

***SSMIS Upper Atmosphere Radiance Assimilation:
Preprocessing Requirements and Preliminary Results***

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The SSMIS Upper Atmosphere Sounding (UAS) channel set provides the first operational measurements of microwave radiation emitted by the earth's atmosphere at mesospheric altitudes. The SSMIS receives polarized radiation in the 60 GHz oxygen complex, specifically the 7+, 9+, 15+ and 17+ O₂ lines. Significant hardware and scientific technical challenges arise from microwave temperature sounding of the mesosphere. These include 1) addressing the impact of large Noise Equivalent Temperature Difference (NEDT) associated with narrow channel bandwidths; 2) achieving high channel center frequency stability; 3) compensation of large spacecraft-induced Doppler shift; 4) better characterization the Zeeman splitting of the oxygen absorption lines; 5) development of a fast polarimetric radiative transfer model (RTM). Preliminary global simulation results comparing the fully polarized NRL Line-by-Line (LBL) RTM with the fast RTM including Zeeman effects (CRTM-Z) showed the two models agreed to under a 1.0 K RMS, but the bias patterns indicated both residual geomagnetic and earth rotation Doppler signatures. Earth rotation Doppler signatures were shown to be significant when circular polarized radiation is being measured. The preliminary global simulations were performed using ECMWF analyses merged with COSPAR climatology above ~80 km level, and showed OB-BK biases in the 10-15 K for the highest peaking UAS channels. Results using the fast RTM with Zeeman effects to map the model backgrounds into SSMIS brightness temperatures for both NRL's high-altitude global NWP model (NOGAPS-ALPHA) and the new L70 Met Office global forecast model (model lid at ~80km) will be presented. Details of the SSMIS UAS preprocessing steps required prior to assimilation will also be presented.

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