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Simulation of satellite passive microwave observations in rainy atmospheres at Meteorological Service of Canada (MSC).

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The use of SSM/I brightness temperatures (Tbs) in cloudy and rainy skies in data assimilation systems requires that numerical weather preciction (NWP) models have a good skill to simulate clouds and precipitation. In the present study, short-range forecasts (9 and 12 hours) from a research version of the Meteorological Service of Canada (MSC) Global Environmental Multi-Scale (GEM) NWP model are evaluated by comparing simulated and observed SSM/I Tbs. The evaluation is done for two 15-day periods, one in winter and one in summer. Observations from the three DMSP (Defense Meteorological Satellites Program) satellites F-13, F-14, and F-15 are used over open oceans. Firstly, the cumulative impact of various atmospheric constituents (i.e. water vapour, cloud water, liquid and solid precipitation fluxes) on the probability density functions of Tb is evaluated. Secondly, spatial distributions of opacity occurrence based on Tb thresholds for surface detection are compared. Thirdly, simulated and observed Tb histograms are produced for the two periods leading to a qualitative evaluation of the differences. Fourthly, simulated and observed Tb are presented for different case studies. Generally, the results obtained are very similar to those from Chevallier and Bauer (2003) with the ECMWF NWP model. The improved emissivity model of the radiative transfer model (RTM) used to simulate Tbs reduces biases between the observation and the simulation in the vertical polarisation noticed by Chevallier and Bauer (2003). The water vapour of the GEM model is accurately simulated, but the cloud liquid water path appeares overestimated especially in the Tropics. Similarly an overestimation of rain column is also present with the GEM model but is less pronounced that with the ECMWF model. The overall performance of the GEM mesoglobal model is similar to the version of the ECMWF model used by

Chevallier and Bauer (2003). Finally these results are encouraging enough to continue investigations on the assimilation of Tbs in cloudy and rainy skies at MSC.