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The role of vibrationally excited nitrogen in the formation of the mid-latitude negative ionospheric storms

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Abstract. Millstone Hill ionospheric storm time measurements of the electron density and temperature during the ionospheric storms (15-16 June 1965; 29-30 September 1969 and 17-18 August 1970) are compared with model results. The model of the Earth's ionosphere and plasmasphere includes interhemispheric coupling, the H^+, $O^+(^4S)$, $O^+(^2D)$, $O^+(^2P)$, NO^+, O^+_2 and N^+_2 ions, electrons, photoelectrons, the electron and ion temperature, vibrationally excited N_2 and the components of thermospheric wind.

In order to model the electron temperature at the time of the 16 June 1965 negative storm, the heating rate of the electron gas by photoelectrons in the energy balance equation was multiplied by the factors 5-30 at he altitude above 700 km for the period 4.50-12.00 LT, 16 June 1965. The $[O]/[N_2]$ MSIS-86 decrease and vibrationally excited N_2 effects are enough to account for the electron density depressions at Millstone Hill during the three storms. The factor of 2 (for 27-30 September 1969 magnetic storm) and the & actor 2.7 (for 16-18 August 1970 magnetic storm) reduction in the daytime peak density due to enhanced vibrationally excited N_2 is brought about by the increase in the $O^+ + N_2$ rate factor.

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