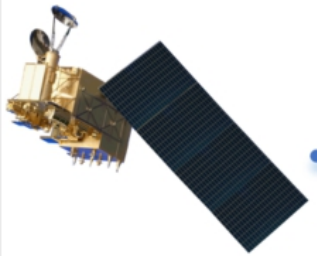

Progress on FY-3/MWRI FCDR

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National Satellite Meteorological Center

Hongxin Xu, Jiakai He
Shanghai Institute of Space Communication Technology

GSICS MWSG
2021.03.31

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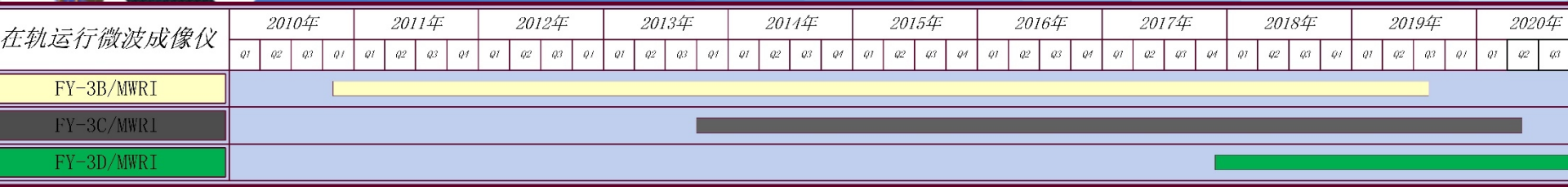
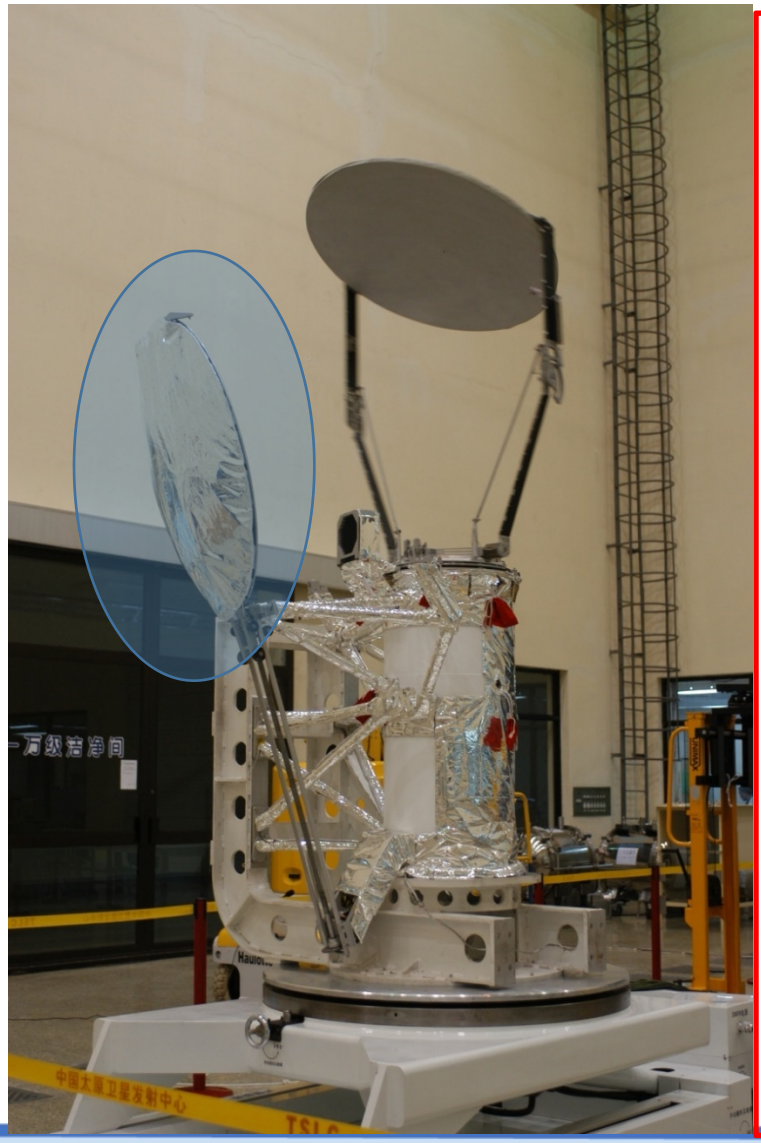
Current Status and Future Plan



2021:FY-3F(Morning orbit, Antenna size: 1.8m);
2022:FY-3P(Low orbit, Antenna size: 1.6m);
2023:FY-3G(Afternoon orbit, Antenna size: 1.8m);
Antenna performance and NedT improved based on FY-3 02

	FY-3A/B/C/D MWRI	FY-3F/G/P MWRI
Frequency（GHz）	10/18/23/36/89	10/18/23/36/50/89/118/166/183
Antenna（m）	1	1.8/1.6
NedT（K）	0.8/1.0	0.5/0.8
Accuracy（K）	2.0	0.8/1.2
Co-location（Km）	/	2
Main beam	0.9	0.95

Error Source of MWRI Calibration



- **Back lobe of hot reflector**
- **Emission of hot reflector**
- **Hot load efficiency**
- **RFI Via cold reflector**
- **Non-linearity of receiver**

Roadmap of Recalibration

$$L_W = \\ = T_{EA}(1-\eta_A) \\ -\eta_A\{T_{ET}(1-\eta_T) \\ +\eta_T[(1-\varepsilon)T_{EC}(1-\eta_H)+(1-\varepsilon)T_H\eta_H \\ +\varepsilon T_R]\}$$

$$L_{nl} = u \times G^2 \times (C_O - C_C) \times (C_O - C_W)$$

$$u = f(T_{rec}, AGC)$$

$$L_O = L_W + \frac{L_W - L_C}{C_W - C_C} \times (C_O - C_W) + L_{nl} + \Delta L_A$$

（1）Back-lobe
（2）hot reflector ε;
（3）Hotload
（4）non-linear correction

$$\Delta L_A = L_{sys}\left[\frac{1}{\Delta v\tau} + \left(\frac{\Delta G}{G}\right)^2\right]^{1/2}$$

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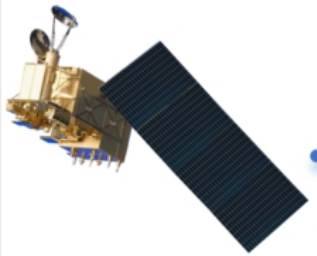


MWRI: Calibration Equation and Parameters needs Correction

$$L_O = L_W + \frac{L_W - L_C}{C_W - C_C} \times (C_O - C_W) + L_{nl} + \Delta L_A \quad \textbf{V2}$$

Calibration Target

$$L_W = T_{EA}(1-\eta_A) + \eta_A\{T_{ET}(1-\eta_T) + \eta_T[(1-\varepsilon)T_{EC}(1-\eta_H) + (1-\varepsilon)T_H\eta_H + \varepsilon T_R]\} \quad \textbf{V1}$$

Receiver

$$L_{nl} = u \times G^2 \times (C_O - C_C) \times (C_O - C_W)$$

$$u = f(T_{rec}, AGC)$$

$$\Delta L_A = L_{sys}\left[\frac{1}{\Delta v \tau} + \left(\frac{\Delta G}{G}\right)^2\right]^{1/2}$$

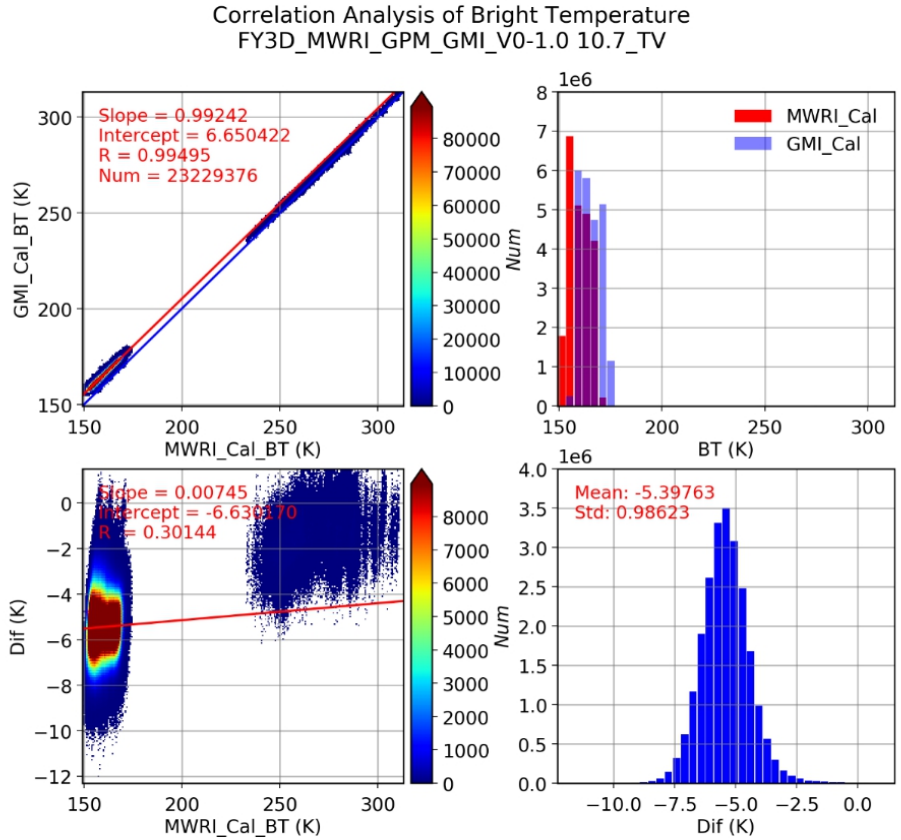
Parameters type

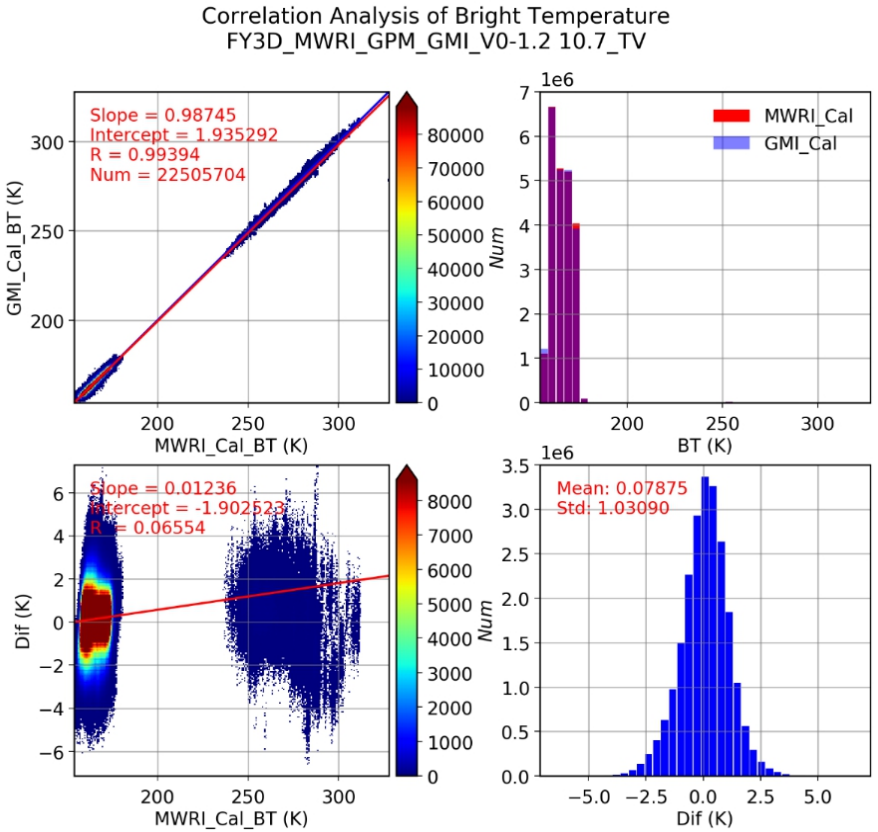
Reflector

Source

Receiver

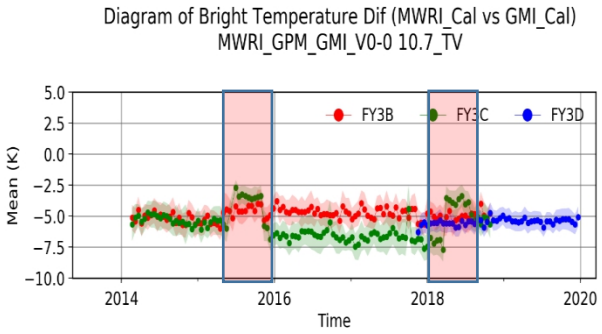
10.7GHz V pol

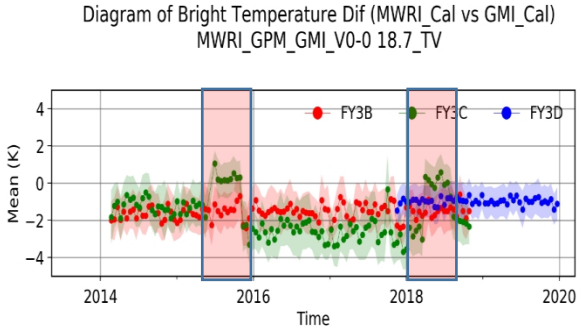

Correlation Analysis of Bright Temperature
FY3D_MWRI_GPM_GMI_V0-1.0 10.7_TV
Slope = 0.99242
Intercept = 6.650422
R = 0.99495
Num = 23229376
GMI_Cal_BT (K)
MWRI_Cal_BT (K)
Num
MWRI_Cal
GMI_Cal
BT (K)
Slope = 0.00745
Intercept = -6.630170
R = 0.30144
Dif (K)
Mean: -5.39763
Std: 0.98623

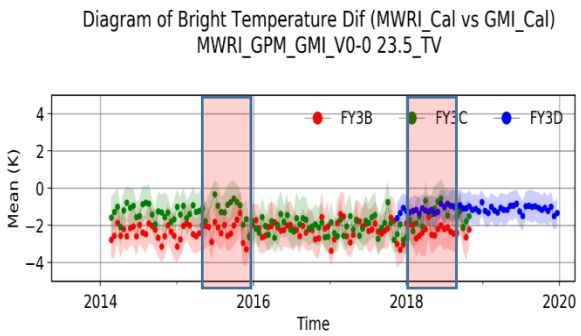

Correlation Analysis of Bright Temperature
FY3D_MWRI_GPM_GMI_V0-1.2 10.7_TV
Slope = 0.98745
Intercept = 1.935292
R = 0.99394
Num = 22505704
GMI_Cal_BT (K)
MWRI_Cal_BT (K)
Num
MWRI_Cal
GMI_Cal
BT (K)
Slope = 0.01236
Intercept = -1.902523
R = 0.06554
Dif (K)
Mean: 0.07875
Std: 1.03090

FY-3B/C/D MWRI time series

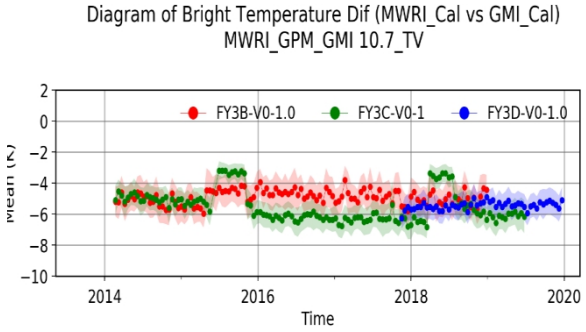
Operational

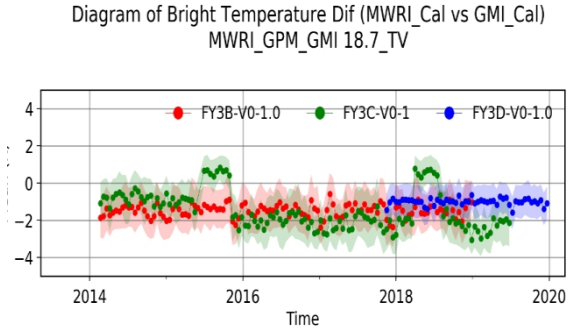


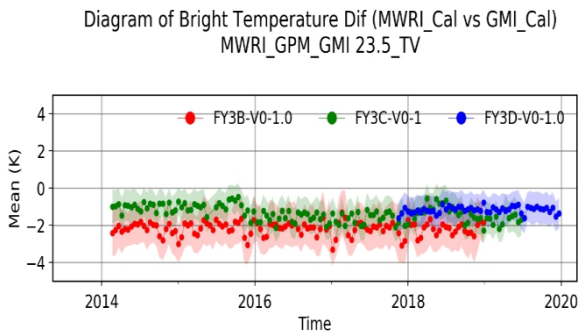




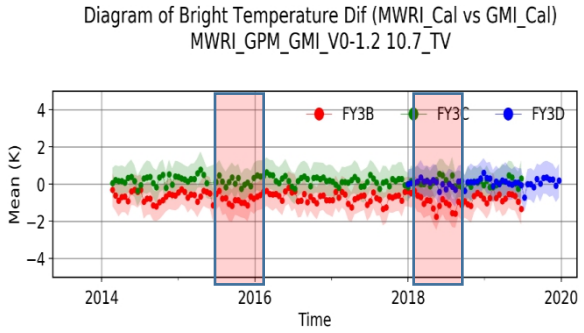
Recal V1.0

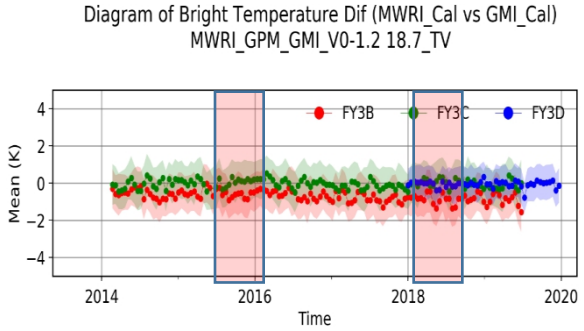


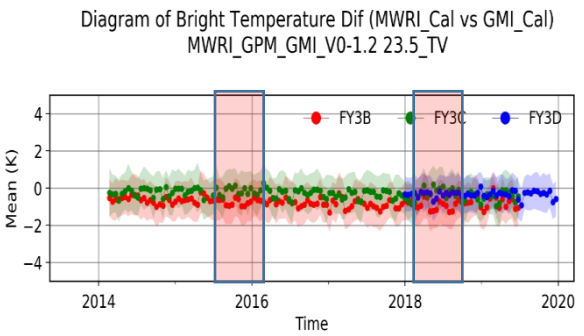




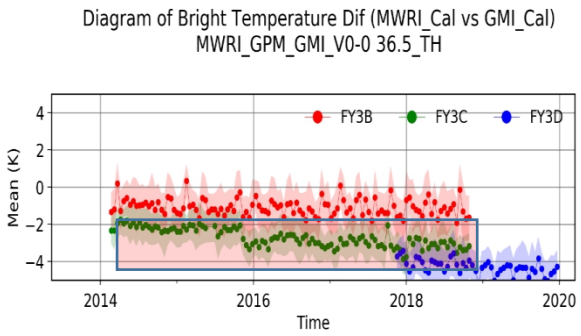
Recal V2.0

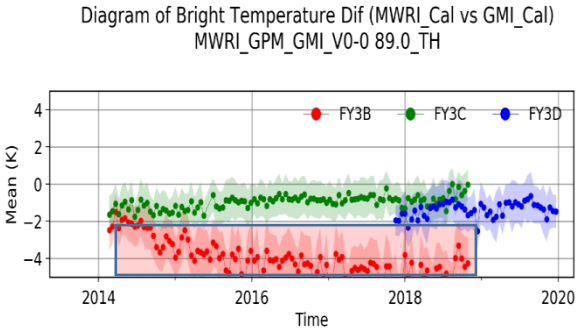




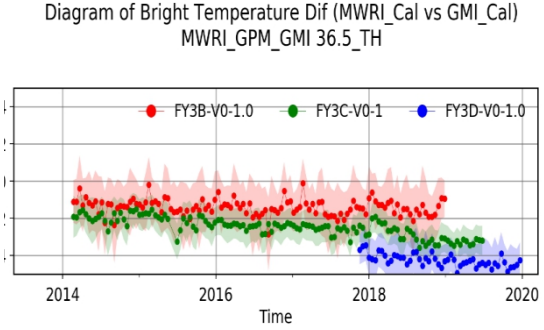


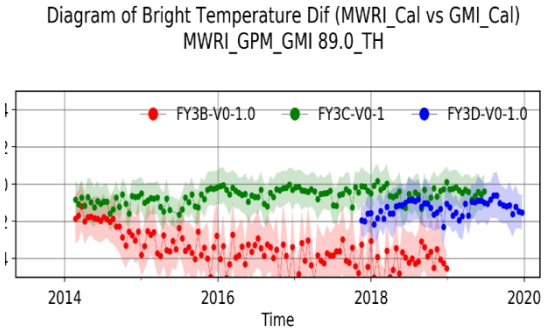
Operational



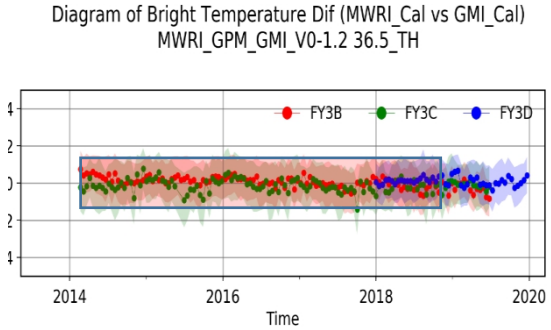


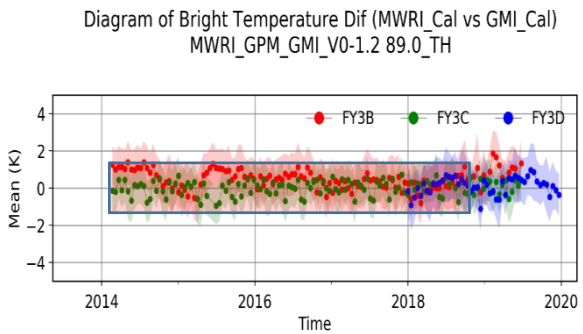
Recal V1.0



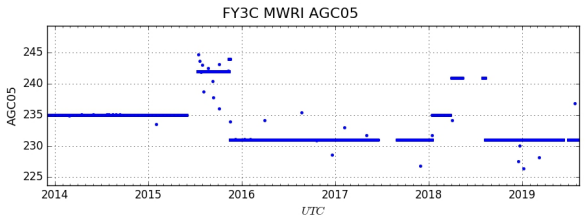


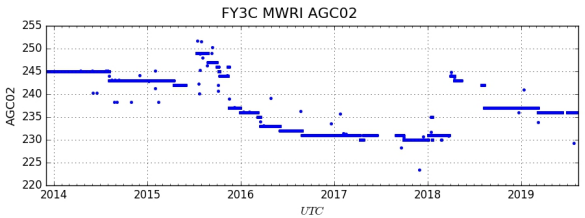
Recal V2.0

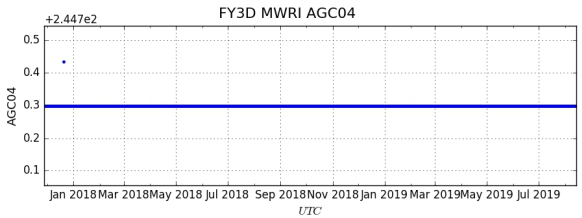




AGC (Automatic Gain Control) of Receiver







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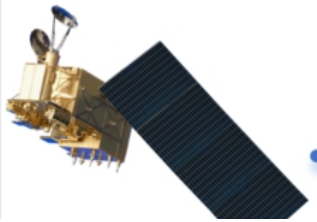
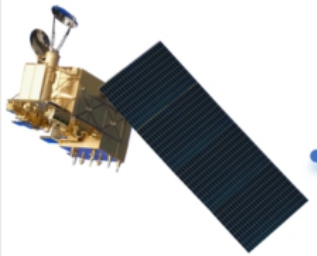


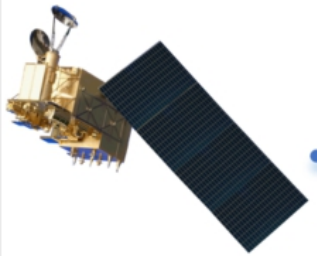
FY-3B/C/D MWRI

channel	Typical BT (K)	Mean of RMSE (K)		
		operational	Recal V1.0	Recal V2.0
FY-3B				
10V	166.2	5.00	5.00	1.15
10H	91.8	5.66	5.68	1.21
18V	119.4	1.91	1.87	1.26
18H	127.5	3.12	3.15	1.34
23V	224	2.51	2.46	1.29
36V	223.5	5.76	5.59	0.94
36H	172.1	1.62	2.03	1.10
89V	268.8	2.13	2.19	1.02
89H	248.8	4.24	3.85	1.34
FY-3C				
10V	166.2	5.85	5.85	0.88
10H	91.8	8.12	8.15	0.91
18V	119.4	2.27	2.72	1.07
18H	127.5	2.13	2.13	1.08
23V	224	1.95	1.95	1.10
36V	223.5	3.69	3.69	1.04
36H	172.1	2.87	2.87	1.26
89V	268.8	1.62	1.62	0.88
89H	248.8	1.38	1.38	1.15
FY-3D				
10V	166.2	5.51	5.51	0.91
10H	91.8	6.80	6.87	1.04
18V	119.4	1.32	1.33	0.93
18H	127.5	1.79	1.80	1.08
23V	224	1.41	1.45	1.02
36V	223.5	4.28	4.24	0.94
36H	172.1	4.41	4.39	1.09
89V	268.8	1.64	1.63	0.93
89H	248.8	1.82	1.76	1.33



Conclusion

- Calibration algorithm improvement on: Back lobe of hot reflector/mission of hot reflector/Hot load efficiency/RFI Via cold reflector/Non-linearity of receiver were applied to FY-3B/C/D-MWRI ;
- Significient improvements on both bias and stability for all channels of all sensors (RMSE agianst GMI<1.5K for all channels, including land and ocean);
- 10-years datasets has been pre-released to 8 institutes/colleges of China, for SWE, SM, SIC, and LSE research.



Thanks