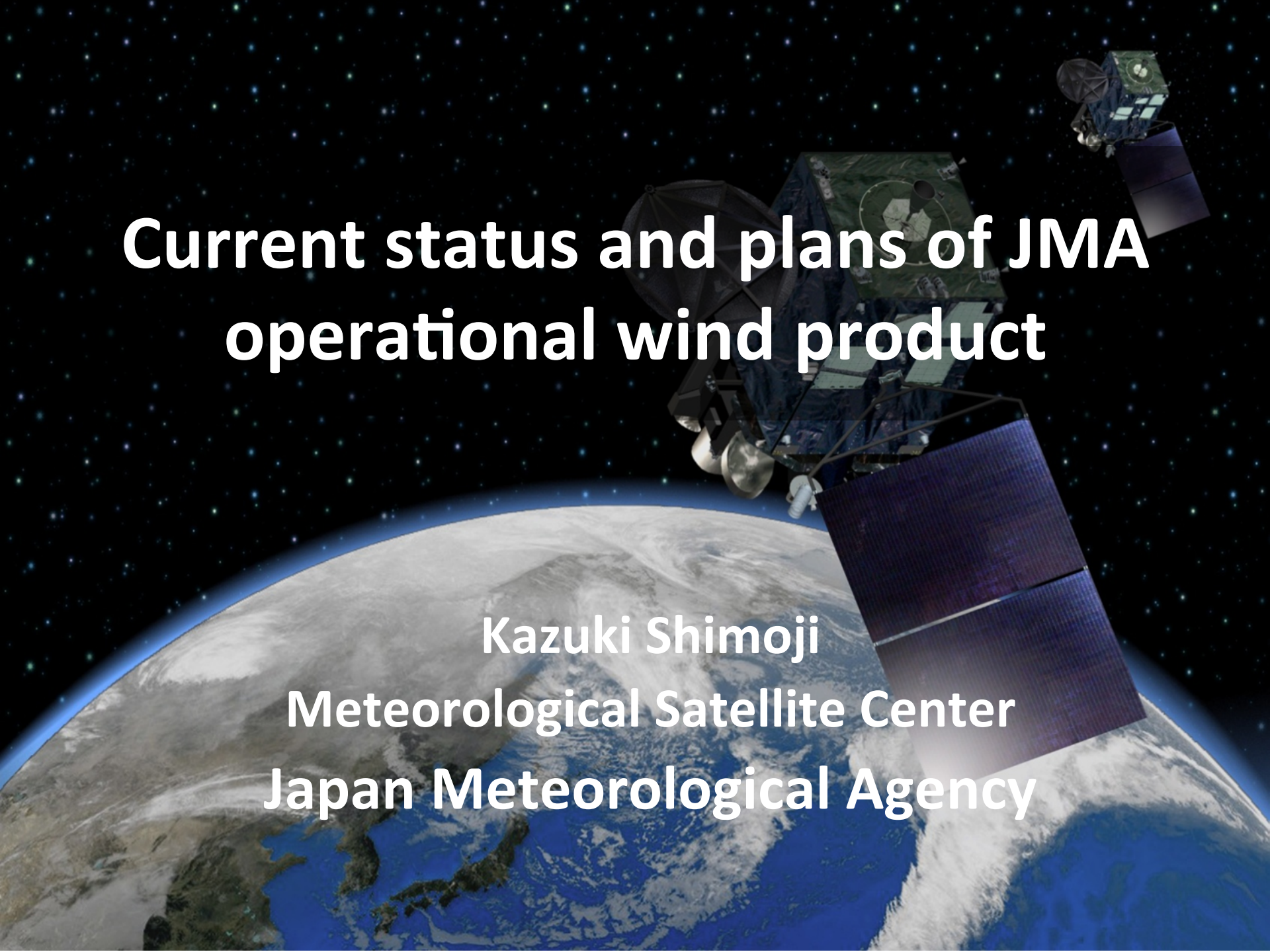

Current status and plans of JMA operational wind product

Kazuki Shimoji
Meteorological Satellite Center
Japan Meteorological Agency

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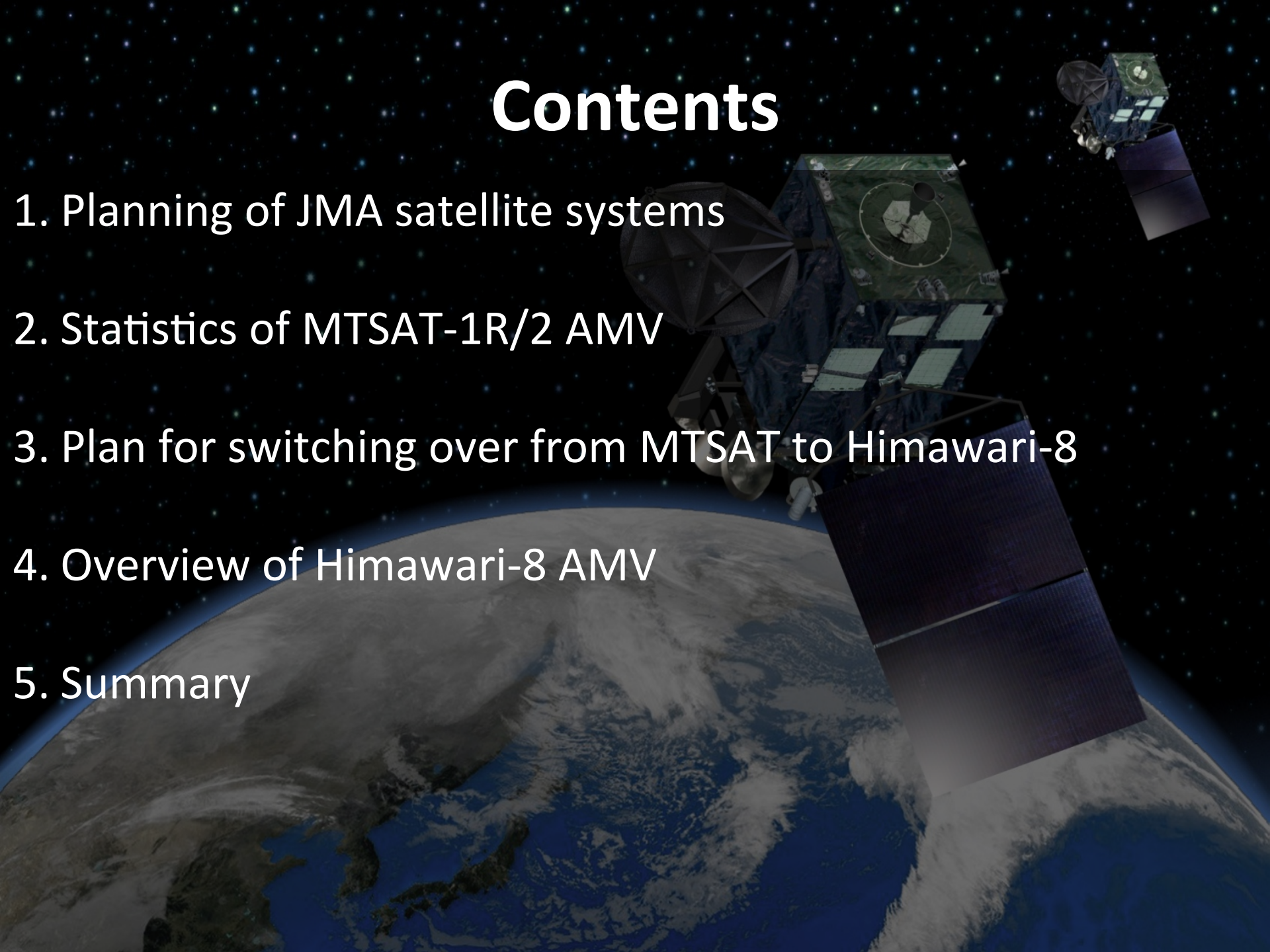


1. Planning of JMA satellite systems

2. Statistics of MTSAT-1R/2 AMV

3. Plan for switching over from MTSAT to Himawari-8

4. Overview of Himawari-8 AMV

5. Summary

Overview - Planning of JMA satellite systems (Himawari-series)

GMS (Geostationary Meteorological Satellite)

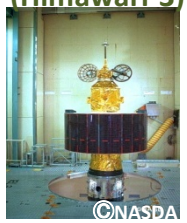
GMS (Himawari)

Jul 1977

GMS-2 (Himawari-2)

Aug 1981

GMS-3 (Himawari-3)



Aug 1984

GMS-4 (Himawari-4)

Sep 1989

GMS-5 (Himawari-5)

Mar 1995

(GOES-9)

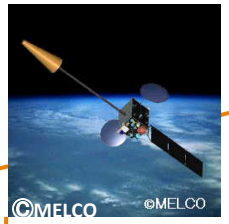
Back-up operation of GMS-5 with GOES-9 by NOAA/NESDIS from May 22, 2003 to June 28, 2005

MTSAT (Multi-functional Transport SATellite)

MTSAT-1R (Himawari-6)

Feb 2005

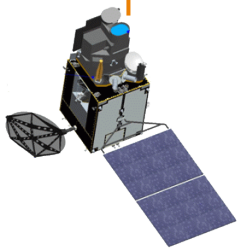
MTSAT-2 (Himawari-7)



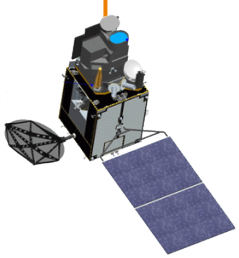
Feb 2006

Himawari-8 Himawari-9 Himawari

2014



2016



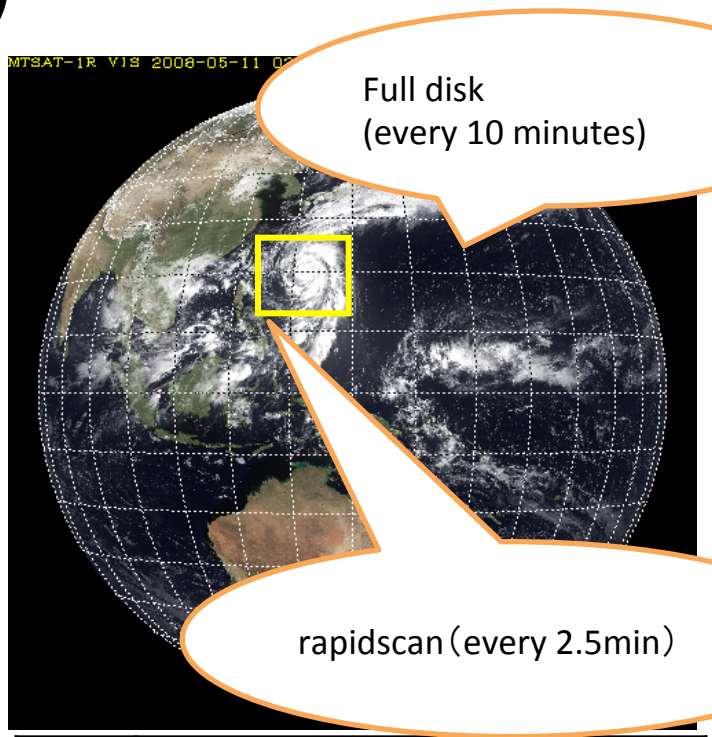
Satellite	Observation period
GMS	1978 – 1981
GMS-2	1981 – 1984
GMS-3	1984 – 1989
GMS-4	1989 – 1995
GMS-5	1995 – 2003
GOES-9	2003 – 2005
MTSAT-1R	2005 – 2010
MTSAT-2	2010 – 2015
Himawari-8	2015 – 2022
Himawari-9	2022 – 2029

Specification of Advanced Himawari Imager (AHI)

HIMAWARI-8/9

Band	Central Wavelength [μm]	Spatial Resolution
1	0.43 - 0.48	1Km
2	0.50 - 0.52	1Km
3	0.63 - 0.66	0.5Km
4	0.85 - 0.87	1Km
5	1.60 - 1.62	2Km
6	2.25 - 2.27	2Km
7	3.74 - 3.96	2Km
8	6.06 - 6.43	2Km
9	6.89 - 7.01	2Km
10	7.26 - 7.43	2Km
11	8.44 - 8.76	2Km
12	9.54 - 9.72	2Km
13	10.3 - 10.6	2Km
14	11.1- 11.3	2Km
15	12.2 - 12.5	2Km
16	13.2 - 13.4	2Km

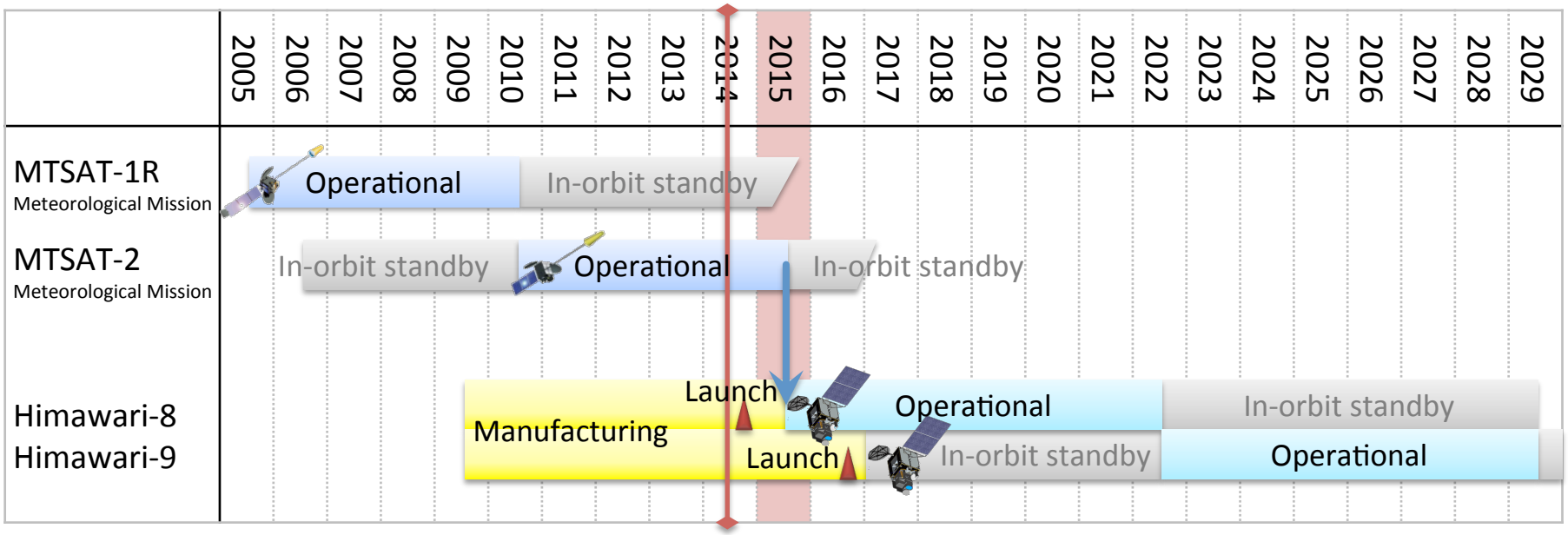
RGB



Band	Central Wavelength [μm]	Spatial Resolution
1	0.55 – 0.90	1Km
2	3.50 – 4.00	4Km
3	6.50- 7.00	4Km
4	10.3 – 11.3	4Km
5	11.5 – 12.5	4Km

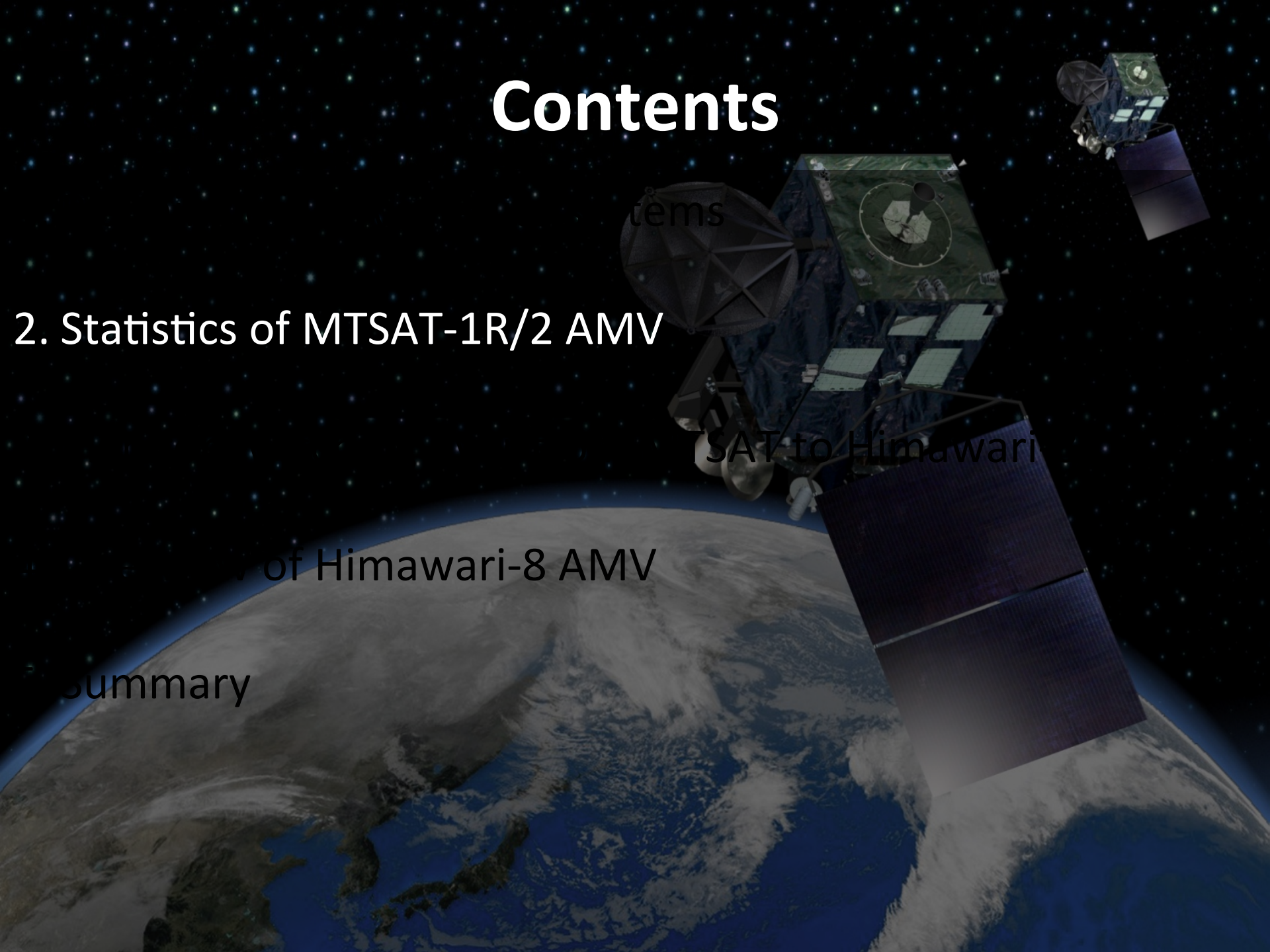
MTSAT-1R/2

Schedule for switching over from MTSAT to Himawari-8



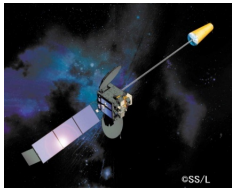
- JMA plans to launch **Himawari-8** in **2014** and begin its operation in **2015**.
  Around early July, JMA will announce the launch date of Himawari-8.
- The launch of **Himawari-9** for in-orbit standby is scheduled in **2016**.
- **Himawari-8/9** will be in operation at **140 degrees East** covering the East Asia and Western Pacific regions for 15 years.

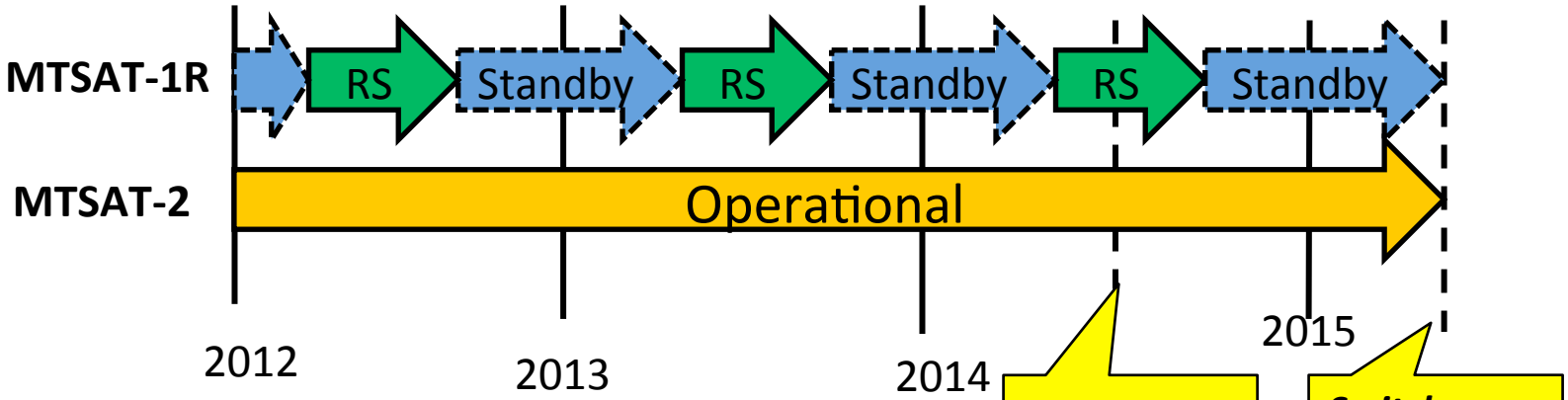
Contents



Production and Dissemination of MTSAT-operational AMV

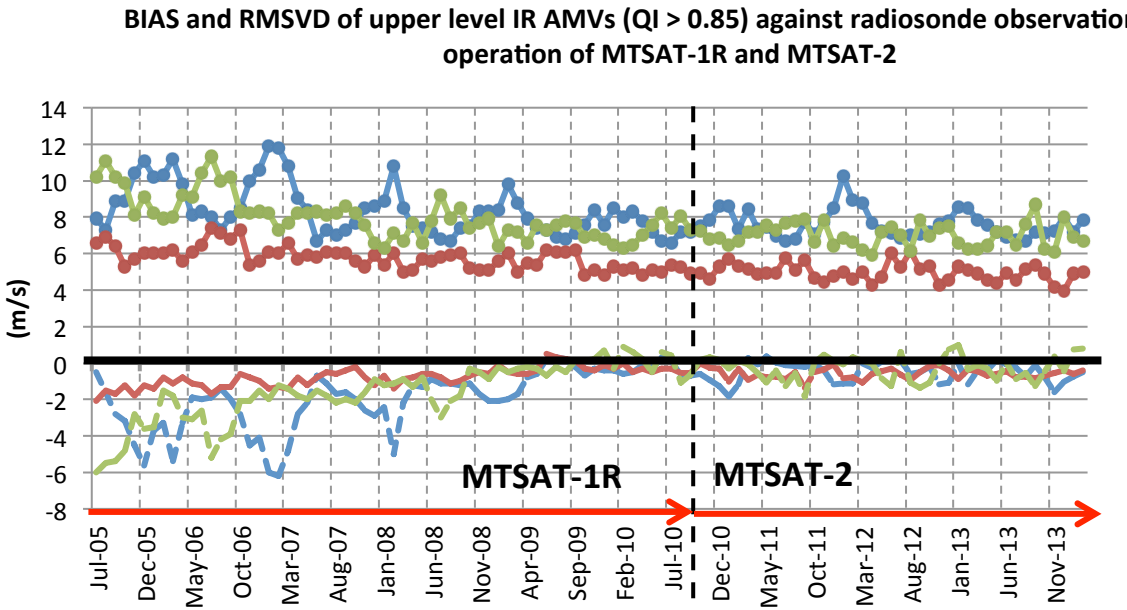
	AMV type	Level of height *	Time (UTC)	Image sector	Image interval (minutes)	Distribution
IR1	Infrared: IR (10.8 micrometer)	Upper, middle, low	00, 06, 12, 18	Full disk	15	BUFR Ver.4 via GTS
			02-05, 08-11, 14-17, 20-23	Northern Hemisphere	30	
			01, 07, 13, 19		60	
			01-05, 07-11, 13-17,19-23	Southern Hemisphere	60	
WV	Wator Vapor: WV (6.8 micrometer)	Upper, middle	00, 06, 12, 18	Full disk	15	BUFR Ver. 4 via GTS
			02-05, 08-11, 13-17, 19-23	Northern Hemisphere	30	
			01, 07, 13, 19		60	
			01-05, 07-11, 13-17,19-23	Southern Hemisphere	60	
VIS	Vissible: VIS (0.63 micrometer)	Low	00, 06	Full disk	15	BUFR Ver.4 via GTS
			02-05, 08-09, 21-23	Northern Hemisphere	30	
			01, 07		60	
			01-05, 07-09, 21-23	Southern Hemisphere	60	
IR4	Short-wave Infrared: IR4 (3.8 micrometer)	Low	12,18	Full disk	15	Internal use only
			08-11, 14-17, 20-23	Northern Hemisphere	30	
			07, 13, 19		60	
			07-11, 13-17, 19-23	Southern Hemisphere	60	

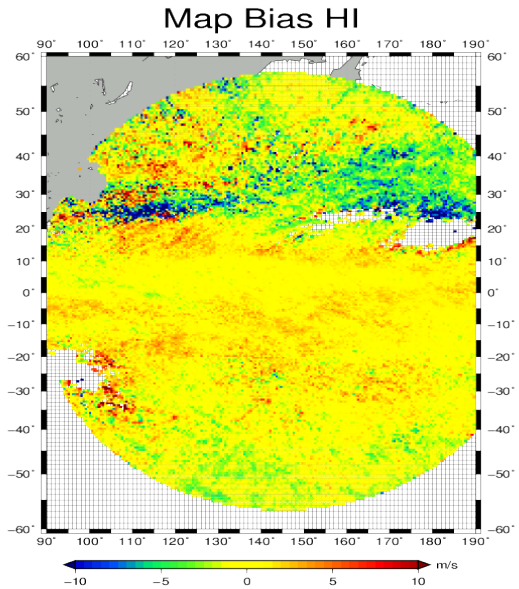




RS AMV is computed for internal use only

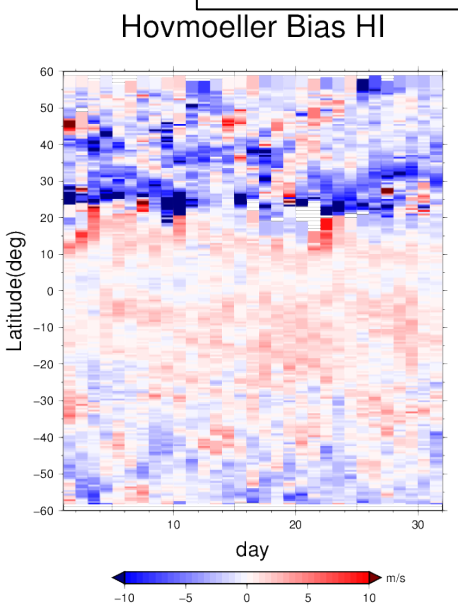
Historical statistic for Upper Level MTSAT AMV

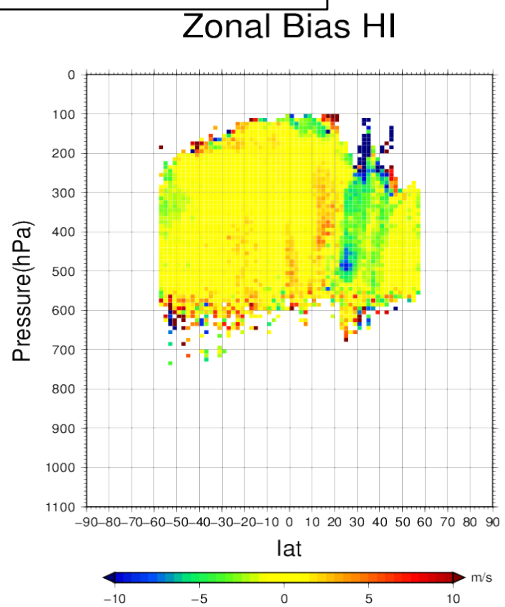




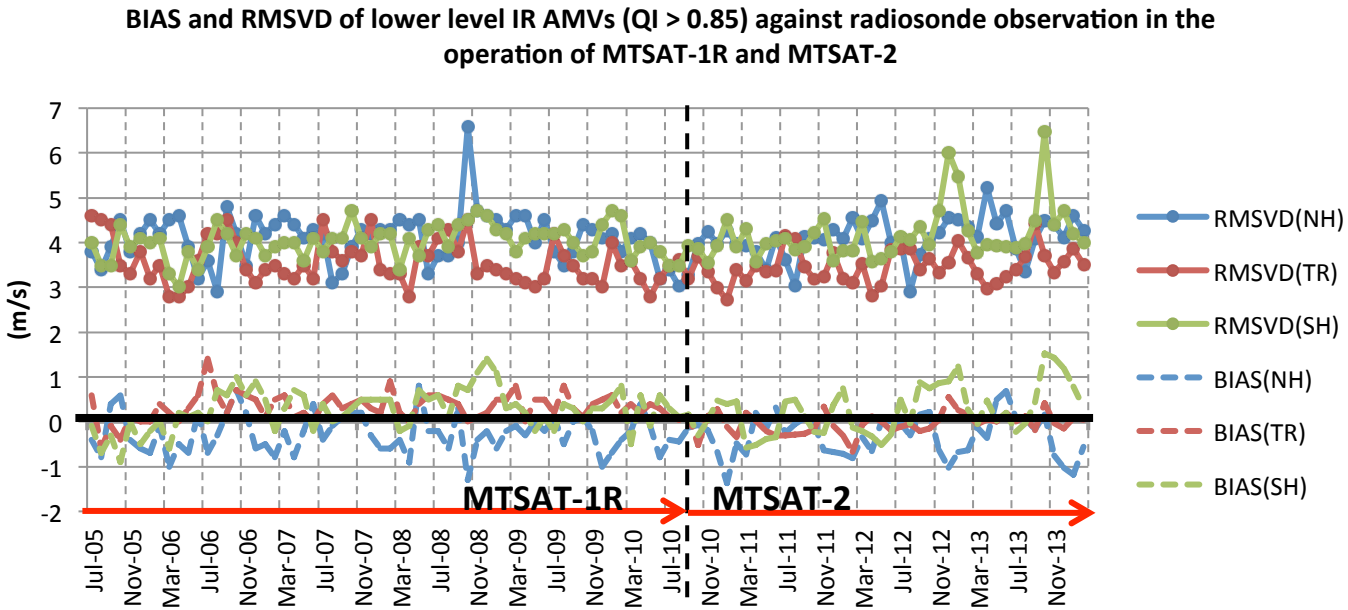
O-B statistic for Jan. 2013

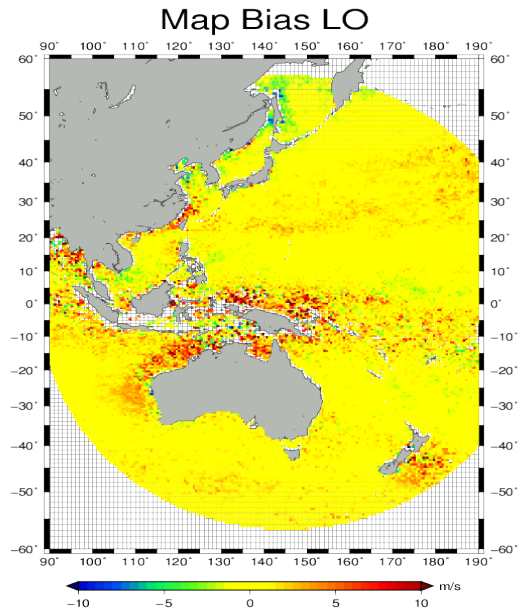
- **Negative wind speed BIAS was significantly improved by CCC and other method, but Negative BIAS still can be confirmed around jet in winter season**





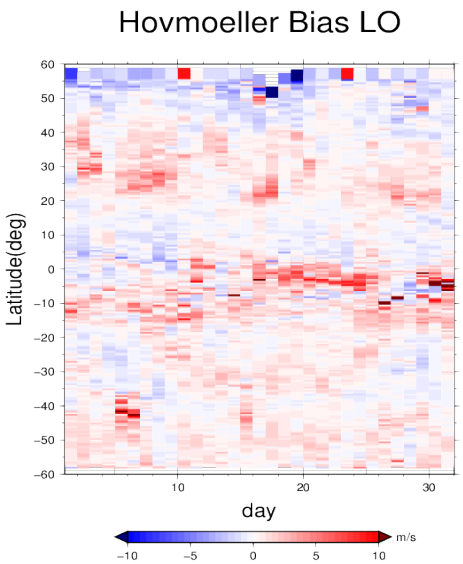
Historical statistic for Lower Level MTSAT AMV

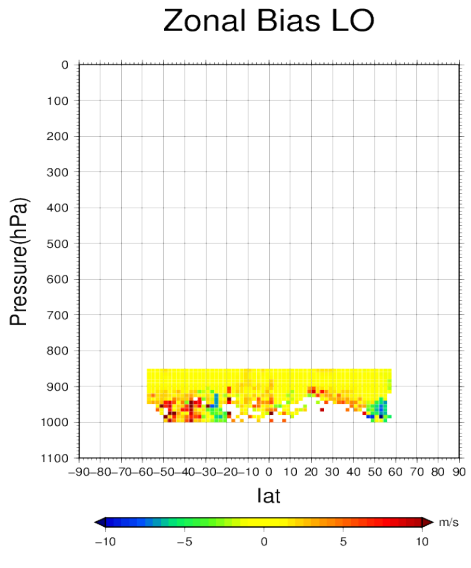




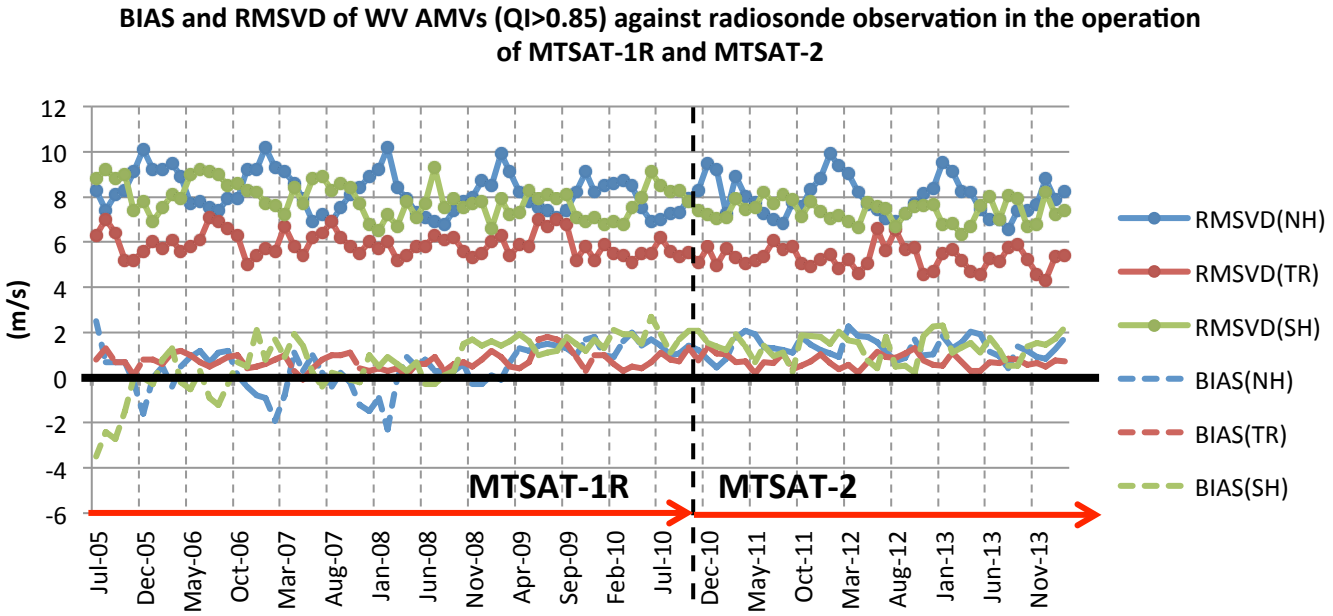
- **Positive wind speed BIAS significantly debase quality of lower level AMV over tropical area**

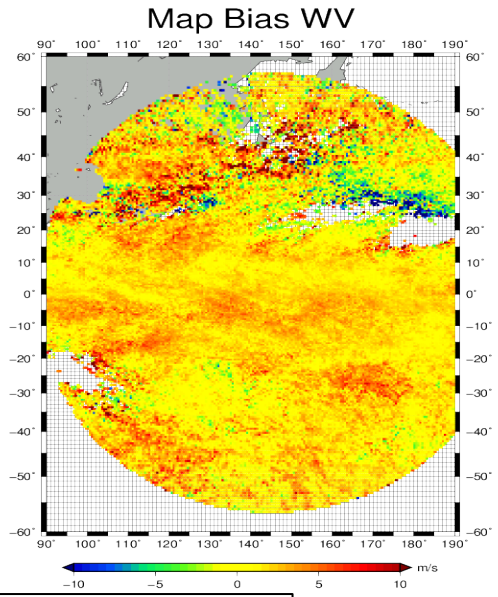
O-B statistic for Jan. 2013





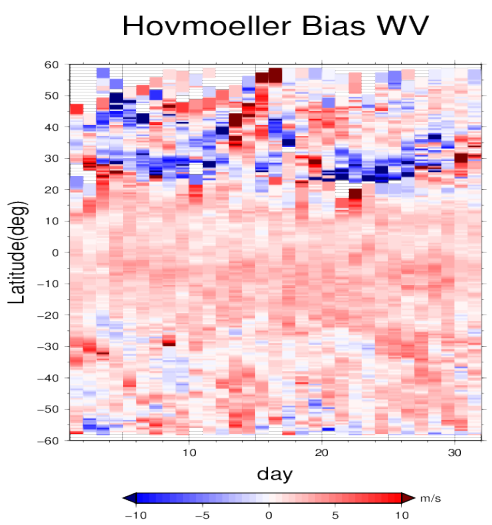
Historical statistic for WV MTSAT AMV (cloudy)

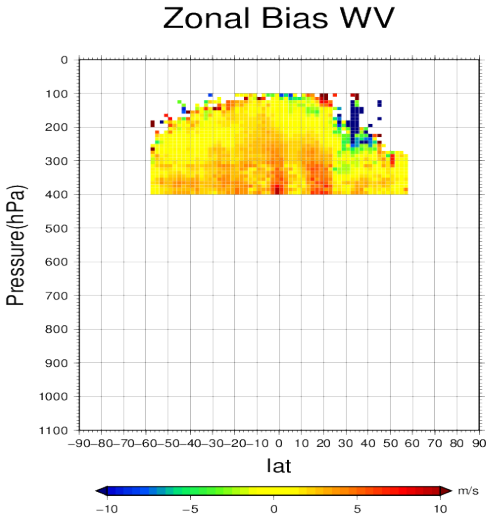




- **positive wind speed BIAS in all season globally**
- **negative wind speed BIAS around jet in winter season**

O-B statistic for Jan. 2013





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parallel dissemination via JMA FTP server

Himawari-8 AMV
for evaluation

MTSAT AMV
for backup

Operational MTSAT AMV

Operational Himawari-8 AMV

operational AMV via GTS

launch
summer 2014

April 2015
parallel dissemination

July 2015
Switchover to Himawari-8

October 2015

MTSAT

- **Produced wind**
  VIS, IR and WV
- **Dissemination frequency**
  hourly
- **Data format**
  BUFR EDITION 4

Himawari-8 ANV

- **Produced wind**
  VIS(0.64), WV(6.2,7.0,7.3) and 10.4
- **Dissemination frequency**
  hourly
- **Data format**
  BUFR EDITION 4

algorithm changes for Himawari-8 AMV

- simultaneous utilization of information
- wind vector and height are retrieved by maximizing likelihood function

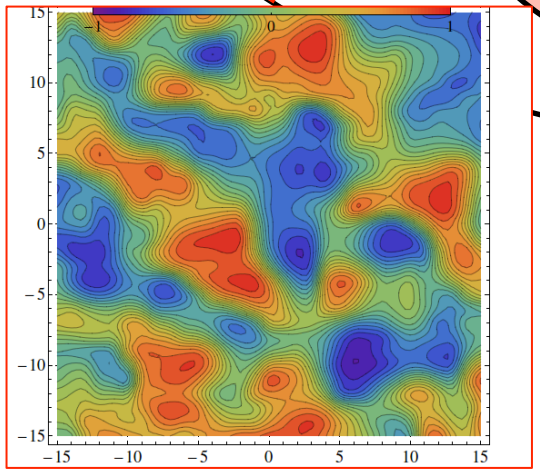
	target selection	tracking	height assignment	quality control
MTSAT AMV	cloud analysis module for MTSAT AMV	cross-correlation method	IR-WV intercept and EBBT methods	EUMETSAT QI
Himawari-8 AMV	Himawari-8 cloud mask product based on NWCSAF and goes-R algorithm	Maximum Likelihood Estimation method using multiple cross-correlation surface	Maximum Likelihood Estimation	EUMETSAT QI

improvement to tracking accuracy

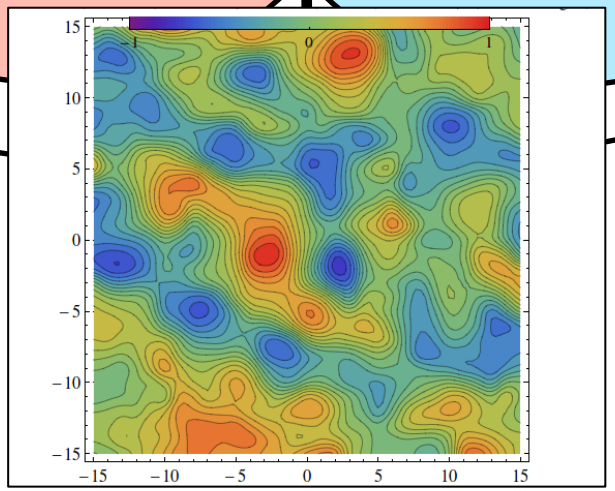
set of potential motion vector

set of
probable motion
vectors
in forward matching

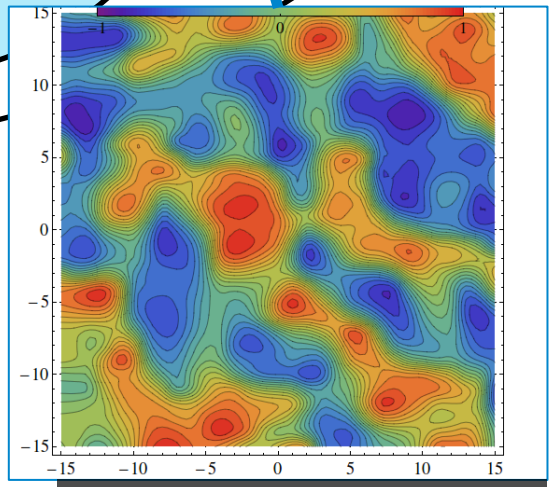
set of
probable motion
vectors
in backward matching



prior information
correlation surface from
forward matching



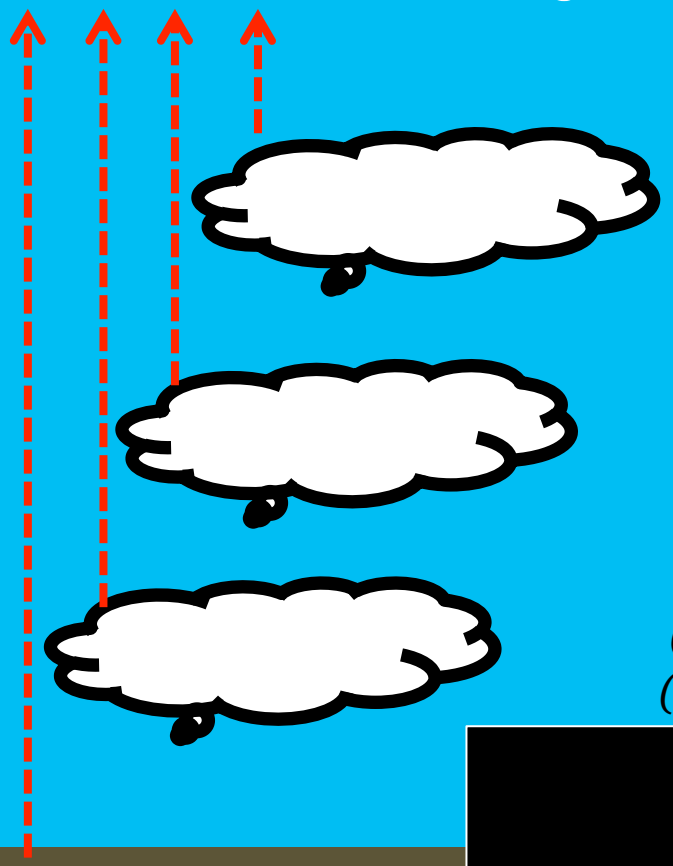
posterior information
averaged correlation surfaces



auxiliary information
correlation surface from
backward matching

optimal estimation for cloud height assignment

- To formulate forward model which gives a relationship between latent variable and observables
- Conversion from the forward model to likelihood functions
- maximizing sum of log likelihood functions

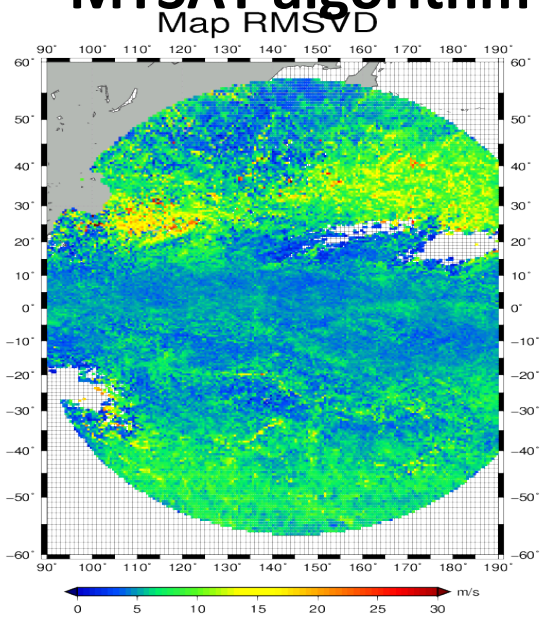


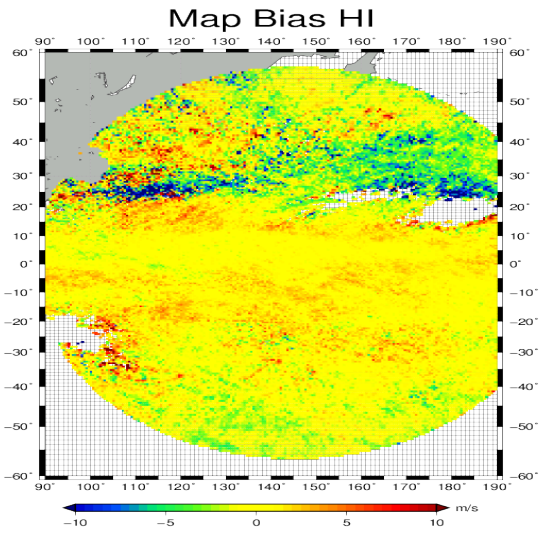
$$R(\rho\downarrow high, \rho\downarrow mid, \rho\downarrow low, h\downarrow high, h\downarrow mid, h\downarrow low) = \rho\downarrow high\ \varepsilon\downarrow high\ (ch)Rad(h\downarrow high) + \rho\downarrow mid\ \varepsilon\downarrow mid\ (ch)Rad(h\downarrow mid) + \rho\downarrow low\ \varepsilon\downarrow low\ (ch)Rad(h\downarrow low) + (1-(\rho\downarrow high+\rho\downarrow mid+\rho\downarrow low))\varepsilon\downarrow ground\ (ch)\mathrm{Rad}(\mathrm{ground})$$

[redacted]

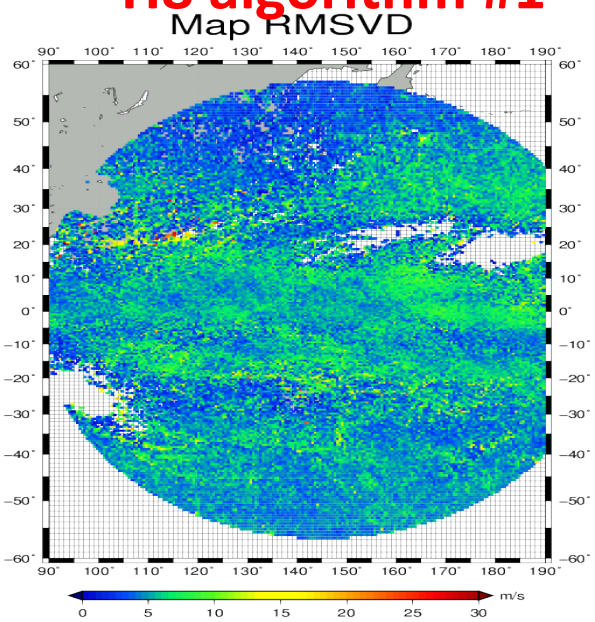
Comparison of MTSAT and Himawari-8 algorithm
IR upper level AMV on Jan. 2013

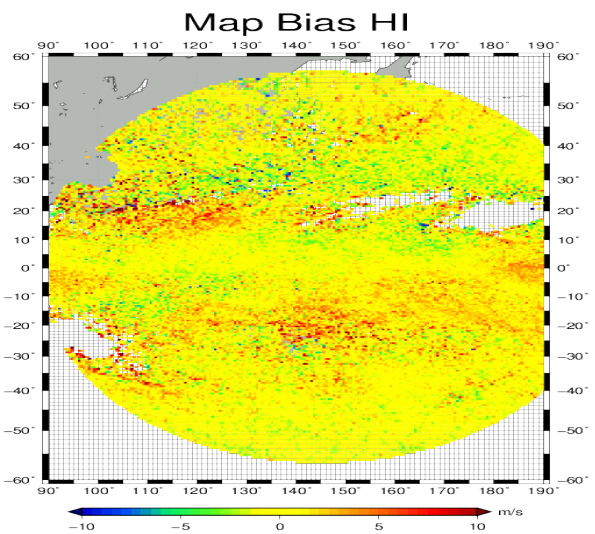
MTSAT algorithm



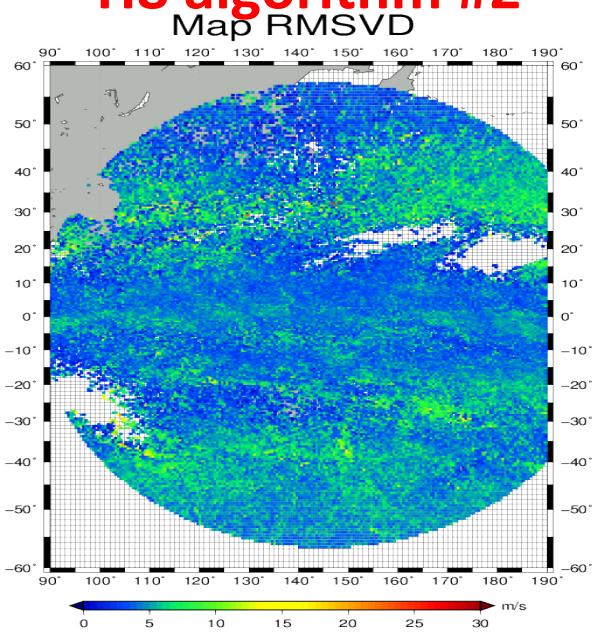


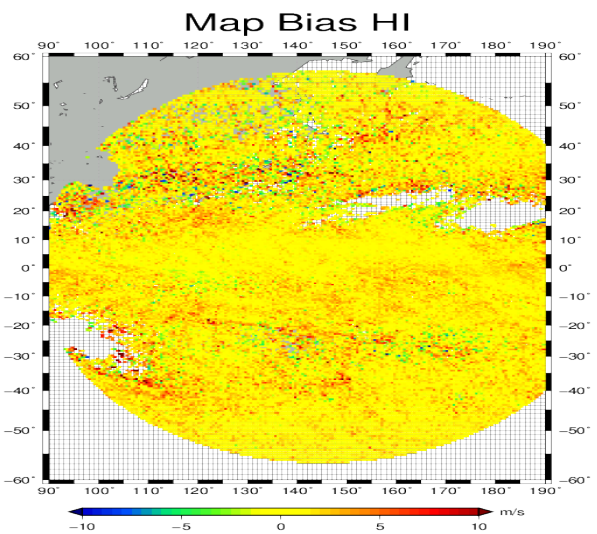
H8 algorithm #1





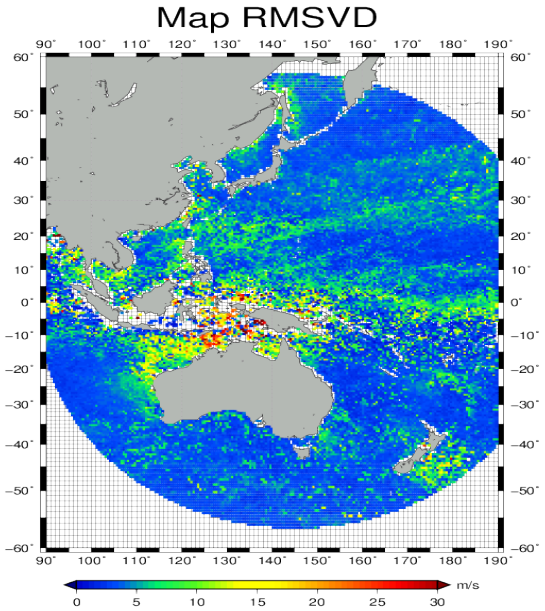
H8 algorithm #2

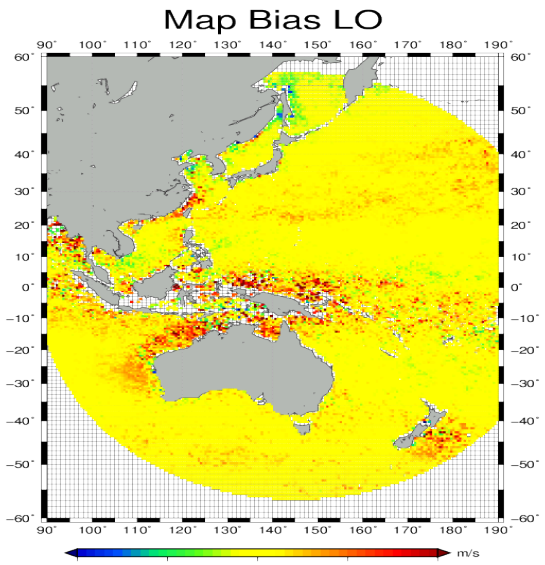




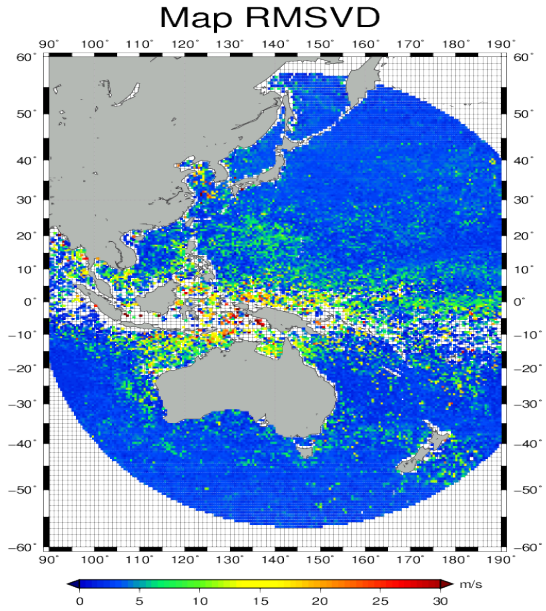
Comparison of MTSAT and Himawari-8 algorithm IR lower level AMV on Jan. 2013

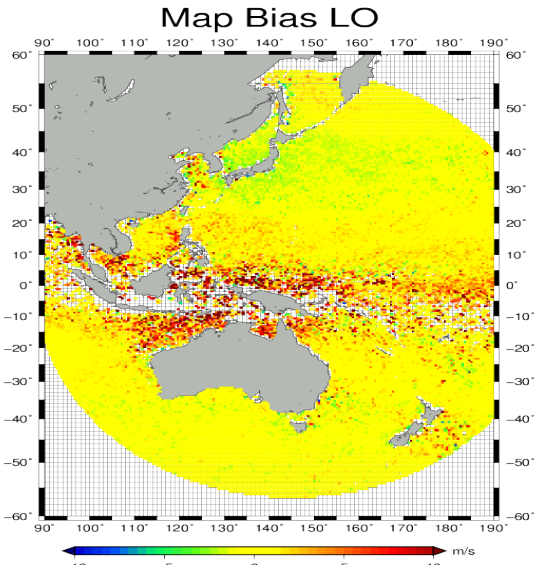
MTSAT algorithm



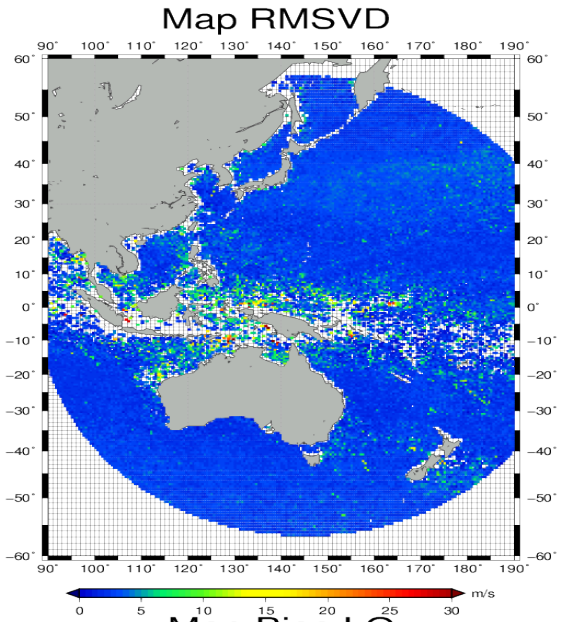


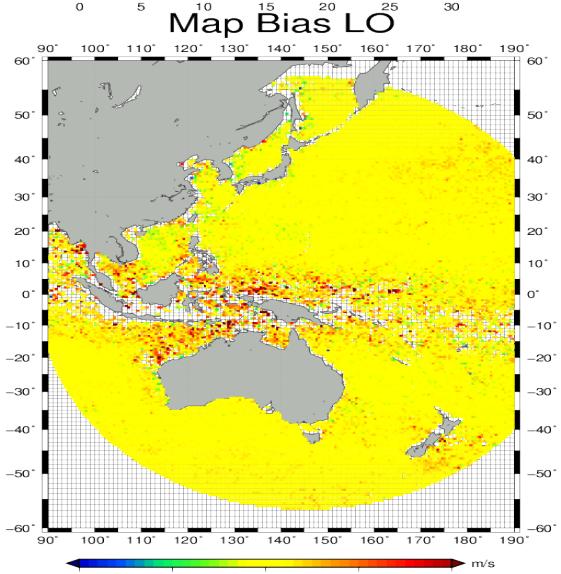
H8 algorithm #1



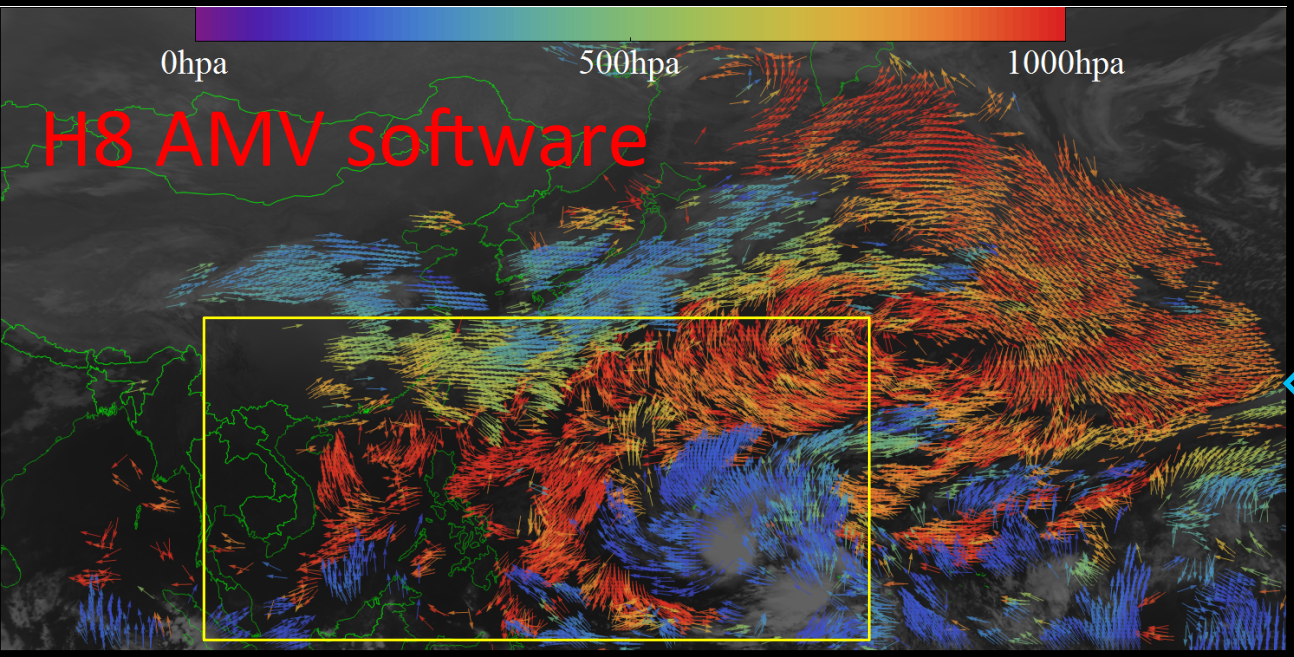


H8 algorithm #2

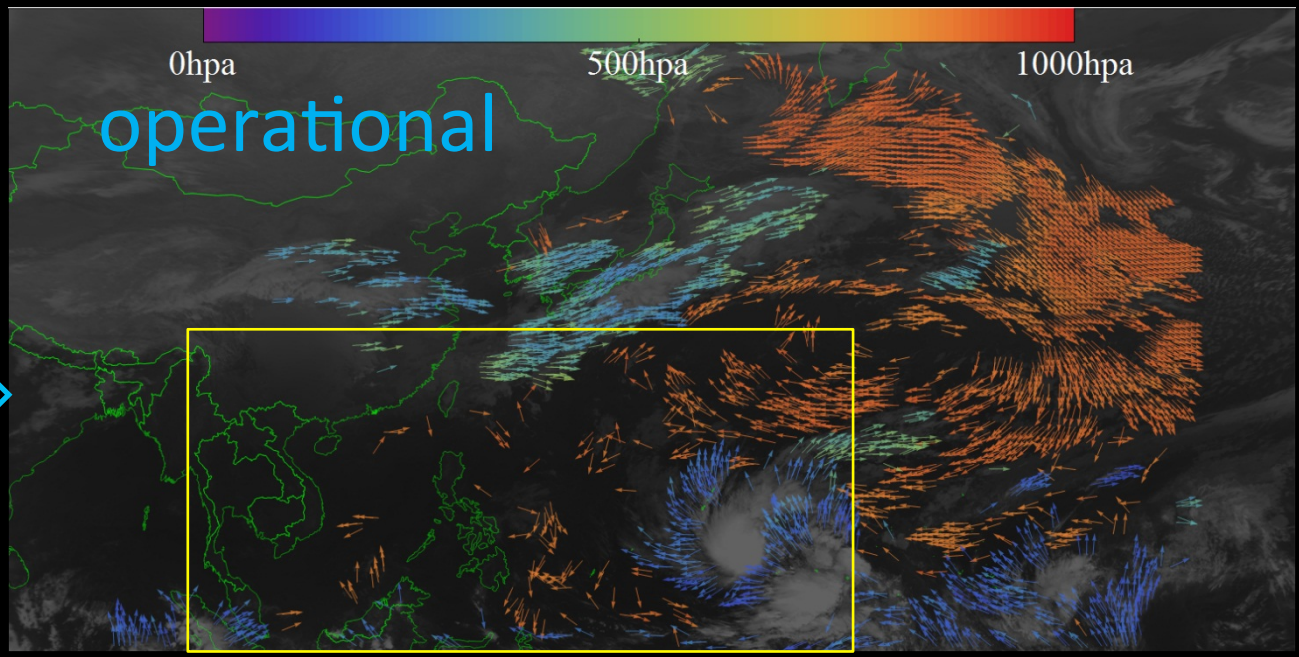




Improvement to spatial coverage

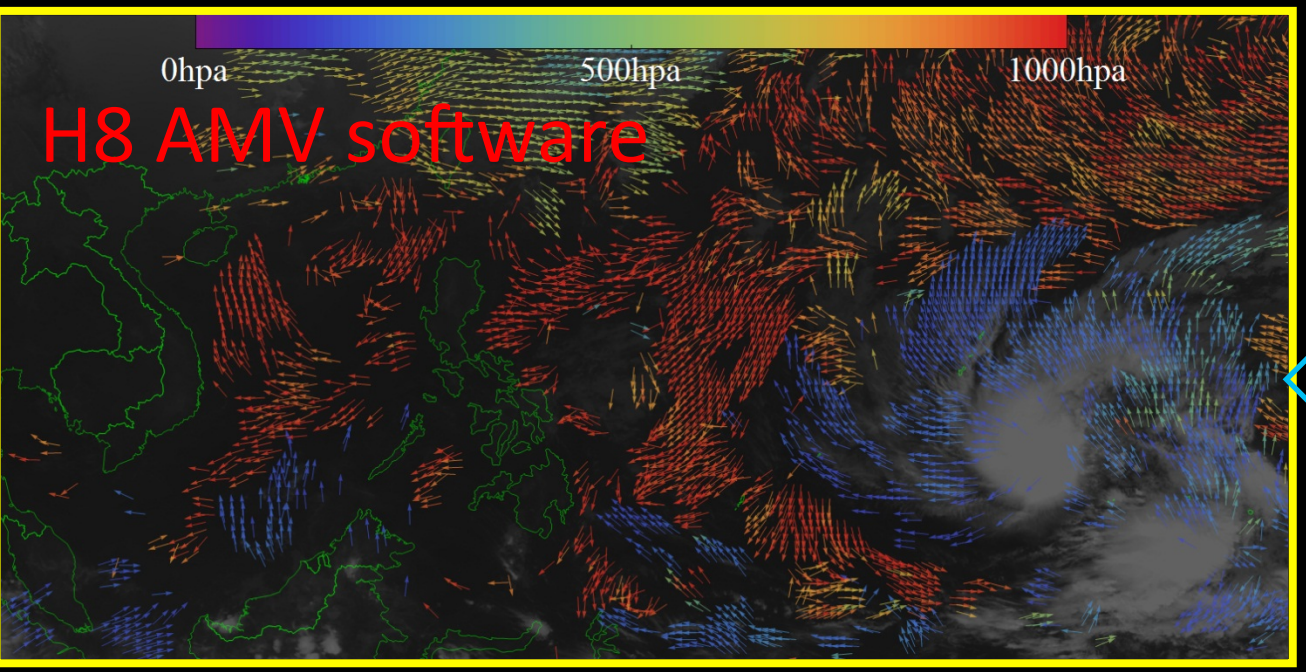


MTSAT IR AMV computed by **Himawari-8 AMV software** (QI>80) for 00UTC 02 March 2014



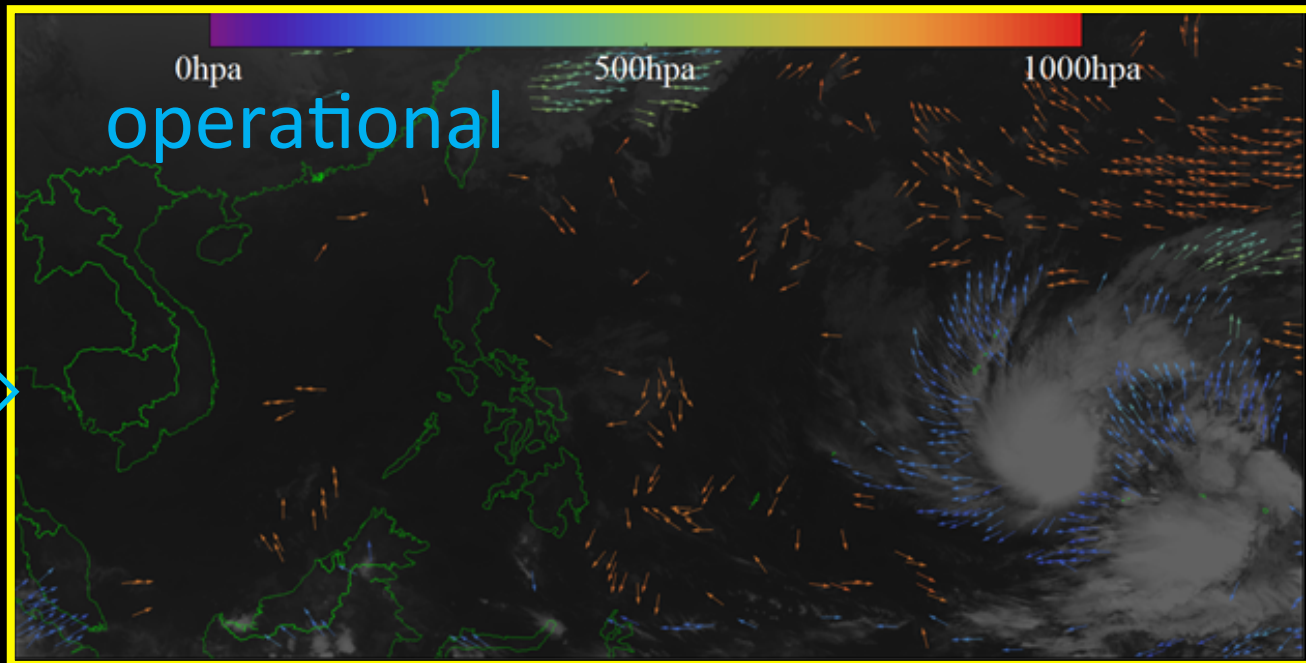
MTSAT IR AMV computed by **operational software** (QI>80) for 00UTC 02 March 2014

Improvement to spatial coverage over tropical region



MTSAT IR AMV computed by **Himawari-8 AMV software** (QI>80) for 00UTC 02 March 2014

MTSAT IR AMV computed by **operational software** (QI>80) for 00UTC 02 March 2014



Summary

- JMA will launch Himawari-8 around end of summer 2014.
- operation of Himawari-8 (and relating products) will start from July 2015.
- parallel dissemination of Himawari-8 AMV will start from April 2015 via JMA ftp server (as same as switchover from MTSAT-1R to MTSAT-2).
- statistical quality and spatial coverage of Himawari-8 AMV will significantly change from that of MTSAT AMV.