

The Effects of Differences in Solar Wind Conditions between 1996 and 2008 on the Earth's Upper Atmosphere

Mariah Law

Embry-Riddle Aeronautical University, Daytona Beach, FL

Mentor: Ingrid Cnossen

Location: High Altitude Observatory, Boulder, CO

The recent solar minimum of 2008 was anomalously low and prolonged. During this time, record lows in both neutral and electron densities were observed in the Earth's upper atmosphere. The low extreme ultraviolet (EUV) irradiance levels observed throughout the 2008 minimum can partially explain this, however it may not be the only process operating. The solar wind conditions of 2008 were also different from those of the 1996 solar minimum. Via coupling through the magnetosphere, this difference in solar wind conditions could also have an effect on the upper atmosphere. This study investigates the effects of systematically varied solar wind conditions on the upper atmosphere through numerical simulations with the Coupled Magnetosphere-Ionosphere-Thermosphere (CMIT) model. The simulation results suggest that the higher solar wind velocity in 2008 compared to 1996 may have had a substantial effect on the electron density levels in the upper atmosphere, but at most a minor effect on the neutral density. While the lower solar wind density in 2008 did not have a significant effect on either the electron or neutral density. Interestingly, a higher solar wind speed resulted in higher electron densities by day, but lower electron densities by night. Further analysis will be needed in order to explore these preliminary results in more detail and to investigate differences in other solar wind parameters, such as the strength of the Interplanetary Magnetic Field (IMF).