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The statistical investigation of amplitude Scintillations at Indian high latitude Station Maitri, Antarctica

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Abstract. We have investigated the occurrence characteristics of ionospheric scintillations, using dual frequency GPS receiver, installed and operated at Indian scientific base station Maitri (71.45S and 11.45E) Antarctica, during December 2009 to December 2010. The scintillation morphology is described in terms of S4 Index. The scintillations are classified into four main categories as Weak (0.2<S4<0.4), Moderate (0.4<S4<0.6), Strong (0.6<S4<1.0) and Saturated (S4>1.0). From the analysis we found that the percentage of weak, moderate, strong and saturated scintillations were 96%, 80%, 58% and 7% respectively. The maximum percentage of all types of scintillation was observed in the summer season, followed by equinox and the least in winter season. As the year 2010 was a low solar activity period, consequently the maximum occurrences of scintillations were those of weak and moderate and only four cases of saturated scintillation were observed.

1. Introduction

The structure of the auroal and high latitude ionosphere is very complicated and varied. Dramatic changes take place very frequently in the auroral and polar regions. In this region, irregularities at different scale are quite common, which cause phase and amplitude fluctuations in the trans-ionospheric signals as these signals encounter the irregularities. The amplitude and phase fluctuations of radio signals are commonly referred to as scintillations. The ionospheric scintillation is a very important parameter for describing the morphological features of ionosphere. The ionospheric disturbances or irregularities produce significant effects on satellite signals used for communication and navigation; hence disturb communication and navigation applications. Therefore scintillation studies involving trans-ionospheric propagation is of considerable interest in understanding the physical processes controlling high latitude ionospheric dynamics viz. generation and transport mechanisms of ionospheric irregularities, soft particle precipitation with energies approximately 100eV, penetration of magnetospheric electric fields and auroral current systems [1].

A number of studies, concerning the GPS scintillations at high latitudes, have been conducted in the recent past [2, 3]. Using GPS observations from 11 high-latitude stations, Aarons [4] noted that phase fluctuation activity has a daily pattern mainly controlled by the motion of the receiver location into the auroral oval. De Franceschi et al. [5] using the observations from a chain of GPS ionospheric scintillation and TEC receivers in Northern Europe during the storm events of 30