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

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CM SAF FCDR Features

  - 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.
Sensor Health

SMMR :: hot load temperature

SSM/I Hot Load Temperatures

SSMIS Hot Load Temperatures
Sensor Sensitivity

SMMR :: Radiometer sensitivities @ cold target

SSM/I

SSMIS

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 $c$

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

$$T''_B = a \cdot T'_B + b + c \cdot (T_{B,v}' - T_{B,h}')$$
Inter-calibration Results
Global Maps

F13 – F16
RDR
CM SAF FCDR
CSU FCDR

19v

19h

19v - 19h
Evaluation TB v19 Normalization

CM SAF FCDR :: TB v19 Ensemble Anomalies :: uncorrected data

CM SAF FCDR :: TB v19 Ensemble Anomalies :: Homogenised
Evaluation FCDR using reanalysis data

**ERA-Interim**
CM SAF FCDR :: TB v37 Anomalies :: before inter-calibration (daily mean)

**ERA-20c**
CM SAF FCDR :: TB v37 Anomalies :: before inter-calibration (daily mean)
Evaluation FCDR using reanalysis data

**ERA-Interim**
CM SAF FCDR :: TB v37 Anomalies :: with inter-calibration (daily mean)

**ERA-20c**
CM SAF FCDR :: TB v37 Anomalies :: with inter-calibration (daily mean)
Evaluation FCDR using reanalysis data

ERA-Interim

ERA-20c
Evaluation FCDR using reanalysis data

**ERA-Interim**
CM SAF FCDR :: TB v22 Anomalies :: with inter-calibration (daily mean)

**ERA-20c**
CM SAF FCDR :: TB v22 Anomalies :: with inter-calibration (daily mean)
Summary

- 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