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Mediterranean D-region ionosphere response to solar flares events

Solar flares significantly ionize the neutral atmosphere, leading to increases in the electron density of the ionosphere. This ionospheric disruption impacts the Earth-Ionosphere waveguide, affecting electromagnetic signal propagation between transmitters and receivers. Such ionization-induced perturbations can be observed as fluctuations in the signal amplitude and phase, and thus can be used to estimate the changes in electron density. In this study, we examine the response of the D-region of the lower ionosphere to solar flares by analyzing the Very Low Frequency (VLF) signals emitted by two separate transmitters in the Mediterranean Sea. By combining signal analysis with the Long Wave Propagation Capability (LWPC) code, we simulated the resulting signal perturbation parameters (amplitude and phase) and obtained an increase in electron density. This approach offers insights into the complex interactions between the solar flares and the ionospheric, which is important for communication and navigation systems.

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