Construction of Consistent Microwave Sensor Temperature Records and Tropopause Height Climatology using MSU/AMSU Measurements, GPS RO Data, and Radiosonde Observations

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Outline

1. Project Description
2. Production Generation Approach
3. Quality Assurance Approach
4. Applications
5. Schedule & Issues

1. Project Description

1. Quantify the pixel-level MSU/AMSU temporal and spatial temperature anomalies using GPS RO data from 2001 to 2012 TLS (temperature in the lower stratosphere :AMSU ch9, MSU ch4) and TTS (temperature in the tropshere and stratosphere: AMSU ch7 and MSU ch3)as climate benchmark datasets.

2. The 'adjusted' MSU/AMSU TLS/TTS data that were calibrated by multiple RO missions will serve as reference data to calibrate other overlapped MSU/AMSU data from 1978 to 2013. Those radiosondes that are consistent with RO profiles are used to calibrate MSU/AMSU measurements and the calibrated MSU/ AMSU data will be used to calibrate other overlapped MSU/AMSU data.

3. To use GPS RO soundings collected from multi-RO missions to construct tropopause height climatology from 2001 to 2013.

1. Project Description

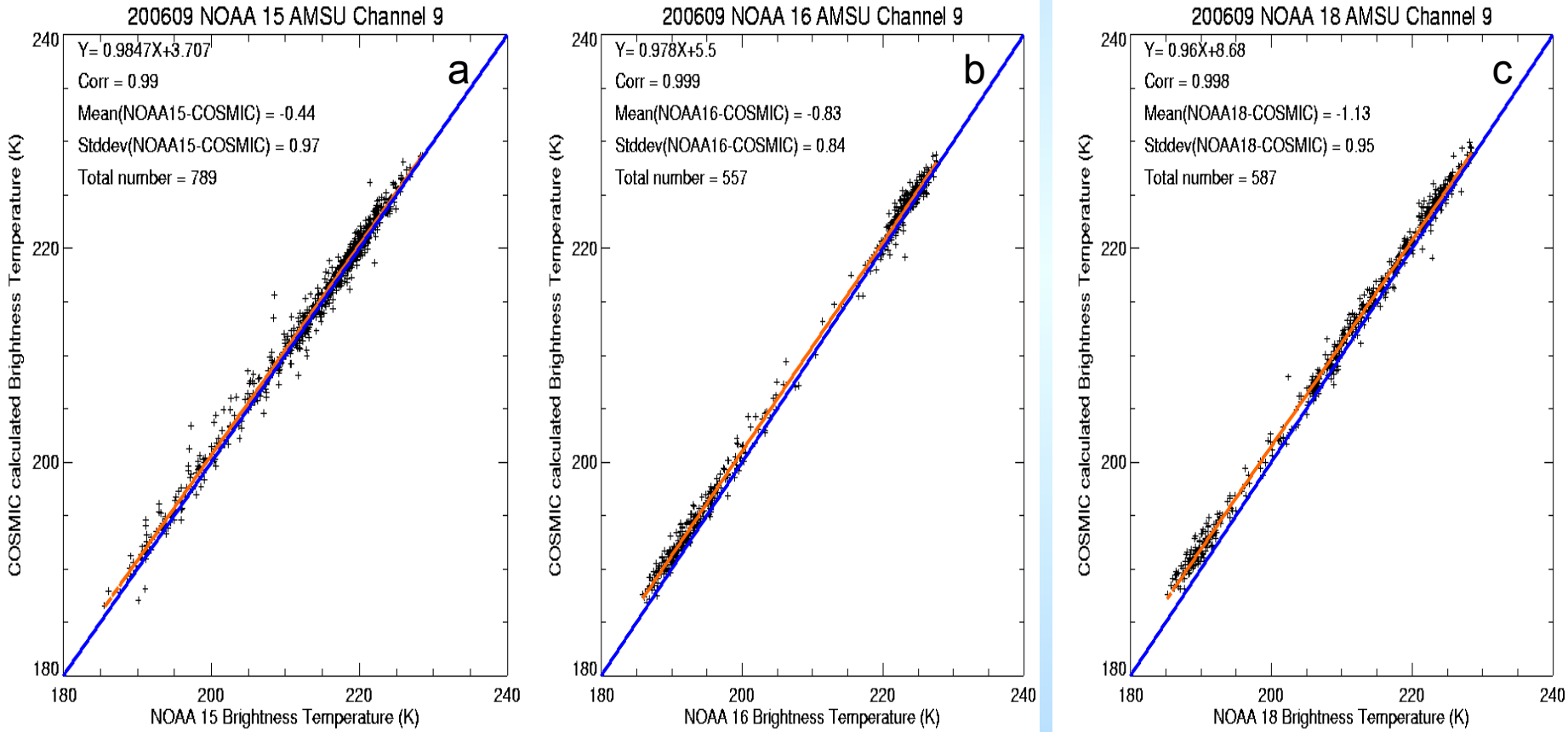
CDR(s) (Validated Outputs)	Period of Record	Spatial Resolution; Projection information	Time Step	Data format	Inputs	Uncertainty Estimates (in percent or error)	Collateral Products (unofficial and/or unvalidated)
TLS (AMSU ch9 and MSU ch4)	From 1978 to 2012	2.5x2.5 mean TLS	Monthly Mean	netCDF	RO temperature profiles from COSMIC, CHAMP, GRACE, …	Precision within 0.05K	
TTS (AMSU ch7 and MSU ch3)	From 1978 to 2012	2.5x2.5 mean TLS	Monthly Mean	netCDF			
Tropopause Height	From 2001 to 2012	2.5x2.5 grid	Monthly Mean	netCDF	Multiple NOAA MSU/ AMSU missions From 1978 to 2012		

2. Production Approach

- Describe at a high level what goes into it creating the CDR :
  a. How the inputs get transformed into the CDR (keep it at a high level; no need to get down in the weeds)
  b. How do you determine precision and uncertainty in the data.
  c. Specific challenges still to be addressed

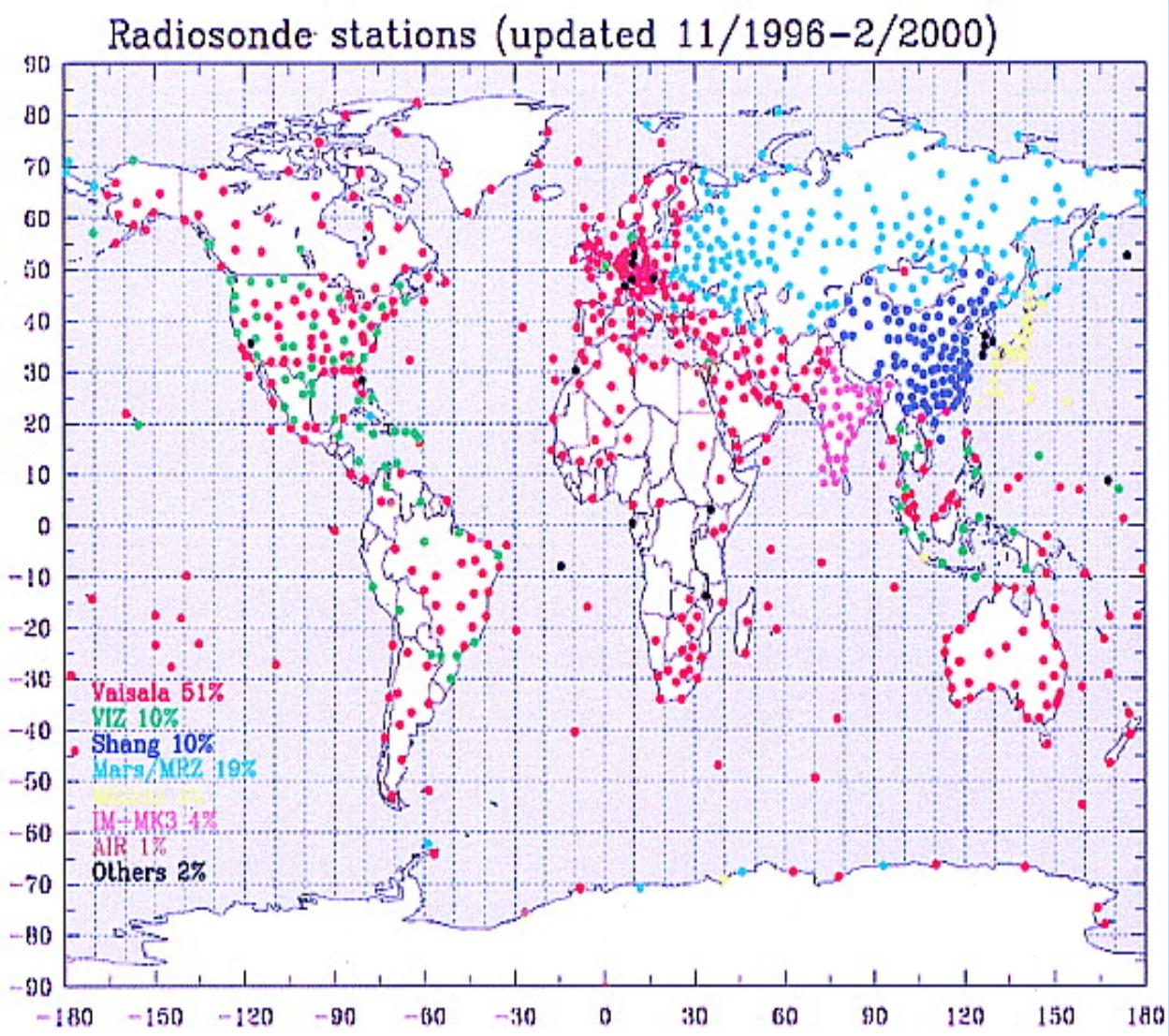
a. How the inputs get transformed into the TLS CDR

Can we use RO data to calibrate other instruments ?



N15, N16 and N18 AMSU calibration against COSMIC

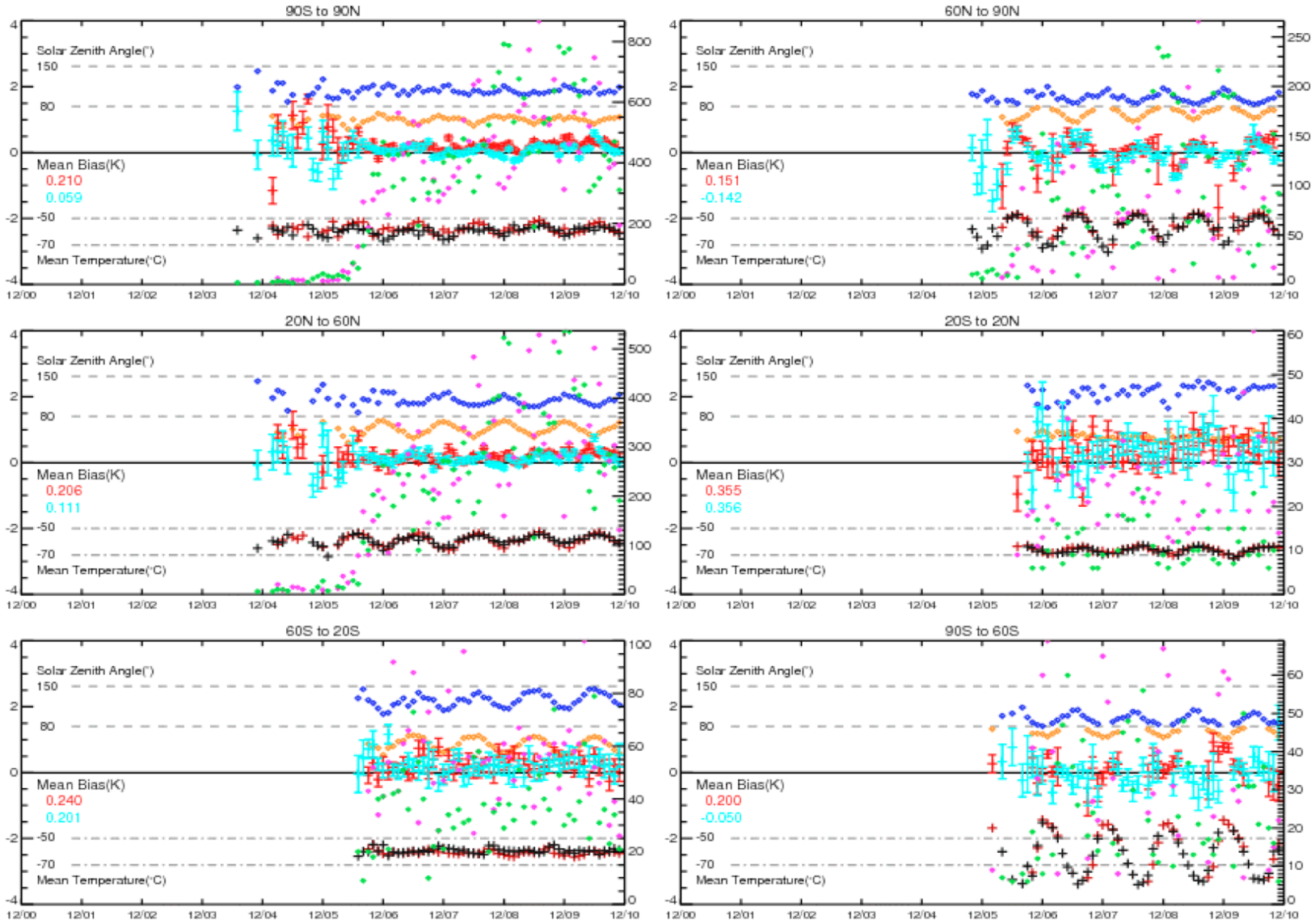
a. How the inputs get transformed into the TTS CDR

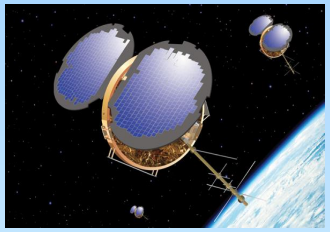


Region	Sonde Type	Matched Sample
Russia	AVK-MRZ	2000 (20%)
China	Shang	650 (6.1%)
USA	VIZ-B2	600 (5.9%)
Others	Vaisala	3140 (30%)

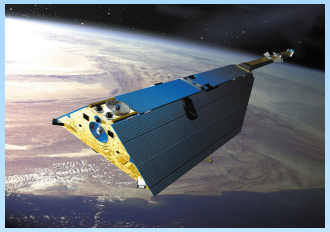
Temperature Monthly Mean Bias (SONDE-RO) /K

Vaisala RS92/Digicora III (Finland), Radiosonde ID = 80, 50hPa





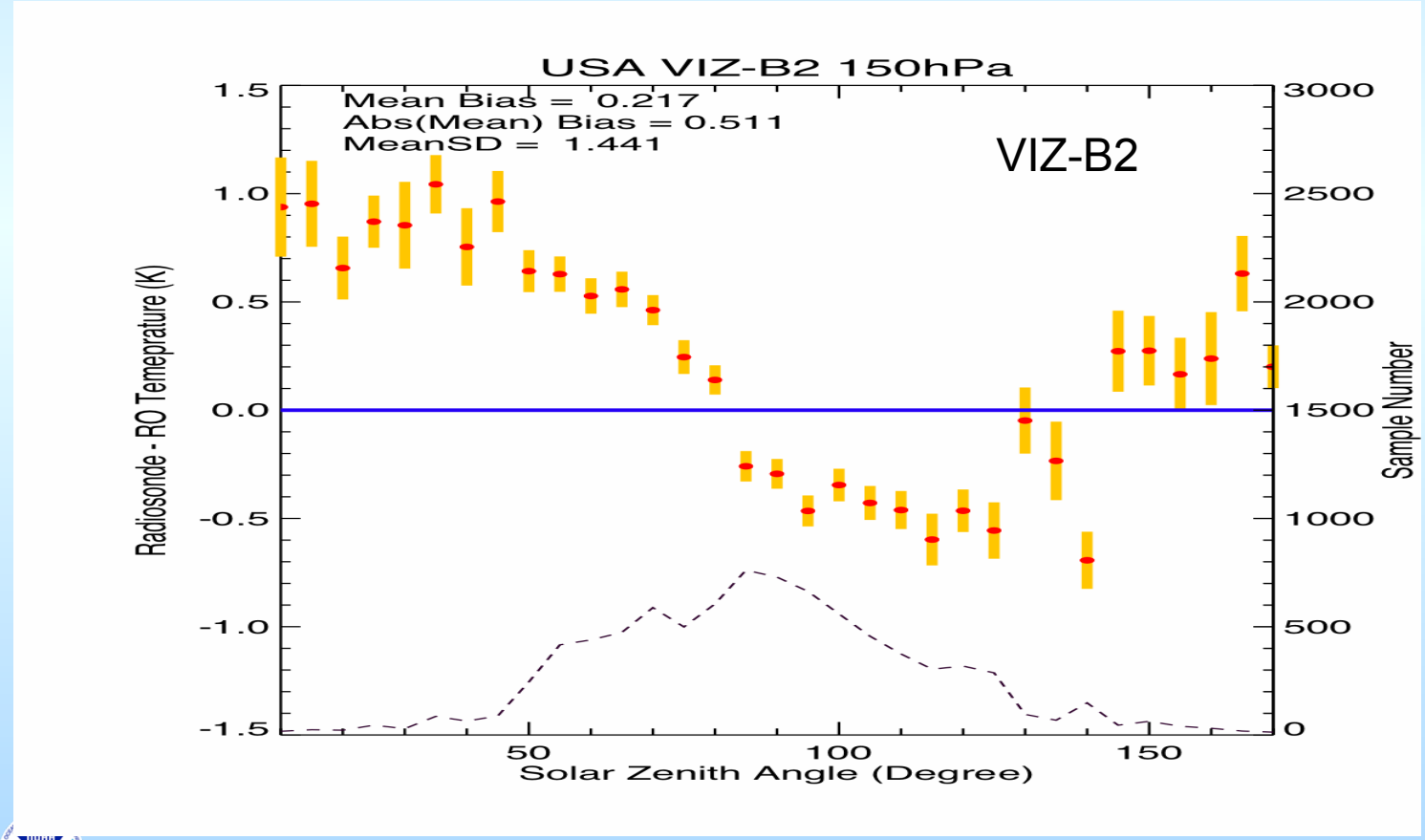
Using RO data to Correct Diurnal variation of Radiosonde Temperature Anomalies



Solar absorptivity = 0.15
IR emissivity = 0.85

150 hPa

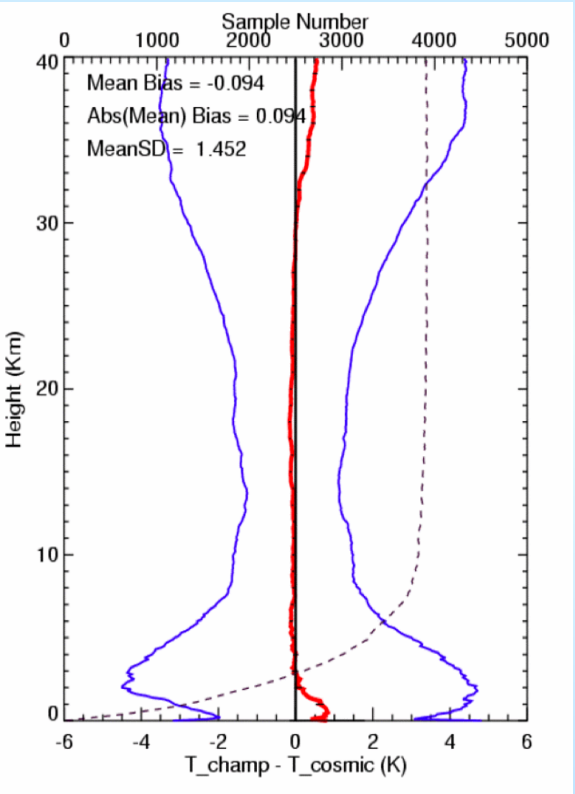
COSMIC from 2006 to 2009
CHAMP from 2001 to 2008
Radiosodne data DS351.0 from NCAR



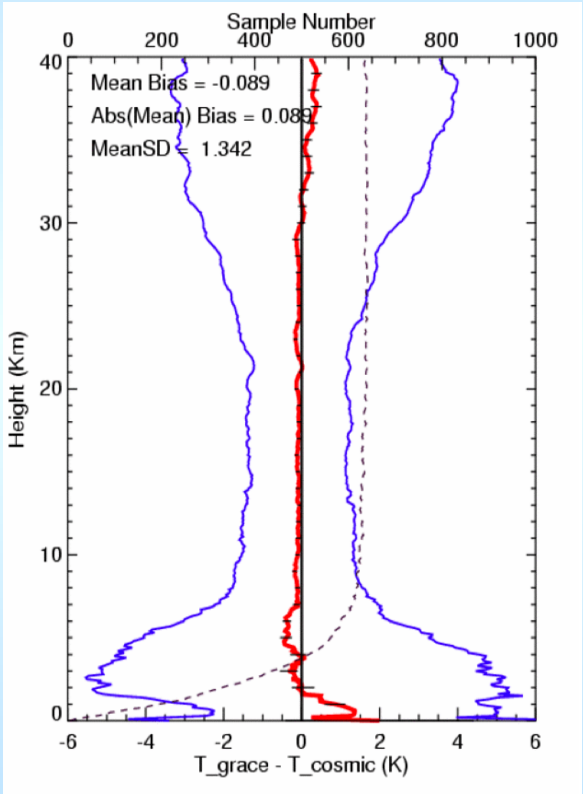
b. How do you determine precision and uncertainty in the data

Global COSMIC, CHAMP, SAC-C, GRACE-A, Metop/GRAS Comparison

Within 60 Mins, and 50 Km



CHAMP-COSMIC
2007-2008



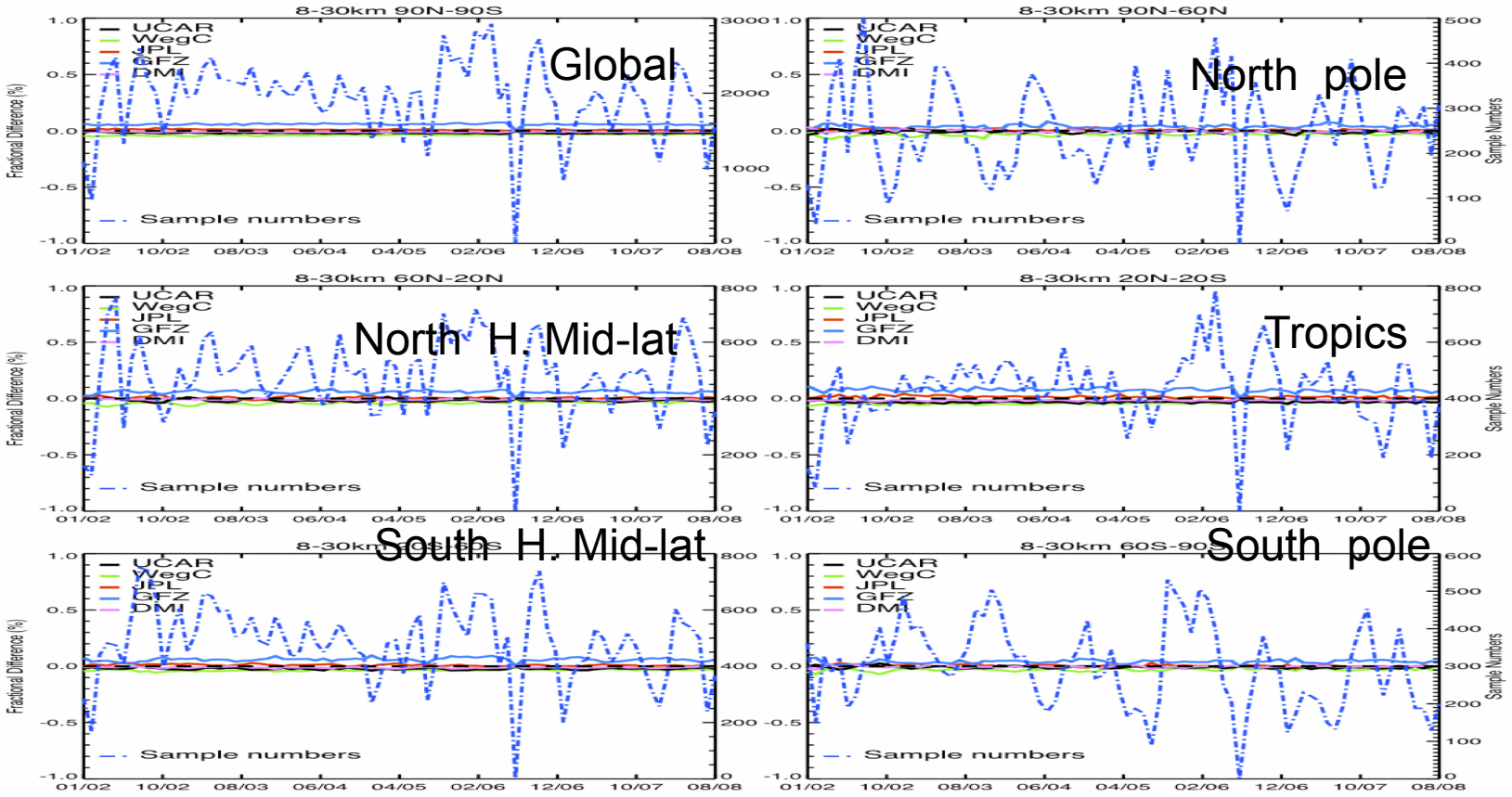
GRACE-COSMIC
2006

- Comparison of measurements between old and new instrument
- CHAMP launched in 2001
- COSMIC launched 2006
- GRACE launched 2002

Don't need to have stable calibration reference

b. How do you determine precision and uncertainty in the data

Quantify the quality of RO data among different centers centers : reproducibility



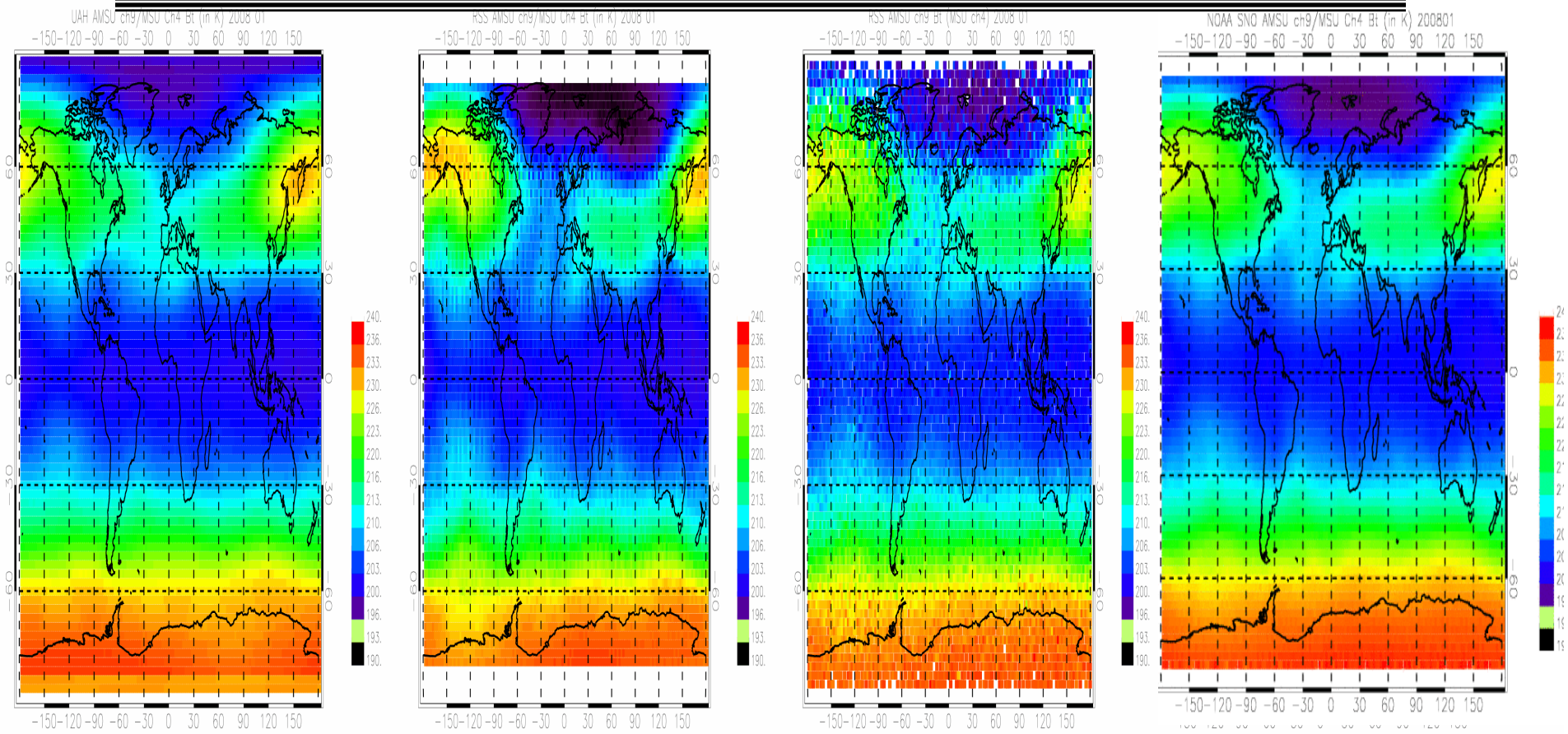
8-30 km

c. Specific challenges still to be addressed

1) MSU and AMSU conversion

2) Before and after RO era

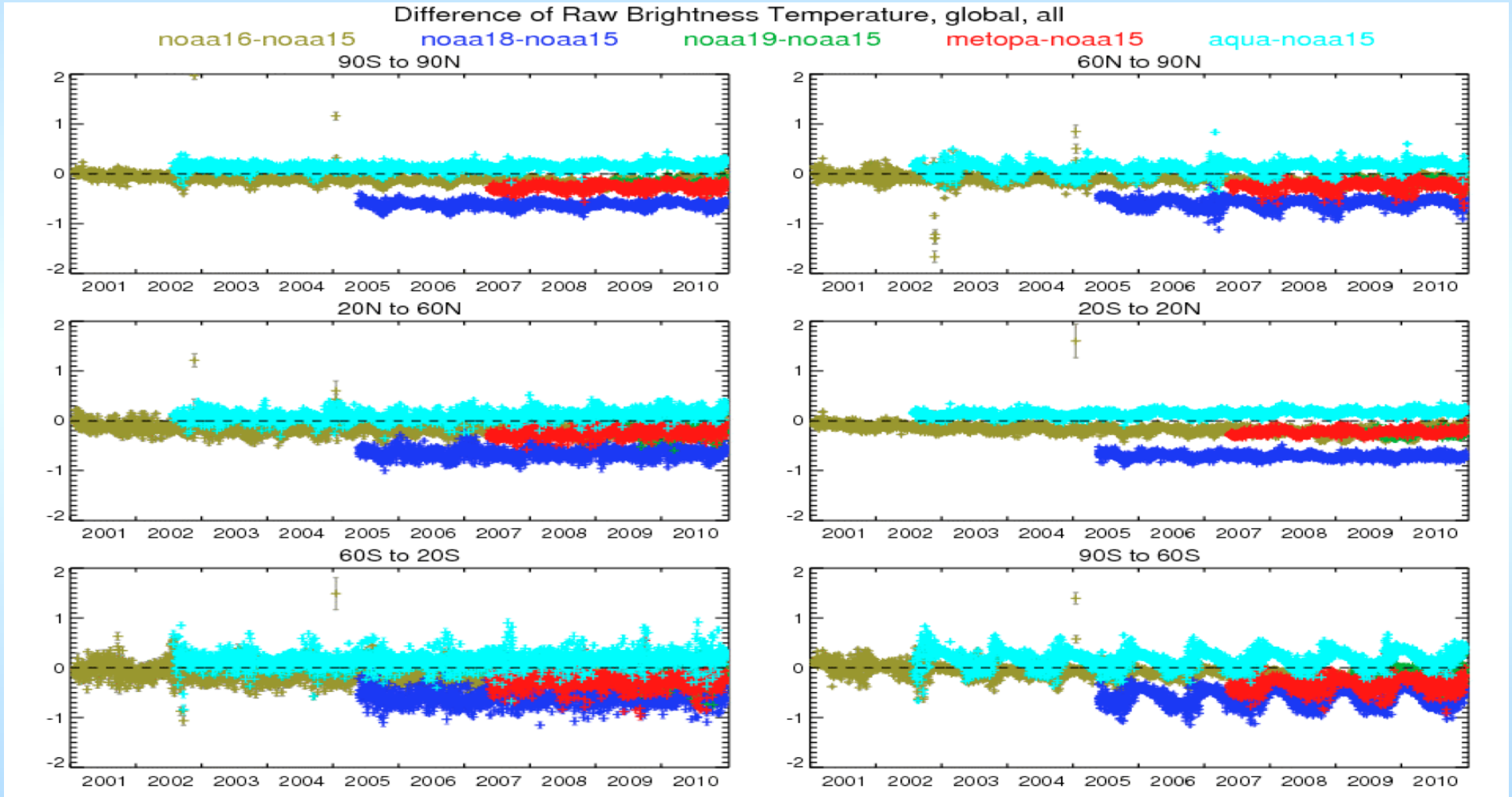
3. Quality Assurance Approach



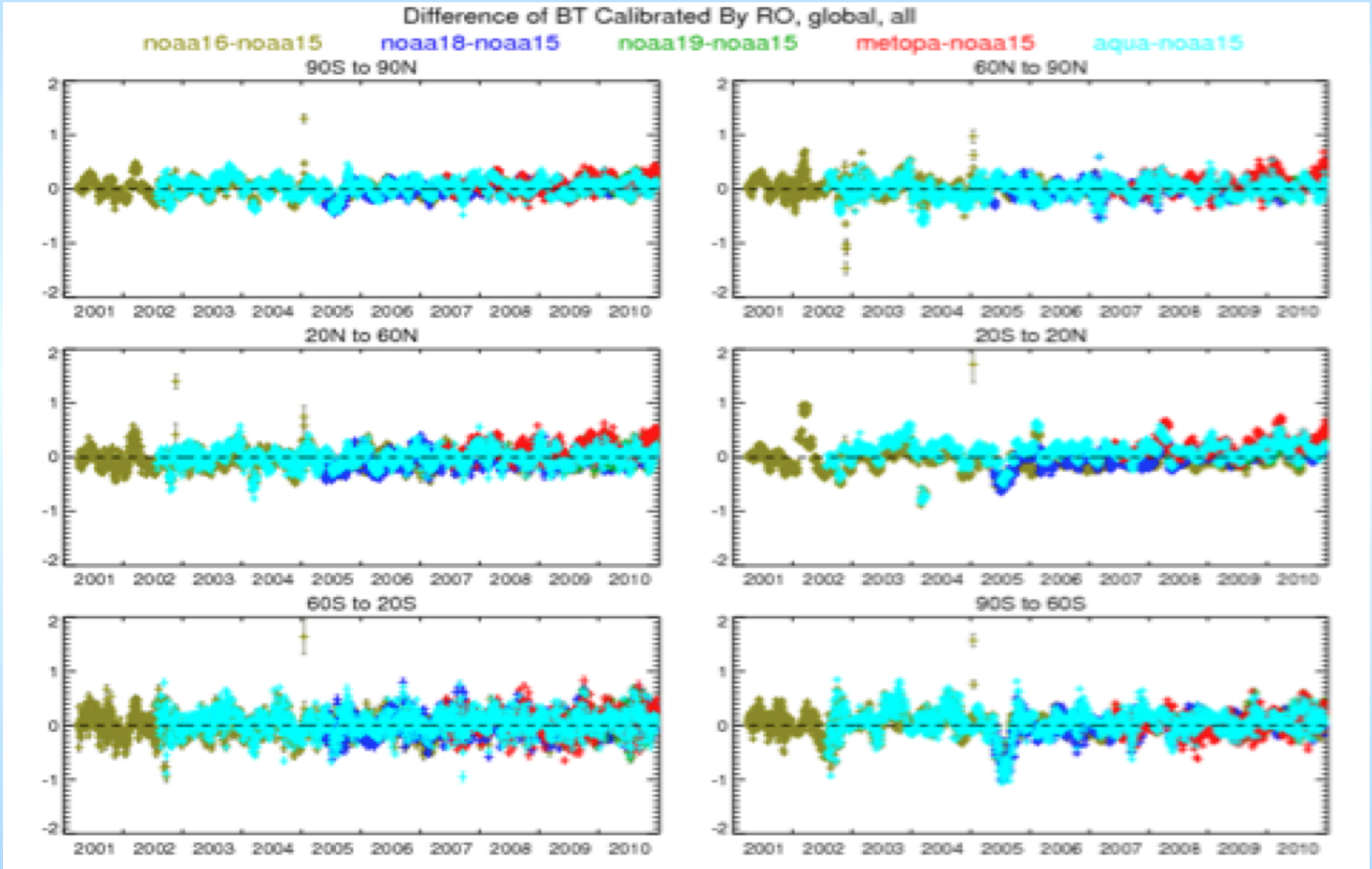
UAH RSS RO_AMSU STAR

Monthly mean 2.5x.2.5 global TLS

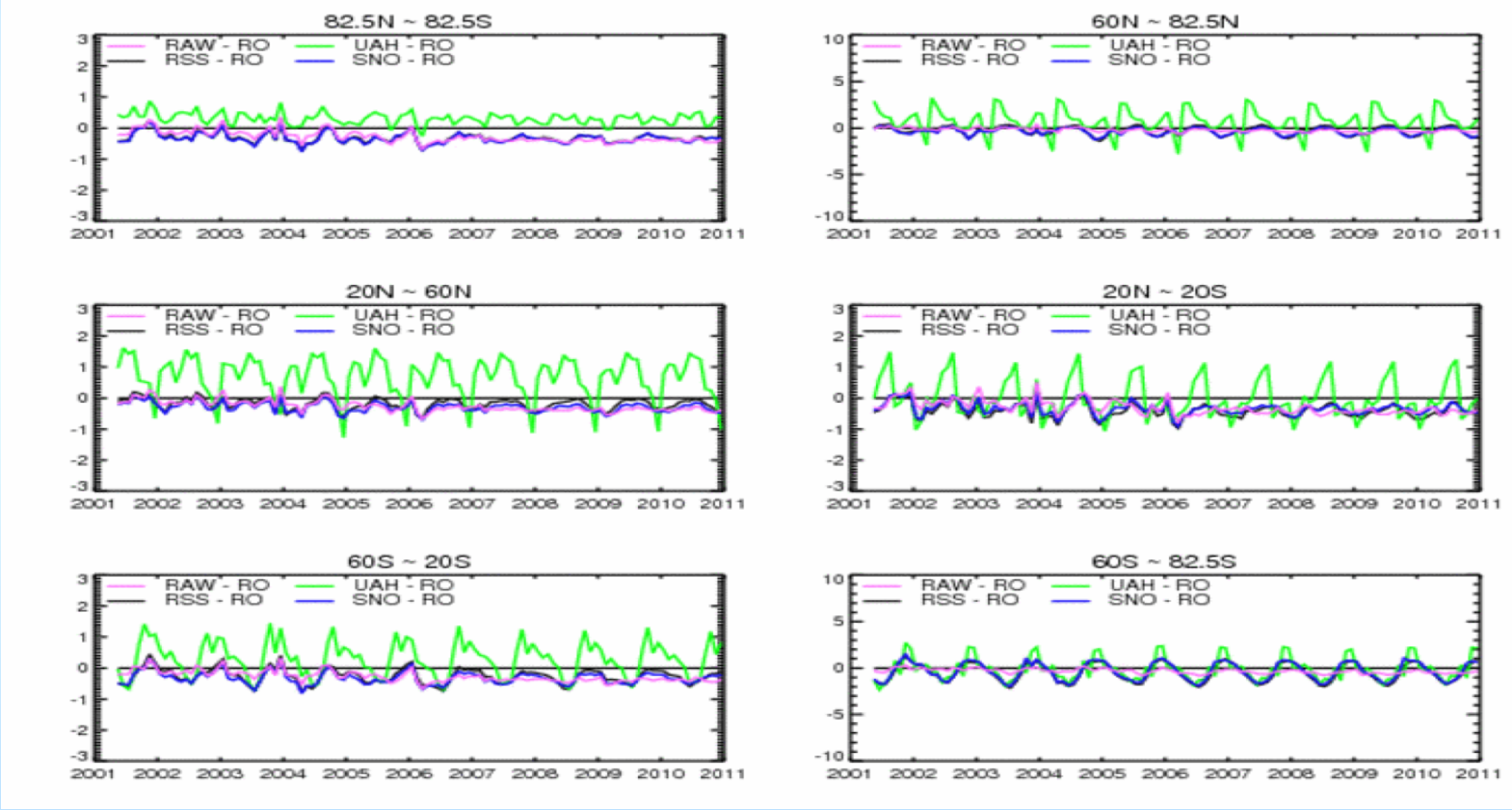
TLS among NOAA missions before calibration



TLS among NOAA missions after calibration



Time series of TLS from RSS, UAH, STAR, and RO-calibrated TLS



4. Applications

- **This proposed inter-satellite data comparison study will help to quantify systematic errors of temperature data records generated from multiple-platform and multiple-sensor satellite data obtained from international data providers, and improve their error estimates, which will enhance our understanding of important climate variation and processes.**

4. Applications

Analysis from this study will help the science community, particular the climate science community, by improving

i) Analysis: comprehensive of integrated climate products,

ii) Assimilation: model initialization,

iii) Reanalysis: improving the reprocessing of other data and re-analyses, and

iv) Predictions: predictions in multiple time scales.

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5. Schedule & Issues

- State project status and plans for next phase of the project

a. Refining the SNO method for the data from 1978 to 2000
b. Linking data from 1978 to 2000 and from 2000 to 2012
c. Refining the algorithm to combining tropopause height derived form multiple RO missions

- State any risks or concerns
  - Have no control for the re-processing of multiple RO missions from 2001 to 2012

- How can the CDR Program better assist you?

Sixth FORMOSAT-3/COSMIC Data Users' Workshop

30 October - 1 November 2012

Boulder, Colorado, U.S.A

http://www.cosmic.ucar.edu/oct2012workshop/index.html.