

# Performance Status of FY-3E/HIRAS-II and FY-4B/GIIRS

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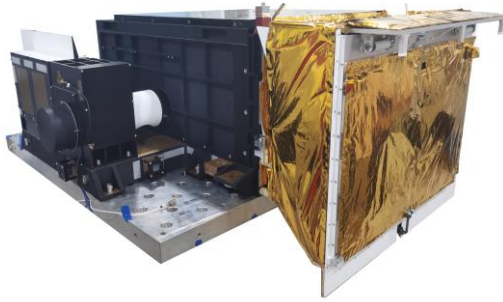


GSICS Annual Meeting 14-18 March 2022

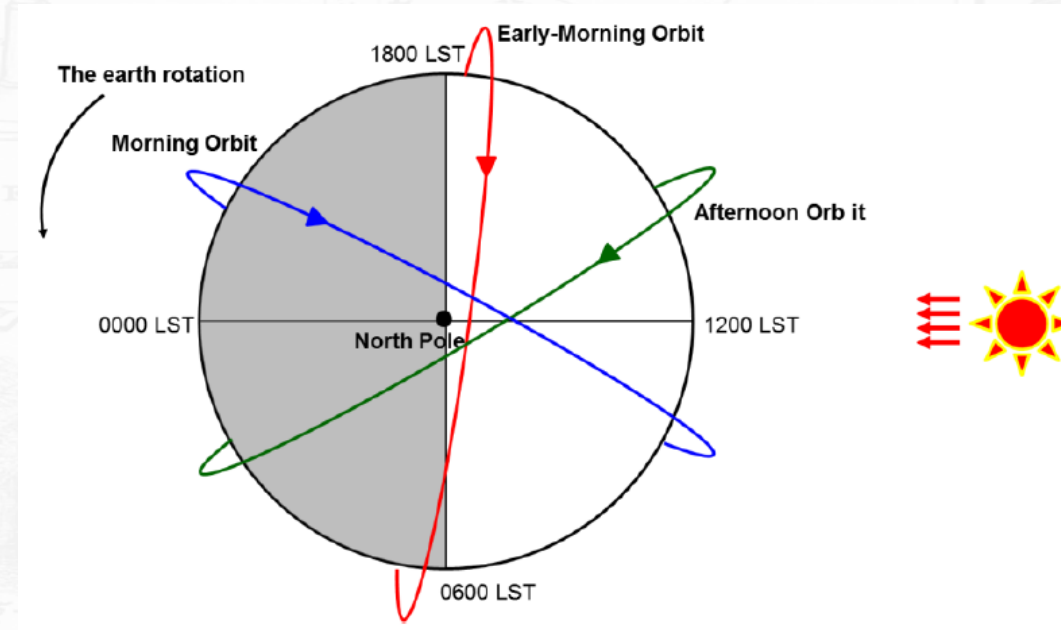
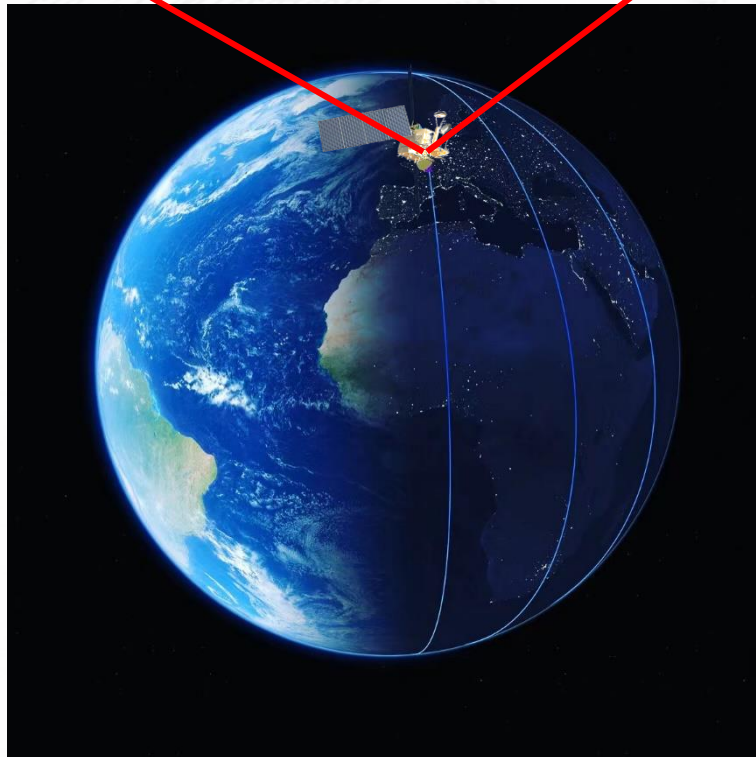
# Outline

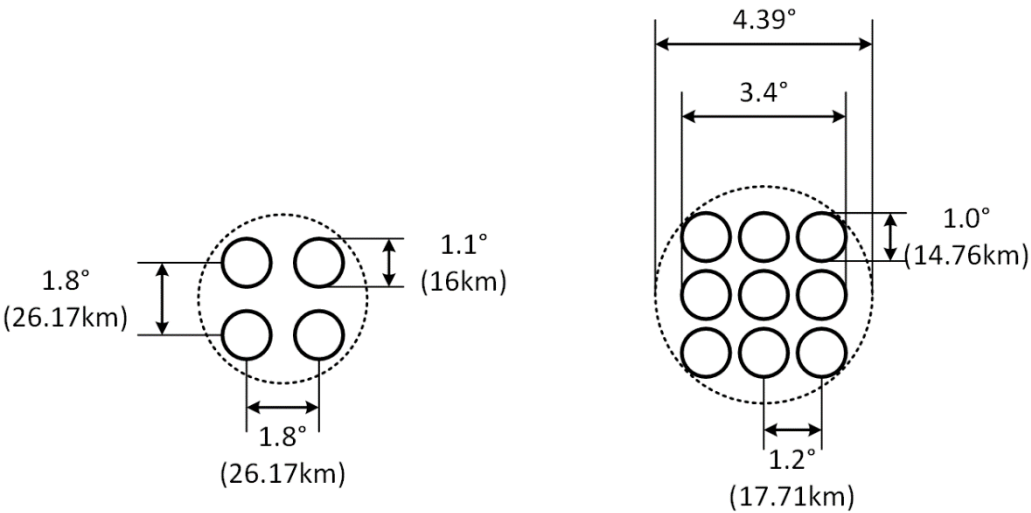
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- FY-3E/HIRAS On-board Performance Status
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### HIRAS



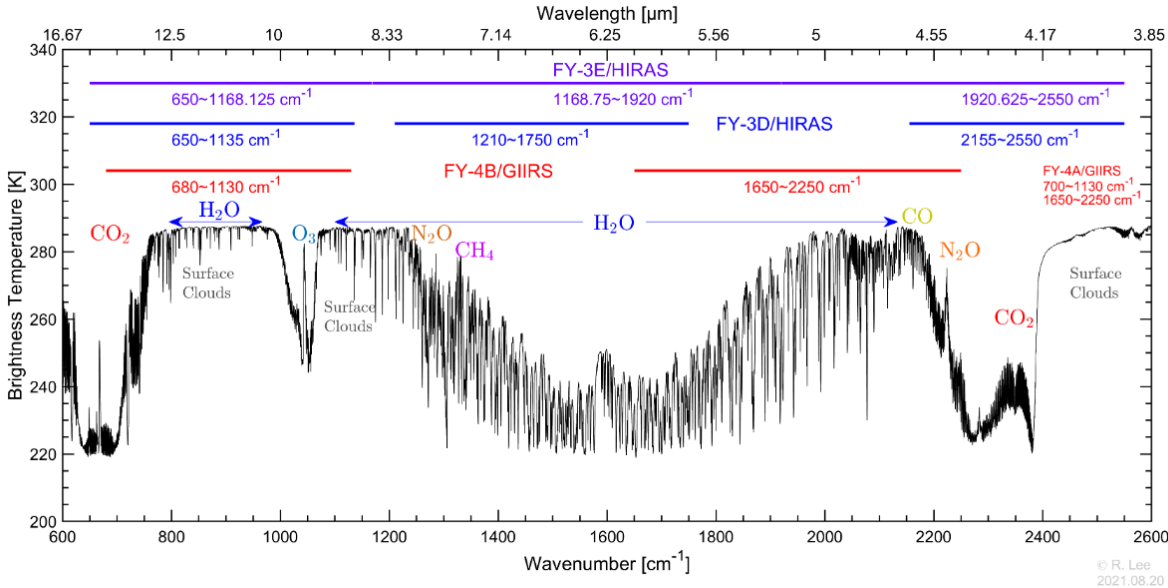
- FY-3E was launched successfully on July 5, 2022.
- FY-3E is the world's first early-morning-orbit meteorological satellite for civil use.
- HIRAS-II is the second hyperspectral IR sounder onboard FY-3 series satellites.





(a) FY-3D/HIRAS Detector Layout

(b) FY-3E/HIRAS Detector Layout

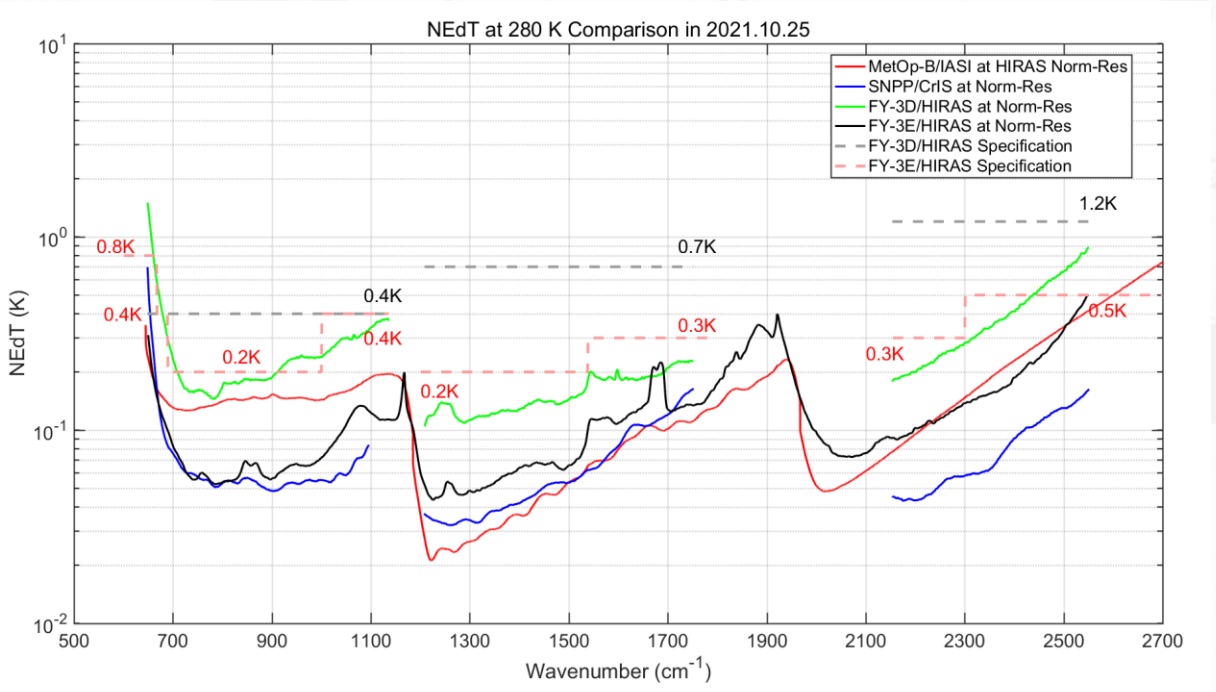
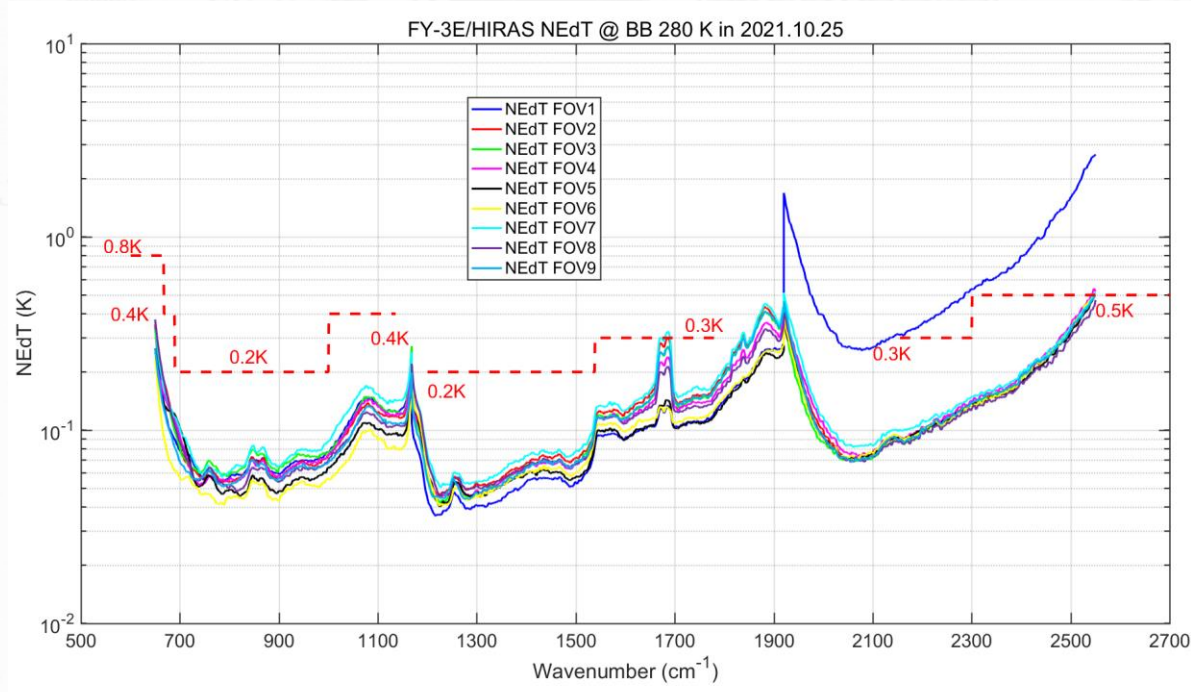


Band	Spectral Range (cm <sup>-1</sup> )	Spectral Resolution (cm <sup>-1</sup> )	Sensitivity (NEΔT@280K)			Radiometric Accuracy		Spectral Uncertainty	
			FY-3D	FY-3E		FY-3D	FY-3E	FY-3D	FY-3E
LWIR	650~1168.125 (15.38 μm~8.56 μm)	0.625	0.4 K	650 ~ 667 cm <sup>-1</sup>	0.8 K	0.7 K	1.0 K	10 ppm	7 ppm
				667~689 cm <sup>-1</sup>	0.4 K		0.5 K		
				689~1000 cm <sup>-1</sup>	0.2 K		0.4 K		
				1000~1136 cm <sup>-1</sup>	0.4 K		0.5 K		
MWIR	1168.75~1920 (8.55 μm~5.21 μm)	0.625	0.7K	1210~1538 cm <sup>-1</sup>	0.2 K	0.7 K	0.4 K		
				1538~1750 cm <sup>-1</sup>	0.3 K		0.5 K		
SWIR	1920.625~2550 (5.21 μm~3.92 μm)	0.625	1.2 K	2155~2300 cm <sup>-1</sup>	0.3 K	0.7 K	0.5 K		
				2300~2550 cm <sup>-1</sup>	0.5 K		0.6 K		



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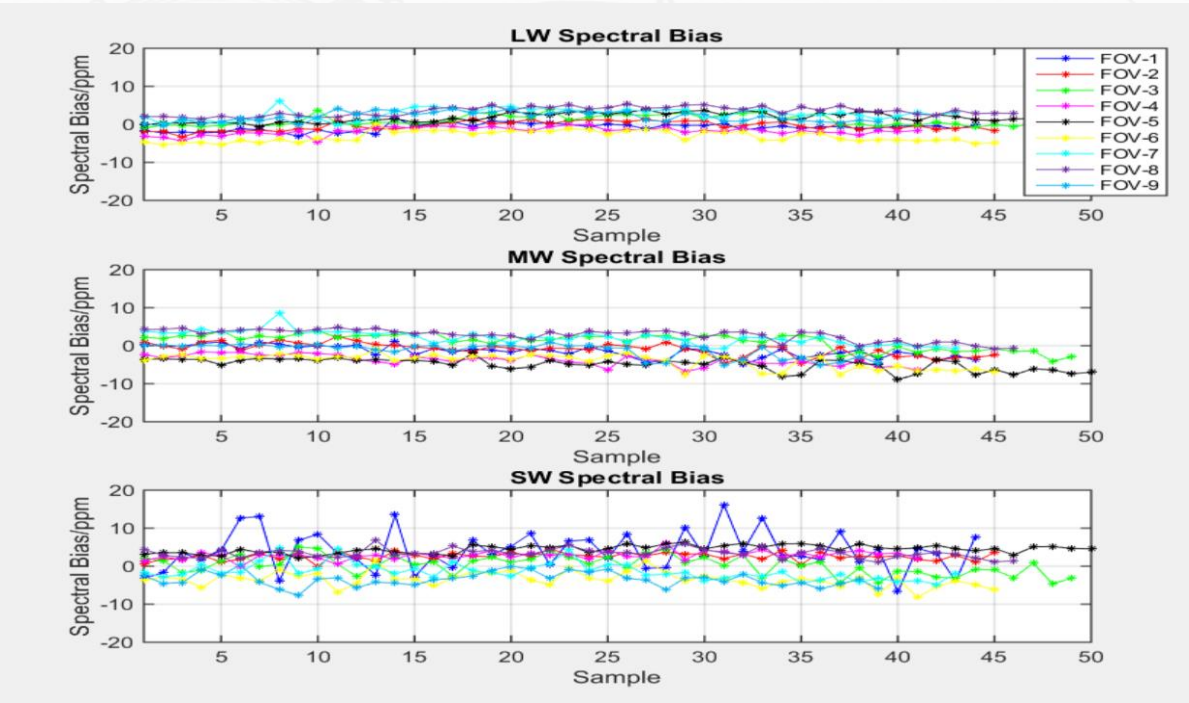
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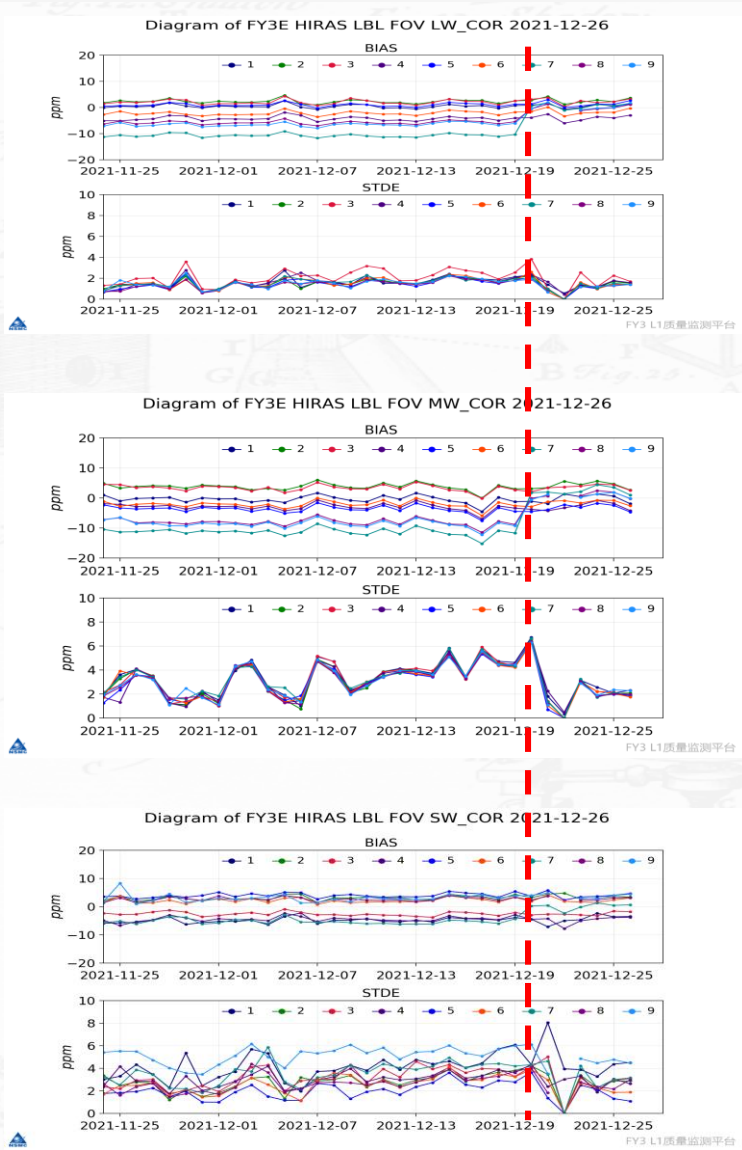
FY-3E/HIRAS-II LWIR and MWIR have good noise performance

SWIR FOV-1 is out of family and larger than specification

FY-3E/HIRAS-II NEdT performance is better than FY-3D/HIRAS except for the FOV-1 in SWIR.



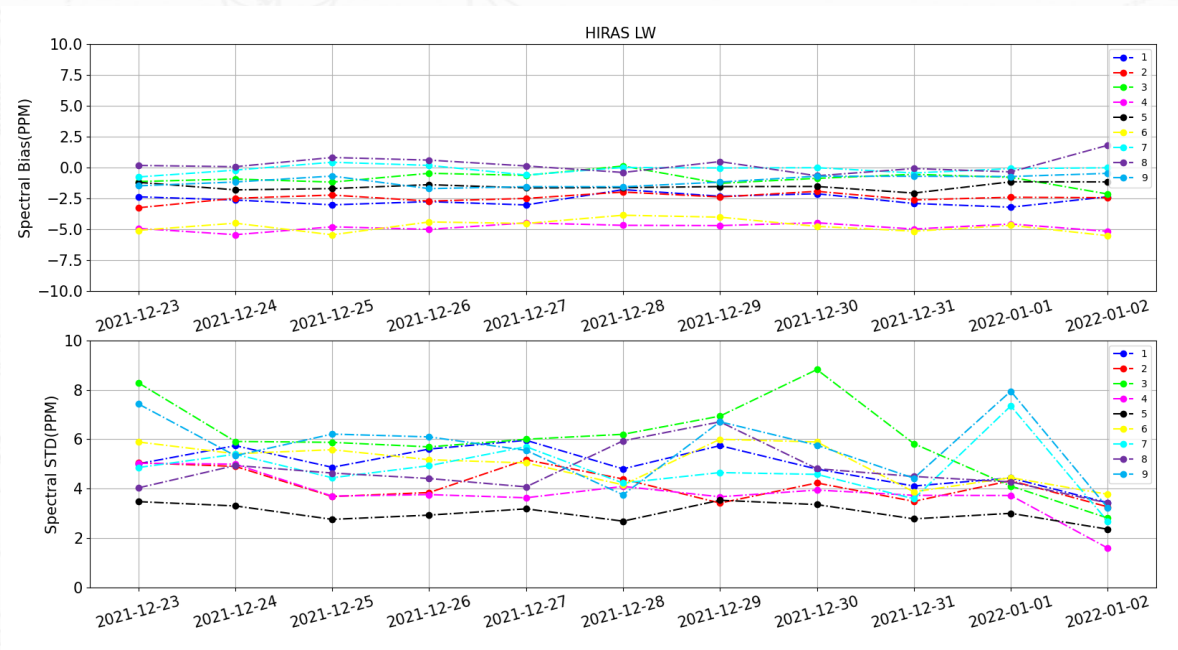
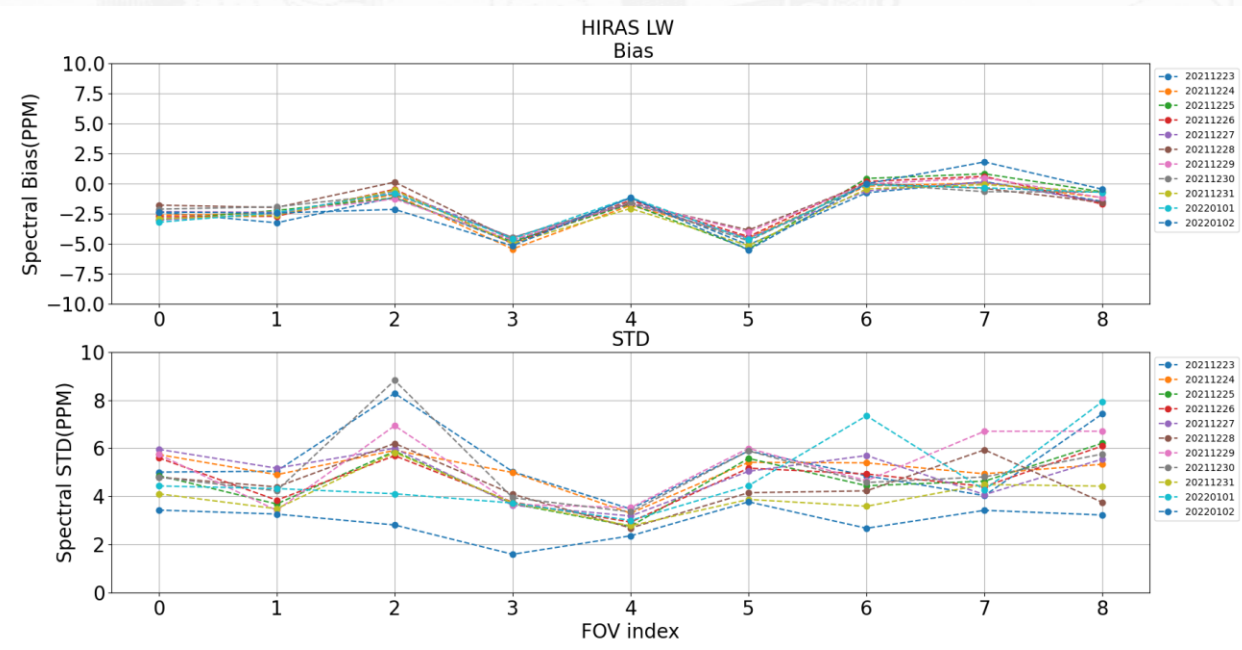
The spectral offsets for all three bands are within  $\pm 5$  ppm after the spectral calibration parameter updated on Dec. 20, 2021.





# HIRAS-II on-board spectral calibration

based on SNO IASI-C spectra

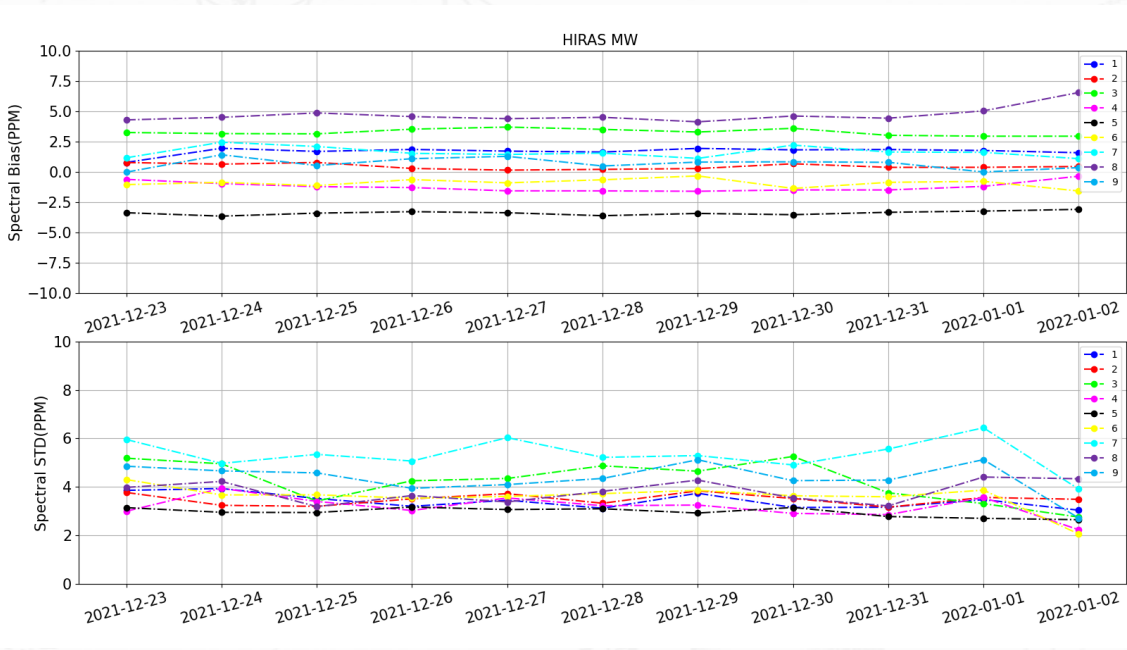
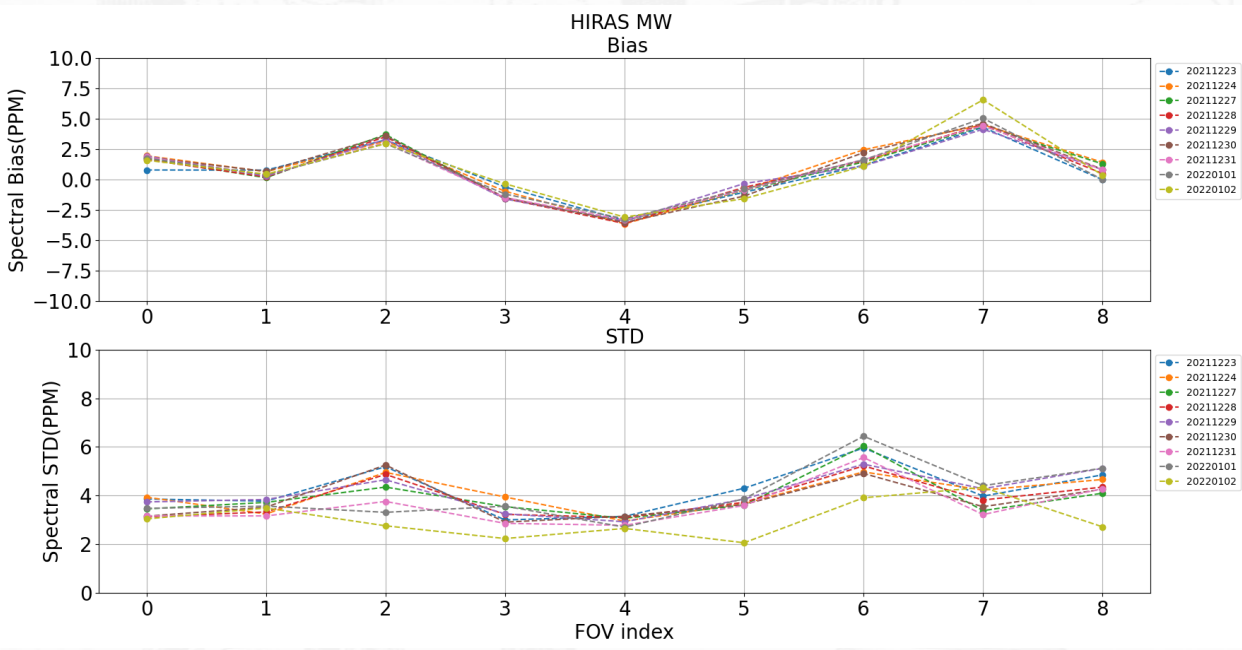


LWIR spectral offsets are within  $\pm 5$  ppm

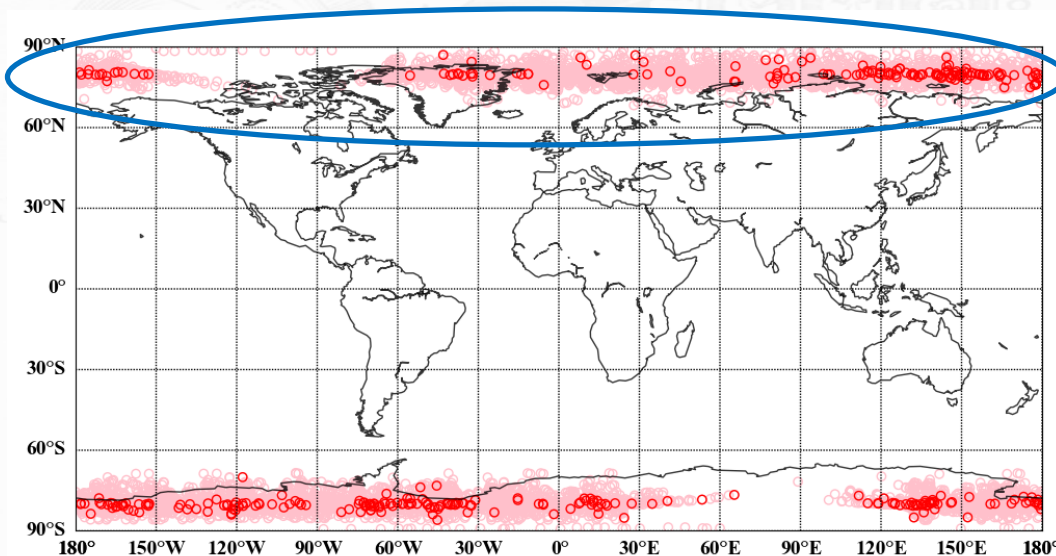


# HIRAS-II on-board spectral calibration

based on SNO IASI-C spectra



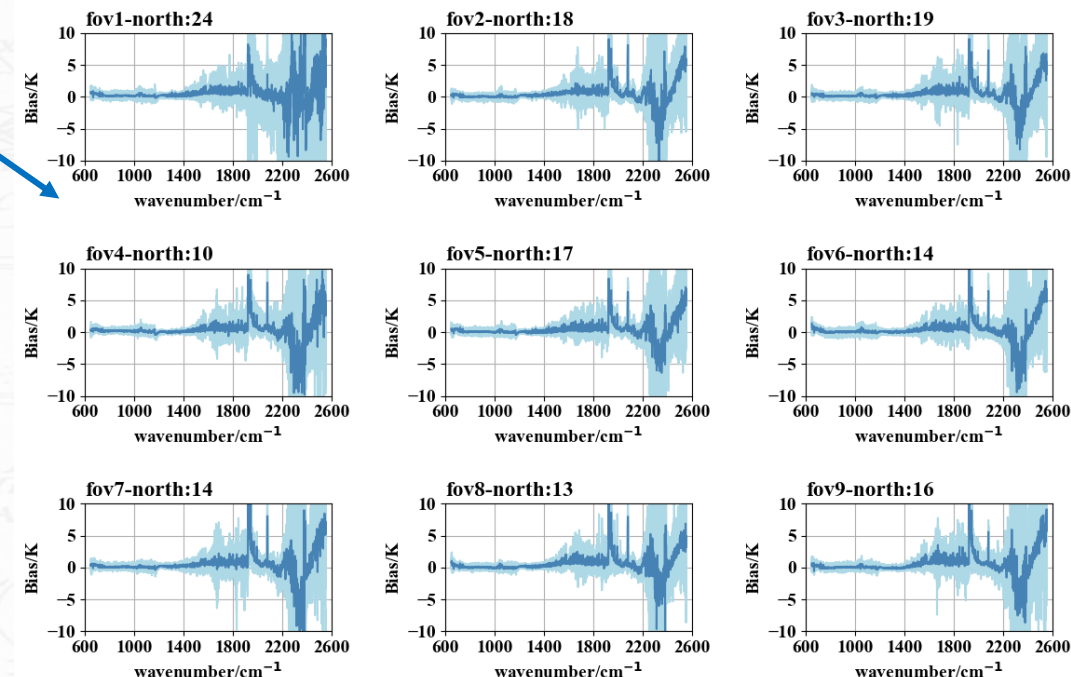
MWIR spectral offsets are within  $\pm 5$  ppm

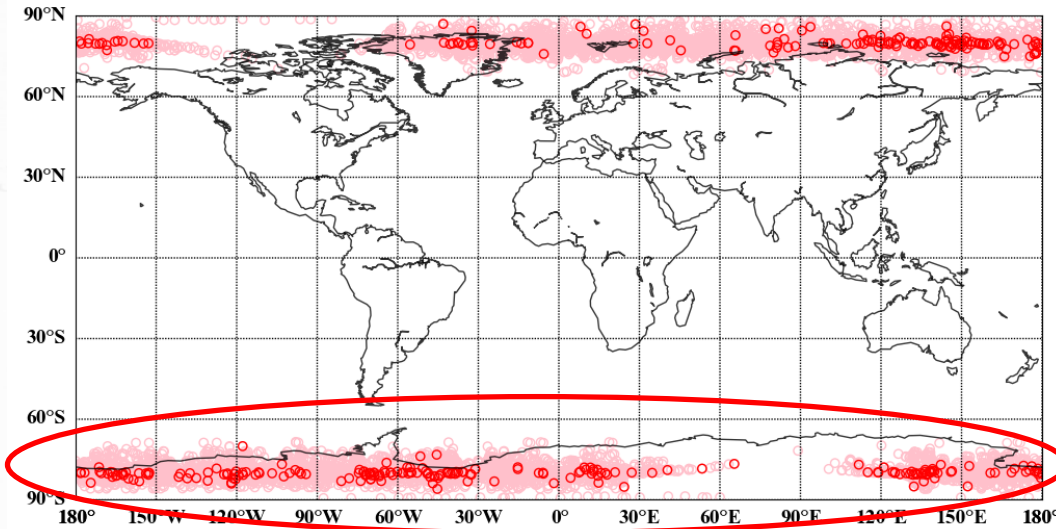


HIRAS-II to IASI-B SNOs in the polar regions  
(from Nov.14 to Dec.01 2021)

The BT differences in LWIR and MWIR are less than 1.0 K (std. dev. < 1K).

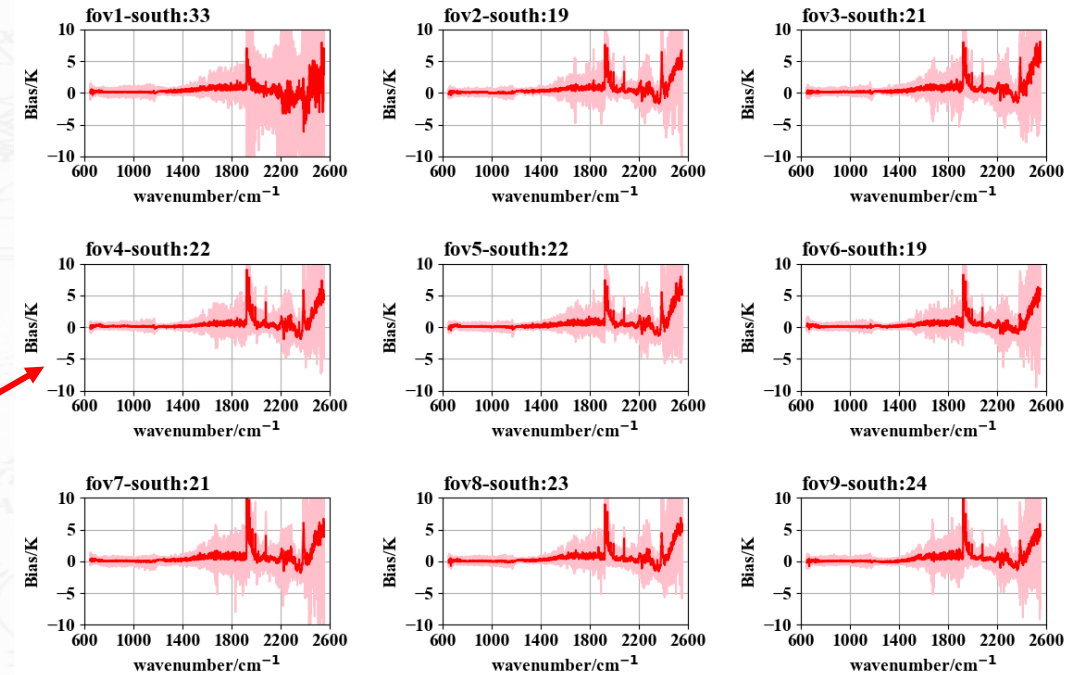
The SWIR BT differences are larger than that in LWIR and MWIR, because of the cold scenes in Arctic regions.



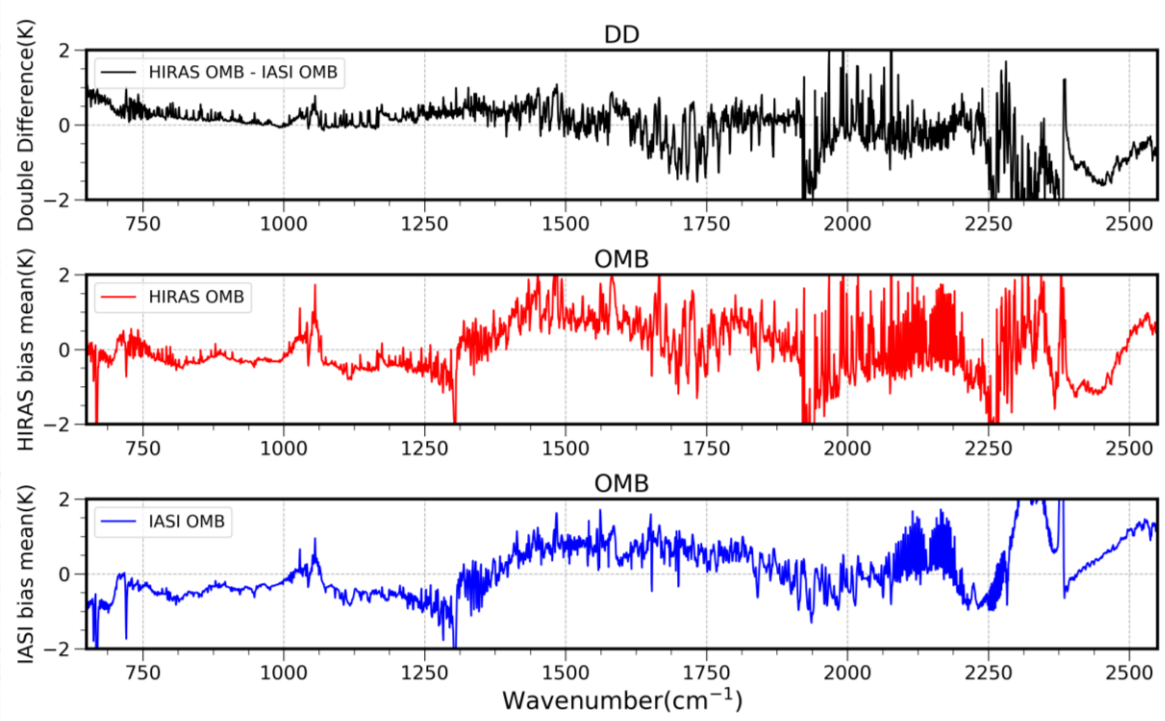
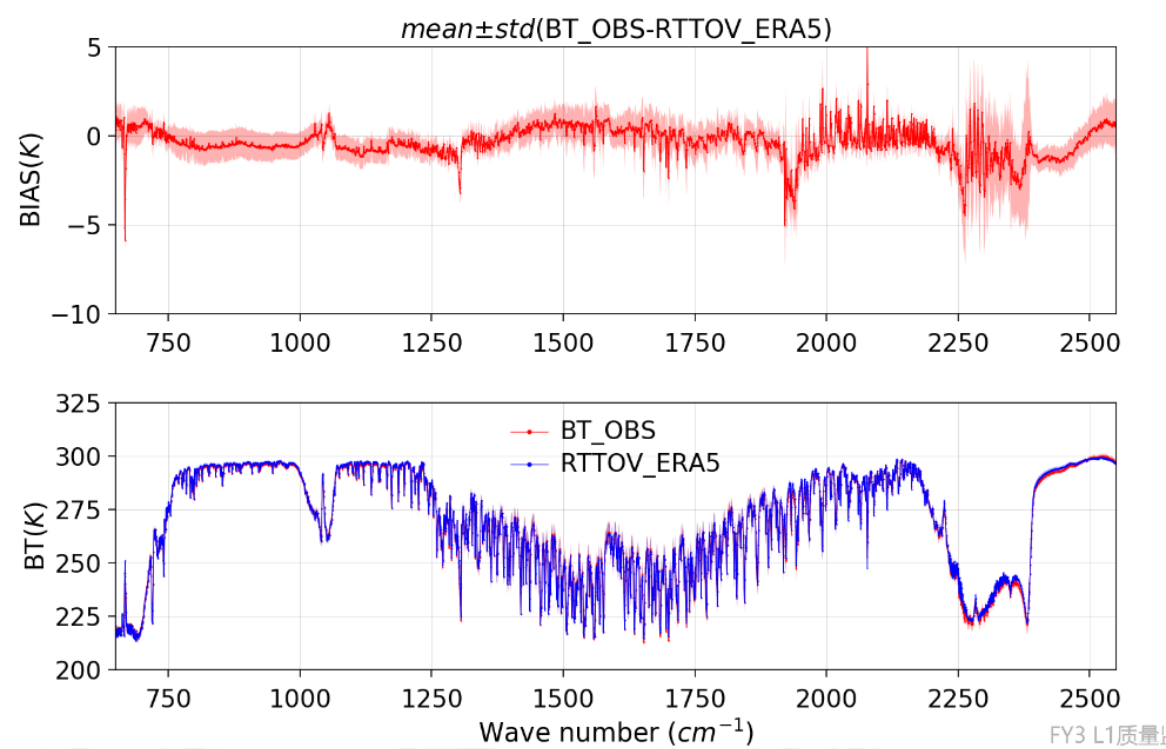


HIRAS-II to IASI-B SNOs in the polar regions  
(from Nov.14 to Dec.01 2021)

Since the SNO scenes in Antarctic are warmer than Arctic, the SWIR BT dev. has been reduced considerably.







The RTTOV spectra are calculated for clear scenes using ERA5.

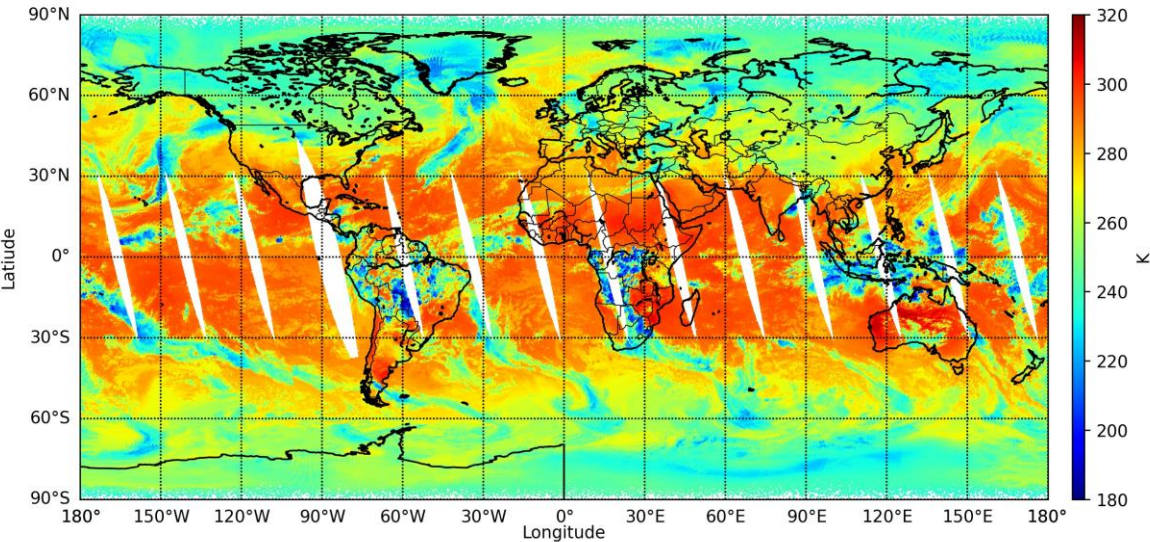
LWIR radiometric accuracy is better than 0.5 K, and MWIR is about 0.5 to 1.0 K.

SWIR is larger than specification, and is about 0.5 to 2.0 K.

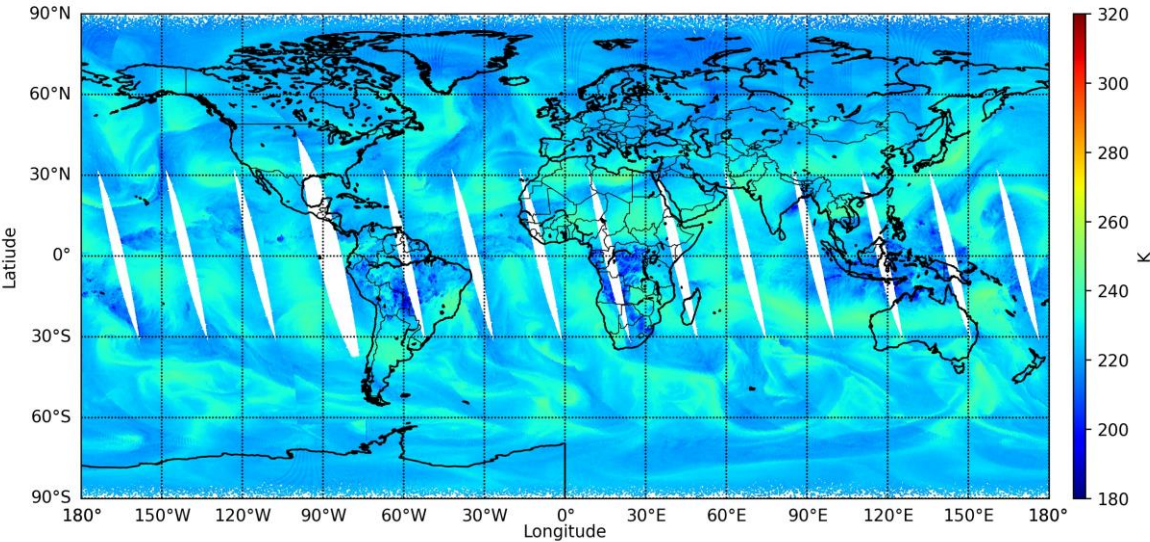


# HIRAS-II Brightness Temperature

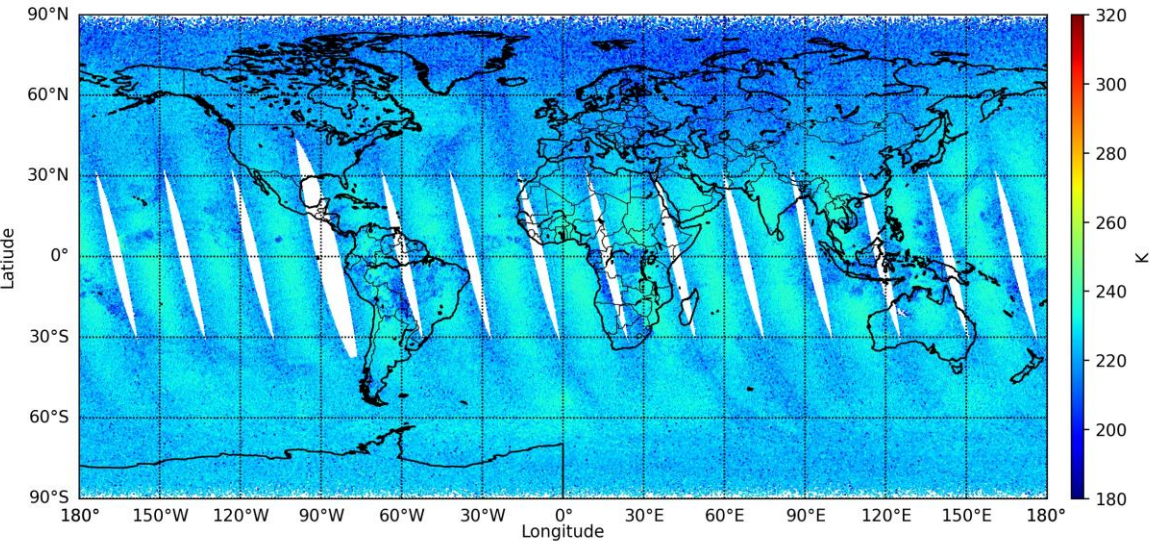
FY3E\_HIRAS\_20211204\_CH420\_A\_911.25 cm-1\_Bright\_Temperature(K)



FY3E\_HIRAS\_20211204\_CH532\_A\_1500 cm-1\_Bright\_Temperature(K)



FY3E\_HIRAS\_20211204\_CH929\_A\_2500 cm-1\_Bright\_Temperature(K)



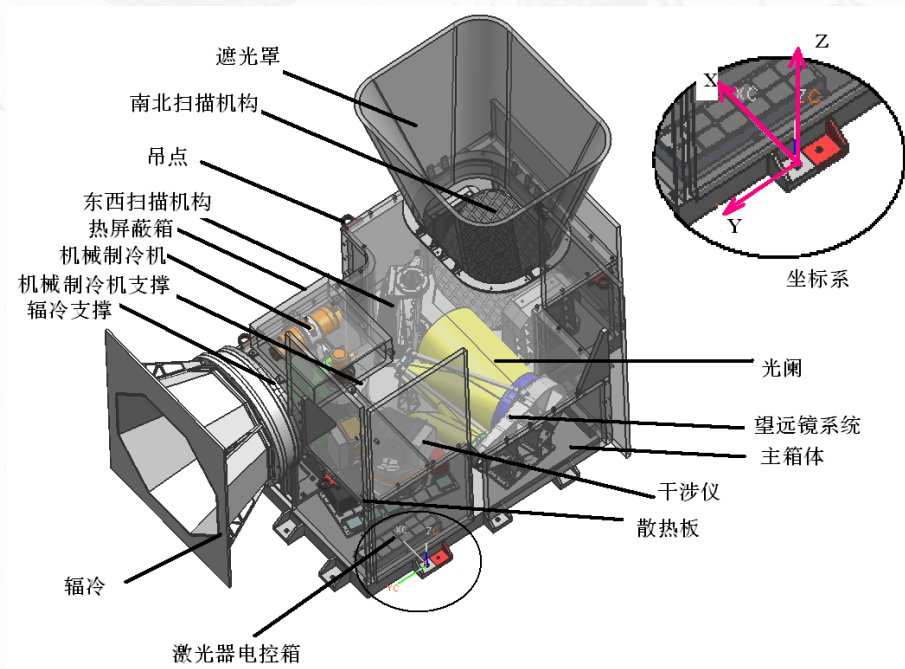
FY-3E/HIRAS-II day-1 global BT images.

# Outline

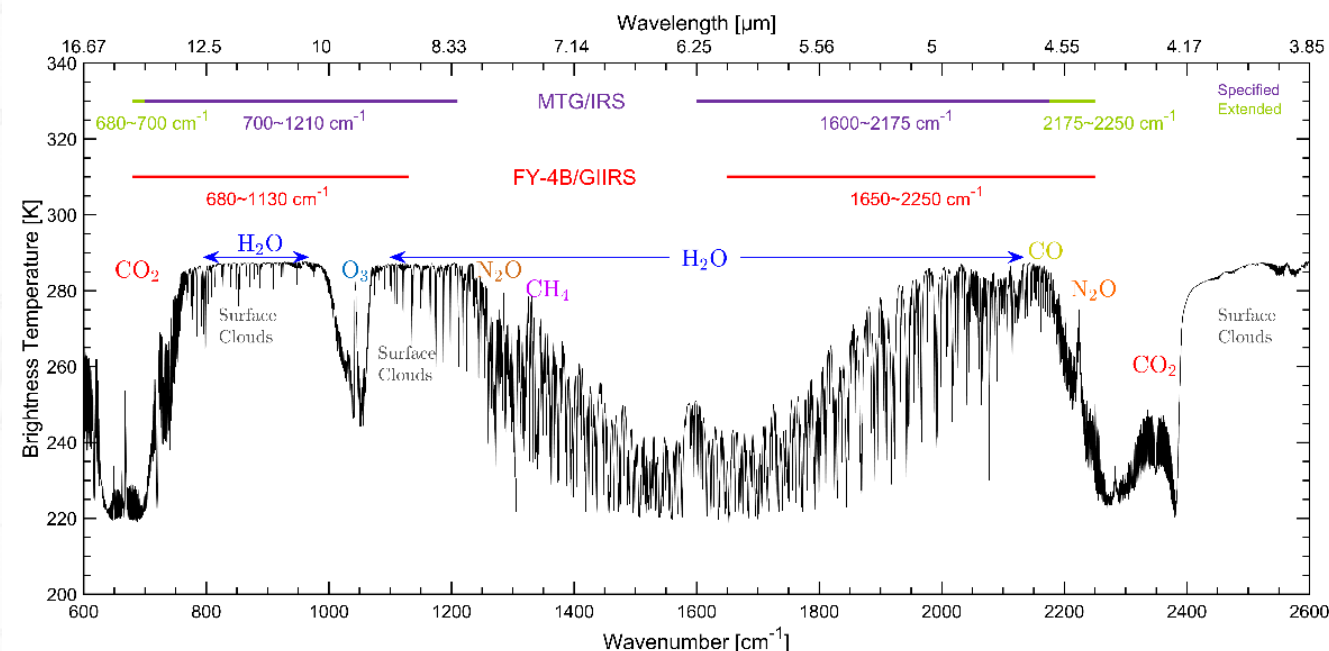
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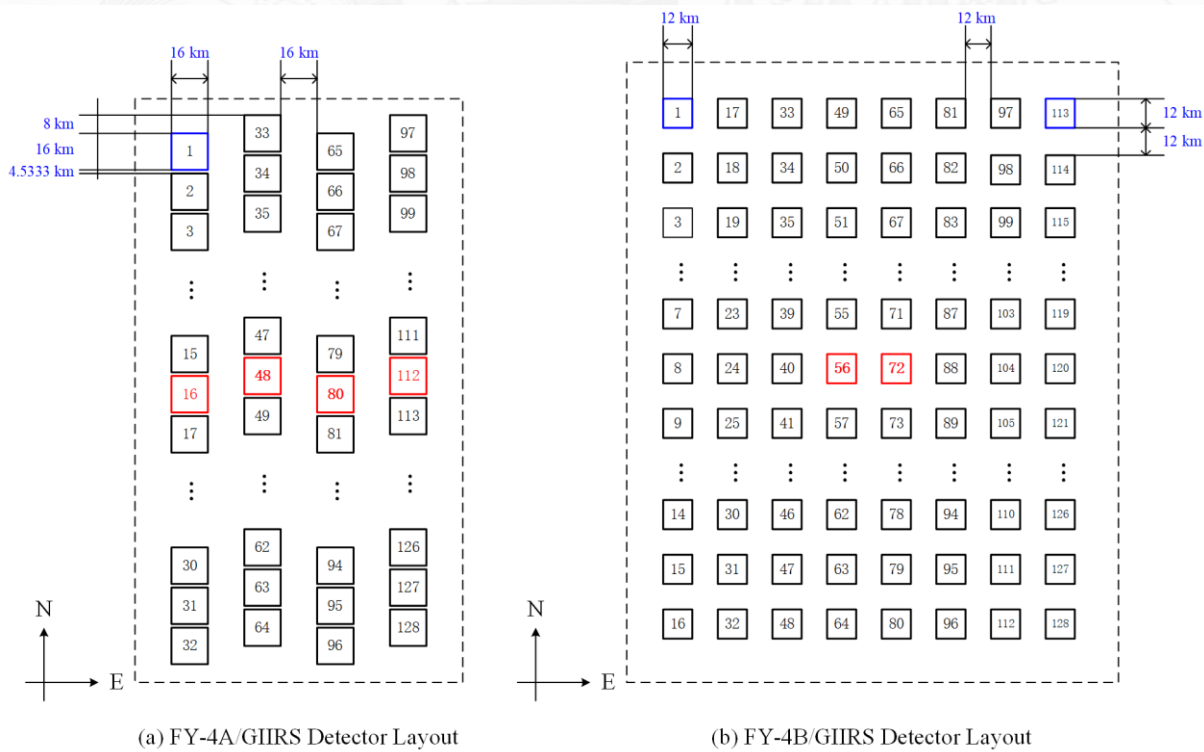


- FY-4B/GIIRS was launched successfully on June 3, 2021, which is China's second hyperspectral IR sounder on the GEO satellite.
- Unlike the demonstration of FY-4A/GIIRS, this sounder is expected to be used for NWP operational model.



GIIRS Model





Item	Band	
	LWIR	MWIR
Spectral range/cm <sup>-1</sup>	680~1130	1650~2250
MPD/cm	0.8	0.8
Resolution/cm <sup>-1</sup>	0.625	0.625
Number of Channels	721	961
NEdR/[mW/(m <sup>2</sup> ·sr·cm <sup>-1</sup> )]	< 0.5	< 0.1
Spatial resolution (s.s.p)/km	12×12	12×12
Frequency uncertainty/ppm	10	10
Radiometric CAL. accuracy/K	0.7	0.7

➤ The detector layout has been updated from 32×4 to 16×8, with spatial sampling from 16×16 km to 12×12 km at Nadir.

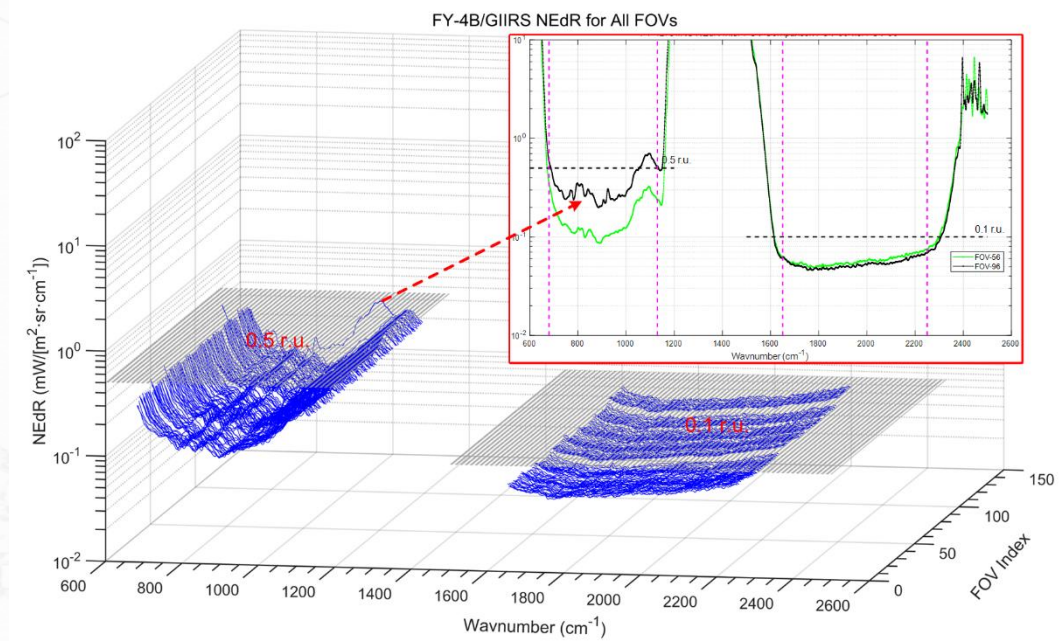
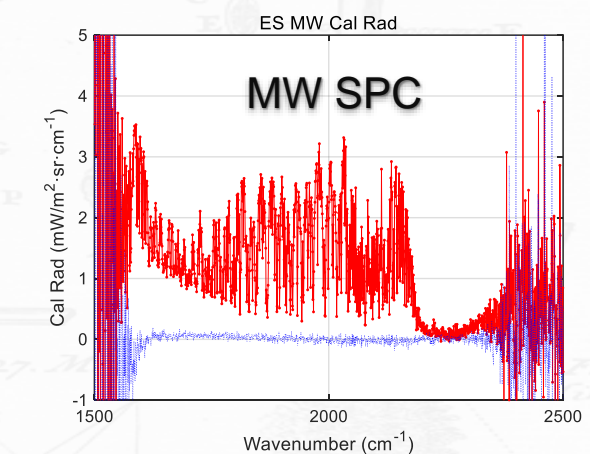
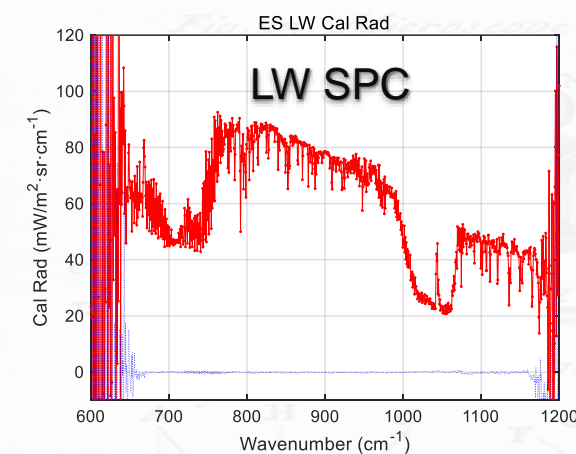
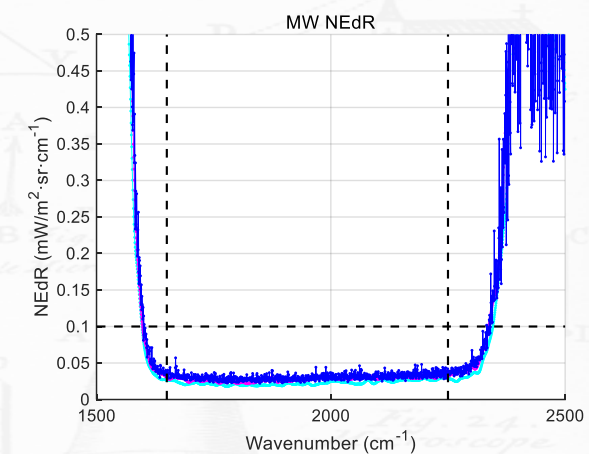
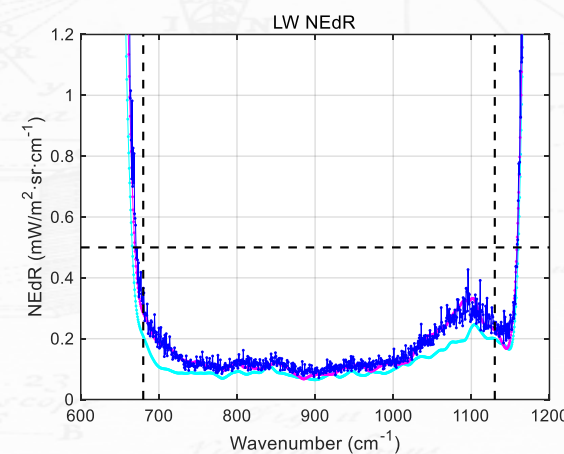
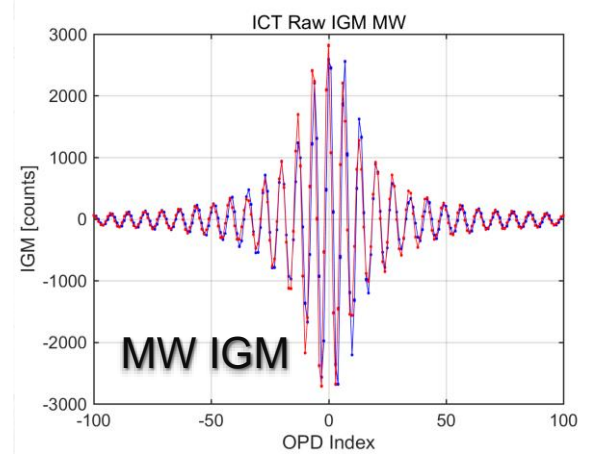
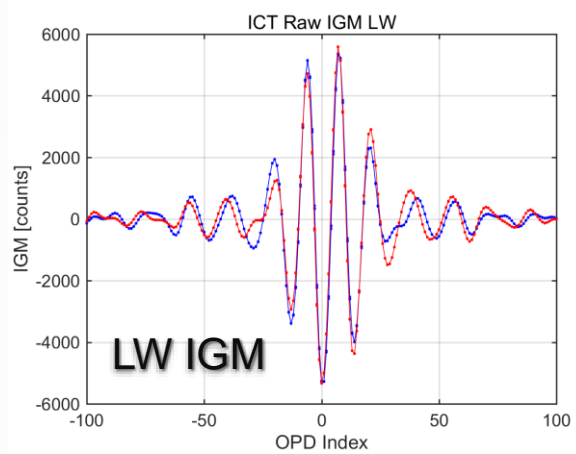


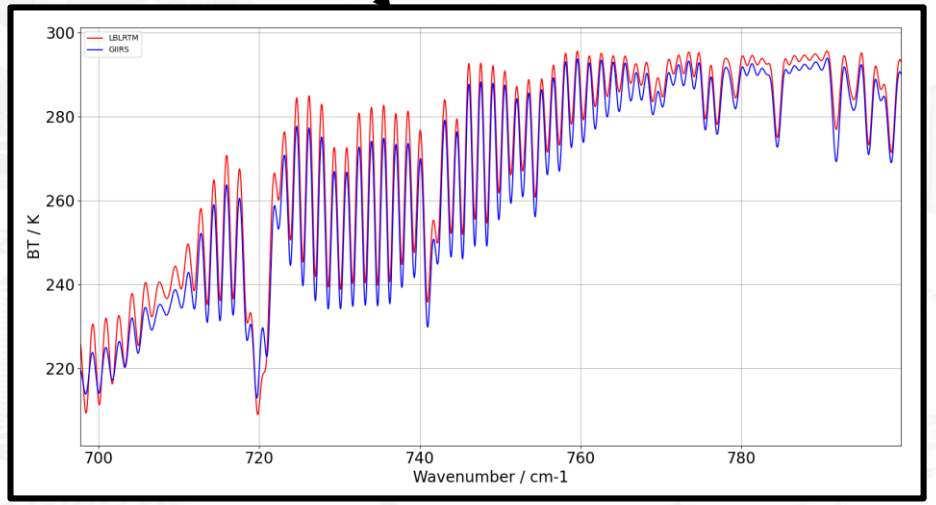
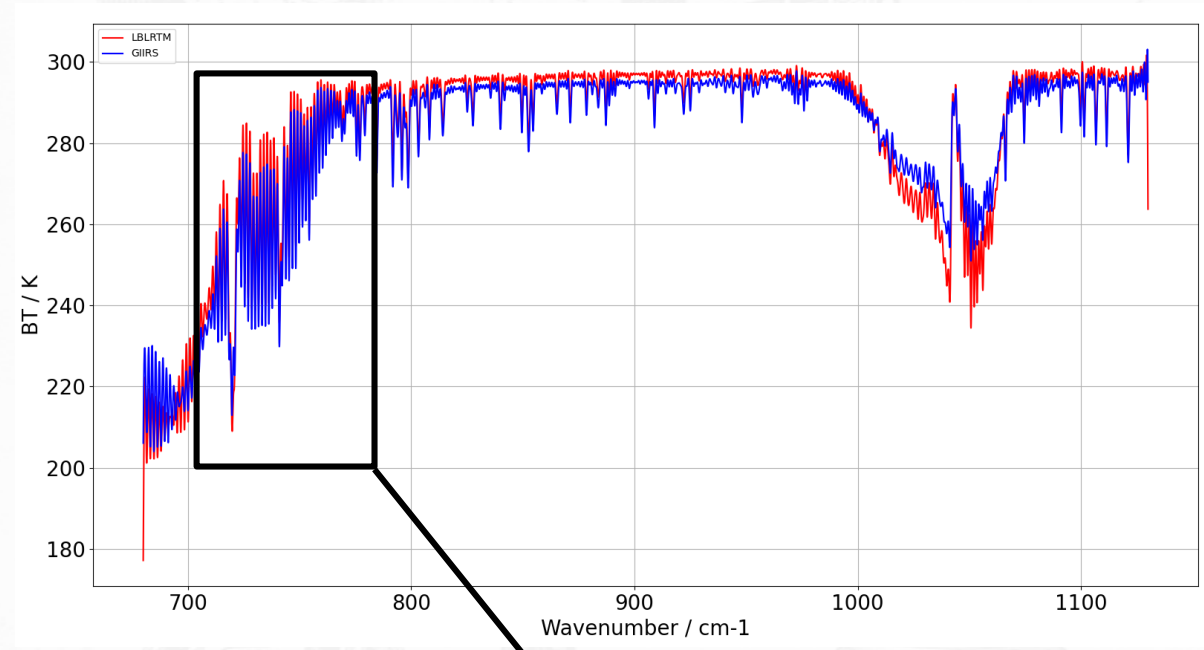
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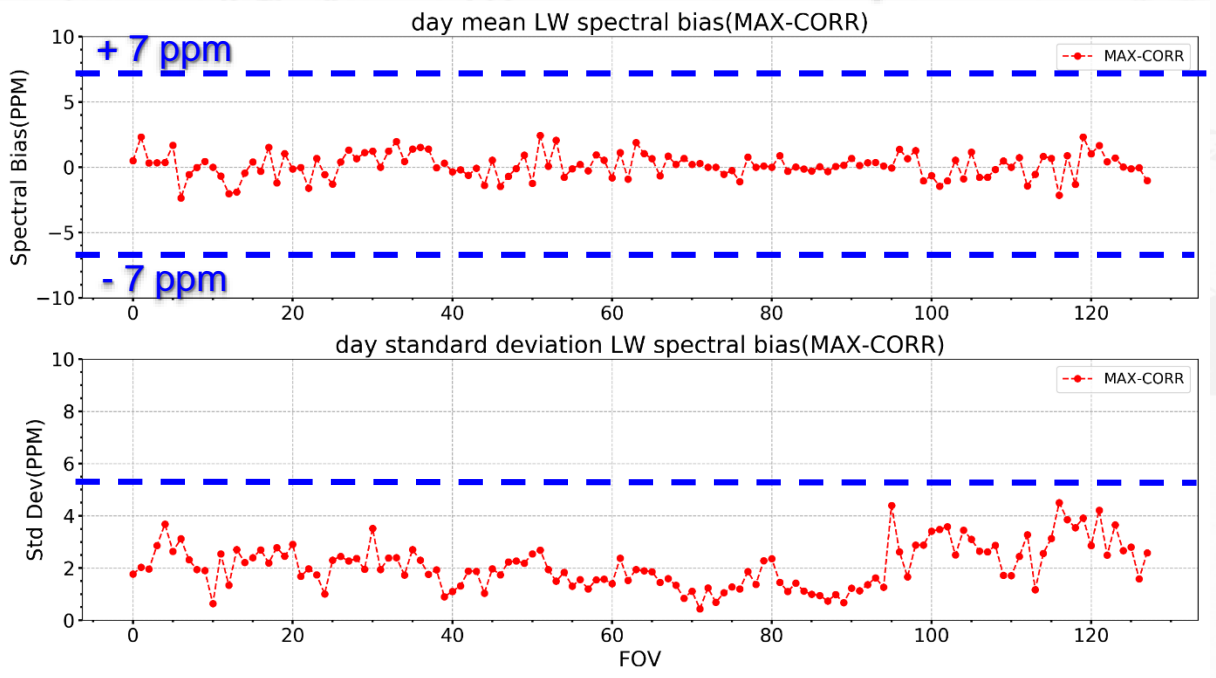
# FY-4B/GIIRS Day-1 data check

## Day-One Data Check

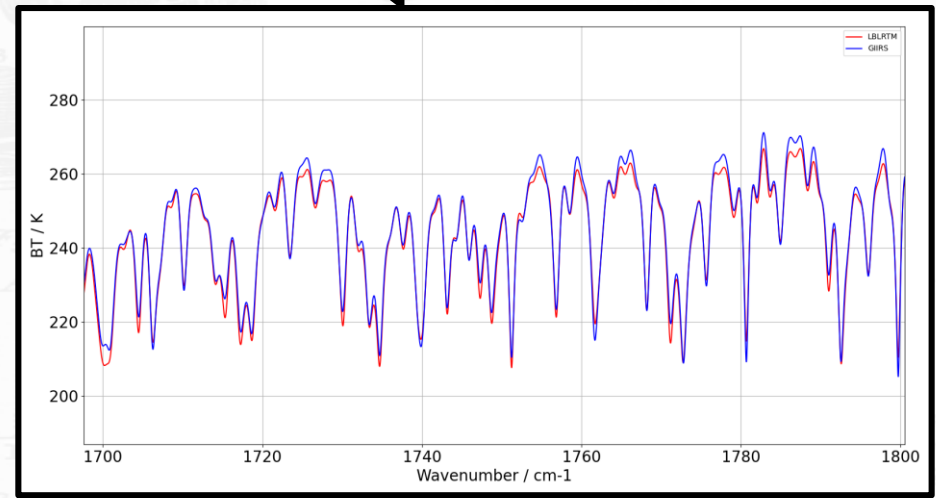
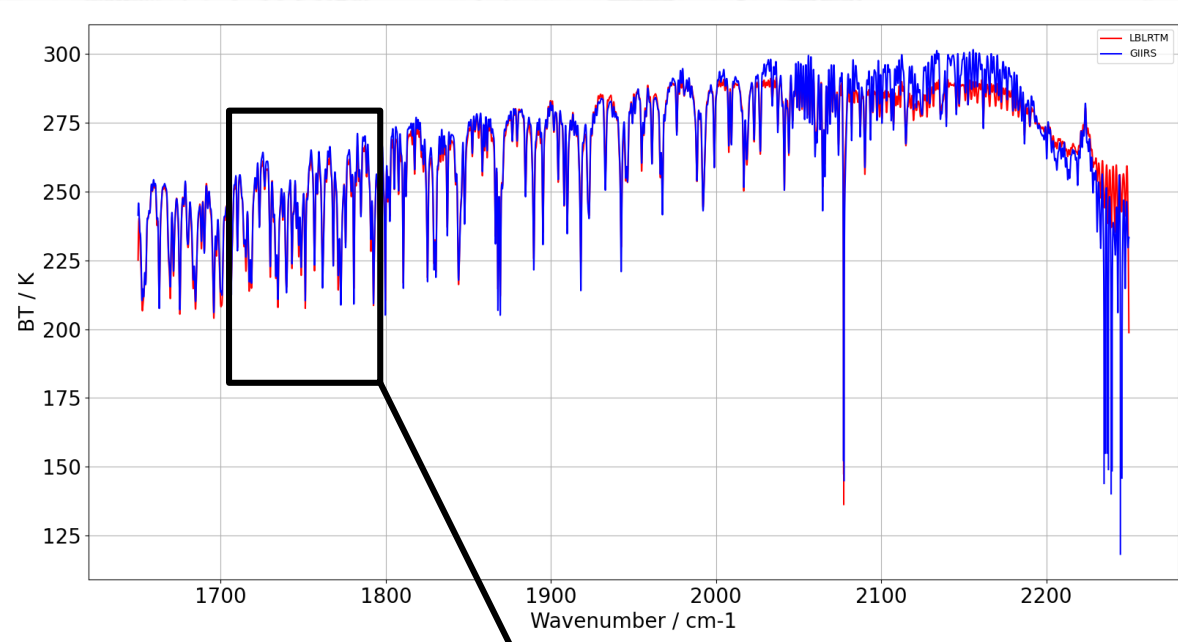




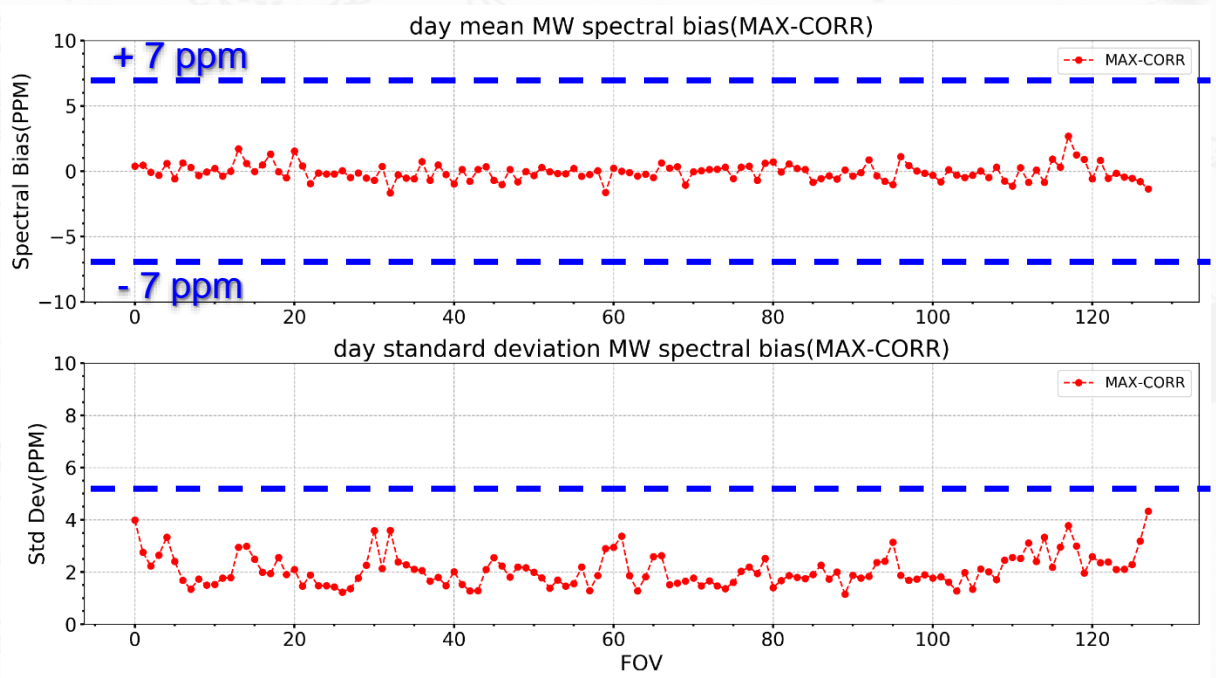
Take 2022.01.11 data for example



➤ FY-4B/GIIRS LWIR spectral calibration accuracy : within  $\pm 7$  ppm (std. < 5ppm)

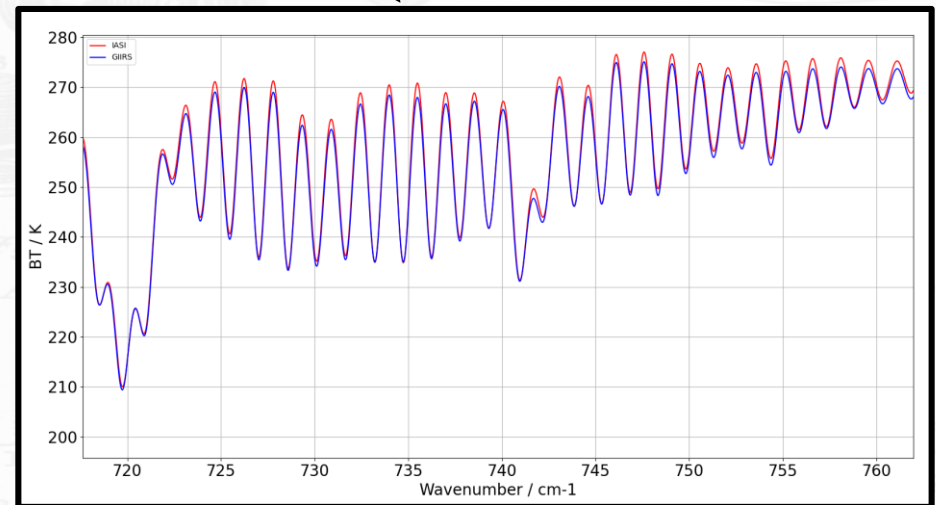
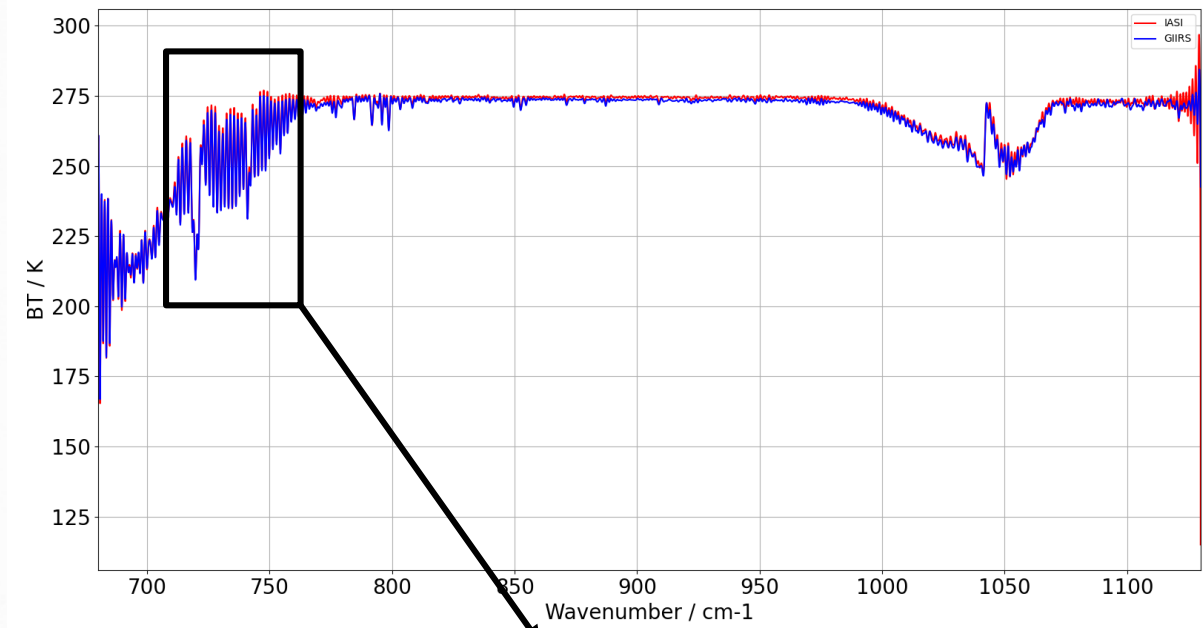


Take 2022.01.11 data for example

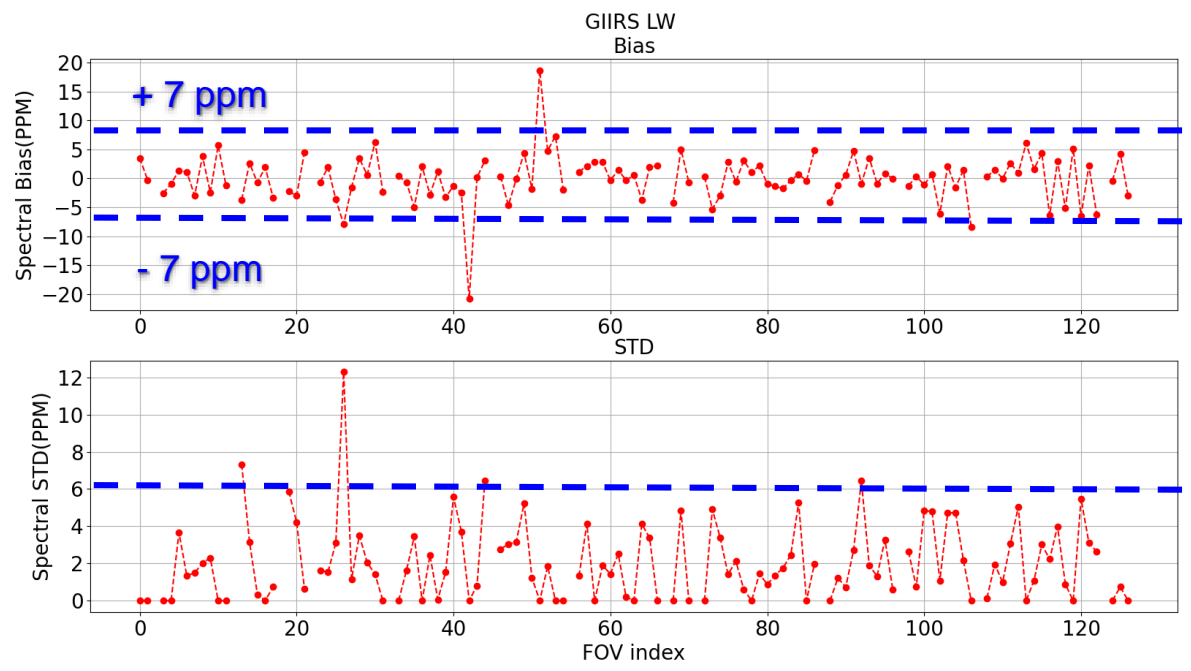


➤ FY-4B/GIIRS MWIR spectral calibration accuracy : within  $\pm 7$  ppm (std. < 5ppm)

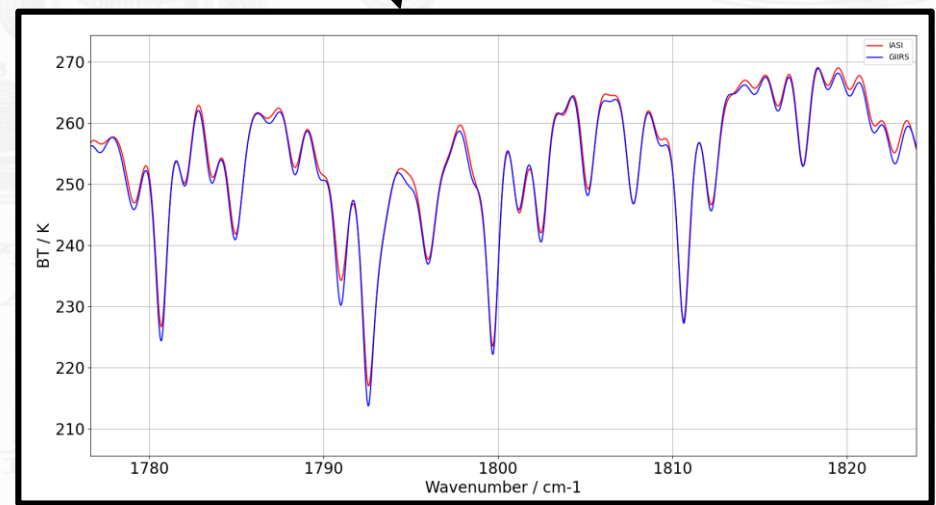
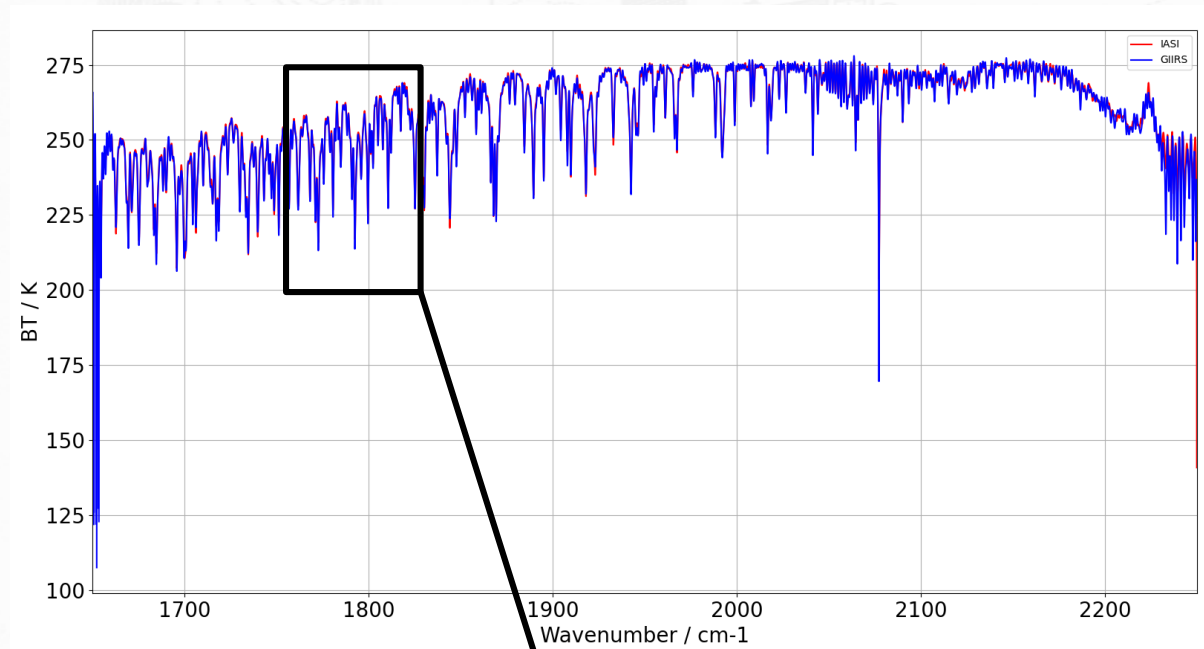




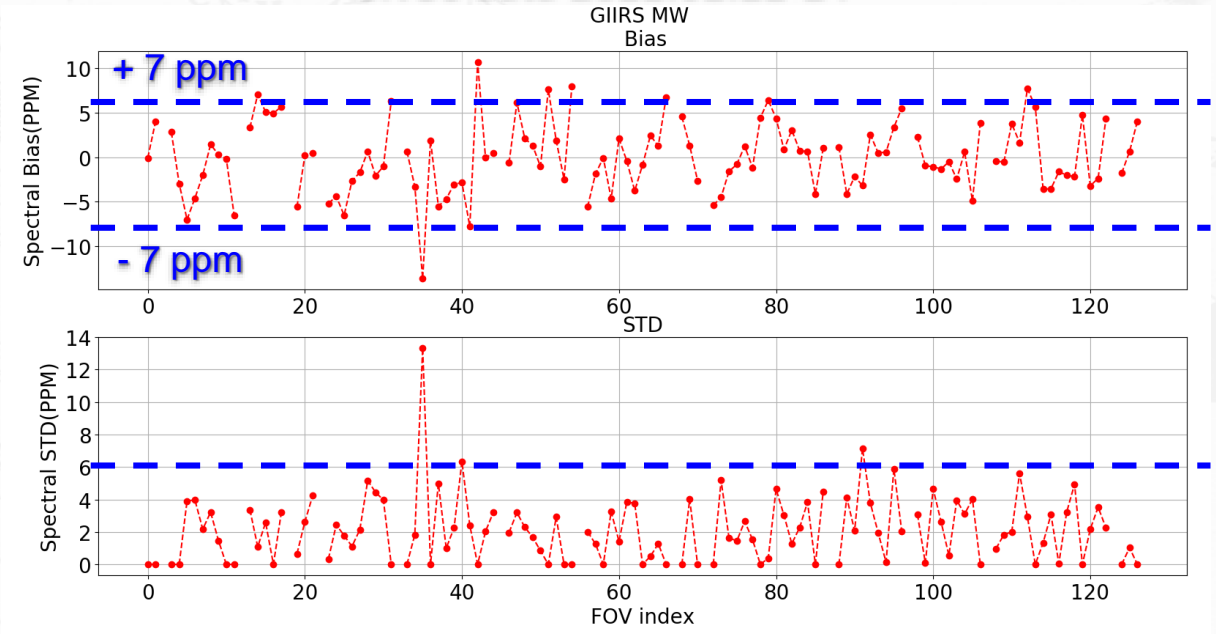
SNOs data 2022.02.22-24



➤ FY-4B/GIIRS LWIR spectral calibration accuracy :  
most FOVs within  $\pm 7$  ppm (std. < 6ppm)

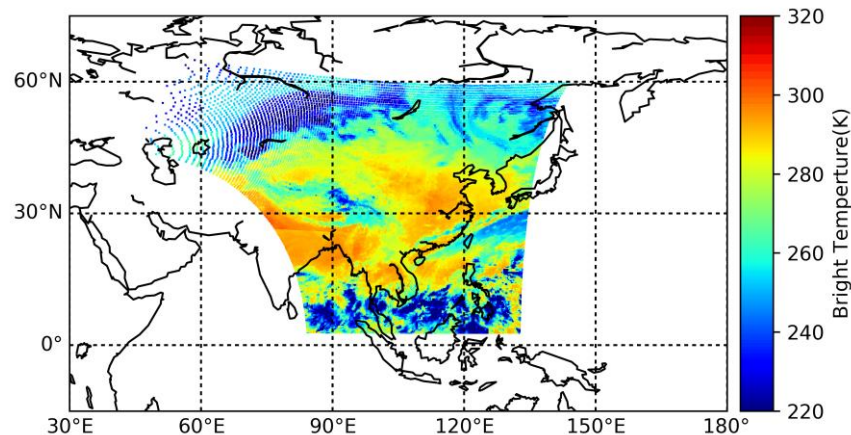


SNOs data 2022.02.22-24

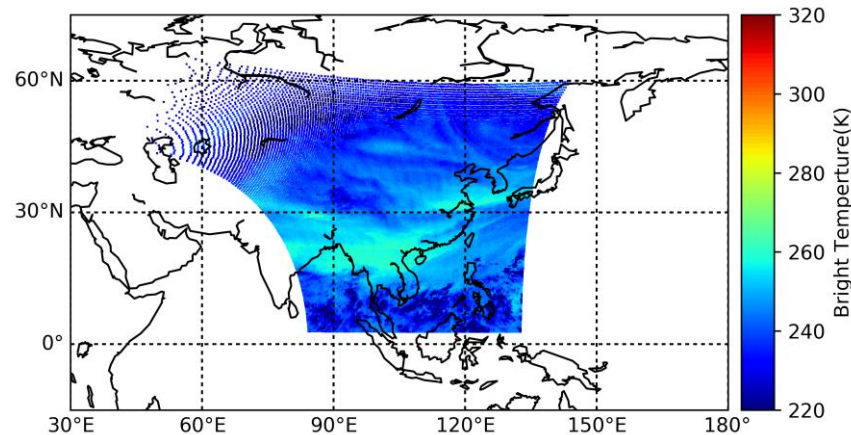


➤ FY-4B/GIIRS MWIR spectral calibration accuracy : most within  $\pm 7$  ppm (std. < 6ppm)

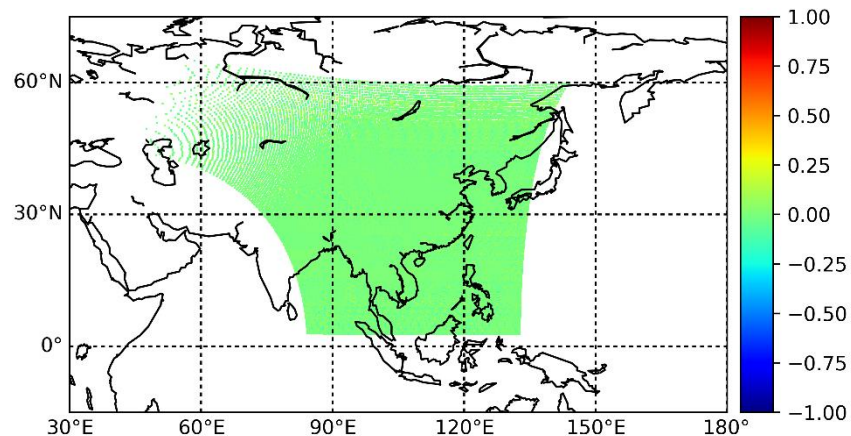
BT image animation from Nov. 25 to 30, 2021



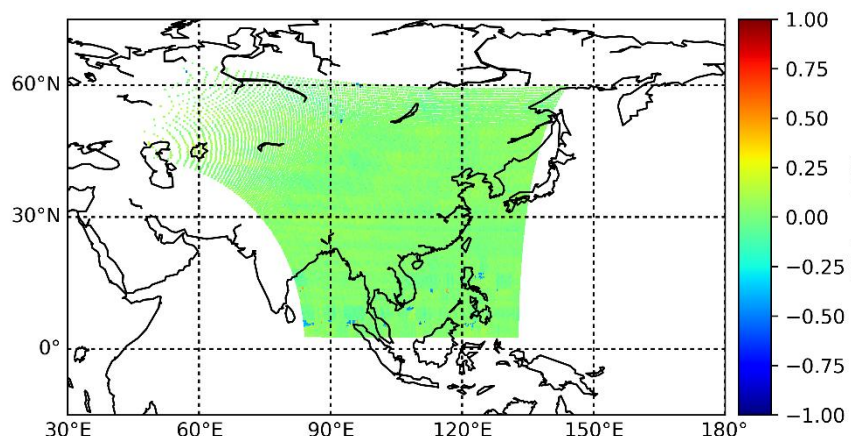
LW in 900 cm<sup>-1</sup> channel



MW in 1870 cm<sup>-1</sup> channel



Imag. Part



Imag. Part



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➤ **FY-3E/HIRAS-II performs well and the L1 data meet the provisional maturity**

- NEdT: all FOVs and bands are within the specification except for SWIR FOV-1, remarkable improved over FY-3D/HIRAS
- Spectral uncertainty: spectral offset for all three bands are around within  $\pm 5$  ppm
- Radiometric uncertainty: LW and MW are well calibrated with accuracy within 0.5 K and 1.0 K, SW is not good enough.

The fine accuracy analysis is still under going.

➤ **FY-4B/GIIRS performance has been improved over FY-4A/GIIRS**

- NEdR: all FOVs and bands within the specification except for LWIR FOV-96
- Spectral uncertainty: spectral offset for all two bands are within  $\pm 7$  ppm
- Radiometric uncertainty: radiometric accuracy analysis is still under going

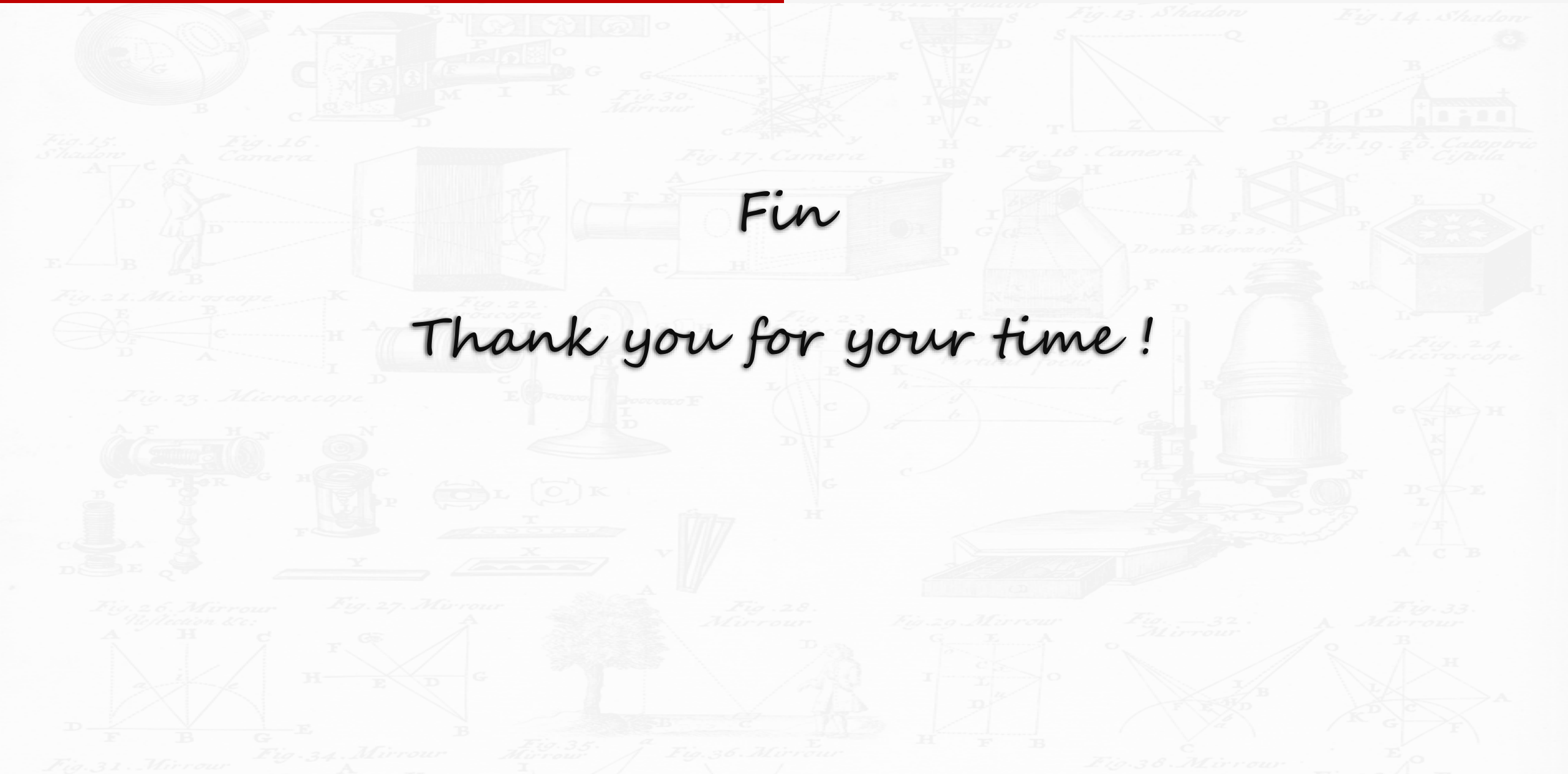
## ➤ FY-3E/HIRAS-II

- The spectral and radiometric calibration accuracy and stability need to be improved
- The long-term monitoring of sensor sensitivity and spectral responsivity (InsResp) are under going

## ➤ FY-4B/GIIRS

- The radiometric accuracy will be improved by adjusting the algorithm
- Spectral offset stability requires long-term monitoring
- The long-term monitoring of sensor sensitivity and spectral responsivity (InsResp) are under going





Fin

Thank you for your time!