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Solar Eclipses and Ionospheric Effects: Some Historical Perspectives

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ABSTRACT

The upper most part of the Earth's atmosphere consists of the gas molecule and atoms which interact with the ultraviolet and X-ray radiations coming from the Sun. This interaction results in the ionization of gases resulting in the creation of large number of free negatively and positively charged particles. Such a region of the atmosphere, where ionization of gases takes place is called the Ionosphere. The ionization phenomena vary with solar intensity, solar cycle and season. Apart from external factors like solar disturbances the dynamics of ionosphere is also controlled by internal processes taking place within the ionospheric plasma itself. Since the internal and external disturbances take place simultaneously it really becomes very difficult to isolate the effect due to a single factor. Since during total solar eclipses major portion of solar radiation is blocked therefore such events provide us unique opportunity to study the internal dynamics of ionosphere in the absence of external factors. In this article we review the various studies that have been carried out to study the effect of solar eclipses and behavior of ionosphere during these events.

Keywords: X-Rays, Plasma, Solar Eclipse.

1. Introduction

A solar eclipse provides us with a rare opportunity to study the ionospheric effects associated with an accurately estimated variation of solar radiation during the eclipse period. Ionospheric phenomenon occurs naturally and as such, all processes usually act simultaneously but with varying degree of importance. It therefore becomes very difficult, most of the time, to sort out and isolate the causes and effects from the observed experimental data without some degree of ambiguity. The problem is compounded by the fact that the involved ionospheric processes are numerous, these include ionization, chemical reaction, ambipolar diffusion, buoyancy forces, electrodynamic drift, thermalization, neutral wind effects etc. The ionization process undergoes rapid predictable changes during the solar eclipse, a rare event and is unencumbered by the slow transition of solar rays through low elevation angles such as at sunrises or sunsets. For this reason, the ionospheric measurements during solar eclipses are of Great interest.
Since the main causes of ionization is believed to be the ultraviolet light and the neutral wind corpuscles from the Sun, the solar eclipse effects on the ionosphere has drawn keen attention of the observers throughout the world. These observations have led to the conclusion that regions E and F_1 are apparently affected by the light, the principal ionizing agency in these regions is ultra-violet light, whereas in region F_2 ultra-violet