Geocoronal hydrogen density estimates using solar absorption in the exosphere

Abstract

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The geosynchronous GOES satellites have been making continuous measurements of extreme ultraviolet (EUV) solar irradiance since 2009 at an altitude of 42,000 km. Although the original intent of the GOES EUV instrumentation was to measure solar irradiance, the aim of this study is to use the EUV measurements for a new absorption technique in order to monitor the terrestrial atmosphere. When a GOES satellite is on the anti-solar side of the Earth, it observes the Sun through the geocorona, and exhibits a multi-hour decrease of Lyman-α irradiance of up to 2-7%. This project uses the GOES irradiance measurements and satellite position data for the absorption dips with the Levenberg-Marquardt algorithm in order to calculate the hydrogen density as a function of r (radius from the Earth's center). Although several comparisons of different fits have been made, more work has yet to be done to determine the best fit. In addition, two different satellite position data sets were compared, and were found to be in close agreement with some occasional discrepancies due to the generation method of the data sets. With the continuous operation of GOES satellites, the results from this study should provide the basis for long term monitoring of the hydrogen density distribution in the geocorona and thus, improved atmospheric and plasma models.