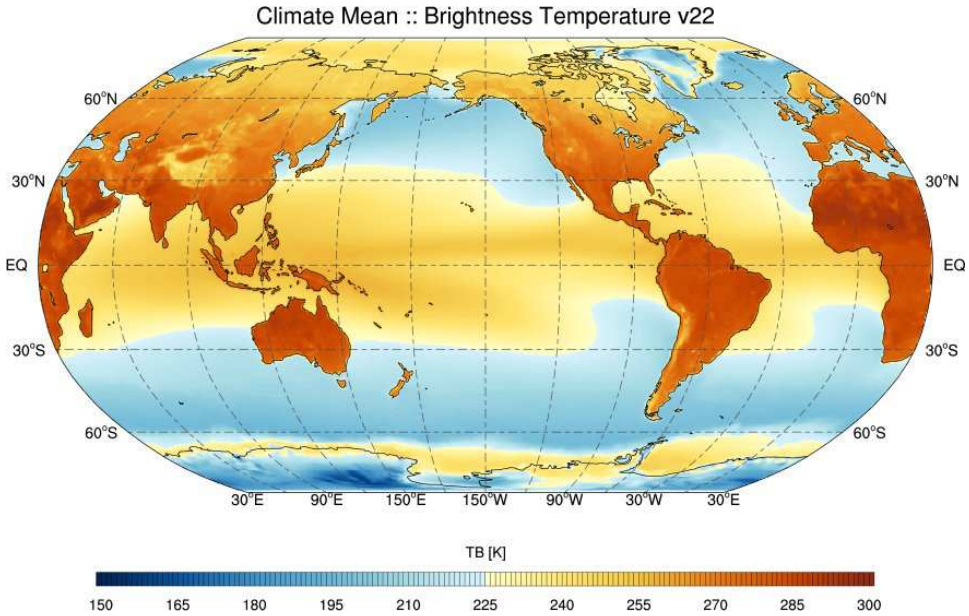
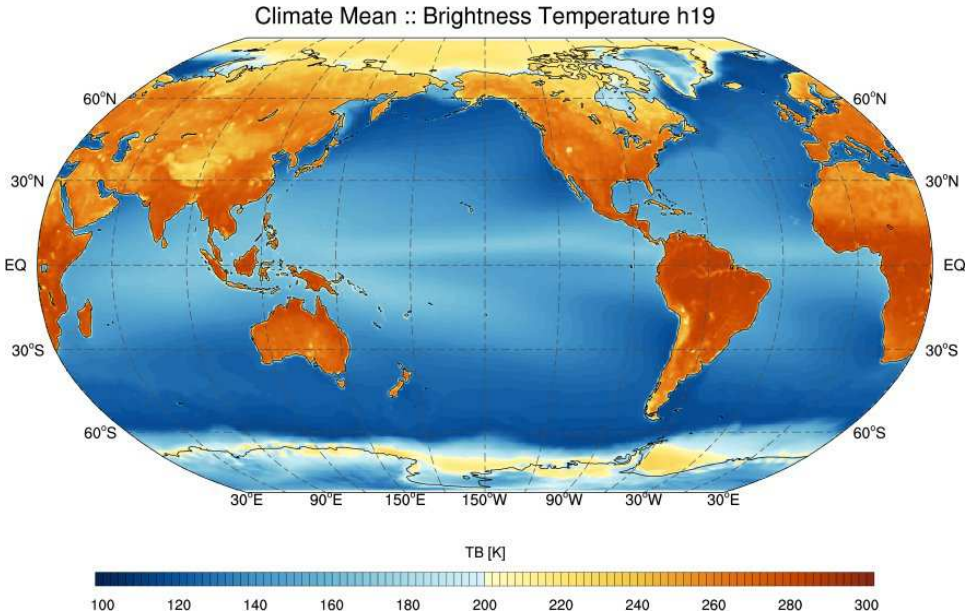
The Fundamental Climate Data Record of SSM/I Brightness Temperatures from CM SAF





Karsten Fennig, Marc Schröder, Axel Andersson
Satellite-Based Climate Monitoring, DWD

Background

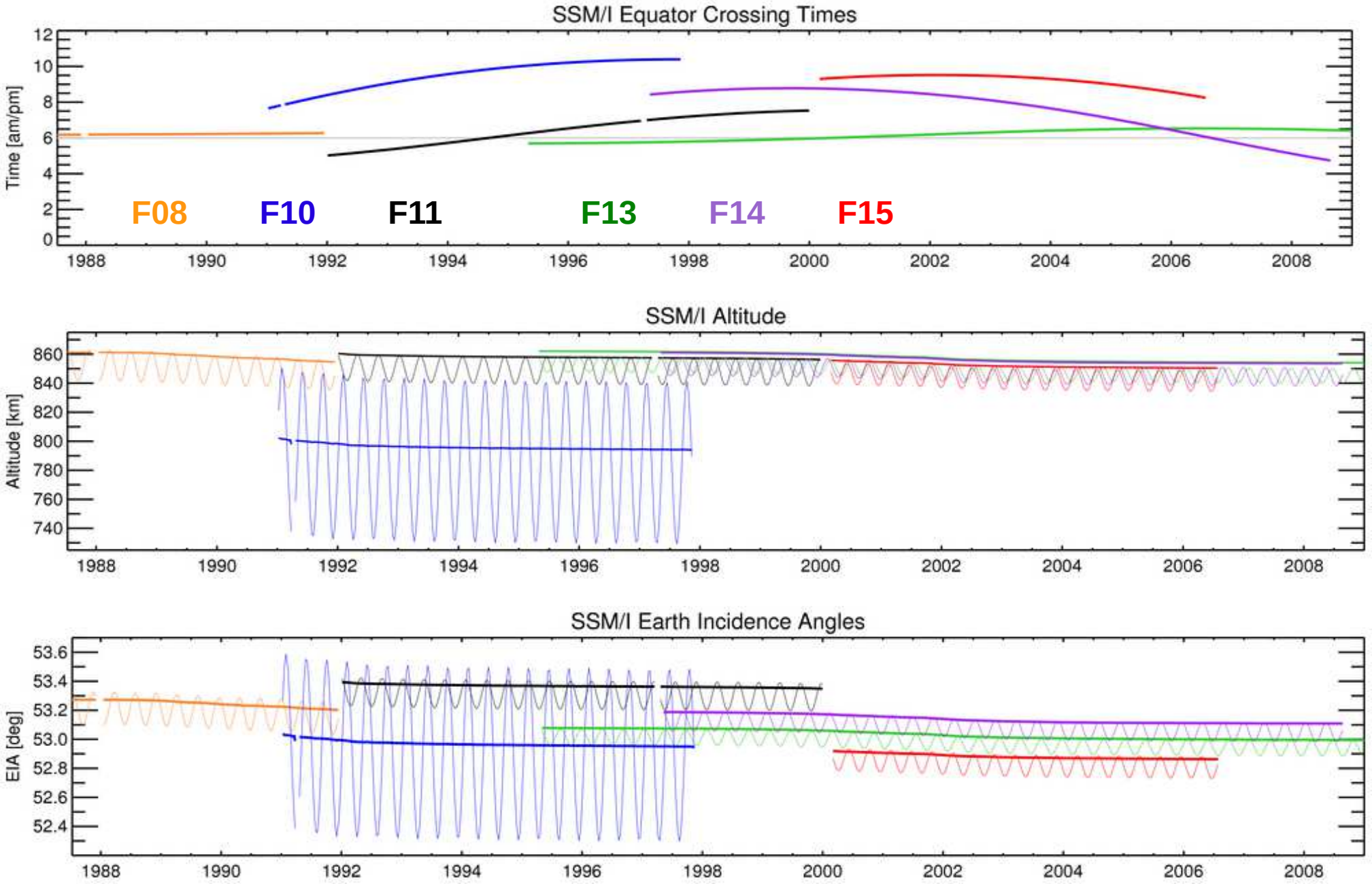
- Predecessors of this FCDR and the processing chain have been developed at the MPI-M and University of Hamburg for the **H**amburg **O**cean **A**tmosphere **P**arameters and Fluxes from **S**atellite Data climatology (**HOAPS**, *http://www.hoaps.org/*)
- HOAPS is a compilation of climate data records for analysing the water cycle components over the global oceans.
- Main satellite instrument employed to derive the parameters is the Special Sensor Microwave/Imager (SSM/I) providing a time-series of microwave observations from the same type of instrument from 1987 to 2008.

- SSM/I was designed for NWP and not for climate applications and the raw data records must be carefully homogenized and processed to the same standard for the complete time period to provide a Fundamental Climate Data Record (FCDR).

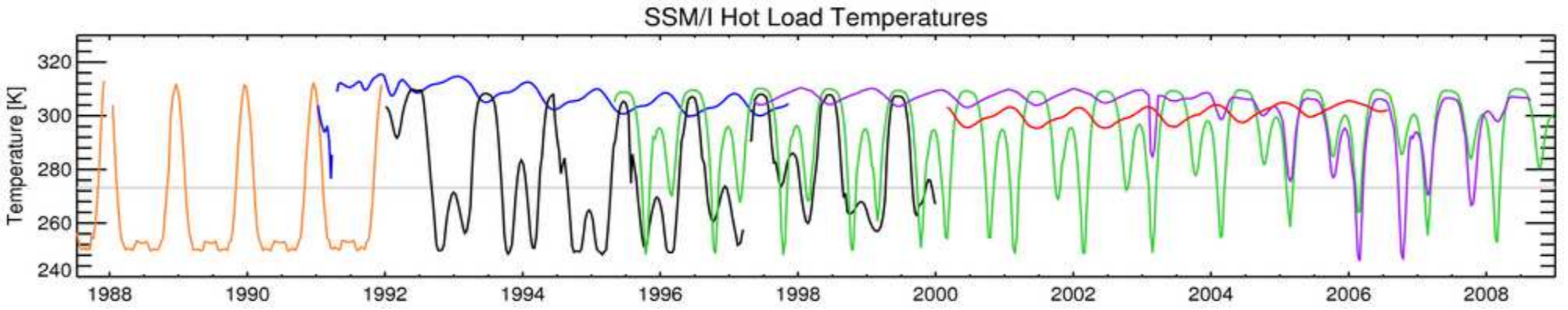
CM SAF FCDR Features

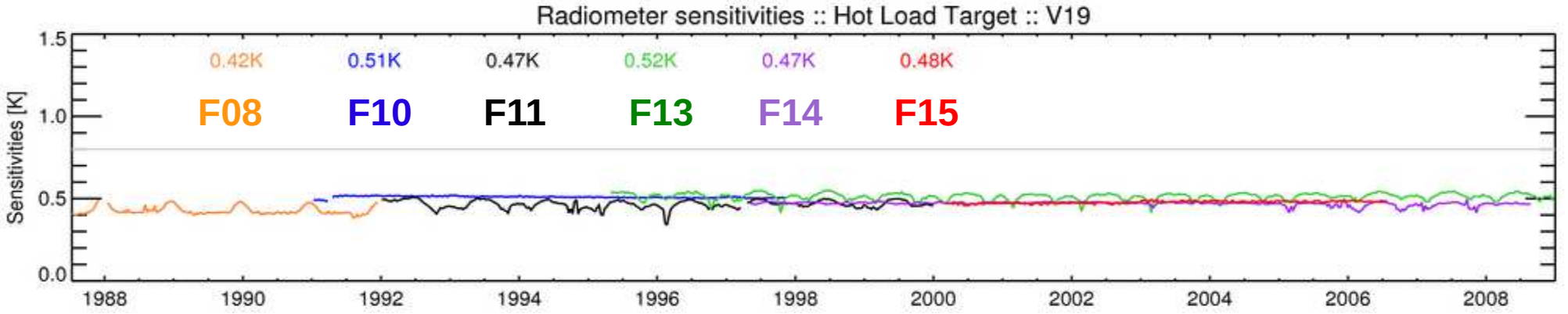
- Covered time period July 1987 – December 2008.
- Completely and consistently reprocessed data record, starting from measured counts.
- Calibration with smoothed cold and hot load readings.
  - Centred averaging kernel of ±5 scans with Gaussian weights.
- New geolocation based on smoothed daily TLEs.
- Data processing accounts for identified instrument issues:
  - Moonlight-intrusions,
  - Sunlight-intrusions,
  - Along-scan non-uniformity.
- Antenna pattern matching:
  - 85 GHz Brightness temperatures averaged to 37 GHz antenna pattern.
- Synthetic 85 GHz data over ocean for F08 period with defective 85GHz channels.
- Earth incidence angle normalization offsets (Furhop and Simmer, 1997).
- Non-linearity calibration coefficient.
- Scene dependent inter-calibration to F11 (as separate offset).

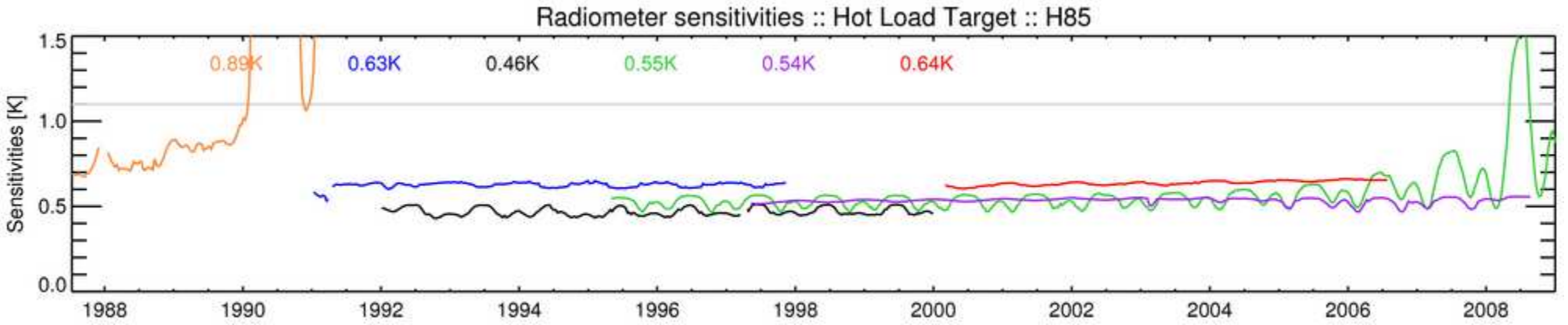
Platform stability



Sensor Health & Sensitivity







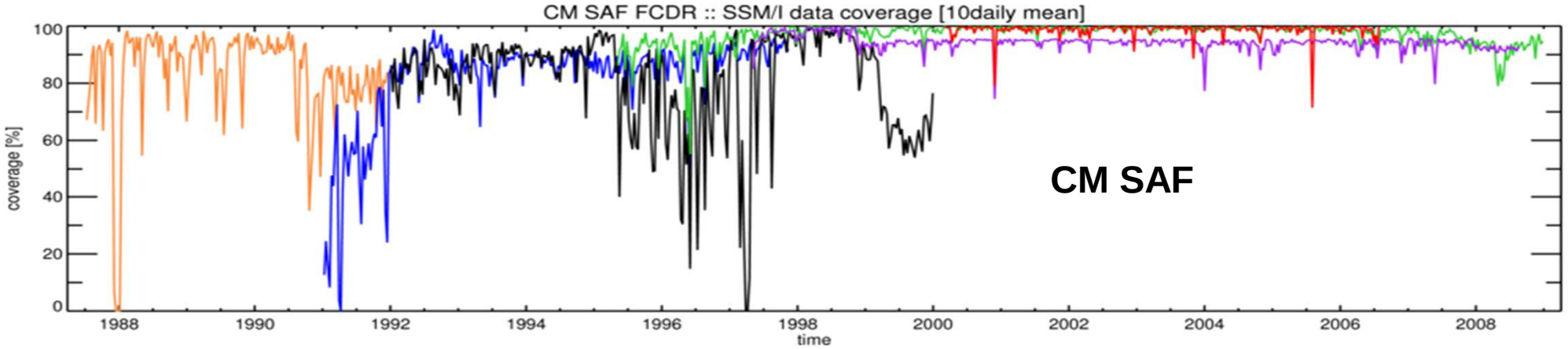
The EUMETSAT Network of Satellite Application Facilities

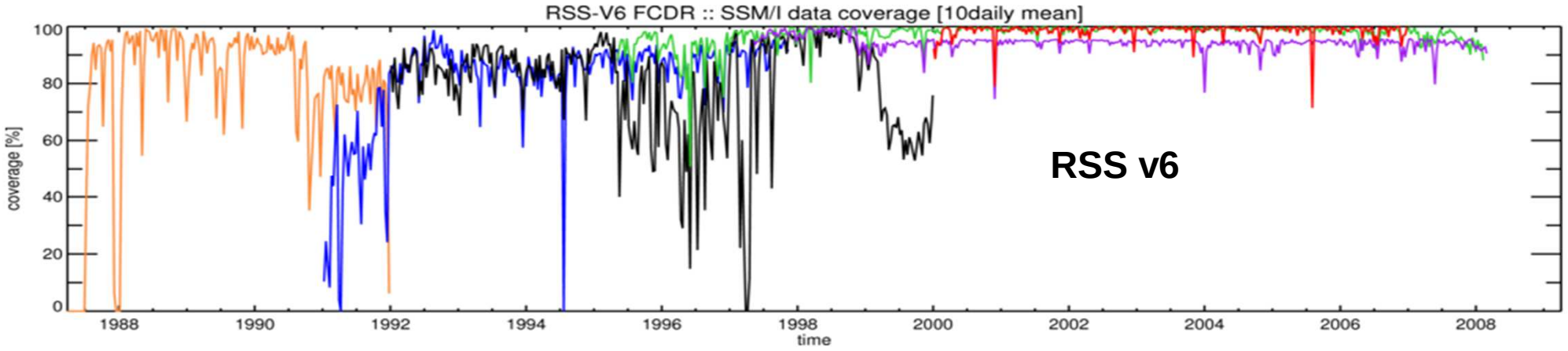
CM SAF Climate Monitoring

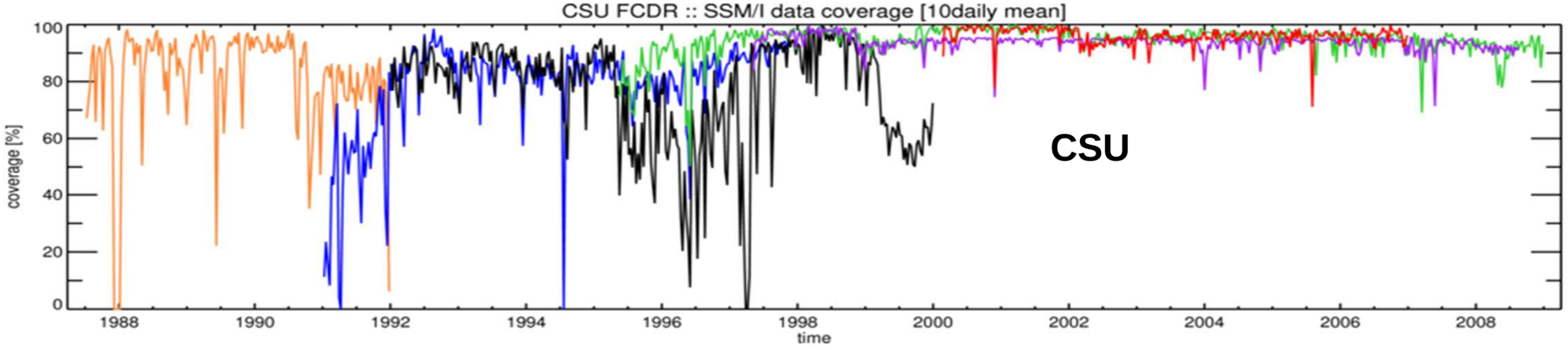
SSM/I FCDRs Coverage

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

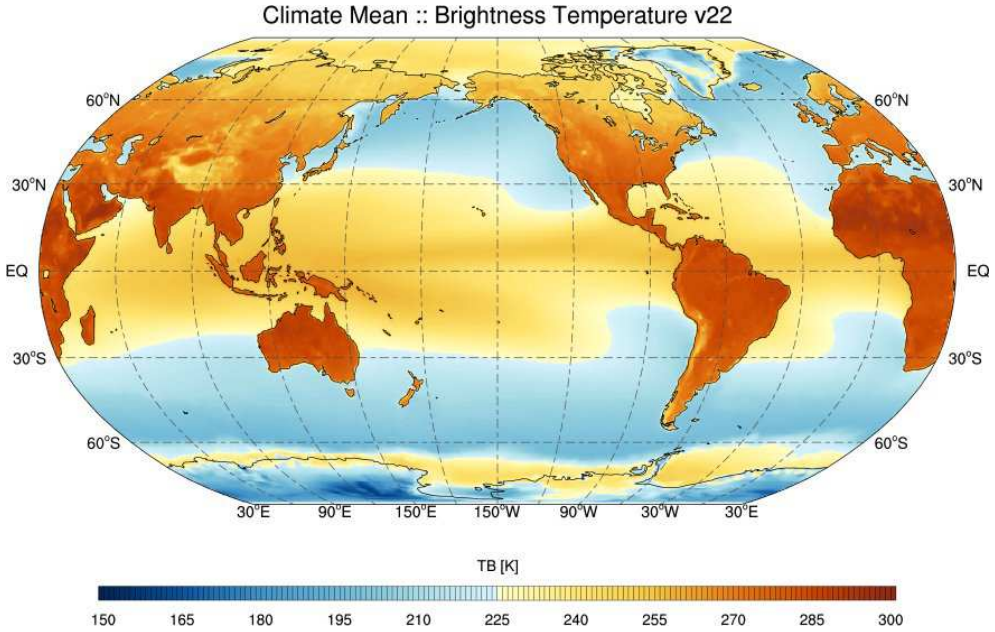
DWD

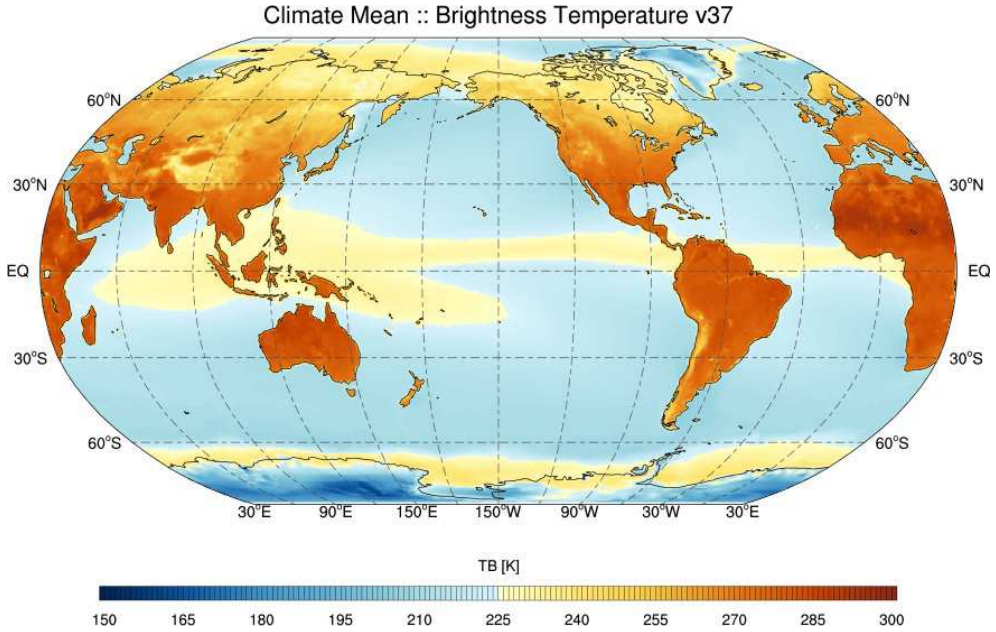






CM SAF FCDR
Inter-calibration model





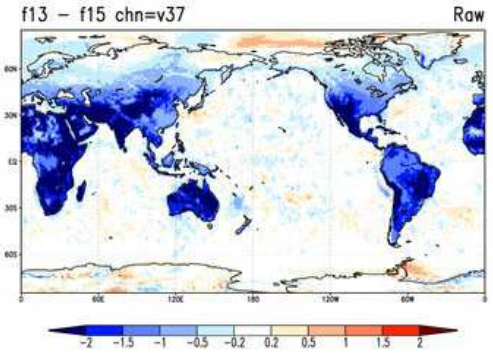
- Limited dynamic range over ocean for scene-dependent inter-calibration.
- Minimization procedure includes sea-ice and cold land scenes (>60˚ and <-60˚) and all scenes as double differences.
- Inter-calibration Model includes non-linearity calibration coefficient *d*, scene dependent scale factor *a*, offset *b*, and cross-polarization factor *c*

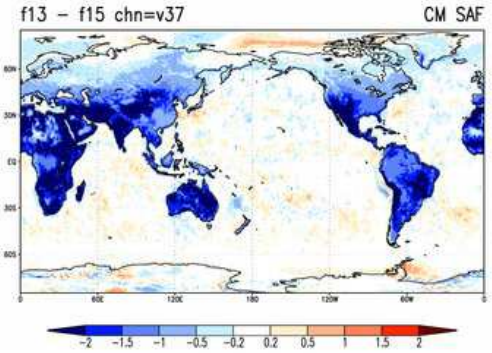
$$T'_A = T_A + d \cdot \left(T_A - \left\langle T^H \right\rangle\right) \cdot \left(T_A - T^C\right) \qquad T''_B = a \cdot T'_B + b + c \cdot \Delta_{v,h}$$

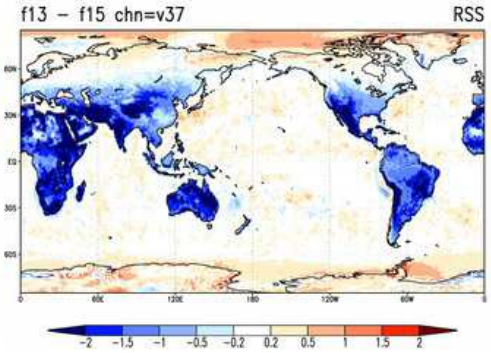
Inter-calibration Results Global Maps

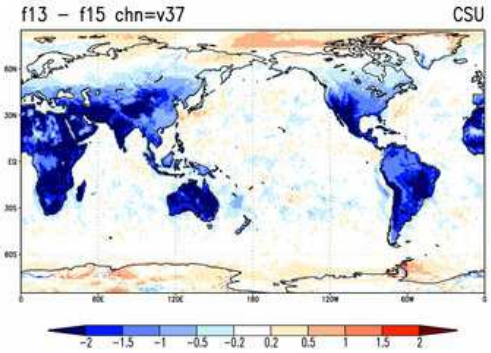
F13 – F15 RDR | CM SAF FCDR | RSS v6 FCDR | CSU FCDR

37v

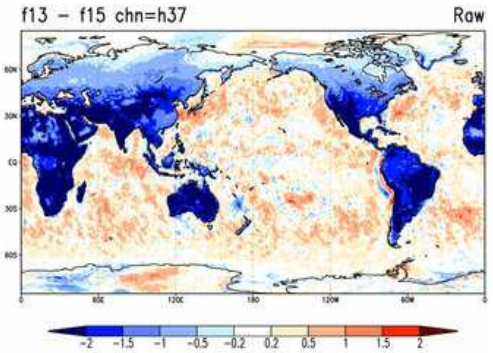


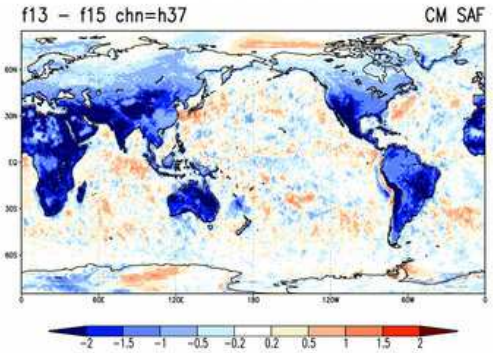


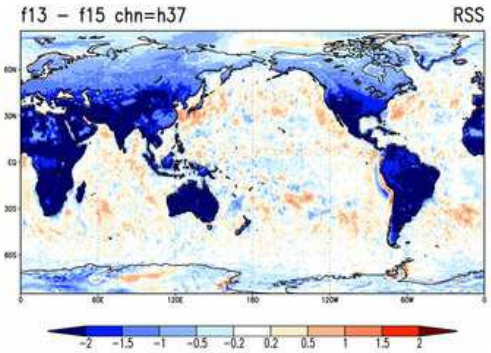


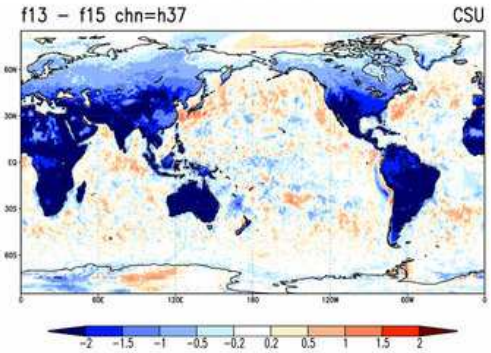


37h

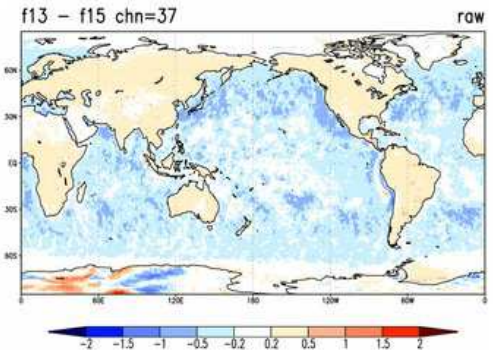


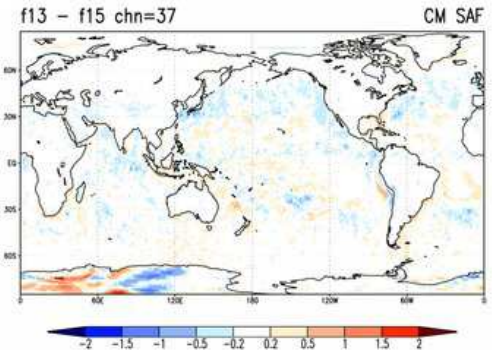


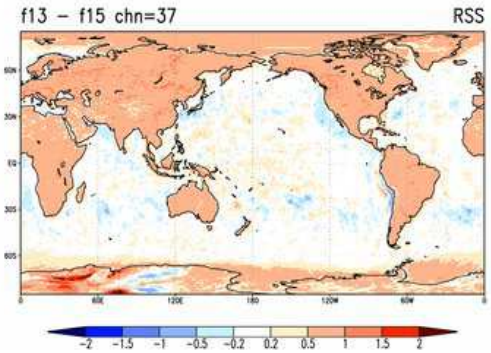


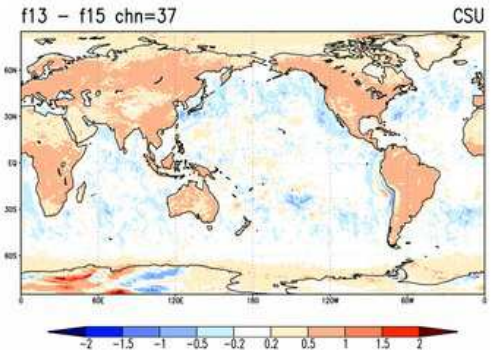


37v - 37h





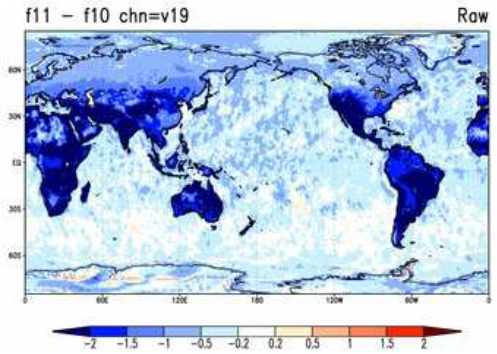


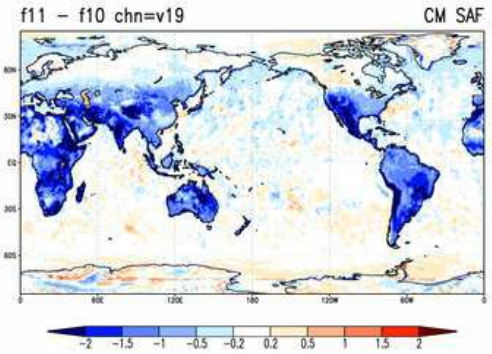


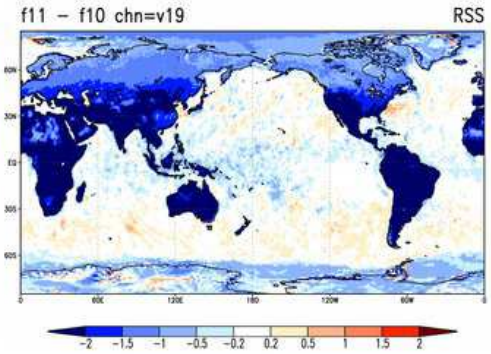
Inter-calibration Results Global Maps

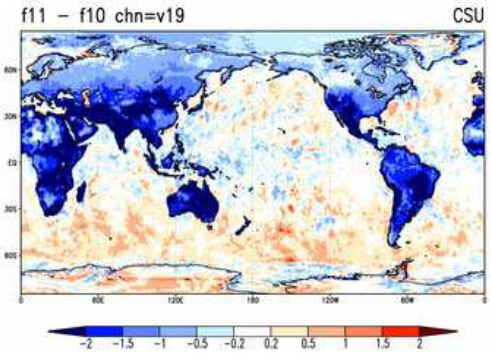
F11 – F10 RDR CM SAF FCDR RSS v6 FCDR CSU FCDR

19v

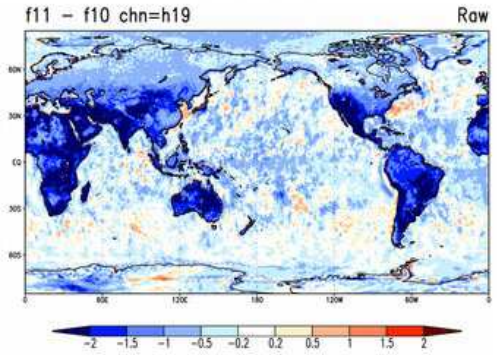


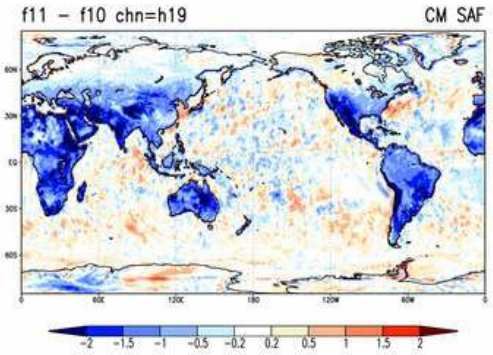


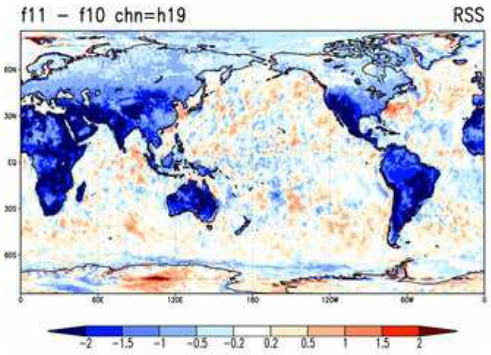


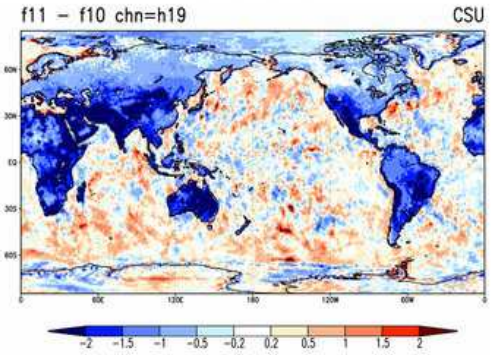


19h

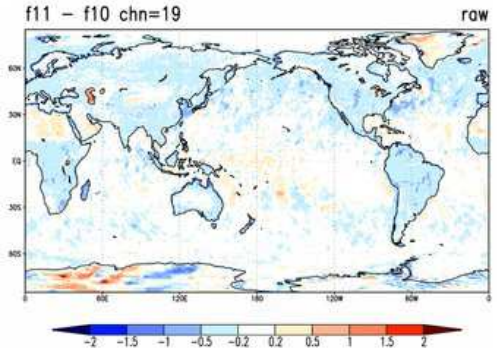


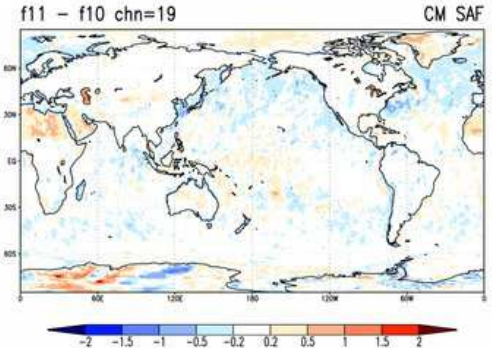


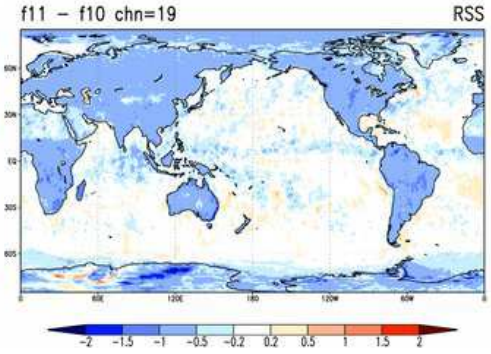


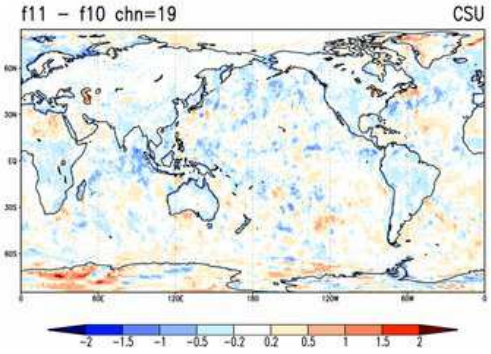


19v - 19h

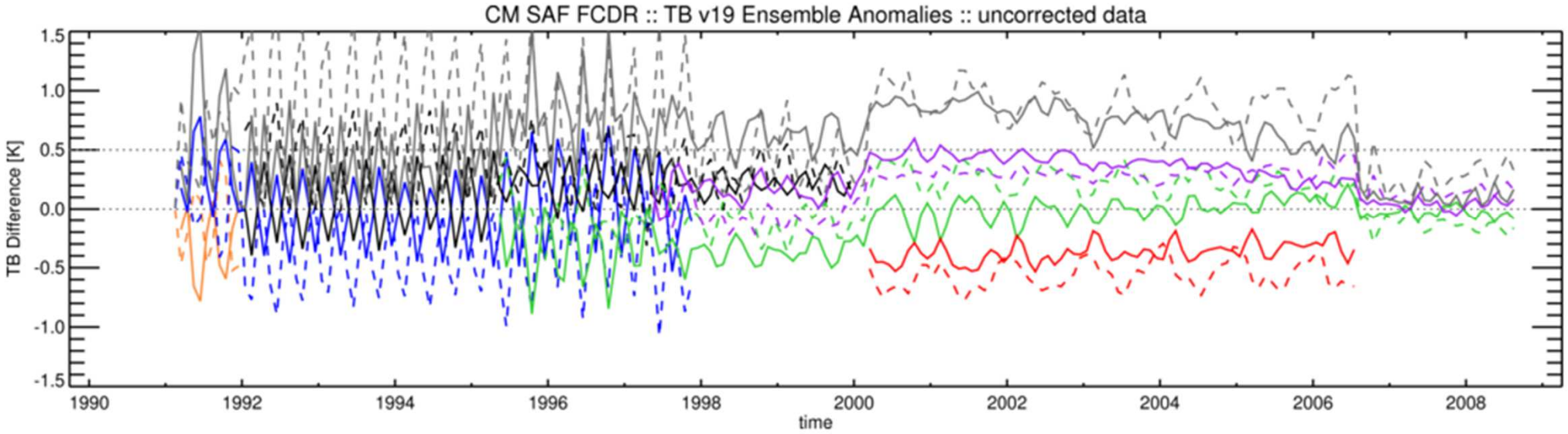


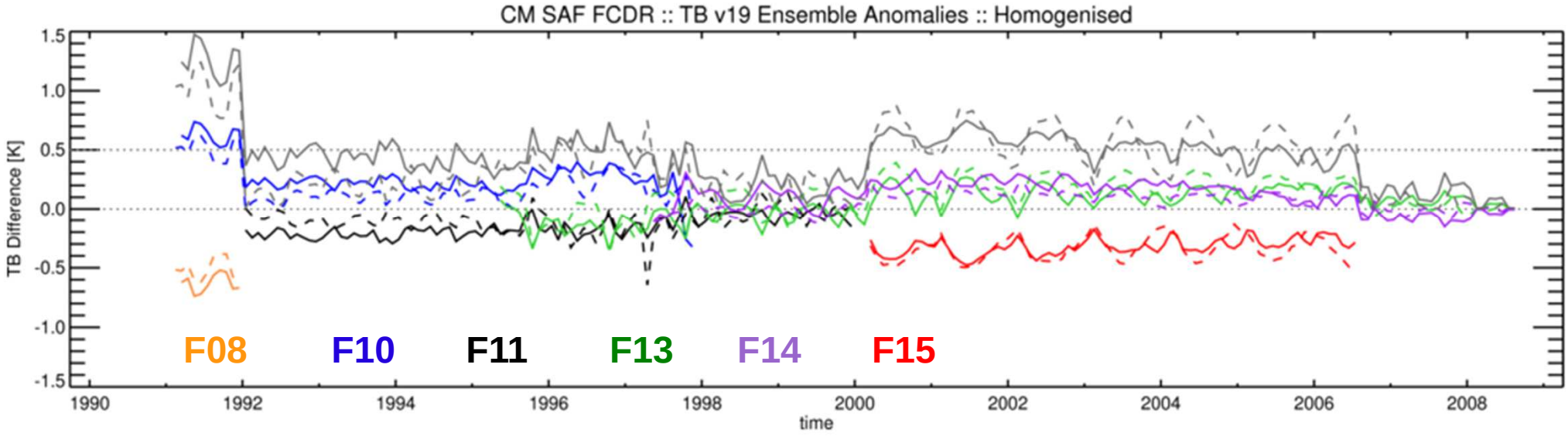




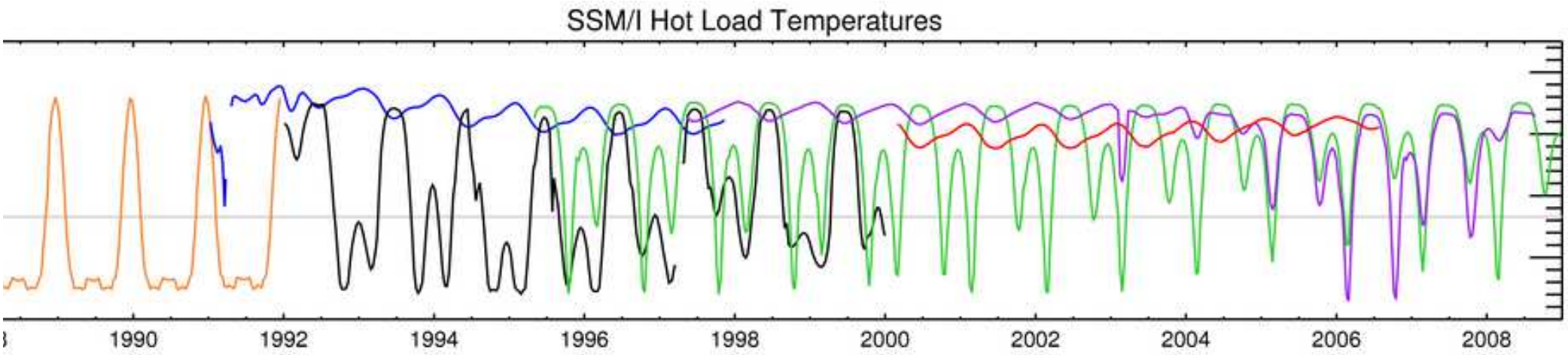


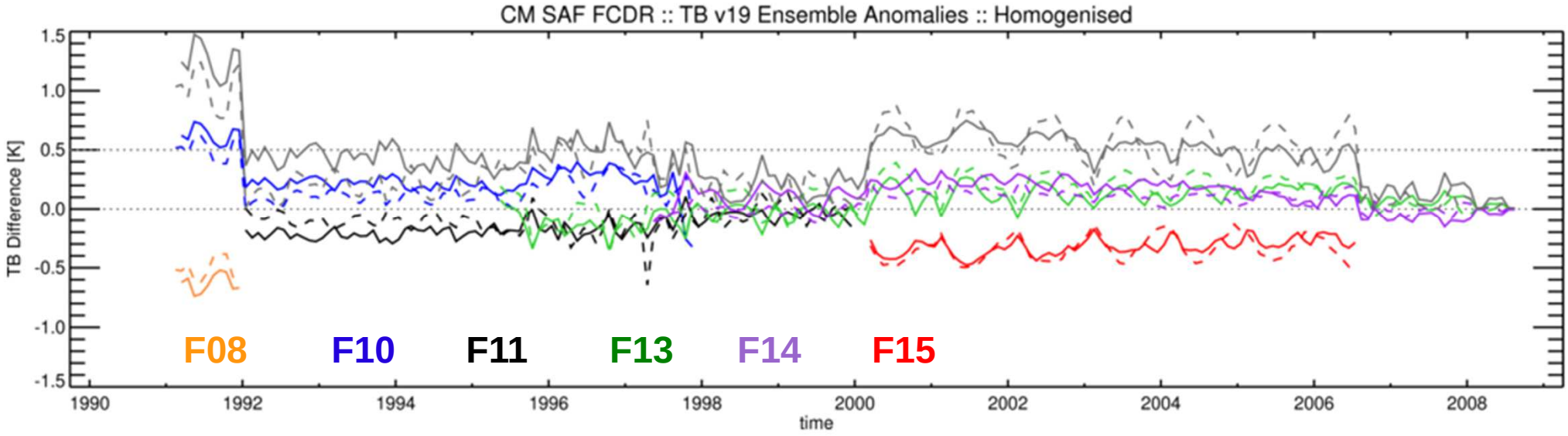
Evaluation TB v19 Normalization



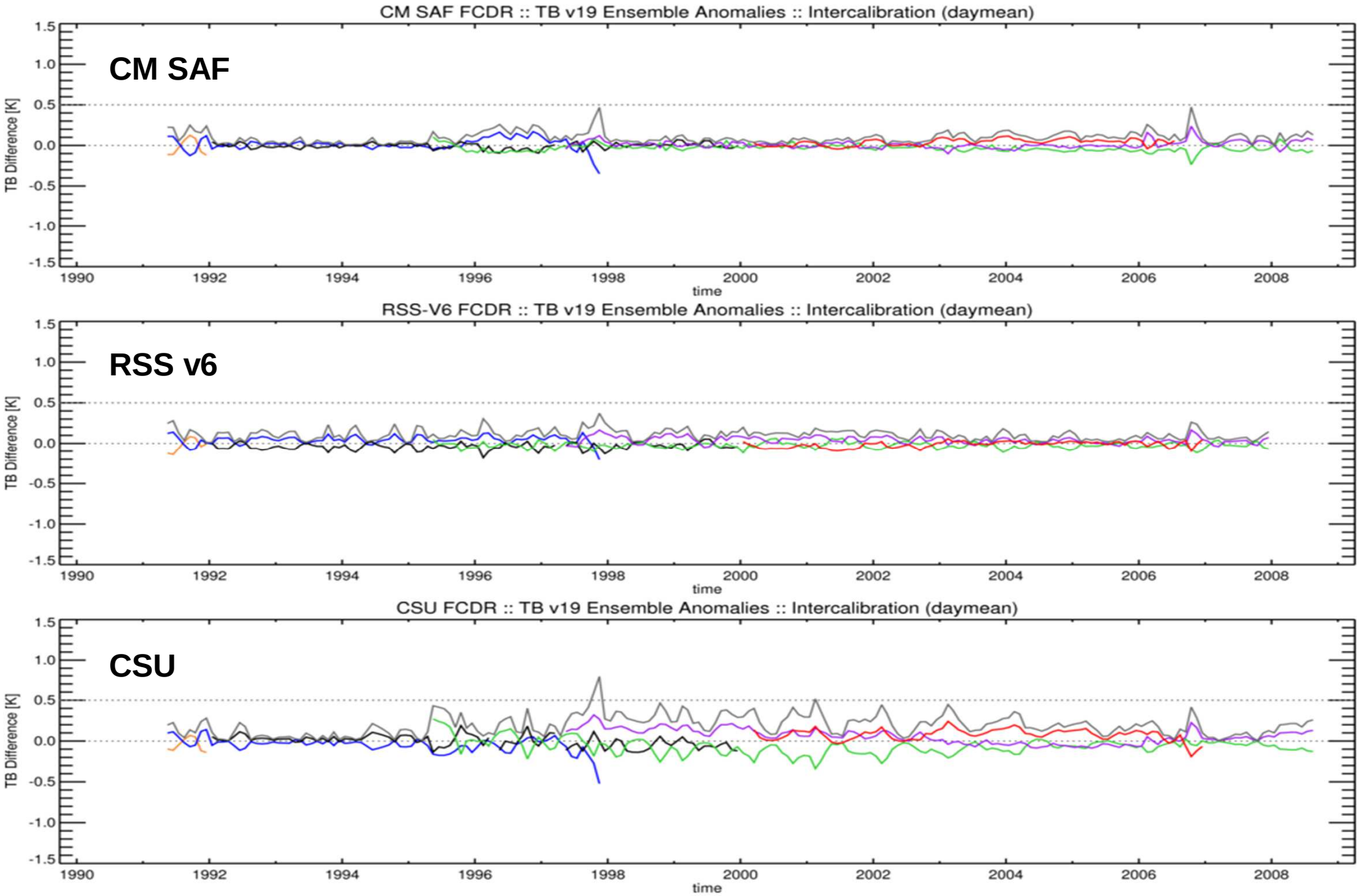


Evaluation TB v19 Normalization

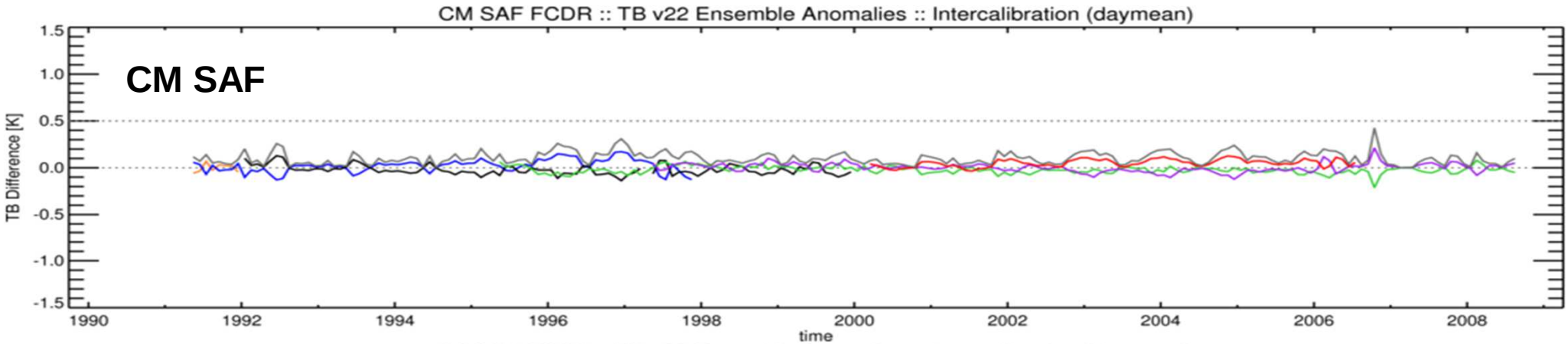


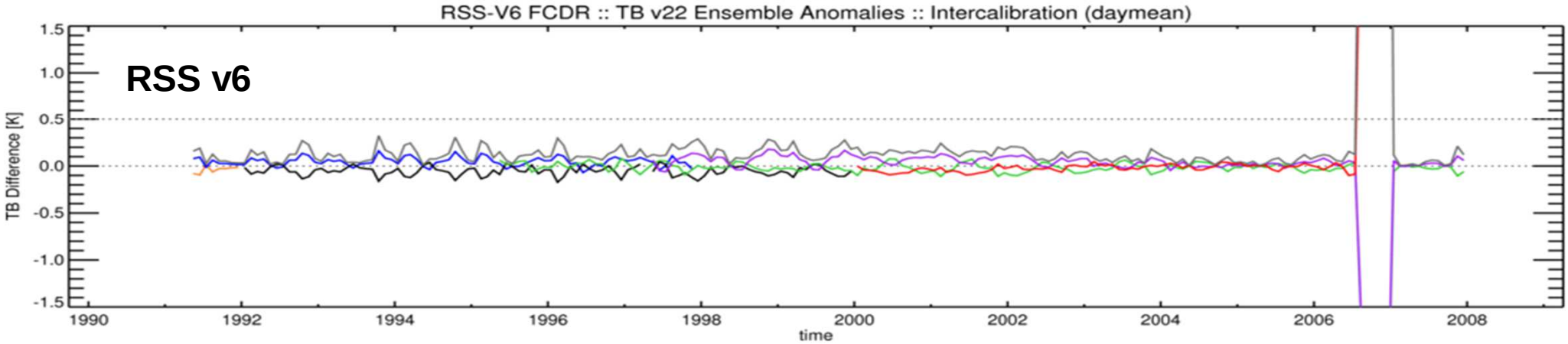


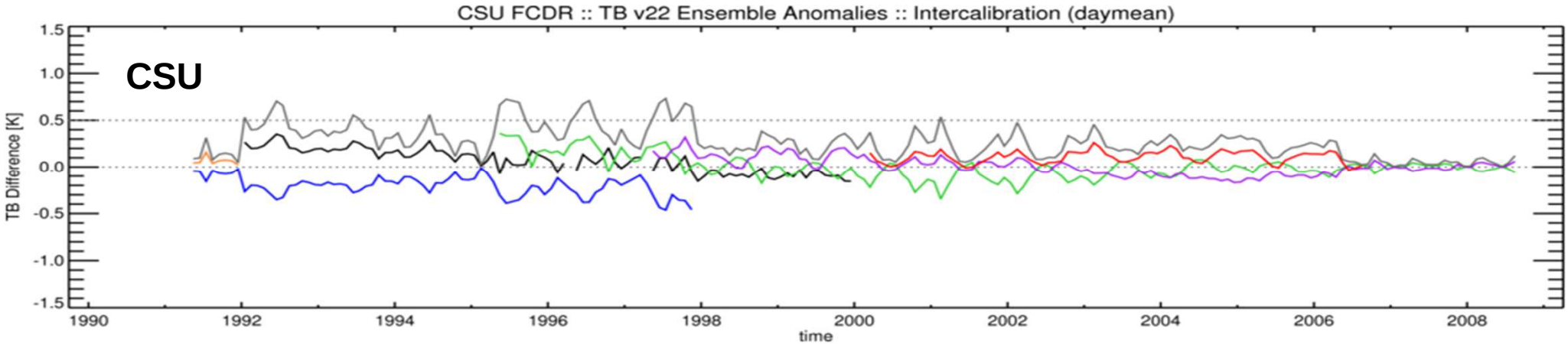
Evaluation TB v19 Inter-calibration



Evaluation TB v22 Inter-calibration







Summary

- CM SAF SSM/I FCDR provides carefully inter-calibrated Brightness Temperatures for instruments aboard F08, F10, F11, F13, F14, and F15.
- FCDR data processing accounts for identified issues: moonlight-intrusions, sunlight-intrusions, along-scan correction and assigns quality control flags.
- Data files are available as daily collections in NetCDF-4 conforming to CF Metadata Conventions 1.5.
- Data files include all raw data record sensor information plus:
  - Quality control flags (scan, channel, FOV),
  - Earth incidence angles,
  - Averaged 85 GHz TBs,
  - Incidence angle normalization offsets (over ocean) as separate layer,
  - Inter-sensor calibration offsets as separate layer,
  - Sensor sensitivities (e.g. NEdT) as daily estimates,
  - Surface type based on daily sea ice masks.

Thanks for your attention!

FCDR is available from *http://www.cmsaf.eu/wui* ,
ATBD, PUM, and validation report from *http://www.cmsaf.eu/docs*

http://dx.doi.org/10.5676/EUM_SAF_CM/FCDR_SSMI/V001