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Space Weather driven electron density spatial scales in the Martian Ionosphere.

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Mars is an unmagnetized planet with small crustal magnetic regions in the southern hemisphere, which give rise to regions called mini-magnetospheres, but as a whole, planet Mars is not protected from the solar wind. The solar winds directly interact with the upper atmosphere of Mars, which leads to the stripping away of the atmosphere. During active space weather conditions, like the flares and particularly the impact of CMEs, this effect can be enhanced as the charged particles penetrate the lower parts of the ionosphere. In a general scenario, the CME wavefront compresses the ionosphere [1], resulting in the redistribution of electrons with enhancement in density and temperature; such conditions are favorable for the generation of plasma instabilities and can lead to the formation of ionospheric irregularities. As an unmagnetized planet, the Martian ionosphere is turbulent even in low solar active conditions, which can be observed as ionospheric irregularities are the density perturbations over background density; low background neutral density on Mars reduces the collisional effect; hence, density perturbations can be seen prominently in the magnetic field data as the electrons are frozen to the magnetic field [2]. However, in solar active conditions, such plasma instability-driven irregularities show enhancement and lead to the generation of small-scale structures. Though the electron density is a scalar quantity, its property of freezing with a magnetic field gives density a directional property. In this study, the spatial scales of electron densities are computed for quiet and disturbed days. Such information is important as the small-scale irregularities are a potential source of degradation to the radio signals traversing through them.

References:

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