Use of NPP data in the US Navy's Global Assimilation System

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Introduction

The NAVDAS-AR system is a 4D-Var atmospheric analysis developed at the Naval Research Laboratory. This system is operationally used by Fleet Numerical Meteorology and Oceanography Center (FNMOC) along with the Navy Operational Global Atmospheric Prediction System (NOGAPS) forecast model. Currently operational NOGAPS is about 45km horizontal resolution with a model top of 0.01 hPa. The NAVDAS-AR system inner loop minimization is performed at about 100km resolution with a single inner loop. The system ingests about 25 million raw observations with including satellite radiances from IASI, AIRS, AMSU-B, MHS and SSMIS and bending angle from GRAS, Grace-A, Terra SAR-X, and COSMIC.

Monitoring

The NAVDAS-AR system data flow is monitored with a number of routine diagnostics. One of the most straightforward is the data counts for each data type to watch for gaps in the coverage. An observation impact metric is used to determine the impact of sensors on the system using adjoints of both NAVDAS-AR and the NOGAPS systems. This monitors every observation in the system and can be then summarized by sensor, channel of sensor, or geographically. Fit to radiosonde temperature, moisture and wind is examined against both the first-guess background and the final analysis. The convergence of the AR system is examined over time to watch for changes in either the number of iterations to convergence and the size of the cost function itself.
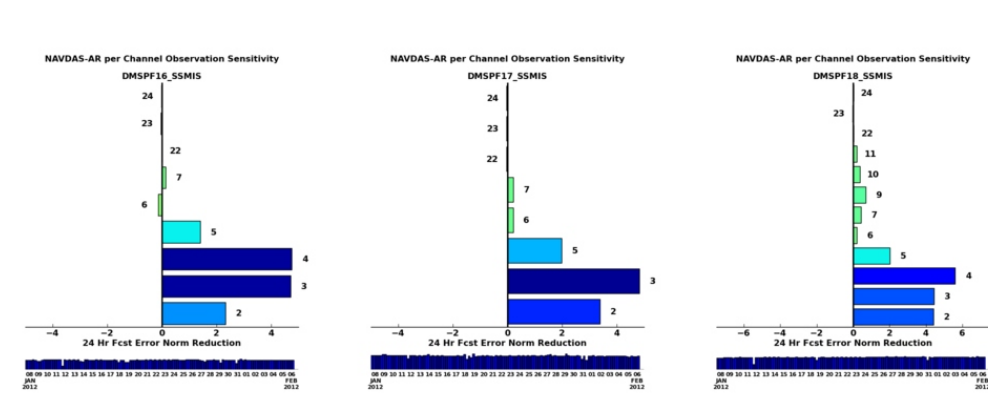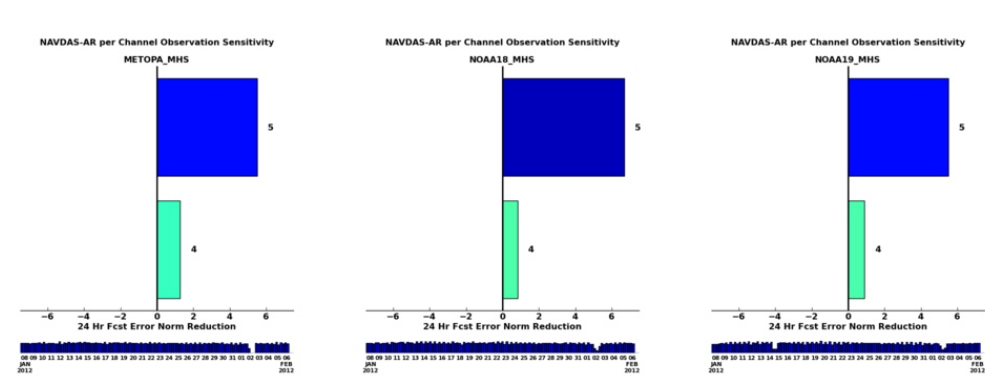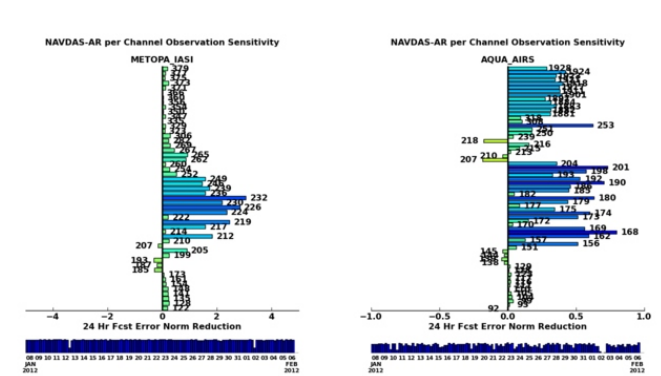
NAVDAS-AR Routine Monitoring

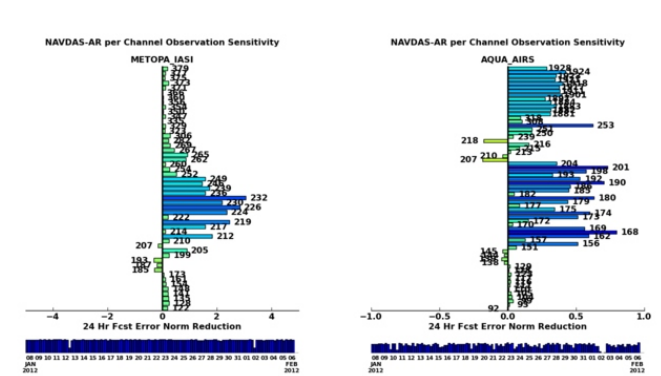Stoplight - Data Count
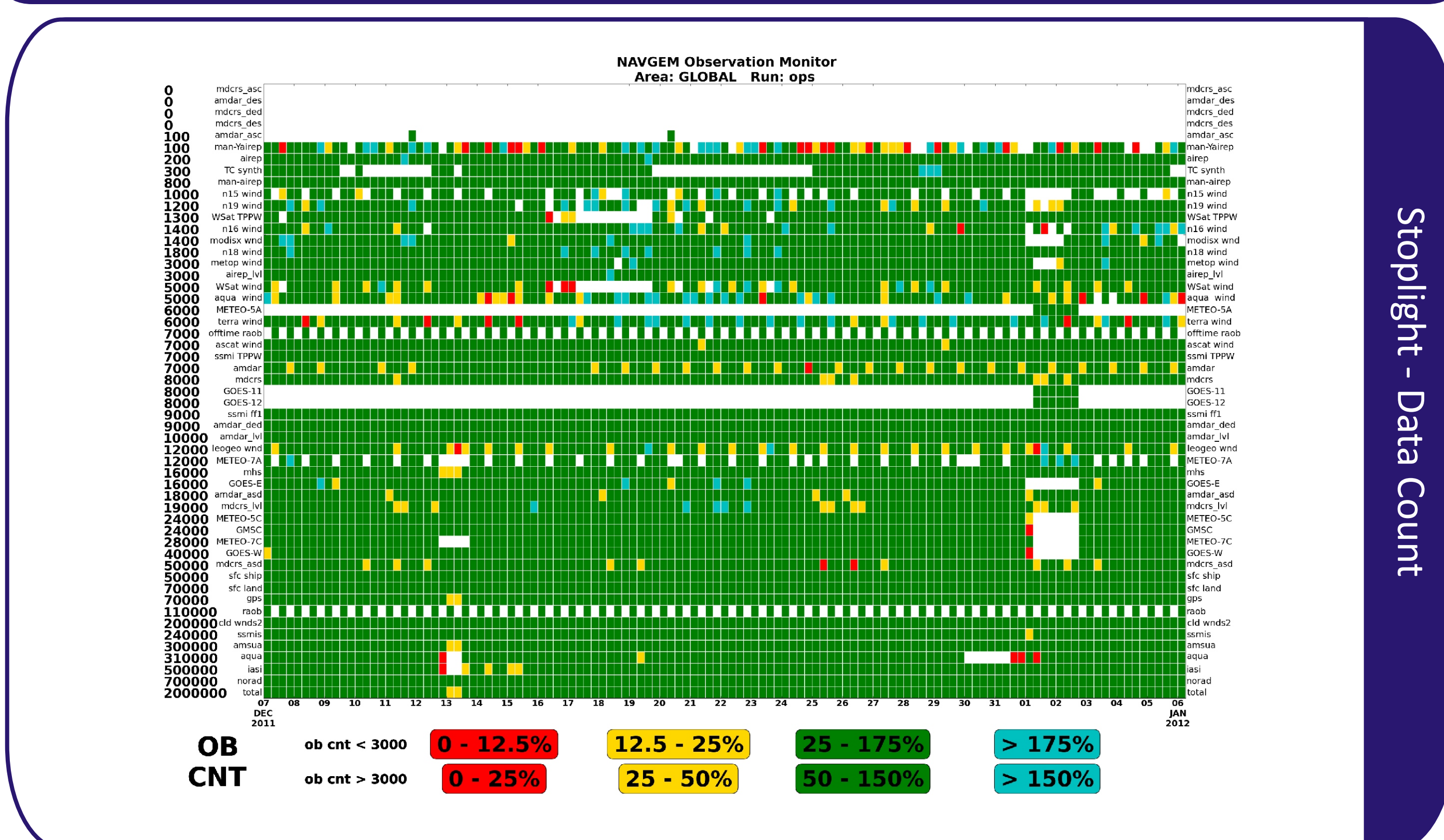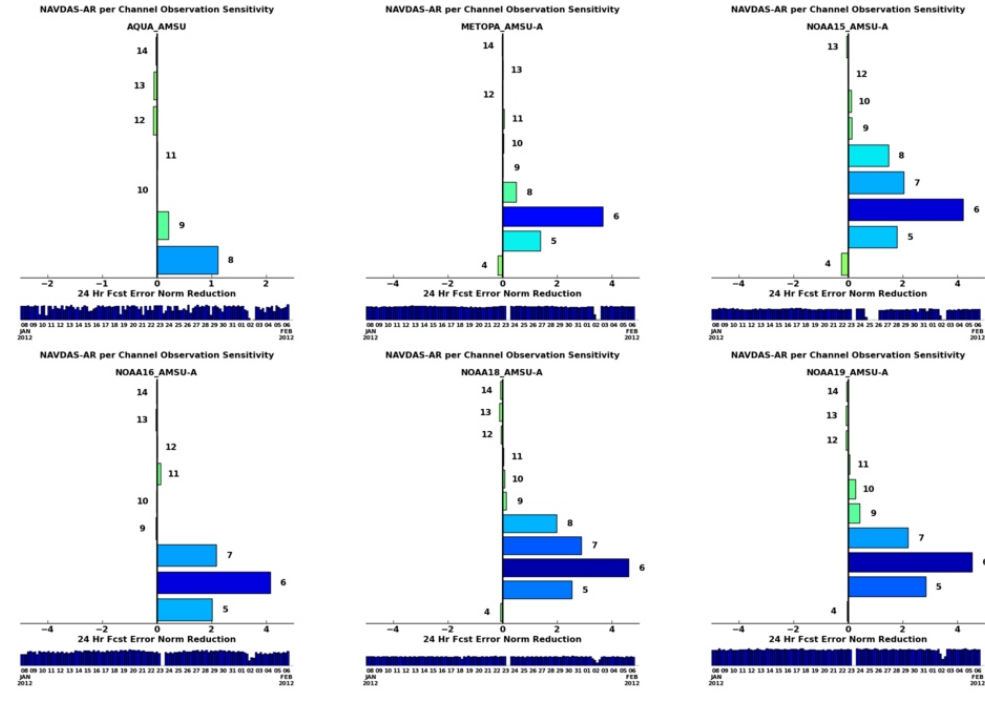
Observation Impact on Forecast Error

Radiosonde (OB-BK) and (OB-AN)

Stability of Minimization

NPP ATMS

Sensor Noise NEΔT

ATMS Raw T_B
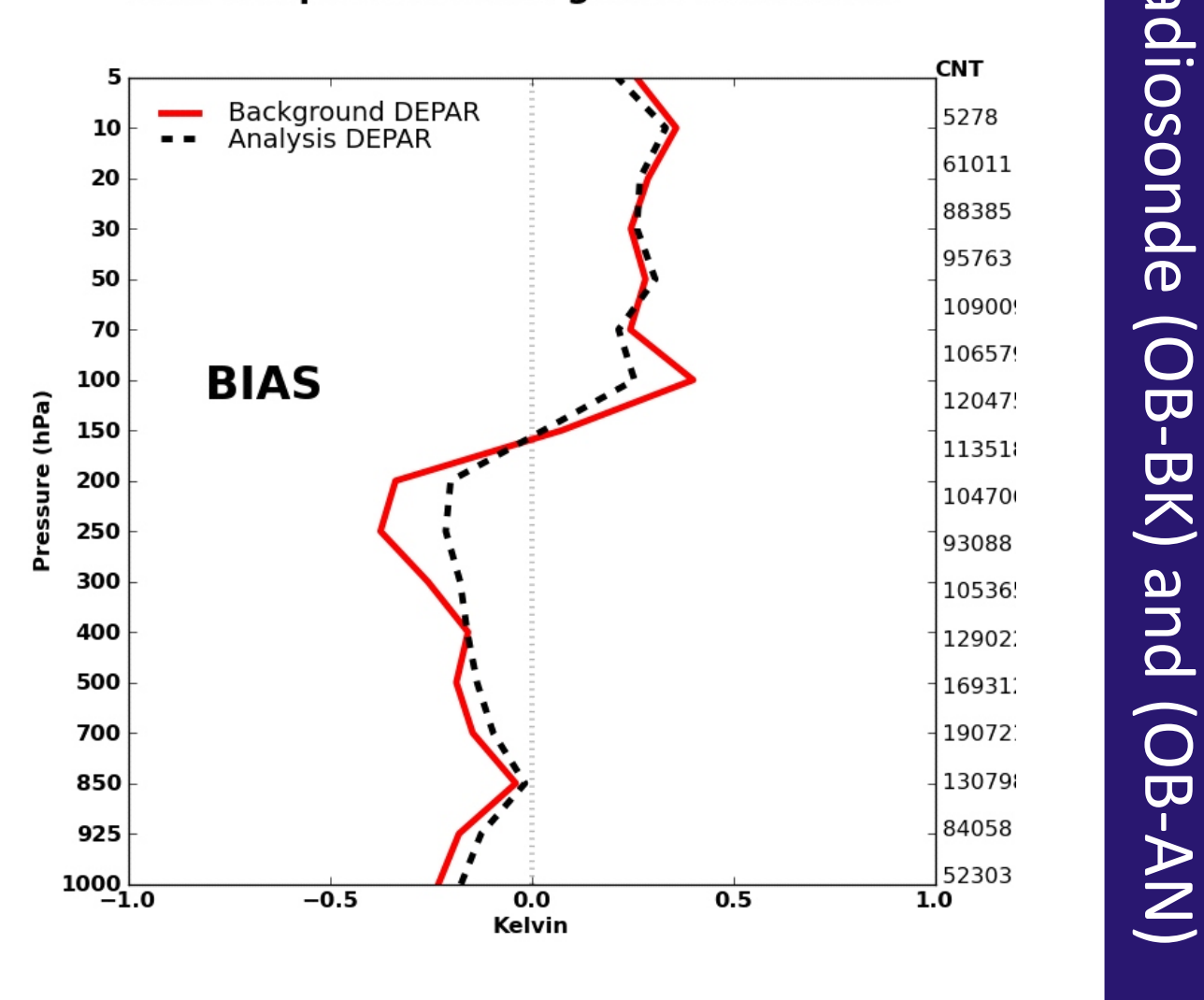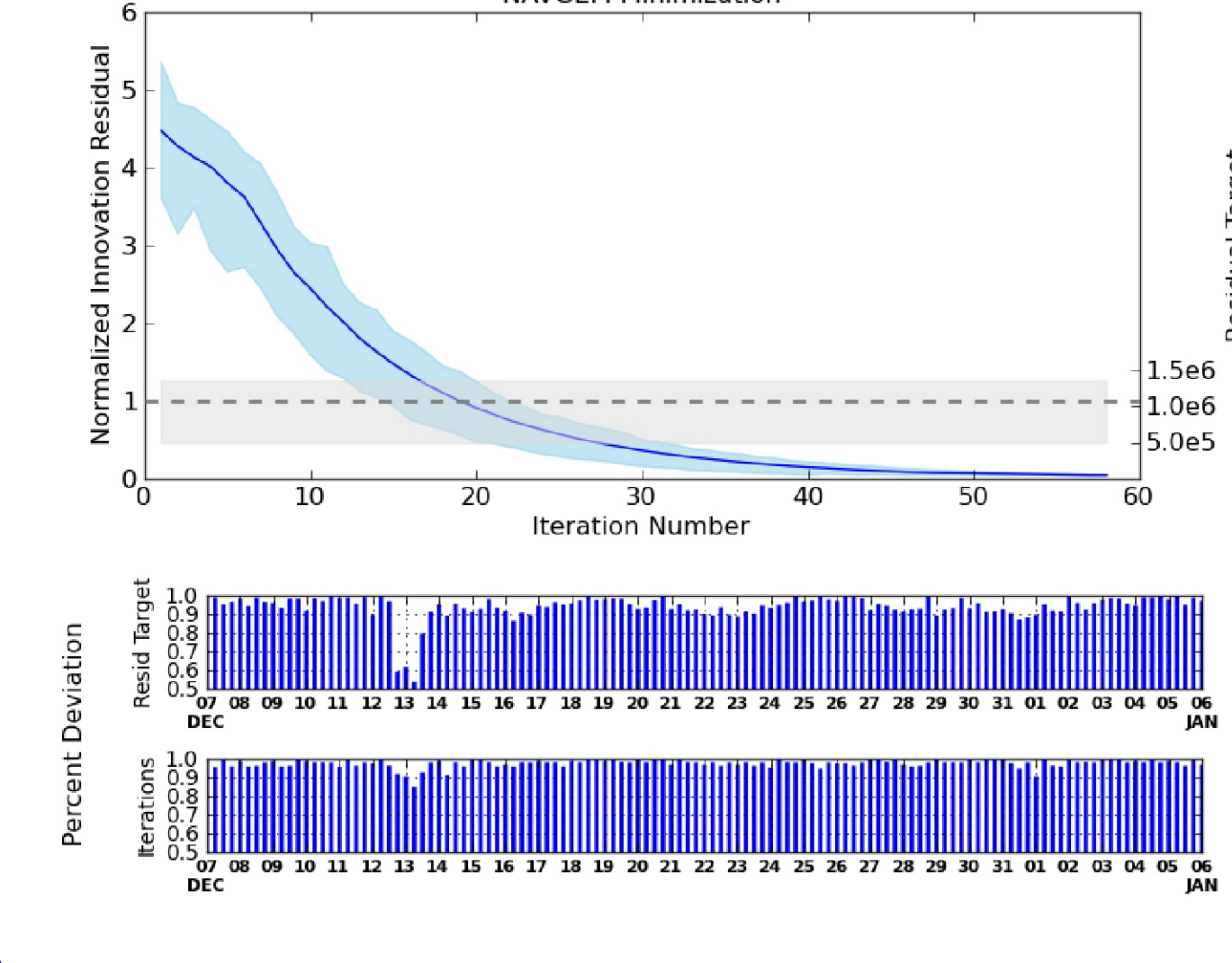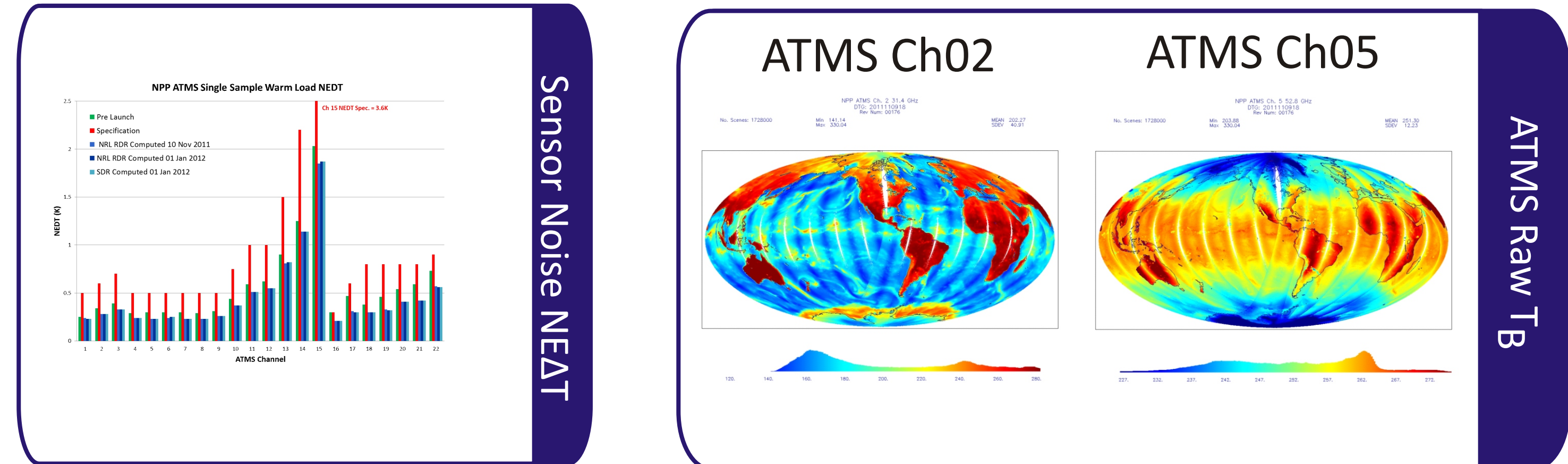
### ATMS Calibration/Validation

The NPP ATMS sensor is received via a US Air Force Weather Agency (AFWA) feed in HDF5 format. In addition to the Sensor Data Record (SDR) product NRL is also receiving the Raw Data Record (RDR) from which an evaluation of the sensor noise can be performed. Beyond the sensor noise evaluation, oversight of the raw brightness temperature (T_B) compared against the SDR can be examined for undesirable artifacts.
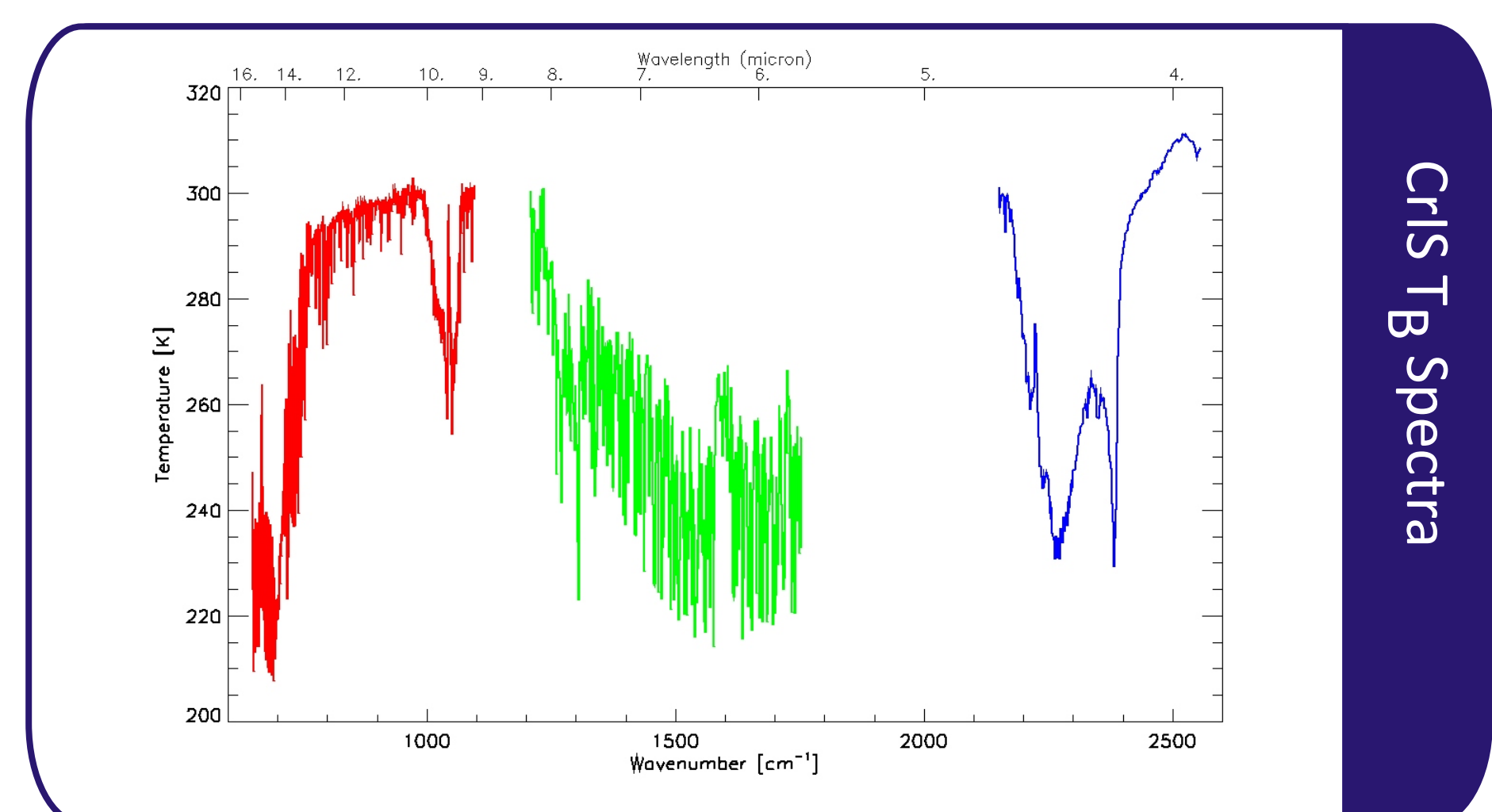
ATMS Assimilation

Bias Correction

Airmass   Scan
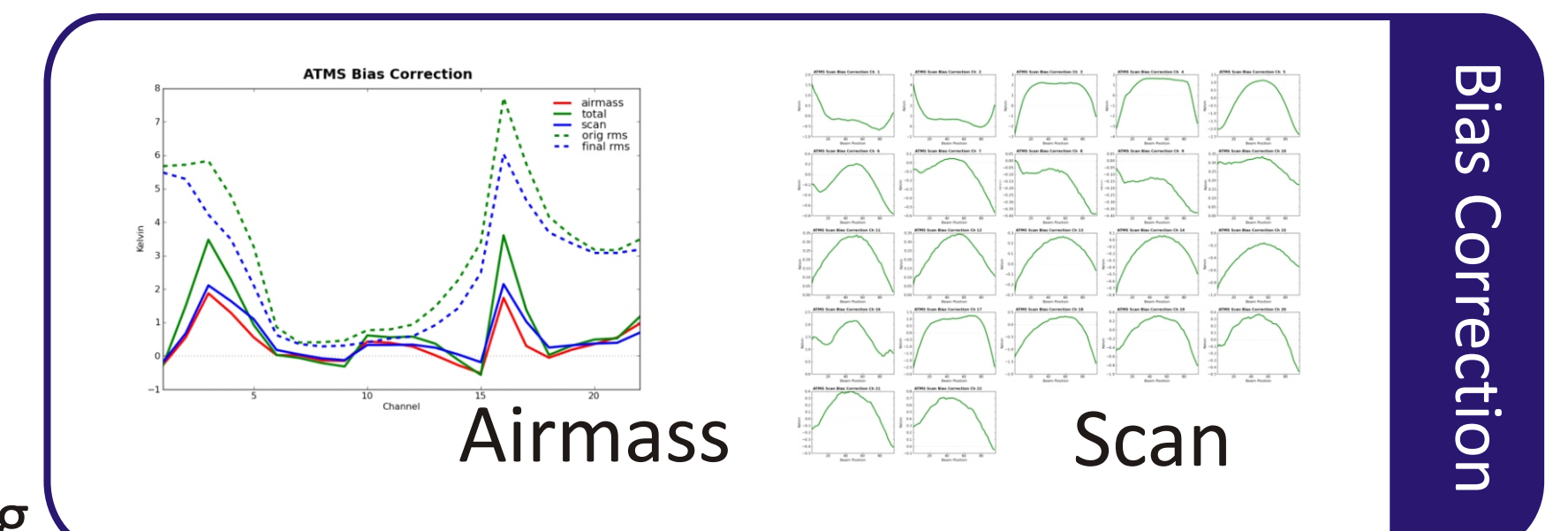
The NPP ATMS data is flowing through the NAVDAS-AR system in preparations for operational assimilation by FNMOC. The current operational bias correction is an offline method using a scan bias by scan position and two atmospheric thickness predictors. The development of the bias correction coefficients is being performed to allow for rapid activation of the live data stream. In the assimilation system itself the zonal mean of the innovation or observation minus background (OB-BK) by channel is compared to that of AMSU-A.

Zonal Mean (OB-BK)

AMSU-A   ATMS

NPP CrIS

CrIS T_B Spectra
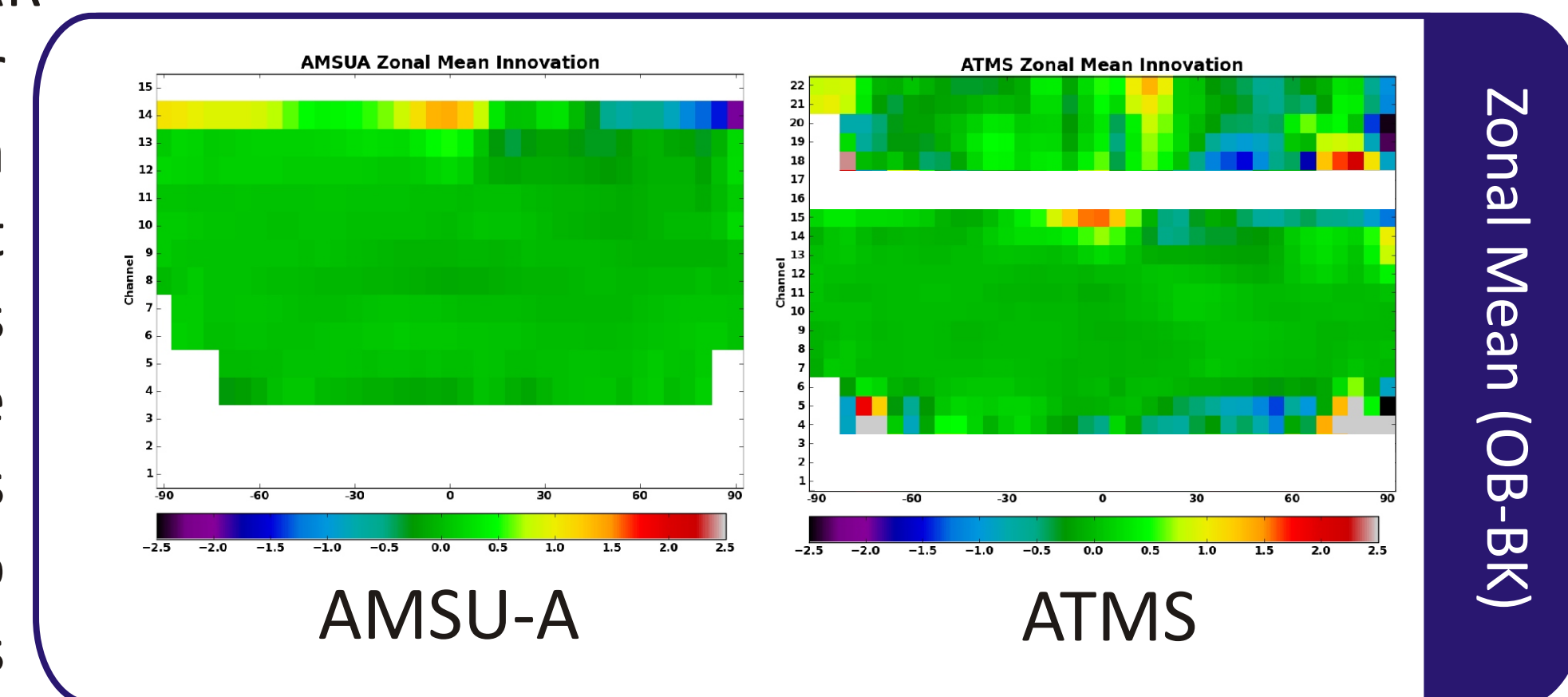
Initial CrIS Examination

The NPP CrIS data is received at FNMOC via the AFWA data feed in HDF5 format. The data is the raw unapodized spectra. Currently the data does not contain geolocation information so it is not yet available for assimilation into the operational system. A brightness temperature (T_B) spectra can be examined for individual pixels or aggregates. Also strip images of the data scan position versus scan line are used to begin preliminary examination of the data quality and consistency. The ground processing team is working vigorously to activate the ability to transmit the geolocation information with the data which will allow the customers to begin more detailed investigations in the data use and quality.

CrIS T_B Strip Images