

Atmospheric effects of radiation belt precipitation over Antarctica

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The effects of a moderate geomagnetic storm in July 2009 have been investigated using a microwave radiometer stationed at Troll, Antarctica (72S, 2.5E, L=4.76). The radiometer operated at 250/230 GHz to give high temporal and vertical resolution of the NO, O₃ and CO column. This data was combined with satellite and ground-based observations over Antarctic stations at Rothera (68S, 68W) and Sanae (72S, 3W). We compare simultaneous measurements of ozone and nitric oxide from a microwave radiometer at Troll, with changes in radar derived mesospheric winds at Rothera and Sanae and hydroxyl nightglow derived temperature and radiance levels observed at Rothera. During the moderate July 2009 storm, we use POES satellite data to identify and analyze the particles that precipitated over Antarctica during the storm. We observe an NO increase spatially and temporally overlapping with an O₃ depletion of 30% between 60 and 80 km altitude. This O₃ depletion lasted for 9 days, and descended to 55 km altitude at a vertical velocity of 1-3 m/s as confirmed by CO descent rates. Coincident with these composition changes we observe a strong increase in mesospheric temperature of 15K. We examine the changes in the atmospheric temperature, wind and hydroxyl radiance in terms of the energy input of the precipitating particles and the observed compositional changes in order to infer the impact of this precipitation on the high southern latitude dynamics.