Evaluation of the EUMETSAT 183GHz FCDRs

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GRWG/GDWG Web Meeting 23 July 2019

Background

- The FIDUCEO (Fidelity and uncertainty in climate data records from Earth Observations) Horizon 2020 project, has produced FCDRs for the microwave humidity sounders **SSM/T2**, **AMSU-B**, and **MHS** (Hans et al., 2019)

- EUMETSAT adapted their software to produce FCDRs for **MWHS-1 & -2**, and **ATMS** and have extended the MHS/MetOp-A & -B FCDRs to 2018

- FIDUCEO and EUMETSAT FCDRs are complementary

- They provide detailed **quality and uncertainty data** that offer users additional information compared with the conventional BT datasets provided by other data set developers

Hans, I.; Burgdorf, M.; Buehler, S.A.; Prange, M.; Lang, T.; John, V.O., 2019, An Uncertainty Quantified Fundamental Climate Data Record for Microwave Humidity Sounders. *Remote Sens.*, *11*, 548.

Study Objectives

- Evaluate the EUMETSAT FCDRs
- Approach:
  - Comparison with ‘operational’ BTs
  - Comparison with simulated BTs
  - Analysis of simultaneous nadir overpasses (SNO; includes SAPHIR)
  - Assessment of uncertainties
  - Examination of QC flags

EUMETSAT FCDRs

Instrument	Satellite	Period	LECT desc.
MHS	MetOp-A	10/2006-12/2018	09:30
MHS	MetOp-B	04/2013-12/2018	09:30
MWHS-1	FY-3A	07/2008-05/2014	09:05
MWHS-1	FY-3B	11/2010-12/2018	01:38
MWHS-2	FY-3C	09/2013-12/2018	10:15
ATMS	S-NPP	12/2011-12/2018	01:25

FCDR channels

Sensor	183.31 ±1 GHz	183.31 ±1.8 GHz	183.31 ±3 GHz	183.31 ±4.5 GHz	183.31 ±7 GHz	190.31 GHz
MHS	3		4			5
MWHS-1	3		4		5	
MWHS-2	11	12	13	14	15	
ATMS	22	21	20	19	18	

Summary for other sensors

- **FY-3B agreement very good**: mean differences approx. -0.2 to 0.1 and StDev <0.1. There is a discontinuity in the BT differences (FCDR minus operational) at the end of 2016 negative step of ~0.1 K in 183.31±7 GHz channel.

- **FY-3C agreement good**: mean diffs a few tenths of a K, StDev ~0 K. Discontinuities mid-2014 and early 2015. For 2015 event, there is a positive step of ~0.5 K in 183.31±1 GHz channel.

- **MetOp-A agreement excellent**: mean diffs & StDevs <0.1 K, 3-month discontinuity near start of record of up to 0.2 K.

- **MetOp-B agreement excellent**: mean diffs & StDev a few hundredths of a K

- **S-NPP agreement poor but very stable**: mean diffs ~1.4 K and ~1.9 K (FCDR is warm), StDev <0.5 but typically much less than this.

Conclusions

- FCDRs for MetOp-A and -B are of very good quality and the data are in almost exact agreement with each other, and with the operational data, except for MetOp-A near the beginning of the record for ~3 months.
- FCDR for S-NPP is also very good and agrees well with MetOp-A & -B: Zonal mean differences between MetOp-A/B and S-NPP do not exceed ±1 K and the differences between SNOs at the poles and their standard deviations are also around ±1 K.
- Thus the large offset between the S-NPP FCDR and operational S-NPP BTs (~1.4 to ~1.9 K; FCDR warm) may indicate a systematic error in the operational S-NPP data.
- An independent assessment of the FCDRs based on SNOs with SAPHIR observations supports the assessment of the MetOp-A, -B and S-NPP.

Conclusions (2)

- FCDRs for FY-3A/B/C appear to be of lower quality than MetOp-A/B and S-NPP. The good agreement (few tenths of a K for FY-3B and -3C, ~1 K for FY-3A) between the FCDRs and operational data suggests some of the issues may originate from the L1a data.
- Results suggest that the FY-3 FCDRs may have a non-linear BT-dependent response.
- All the FY-3 FCDRs have significant discontinuities.
- Total uncertainties for all FCDRs are generally <1 K (very often <0.7 K) and appear to be underestimated, particularly for FY-3.
- Using the QC information typically rejects 5-10% of the FCDR data and appears to successfully remove many ‘bad’ data.

Thank you for listening

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