



Introduction to STAR ICVS and Inter-Sensor Comparison for Microwave Sensor Monitoring

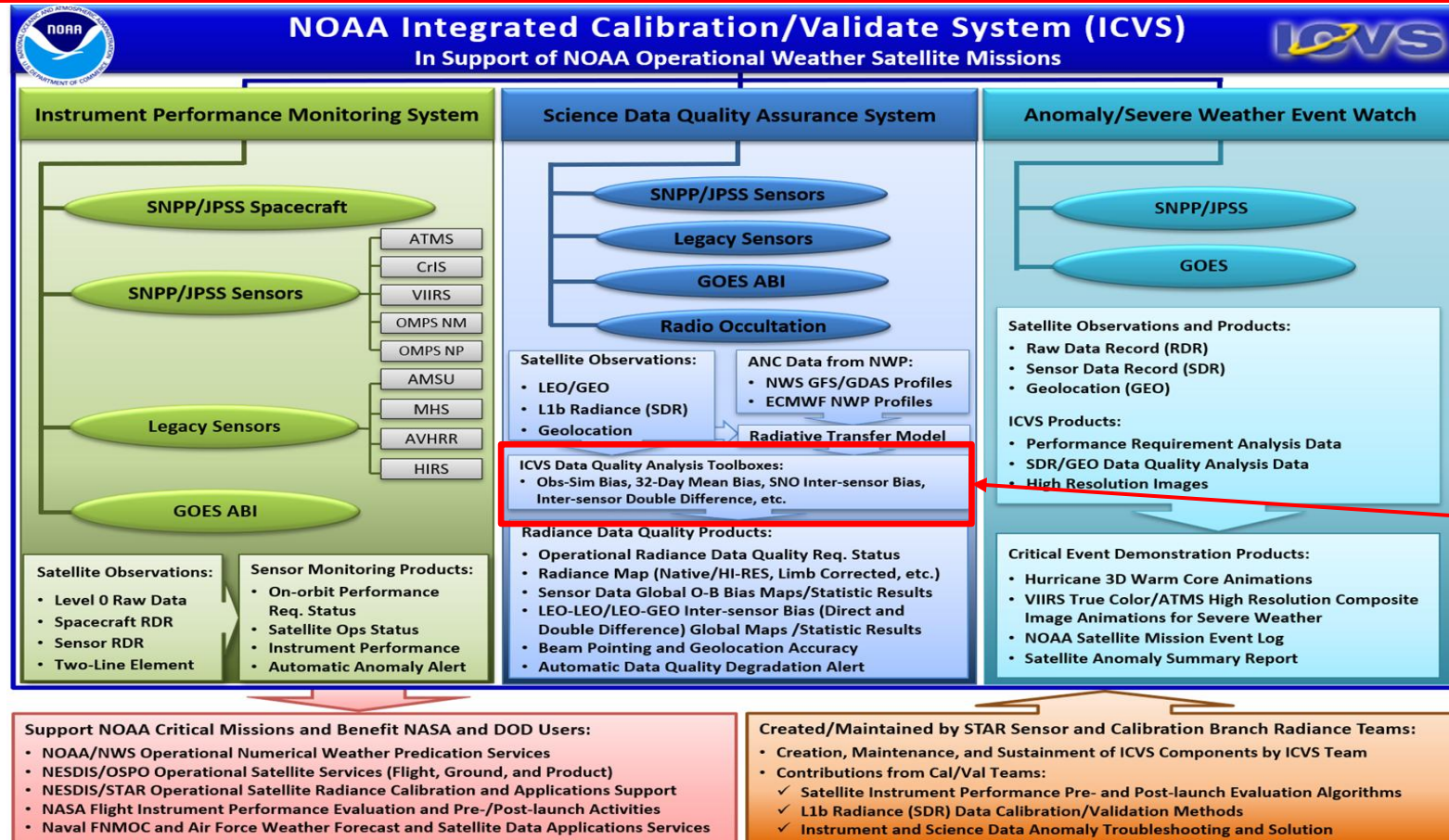
May 21, 2026

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- ❖ Introduction to NOAA Integrated Calibration/Validation System (ICVS)
- ❖ NOAA ICVS Inter-sensor Comparison Products to Support the GSICS Community
 - Inter-Sensor Radiometric Calibration Bias Assessment (iSensor-RCBA) Monitoring Tools
 - Key Showcases and Products
 - ATMS Inter-sensor Bias through SNO and 32-Day Mean Methods
 - ATMS Inter-sensor Bias through CRTM Simulation O-B Double Difference
- ❖ Path Forward



ICVS Inter-Sensor Radiometric Calibration Bias Assessment (iSensor-RCBA) Tool

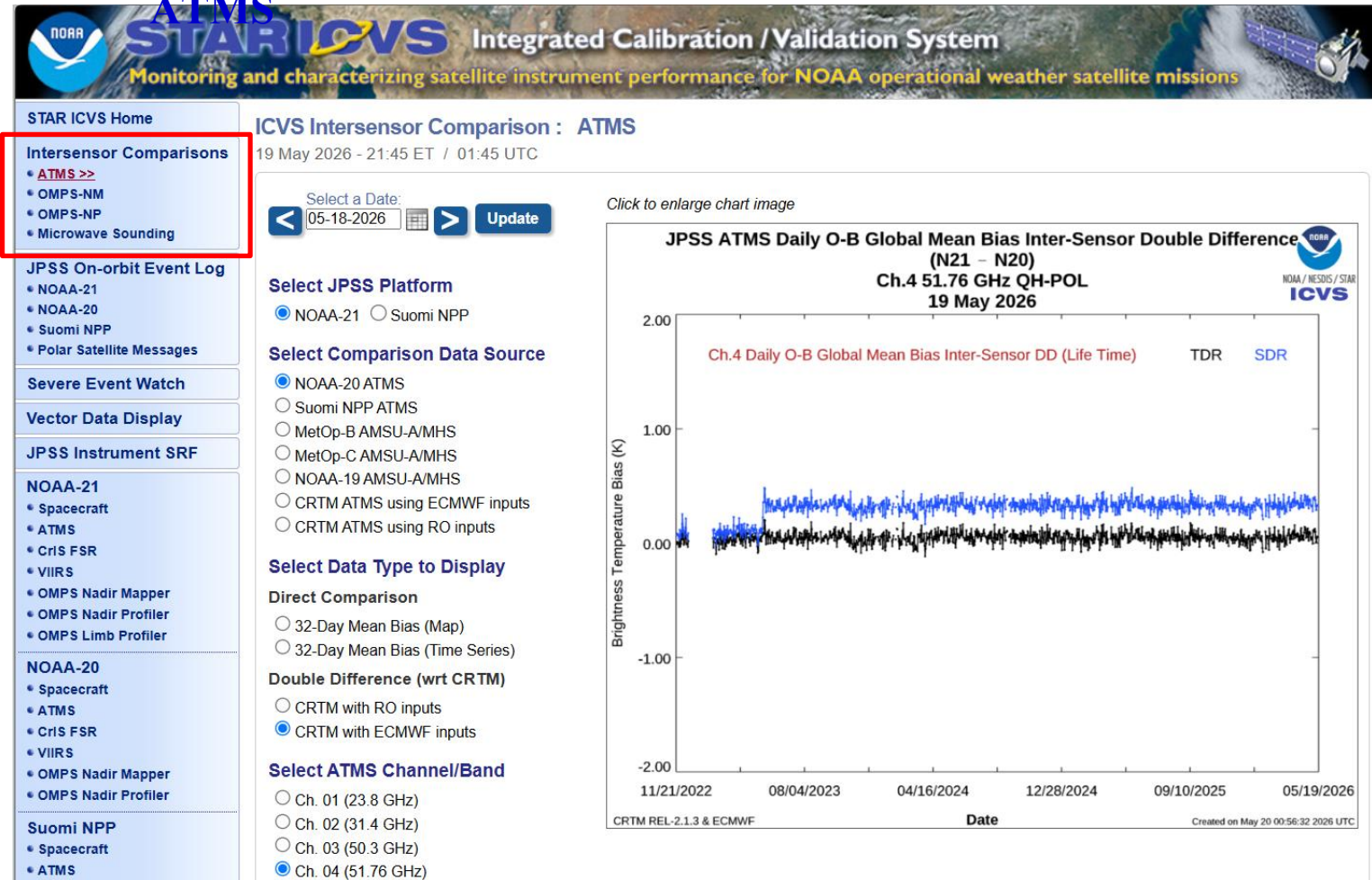
❖ What does **ICVS** do?

- An integrated calibration and validation system (ICVS) for Satellite Instrument Near-Real Time (NRT) Performance and Data Quality Monitoring to support all NOAA satellite missions
- ICVS is an important tool for level 1b or Sensor Data Records (SDR), and is used by OSPO, NWS, ECMWF, EUMETSAT, NASA, Air Force, NAVO, as well as STAR scientists (especially the radiance or SDR teams)
- Currently monitoring 24+ satellite instruments with more than 3000 parameters online (<https://www.star.nesdis.noaa.gov/icvs/>)

❖ iSensor-RCBA Inter-sensor Comparison Tool Key Features (Yan et al., 2025; 2026)

- Covering various instruments across several satellite programs, e.g., the ATMS, CrIS, VIIRS, and OMPS instruments onboard SNPP/NOAA-20/NOAA-21, the ABI instrument onboard GOES-18 and GOES-19; the AMSU-A, MHS, and IASI instruments onboard legacy Metop-B/C.
- Use multi-methods for inter-sensor radiometric calibration error assessments
 - Use CRTM as a transfer (CRTM-Double Difference) (ECMWF forecasts and RO-derived profiles respectively)
 - Use 3rd sensor as a transfer (SNO based)
 - Direct comparison (32-day direct differences)
 - Inter-sensor comparison via deep convective cloud targets
- Serves as a web-based dashboard for satellite instrument status (a publicly accessible website: https://www.star.nesdis.noaa.gov/icvs/comparison_ATMS.php)

An Example: ICVS Inter-sensor Comparison Website for ATMS



Currently provide ATMS and OMPS inter-sensor comparison monitoring






remote sensing



Article

Long-Term Assessment of Inter-Sensor Radiometric Biases Among SNPP, NOAA-20, NOAA-21 OMPS Nadir, and CrIS Instruments Using the NOAA ICVS-*i*Sensor-RCBA Portal

Banghua Yan ^{1,*}, Ding Liang ², Xin Jin ², Ninghai Sun ², Flavio Iturbide-Sanchez ¹, Xiangqian Wu ¹
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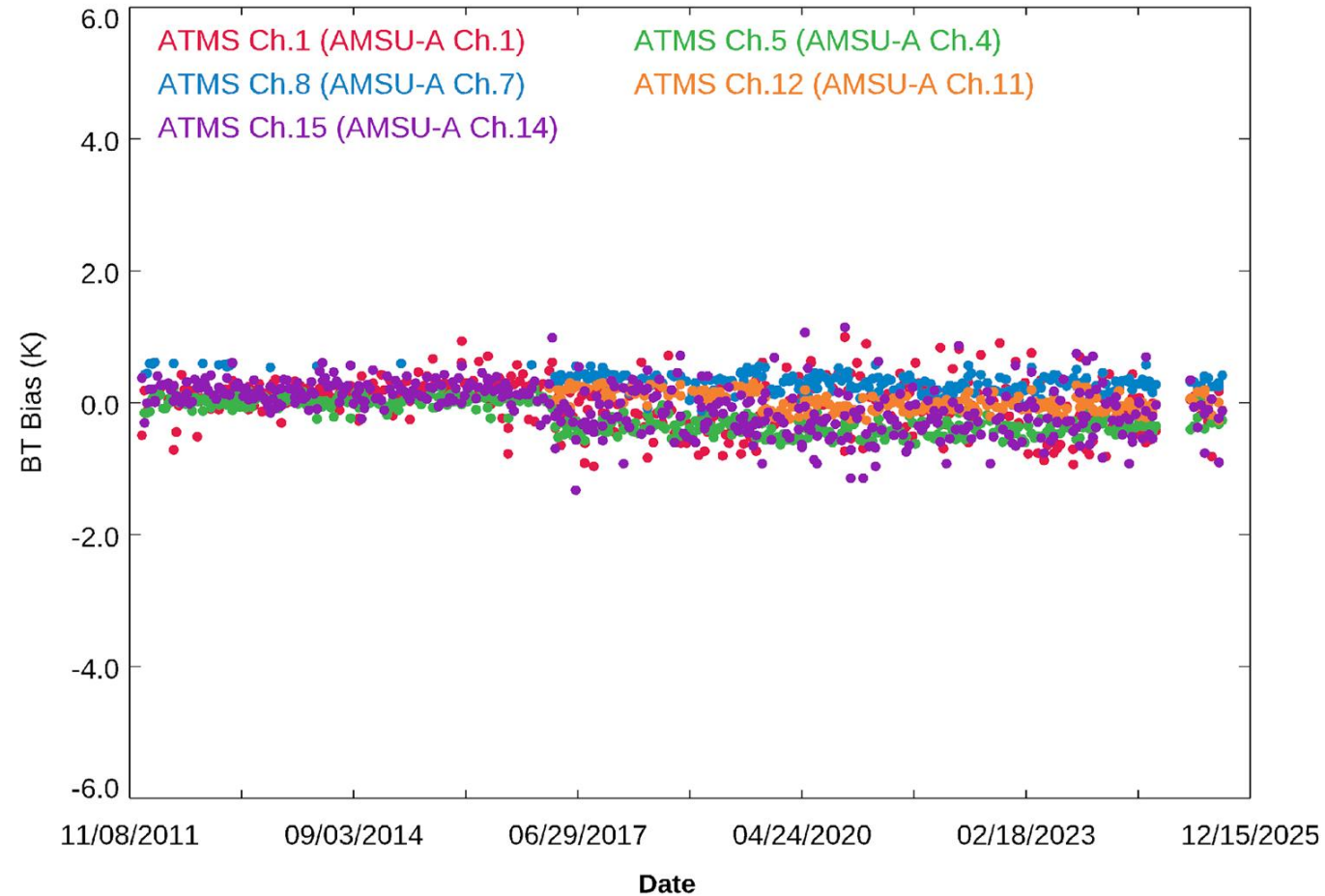
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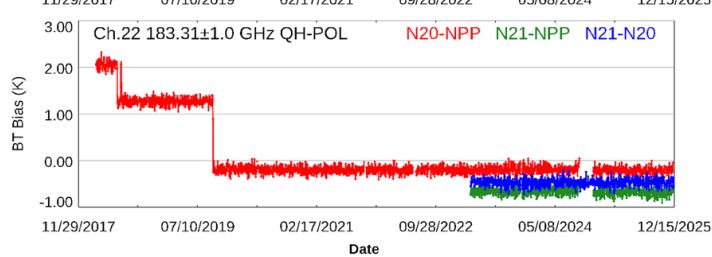
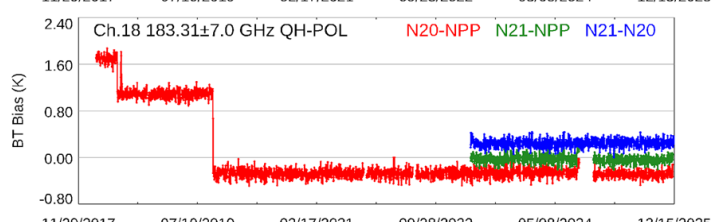
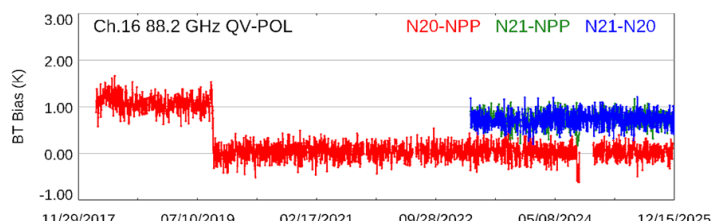
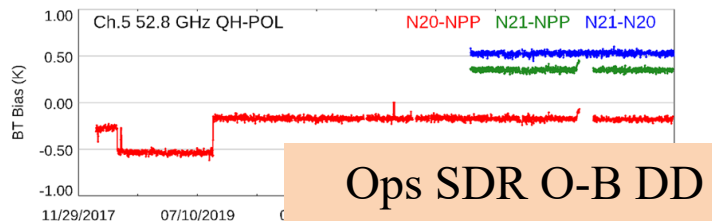
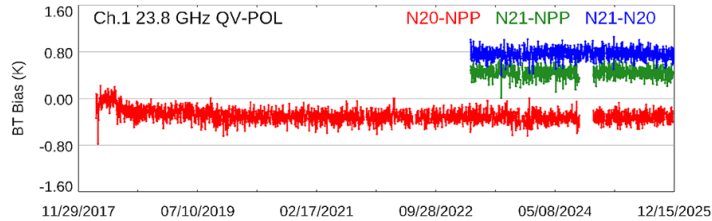
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S-NPP ATMS TDR vs. NOAA-19 AMSU-A L1B SNO Inter-Sensor Bias
8 Nov 2011 ~ 15 Dec 2025



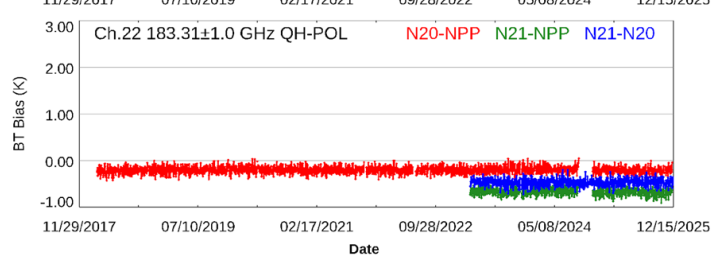
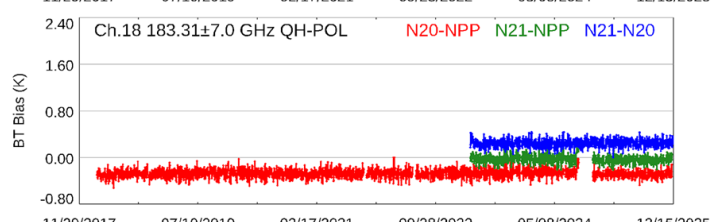
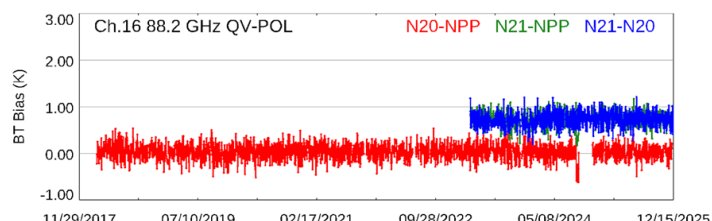
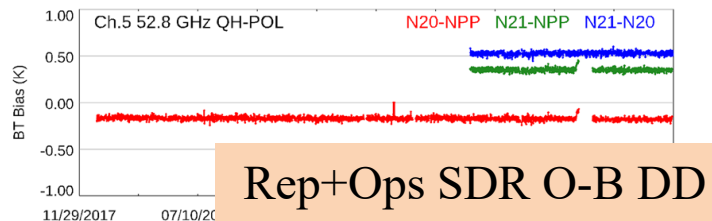
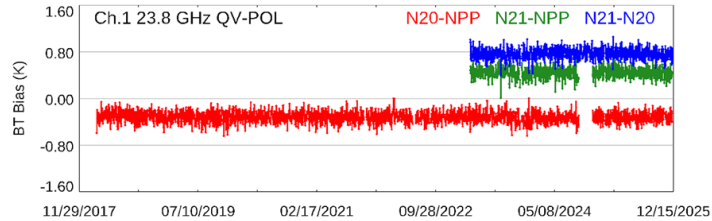
Bias systematic shift in 2017 due to the ATMS calibration algorithm change and channel dependent non-linearity correction coefficient update

JPS5 ATMS OPS SDR O-B Inter-Sensor Double Difference Time Series (Without Bias Correction)
29 Nov 2017 ~ 15 Dec 2025



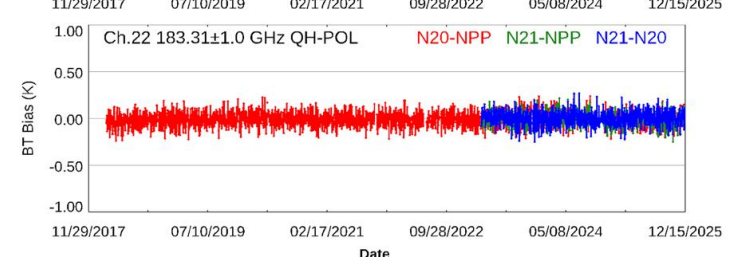
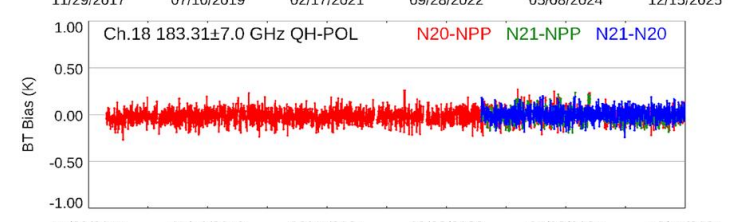
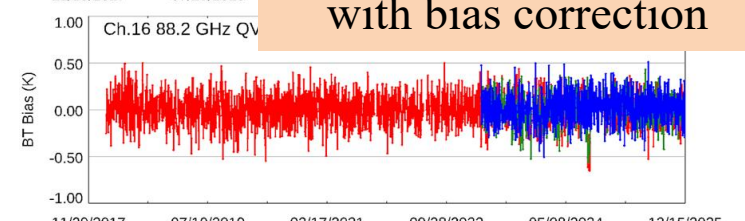
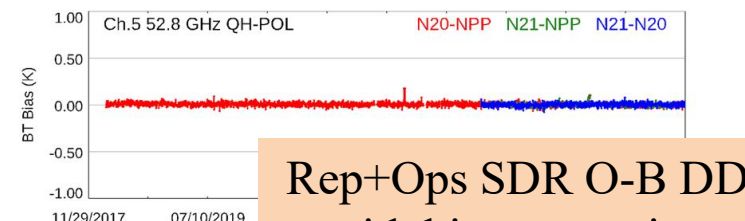
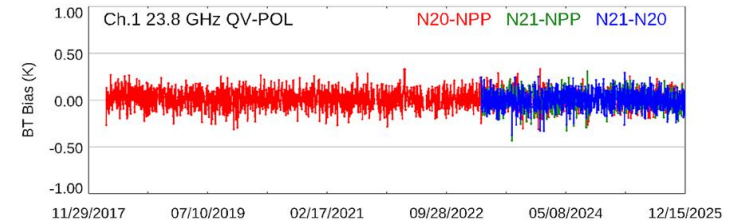
Ops SDR O-B DD

JPS5 ATMS REP SDR O-B Inter-Sensor Double Difference Time Series (Without Bias Correction)
29 Nov 2017 ~ 15 Dec 2025



Rep+Ops SDR O-B DD

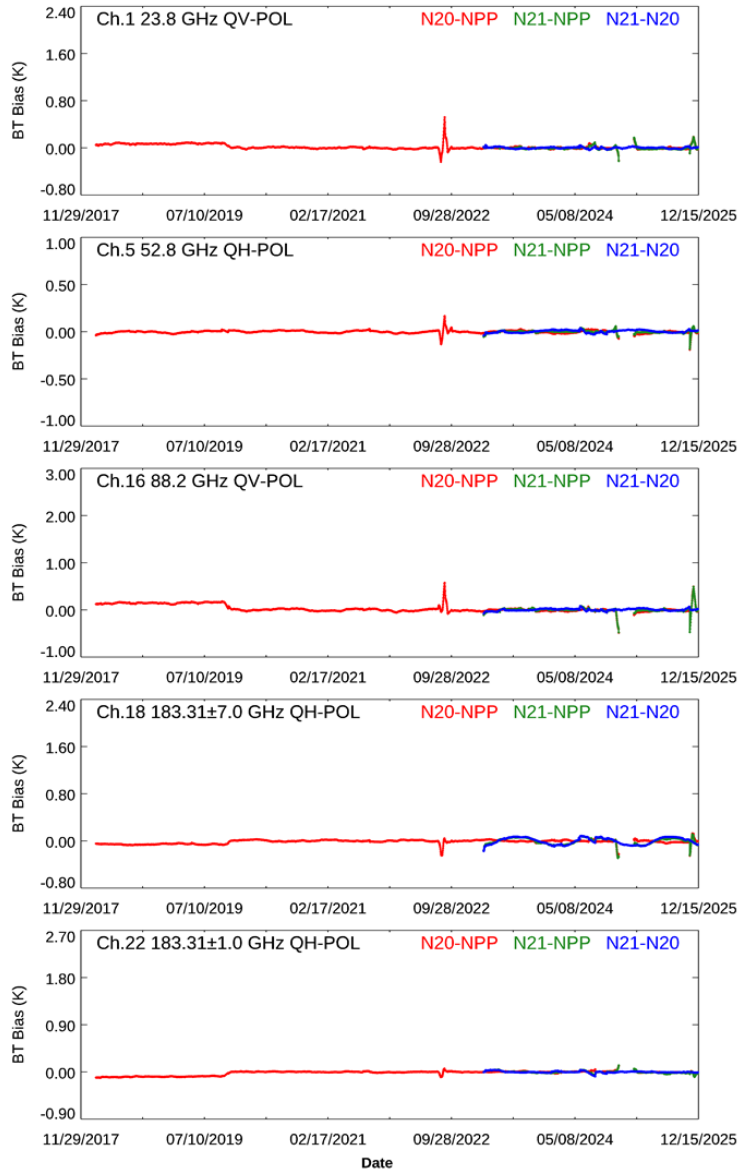
JPS5 ATMS REP SDR O-B Inter-Sensor Double Difference Time Series (With Bias Correction)
29 Nov 2017 ~ 15 Dec 2025



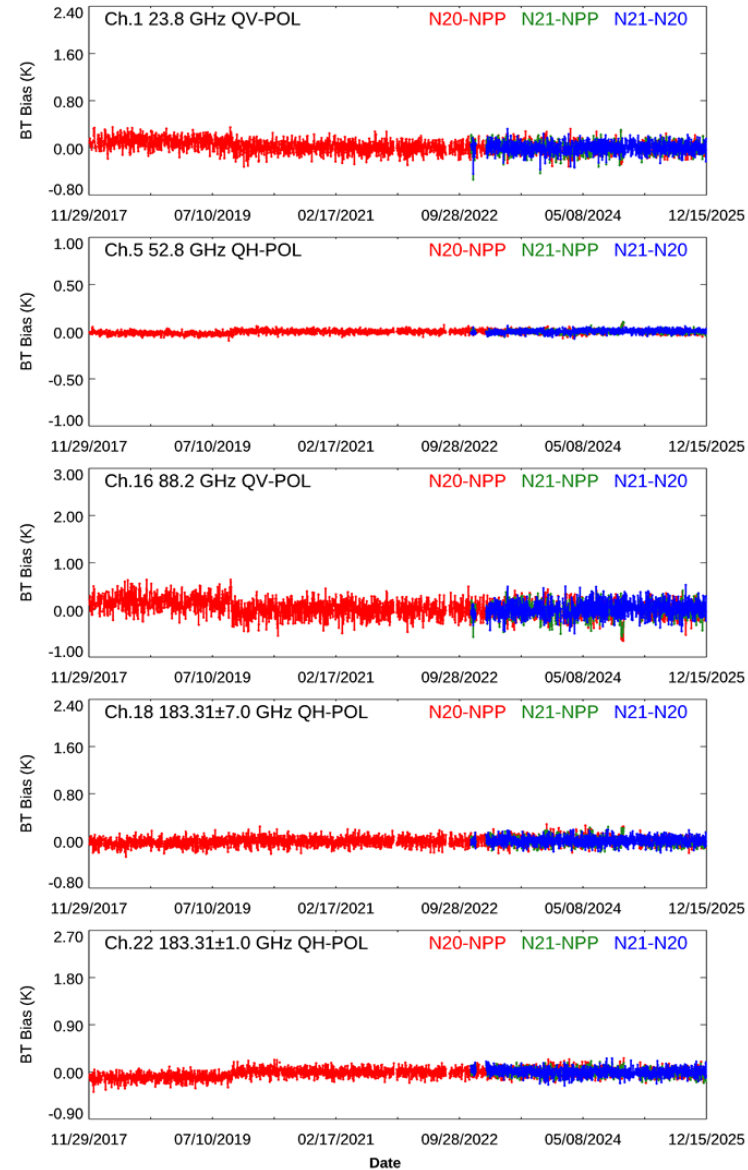
Rep+Ops SDR O-B DD with bias correction

ATMS 32-Day Mean Direct Bias vs. O-B Double Difference

JPSS ATMS TDR 32-Day Direct Inter-Sensor Bias Time Series
29 Nov 2017 ~ 15 Dec 2025



JPSS ATMS TDR O-B Inter-Sensor Double Difference Time Series
29 Nov 2017 ~ 15 Dec 2025



Results are consistent between two inter-sensor bias analysis methods

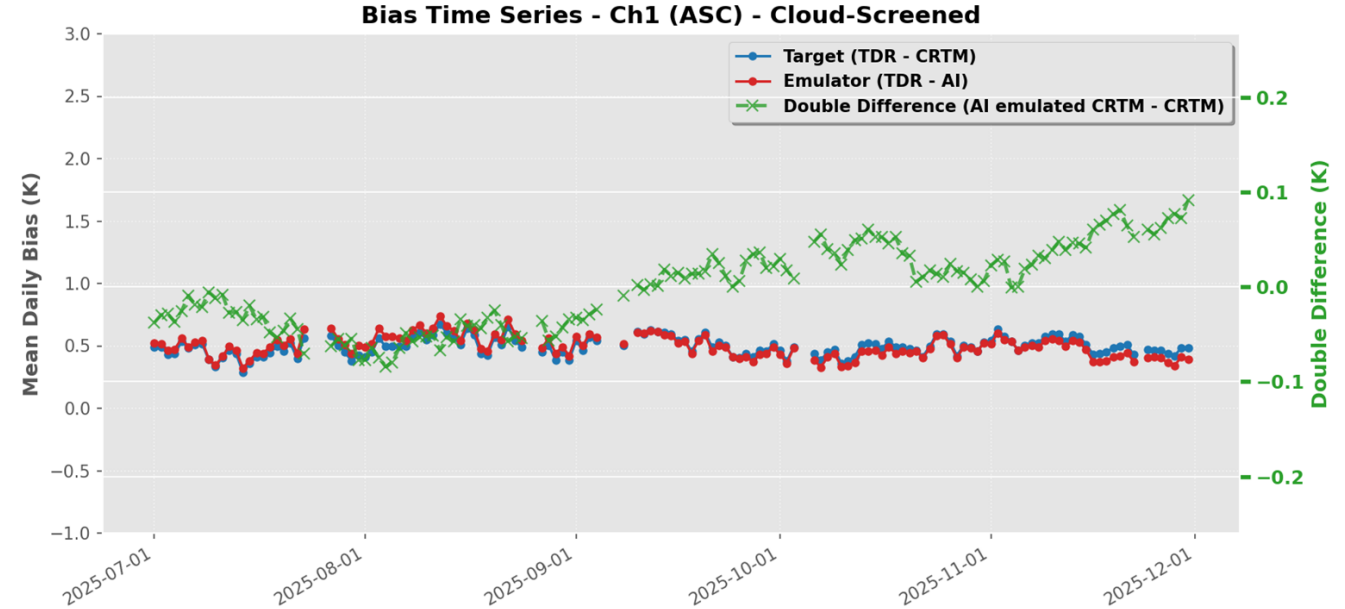
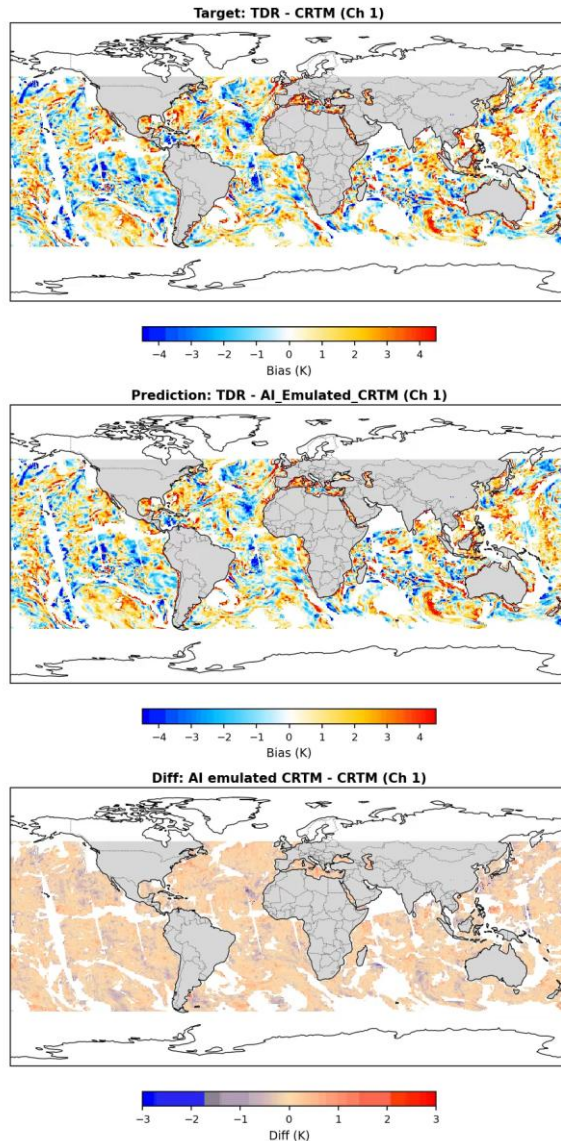


Demonstration of ICVS-iSensor-RCBA ATMS Portal



https://www.star.nesdis.noaa.gov/icvs/comparison_ATMS.php

Global AI Emulator Analysis: 2025-07-01 | Cloud-Screened



Scalable AI Emulating model setup:

- Algorithm: LightGBM (Gradient Boosting Decision Tree).
 - Superior handling of tabular data and precise capture of non-linear physical relationships.
 - Fast and suitable for CPU-only platform.
- Feature engineering:
 - Grouped ATMS channels which has similar characteristics.
 - For channel 11-15, all 91 levels of water vapor profiles were removed, i.e. considered as dry air.
- Model setup:
 - Each channel was trained separately.
 - 300-400 features were used for different channels.
 - The method solved the OOM issue and is scalable for larger dataset training

(Courtesy of H. Lin)

- ❖ Implement the STAR RO profile ATMS O-B monitoring
 - RO profile only simulation without NWP model profile filling
 - Inter-sensor bias monitoring through RO profile O-B double difference
- ❖ Implement the ATMS AI emulator O-B monitoring
- ❖ Implement the ATMS vs. MWS inter-sensor comparison monitoring
 - SNO and 32-Day running mean direct comparison
 - Double difference through RO profile and NWP profile CRTM O-B simulations
- ❖ Develop the ATMS vs. QuickSounder inter-sensor comparison monitoring