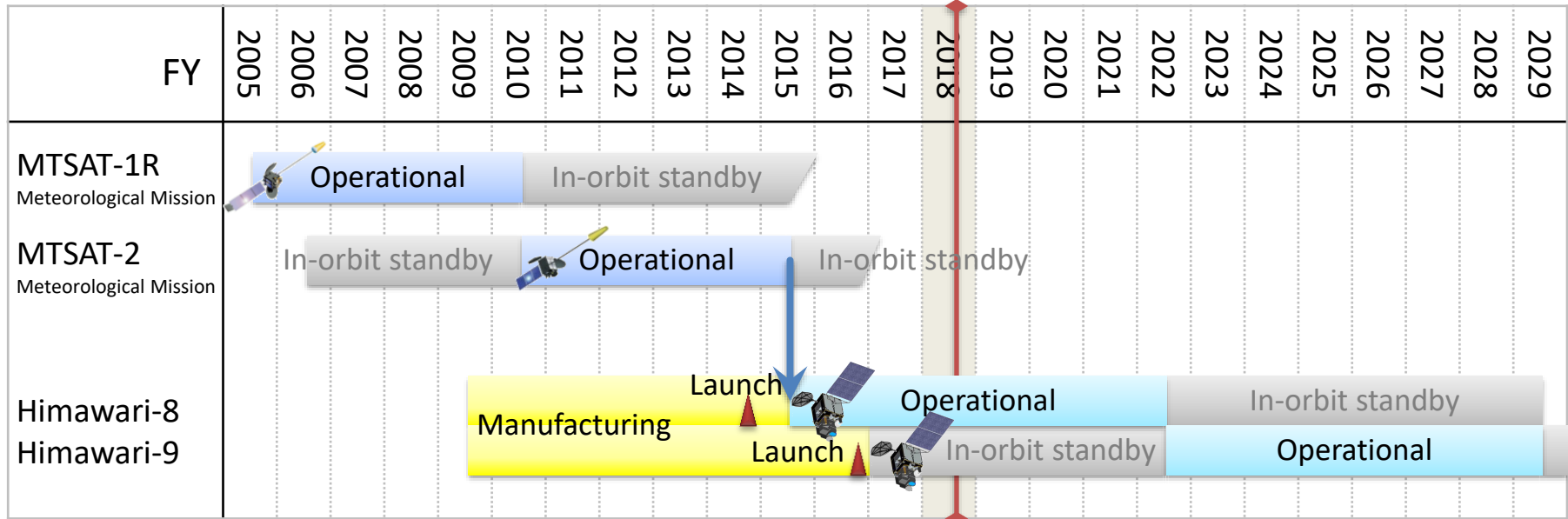


2014

2016

Satellite	Observation period
GMS	1978 – 1981
GMS 2	1981 – 1984
GMS-3	1984 – 1989
GMS-4	1989 – 1995
GMS-5	1995 – 2003
GOES-9	2003 – 2005
MTSAT-1R	2005 – 2010
MTSAT-2	2010 – 2015
Himawari-8	2015 – 2022
Himawari-9	2022 – 2029

Himawari-8/9 Schedule



- Himawari-8: Operational since July 7, 2015
- Himawari-9: Standby for backup since March 10, 2017
- Switch over from H-8 to H-9 planned in 2022

Himawari-8/9 Operational Status

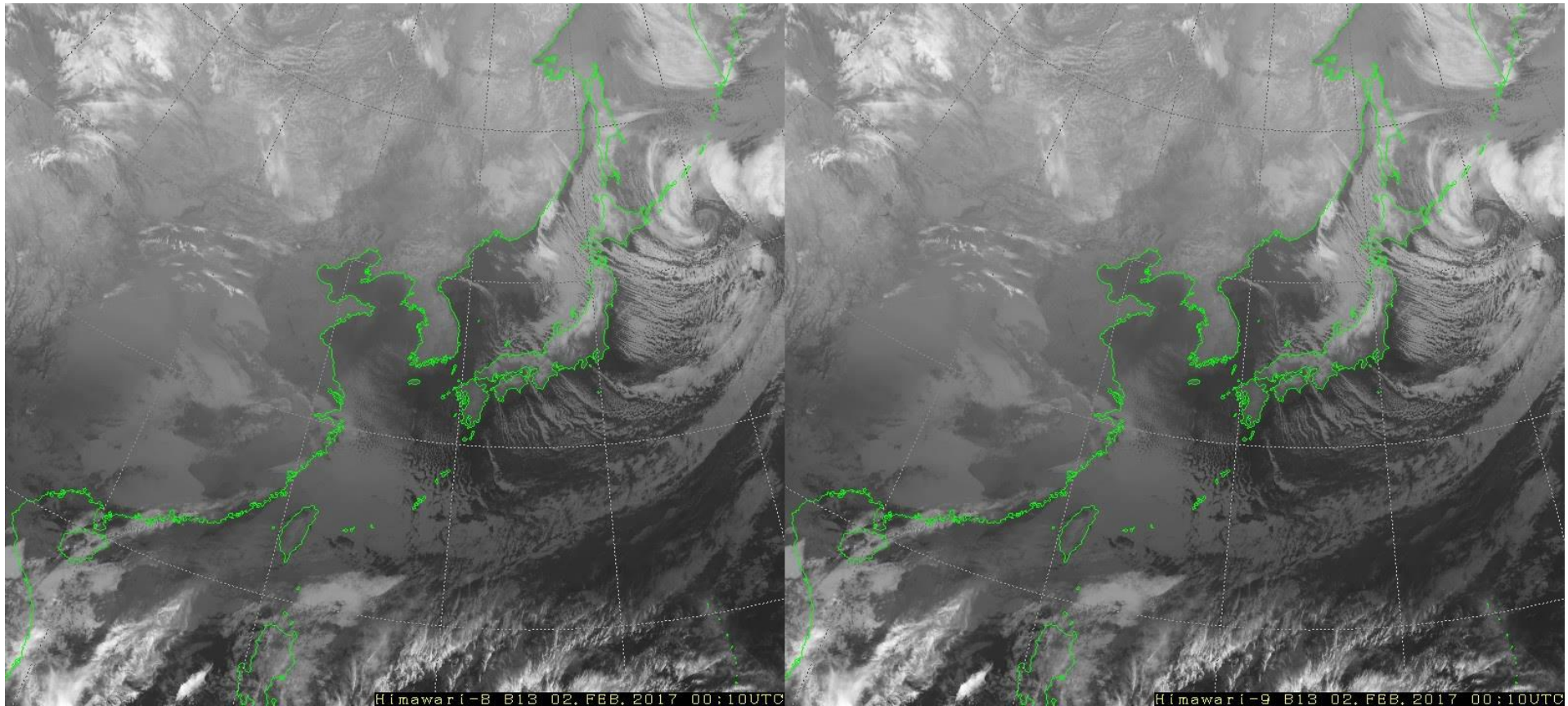


- **Himawari-8: operational at around 140.65 degE**
 - AHI (16-band Imager) and DCS (Data Collection System) operational
 - AHI maintenance scheduled once a year
 - H-9/AHI becomes operational during the maintenance
 - This year (2018), conducted on February 13-14
- **Himawari-9: standby at around 140.75 degE**
 - H-9 will become operational in case of H-8 anomaly
 - AHI “Health Check” conducted several times a year to confirm AHI functionality (this operation requires LHP(Loop Heat Pipe) startup)
 - 2017: May 29 - June 12, Aug 29 - Sep 13, Nov 28 - Dec 12
 - 2018: Jan 31 - Feb 16, Oct 2 - Oct 19



Himawari-8/AHI

Himawari-9/AHI



Band 13, Feb 02, 2017

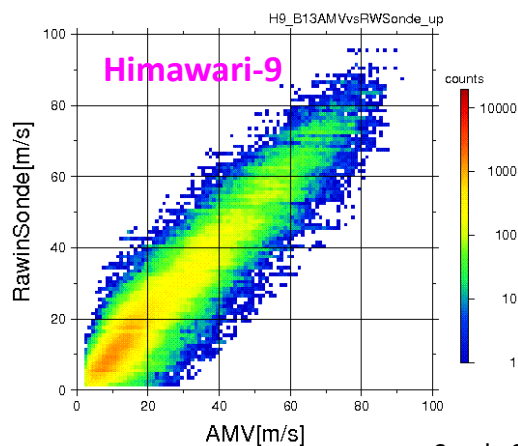
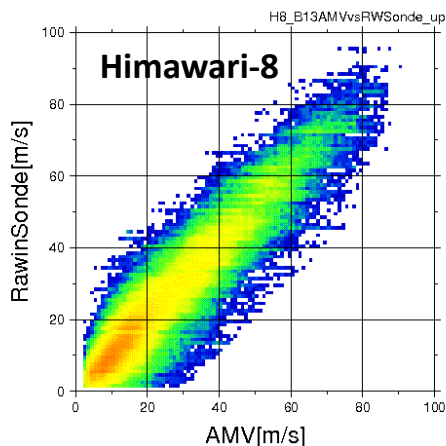
H-8 and H-9 are functionally identical

Himawari-8/9 AMV

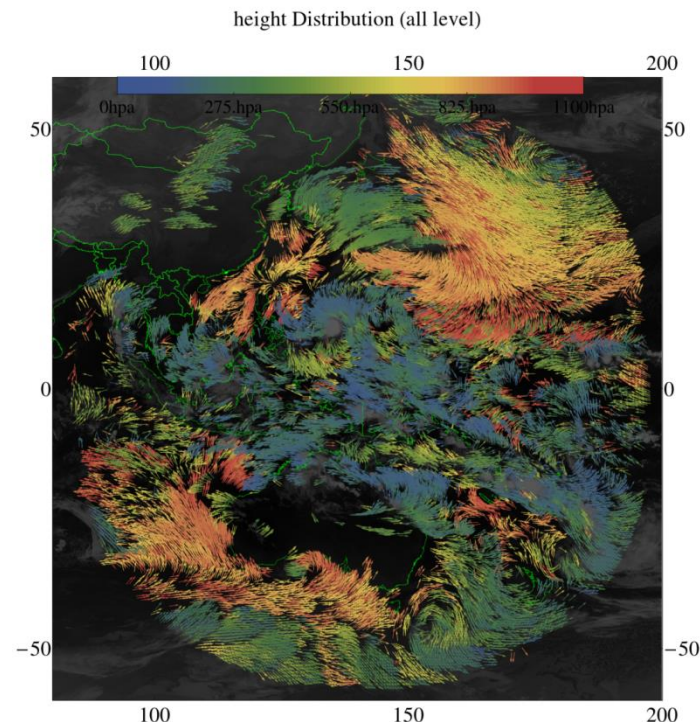
Atmospheric Motion Vector



- Himawari-8/9 AMV (VIS, IR, WV1,2,3) is derived hourly using Full-Disk imagery and is distributed in BUFR format via GTS.
- Himawari-8 AMV has been disseminated operationally since July 2015.
- Himawari-9 AMV has also been ready for the backup of Himawari-8 AMV.



RAOB statistics of IR(10.4um) upper-level wind speed using the Himawari-9 health check operation data for about two weeks (2 – 14 Feb 2018)



Himawari-8 AMV (IR, 10.4um)
Height distribution

Sonde Statistics collocation condition
QI(w/ fcst) > 0.85
within 150 km FM station
AMV Height within 50hPa (< 700hPa)
AMV Height within 35hPa (>700hPa)

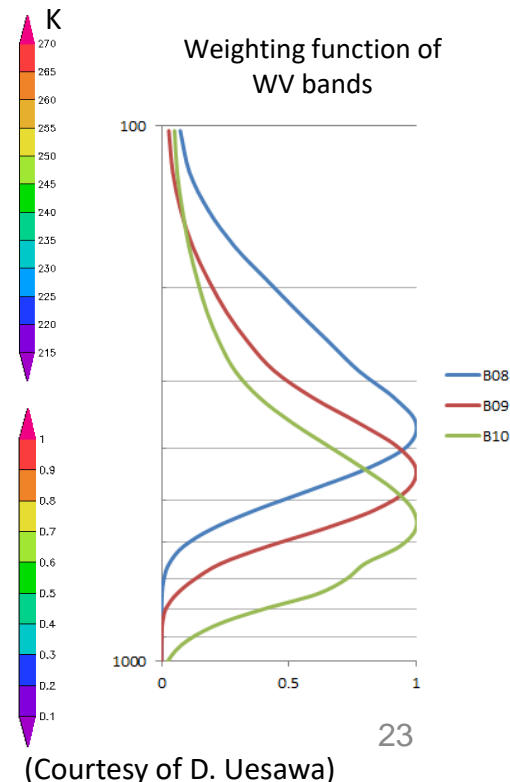
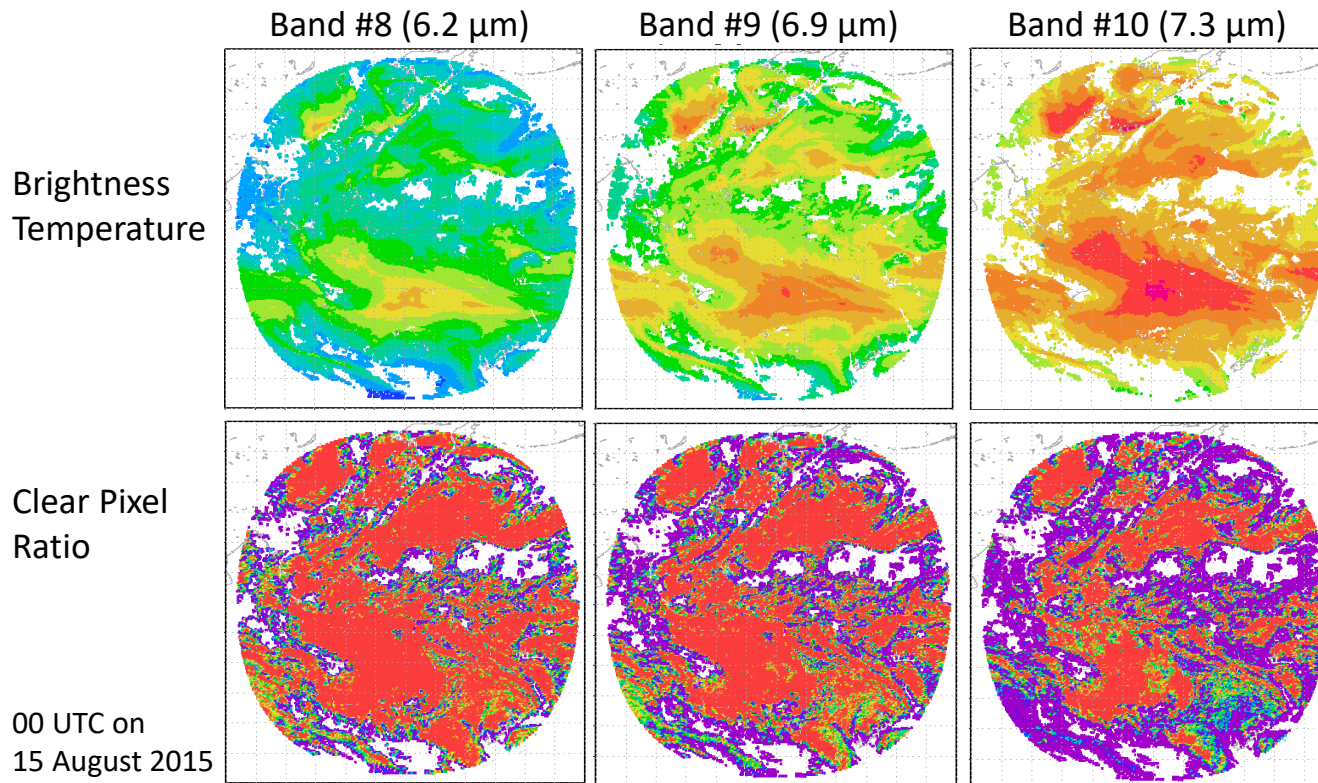
Himawari-8/9 CSR

Clear Sky Radiance

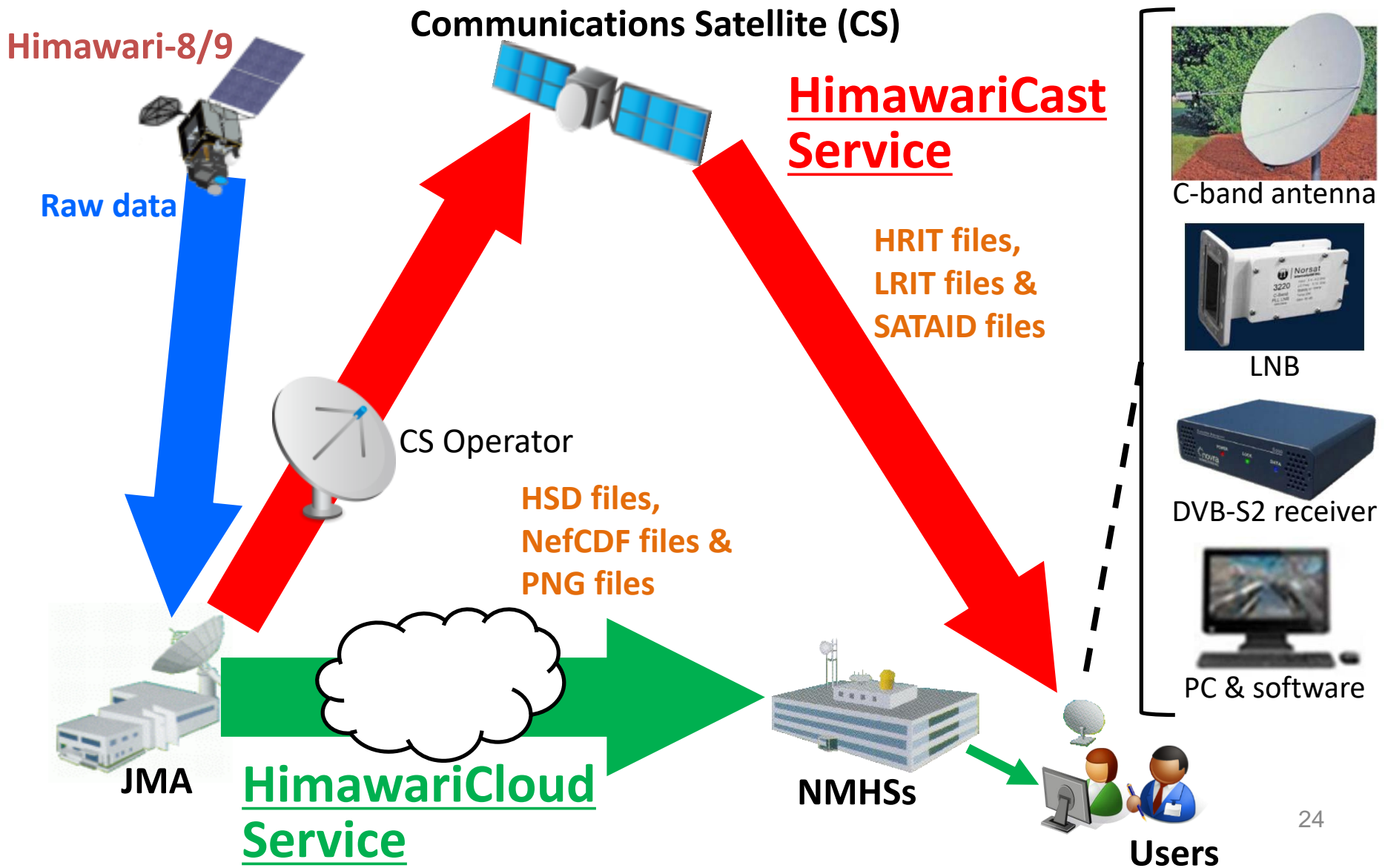


➤ Area averaged clear sky brightness temperature

- ✓ All IR bands (3.9, 6.2, 6.9, 7.3, 8.6, 9.6, 10.4, 11.2, 12.4, 13.3 μm)
- ✓ Full disk, **hourly produced** and distributed via GTS mainly for NWP community
- ✓ Spatial resolution (averaging size): **16 x 16 pixel** (IR) (i.e. **32 x 32 km** @SSP)
- ✓ **Band dependent** clear pixel ratios for clear pixel detection
- ✓ *Provided to NWP centers via GTS*



HimawariCast/Cloud Services



NMHS users of Himawari



HimawariCast Receiving Systems

Already installed **32**



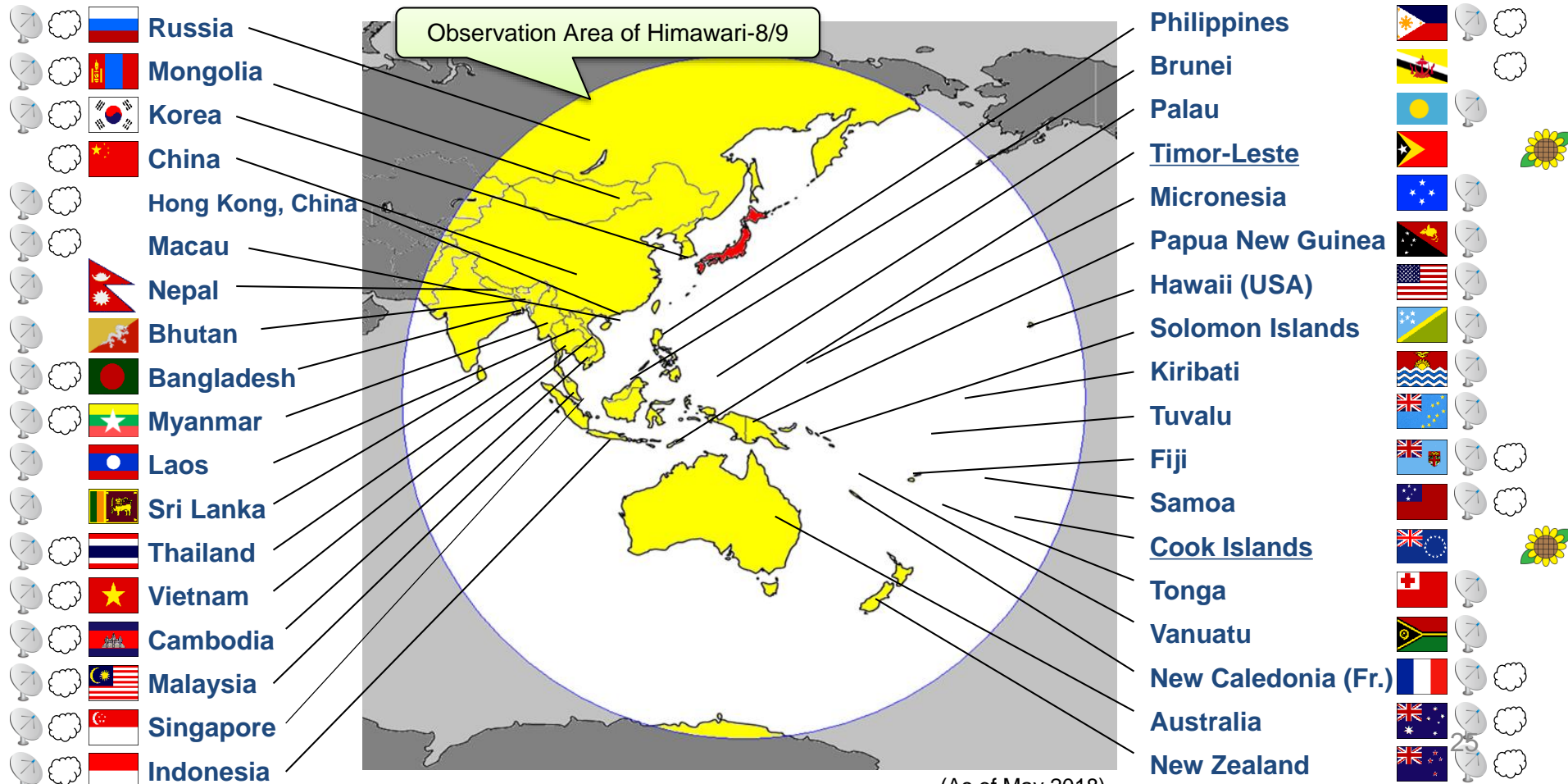
HimawariCloud accounts

21 users
(In addition to these, NOAA/NESDIS and EUMETSAT have accounts.)



Web service covers

42 areas
(including Timor-Leste and Cook Islands)

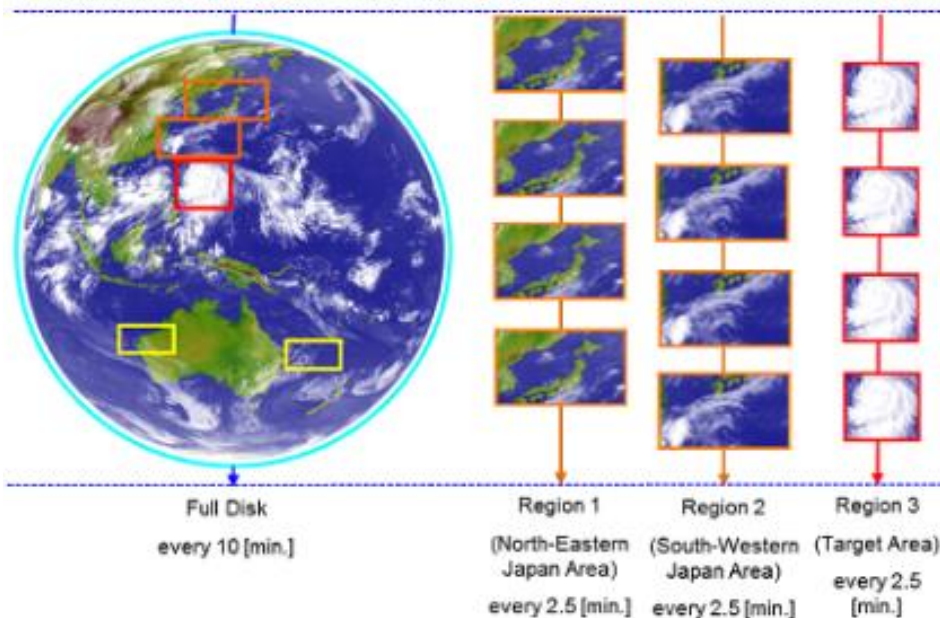


(As of May 2018)

HimawariRequest Service



- In January 2018, JMA launched a new international service “HimawariRequest”, in collaboration with Australia’s Bureau of Meteorology (BoM).
- The service allows NMHS users in WMO RA II and RA V to request Himawari-8/9 Target Area observation covering a 1000 km x 1000 km area every 2.5 minutes.



**Users are able to request
Target Area observation
conducted every 2.5 min!**

Current Status



12 Registrations

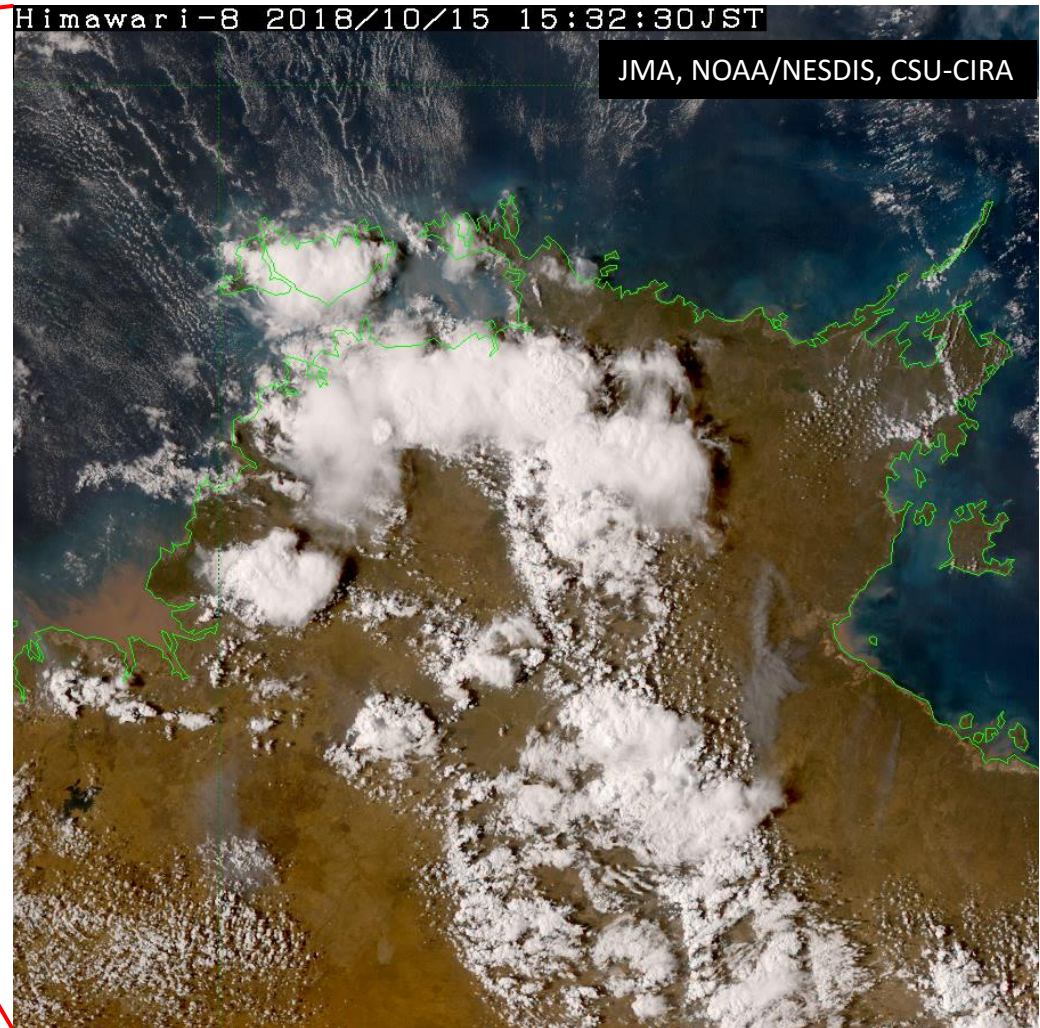
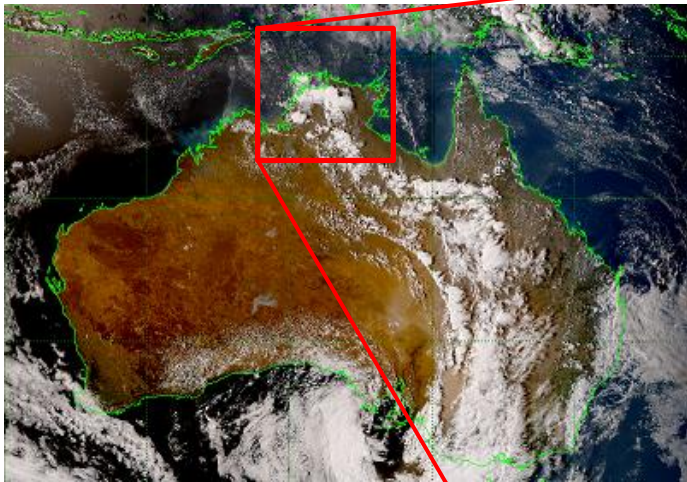
the Solomon Islands, Myanmar, Australia, Hong Kong, Bangladesh, New Zealand, Malaysia, Samoa, Nepal, Thailand, Fiji and Russia

9 Users (preparations for request submission completed)

the Solomon Islands, Hong Kong, New Zealand, Nepal, Australia, Malaysia, Fiji, Thailand and Russia

During Oct 16 – 17, 2018, Himawri-8 conducted the first observation under the HimawariRequet service in response to BoM's request.

Request-based Observation for BoM



True Color Reproduction imagery during Himawari-8 Target Area observation requested by Australia's Bureau of Meteorology (BoM)

This request was intended to monitor severe weather conditions associated with convective cloud activity around Darwin, in northern Australia.

Status Report of RTH Tokyo

RTH focal point for Tokyo

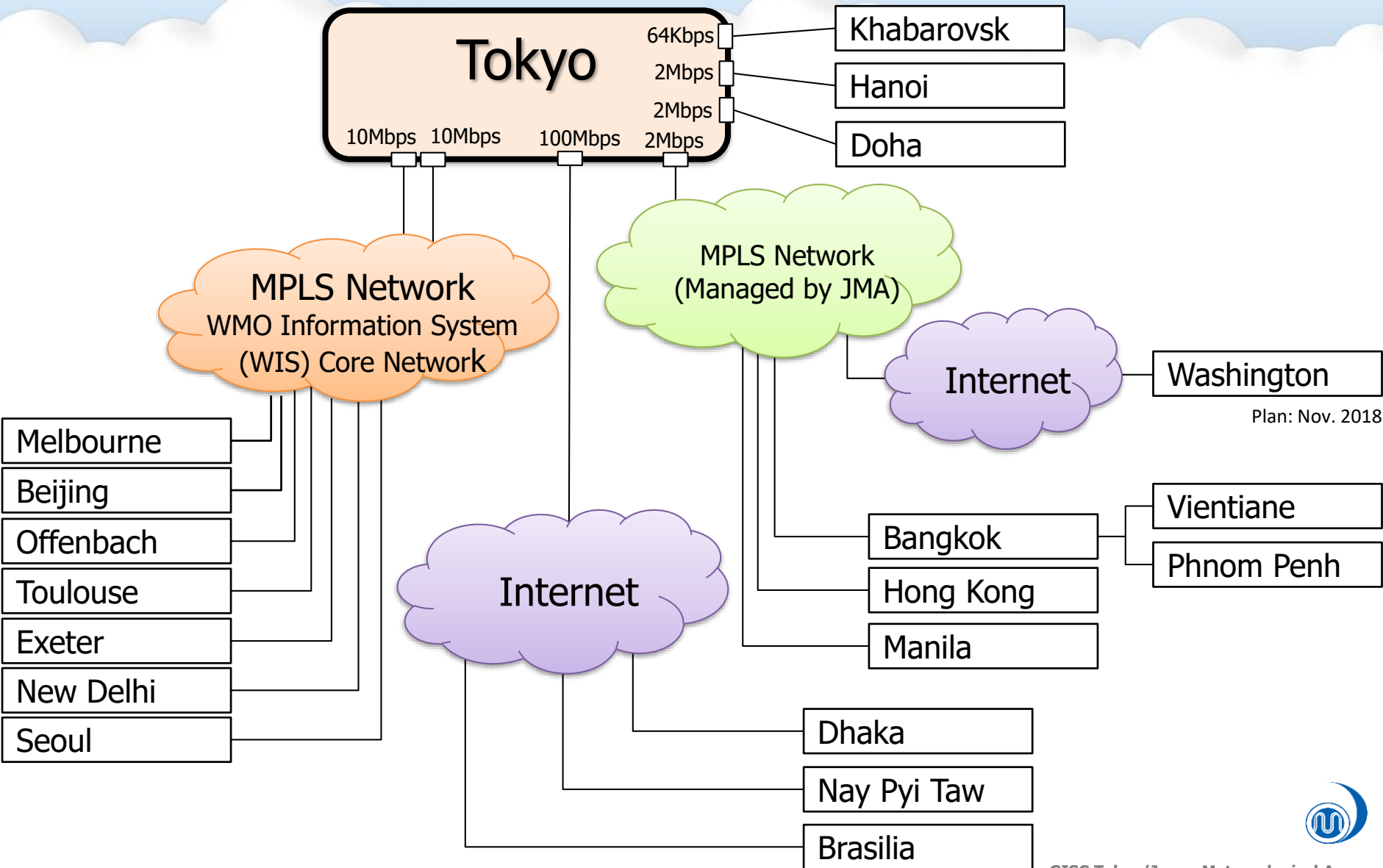
Presented by
(Numerical Prediction Division of JMA)

Second Meeting on Global Operational Data Exchange
for NWP (GODEX-NWP-2)

(New Delhi, India, 27 to 30 November 2018)

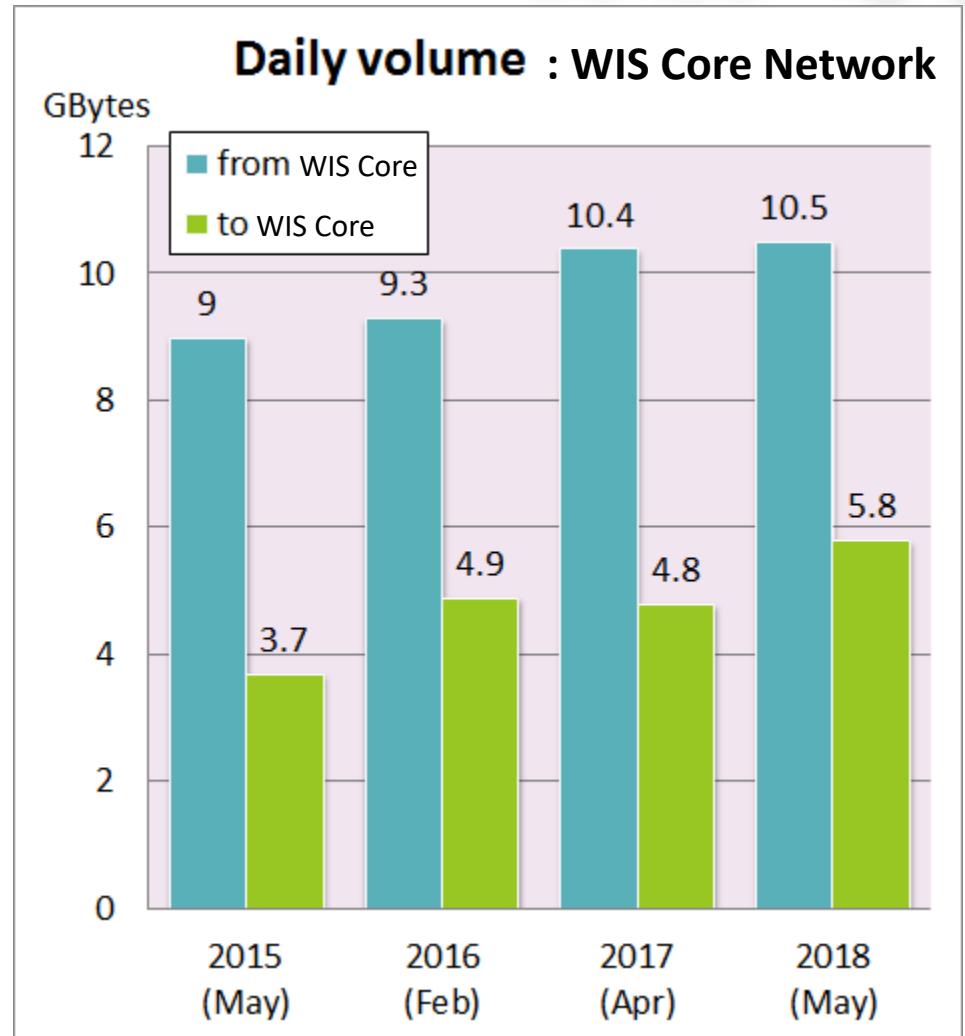


GTS Connections (Sep. 2018)



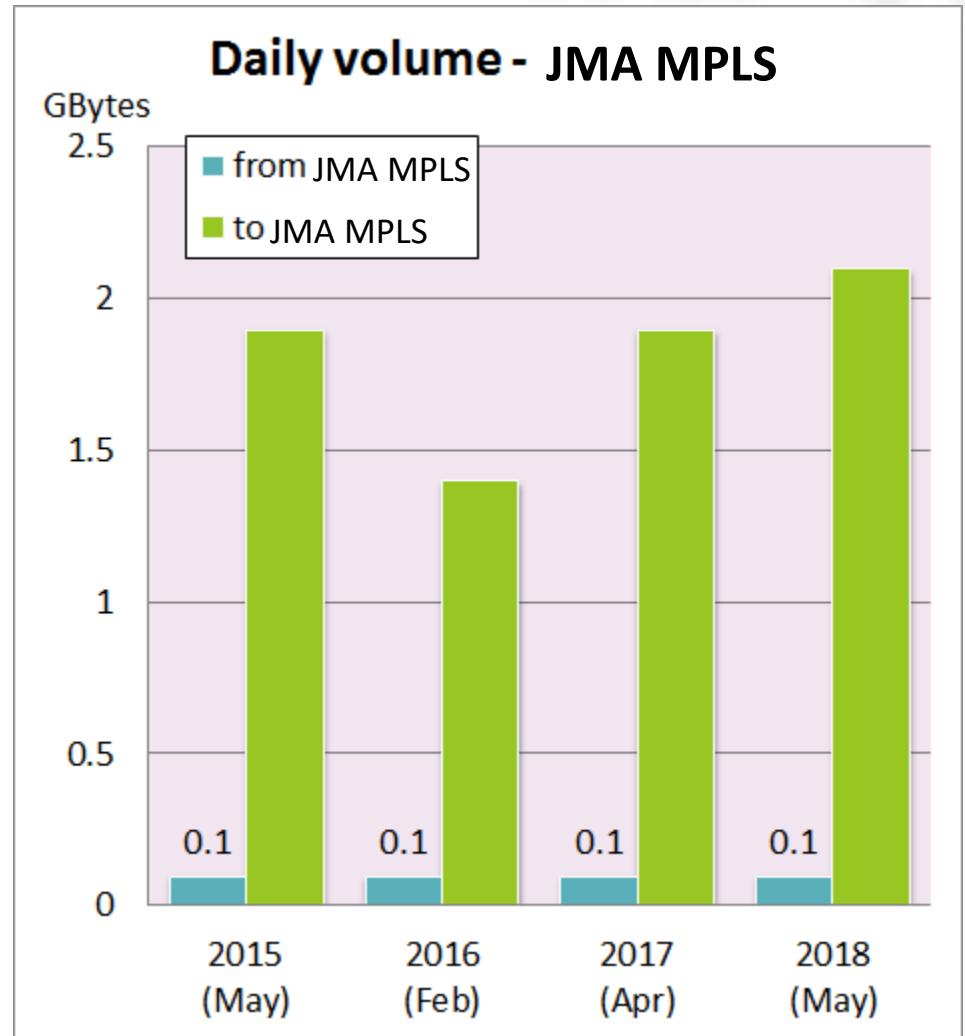
Daily Volume

- MPLS (WIS Core Network)
 - Washington
 - Melbourne
 - Exeter
 - Beijing
 - Seoul
 - New Delhi
 - Toulouse
 - Offenbach

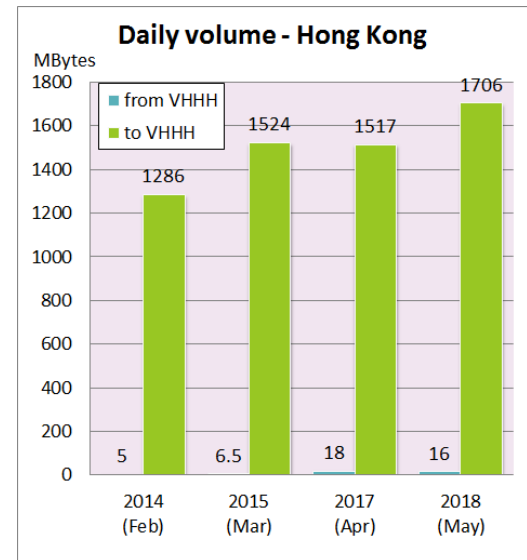
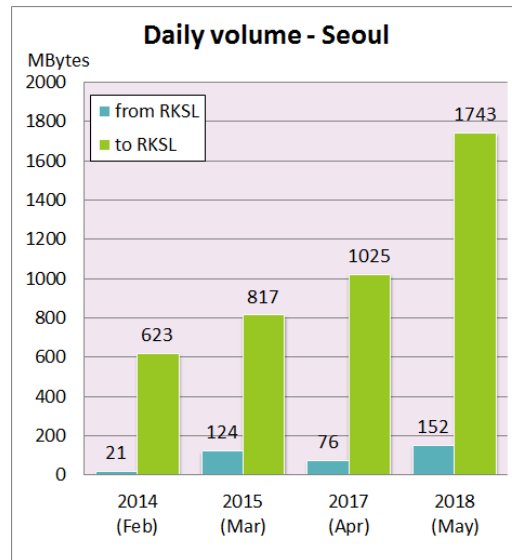
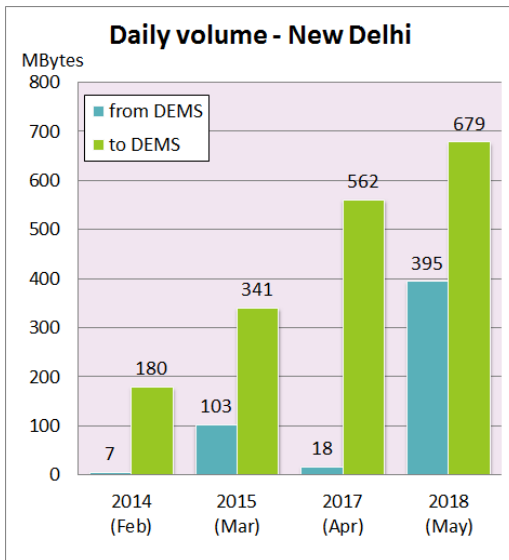
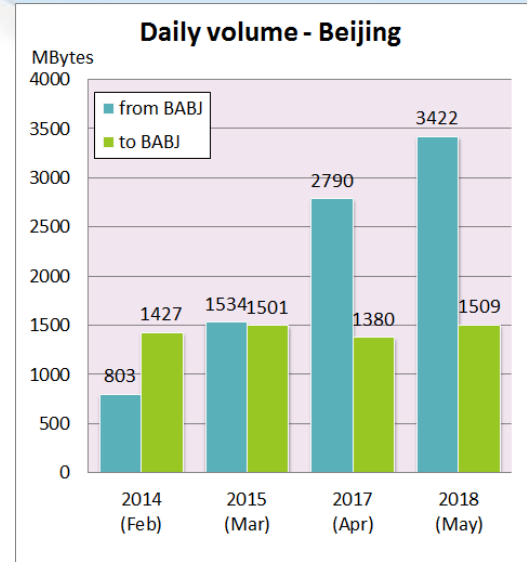
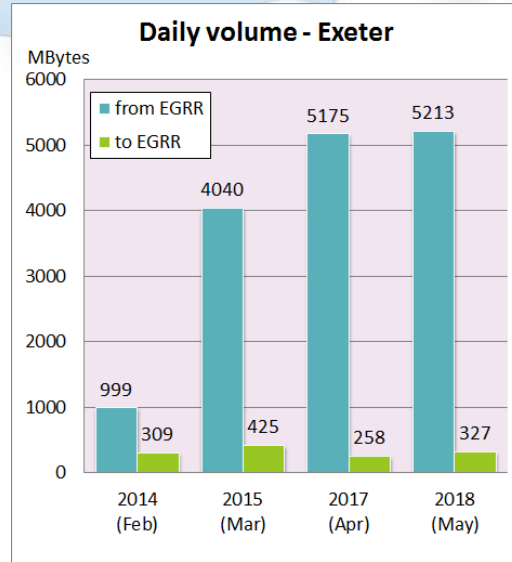
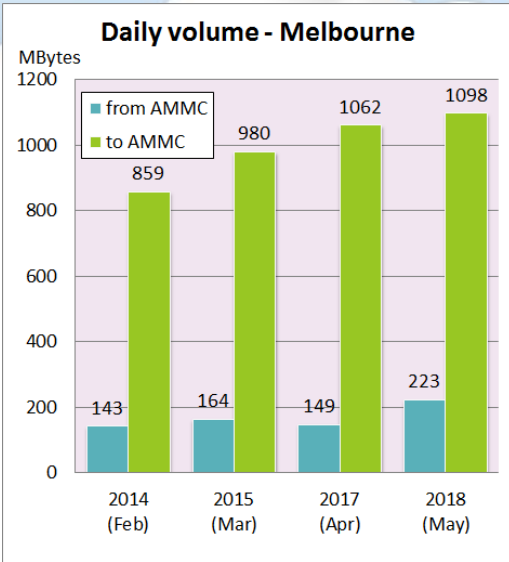


Daily Volume

- MPLS (managed by JMA)
 - Hong Kong
 - Bangkok
 - Manila



Daily Volume



Satellite Data Exchange

GODEX-NWP1 to GODEX-NWP2

- **Megha-Tropiques**

ROSA (Radio Occultation Sensor for Vertical Profiling of Temperature and Humidity) data from India

- **May 2017**

To Exeter, Melbourne, Offenbach, Toulouse, Beijing, Seoul, Hong Kong, Manila, Doha

- **FY3-C**

GNOS GPS-RO data from China

- **August 2017**

To Exeter, Melbourne, Beijing, New Delhi, Seoul, Hong Kong, Manila

MWHS2, IRAS data from China

- **June 2018**

To Exeter, Melbourne



Satellite Data Exchange

GODEX-NWP1 to GODEX-NWP2

- **Suomi-NPP**

ATMS, CrIS data from Washington

- **January 2018**

To Seoul

ATMS, CrIS data from Seoul (received at Jincheon Station)

- **August 2018**

To Exeter, Melbourne, Offenbach, Toulouse, Beijing,
New Delhi, Hong Kong, Doha

- **COMS**

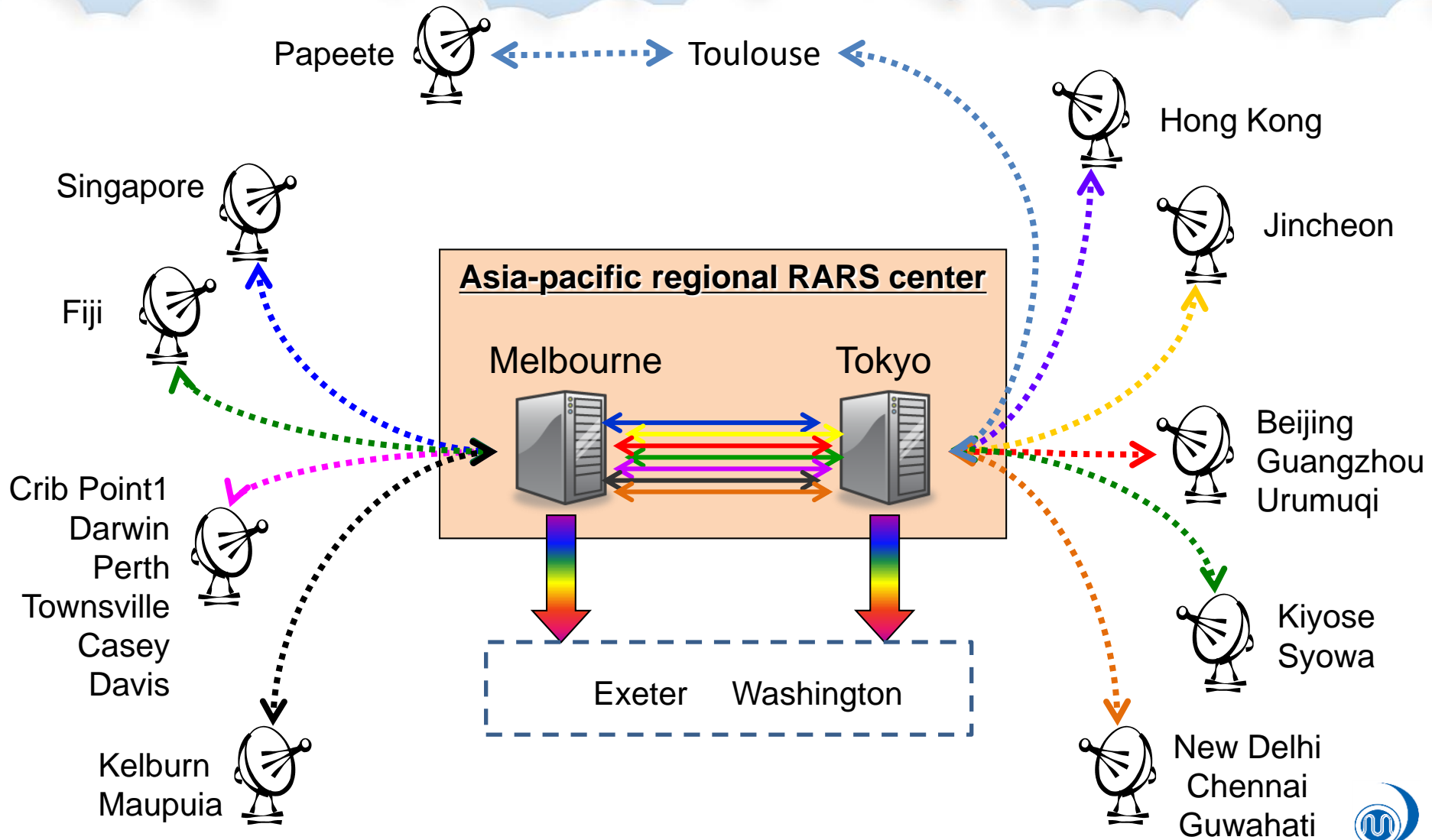
CSR data from Seoul

- **April 2018**

To Exeter, Melbourne, Offenbach, Toulouse, Beijing,
New Delhi, Hong Kong, Doha



AP-RARS connectivity



Thank you for your attention.