

# Validation of Microwave Humidity Sounder- II and Microwave Temperature Sounder-III onboard FenYun-3F in the post-launch phase

**Yang Guo**

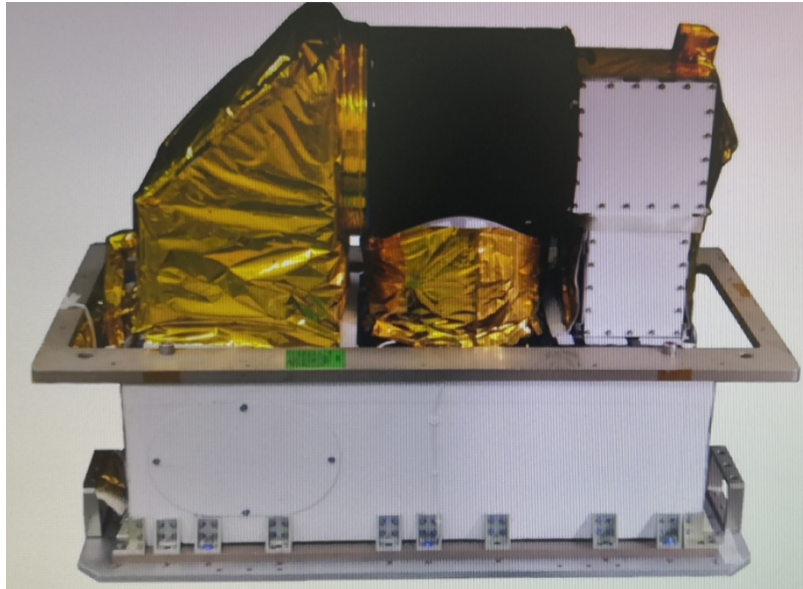
Juyang Hu, Songyan Gu, Fangli Dou, Chengli Qi, Ling Sun, Xiuqing Hu

**CMA**

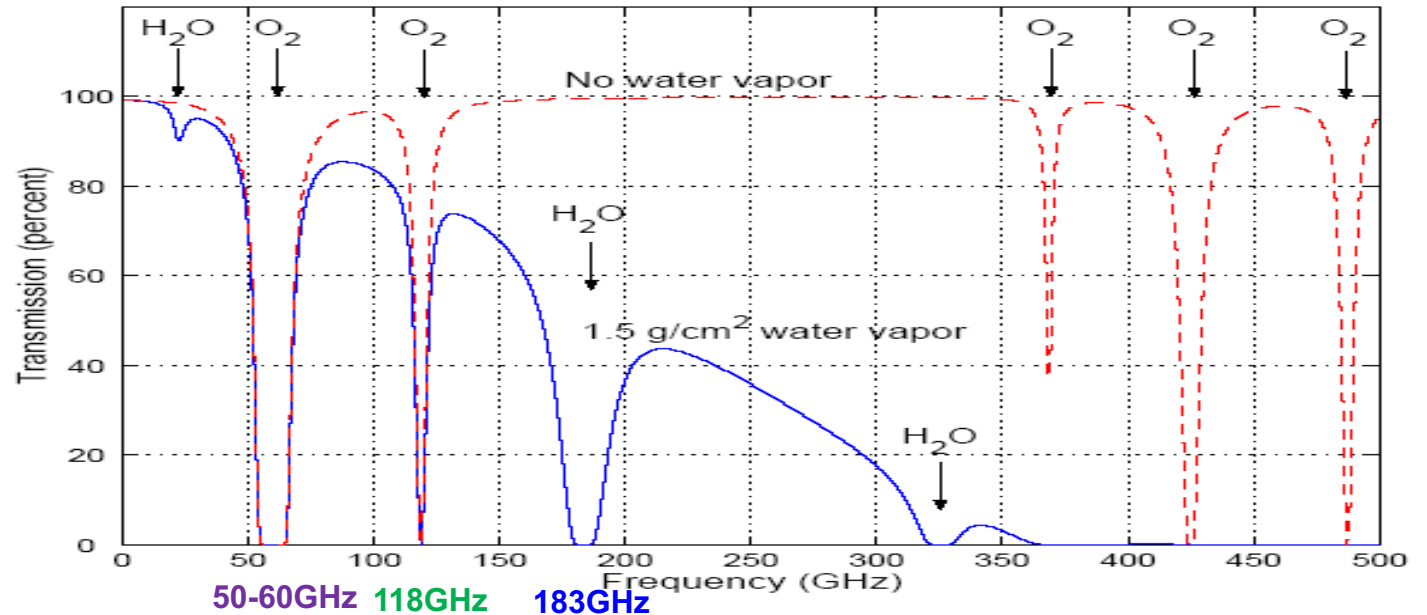
# Outline

- ❖ Instrument introduction
- ❖ On-orbit instrument performance
  - MWHS-II
  - MWTS-III
- ❖ Summary

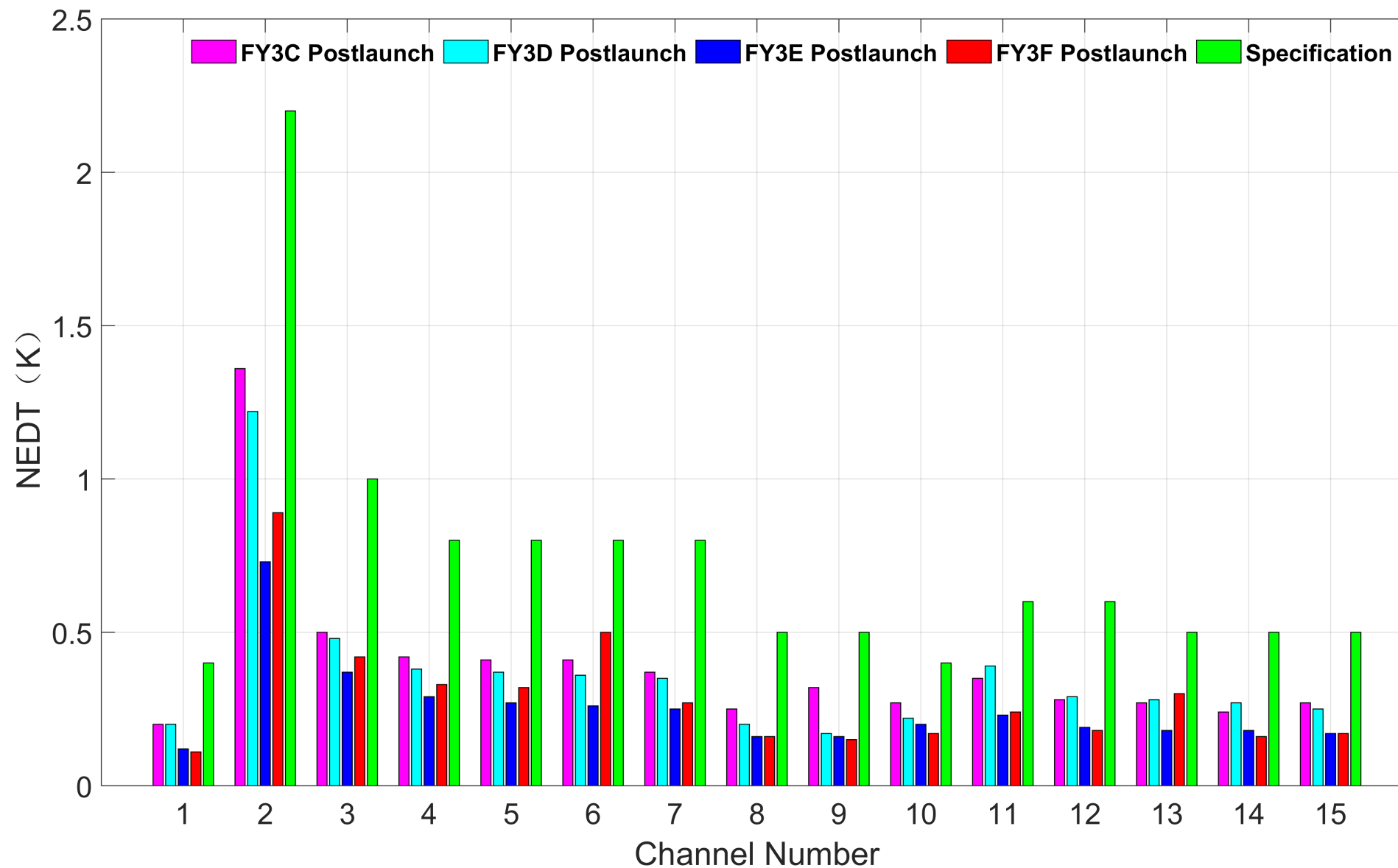
# Instrument introduction



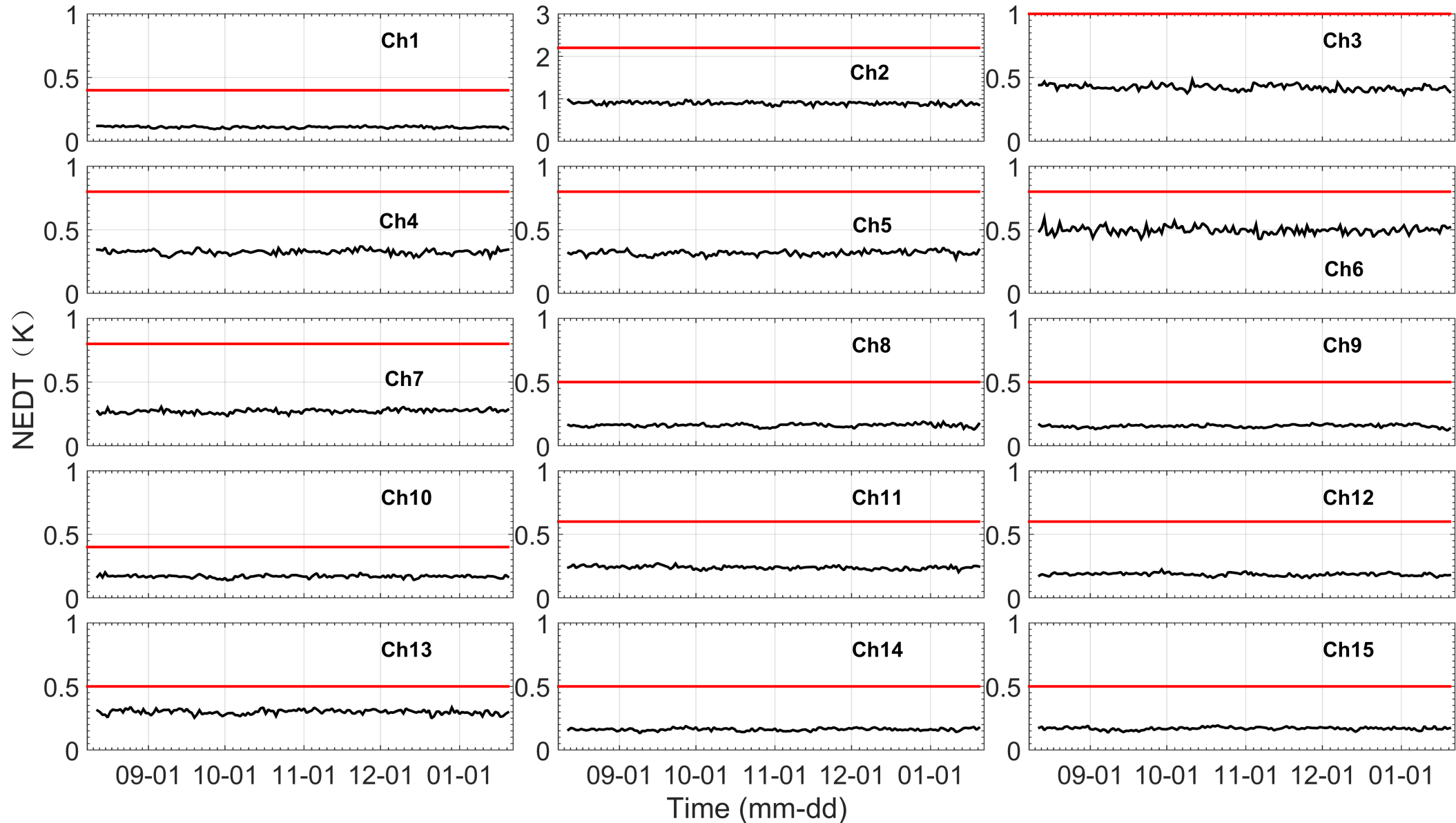
- ✓ FY-3F MWHS-II was turned on August 8, 2023, and has been operating normally in orbit ever since.
- ✓ FY-3F MWTS-III was turned on August 9, 2023, and has been operating normally in orbit ever since.



# On-orbit instrument performance-MWHS-II



# On-orbit instrument performance-MWHS-II



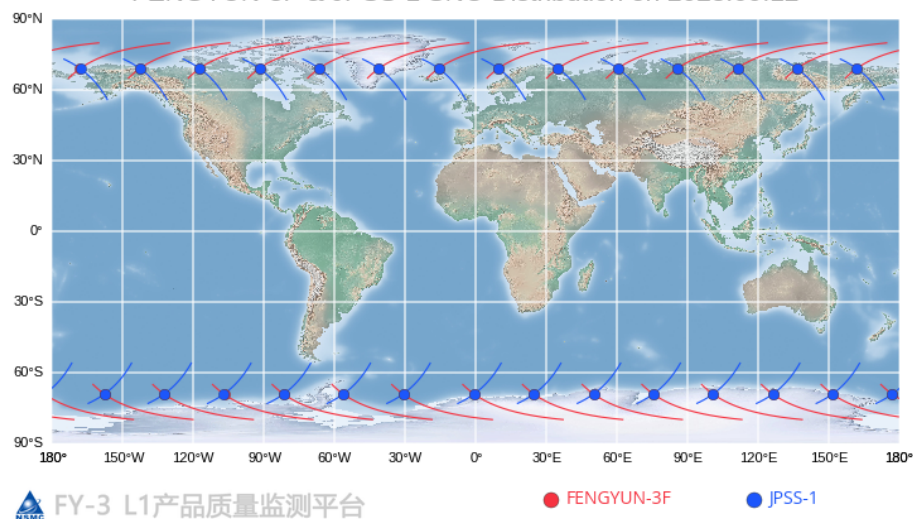
# On-orbit instrument performance-MWHS-II

The SNO data with a time difference greater than 15 min and spatial distance greater than 3 km are rejected in the comparison. The data used in this study is within an earth-viewing-angle of  $\pm 5^\circ$

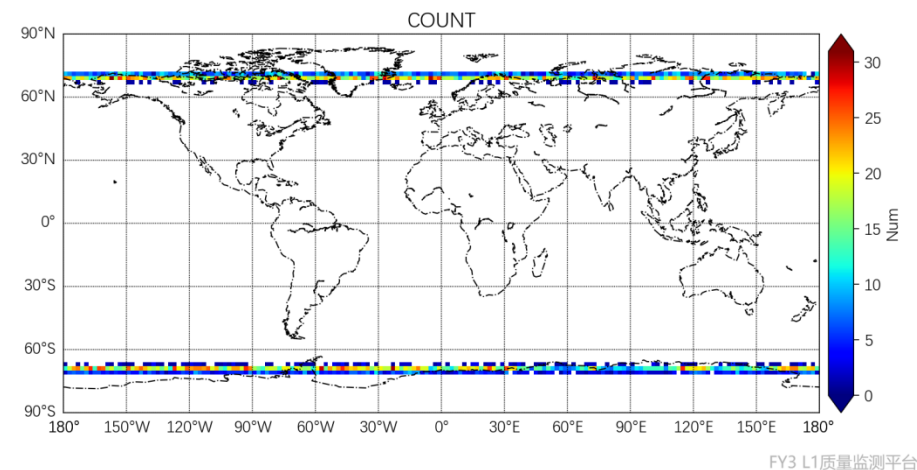
Compared Channel

Center Frequency ( GHz )	MWHS-II (Channel Number)	ATMS (Channel Number)
183.31±1	11	22
183.31±1.8	12	21
183.31±3	13	20
183.31±4.5	14	19
183.31±7	15	18

FENGYUN-3F & JPSS-1 SNO Distribution on 2023.09.12



Spatial Distribution of Bright Temperature (MWHS-ATMS) 2023-08-08~2023-09-15  
FY3F\_MWHS\_JPSS-1\_ATMS. 183.31\_1GHz

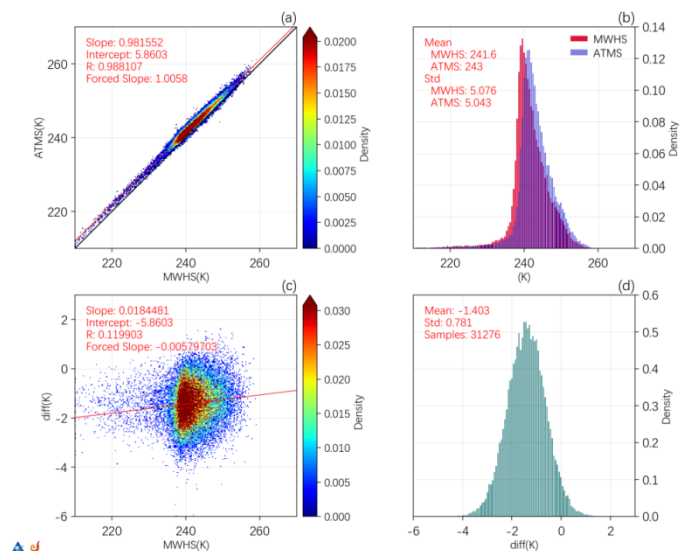




# On-orbit instrument performance-MWHS-II

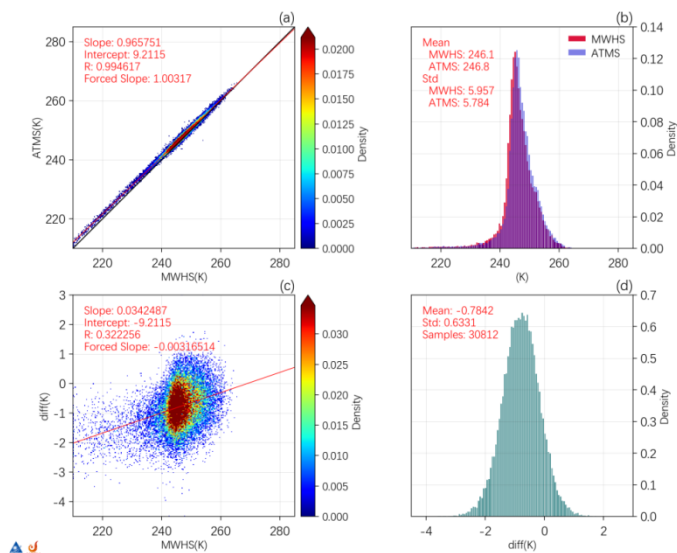
**183.31±1GHz**

Correlation Analysis of Bright Temperature 2023-08-08~2023-12-25  
FY3F\_MWHS\_IPSS-1\_ATMS. 183.31\_1GHz



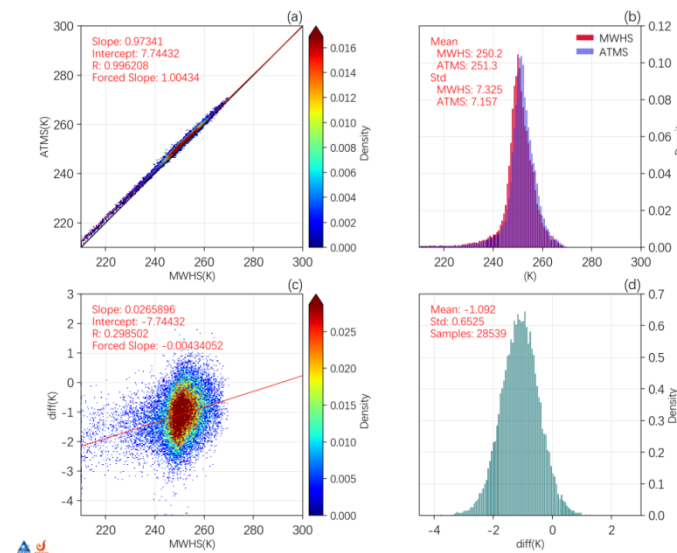
**183.31±1.8GHz**

Correlation Analysis of Bright Temperature 2023-08-08~2023-12-25  
FY3F\_MWHS\_IPSS-1\_ATMS. 183.31\_1.8GHz



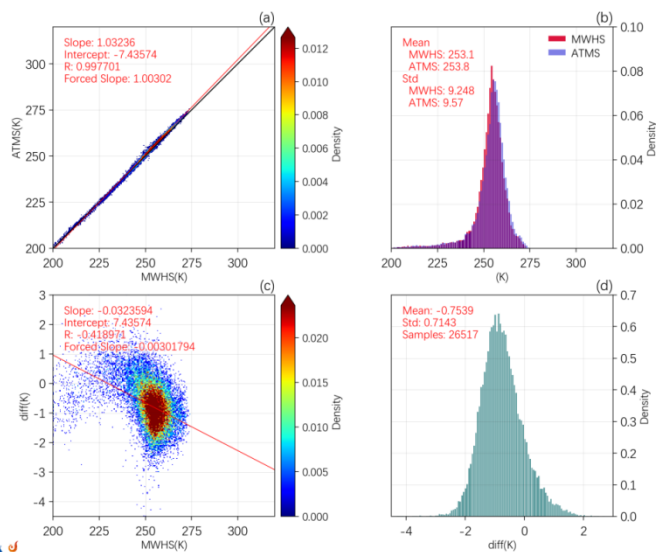
**183.31±3GHz**

Correlation Analysis of Bright Temperature 2023-08-08~2023-12-25  
FY3F\_MWHS\_IPSS-1\_ATMS. 183.31\_3GHz



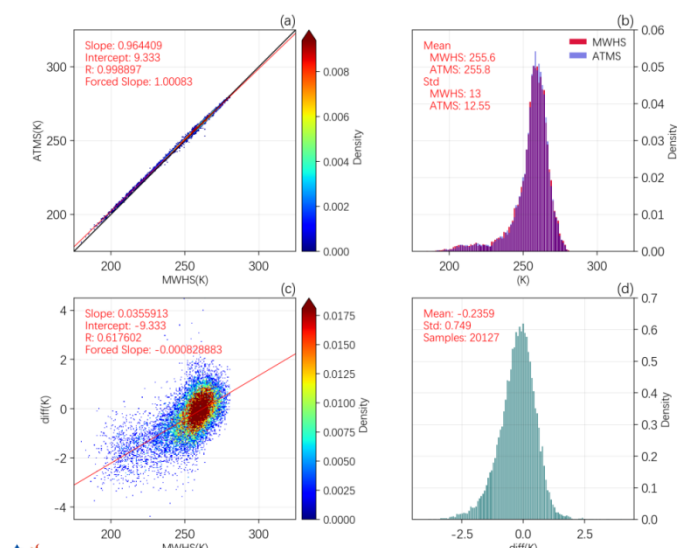
**183.31±4.5GHz**

Correlation Analysis of Bright Temperature 2023-08-08~2023-12-25  
FY3F\_MWHS\_IPSS-1\_ATMS. 183.31\_4.5GHz

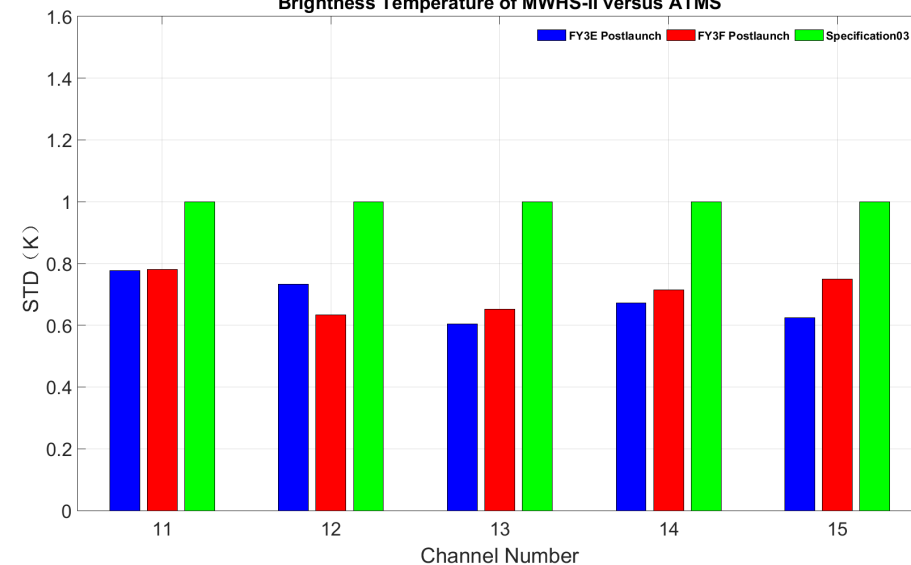


**183.31±7GHz**

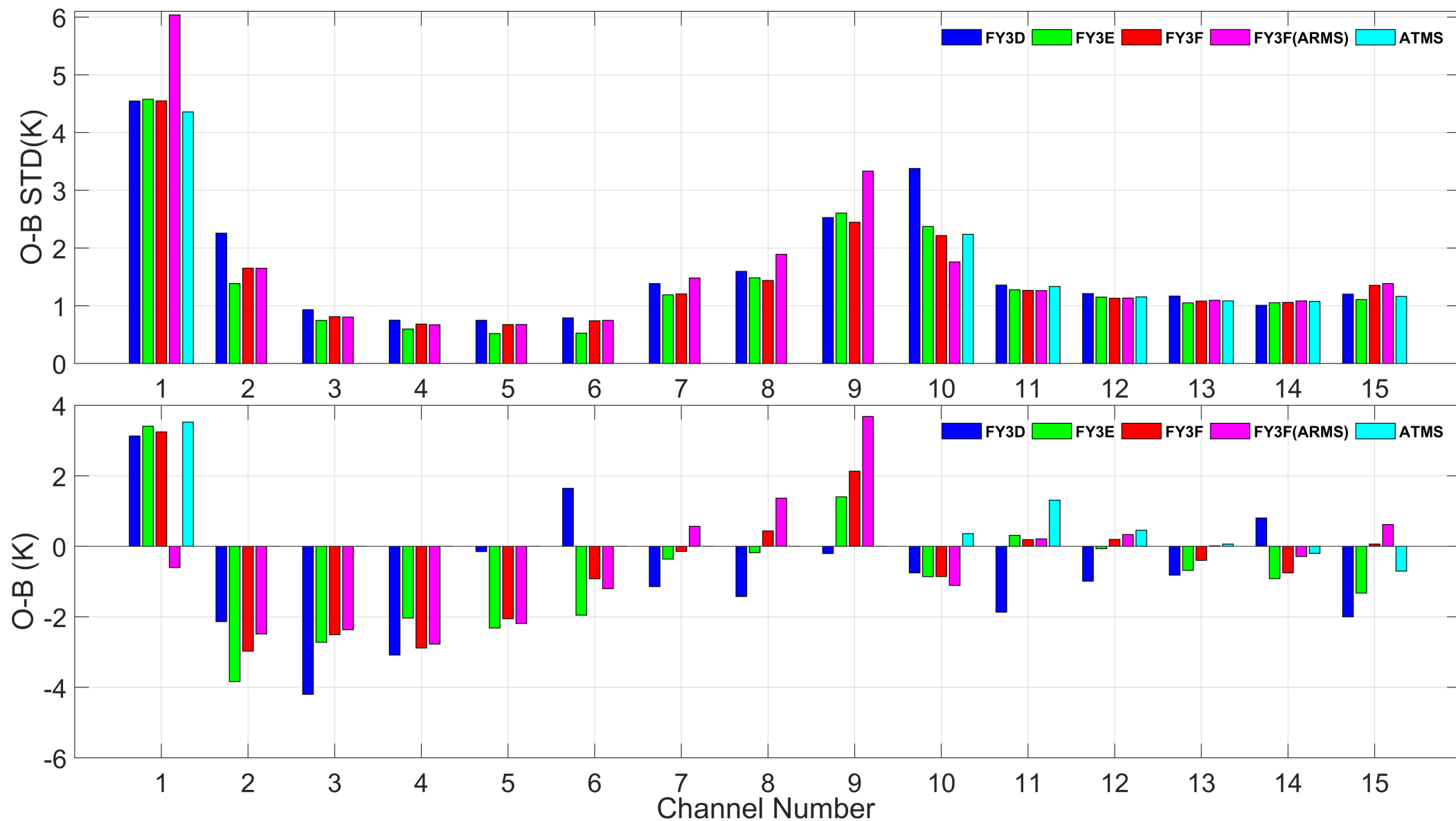
Correlation Analysis of Bright Temperature 2023-08-08~2023-12-25  
FY3F\_MWHS\_IPSS-1\_ATMS. 183.31\_7GHz



**Brightness Temperature of MWHS-II versus ATMS**



# On-orbit instrument performance-MWHS-II



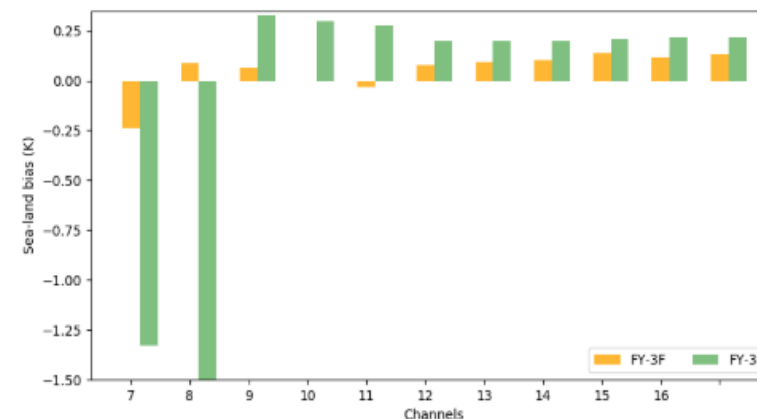


# On-orbit instrument performance-MWTS-III

## (3) Sea-Land contrast bias in sounding channels

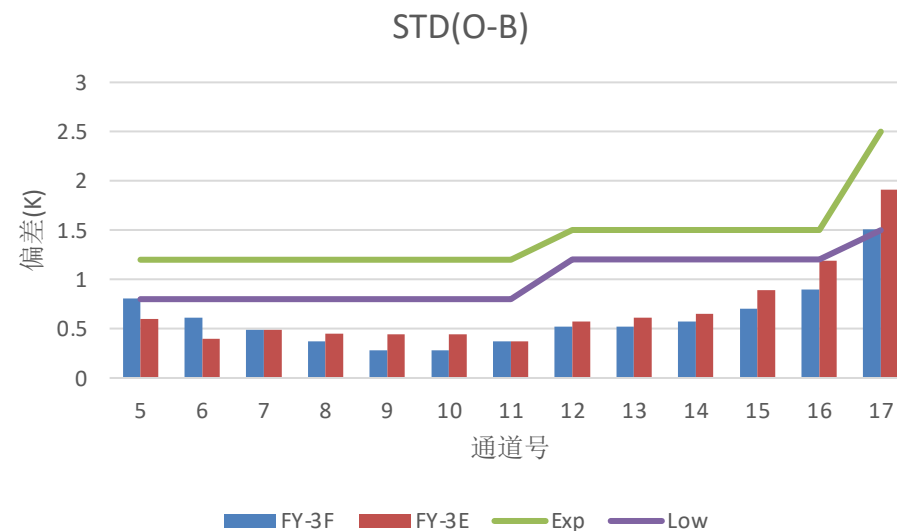
FY-3F MWTS-III improves the out-of-band response for channels 6-8 and crosstalk on channels 7-17, and significantly mitigates the sea-land contrast bias.

Sea-land contrast bias comparison



## (4) Calibration Accuracy

Compared to the BTs simulated using RTTOV and ERA5, the deviations of FY-3F MWTS-III are smaller than those of FY-3E MWTS-III.



# On-orbit instrument performance-MWTS-III

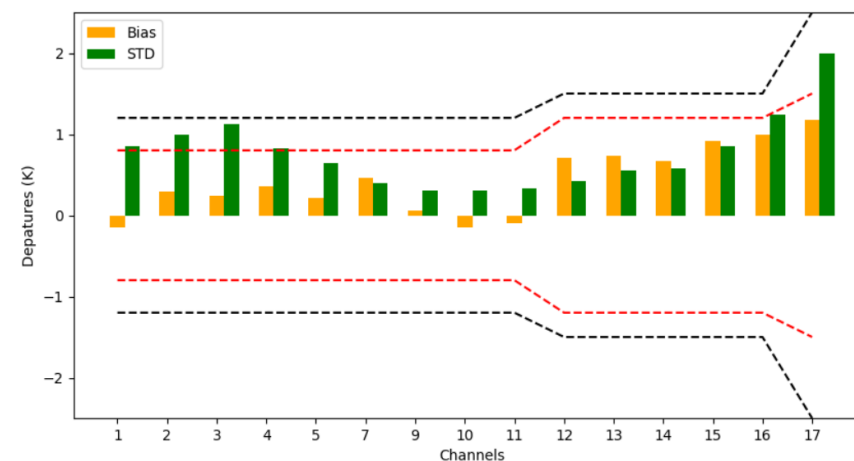
## (4) Calibration Accuracy

- Compared to JPSS-1 ATMS

MWTS-III			ATMS	
Center frequency (GHz)	No.	Polarization	No.	Polarization
23.8	1	QH	1	QV
31.4	2	QH	2	Qv
50.3	3	QV	3	QH
51.76	4	QV	4	QH
52.8	5	QV	5	QH
53.246±0.08	6	QV		
53.596±0.115	7	QV	6	QH
53.948±0.081	8	QV		
54.40	9	QV	7	QH
54.94	10	QV	8	QH
55.50	11	QV	9	QH
57.290344(fo)	12	QV	10	QH
fo±0.217	13	QV	11	QH
fo±0.3222±0.048	14	QV	12	QH
fo±0.3222±0.022	15	QV	13	QH
fo±0.3222±0.010	16	QV	14	QH
fo±0.3222±0.0045	17	QV	15	QH

Data : 2023. 10. 9—2023. 11. 20

- Key match-up conditions
  - Difference of observing times < 20 minutes
  - Nadir two pixels
  - Distance < 20 km
- Uniformity check : STD ( $3 \times 3$  pixels BT) < 1 K
- Comparison Data:
  - Band 1-5 (near surface channels) : BT\_MWTS-BT\_ATMS
  - Band 7-17 (sounding channels): OMB\_MWTS-OMB\_ATMS
  - OMB: Observation-simulation(RTTOV+ERA5)

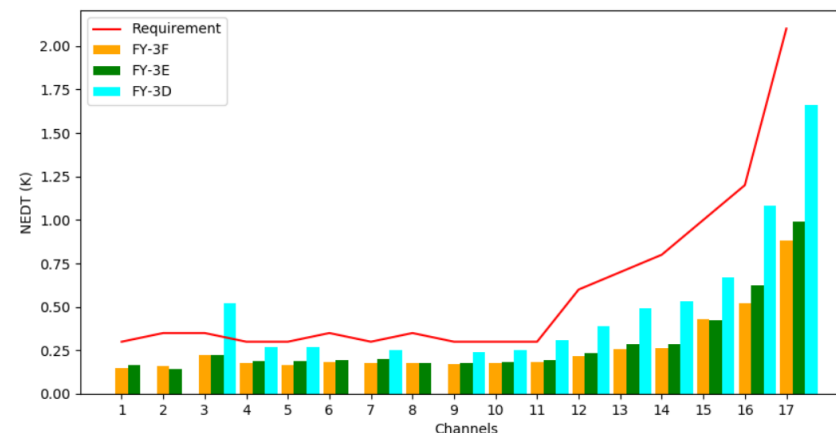


- The biases for channels 1-16 are lower than 1K, while that for channel 17 is 1.12K.
- The STDs for sounding channels 7-15 are lower than 1K.<sup>10</sup>

# On-orbit instrument performance-MWTS-III

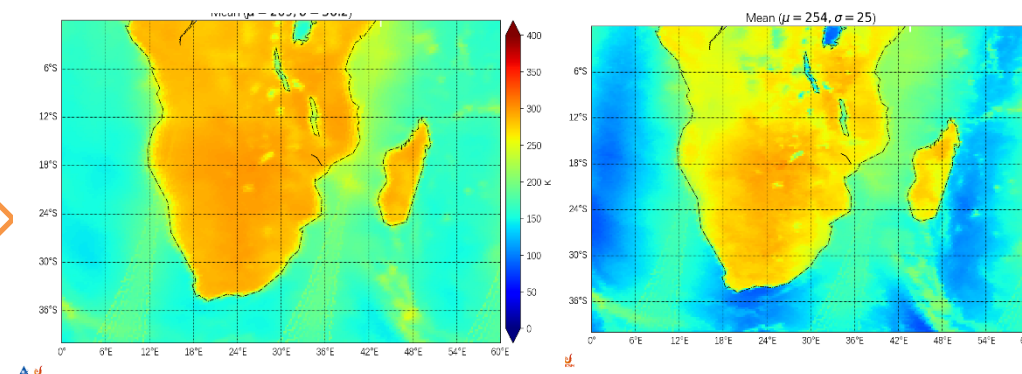
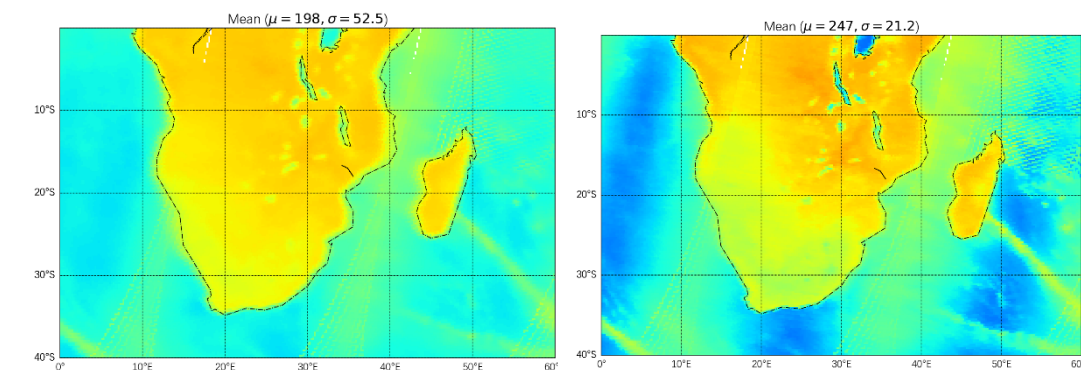
## (1) NEDT

✓ The quality of FY-3F MWTS-III such as NEDT, alignment accuracy and calibration accuracy are better than those of FY-3E.



## (2) Alignment accuracy

Alignment deviation between ch 2 and ch 3 of FY-3E MWTS-III is **1.47 pixels**, but that of FY-3F MWTS-III is **0.3 pixels**.



Channel 2

Channel 3

Channel 2

Channel 3

# Summary

- ✓ The in-orbit behavior of MWHS-II and MWTS-III evaluated by SNO with ATMS and the difference between O-B.
- ✓ As a substitute for its predecessor FY-3C, the performance of MWHS-II onboard FY-3F is compliant with requirements.

## Lunar microwave calibration group

National Satellite  
Meterological Cente  
CMA



National Space Science  
Cente  
Chinese Academy of  
Sciences

Sun Yat-sen University  
National Satellite  
Meterological Cente  
CMA

Fudan  
University

National Satellite  
Meterological Cente  
CMA

# Thank you for your attention

**Email:** [guoyang@cma.gov.cn](mailto:guoyang@cma.gov.cn)  
[hujy@cma.gov.cn](mailto:hujy@cma.gov.cn)