



Thermosphere Response to Geomagnetic Variability during Solar Minimum Conditions

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The response of thermosphere mass density to variable geomagnetic activity at solar minimum is revealed as a function of height utilizing accelerometer data from GRACE near 480 km, CHAMP near 320 km, and GOCE near 260 km during the period October-December, 2009. The GOCE data at 260 km, and to some degree the CHAMP measurements at 320 km, reveal the interesting feature that the response maximum occurs at low latitudes, rather than at high latitudes where the geomagnetic energy input is presumed to be deposited. The latitude distribution of the response is opposite to what one might expect based on thermal expansion and/or increase in mean molecular weight due to vertical transport of N₂ at high latitudes. We speculate that what is observed reflects the consequences of an equatorward meridional circulation with downward motion and compressional heating at low latitudes. A numerical simulation using the National Center for Atmospheric Research (NCAR) Thermosphere-Ionosphere-Mesosphere Electrodynamics General Circulation Model (TIME-GCM) is used to assist with this diagnosis. At 480 km GRACE reveals maximum density responses at high southern (winter) latitudes, consistent with recent interpretations in terms of compositional versus temperature effects near the oxygen-helium transition altitude during low solar activity.