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Modeled E-region nitric oxide response to energetic electron precipitation

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In April 2010, a coronal mass ejection and a corotating interaction region on the Sun resulted in energetic electron precipitation (EEP) influencing the Earth's atmosphere from 50 to 150 km altitude. In this study we investigate the direct and indirect nitric oxide (NO) response to the EEP, using observations from TED and MEPED / POES (Total Energy Detector and the Medium Energy Proton and Electron Detector on the National Oceanic and Atmospheric Administration's Polar orbiting Operational Environmental Satellites), and SOFIE / AIM (Solar Occultation For Ice Experiment / Aeronomy of Ice in the Mesosphere). In comparison to the simulations using the Whole Atmosphere Community Climate Model (WACCM), we find that EEP production of NO in the D-region is well simulated when both medium energy electron precipitation and negative and cluster ion chemistry is included. However, the main EEP production of NO occurs in the E-region, and there the observed and modeled production differ. The pre-storm NO levels are higher in the model than in observations, and the modeled storm time increase is lower than in observations. To investigate the cause of this discrepancy, and to ascertain if this is a general tendency of the model we extend the comparisons to include temperature, transportation and seasonal effects in the observations and model.