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Evaluation of SAPHIR / Megha-Tropiques observations – CINDY/DYNAMO Campaign

Gaelle CLAIN (1), Hélène Brogniez (1), Viju John (2), Vivienne Payne (3), and Ming Luo (3)

(1) CNRS, LATMOS, France (gaelle.clain@latmos.ipsl.fr), (2) MetOffice Hadley Center, Exeter, UK (vijuojohn@gmail.com), (3) Jet Propulsion Laboratory, Pasadena, USA (Vivienne.H.Payne@jpl.nasa.gov)

The SAPHIR sounder (Sondeur Atmosphérique du Profil d'Humidité Intertropicale par Radiométrie) onboard the Megha-Tropiques (MT) platform observes the microwave radiation emitted by the Earth system in the strong absorption line of water vapor at 183.31 GHz. It is a multi-channel microwave humidity sounder with 6 channels in the 183.31GHz water vapor absorption band, a maximum scan angle of 42.96° around nadir, a 1700 km wide swath and a footprint resolution of 10 km at nadir.

A comparison between the sensor L1A2 observations and radiative transfer calculations using in situ measurements from radiosondes as input is performed in order to validate the satellite observations on the brightness temperature (BT) level. The radiosonde humidity observations chosen as reference were performed during the CINDY/DYNAMO campaign (september 2011 to March 2012) with Vaïsala RS92-SGPD probes and match to a spatio-temporal co-location with MT satellite overpasses. Although several sonde systems were used during the campaign, all of the sites selected for this study used the Vaïsala RS92-SGPD system and were chosen in order to avoid discrepancies in data quality and biases.

This work investigates the difference – or bias - between the BTs observed by the sensor and BT simulations from a radiative transfer model, RTTOV-10. The bias amplitude is characterized by a temperature dependent pattern, increasing from nearly 0 Kelvin for the 183.31 $\pm$ 0.2 channel to a range of 2 K for the 183.31 $\pm$ 11 channel.

However the comparison between the sensor data and the radiative transfer simulations is not straightforward and uncertainties associated to the data processing must be propagated throughout the evaluation.

Therefore this work documents an evaluation of the uncertainties and errors that can impact the BT bias. These can be linked to the radiative transfer model input and design, the radiosonde observations, the methodology chosen for the comparison and the SAPHIR instrument itself.