



Destruction of the Tertiary Ozone Maximum during a Solar Proton Event

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Ozone observations from the GOMOS instrument on-board the Envisat satellite, launched Mar 2002, together with a coupled ion and neutral chemistry model are used to study the effects of the January 2005 solar storms on the polar winter middle atmosphere. The model results indicate strong enhancements of the ozone destroying HO_x ($\text{H} + \text{OH} + \text{HO}_2$), and NO_x ($\text{N} + \text{NO} + \text{NO}_2$) gases in the mesosphere, and simultaneous ozone depletion maximizing between 70-80km.

During strong proton forcing GOMOS measurements show the destruction of the tertiary ozone maximum, observed at polar latitudes near 72km before the events. This altitude is concurrent with the largest HO_x enhancements in the model results. We observe for the first time the loss of the tertiary ozone maximum, and determine the underlying cause. With subsiding proton forcing GOMOS measurements show the reappearance of the tertiary ozone maximum, returning to normal values by Jan 24. Our results indicate that even moderate solar events like the one in Jan 2005 ($>10\text{MeV}$ proton flux of $>5000\text{pfu}$) can cause significant ozone depletion ($>70\%$) in the middle atmosphere.