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THE EFFECT OF SOLAR CORONAL HOLES ON SKY WAVE PROPAGATION AND VHF WIRELESS COMMUNICATIONS

Abstract

Telecommunication through the sky waves is vital in global navigation systems, automated weather stations, international broadcasting, and many other applications. Its frequency range (from 1.8 to 35 MHz) allows users to connect worldwide using the ionosphere, which bends them back to Earth. The ionosphere is formed due to the Sun's UV radiation, and it is affected by solar conditions, including sunspots, solar flares, and the coronal holes that emerge on the Sun's outer layer, allowing the solar wind to escape, regardless of the Sun's phase in the solar cycle. Usually, geomagnetic storms follow the coronal hole development and last several days. This kind of storm directly affects the propagation of the sky waves with some associated variations in the Very High-Frequency (VHF) band characteristics. One of the signs of the geomagnetic storm's occurrence is a rapidly increasing ionospheric D-layer absorption over the polar regions, which then extends to the temperate latitudes. The same effect is usually observed when the coronal mass ejections (CME) arrive at Earth's upper atmosphere. The disturbance of most geomagnetic storm types could be detected using an HF receiver attached to a skyward directional antenna. The solar radio spectrometer located at the Sharjah Academy for Astronomy, Space Sciences, and Technology (SAASST) detects the impact of this kind of geomagnetic storm on the sky wave propagation as erratic patterns that appeared on both radio and audio-converted spectrograms. This study is based on radio observations from 17-47 MHz that cover the period from January 2022 to June 2024, which is close to the peak of the 25th solar cycle.