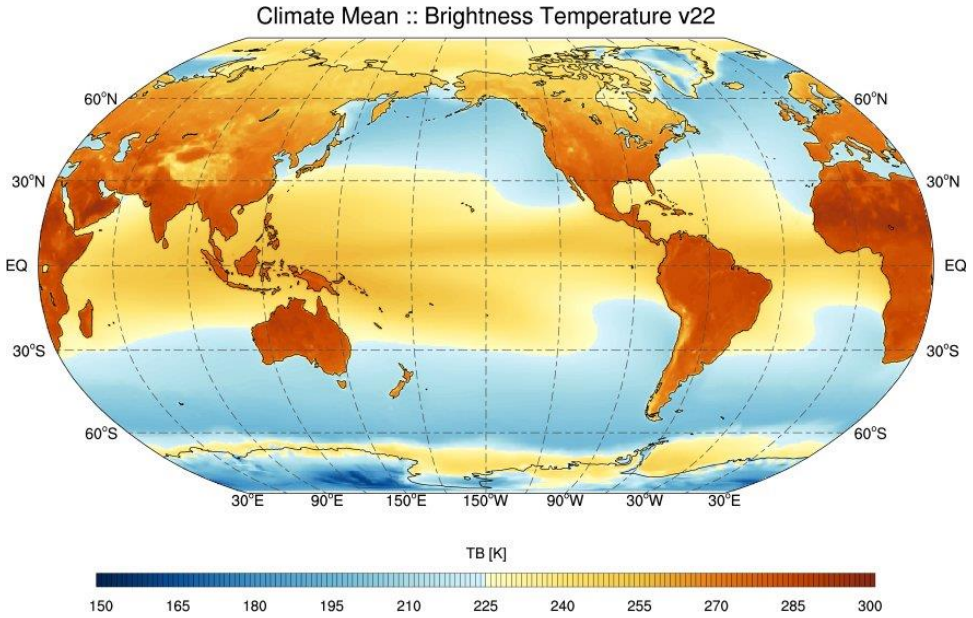
The EUMETSAT Network of Satellite Application Facilities

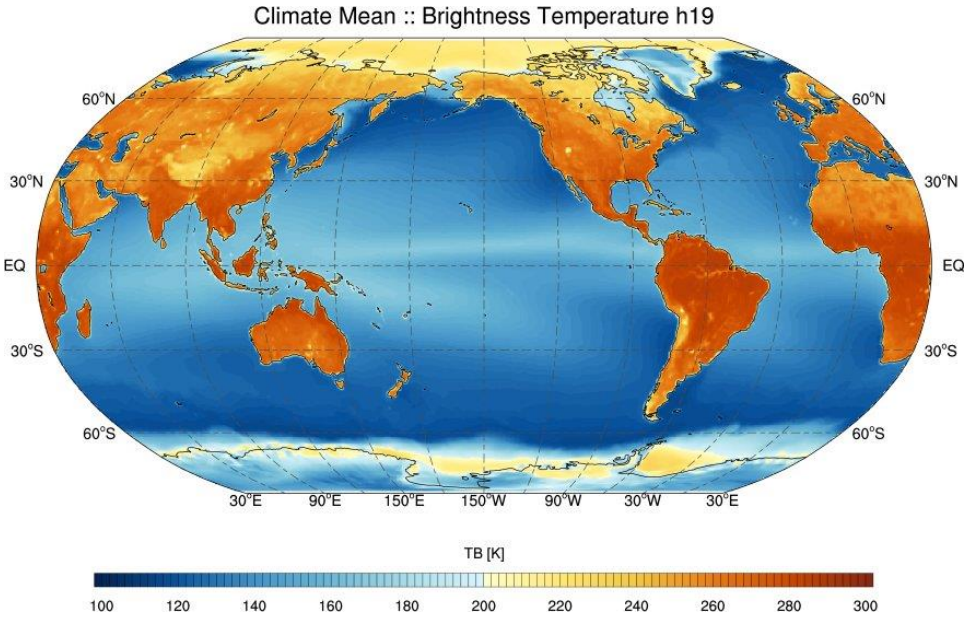
CM SAF Climate Monitoring

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DWD

A Fundamental Climate Data Record of SSM/I, SSMIS, and SMMR brightness temperatures





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DWD, Satellite Application Facility on Climate Monitoring

CM SAF FCDR Features

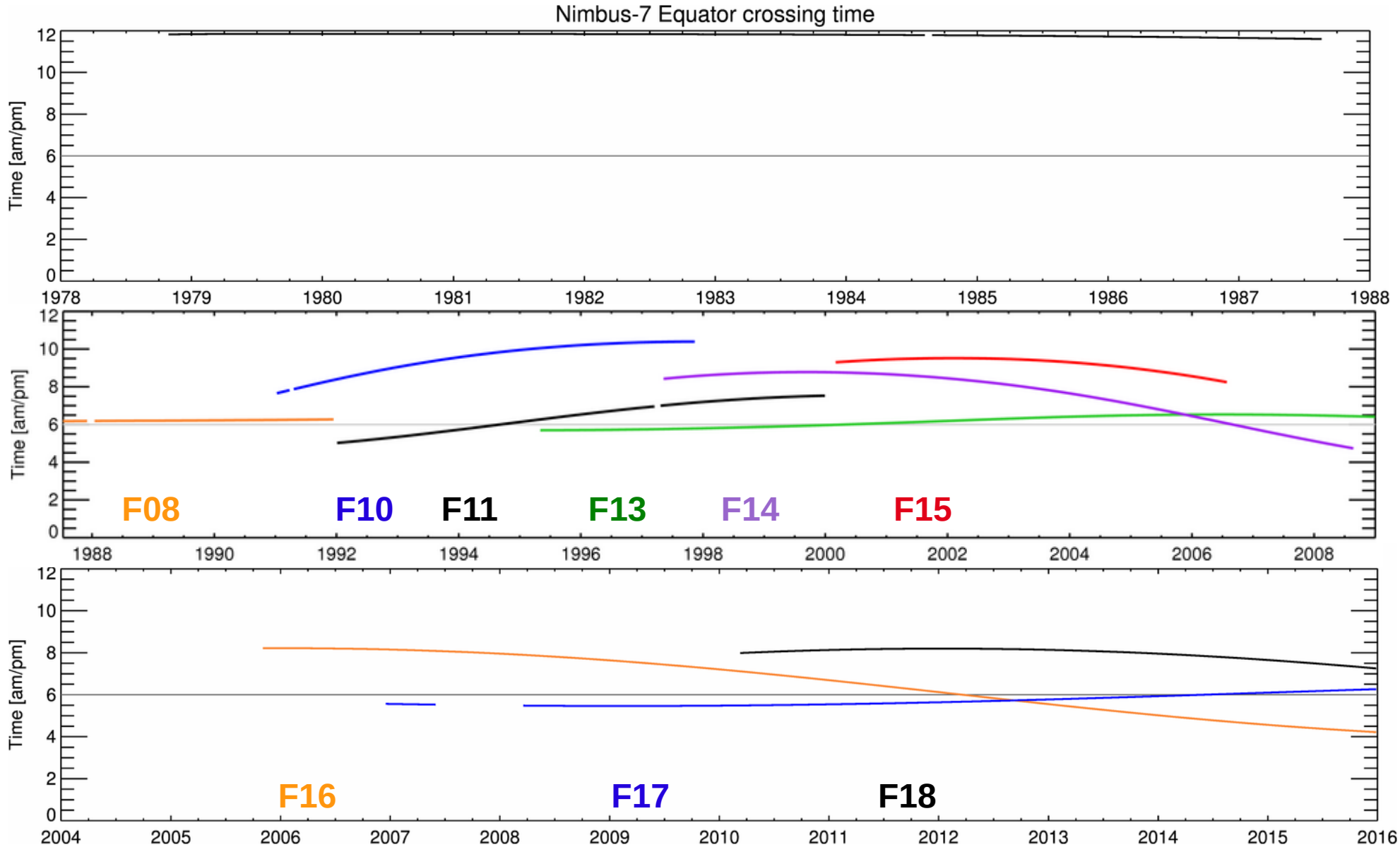
- Covered time period 1978 – 2015.
  - SMMR 1978 – 1987 (Nimbus 7)
  - SSM/I 1987 – 2008 (F08,F10,F11,F13,F14,F15)
  - SSMIS 2006 – 2015 (F16, F17, F18)
- Completely reprocessed data record, starting from measured counts (SSM/I,SSMIS).
- New Earth scene geolocation based on smoothed daily TLEs (SSM/I, SSMIS).
- Data processing accounts for identified instrument issues:
  - Moonlight-intrusions, Sunlight-intrusions, Along-scan non-uniformity, Reflector emissivity.
- Antenna pattern matching: 85 / 91 GHz TBs averaged to 37 GHz antenna pattern.
- Synthetic 85 GHz data over ocean (SSM/I F08, SSMIS).
- Earth incidence angle normalization offsets (SSM/I, SSMIS).
- Scene dependent inter-sensor calibration to F11 via transfer targets F13 and F16 for SSMIS and ERA-20c for SMMR.

Platform stability

SMMR

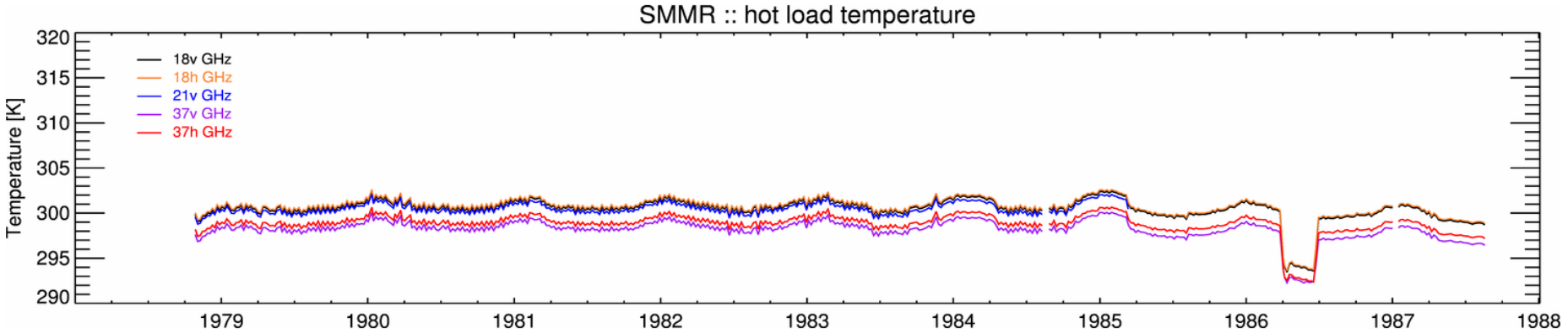
SSM/I

SSMIS

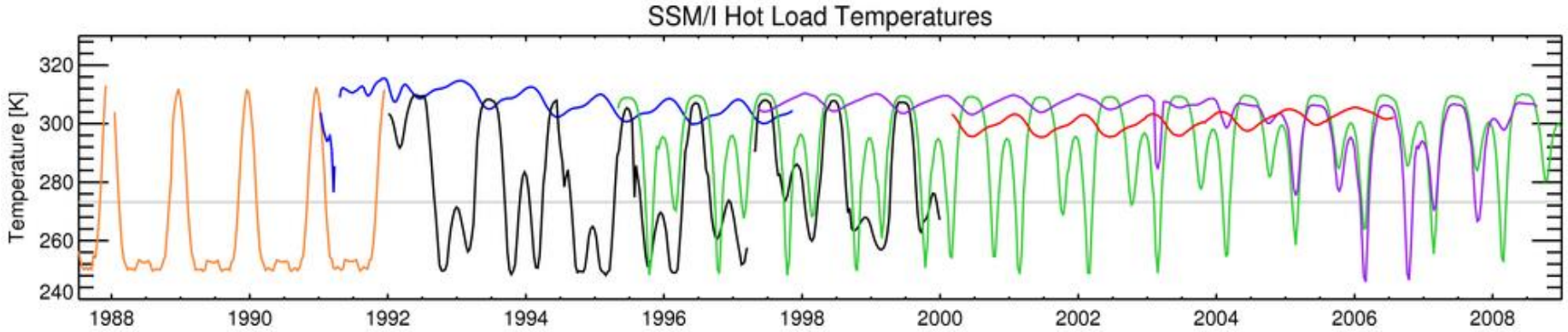


Sensor Health

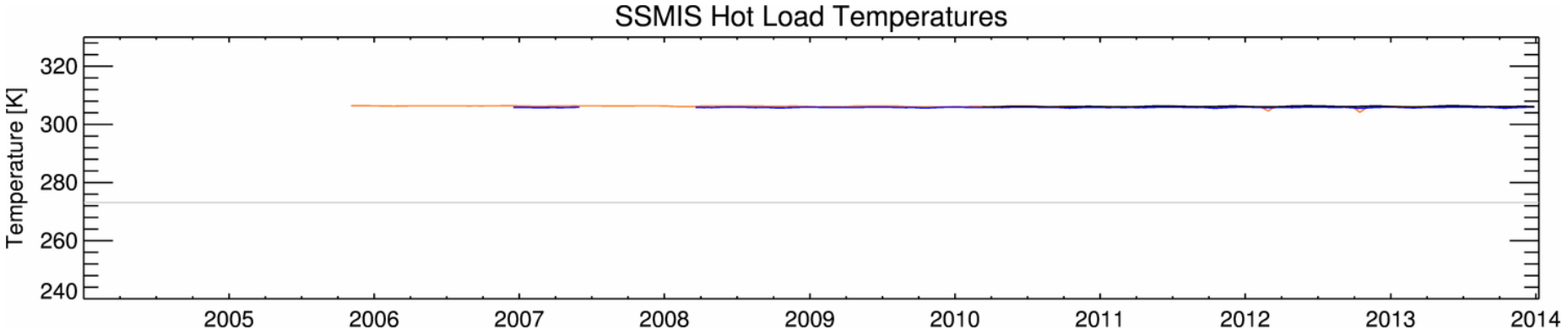
SMMR



SSM/I

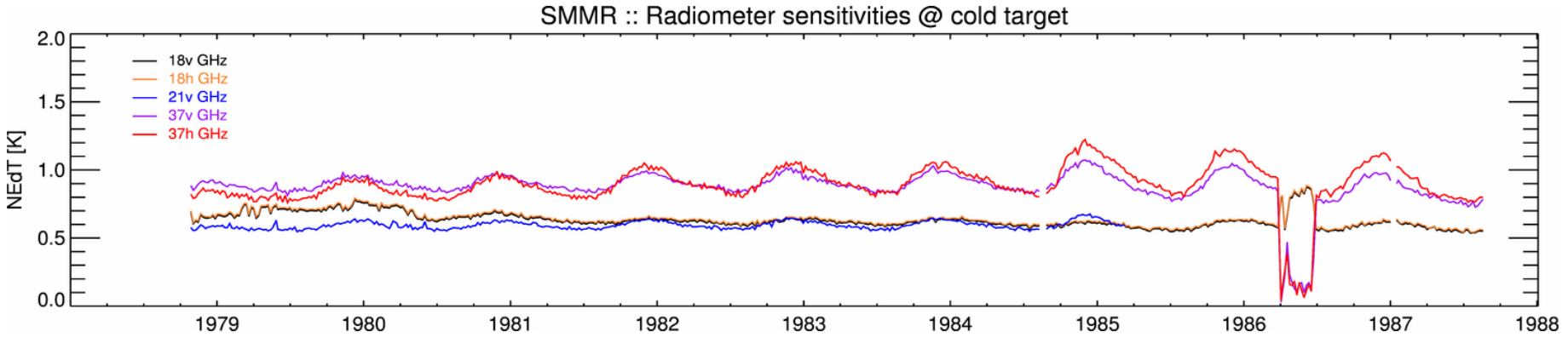


SSMIS

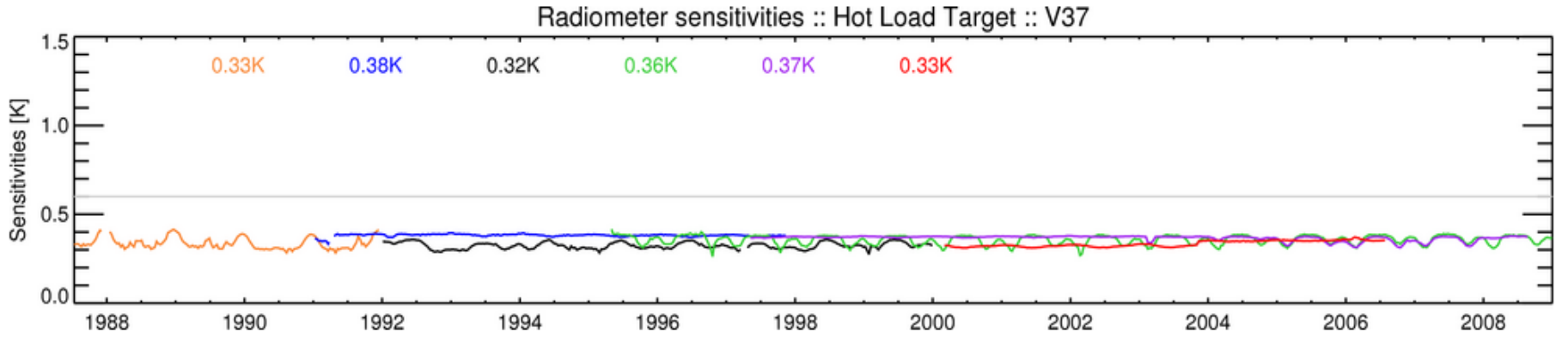


Sensor Sensitivity

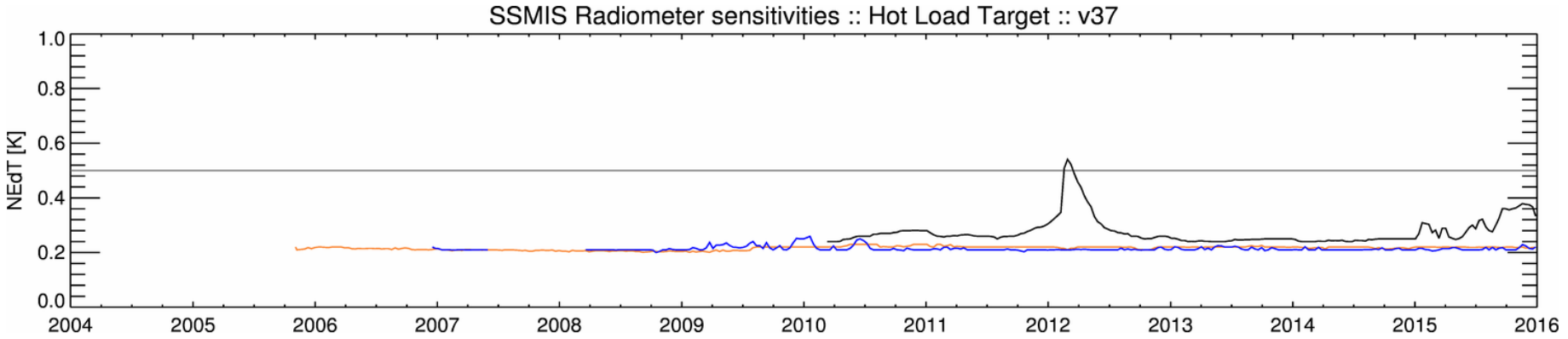
SMMR



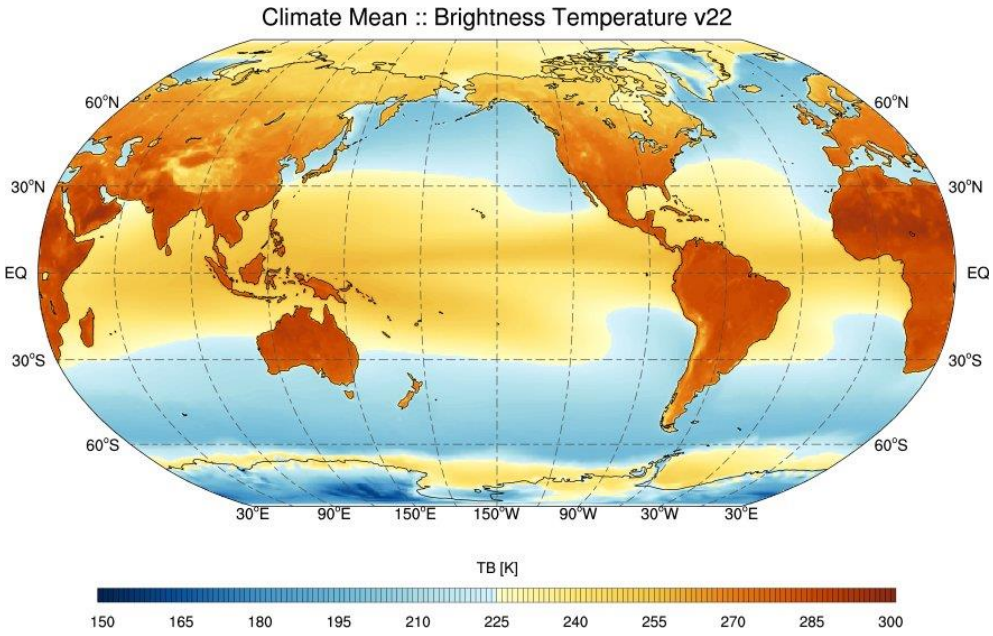
SSM/I

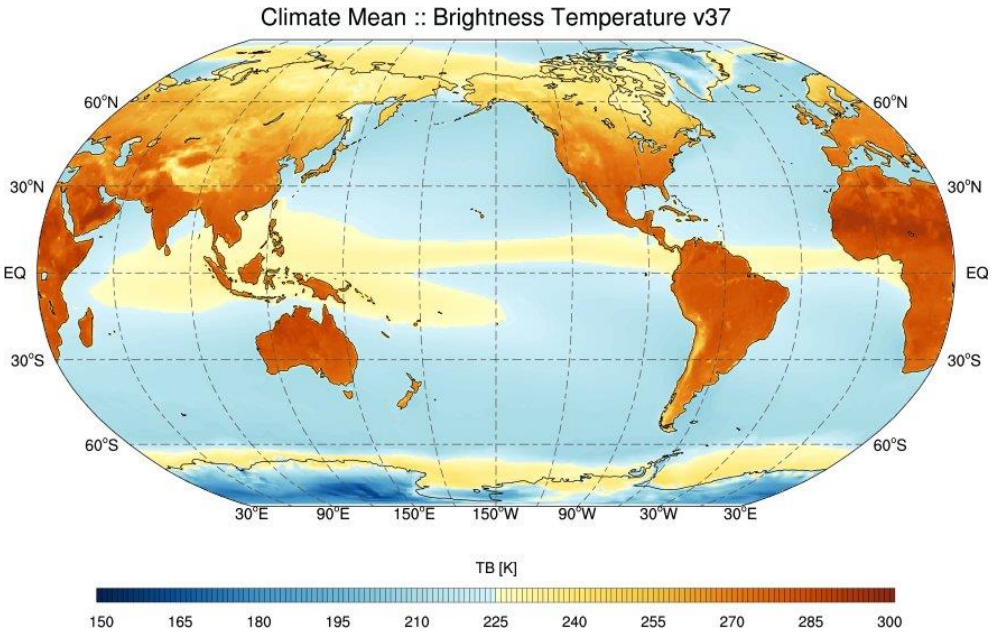


SSMIS



CM SAF FCDR
Inter-calibration model



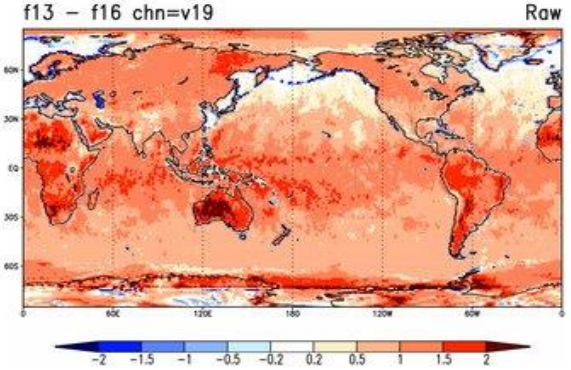
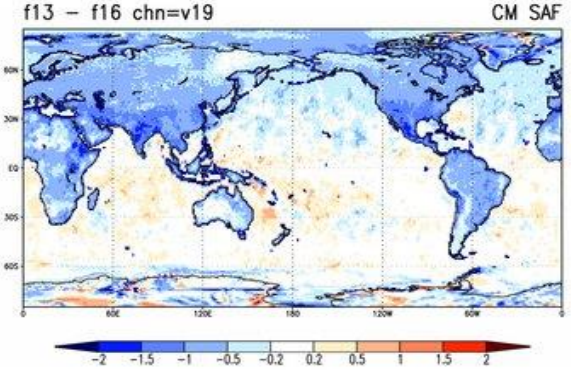
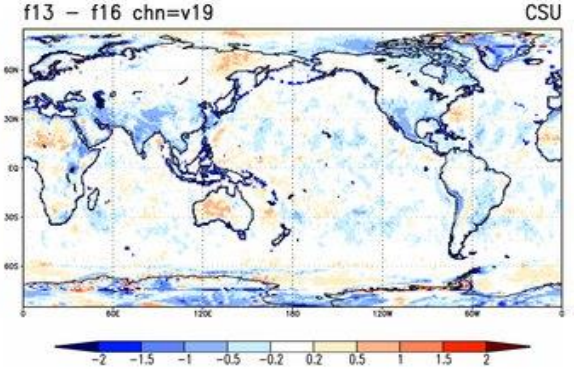
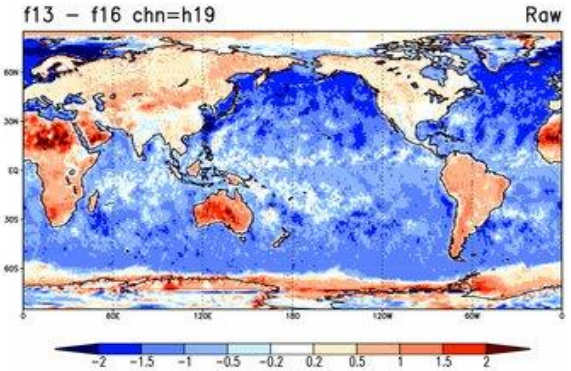
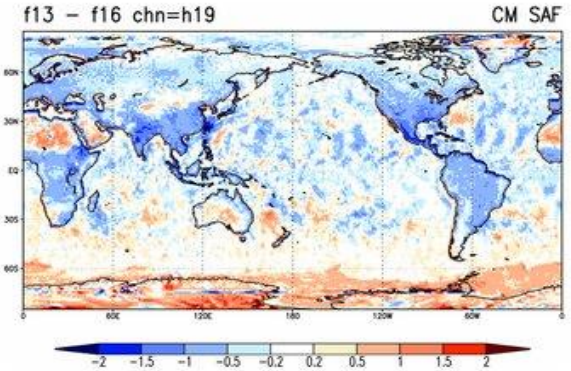
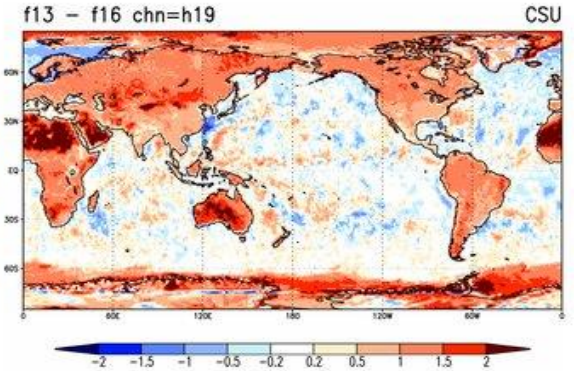
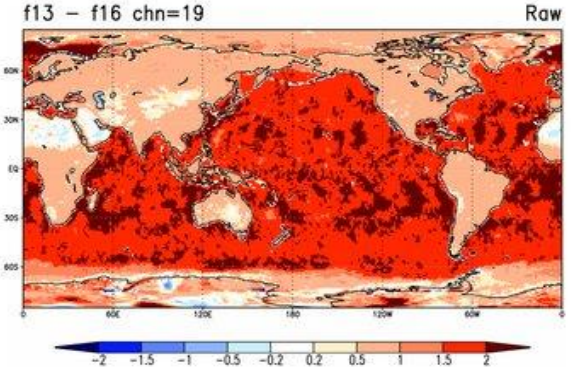
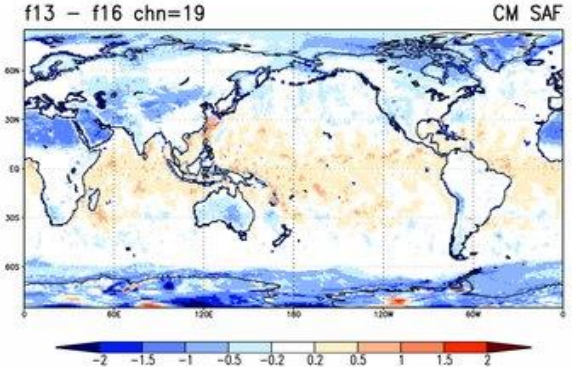
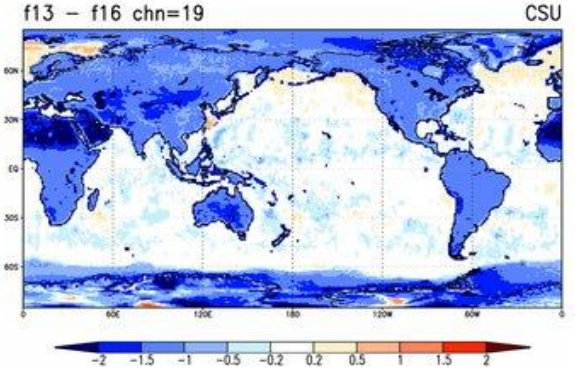


- Limited dynamic range over ocean for scene-dependent inter-calibration.
- Minimization procedure includes sea-ice and land scenes as double differences $\Delta_{v,h} = (T_{v1} - T_{v2}) - (T_{h1} - T_{h2})$ to minimize diurnal cycle variations.
- Inter-calibration Model includes non-linearity calibration coefficient *d*, scene dependent scale factor *a*, offset *b*, and cross-polarization factor *c*

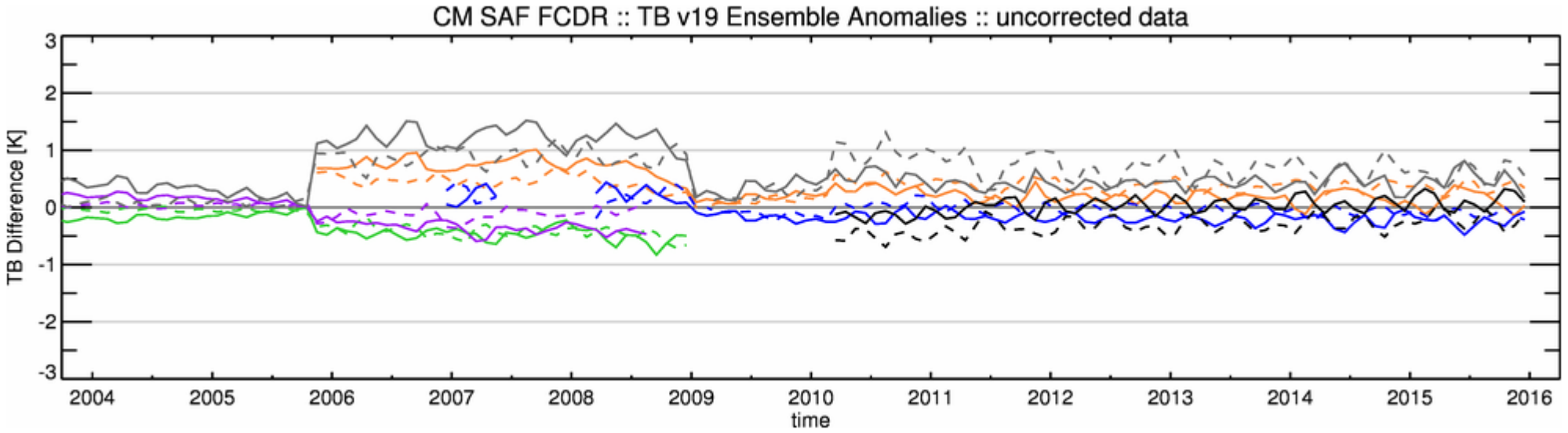
$$T'_A = T_A + d \cdot (T_A - T^H) \cdot (T_A - T^C) \qquad T''_B = a \cdot T'_B + b + c \cdot \left(T'_{B,v} - T'_{B,h}\right)$$

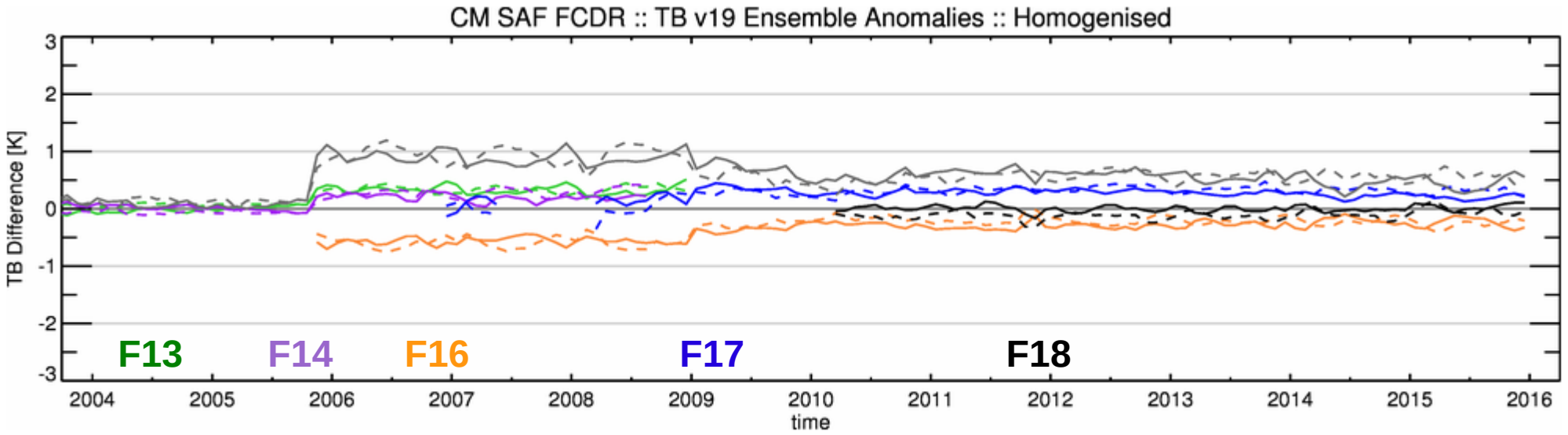
Inter-calibration Results Global Maps

F13 – F16

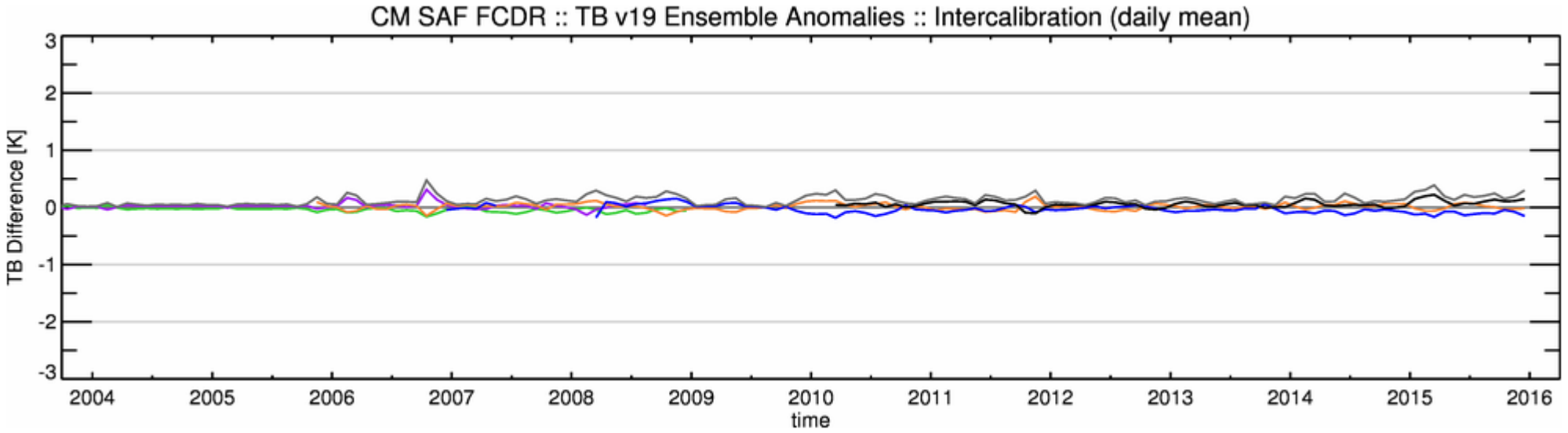
	RDR	CM SAF FCDR	CSU FCDR
19v			
19h			
19v - 19h			

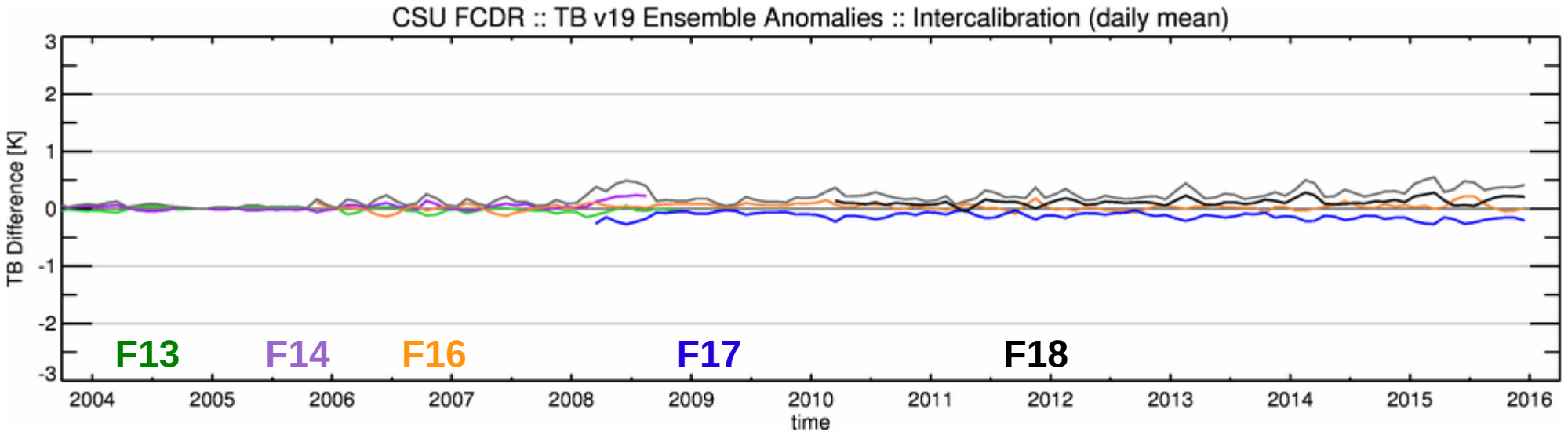
Evaluation TB v19 Normalization





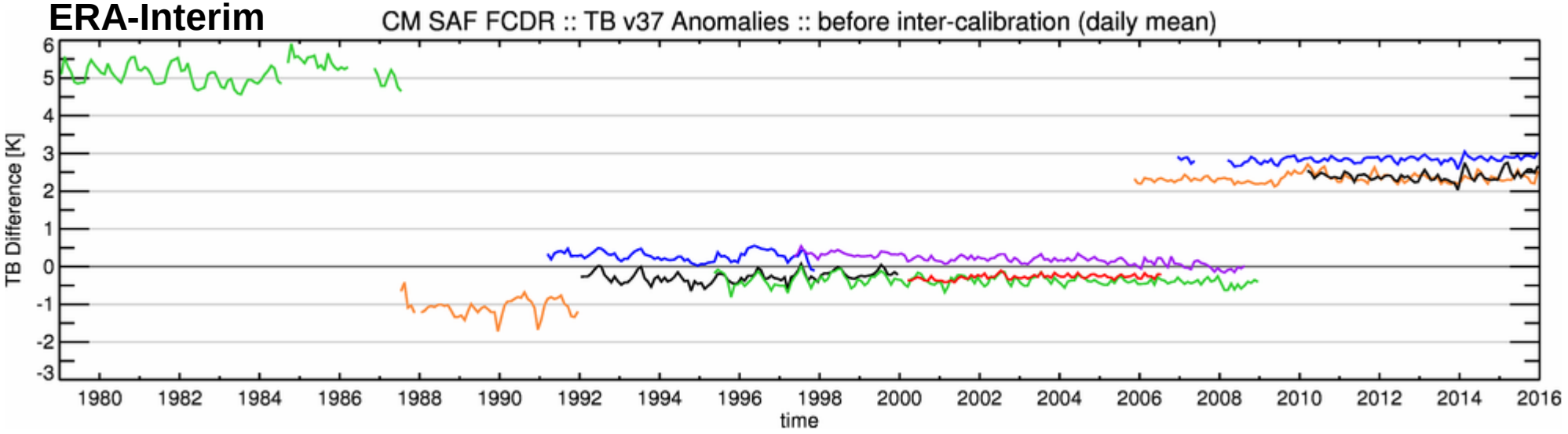
Evaluation TB v19 Normalization



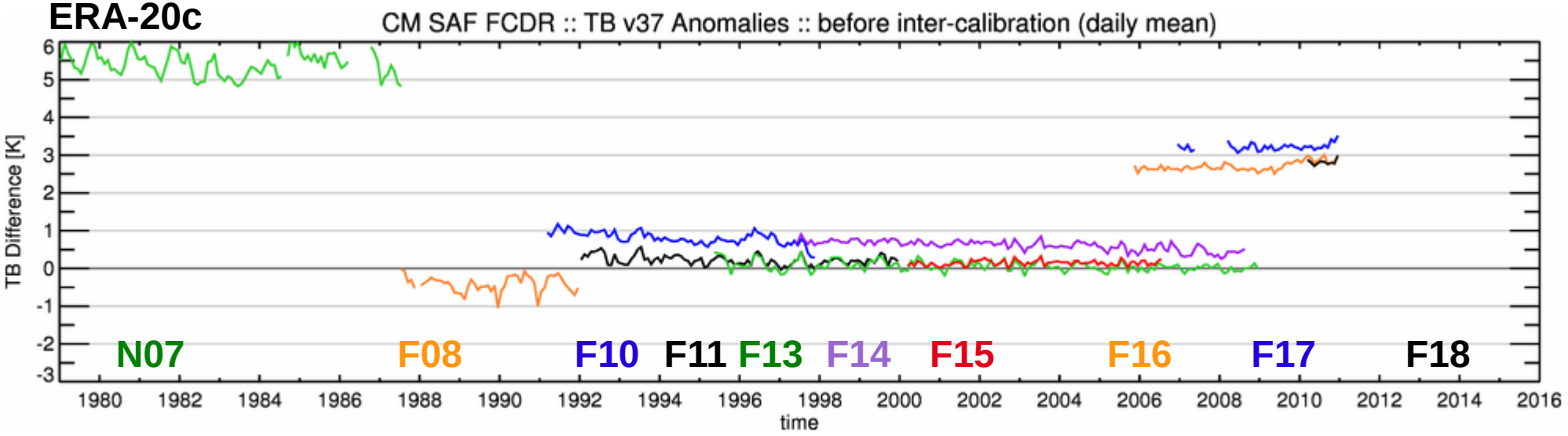


Evaluation FCDR using reanalysis data

ERA-Interim

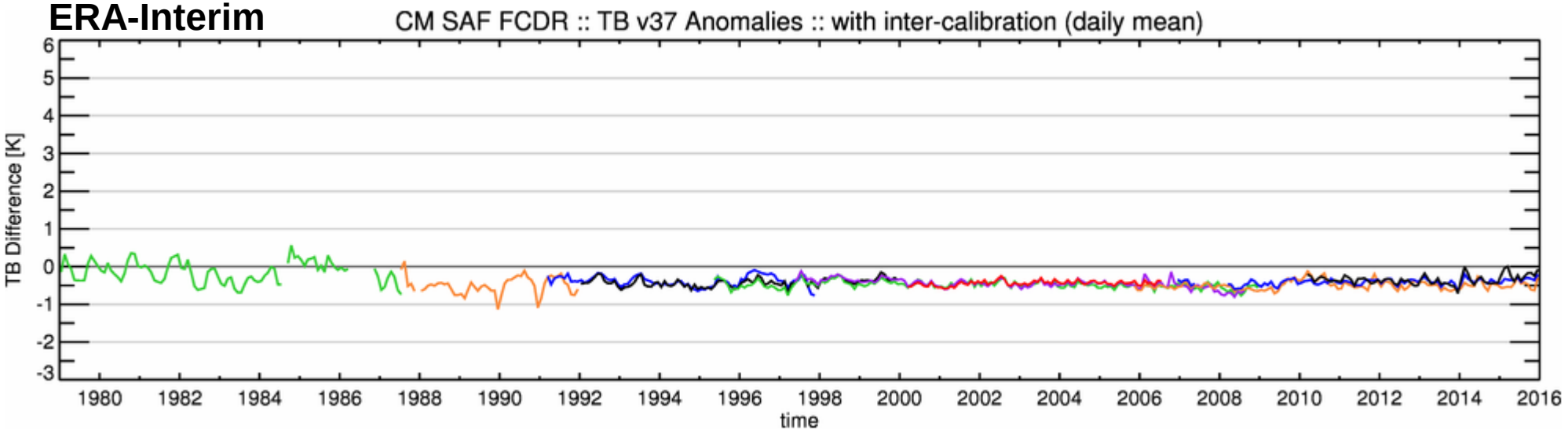


ERA-20c



Evaluation FCDR using reanalysis data

ERA-Interim



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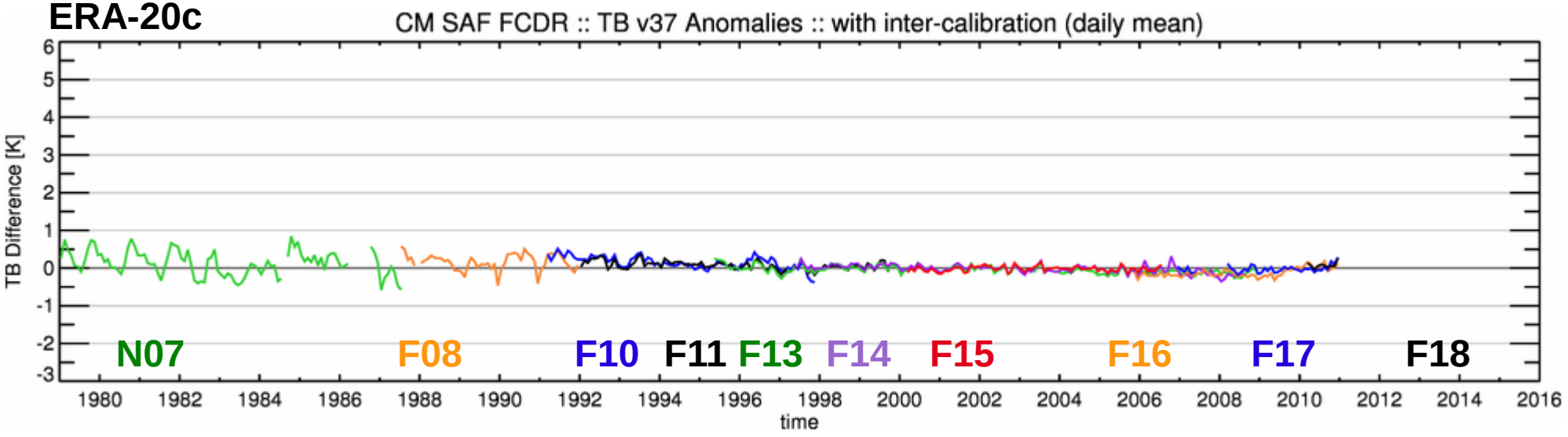

Evaluation FCDR using reanalysis data

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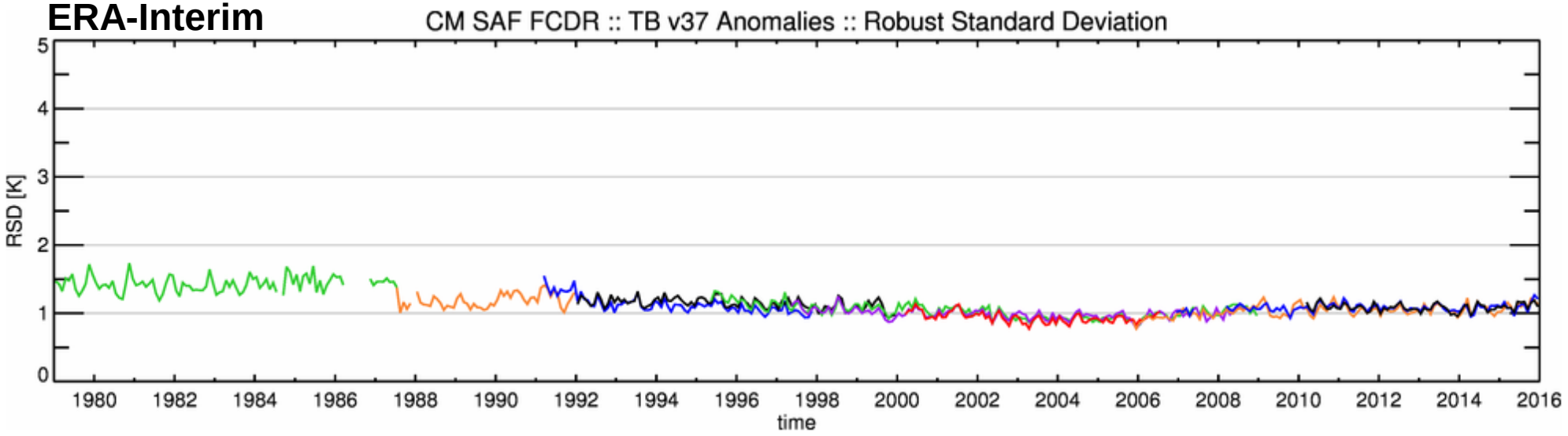

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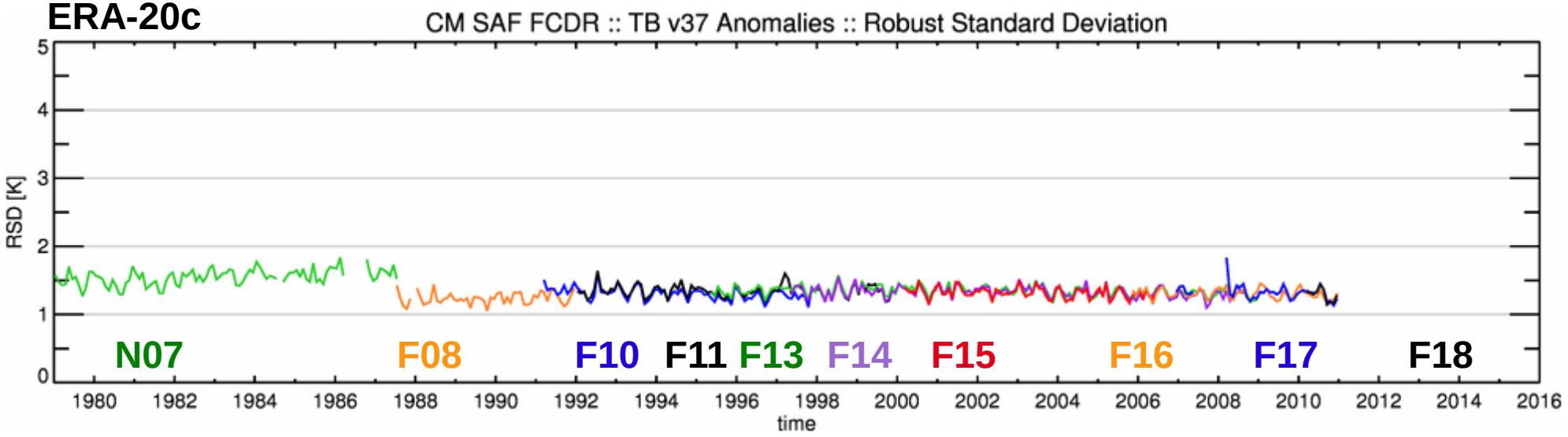
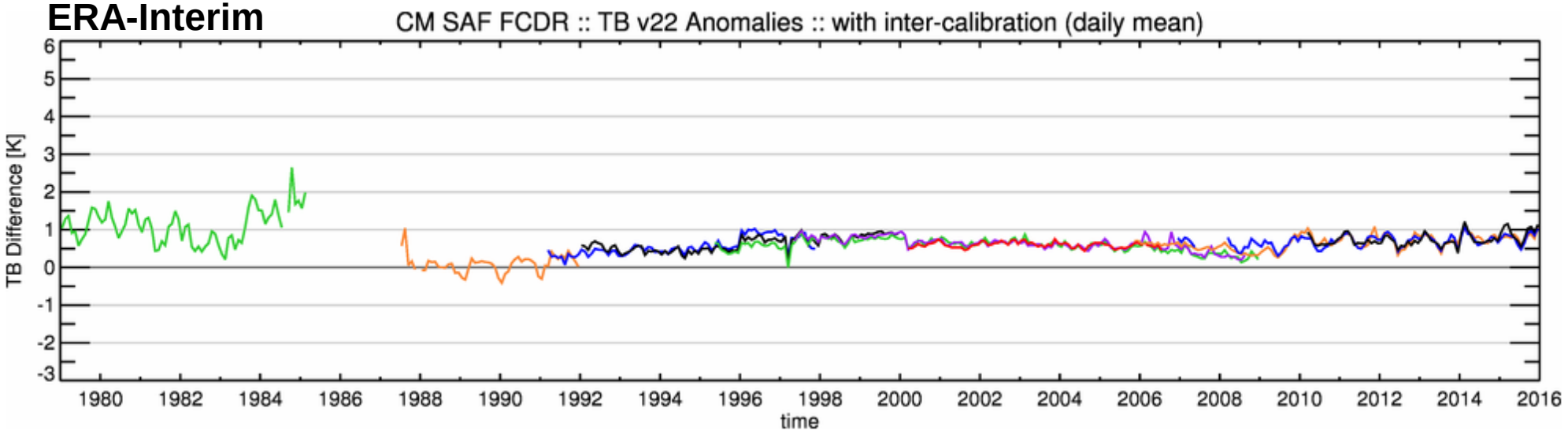
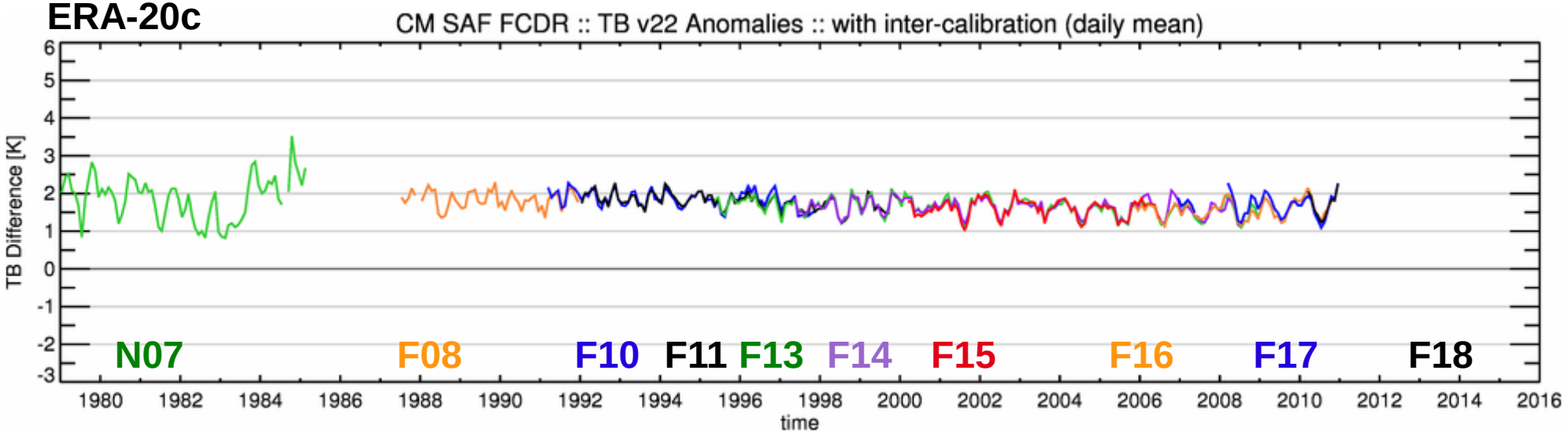


Evaluation FCDR using reanalysis data

ERA-Interim



ERA-20c



Summary

- CM SAF FCDR provides carefully inter-calibrated Brightness Temperatures for the instruments SMMR, SSM/I, and SSMIS aboard 10 different platforms covering 1978 – 2015.
- Extension of existing SSM/I FCDR with inter-calibration via F13/F16 overlap to SSMIS and ERA-20c to SMMR.
- FCDR data processing accounts for identified issues: moonlight-intrusions, sunlight-intrusions, along-scan correction, reflector emissivity and assigns quality control flags.
- Data files are available as daily collections in NetCDF-4 conforming to CF Metadata Conventions 1.6. from **http://wui.cmsaf.eu/**
- Data files include all sensor specific raw data record sensor information plus:
  - Quality control flags (scan, channel, FOV),
  - Earth incidence angles,
  - Averaged 91 GHz TBs and 85 GHz TBs over ocean (SSM/I F08 and SSMIS),
  - Incidence angle normalization offsets (over ocean) as separate layer (SSM/I, SSMIS),
  - Inter-sensor calibration offsets as separate layer,
  - Sensor sensitivities (e.g. NEdT) as daily estimates,
- Processing is finished, Review underway
  - Release planned for end of 2016