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Simulations of a mesospheric source of nitrous oxide in WACCM

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The UK Met Office are 'raising the roof' of the Unified Model (UM) from 85 km to 100-140 km. At this increased altitude the impacts of space weather on atmospheric chemistry become more significant. We plan to add a detailed description of the mesosphere/lower thermosphere (MLT) neutral and ion chemistry to this extended UM. The NCAR Whole Atmosphere Community Climate Model (WACCM) has an efficient neutral and ion chemistry scheme that will provide a template for this part of the development.

Nitrous oxide (N2O) is the third most significant greenhouse gas associated with climate change. Additionally, when transported down into the stratosphere, N2O has a significant role in the depletion of ozone. It was previously assumed to only be produced at the Earth's surface, however a mesospheric source has since been identified. This was first postulated by Zipf and Prasad (1982), and more recently Sheese et al. (2016) reported satellite observations of large N2O mixing ratios in the upper atmosphere. The likely mechanism for this is energetic electron precipitation (EPP) which promotes N2 to the excited triplet state, followed by a reaction with O_2. Currently, WACCM does not include this mesospheric source of N2O. As a first stage in this work we will describe the inclusion of this additional source of N2O in WACCM. We will also compare results from WACCM simulations with and without this additional N2O source.