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The medium energy electron direct effect on mesospheric dynamics during a sudden stratospheric warming event in 2010

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Medium energy electron (MEE) (30-1000 keV) precipitation enhances the production of nitric (NO_x) and hydrogen oxides (HO_x) throughout the mesosphere, which can destroy ozone (O_3) in catalytic reactions. The dynamical effect of the direct mesospheric O_3 reduction has long been an outstanding question, partly due to the concurrent feedback from the stratospheric O_3 reduction. To overcome this challenge, the Whole Atmosphere Community Climate Model (WACCM) version 6 is applied in the specified dynamics mode for the year 2010, with and without MEE ionization rates. The results demonstrate that MEE ionization rates can modulate temperature, zonal wind and the residual circulation affecting NO_x transport. The required fluxes of MEE to impose dynamical changes depend on the dynamical preconditions. During the Northern Hemispheric winter, even weak ionization rates can modulate the mesospheric signal of a sudden stratospheric warming event. The result is a game changer for the understanding of the MEE direct effect.