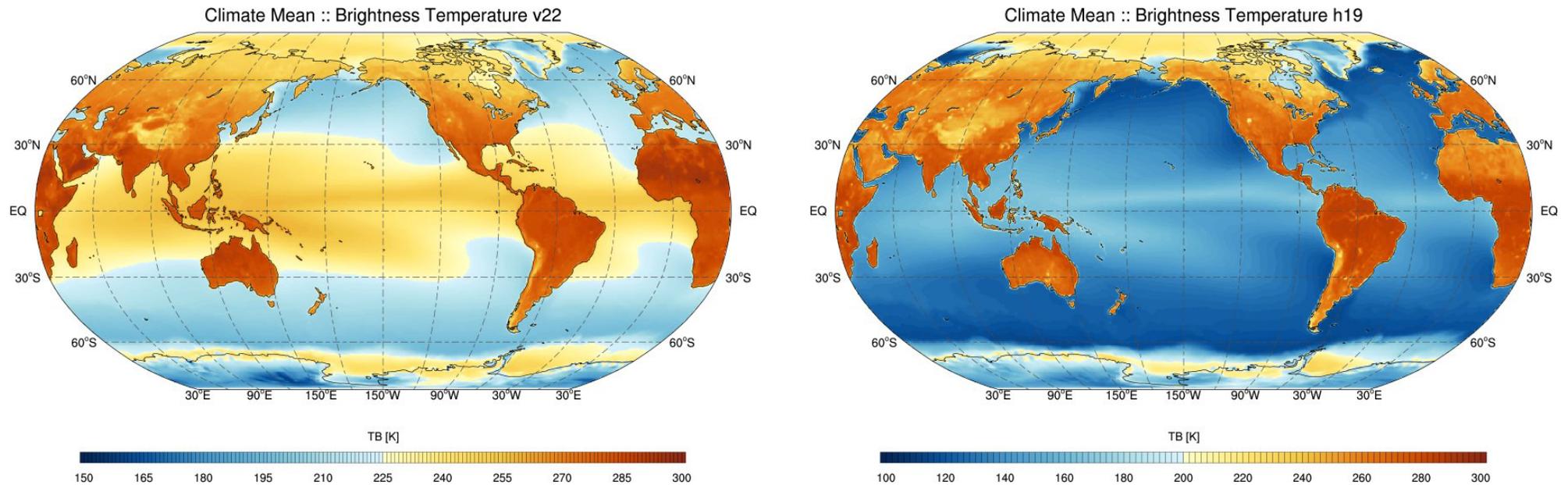


The Fundamental Climate Data Record of SSM/I Brightness Temperatures from CM SAF



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Satellite Application Facility on Climate Monitoring, DWD

Motivation

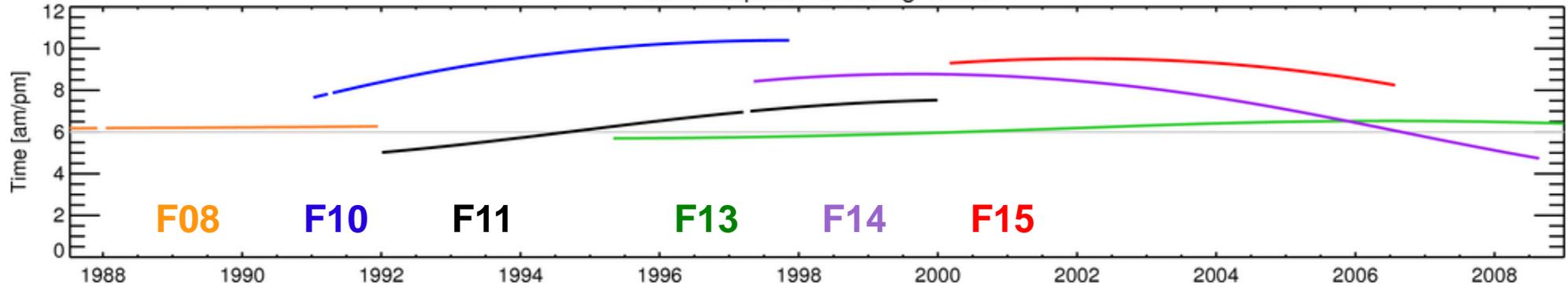
- Predecessors of this FCDR and the processing chain have been developed at the MPI-M and University of Hamburg for the **H**amburg **O**cean **A**tmosphere **P**arameters and Fluxes from **S**atellite Data climatology (**HOAPS**, <http://www.hoaps.org/>)
- HOAPS is a compilation of climate data records 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

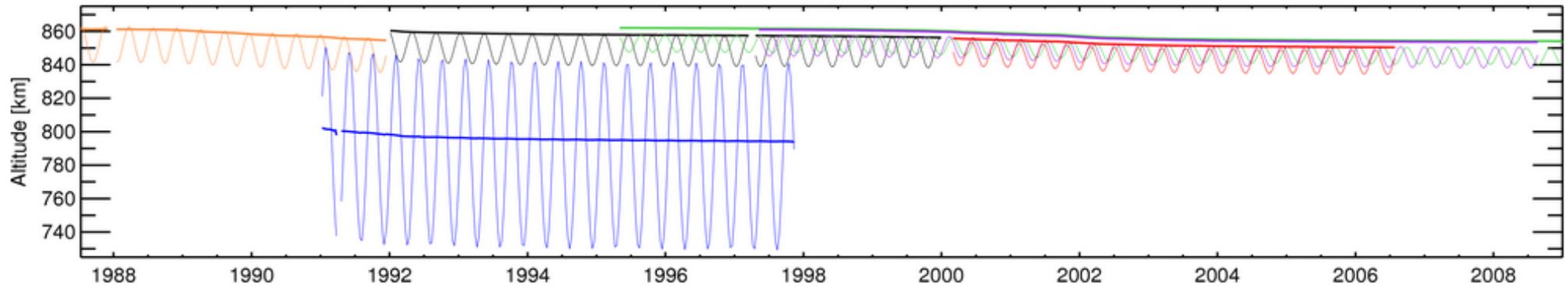
- Covered time period July 1987 – December 2008.
- Completely reprocessed data record, starting from measured counts.
- Calibration with smoothed cold and hot load readings.
 - Centred averaging kernel of ± 5 scans with Gaussian weights.
- New geolocation based on smoothed daily TLEs.
- Data processing 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).



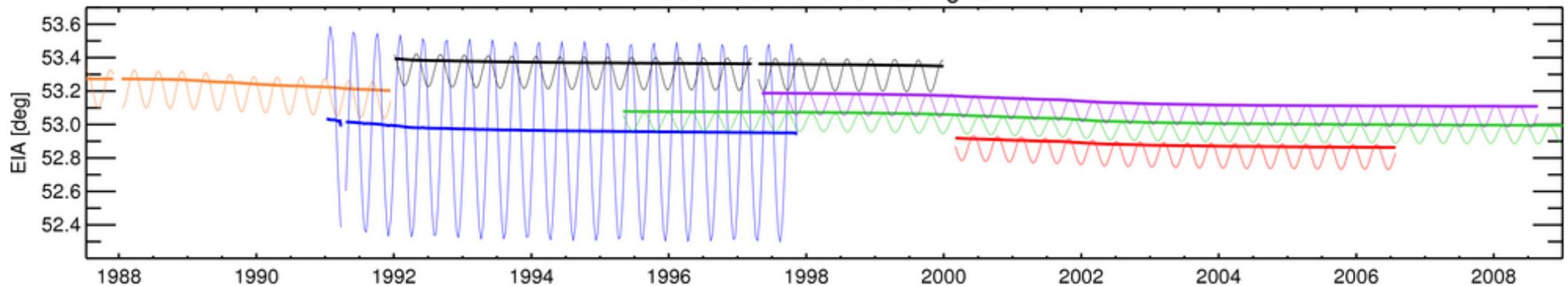
SSM/I Equator Crossing Times



SSM/I Altitude

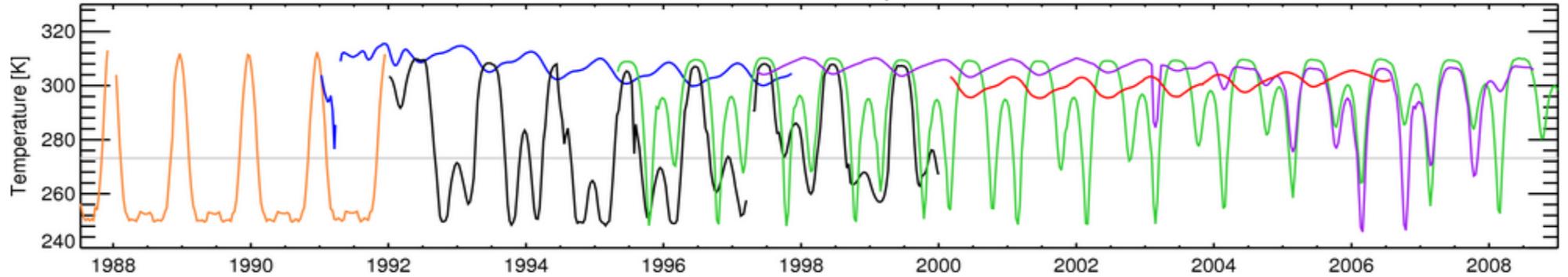


SSM/I Earth Incidence Angles

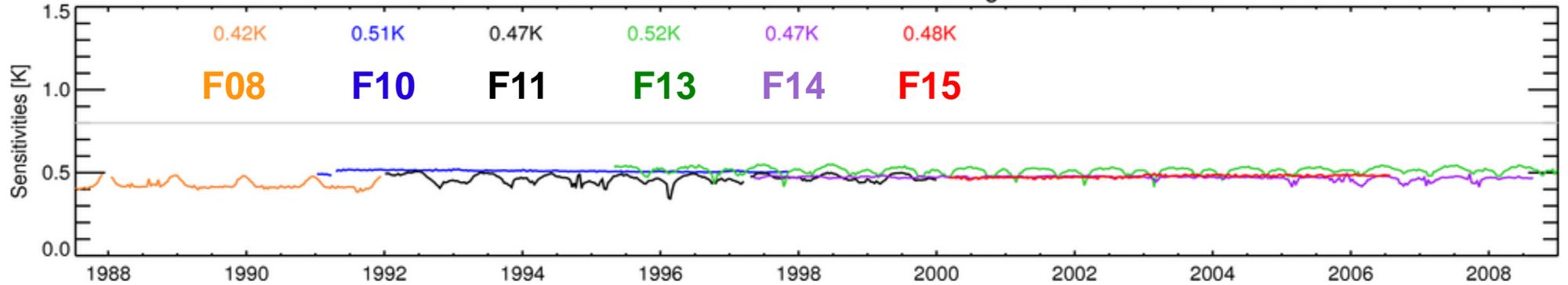




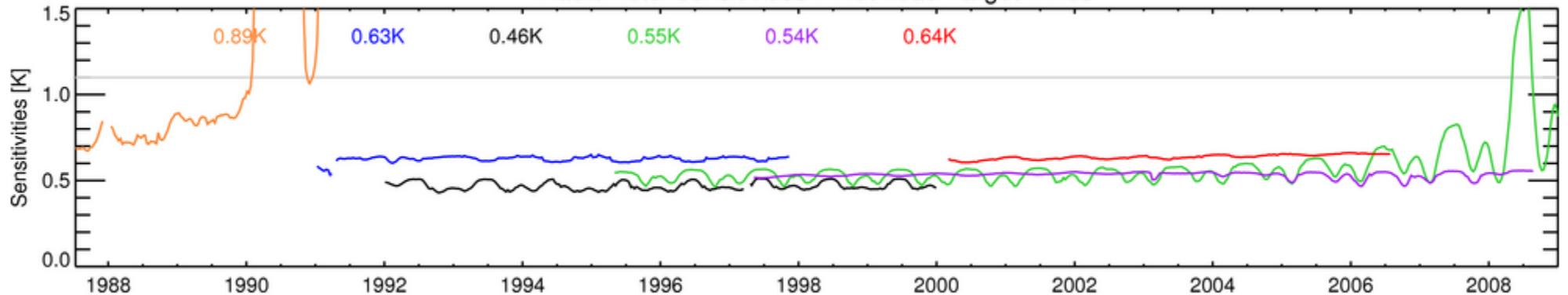
SSM/I Hot Load Temperatures

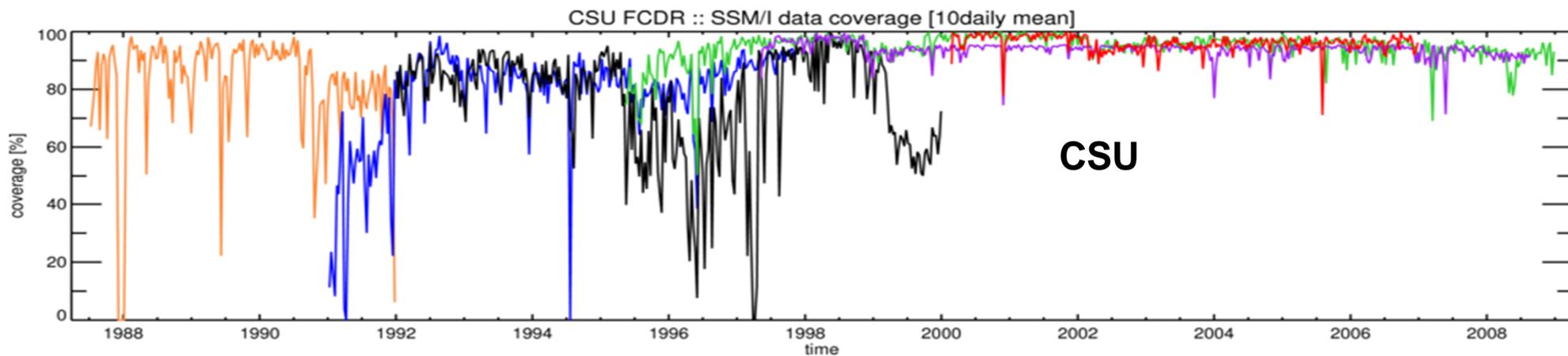
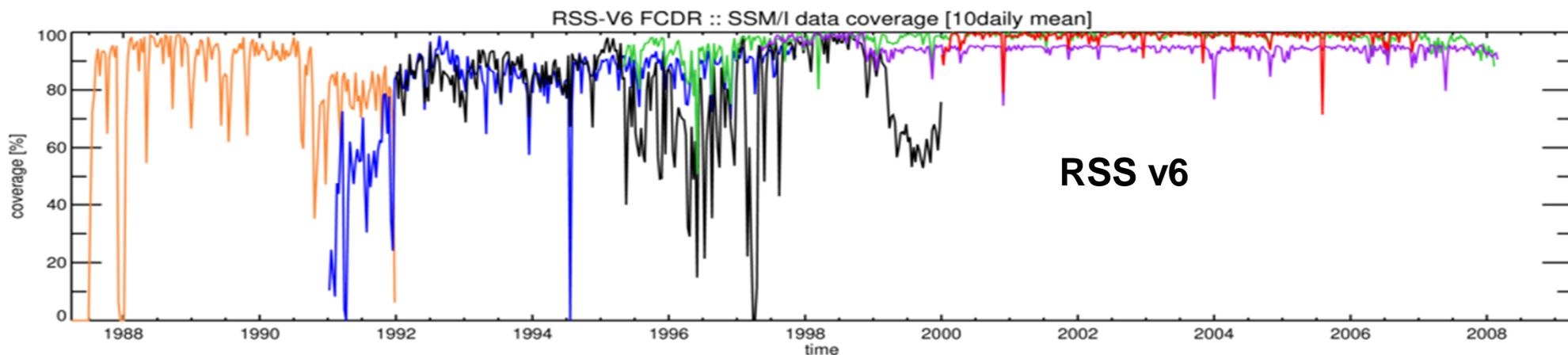
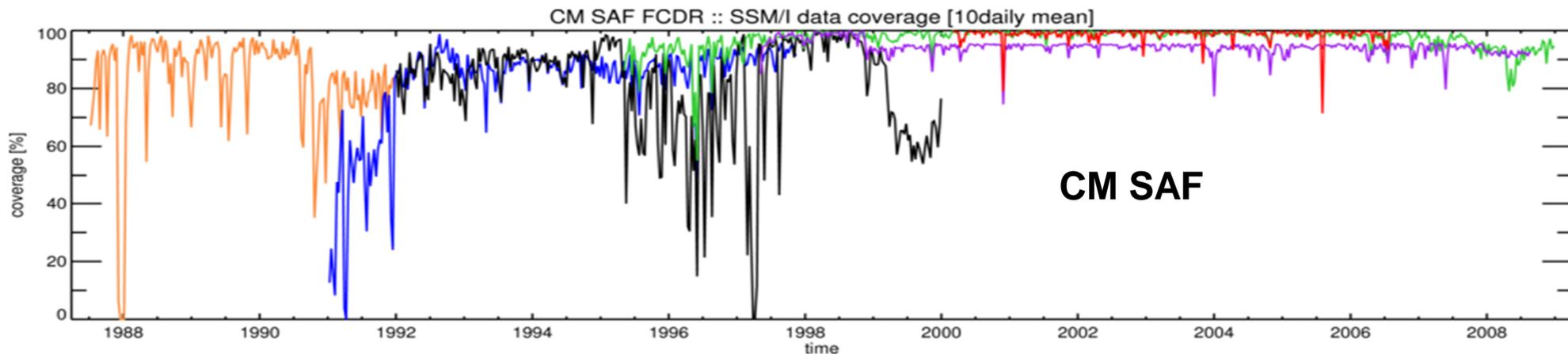


Radiometer sensitivities :: Hot Load Target :: V19

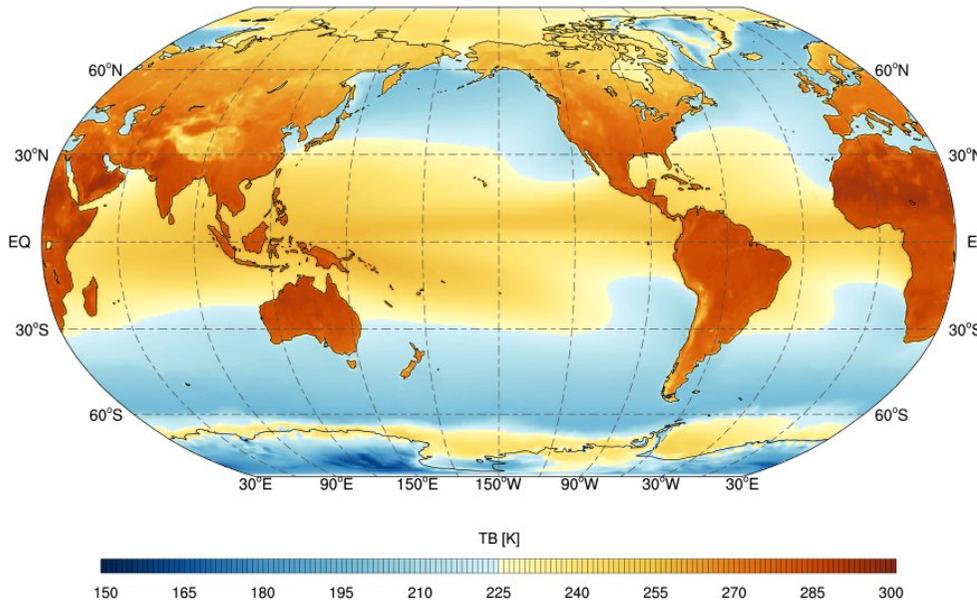


Radiometer sensitivities :: Hot Load Target :: H85

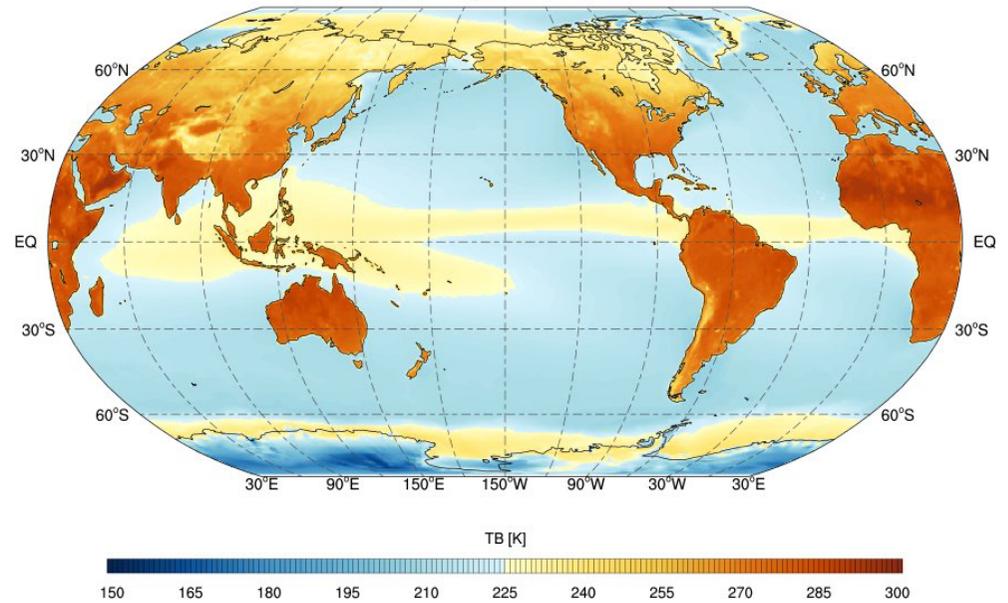




Climate Mean :: Brightness Temperature v22



Climate Mean :: Brightness Temperature v37



- ➔ 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

$$T'_A = T_A + d \cdot (T_A - \langle T^H \rangle) \cdot (T_A - T^C)$$

$$T''_B = a \cdot T'_B + b + c \cdot \Delta_{v,h}$$

F13 – F15

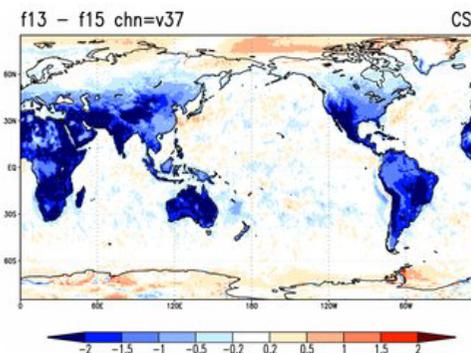
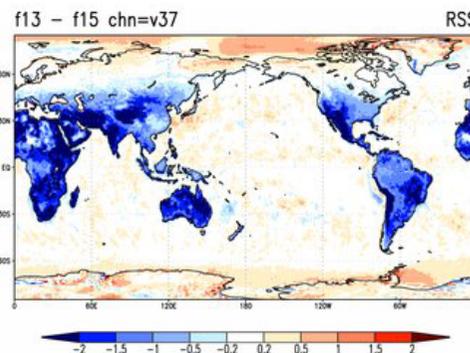
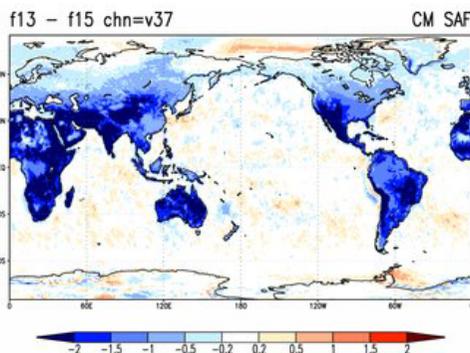
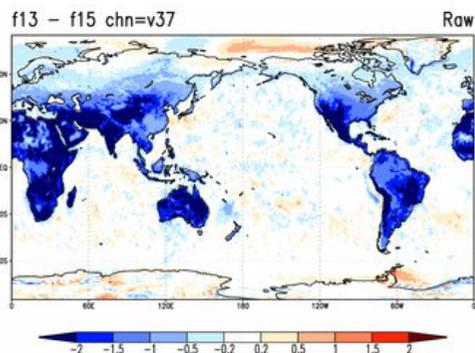
RDR

CM SAF FCDR

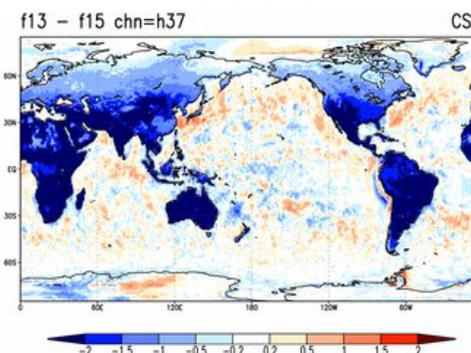
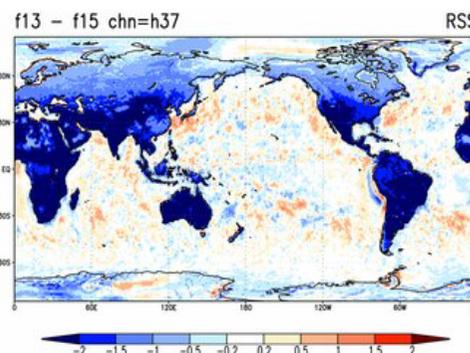
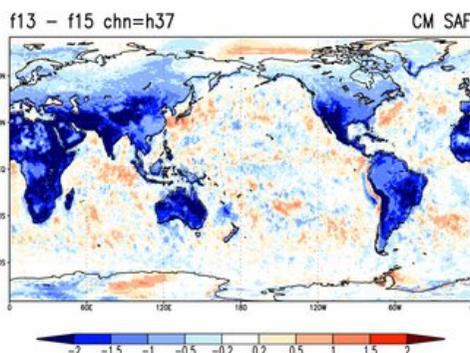
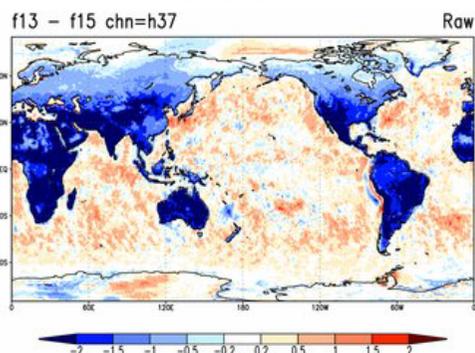
RSS v6 FCDR

CSU FCDR

37v

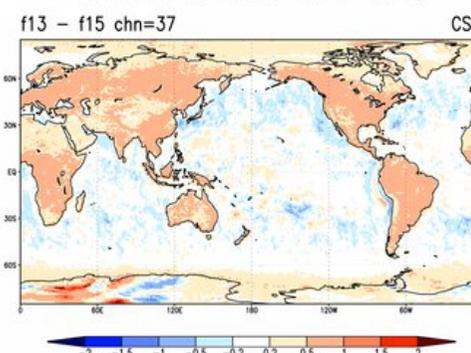
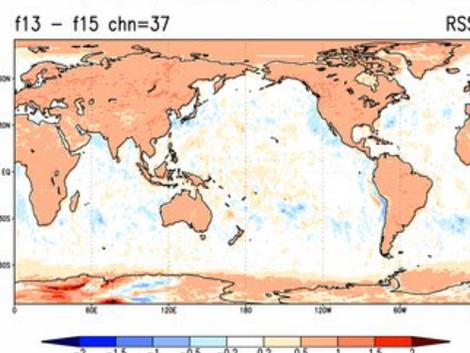
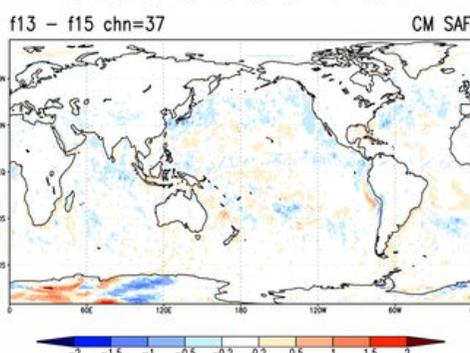
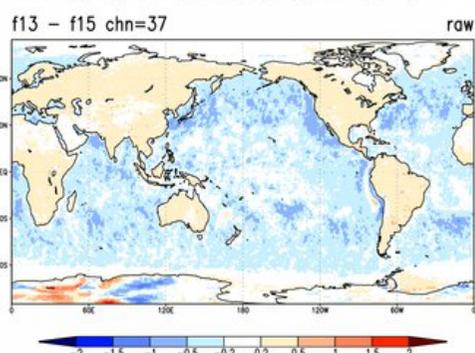


37h



37v

-
37h



F11 – F10

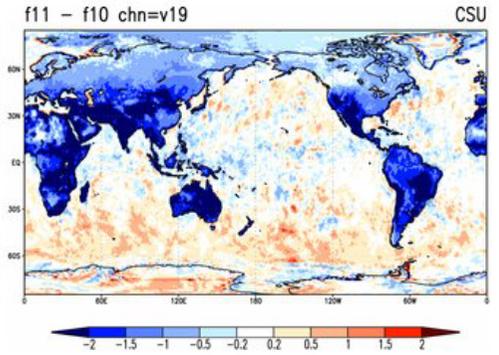
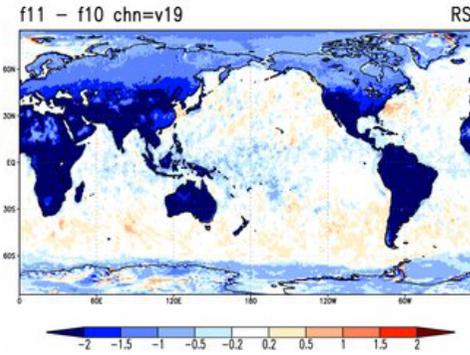
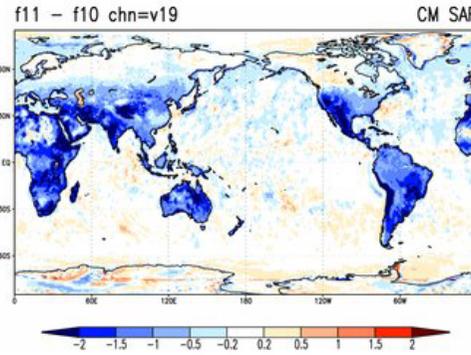
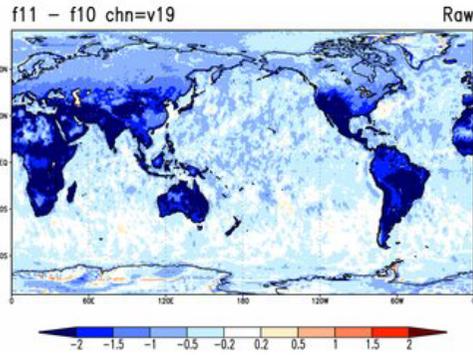
RDR

CM SAF FCDR

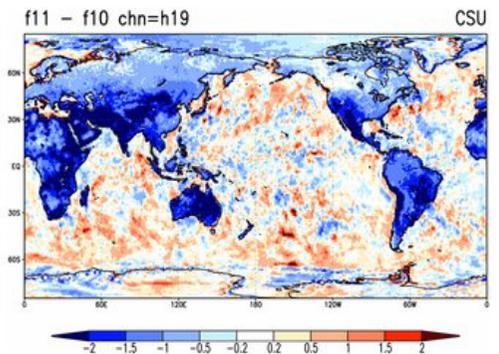
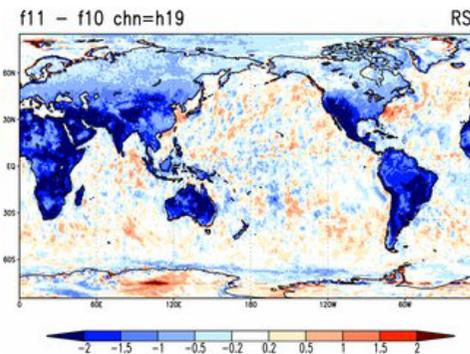
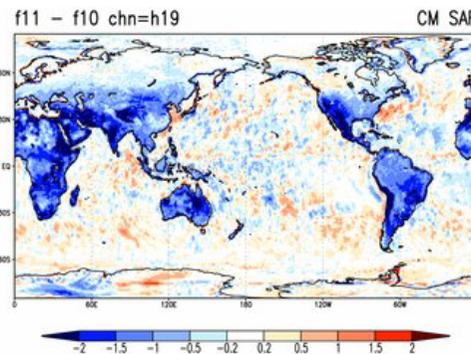
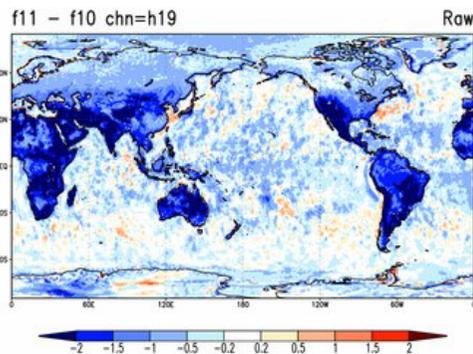
RSS v6 FCDR

CSU FCDR

19v

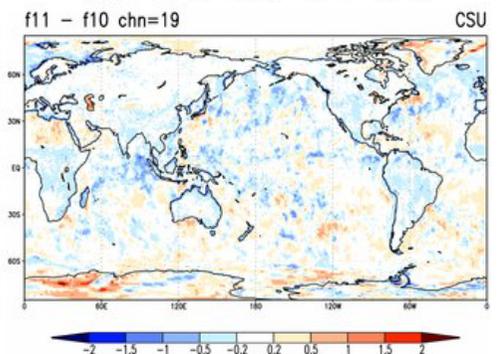
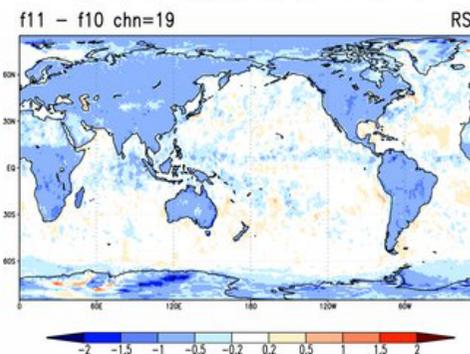
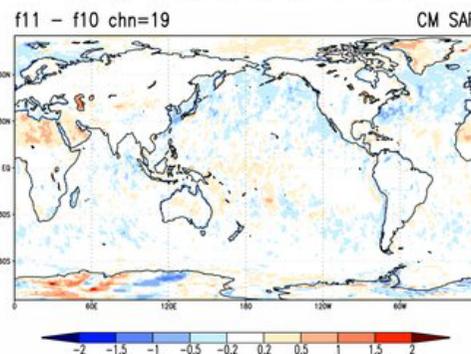
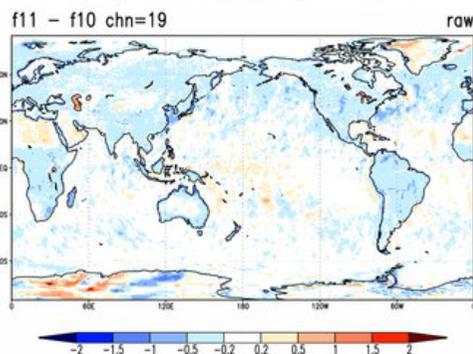


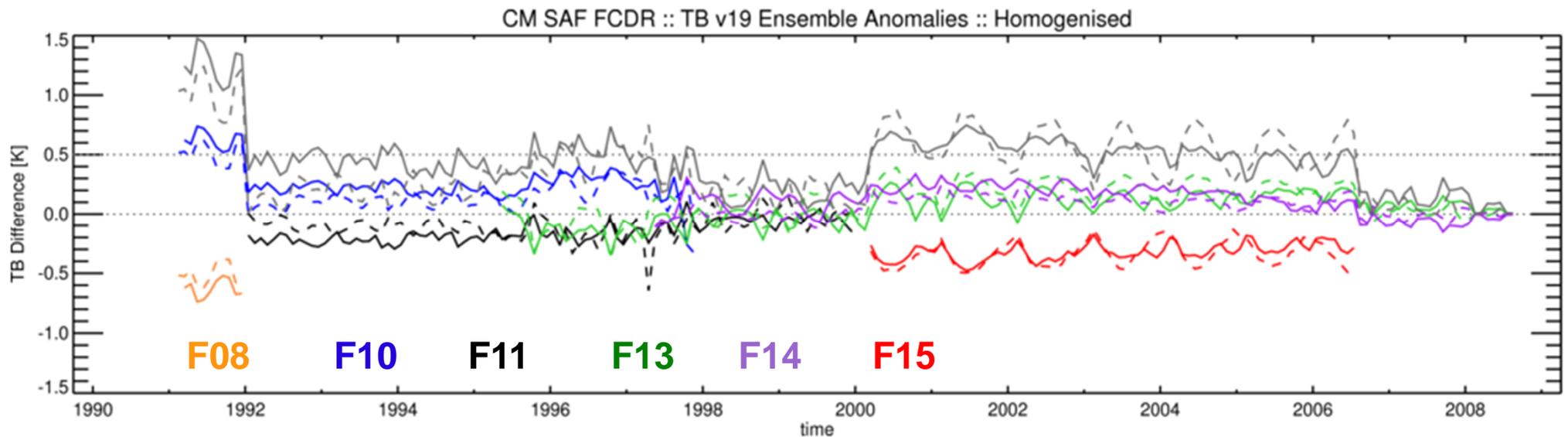
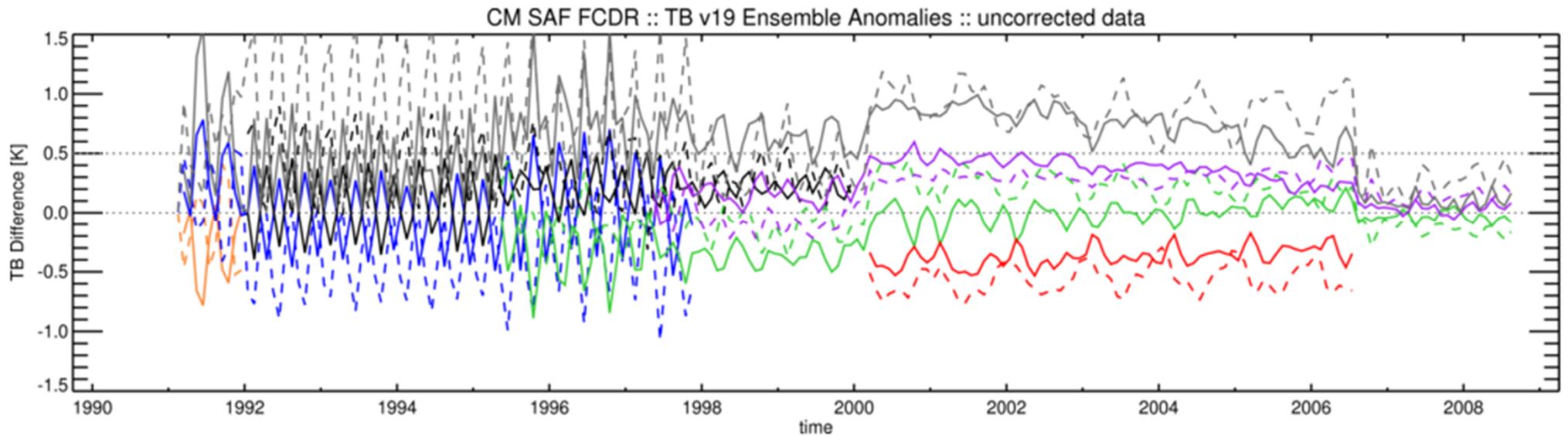
19h



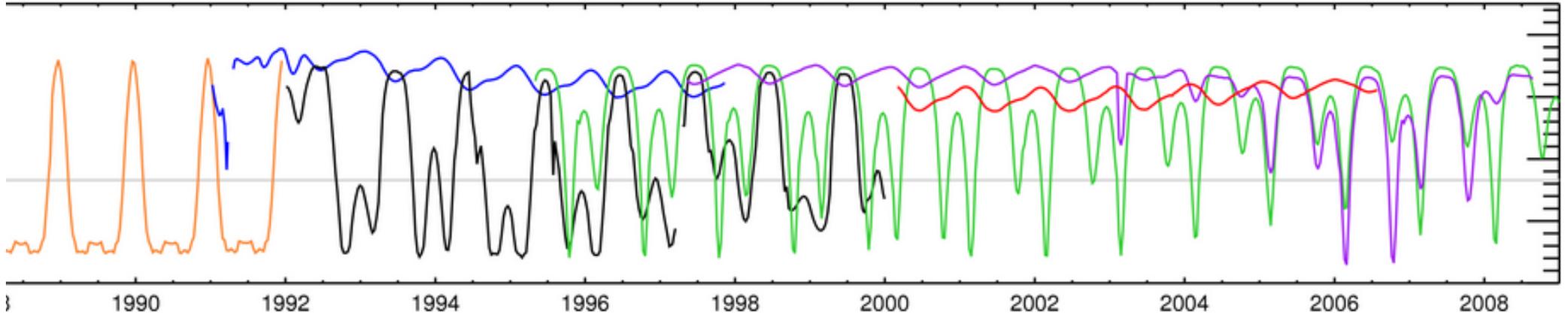
19v

-
19h

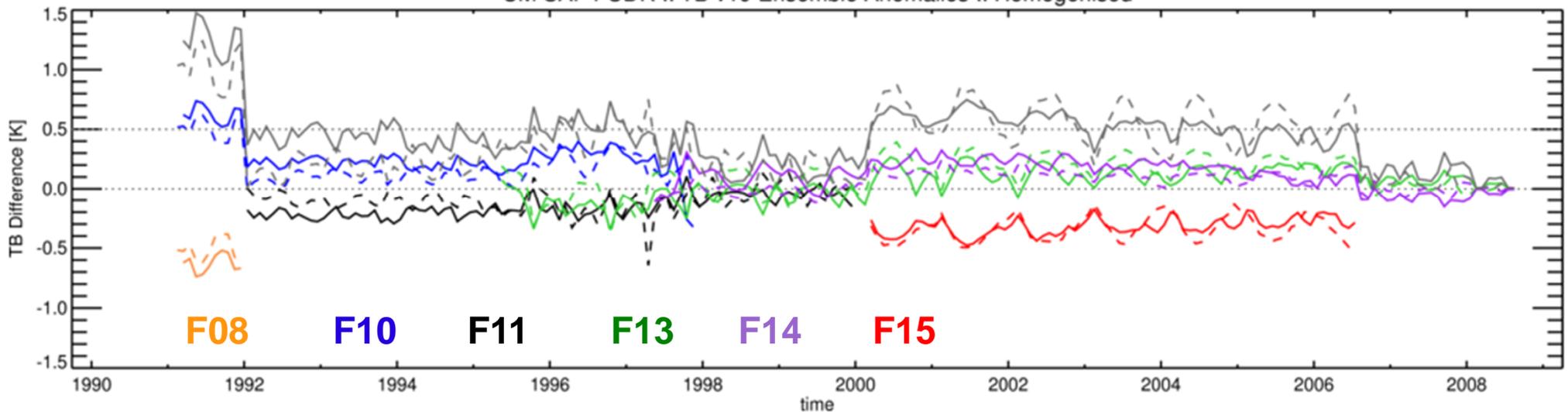


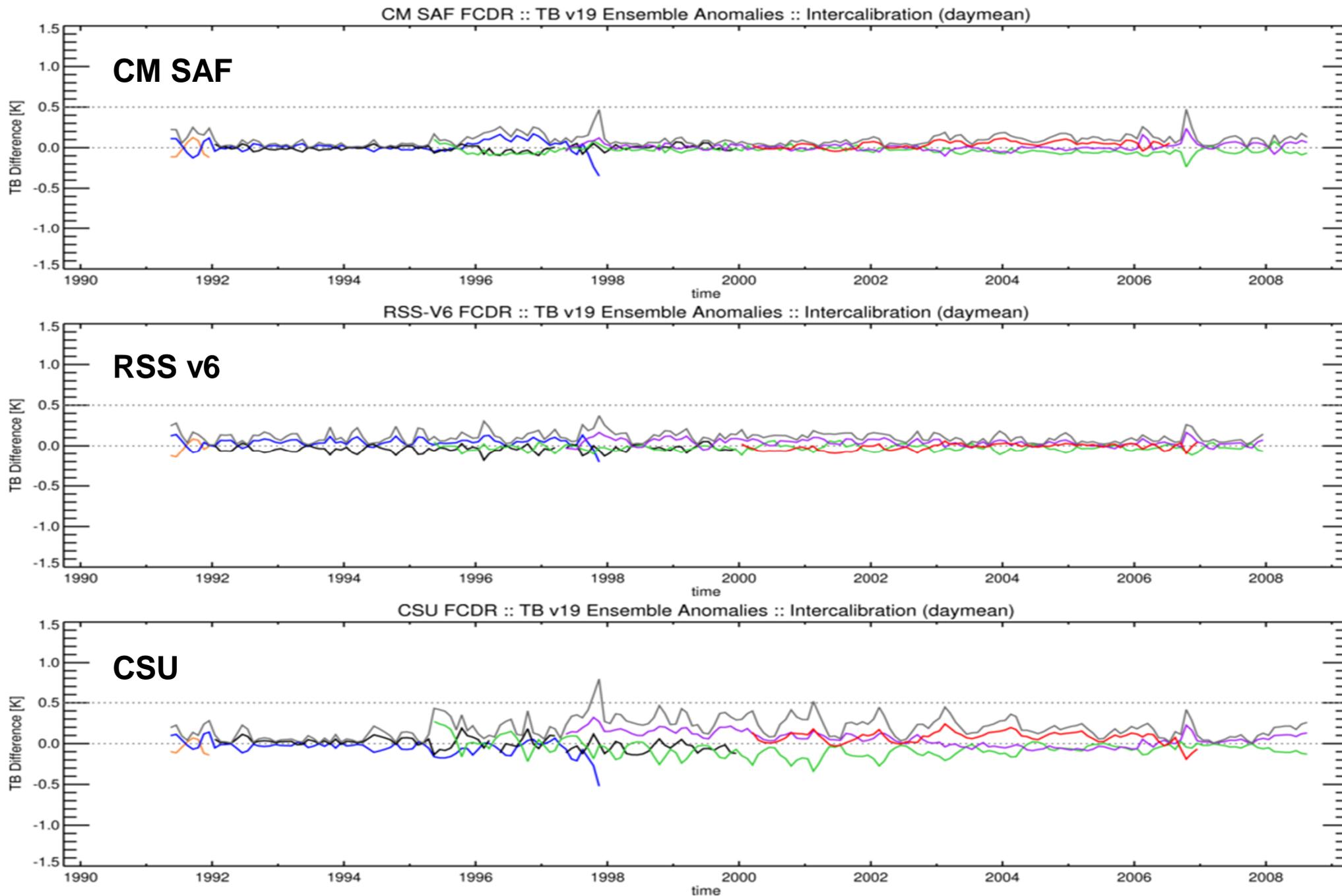


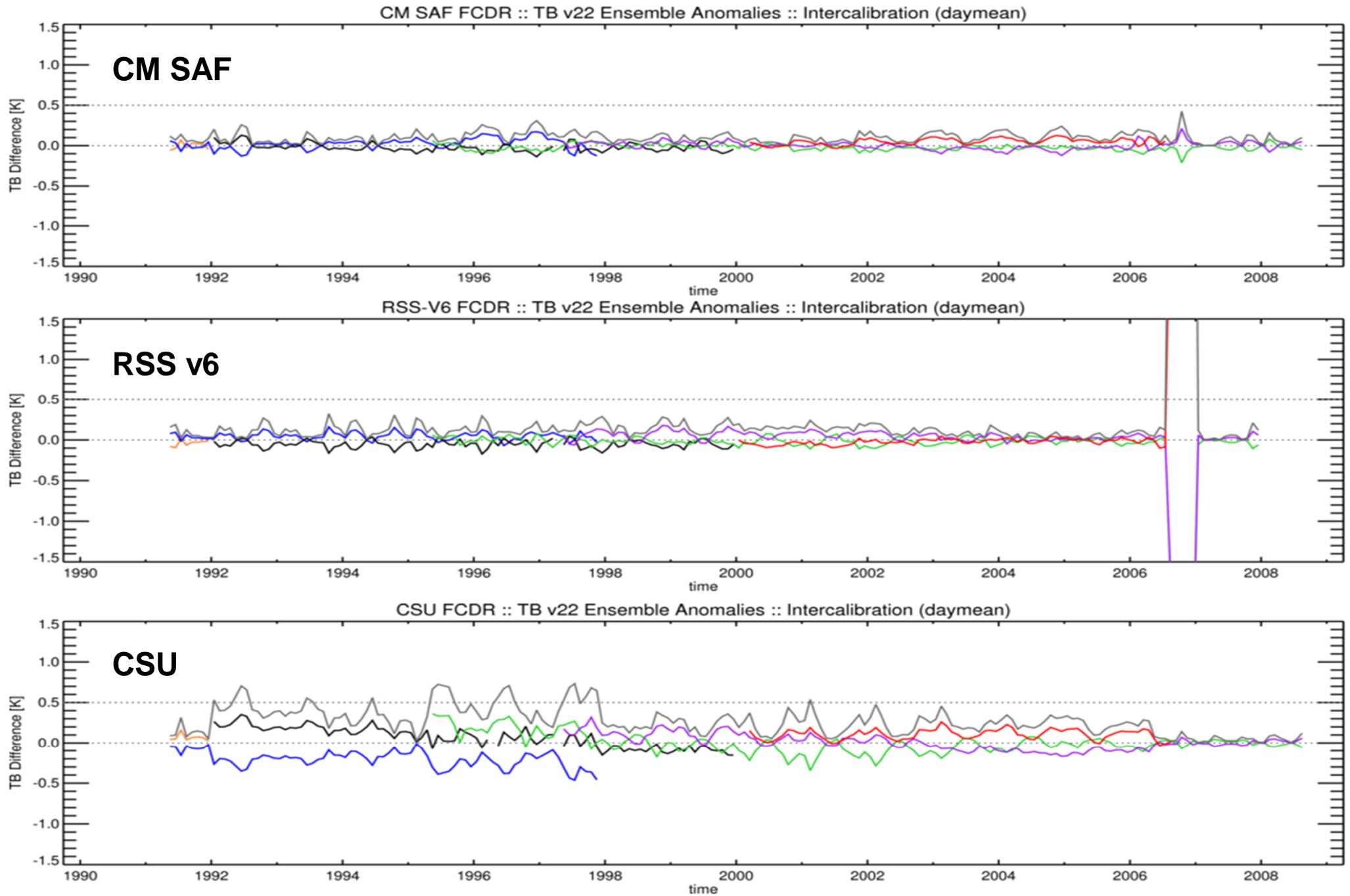
SSM/I Hot Load Temperatures



CM SAF FCDR :: TB v19 Ensemble Anomalies :: Homogenised







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.
- FCDR is available from <http://wui.cmsaf.eu/> together with ATBD, PUM, and validation report.
- http://dx.doi.org/10.5676/EUM_SAF_CM/FCDR_SSMI/V001