Geophysical Research Abstracts
Vol. 21, EGU2019-4949, 2019
EGU General Assembly 2019

Consistent Data Records From Microwave Sounders

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We report on the creation of fundamental climate data records from microwave humidity sounders with complete and traceable estimates of stability and uncertainty. By taking several instrumental effects into account that introduced systematic errors, we were able to increase significantly the consistency among the data sets from different satellites. In particular we found strong evidence that radio
frequency interference is the main cause for biases, and we devised a correction scheme on the raw count signals for MHS on NOAA-19 and AMSU-B.

In order to quantitatively characterize the systematic differences of the calibration of microwave sounders on different satellites, we developed a new inter-calibration method based on opportunistic constant target matchups. It combines the advantages of the currently most common methods for characterizing inter-satellite biases, viz. simultaneous nadir overpasses and zonal averages. Besides, we established the Moon, which is observed occasionally by AMSU-B and MHS over the whole mission, as flux reference for microwaves by measuring the variations of its brightness temperature as a function of phase angle with unprecedented accuracy.

The major improvements of our new processing chain for the microwave humidity sounders compared to previous attempts are that:
1. the data come in a ready-to-use NetCDF format,
2. the data sets provide extensive uncertainty information taking into account the different correlation behavior of the underlying errors,
3. inter-satellite biases have been understood and reduced by an improved calibration.

In a second step, we calculated the upper tropospheric humidity (UTH) from the brightness temperatures provided by the new FCDRs. These CDRs illustrate how the improved quality of the input files results in better consistency and traceable uncertainties for the essential climate data records as well. Moreover, we use a revised definition of UTH for the CDR. In contrast to the established definition, it does not depend on the specific instrument channel that is used to measure brightness temperature. This will allow to combine the microwave UTH CDR and a UTH CDR from the infrared radiometer HIRS to one homogeneous long-term data record.

This research was performed within the project Fidelity and Uncertainty in Climate data records from Earth Observation (FIDUCEO, www.fiduceo.eu), which received funding from the European Union's Horizon 2020 Program for Research and Innovation, under Grant Agreement no. 638822.