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The role of energetic electron precipitation and background dynamics on the seasonal NO variability in the MLT region

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Energetic electron precipitation (EEP) ionizes the Earth's atmosphere and leads to production of nitric oxide (NO) throughout the polar Mesosphere and Lower Thermosphere (MLT). In this study we investigate the direct and indirect NO response to the EEP using the Whole Atmosphere Community Climate Model (WACCM) version 6. In comparison to observations from SOFIE / AIM (Solar Occultation For Ice Experiment / Aeronomy of Ice in the Mesosphere), 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 are included in the model. However, the main EEP production of NO occurs in the E-region, and there the observed and modeled production differ. This discrepancy impacts also the D-region due to downward transport of long lived NO. The transport across the mesopause is seasonally dependent, and WACCM's underestimate of D-region NO is highest during winter when downwelling from above is strong. The drivers of this transport are further investigated by a sensitivity study of WACCM's gravity wave forcing.