The Atmospheric Oxygen, Hydrogen and Helium Responses for the Extreme Geomagnetic Storm of 11 May 2024 over Different Regions

Lake Endeshaw

Department of Physics Werabe University, Werabe, Ethiopia
Department of Space and Planetary Science, Ethiopian Space Science and Geospatial Institute (ESSGI), Addis Ababa University, Addis Ababa,

Geomagnetic storms occur when the Earth's magnetic field interacts with the magnetic fields of the solar wind. Geomagnetic storms have effects on the atmosphere, ionosphere, and magnetosphere. This study analyzes the response of the atmospheric parameters of atomic oxygen, hydrogen, and helium during the extreme magnetic storm of 11 May 2024. The present storm is the most powerful, with a minimum value of Dst -412 nT. The atmospheric oxygen, hydrogen and helium responses during the 11 May 2024 storm are studied by using the empirical atmospheric model of Naval Research Laboratory Mass Spectrometer Incoherent Scatter Extension 2002 (NRLMSISE 2.0) data measurements. To observe the atmospheric parameter responses for the storm, some days before and after the extreme storm day are used with latitudinal variability considerations. The results show that there were anomalies of atmospheric oxygen, hydrogen and helium that occurred some days before, after, and during the storm day of 11 May 2024. The atomic oxygen and helium are increased during the storm day, while the hydrogen is decreased during the main phase of the storm day. The atmospheric model of the NRLMSISE 2.0 accurately captures the anomalies of atmospheric oxygen, hydrogen and helium during the extreme magnetic storm of 11 May 2024.

Keywords Atomic oxygen. Hydrogen. Helium. Geomagnetic storms. NRLMSISE model