Status of operational AMVs from FY-2 satellites since the 11th winds workshop

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Content of talk:

- Current FY-2 satellites status and planned configurations
- Current status of CMA winds
- Changes in operational system since last winds workshop
- Historical dataset reprocessing plan

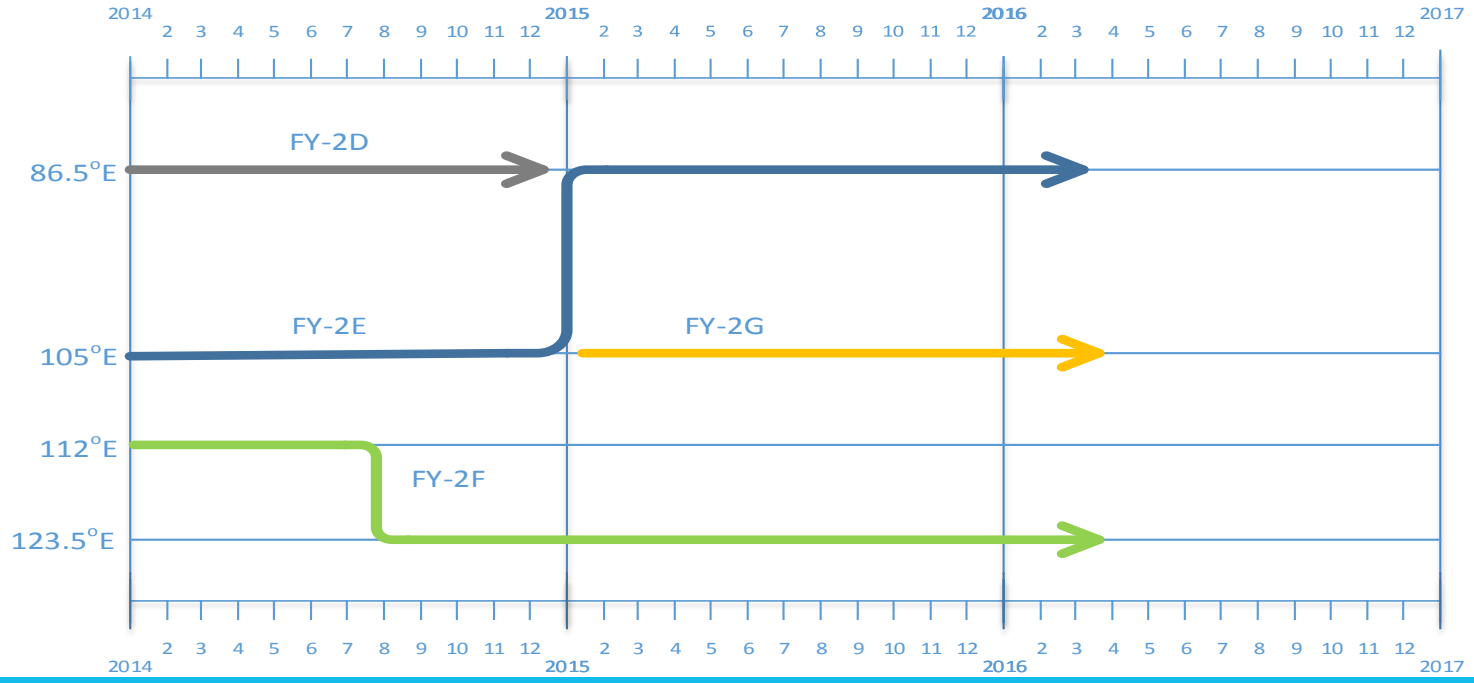
FY-2 Satellite Operations

- Since the 11th wind workshop, FY-2E, FY-2D and FY-2F are both in operation.
- FY-2E at 105˚E → Prime mission.
- FY-2D at 86.5˚E → Prime mission.
- FY-2F at 112˚E → Backup to FY-2E and rapid scan .

Product	Satellite	Nadir longitude	Product times
Infrared and Water Vapour Winds	FY-2E	105˚E	Every 6h 00:00,06:00,12:00,18:00(UTC)
Infrared and Water Vapour Winds	FY-2D	86.5˚E	Every 6h 03:00,09:00,15:00,21:00(UTC)
Infrared and Water Vapour Winds	FY-2F	112˚E	Every 6h (not continuous) 03:00,09:00,15:00,21:00(UTC)

FY-2 Satellite Operations Planning

- FY-2G will be launched in Dec. 2014 and operate at 105˚E.
- FY-2E will replace FY-2D at 86.5˚E .
- FY-2F will drift to 123.5˚E in Aug. 2014.



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Current status of CMA winds

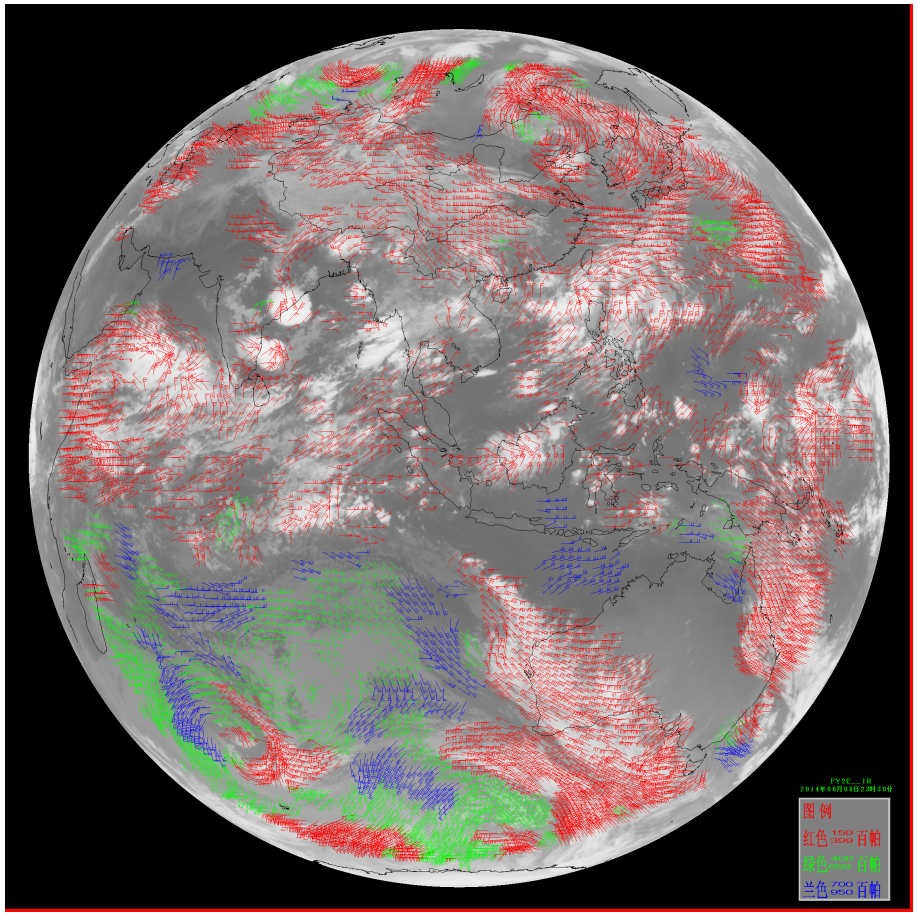
- Since the 11th wind workshop, infrared (IR) and water vapor (WV) channel AMVs derivations are performed for both FY-2E and FY-2D.
- FY-2E and FY-2D AMVs passed quality control are transmitted through GTS in BURF code.
- FY-2F AMVs are derived except in RSS and did not distribute through GTS.

Product	Satellite	Nadir longitude	Product times
Infrared and Water Vapour Winds	FY-2E	105˚E	Every 6h 00:00,06:00,12:00,18:00(UTC)
Infrared and Water Vapour Winds	FY-2D	86.5˚E	Every 6h 03:00,09:00,15:00,21:00(UTC)
Infrared and Water Vapour Winds	FY-2F	112˚E	Every 6h (not continuous) 03:00,09:00,15:00,21:00(UTC)

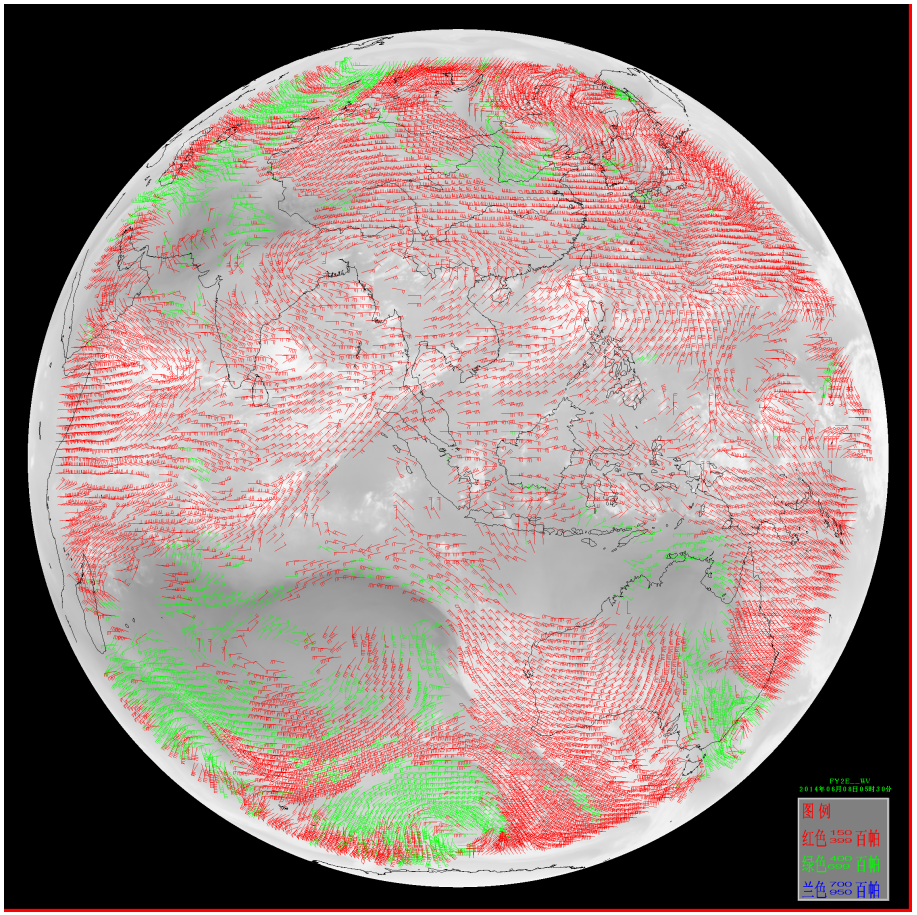
Example of FY-2E AMVs

06UTC on 8 June 2014

High-, middle- and low-level IR AMVs



High- and middle-level WV AMVs



Current status of CMA winds

Mean of departures from FY2-E IR wind speed and those of analysis (QI>0.8)

	High level winds (Above 400hPa)		Middle level winds (between 400-700hPa)		Low level winds (below 700hPa)	
	2012	2013	2012	2013	2012	2013
Jan	-2.12423	-1.94587	-3.50365	-3.9023	-0.56508	-0.58041
Feb	-1.93563	-1.94897	-3.35226	-3.06902	-0.39329	-0.31534
Mar	-2.04533	-2.21874	-3.15719	-2.69138	-0.39004	-0.36816
Apr	-2.18449	-2.7657	-3.02689	-3.17522	-0.4454	-0.32753
May	-2.43691	-2.61128	-2.76822	-2.6329	-0.35193	-0.08515
Jun	-2.47499	-2.7072	-2.57676	-2.50116	-0.44933	-0.17935
Jul	-2.22251	-2.92635	-2.38746	-2.74717	-0.34463	-0.26356
Aug	-2.41222	-2.8553	-2.91576	-3.28757	-0.43861	-0.26695
Sep	-2.15256	-2.90911	-2.8914	-3.10136	-0.34482	-0.19641
Oct	-2.07584	-2.46678	-3.08267	-2.67326	-0.32728	-0.3544
Nov	-2.27077	-2.26952	-3.47111	-3.54425	-0.38728	-0.22208
Dec	-2.09586	-2.08142	-3.97566	-3.86096	-0.51668	-0.31554

Current status of CMA winds

Standard deviation of departures from FY-2E IR wind speed and those of analysis (QI>0.8)

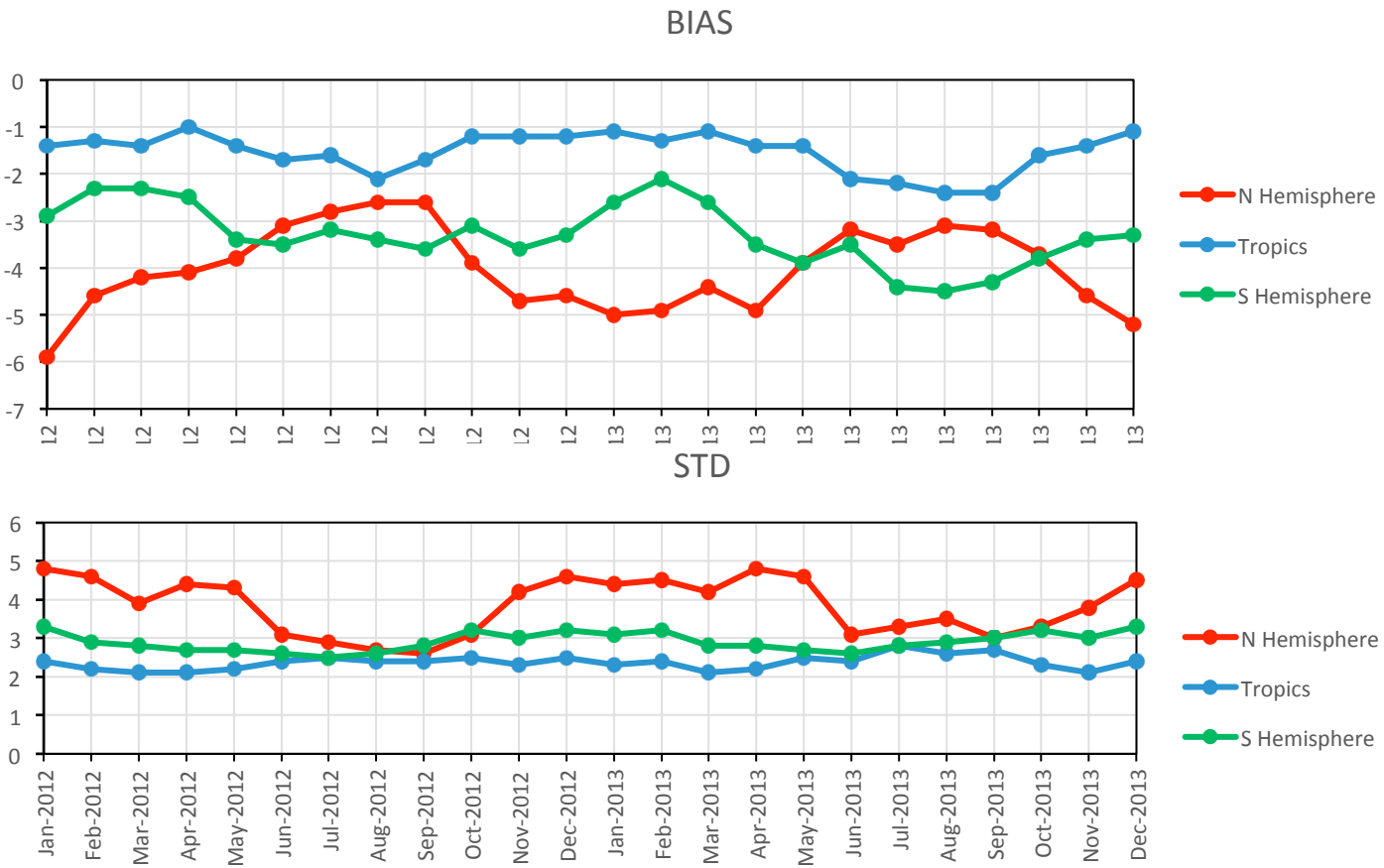
	High level winds (Above 400hPa)		Middle level winds (between 400-700hPa)		Low level winds (below 700hPa)	
	2012	2013	2012	2013	2012	2013
Jan	4.892085	4.64946	6.179803	6.048372	3.320474	3.028624
Feb	4.583046	4.721529	6.082641	6.010609	2.934222	3.125594
Mar	4.809744	4.814942	5.896808	5.813749	2.737408	2.747139
Apr	4.889798	4.91965	5.926031	5.793845	2.594708	2.705312
May	4.759254	4.887551	5.48489	5.657166	2.594291	2.66821
Jun	5.071055	4.940804	5.364794	5.404209	2.542841	2.53057
Jul	4.855787	5.063397	5.460641	5.505674	2.508121	2.808593
Aug	4.820954	5.030996	5.336308	5.524529	2.537602	2.799735
Sep	4.530054	4.967143	5.299152	5.623036	2.662271	2.885943
Oct	4.561009	4.850967	5.562412	5.711941	2.932993	2.839276
Nov	4.508193	4.501802	5.990277	5.61666	2.834245	2.752524
Dec	4.549424	4.506401	6.05042	5.962793	3.160056	3.117601

Current status of CMA winds

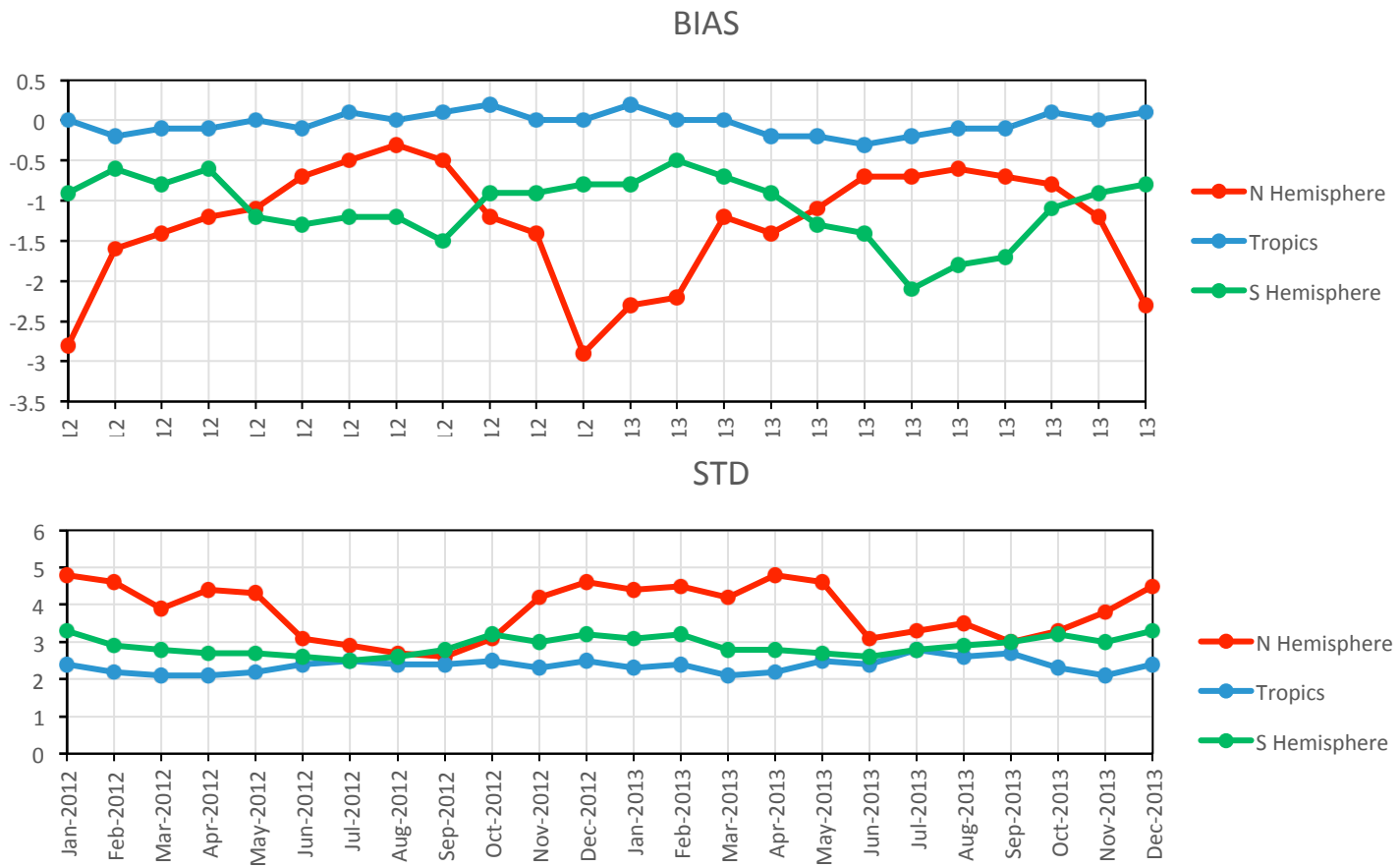
Mean of departures and standard deviation of departures from FY-2E WV wind speed and those of analysis (QI>0.8)

	Bias		STD	
	2012	2013	2012	2013
Jan	-0.50399	-0.38239	4.391838	4.26404
Feb	-0.47929	-0.41272	4.0707	4.286302
Mar	-0.48913	-0.44487	4.136906	3.907031
Apr	-0.5062	-0.66317	4.125719	3.95154
May	-0.54818	-0.68822	4.08815	3.956886
Jun	-0.50877	-0.61573	4.428806	4.252967
Jul	-0.29856	-0.62436	4.338072	4.628991
Aug	-0.26134	-0.49397	4.250763	4.178475
Sep	-0.28748	-0.54414	3.999249	4.053517
Oct	-0.33508	-0.36832	3.838787	3.90512
Nov	-0.46192	-0.43004	3.866909	3.715909
Dec	-0.5712	-0.42291	4.656152	4.170294

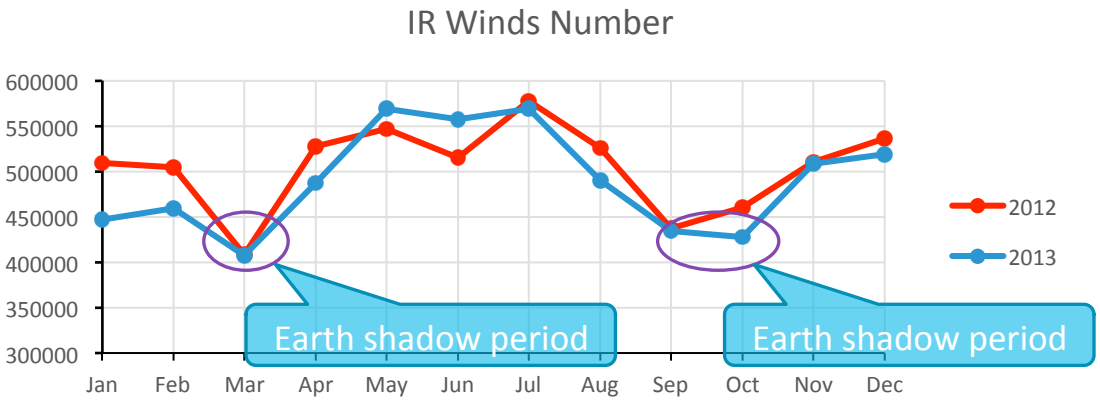
High-level (above 400hPa) IR AMVs STD and wind speed bias

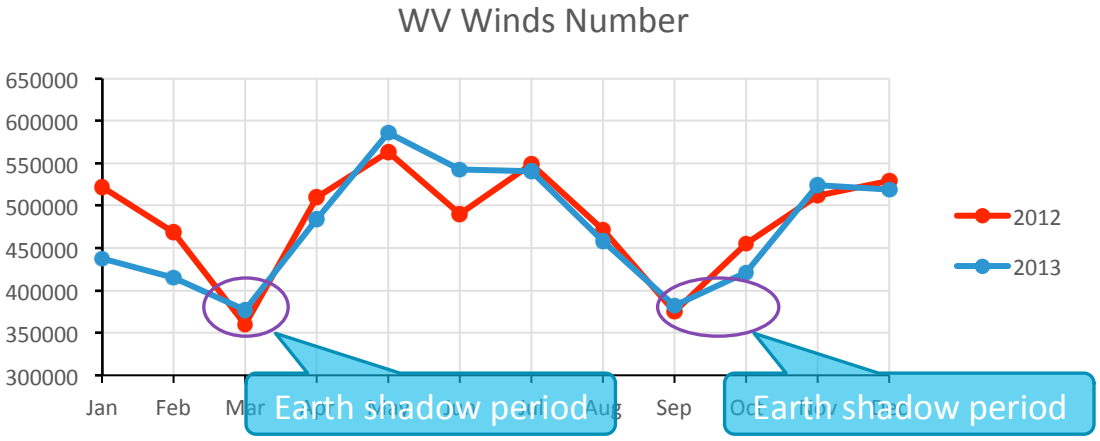


High-level (above 400hPa) WV AMVs STD and wind speed bias



In earth shadow period





FY-2E earth shadow period:

- February 24 ---- April 12
- August 22 ---- October 16

In midnight of earth shadow period, FY-2E doesn't receive image (1600, 1700, 1730, 1800UTC) and AMVs of 1800UTC are not derived.

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- Current FY-2 satellites status and planned configurations
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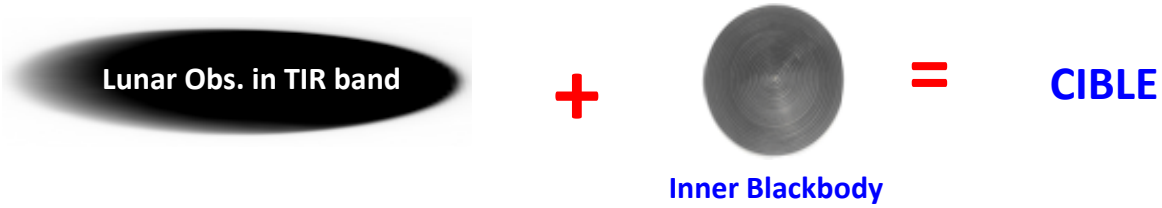
- Changes in operational system since last winds workshop
  - A new calibration system was updated to operational system
  - Eliminate the influence of abnormal satellite image (upcoming)
  - Remove noise in the satellite image (upcoming)
  - Second tracking algorithm (upcoming)
  - Height assignment in inversion layer (upcoming)
  - Height assignment in target box full of cloud (upcoming)
- Historical dataset reprocessing plan

A new calibration system was updated to operational system

Calibration of Inner Blackbody corrected by Lunar Emission (CIBLE)



- CIBLE has been in operation for FY-2F satellite since 21 July, 2012
- CILBE has been in operation for FY-2E satellite since 27 March, 2013
- CILBE has been in operation for FY-2D satellite since 21 May, 2013

→ **see Guo Qiang's talk**

Eliminate the influence of abnormal satellite image (upcoming)
-- influences of abnormal images

- Image navigation influences AMVs derivation greatly.
- Image navigation is a major part of the FY-2 observation process and is based on a mathematical model. The model uses **time series of satellite positions and observation vectors toward earth center** as input.
- FY-2 image navigation quality is good. But some abnormal satellite image will affect the navigation and AMVs quality .

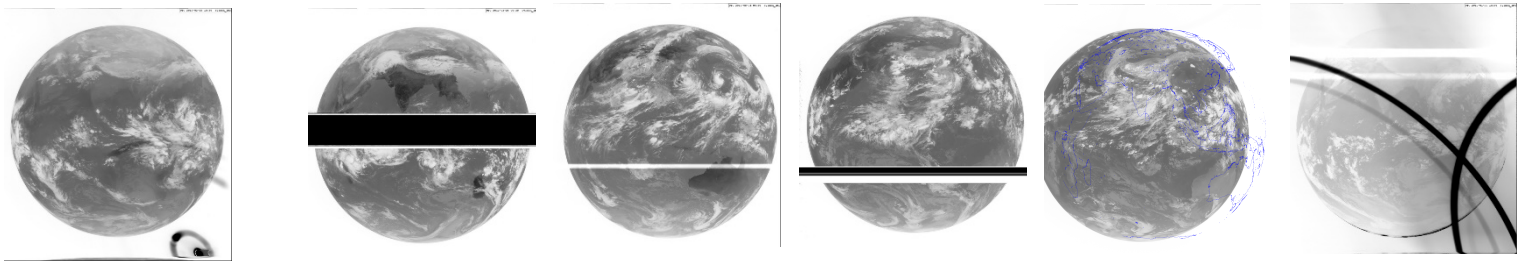
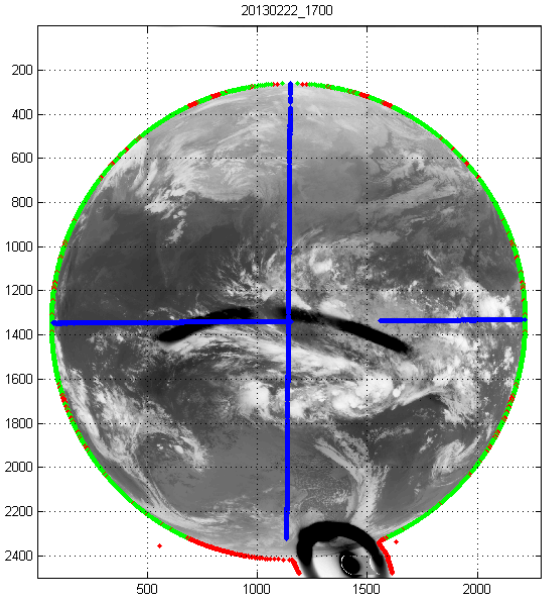


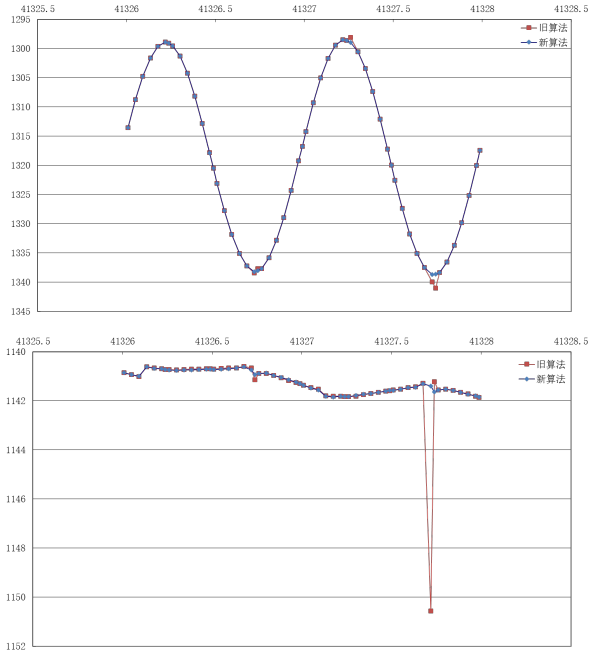
Image of sun | Sun Outage | Moon influence | Error line data | Spin synchronization error | Radiation of imager bracket

Abnormal images

Eliminate the influence of abnormal satellite image (upcoming)
-- a new quality control algorithm performed

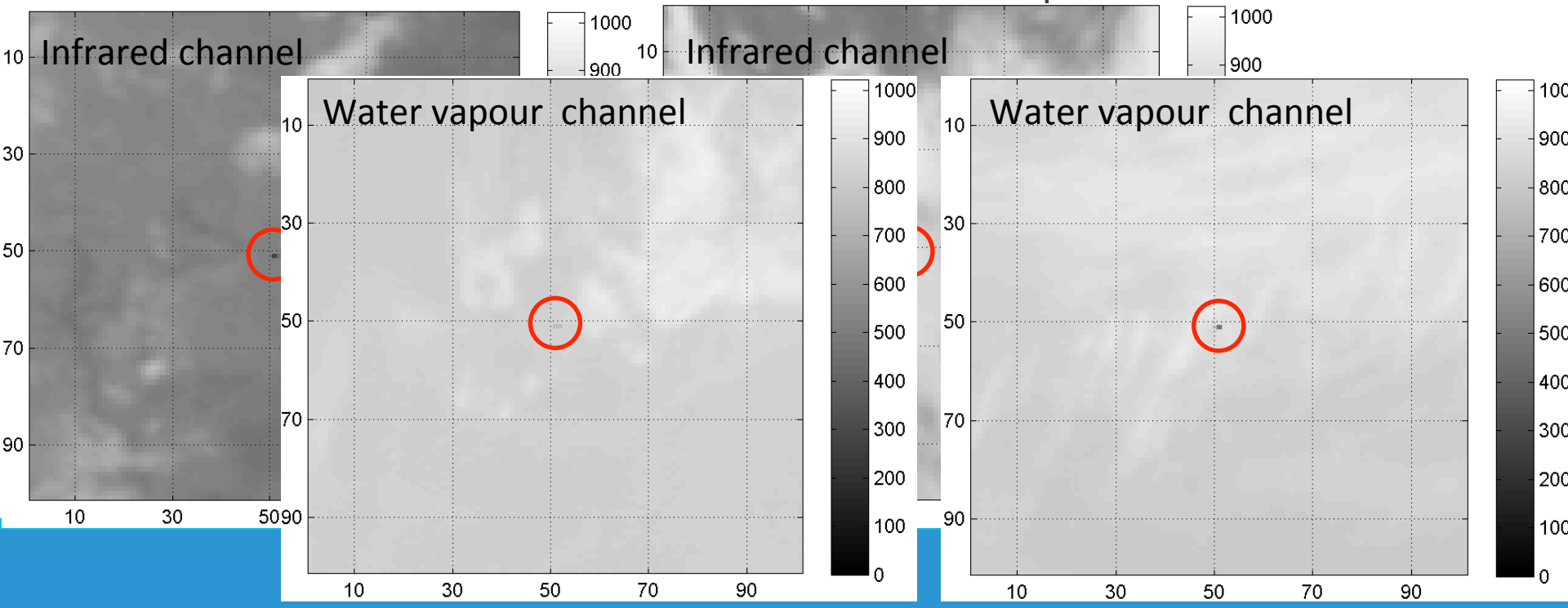
- The abnormal satellite image can break up the **time series of observation vectors toward earth center** and will cause bad navigation quality.
- A quality control algorithm is performed to catch right **observation vectors toward earth center,** then eliminate the influence of abnormal satellite image





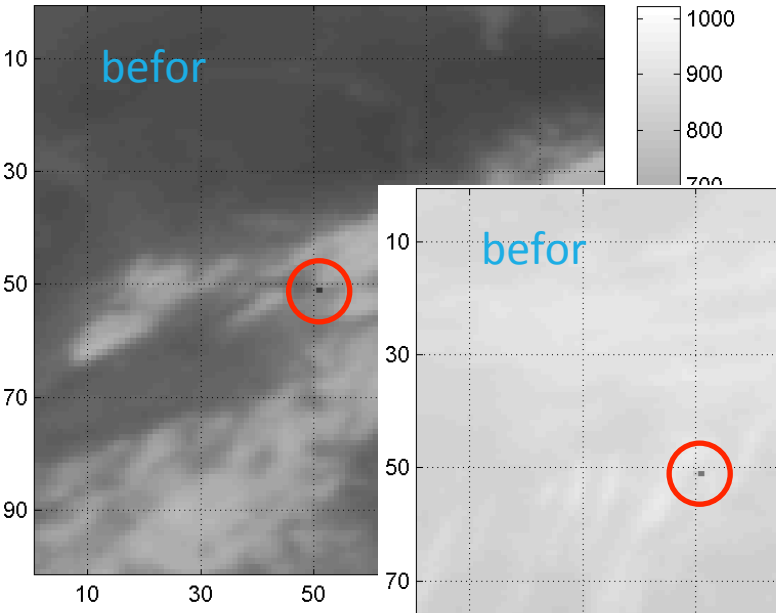
Remove noise in the satellite image(upcoming)

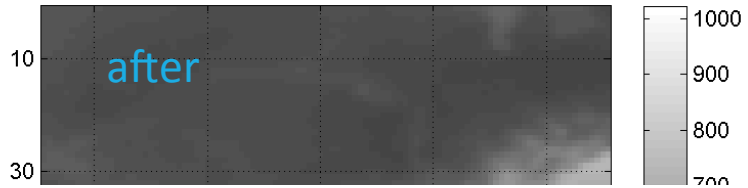
- There are some noise data in the satellite image.
- The noise data will influence the quality of AMVs and must be eliminated before the derivation of AMVs.
- Noise data in both infrared channel and water vapour channel

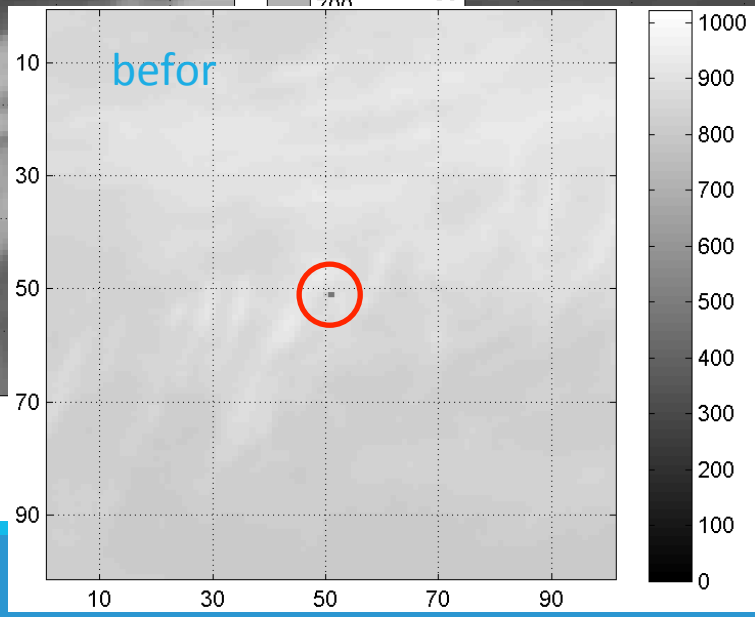


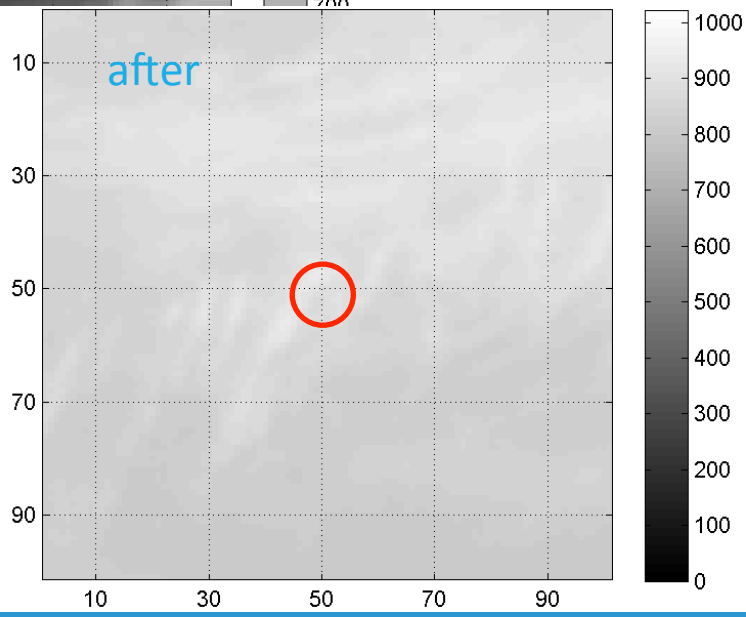
Remove noise in the satellite image(upcoming) --Identify and eliminate the noise

- An algorithm based on median filter will perform to identify and eliminate the noise.
- The algorithm do not change the value except the noise.

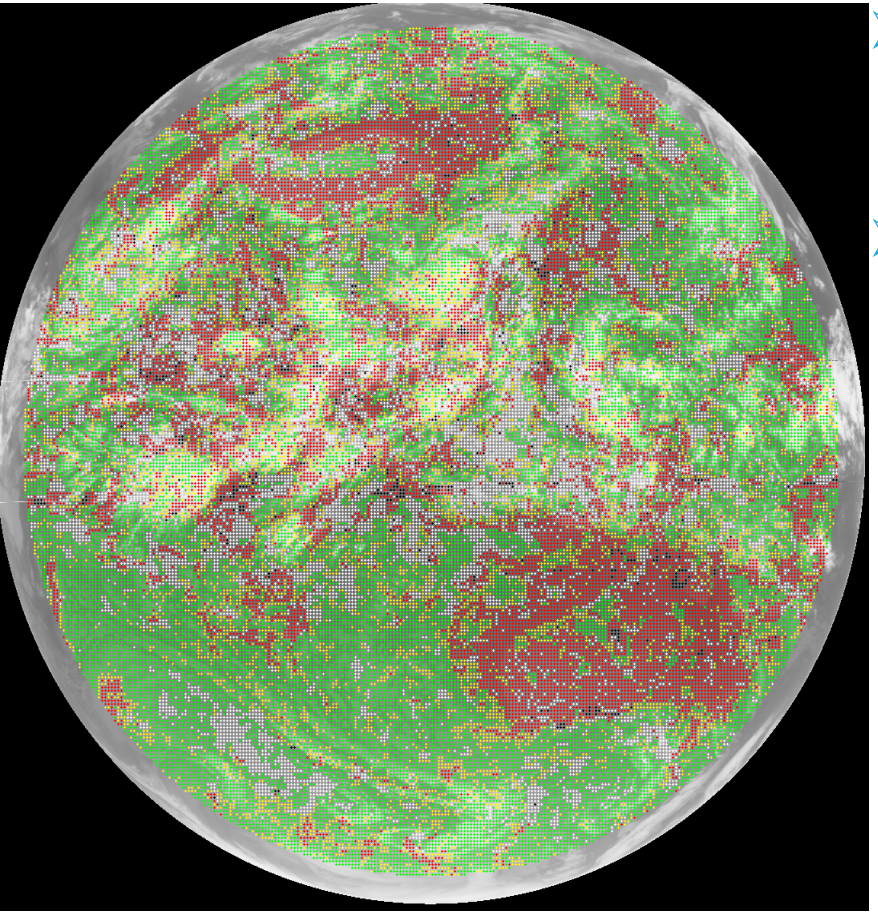








Second tracking algorithm (upcoming)

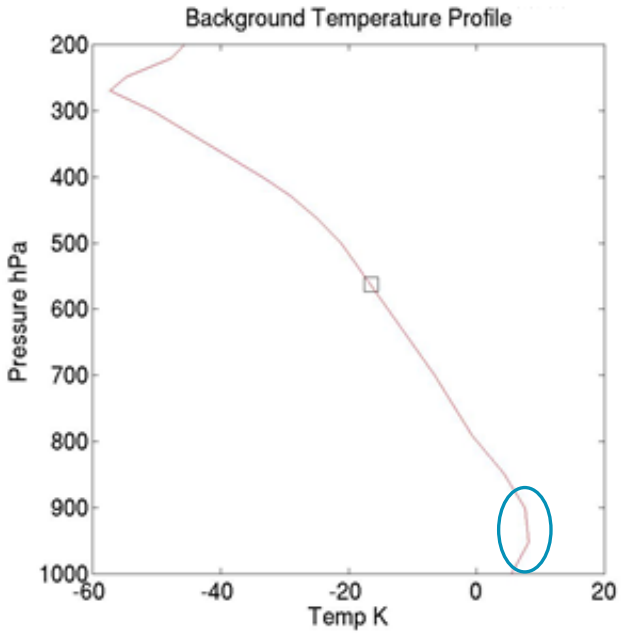


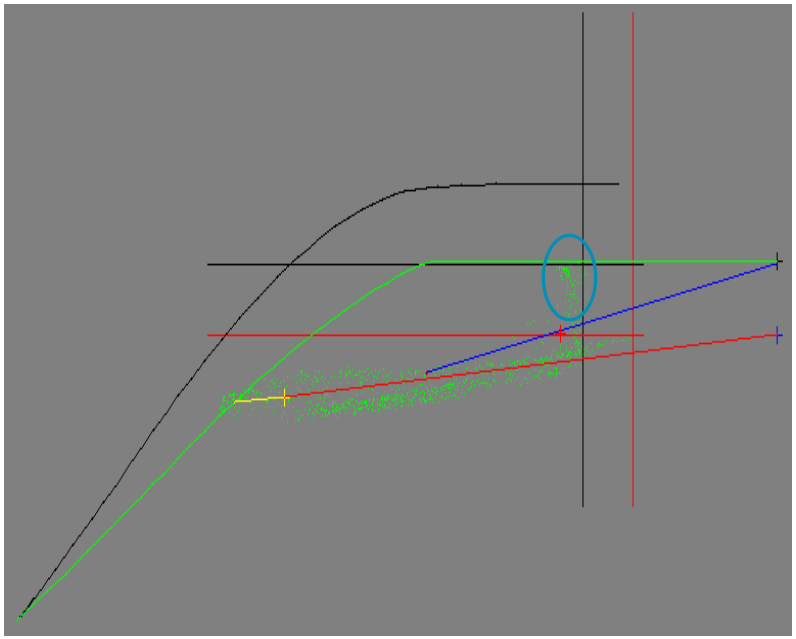
- If the correlation coefficent of first tracking is larger than 0.8, second tracking will be performed.
- The first tracking box is 32 X 32, and the second tracking box is 16 X 16.

In left image:

- Green: Second tracking succeeded.
- Mean speed of First tracking: 11.01 m/s
- Mean speed of Second tracking: 13.70 m/s

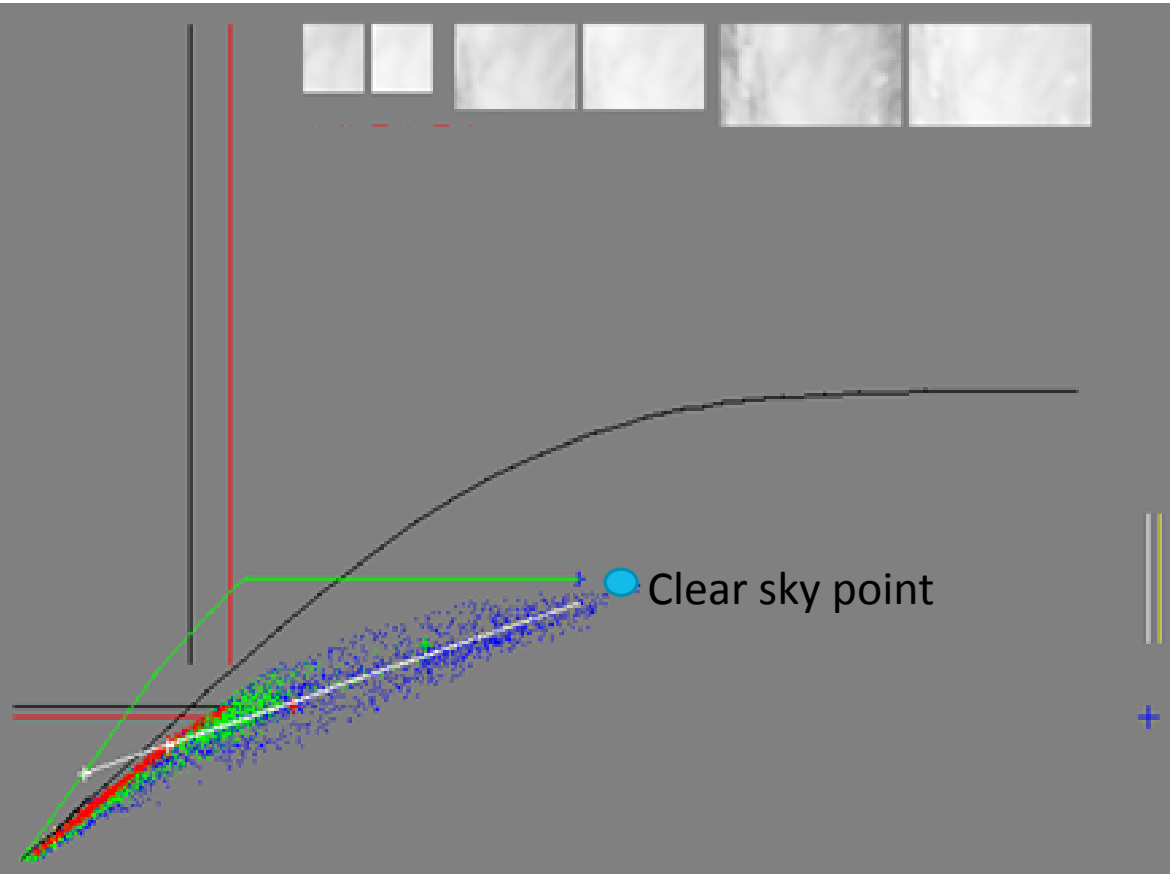
Height assignment in inversion layer





- Low-level inversions layers can produce height assignment errors for winds.
- In IR/WV relationship chart, the temperature of points in inversions layers is higher than the surface. Those points must not be used to determine the clear sky point.

Height assignment in target box full of cloud



- When the target box full of cloud, the clear sky point is difficult to be find.
- The clear sky point can be found in the expand box approximatively.

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Historical dataset reprocessing plan

- CMA already started an project to reprocess the historical AMVs dataset in 2013, and will be finished in end of 2015.
- Reprocess all historical AMVs data with latest AMVs algorithm(CMA Version 2014)

DATE	CONTENT
2013.1 --- 2013.12	Prepare historical data (FY-2 satellite data, NWP data, etc.)
2013.1 --- 2014.6	Improve AMVs algorithm
2014.7 --- 2015.9	Reprocess historical AMVs data with latest AMVs algorithm
2015.10 --- 2015.12	Check quality of the reprocessed AMVs data, and archive

Historical dataset reprocessing plan --historical AMVs data information

- CMA AMV's operation begin from January 2006
- Infrared (IR) and water vapor (WV) channel AMVs derivations were performed for three FY-2 satellites

SATELLITE	NADIR LONGITUDE	DATE	AMVs TIME (UTC)
FY-2C	105°	Jan 1st, 2006 – Nov 24th, 2009	00/06/12/18
FY-2D	86.5°	Feb 14th, 2007 – Dec 31st, 2013	03/09/15/21
FY-2E	105°	Nov 23rd, 2009 – Dec 31st, 2013	00/06/12/18

Historical dataset reprocessing plan --Main work

- Re-calibration of historical satellite data
  - FY-2 On-orbit Operational Calibration Approach(CIBLE)
- Re-navigation of historical satellite data
  - Latest re-navigation algorithm is performed to eliminate the influence of abnormal satellite image
- Eliminate the noise point of infrared and water vapor channel
- Review and improve AMVs algorithm
  - Second tracking algorithm
  - Height assignment in inversion layer
  - Height assignment in target box full of cloud
  - ……

Thank you !