Status of and future plans for JMA's Atmospheric Motion Vectors

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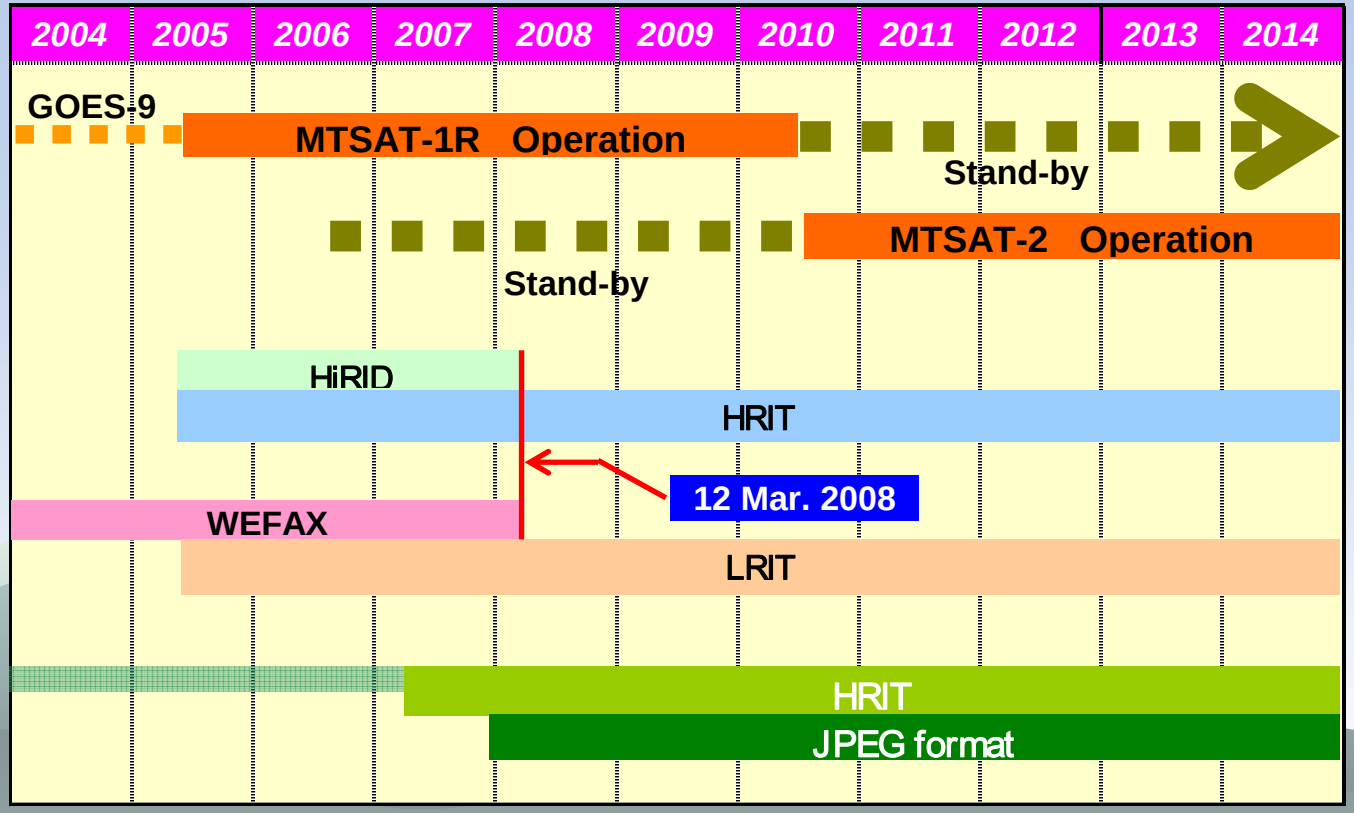
MTSAT Operation Schedule

Operational satellite

Direct broadcast services

Landline service



Specification of MTSAT-1R / JAMI

Channel	VIS	IR1	IR2	IR3 (WV)	IR4
Wavelength (micro-meter)	0.55～0.90	10.3～11.3	11.5～12.5	6.5～7.0	3.5～4.0
Resolution at Nadir (km)	1	4	4	4	4

Number of Observation / day	
Full disk	Half disk
24	32

Status of JMA's AMVs (1/2)

MTSAT-1R AMVs generated by JMA

Kind of AMVs	Level of height	Time (UTC)	Image sector	Image interval (minutes)	Distribution
Infrared (10.8 micro-meter)	Upper, middle, lower	00, 06, 12, 18	Full Disk	15	BUFR via GTS *1
	Upper, middle, lower	02-05, 08-11, 14-17, 20-23	Northern Hemisphere	30	Internal use only
	Upper, middle, lower	01,07,13,19	Northern Hemisphere	60	Internal use only
Water Vapor (6.8 micro-meter)	Upper, middle	00, 06, 12, 18	Full Disk	15	BUFR via GTS *1
	Upper, middle	02-05, 08-11, 14-17, 20-23	Northern Hemisphere	30	Internal use only
	Upper, middle	01, 07, 13, 19	Northern Hemisphere	60	Internal use only
Visible (0.63 micro-meter)	Lower	00, 06	Full Disk	15	BUFR via GTS *1
	Lower	02-05, 08, 09 21-23	Northern Hemisphere	30	Internal use only
	Lower	01, 07	Northern Hemisphere	60	Internal use only
3.8 micro-meter *2	Lower	12, 18	Full Disk	15	Internal use only
	Lower	08-11, 14-17, 20-23	Northern Hemisphere	30	Internal use only
	Lower	13, 19	Northern Hemisphere	60	Internal use only

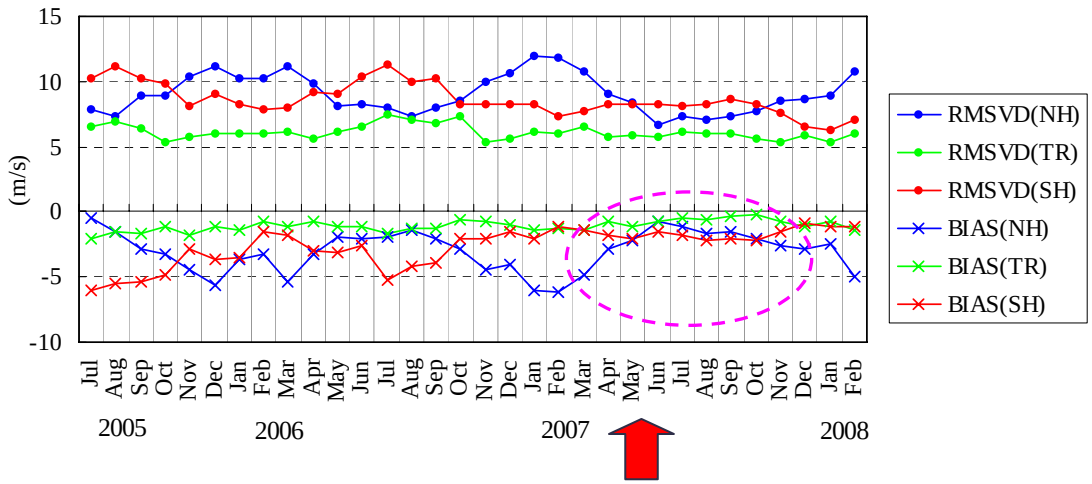
***1 JMA terminated SATOB at 06UTC on 1 April 2008**

***2 JMA started to generate 3.8 micro-meter AMVs in operation on 25 March 2008**

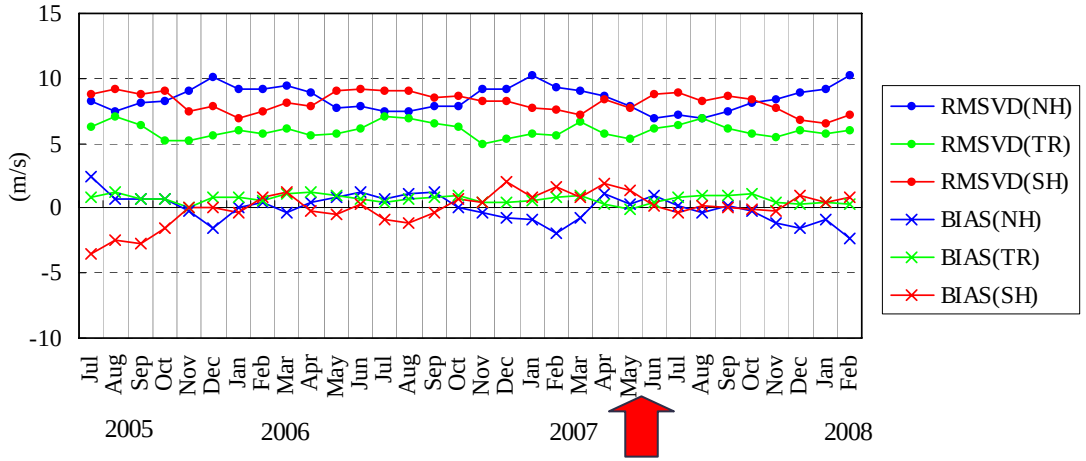
Status of JMA's AMVs (2/2)

Monthly statistics of AMVs (QI>0.85) against sonde observations

Upper-height-level (above 400 hPa) IR AMVs



Cloudy-region WV AMVs (above 400 hPa)



New height assignment scheme was implemented on 30 May 2007

Blue: Northern hemisphere(20-50N)

Green: Tropics(20S-20N)

Red: Southern hemisphere(50-20S)

What change for IR AMVs?

Slow BIAS after the introduction of new scheme is smaller than that before, in particular, over southern hemisphere in winter (inside pink circle)

What change for WV AMVs?

Quality is not significantly changed between before and after the introduction of new height assignment scheme.

New height assignment scheme since 30 May 2007 (1/4)

New height assignment scheme is applied to upper and middle height-level (above 700 hPa) IR AMVs and cloudy-region WV AMVs since 06UTC 30 May 2007.

(1) Improvement of height correction procedure for semi-transparent cloud

In the procedure of H2O-IRW intercept method (Nieman et al., 1993) to correct semi-transparent cloud radiances, opaque cloud radiances of IR and WV channels simulated by using Radiative Transfer Model (RTM) is newly corrected in accordance with observed IR and WV radiances.

(2) Use of the most frequent cloud height level

AMV is newly assigned to the most frequent cloud height of height-histogram accumulated in 50-hPa intervals (In previous scheme, heights of 0.1 and 10 % coldest pixel are used for IR AMVs and cloudy-region WV AMVs, respectively).

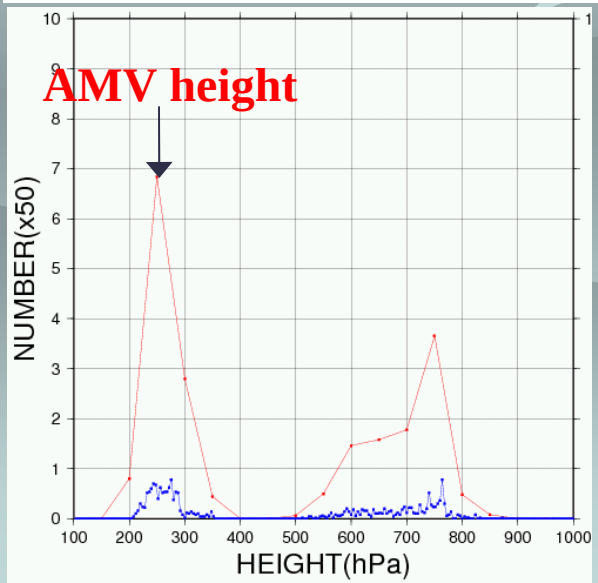


***Figure 1*: Example of height-histogram for an AMV**

Blue: Histogram accumulated in 4-hPa height intervals

Red : Histogram accumulated in 50-hPa height intervals

New height assignment scheme since 30 May 2007 (2/4)

Comparison between new AMVs and previous AMVs

Monthly statistics of AMVs (QI>0.85) against sonde observation

Statistics for *May 2007*

IR AMVs (above 400 hPa)

AMV (QI>0.85) Statistics	NH (50N - 20N)		TR (20N - 20S)		SH (20S - 50S)	
against sonde wind	New	Previous	New	Previous	New	Previous
RMSVD (m/s)	7.39	8.50	5.11	5.96	7.29	8.40
BIAS (m/s)	-1.47	-2.22	-0.78	-1.20	-0.80	-2.11
Number of collocated AMVs	11283	10530	3510	2438	2163	2014
Number of AMVs	52377	53123	36913	29325	39672	39632

IR AMVs (700 to 400 hPa)

AMV (QI>0.85) Statistics	NH (50N - 20N)		TR (20N - 20S)		SH (20S - 50S)	
against sonde wind	New	Previous	New	Previous	New	Previous
RMSVD (m/s)	6.36	7.50	3.84	4.56	6.41	7.43
BIAS (m/s)	-1.02	-1.20	-0.50	-1.74	-0.76	-1.68
Number of collocated AMVs	1090	475	115	56	392	212
Number of AMVs	5854	3093	1669	840	8836	5962

Cloudy-region WV AMVs (above 400 hPa)

AMV (QI>0.85) Statistics	NH (50N - 20N)		TR (20N - 20S)		SH (20S - 50S)	
against sonde wind	New	Previous	New	Previous	New	Previous
RMSVD (m/s)	7.40	7.95	5.44	5.53	7.17	7.79
BIAS (m/s)	0.21	0.36	0.27	-0.06	1.17	1.25
Number of collocated AMVs	25321	14214	5836	1438	2940	1222
Number of AMVs	91495	56982	53801	18708	52777	27196

What difference ?

BIAS and RMSVD are improved by introducing new height assignment scheme.

The number of new AMVs is larger than that of previous AMVs at middle height-level.

What difference ?

The number of new AMVs is larger than that of previous AMVs.

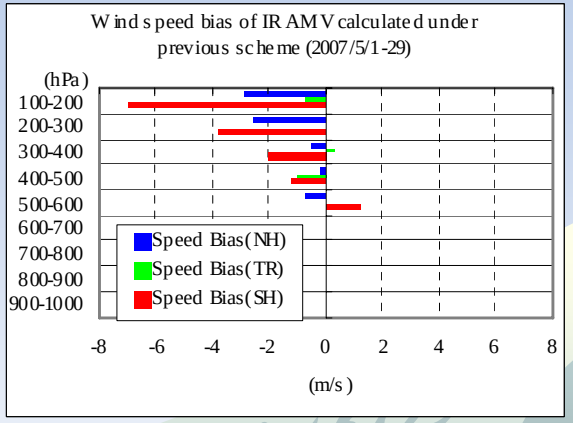
New height assignment scheme since 30 May 2007 (3/4)

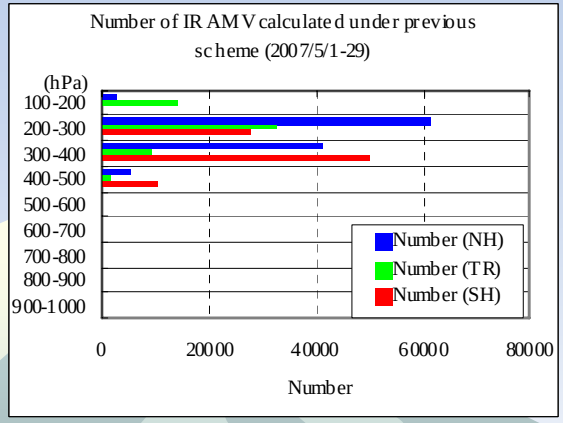
Comparison between new AMVs and previous AMVs

Monthly statistics of AMVs against JMA's NWP first-guess at each height-level

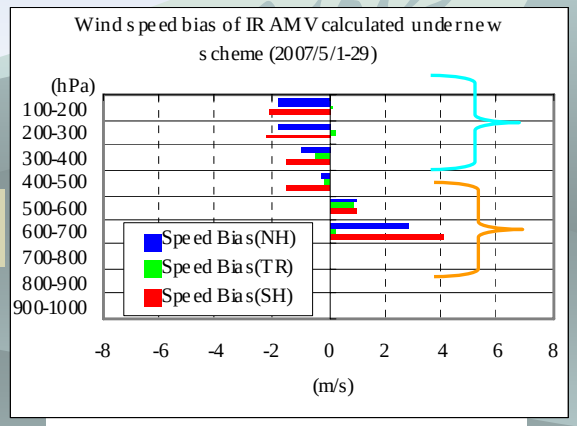
IR AMVs (above 700 hPa) (QI>0.85), *May 2007*

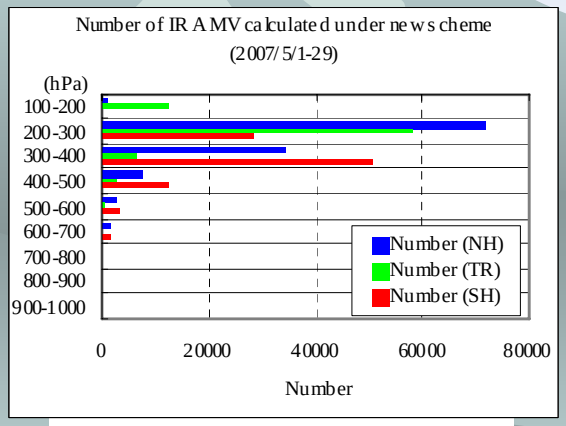
Previous





New





BIAS | **Number**

Blue: Northern hemisphere (50-20N)

Green:Tropics (20S-20N)

Red: Southern hemisphere(50-20S)

1) Between 100 and 400 hPa, slow BIAS of new AMVs is much smaller than that of previous AMVs.

2) Between 500 and 700 hPa, fast BIAS is newly found for new AMVs. → Parts of upper height-level AMVs are erroneously assigned to lower level.

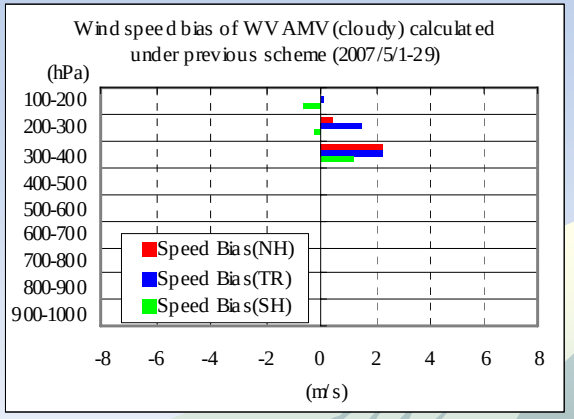
New height assignment scheme since 30 May 2007 (4/4)

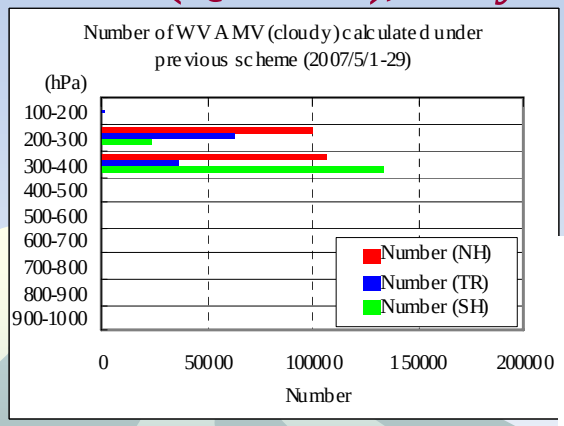
Comparison between new AMVs and previous AMVs

Monthly statistics of AMVs against JMA's NWP first-guess at each height-level

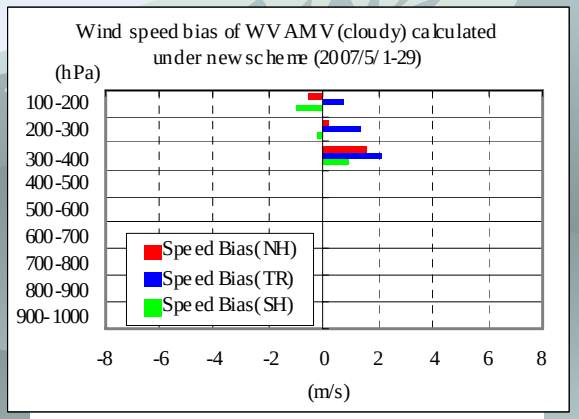
Cloudy-region WV AMVs (QI>0.85), *May 2007*

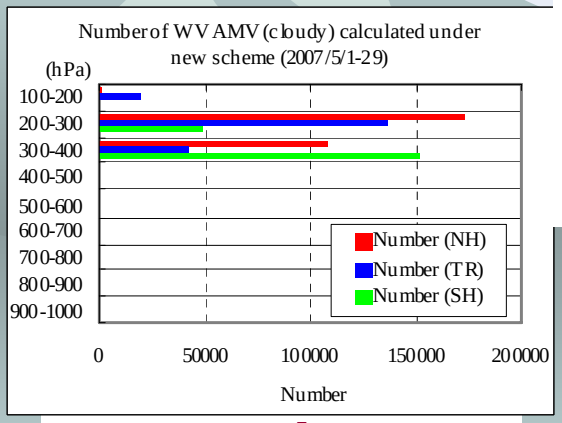
Previous





New





BIAS **Number**

Blue: Northern hemisphere (20-50N)

Green:Tropics (20S-20N)

Red: Southern hemisphere (50-20S)

1) BIAS of new AMVs is nearly same as that of previous AMVs.

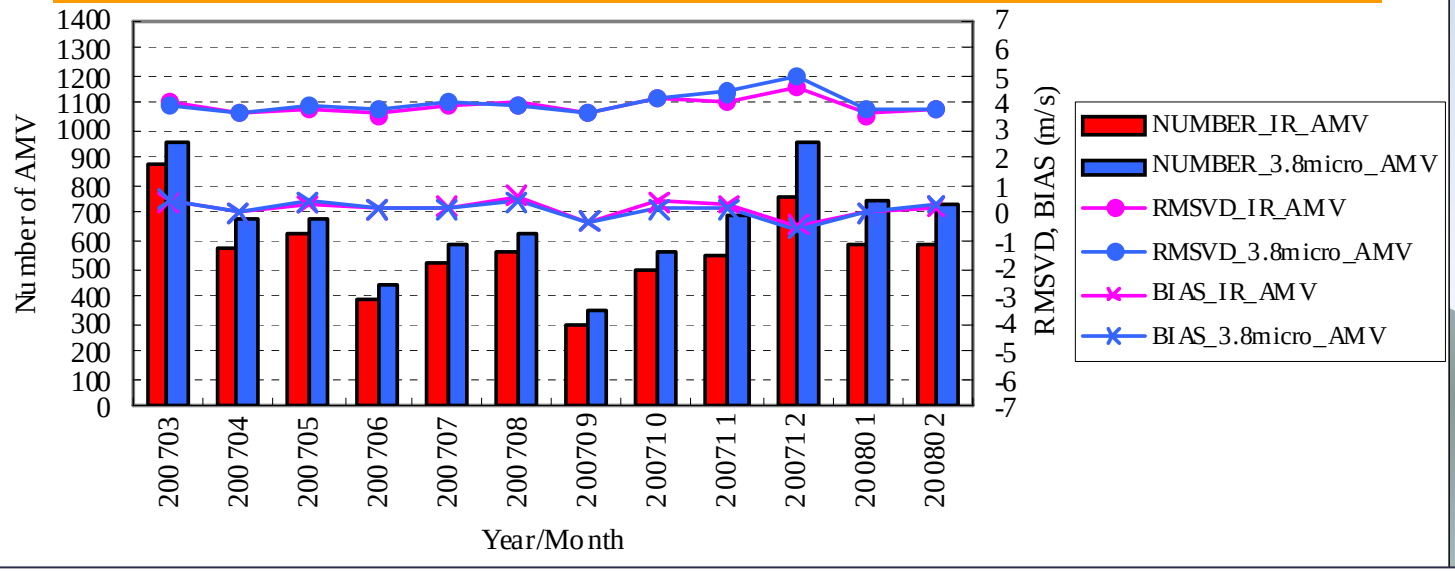
2) The number of new AMVs is larger than that of previous AMVs. → This feature means the quality of new AMVs is generally higher than that of previous AMVs.

Current Activities (1/5)

(1) Introduction of 3.8 micro-meter AMVs

3.8 micro-meter images of MTSAT-1R are used for tracking lower-height-level clouds at nighttime. JMA started to use 3.8 micro-meter AMVs in JMA's NWP on 25 March 2008 (Yamashita, 2008)

Monthly statistics of AMVs (QI>0.85) against sonde observations at 12UTC from March 2007 to February 2008



The number of high-quality (QI>0.85) 3.8 micro-meter AMVs is approximately 10% larger than that of lower-height-level IR AMVs.

3.8 micro-meter AMVs lead to the increase of the available lower-height-level wind data at nighttime

Current Activities (2/5)

(2) Computation of AMVs from Rapid-Scan Images of MTSAT-2

AMVs computed by using the images of currently stand-by MTSAT-2 at several time intervals (15, 7, 4-minutes) are expected to contribute to T-PARC (Thorpex- Pacific Asian Regional Campaign) study scheduled in the summer of 2008.

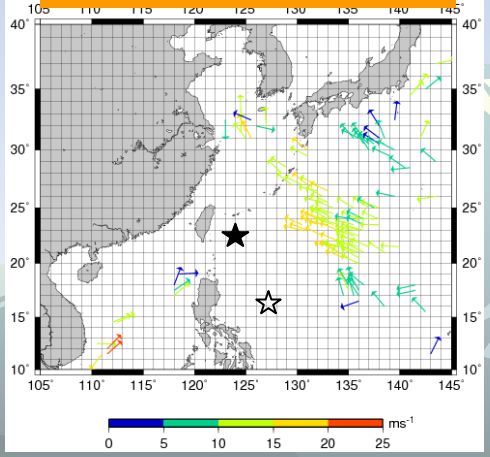
What difference between 4-min AMVs and 15-min AMVs ?

Wind vectors

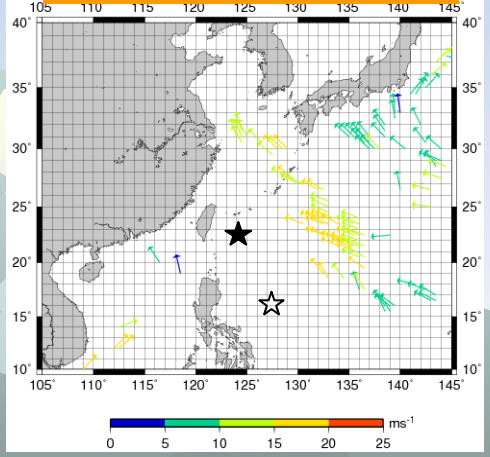
MTSAT-2 images were experimentally captured on 7 August 2007.

QI (with forecast check)

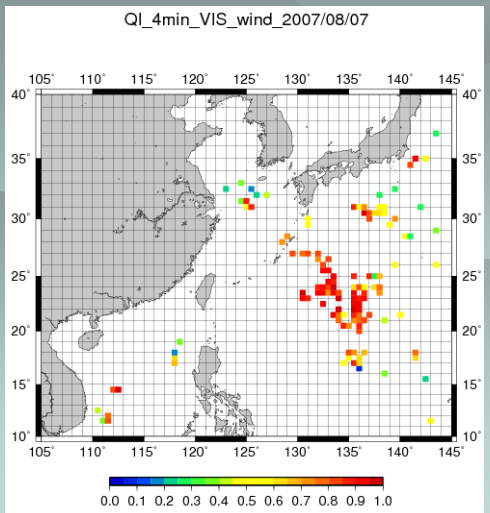
4-min VIS AMVs

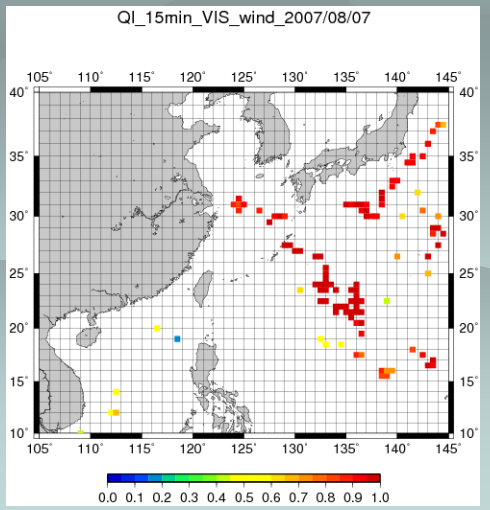


15-min VIS AMVs



The vector distributions of 4-min AMVs and 15-min AMVs are almost same.





QIs of 4-min AMVs are generally smaller than those of 15-min AMVs

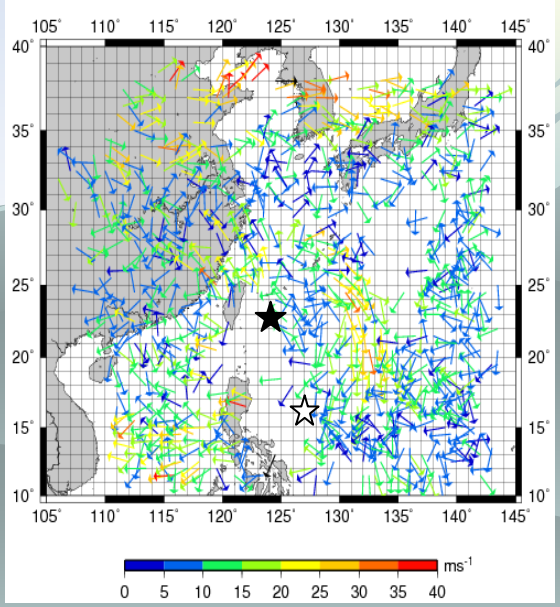
Current Activities (3/5)

(2) Computation of AMVs from Rapid-Scan Images of MTSAT-2

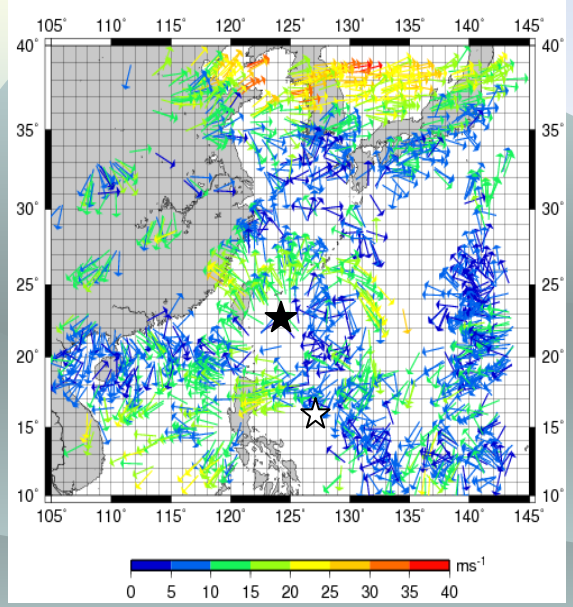
For IR and WV AMVs, 4-min and 7-min AMVs have generally lower quality than 15-min AMVs, in terms of number and QI., due to the lower image-resolutions.

JMA considers "***optical-flow***" method is another available feature-tracking method.

By cross-correlation matching



By "*optical-flow*" method



Feature tracking by "***optical-flow***" could give larger number of high-quality AMVs than cross-correlation matching.

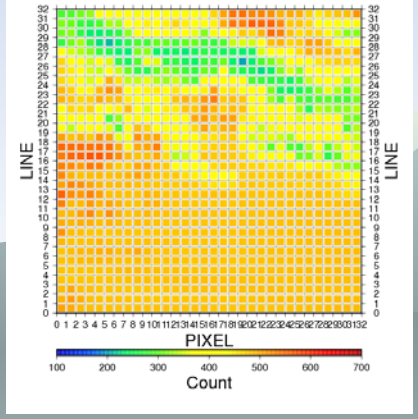
Wind vectors of WV AMVs computed by using MTSAT-2 images at 4-minute intervals between 0500 UTC and 0530 UTC on 7 August 2007. Black Star: T0706, White star:T0707

Current Activities (4/5)

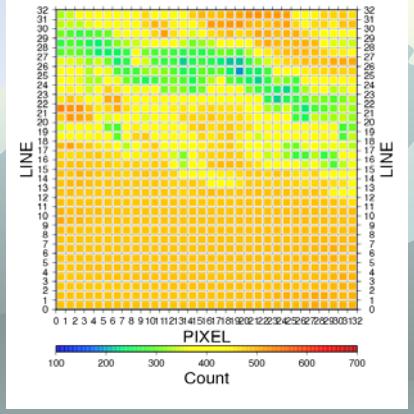
(3) Development of follow-on height assignment scheme

JMA has been developing a follow-on height assignment scheme directly linked to feature-tracking in collaboration with EUMETSAT since 2006. Some experiments show using the information on feature-tracking can reduce fast BIAS of JMA's current IR AMVs at middle-height-level (500-700 hPa), (Oyama et al. (2008)).

Radiance of first image

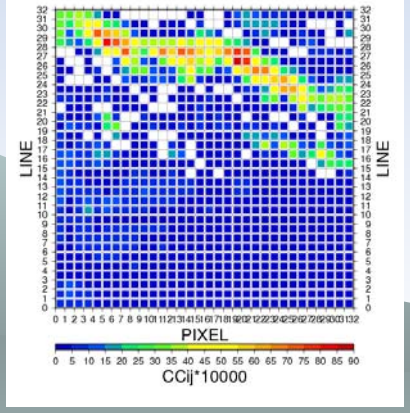


Radiance of second image



Derive each pixel contribution under using cross-correlation matching

Contribution (CCij)



(4) Response to Recommendation 34.15

In response to CGMS Recommendation 34.15 on a comparison of the operational algorithms for the AMV height assignment, JMA calculated AMVs using METEOSAT-8 0.8, 10.8 and 6.2 micro-meter images at 1200, 1215 and 1230 UTC on 18 August 2006 by the current JMA's algorithm.

Current Activities (5/5)

(5) Reprocess of AMVs using past satellite images

Reprocessed AMVs by using GMS images were used in 25-year Japanese long-term ReAnalysis (JRA-25) (Onogi et al., 2007). JMA/MSC plans to reprocess AMVs by using GMS-3 to 5, GOES-9, and MTSAT-1R images in using available best height assignment scheme again.

Preliminary comparison between AMVs by current and previous schemes

GMS-5 AMVs for *January 2000*

IR AMVs (above 400 hPa)

AMV (QI>0.85) Statistics	NH (50N - 20N)		TR (20N - 20S)		SH (20S - 50S)	
against sonde wind	Current	Previous	Current	Previous	Current	Previous
RMSVD (m/s)	10.27	13.34	5.31	5.96	10.47	11.83
BIAS (m/s)	-3.14	-7.16	-0.58	-0.54	-1.37	-2.13
Number of collocated AMVs	727	3073	5167	4801	2159	3716

IR AMVs (700 to 400 hPa)

AMV (QI>0.85) Statistics	NH (50N - 20N)		TR (20N - 20S)		SH (20S - 50S)	
against sonde wind	Current	Previous	Current	Previous	Current	Previous
RMSVD (m/s)	9.13	11.76	5.01	7.29	7.41	7.67
BIAS (m/s)	-0.43	-5.28	-1.02	-1.43	0.61	-1.36
Number of collocated AMVs	3089	1609	201	108	615	299

Cloudy-region WV AMVs (above 400 hPa)

AMV (QI>0.85) Statistics	NH (50N - 20N)		TR (20N - 20S)		SH (20S - 50S)	
against sonde wind	Current	Previous	Current	Previous	Current	Previous
RMSVD (m/s)	10.30	10.64	5.38	5.72	10.48	11.66
BIAS (m/s)	-1.89	-1.99	0.38	0.79	-0.05	0.87
Number of collocated AMVs	1220	2660	6803	3242	2772	2633

Quality of AMVs could be improved by introducing current height assignment scheme into AMV reprocessing !

Summary and future plans (1/2)

Summary

1) JMA introduced new height assignment scheme into upper and middle height-level IR AMVs and cloudy-region WV AMVs on 30 May 2007. The AMV qualities are improved. Particularly, slow BIAS of IR AMVs over middle latitudes are reduced, and the number of high-quality cloudy-region WV AMVs is increased.

2) 3.8 micro-meter AMVs was introduced in operation on 25 March 2008. The 3.8 micro-meter AMVs will contribute to increasing available low-height-level AMVs at nighttime.

3) In response to Recommendation 34.15, JMA calculated AMVs using METEOSAT-8 0.8, 10.8 and 6.2 micro-meter images by the current JMA's AMV computation scheme.

Summary and future plans (2/2)

Future plans

1) JMA will compute MTSAT-2 AMVs by using best parameters (template size etc.) to contribute to T-PARC study. JMA considers "***optical-flow***" method is another available tracking scheme in using images at shorter time intervals.

2) In the future, JMA plans to introduce a follow-on height assignment scheme for upper and middle height-level IR AMVs in operation.

3) JMA plans to reprocess AMVs using the images of past geostationary satellites by using available best height assignment scheme.

Thank you for your attentions !

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