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# **Advanced Technology Microwave Sounder (ATMS) Sensor Data Record (SDR) Error Budget**

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# 1. Radiometric Calibration Accuracy

## 1.1 Radiometric Calibration Uncertainty Specification

Table 1. Requirements of ATMS Channel Radiometric Calibration Accuracy [1]

Channel	Accuracy (K)
1-2	1.00
3-15	0.75
16-22	1.00

## 1.2 Pre-launch Radiometric Uncertainty Budget

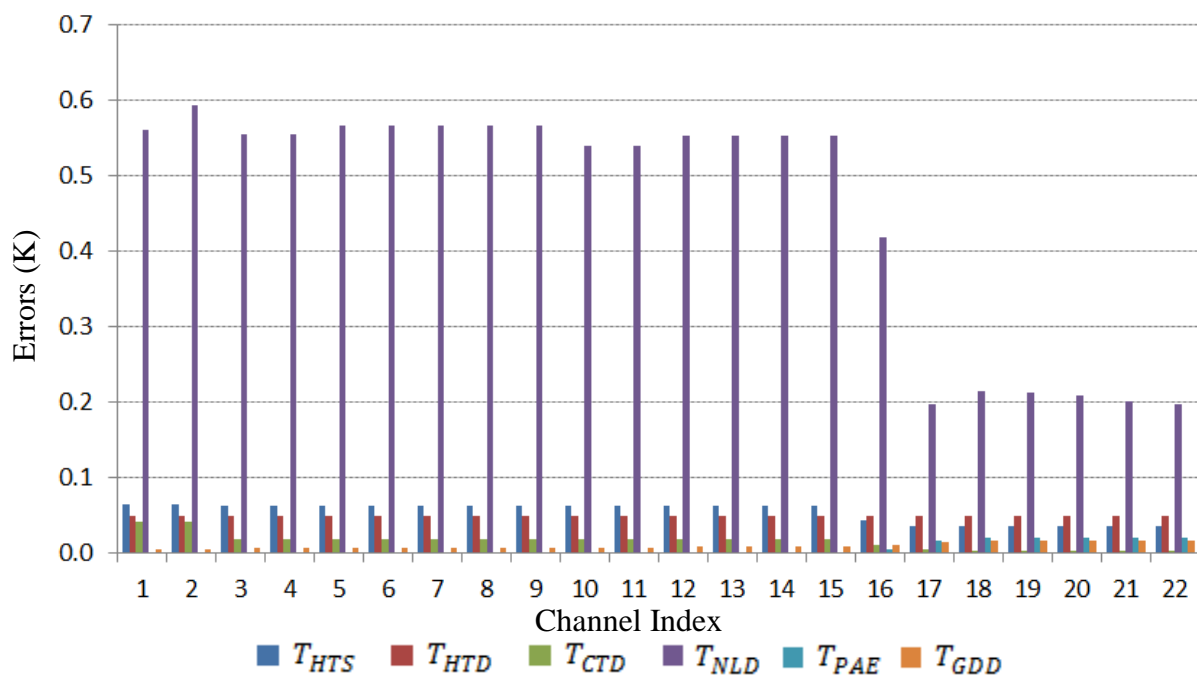


Figure.1: Pre-launch radiometric uncertainty budget [2] for the nominal case given as a function of channel index

$T_{HTS}$ : Hot Target Static (HTS) Error

$T_{HTD}$ : Hot Target Dynamic (HTD) Error

$T_{CTD}$ : Cold Target Dynamic (CTD) Error

$T_{NLD}$ : Nonlinearity Dynamic (NLD) Error

$T_{PAE}$ : Planck Approximation Error (PAE)

$T_{GDD}$ : Gain Drift Dynamic (GDD) Error

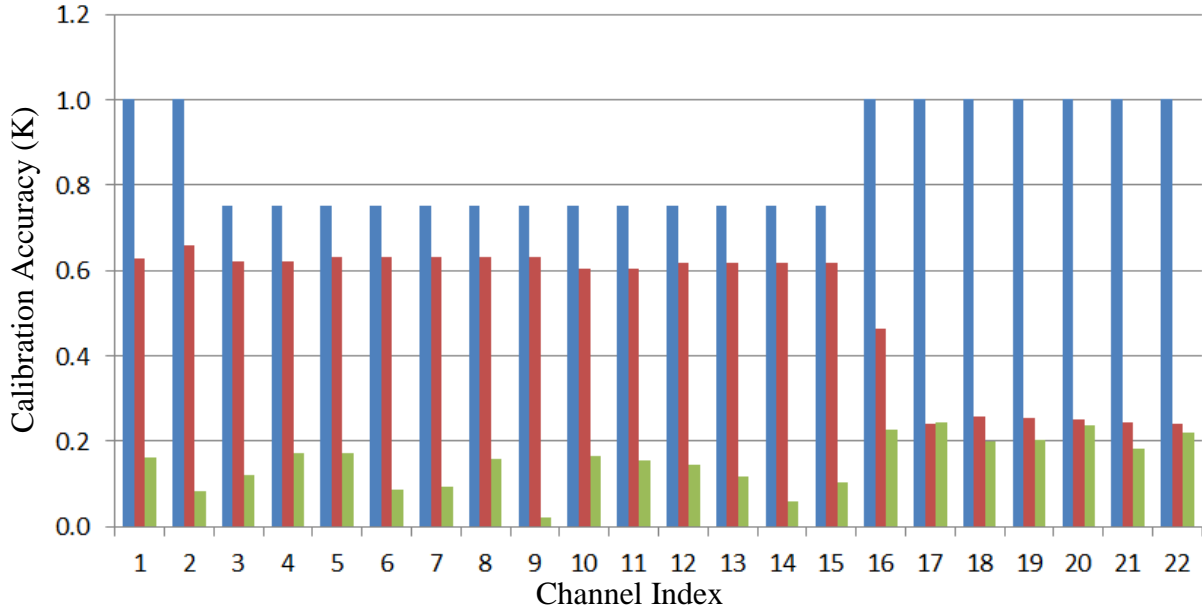
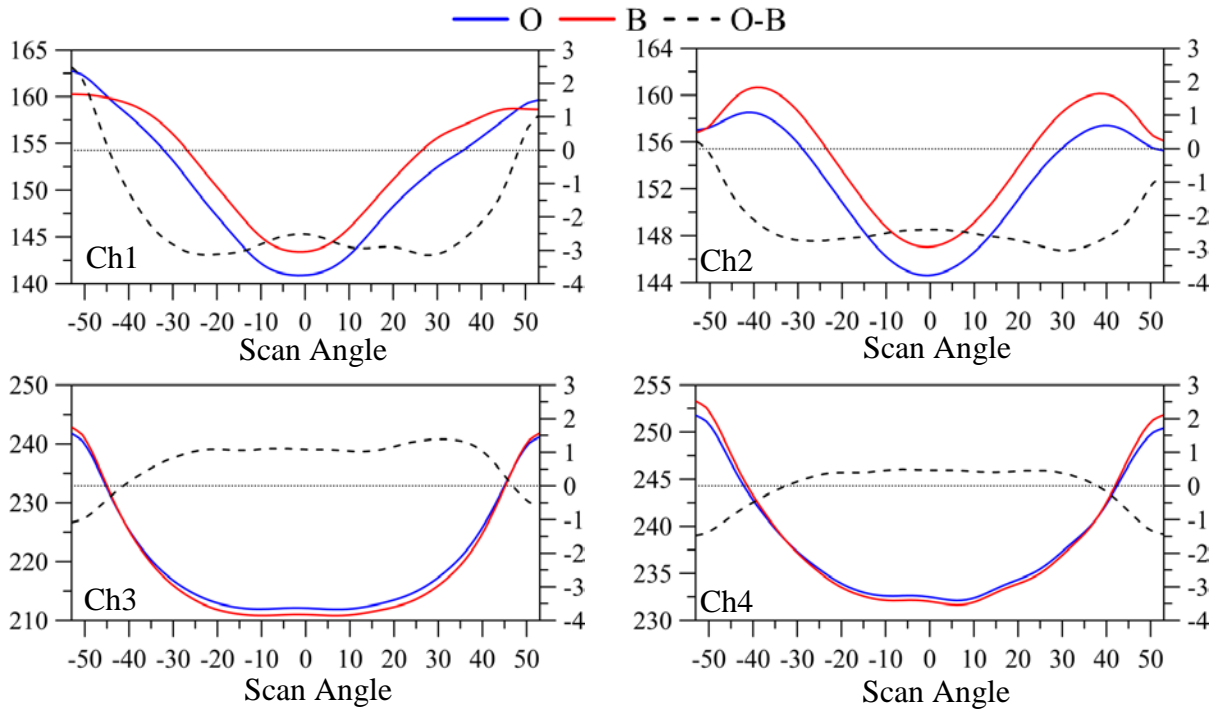
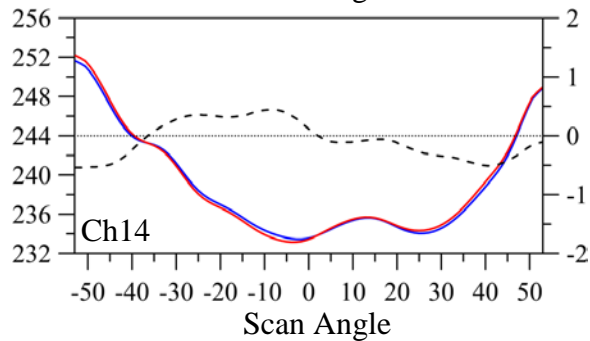
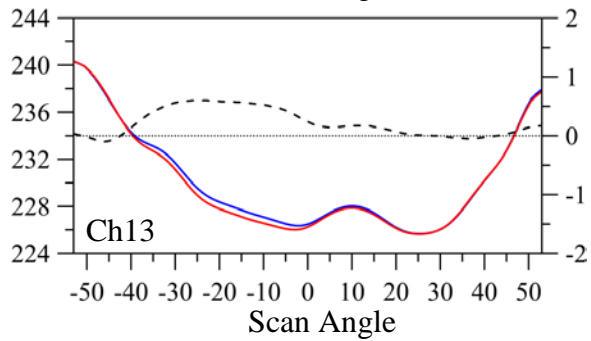
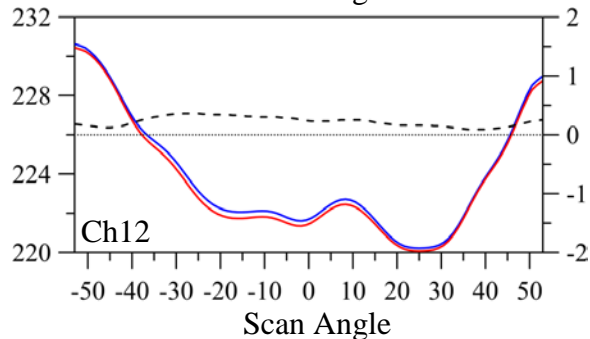
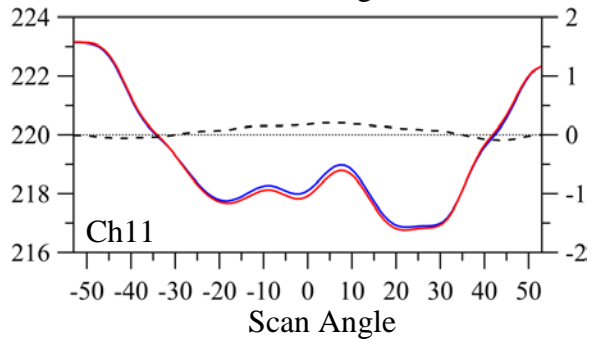
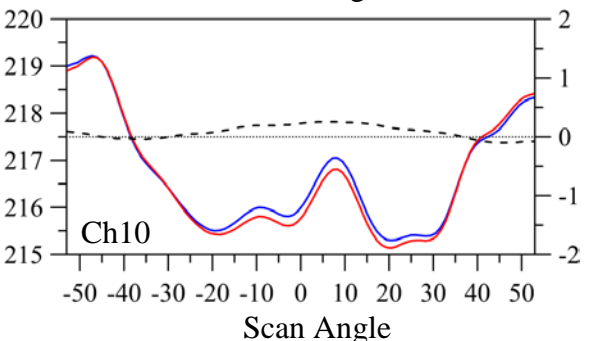
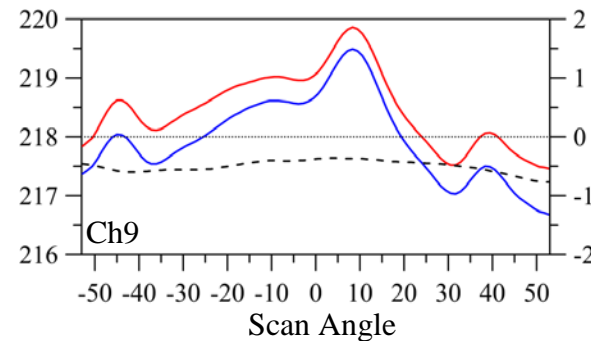
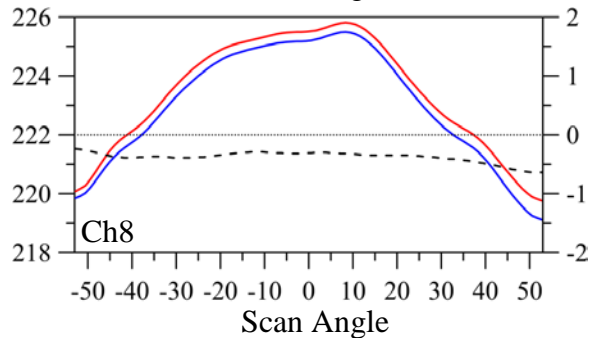
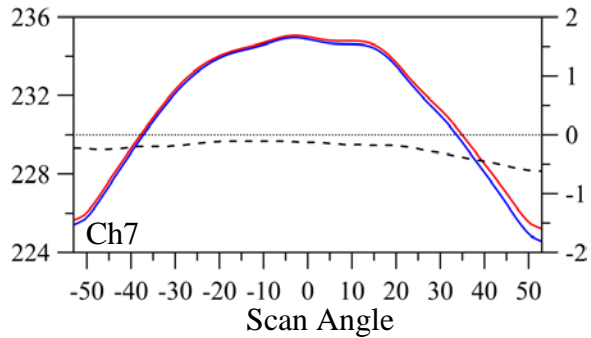
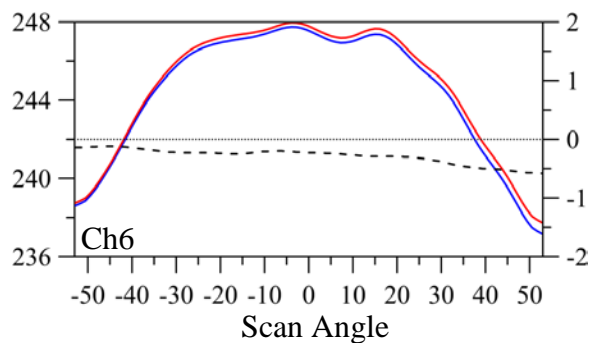
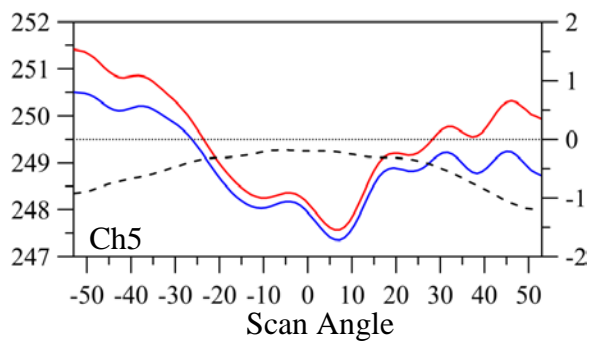


Figure.2: ATMS channel calibration accuracy: blue – specification values [2, 3]; red – values combined from the above nominal case in Figure 1; green – values obtained from prelaunch Thermal Vacuum (TVAC) calibration test

### 1.3 Post-launch Radiometric Uncertainty Estimate





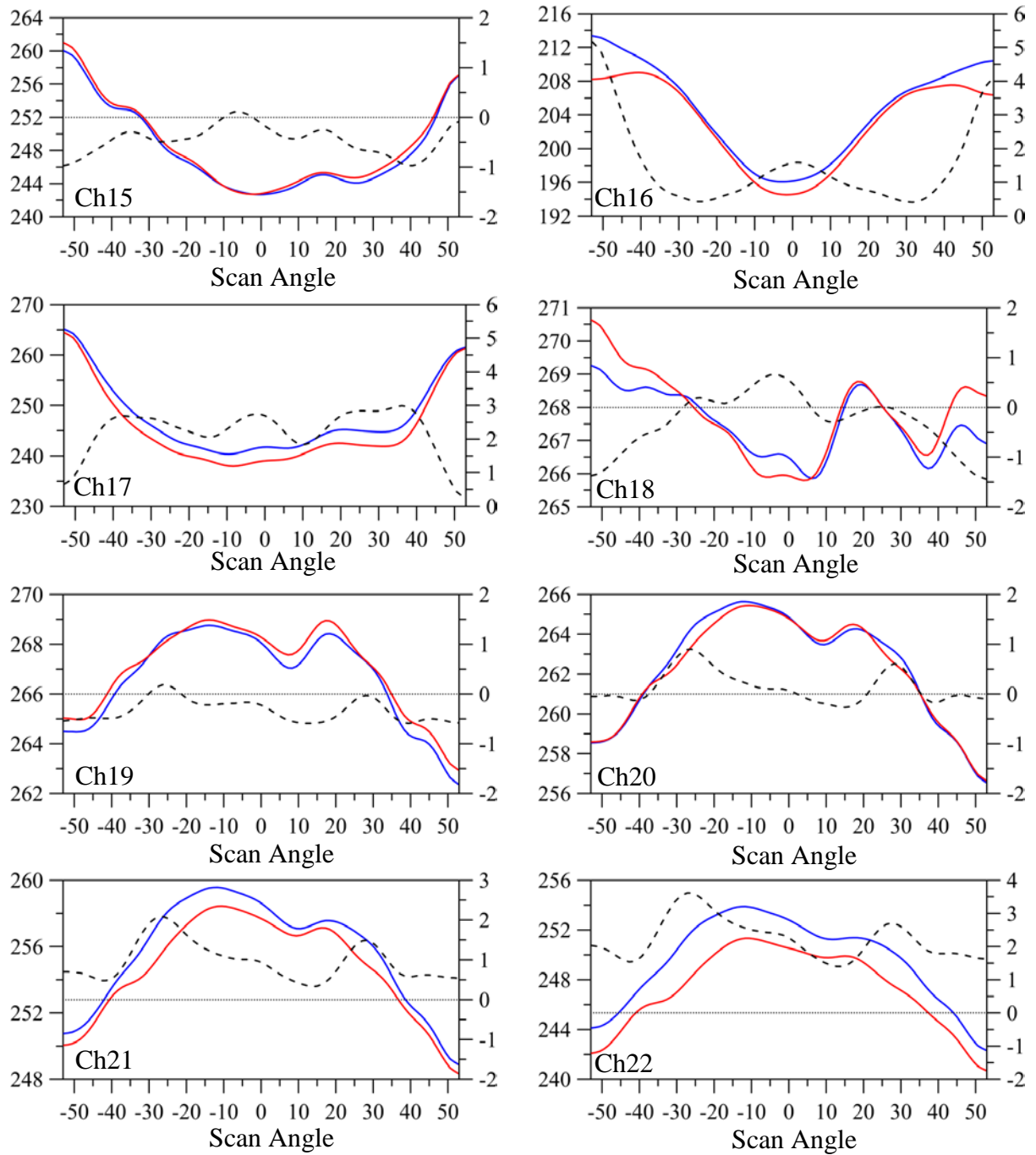
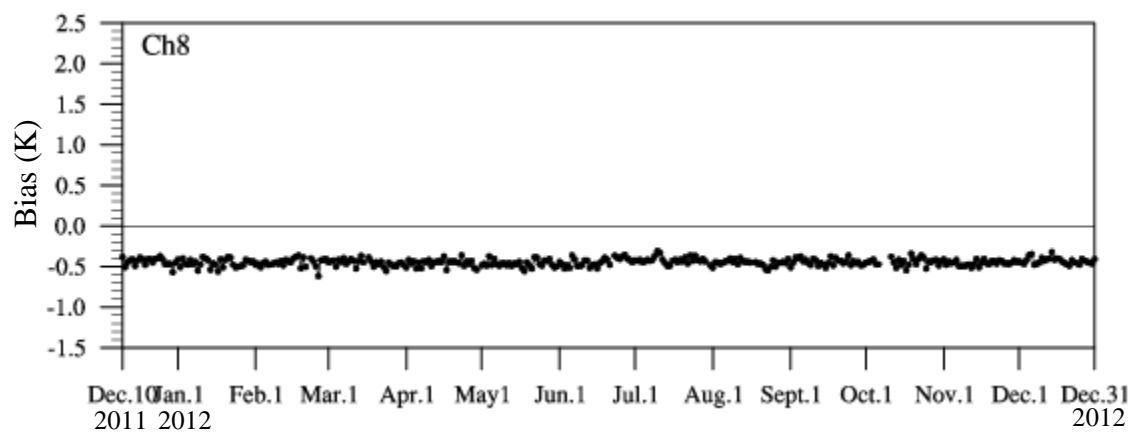
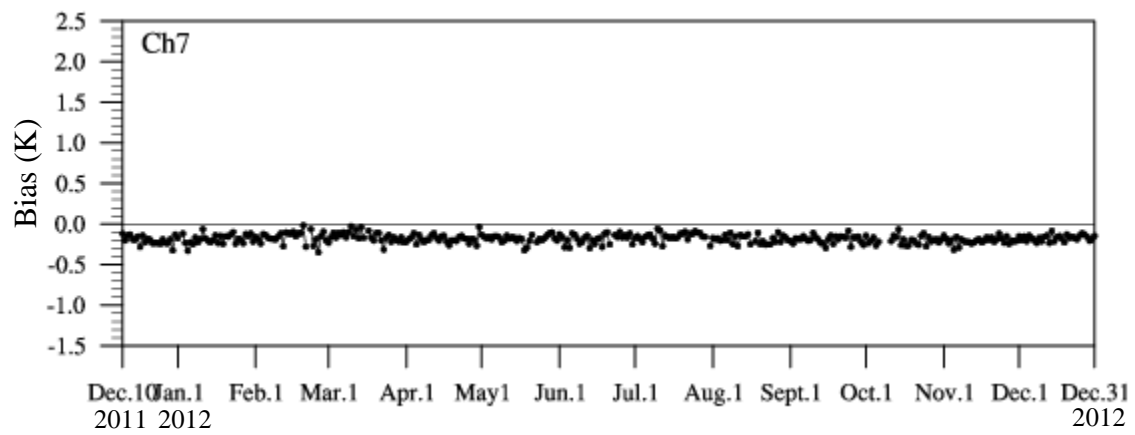
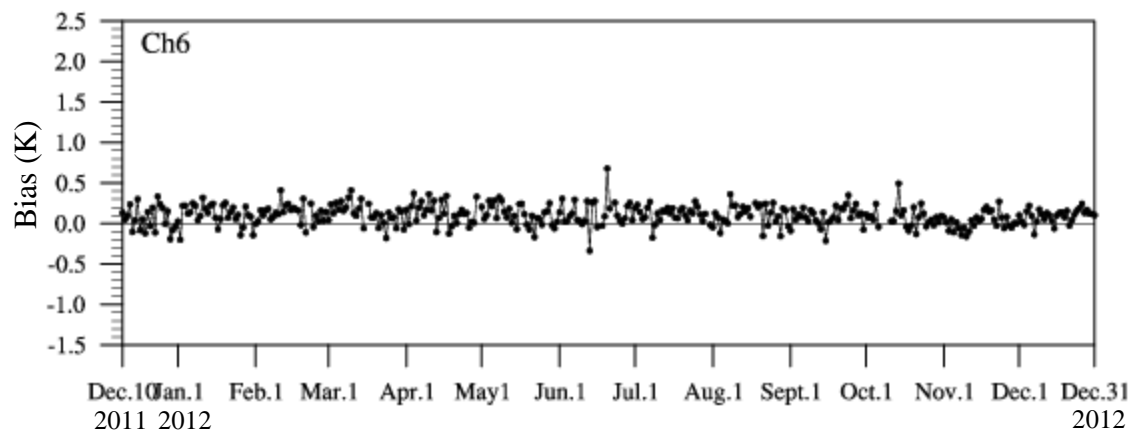
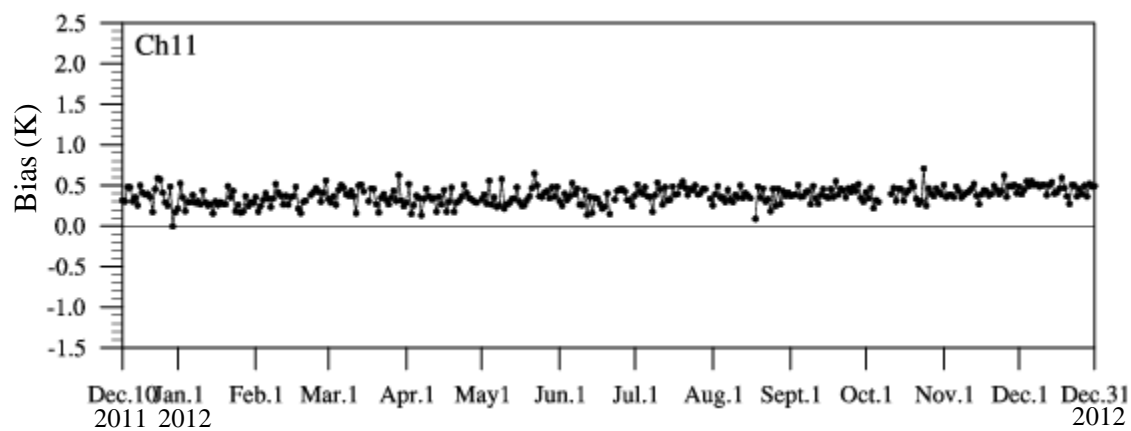
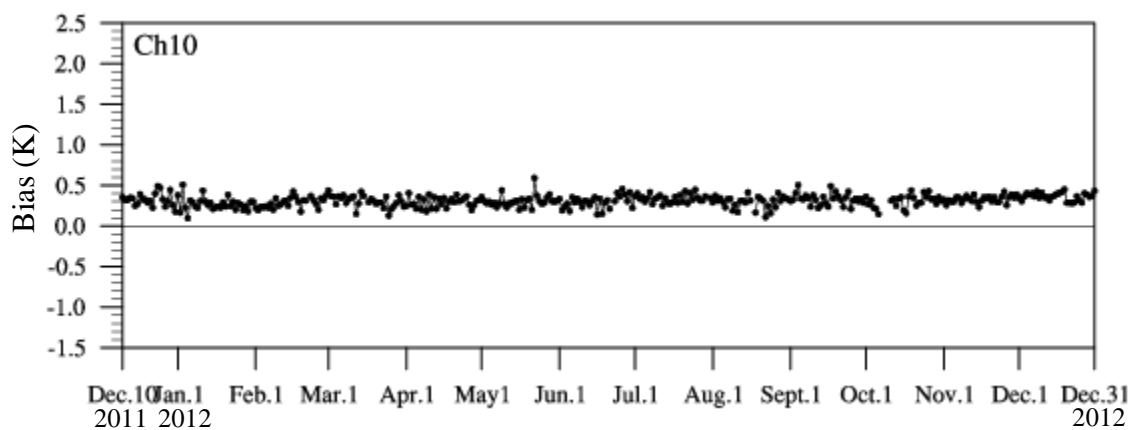
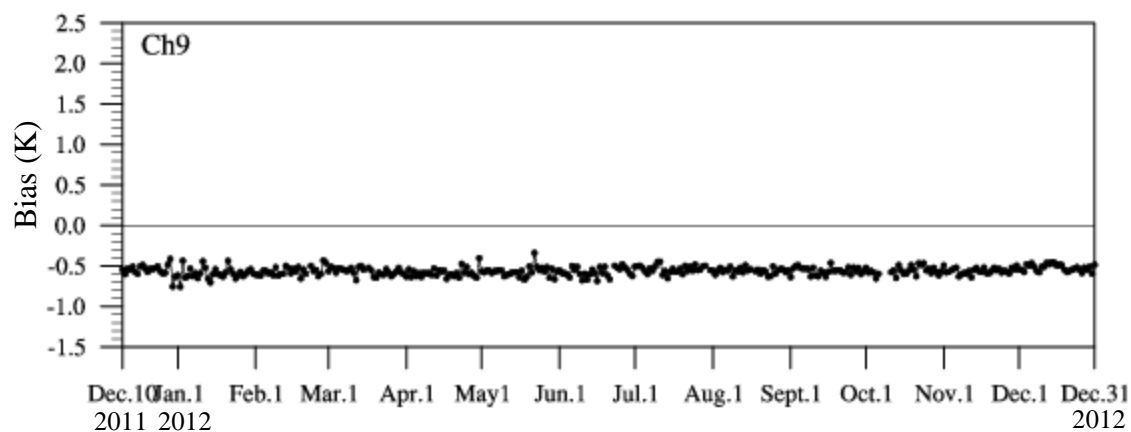


Figure.3: ATMS TDR (O), simulation (B) and the difference between O and B under calm, dry clear-sky for all 22 channels





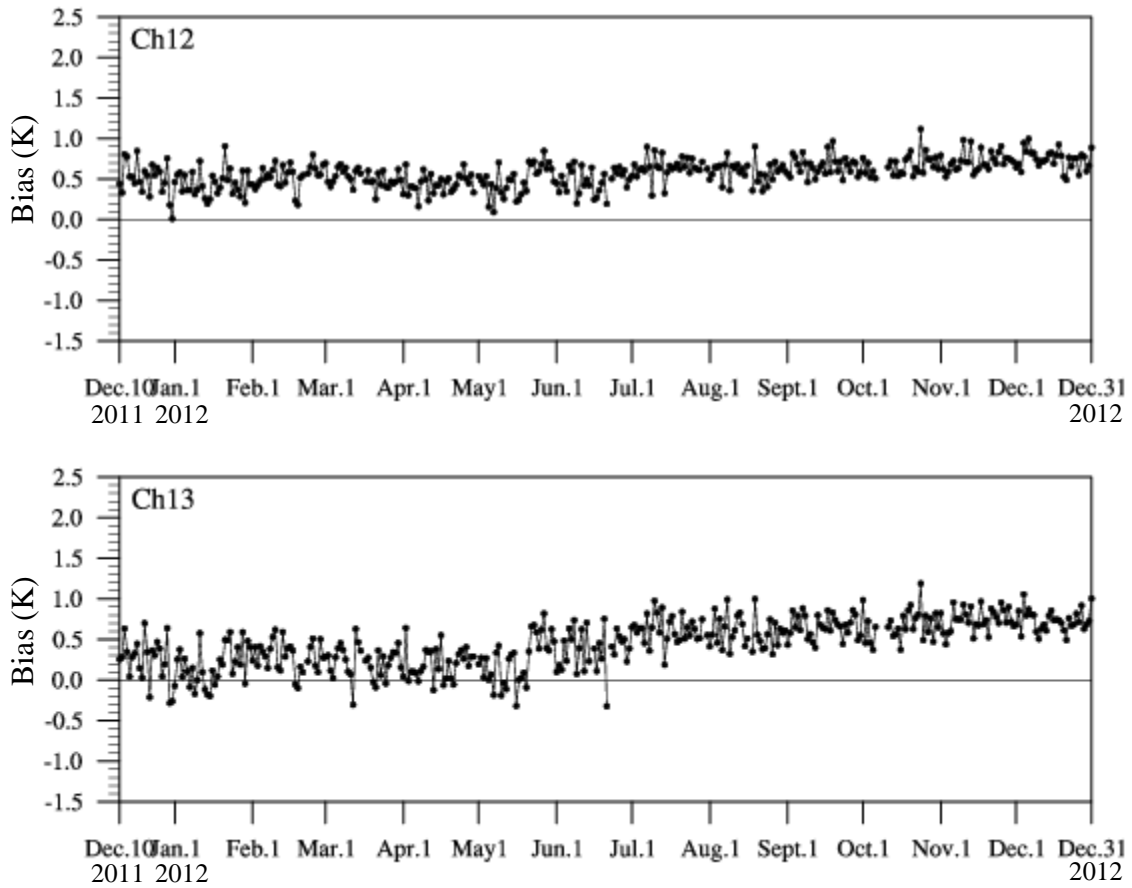
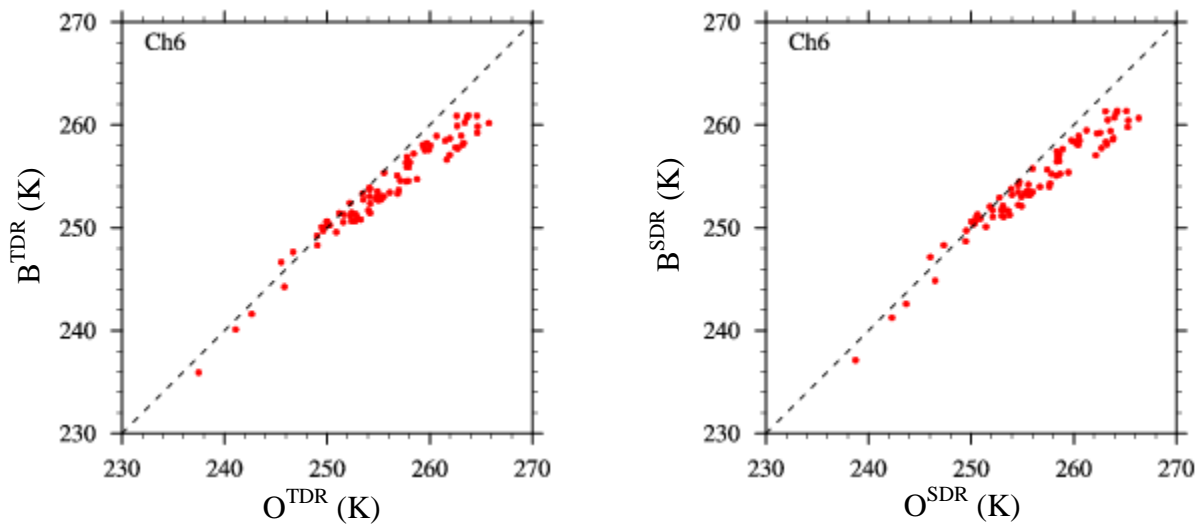
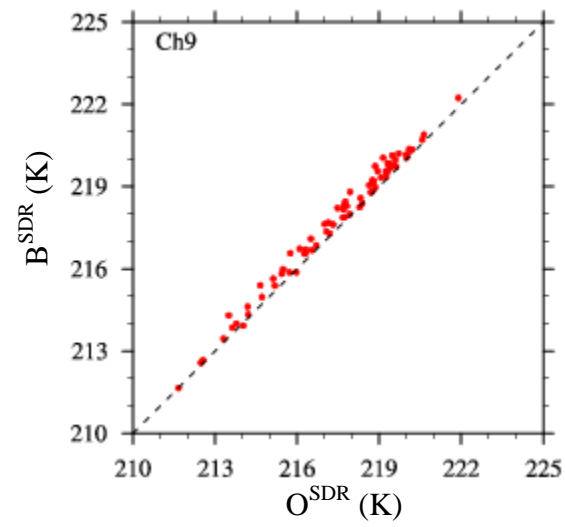
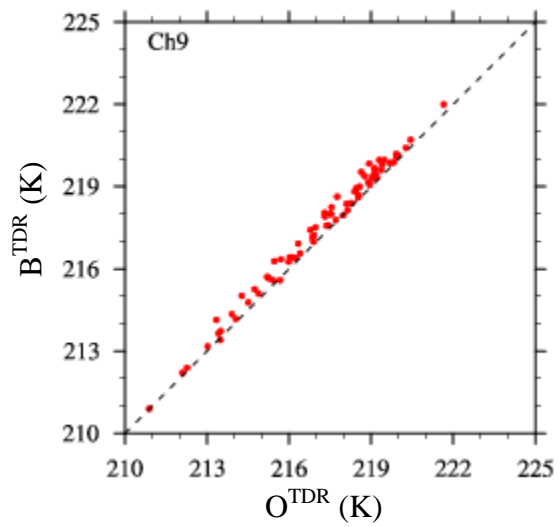
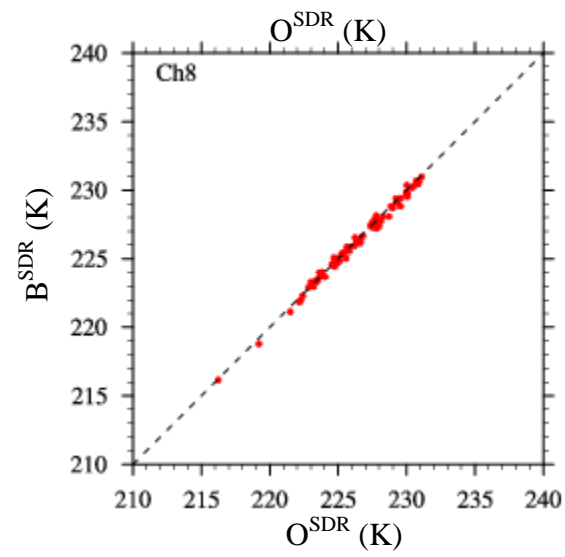
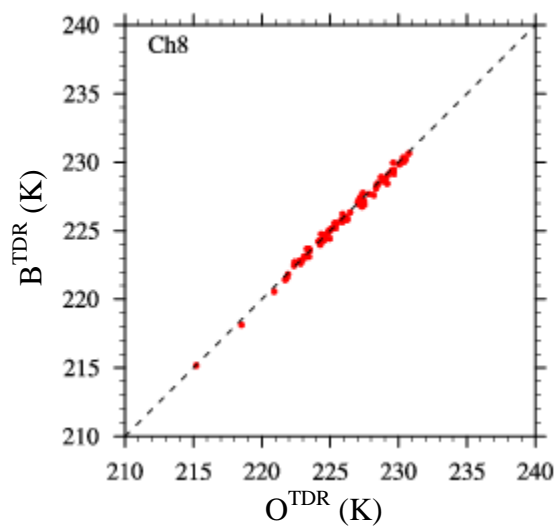
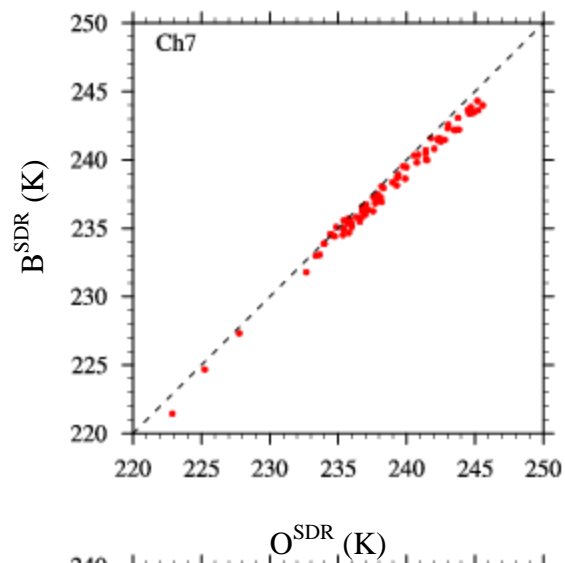
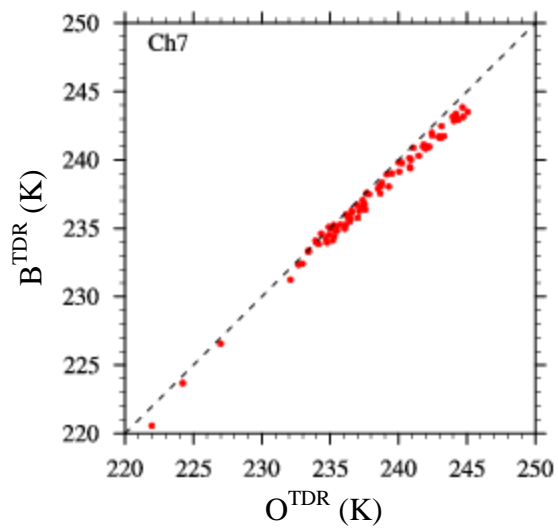
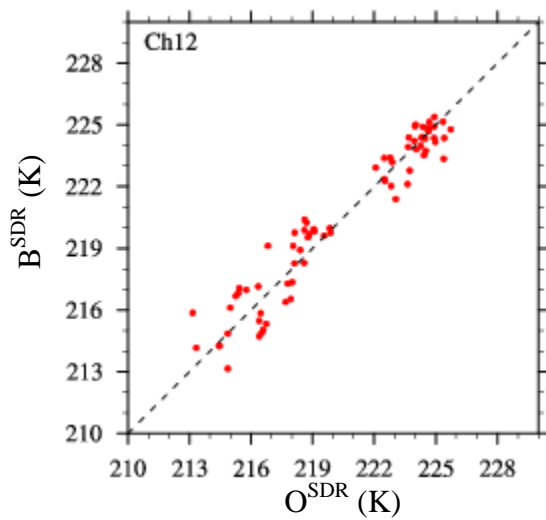
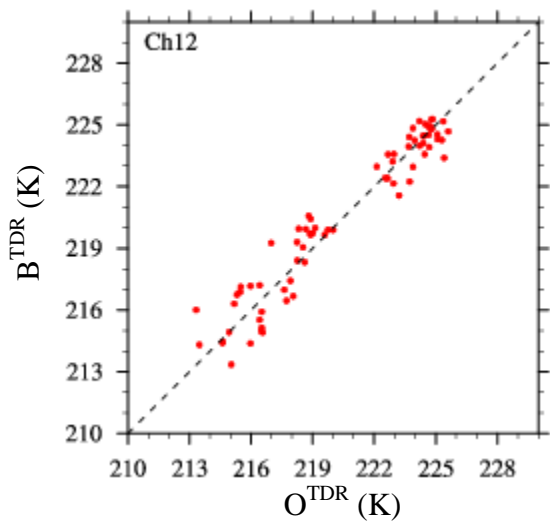
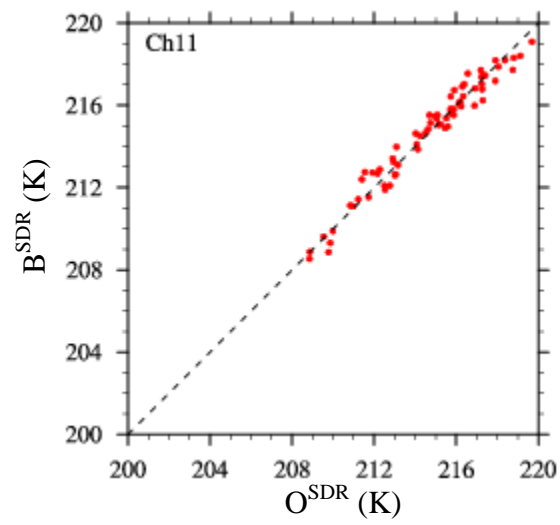
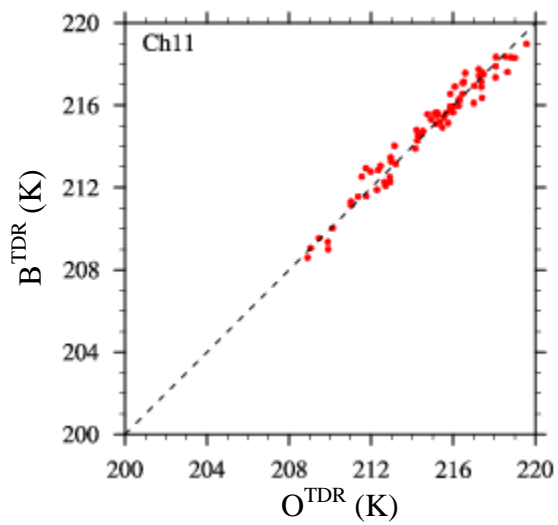
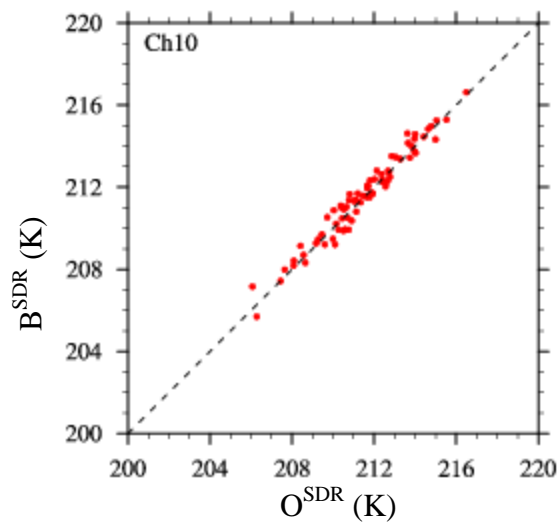
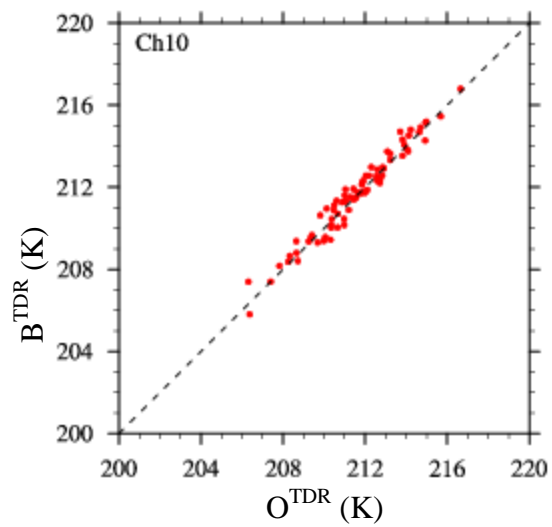


Figure.4: Time series of biases of the daily mean differences between ATMS observations and GPS RO simulations (O-BGPS) [6] calculated for collocated data under clear-sky conditions over ocean and between 60S-60N from December 10, 2011 to December 31, 2012.









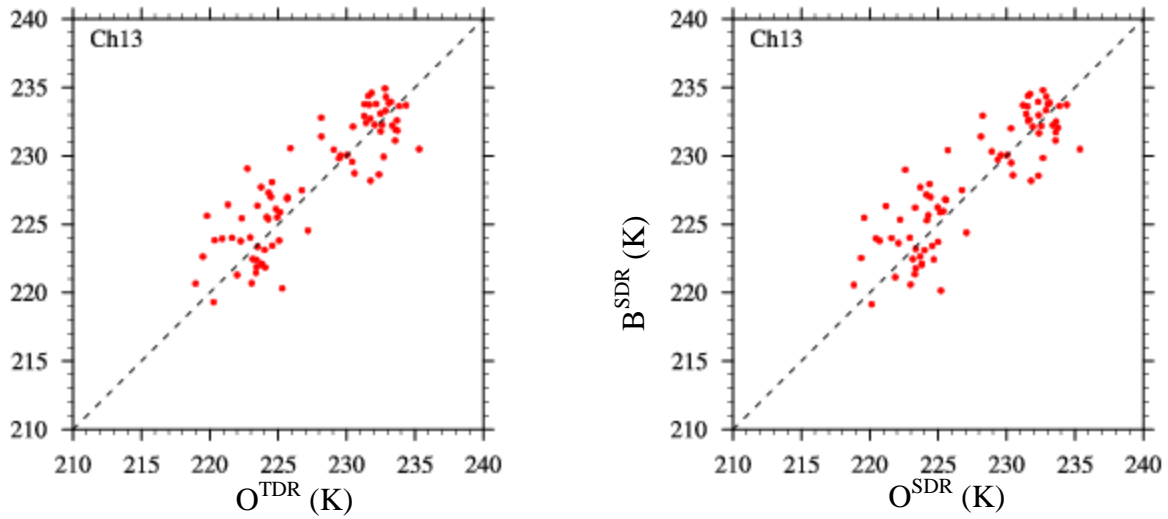


Figure.5: ATMS channels 6-13 scatter plot of  $B^{TDR}$  against  $O^{TDR}$  (left) and scatter plot of  $B^{SDR}$  against  $O^{SDR}$  (right) from the 86 ARM SGP radiosonde and ATMS matchups.

#### 1.4 Prelaunch Channel Noise Sensitivity (NEDT) from TVAC

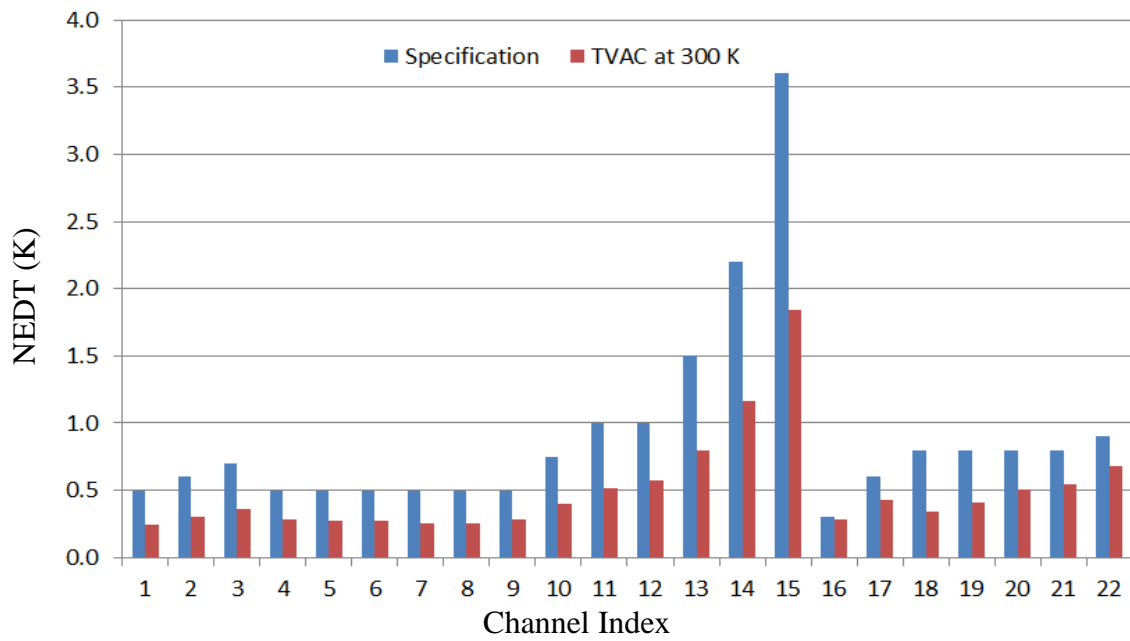
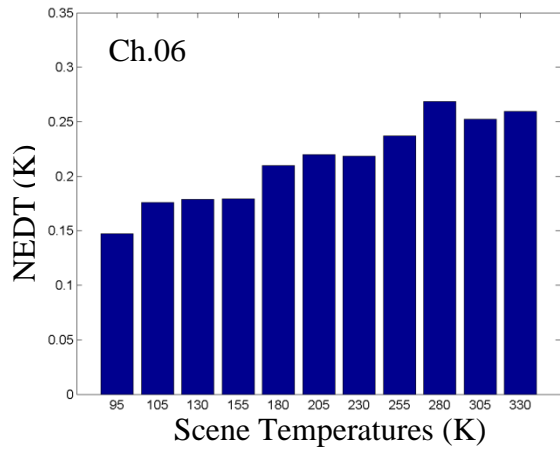
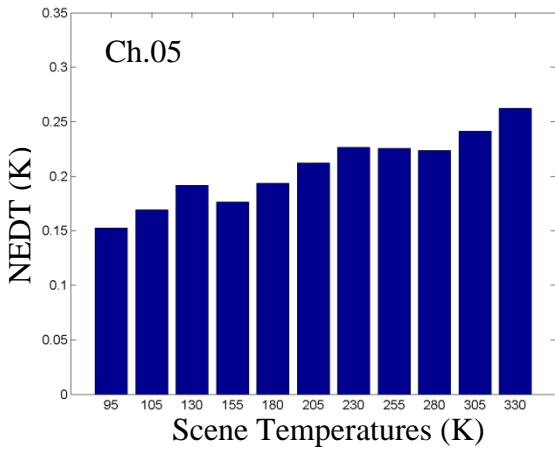
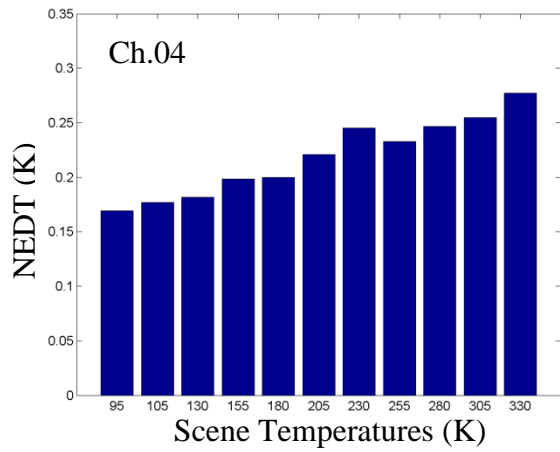
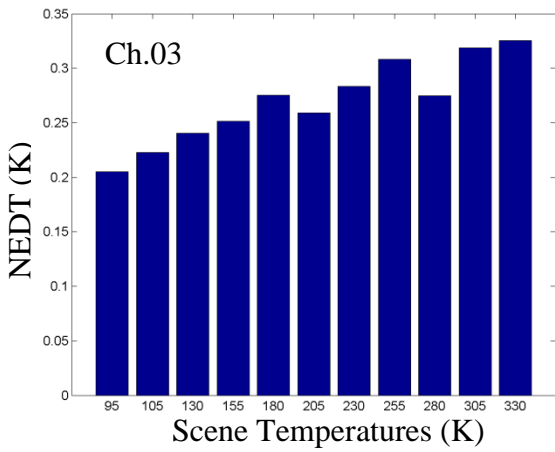
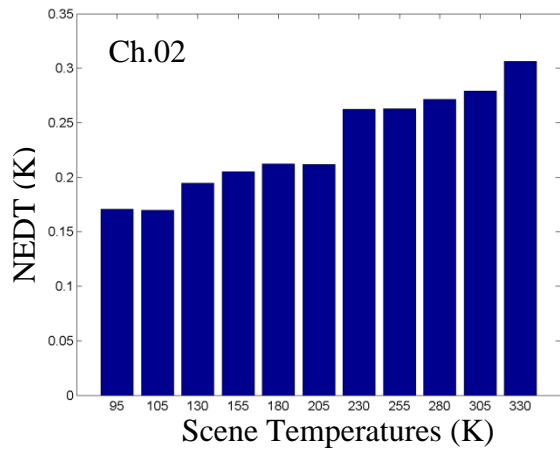
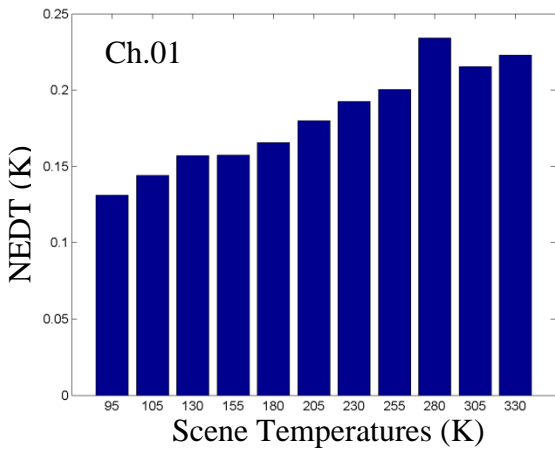
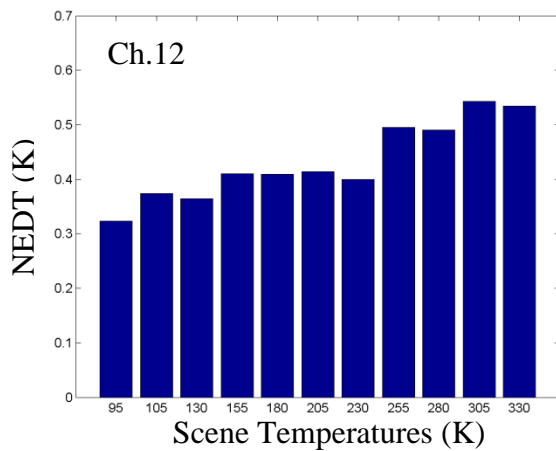
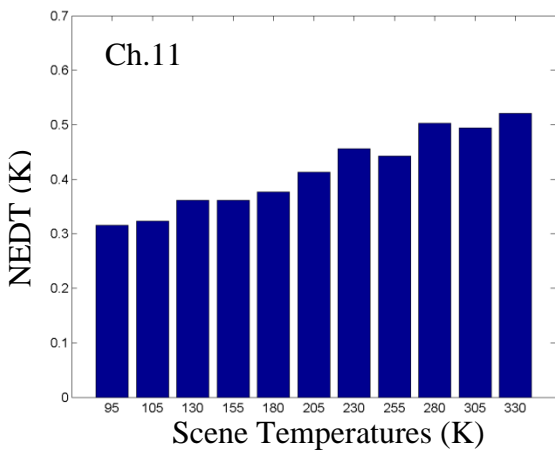
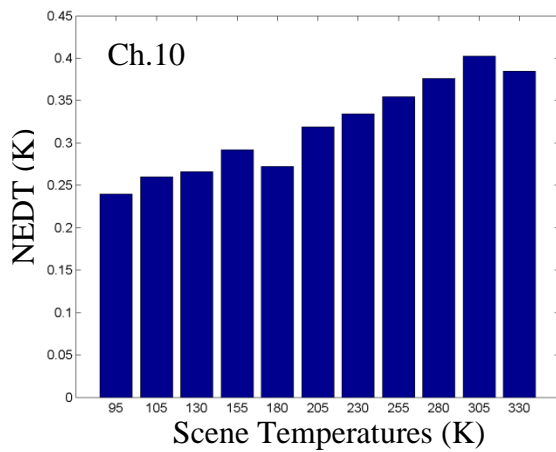
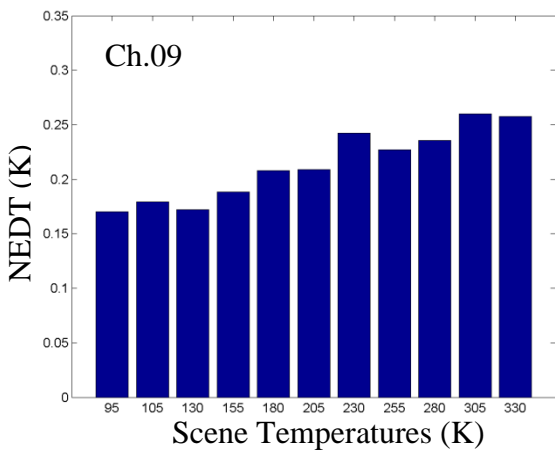
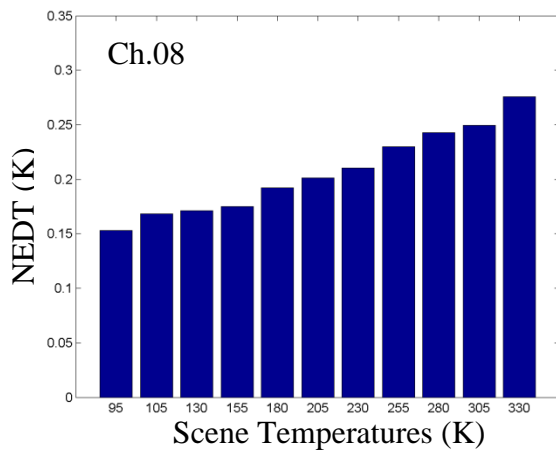
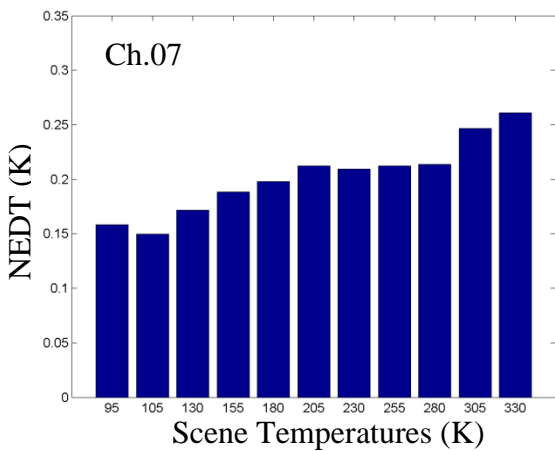
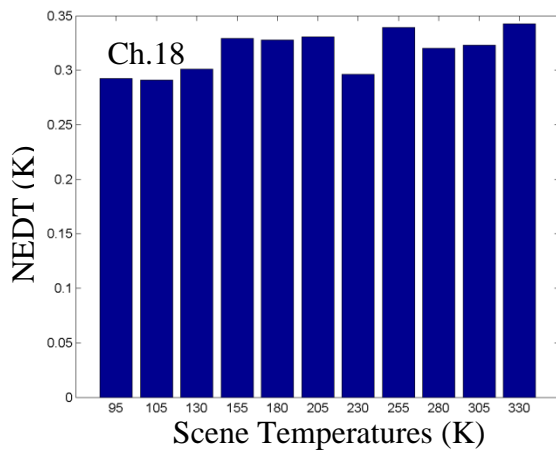
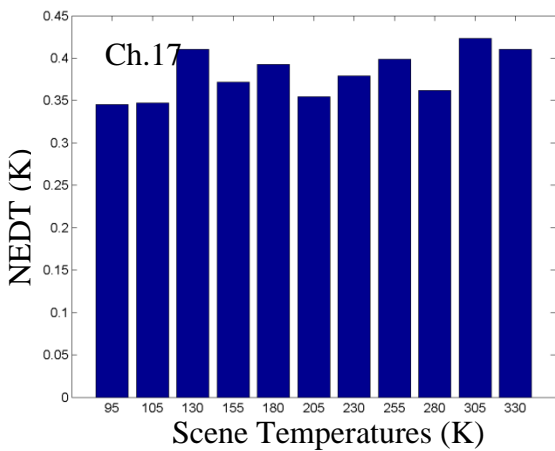
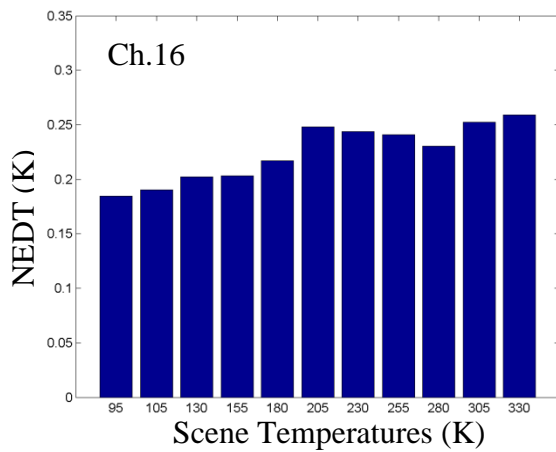
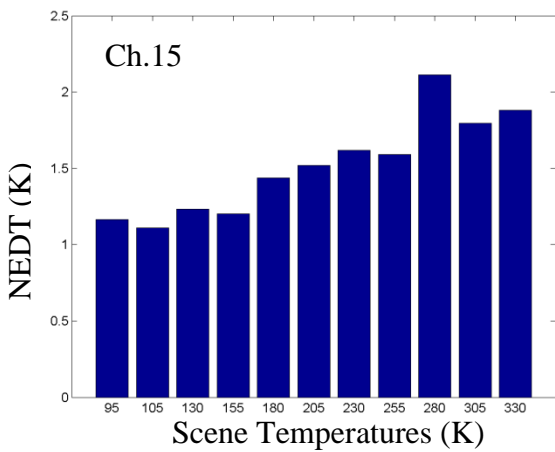
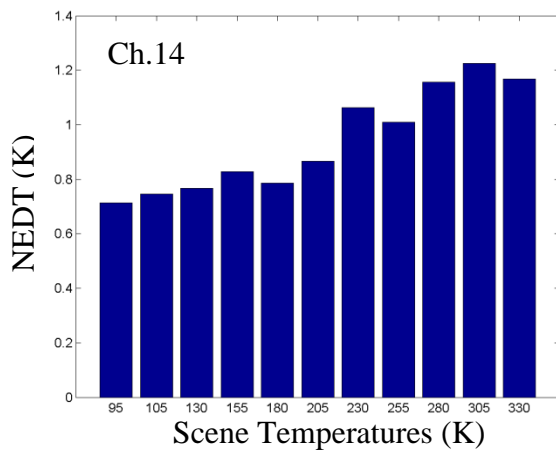
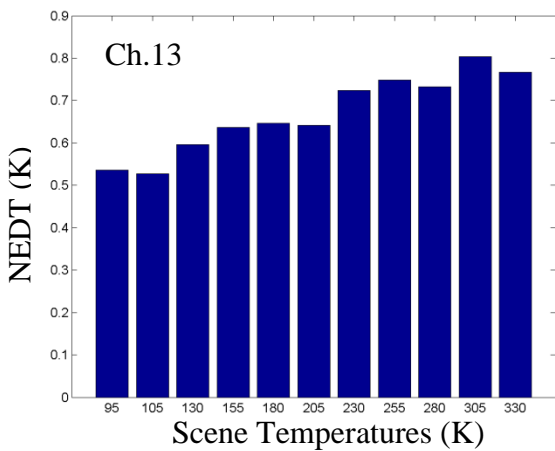


Figure.6: ATMS prelaunch channel NEDT values [4-6]: blue – from specification; red – TVAC at 300 K







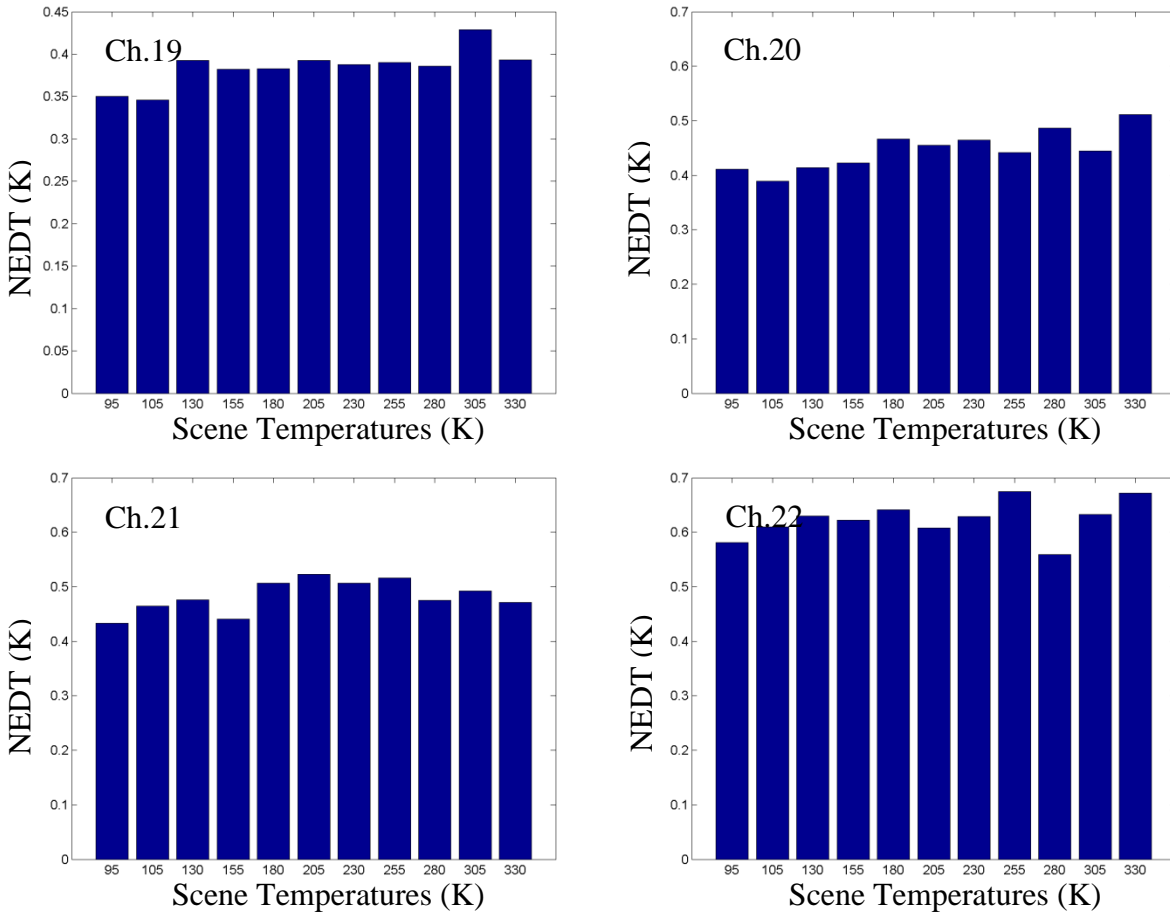


Figure.7: NEDT values of all 22 ATMS channels vs. scene temperatures. Data is from TVAC test for ATMS CP is at 5 °C and RC1.

### 1.5 Post-launch Channel Noise Sensitivity (NEDT) from in-orbit Data

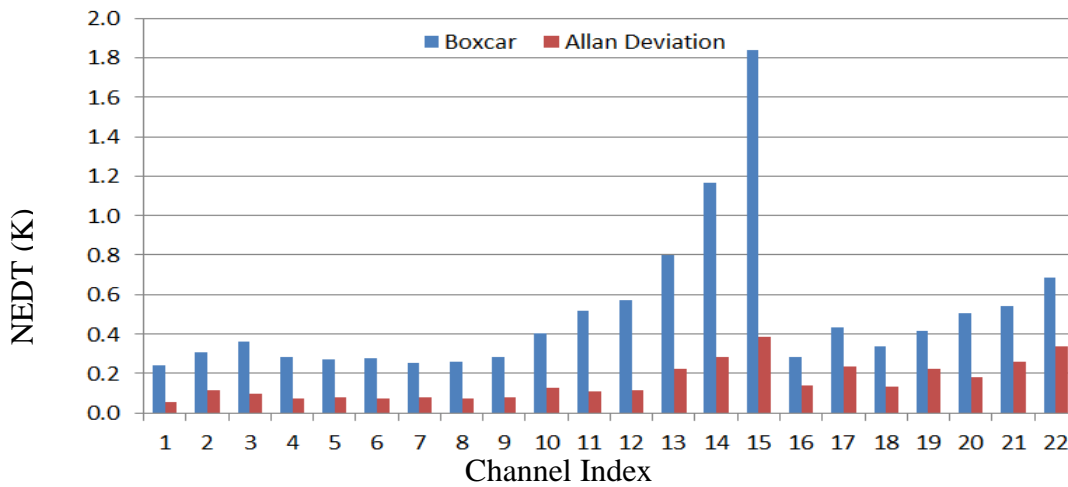


Figure.8: ATMS post-launch in-orbit channel NEDT values computed by the standard deviation and Allan deviation: blue - from standard deviation; red - Allan deviation [7].

## 1.6 Geolocation

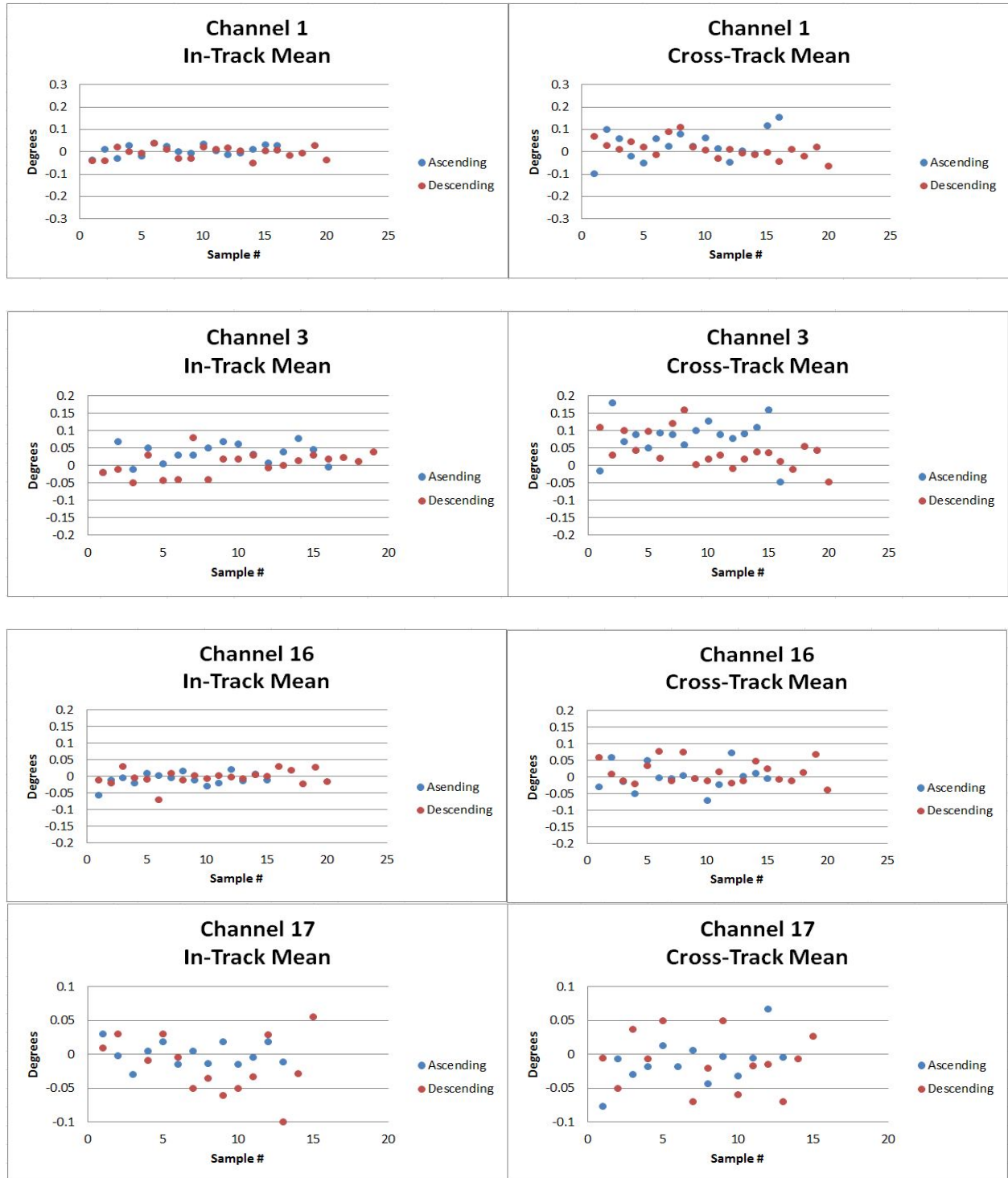


Figure.9: In-track and cross-track mean errors for “edge of scan” geolocation verification analysis: channel 1 ( $\pm 0.3^\circ$ ), channel 3 ( $\pm 0.2^\circ$ ), channel 16 ( $\pm 0.2^\circ$ ), and channel 17 ( $\pm 0.1^\circ$ )



## 2. References

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- [6] X. Zou, L. Lin and F. Weng, "Absolute Calibration of ATMS Upper Level Temperature Sounding Channels Using GPS RO Observations", *IEEE Transactions on Geoscience and Remote Sensing*, 2013
- [7] W. Riley, *Handbook of Frequency Stability Analysis*, chapter 5.2, Hamilton Technical Services, 2007