Satellite and ground-based observations of auroral energy deposition and the effects on thermospheric composition during large geomagnetic storms: 1. Great geomagnetic storm of 20 November 2003

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Abstract: This report describes thermosphenic composition and particle precipitation changes that occurred during the period of the great geomagnetic storm of 20-21 November 2003, an event that was associated with the passage of a magnetic cloud past the Earth. These changes are compared to those observed during geomagnetic activity on 17 November 2003 and during the intervening quieter period. The data used are obtained from (1) ground-based magnetometers, an imaging riometer, a scanning Doppler imaging Fabry-Perot, and photometers from stations in Alaska, (2) photometers from Canadian sites, (3) NOAA POES and DMSP particle sensors, and (4) the TIMED Global Ultraviolet Imager far UV sensor. The composition changes associated with the input of auroral particle and Joule energy showed larger depletions in atomic oxygen on 20 November than on the other nights and greater changes than are seen in the Naval Research Laboratory Mass Spectrometer and Incoherent Scatter (NRLMSIS) model atmosphere. NRLMSIS does better in reproducing the changes during the great magnetic storm with its long duration auroral energy input than during the shorter time duration geomagnetic activity that occurred on 17 November. During the nights with the largest changes in composition the input of Joule energy dominates over auroral particle energy. It is shown that the particle energy distributions associated with the 20-21 November storm in the period around and after the passage of the magnetic cloud had lower average energies and were enhanced at cargies below 0.1 keV than those that caused auroral displays on the preceding days.

Year: 2008
Source title: Journal of Geophysical Research A: Space Physics
Volume: 113

Issue: 1
Art. No.: A01310
Cited by: 2
Link: Scorpus Link
Document Type: Article
Source: Scopus
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