Initial Demonstration of Polar Satellite Microwave Data Climate Monitoring Using GRUAN Radiosonde

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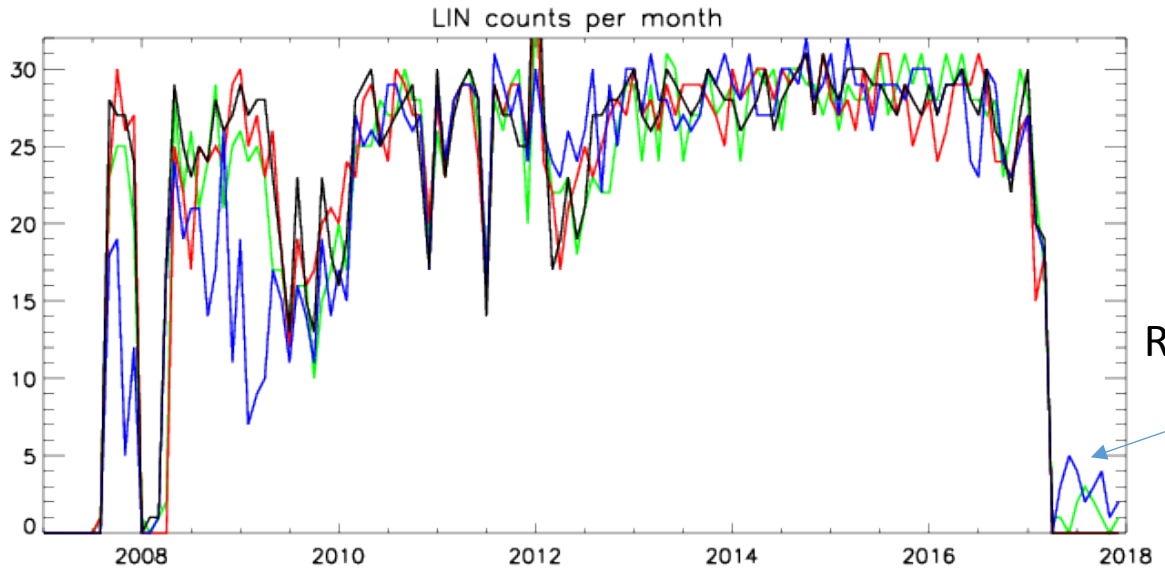
Objective

- GSICS action
- Using GRUAN data to assess the capability of polar satellite microwave observations of monitoring climate
- Lindenberg is used as the site for the demo …will extend to other sites.

Lindenberg, Germany; GRUAN RS92 Radiosonde Sample (profiles per month)

Approved data from NOAA NCEI

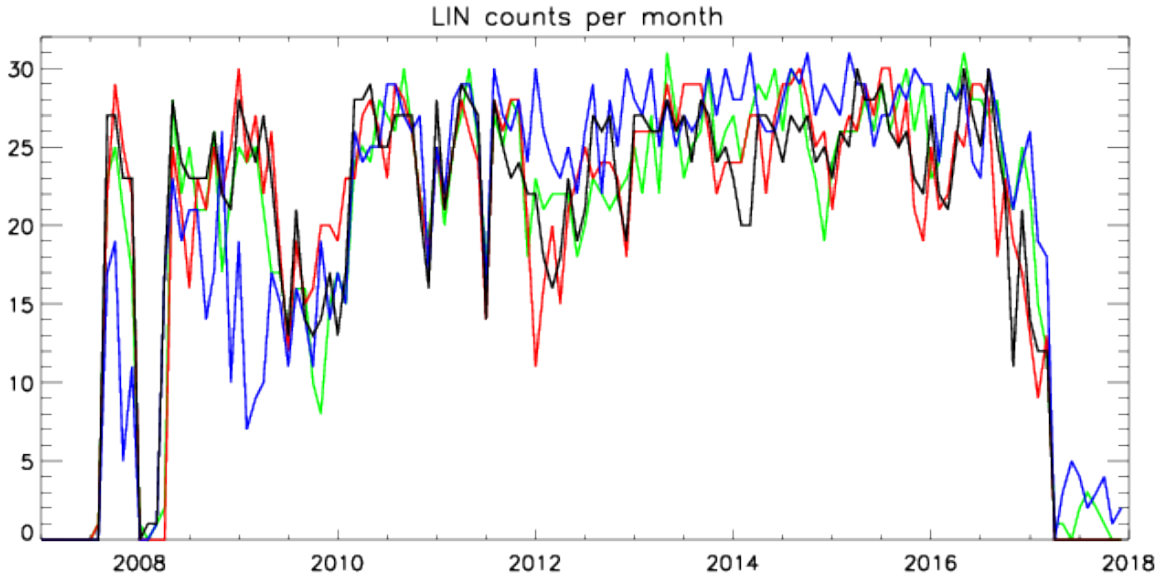
Green: 00 utc
Red: 06 utc
Blue: 12 utc
Black: 18 utc



RS41 has been replacing RS92

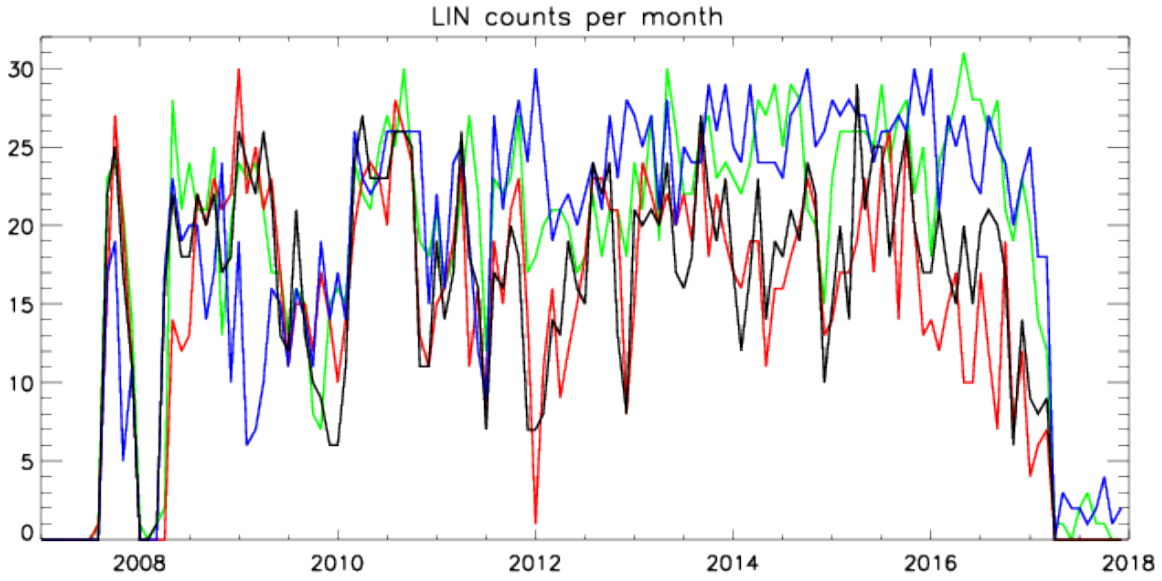
Lindenberg, Germany GRUAN Number of profiles per month REACHING 19 hPa

Green: 00 utc
Red: 06 utc
Blue: 12 utc
Black: 18 utc



Lindenberg, Germany GRUAN Number of profiles per month REACHING 11 hPa

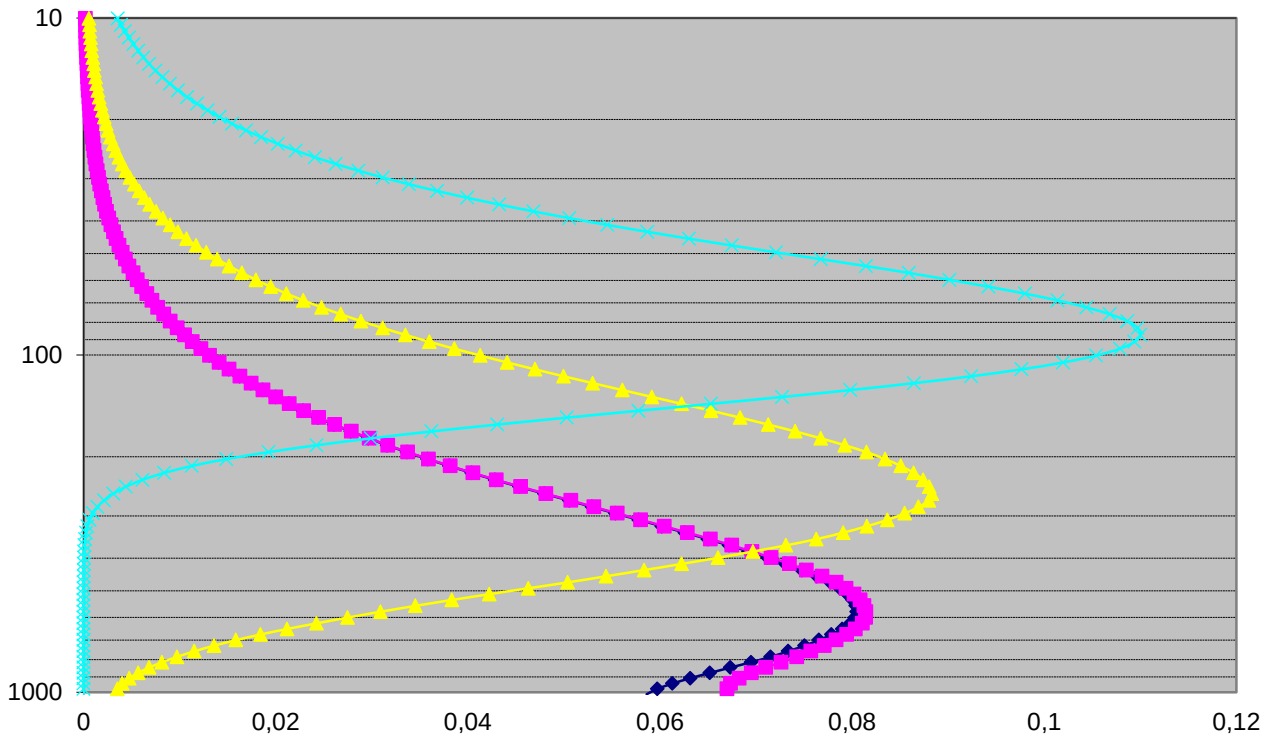
Green: 00 utc
Red: 06 utc
Blue: 12 utc
Black: 18 utc



Method

- Multiply the GRUAN temperature profile by the MSU weighting function to get the microwave equivalent temperature for GRUAN
  - Chan 2
  - Chan 3
  - Chan4

MSU Weighting Functions (nadir)



CH4 (89 hPa)

CH3 (260 hPa)

CH 2 (Sea)

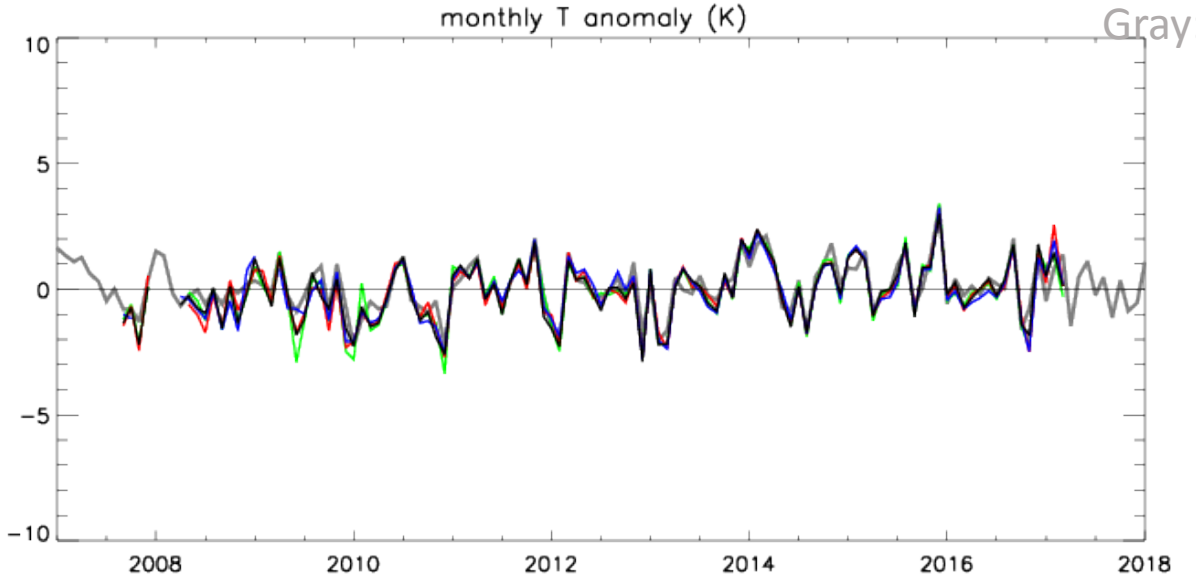
CH2 (Land) (575 hPa)

Lindenberg; GRUAN vs. STAR Microwave CDR
MSU CH2, Middle Troposphere
Monthly Anomaly

Trend:

Green: 00 utc 0.126 (0.043)K/yr
Red: 06 utc 0.134 (0.041)K/yr
Blue: 12 utc 0.117 (0.041)K/yr
Black: 18 utc 0.129 (0.041)K/yr
Gray: STAR 0.093 (0.036)K/yr

Green: 00 utc
Red: 06 utc
Blue: 12 utc
Black: 18 utc
Gray: NOAA STAR MW CDR

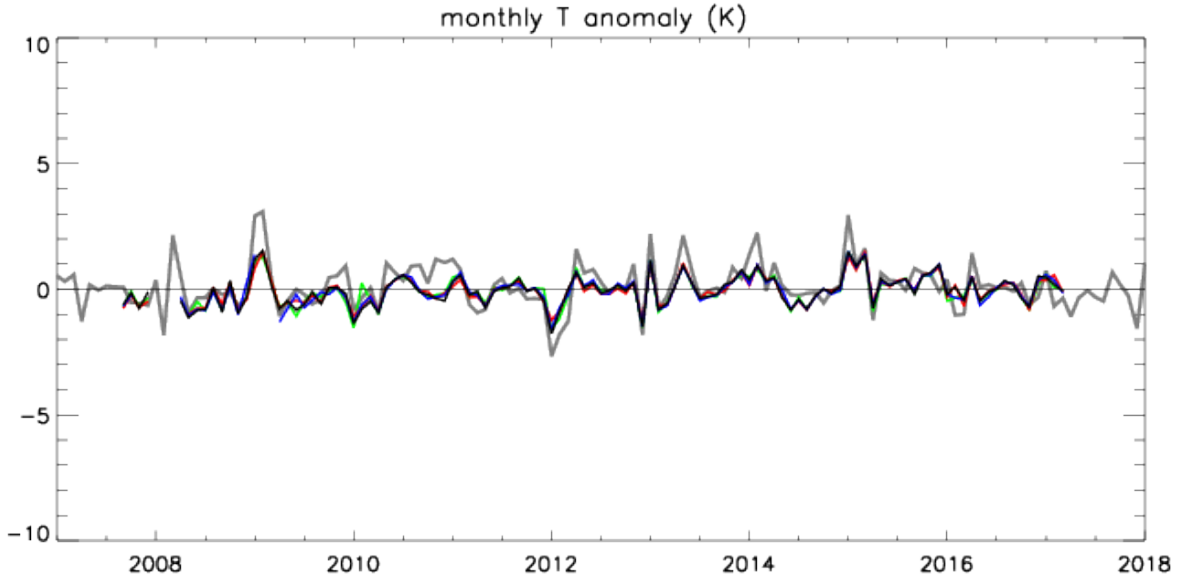


Corr. Coeff.

Green: 00 utc 0.883
Red: 06 utc 0.890
Blue: 12 utc 0.884
Black: 18 utc 0.902

Lindenberg; GRUAN vs. STAR Microwave CDR
MSU CH3, Upper Troposphere
Monthly Anomaly

Green: 00 utc
Red: 06 utc
Blue: 12 utc
Black: 18 utc
Gray: NOAA STAR MW CDR

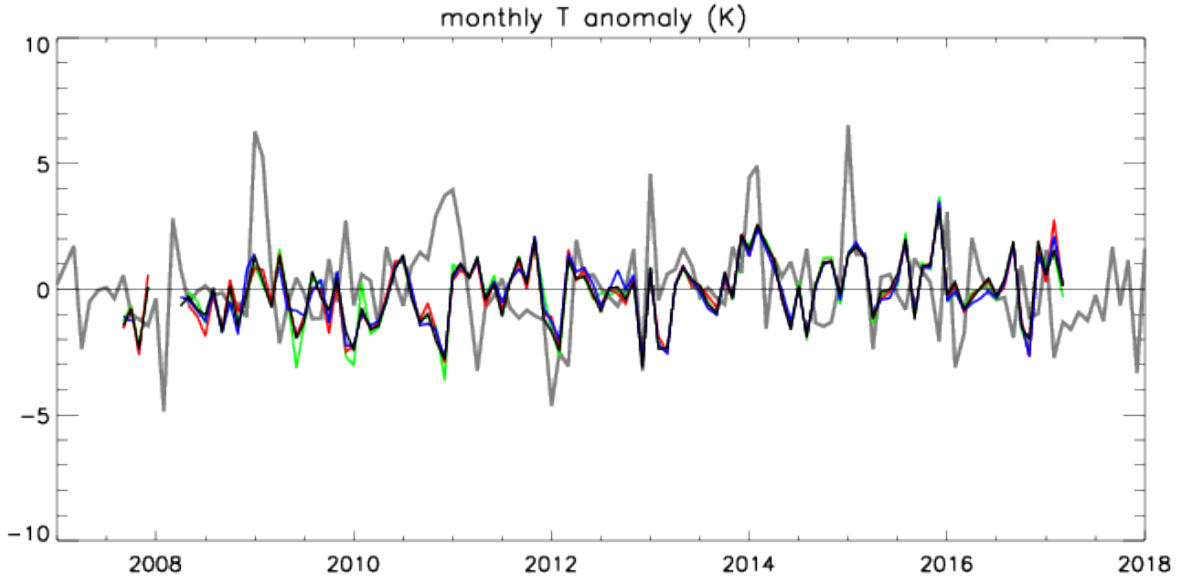


Corr. Coeff.

Green:	00 utc	0.764
Red:	06 utc	0.746
Blue:	12 utc	0.772
Black:	18 utc	0.749

Lindenberg; GRUAN vs. STAR Microwave CDR MSU CH4, Lower Stratosphere Monthly Anomaly

Green: 00 utc
Red: 06 utc
Blue: 12 utc
Black: 18 utc
Gray: NOAA STAR MW product

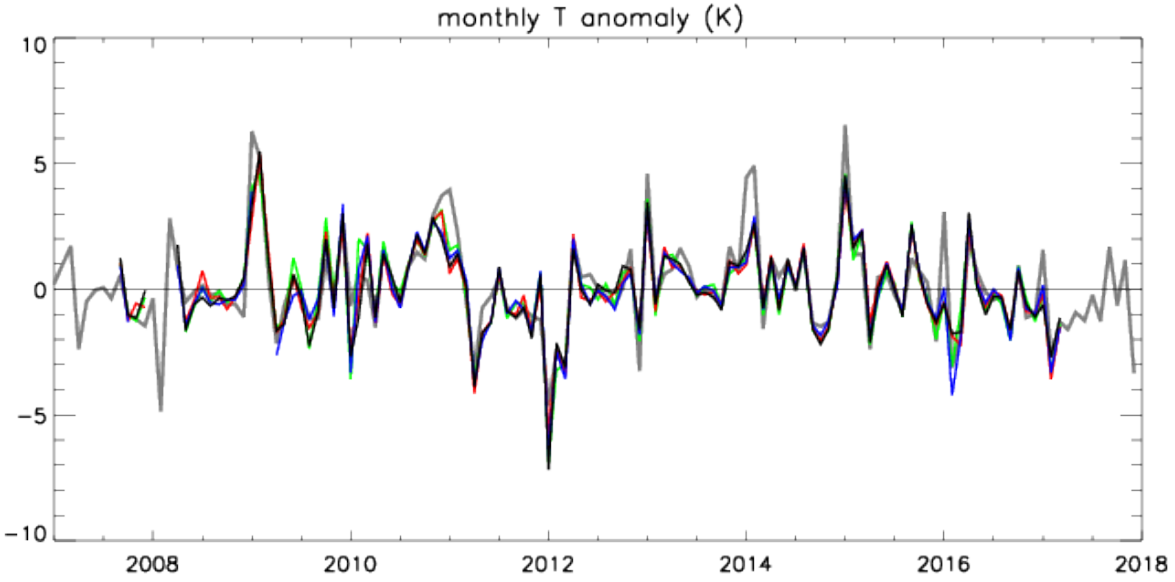


Corr. Coeff.

Green:	00 utc	0.034
Red:	06 utc	0.006
Blue:	12 utc	0.046
Black:	18 utc	0.057

Lindenberg; GRUAN *at 89 hPa* vs. STAR Microwave CDR MSU CH4, Lower Stratosphere Monthly Anomaly

Green: 00 utc
Red: 06 utc
Blue: 12 utc
Black: 18 utc
Gray: NOAA STAR MW product



Corr. Coeff.

Green:	00 utc	0.860
Red:	06 utc	0.853
Blue:	12 utc	0.870
Black:	18 utc	0.847

Preliminary Result & Path Forward

- The GRUAN radiosonde dataset at Lindenberg, Germany is used to assess the NOAA STAR (i..e, Cheng-Zhi Zou et al.) polar satellite MSU CDR in long-term climate monitoring
  - The two datasets match well on inter-annual and decadal time scales for the middle and upper troposphere
  - Lack of radiosonde data and its temporal change in low stratosphere poses challenges
- *Plan to extend the analysis to other GRUAN sites as available, preferably tropical and polar*
- *Plan to include GPSRO data for the inter-validation.*
- *Plan to integrate measurement uncertainties, version-3 GRUAN and address feasibility of using GRUAN for respective satellite sensor monitoring*