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Accessing the contribution of Advanced Technology Microwave Sounder (ATMS) in the Brazilian Numerical Modeling and Data Assimilation System

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The impact of radiance data assimilation from Advanced Technology Microwave Sounder (ATMS) into the Center for Weather Forecasting and Climate Studies of the National Institute for Space Research (CPTEC/INPE), Brazil, is investigated and discussed in this work. The recent discontinuation of the Advanced Microwave Sounding Unit (AMSU-A) in the NOAA series satellites (NOAA-15, 18, and 19) gives the ATMS sensor greater relevance in the process of assimilating microwave radiance data, and this fact is the motivation of this study. The ATMS data used in this study are from the Joint Polar Satellite System (JPSS) series and the National Polar-orbiting Partnership (NPP) satellites. Therefore, understanding and studying the impact of assimilating ATMS sensor radiance channels becomes essential for developing a more realistic numerical weather forecast, especially in extreme atmospheric conditions such as storms, cyclones, and hurricanes. Thus, this work presents results on the impact of ATMS sensor data assimilation on the numerical forecast of Melissa hurricane, which reached category five on October 27, 2025, in the Caribbean Sea, Central America. The Numerical Modeling and Data Assimilation System (SMNA) is used in this study, which is composed of a Gridpoint Statistical Interpolation (GSI) System coupled to the Brazilian Global Atmospheric Model (BAM). Other types of data, such as radiance from AMSU-A data from MetOp (Meteorological Operational satellite programme) satellites, Atmospheric Motion Vectors (AMV) data from geostationary and polar orbit satellites, radio occultation GNSS (Global navigation Satellite System) data, dropsondes, radiosondes, and pilot balloons, were also used in the assimilation process. Different experiments were conducted to explore the radiance channels available in the ATMS sensor and assess their contribution to the improvement of the predictability of the Melissa hurricane. The results reported here are the first using the ATMS data in this center, and they are essential for establishing a consistent radiance database for the assimilation process in the new Brazilian climate prediction model being developed by CPTEC/INPE and partners, the Model for Ocean-laNd-Atmosphere PredictioN (MONAN), in phase of impremention and test.

Keywords: Radiance, ATMS, Data assimilation, Numerical weather prediction, Melissa hurricane.

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