OCCURRENCE OF MAJOR GEOMAGNETIC STORMS AND THEIR RELATION WITH PLASMA PARAMETERS, INTERPLANETARY MAGNETIC FIELD PARAMETERS, AND GEOMAGNETIC INDEX DURING SOLAR CYCLE 23

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ABSTRACT

A geomagnetic storm is a temporary disturbance of the Earth's magnetic field which is magnetosphere usually occurred due to a disturbance in the interplanetary magnetic field (IMF). There are many parameters that can play role in the form of geomagnetic storms. Some of the parameters do play significant role in disturbance time index (Dst) morphology while some do not play significant roles. In this study, some parameters were analyzed to see their roles in the Dst morphology and hence can indicate the parameters that can be used to predict the storms. Three major geomagnetic storms were observed during three phase of the solar cycle. This paper investigates the relationship that exist among the following interplanetary magnetic field (IMF) parameters: (Bz, By, Bt), and the geomagnetic index (GI): (Kp, Dst. Ap, Ae) alongside with the plasma parameters: (T, D, V) during major geomagnetic storms. In this study, major geomagnetic storms were indicated by Dst index below than -200nT. All the data were taken from OMNIWeb Data Explorer. The relationship between IMF parameters, GI, and plasma parameters with disturbance time index (Dst) was studied. The periods of minimum phases of solar cycle 23 are between 1996-1998 and 2004-2006 while maximum phase is during 2000-2001. A correlative study between the geomagnetic indices and the peak of various plasma and field parameters during major geomagnetic storms of solar cycle 23 also presented. From this study, it shows that some parameters used play moderate role ($0.3 < r < 0.5$) in Dst morphology and some do not play significant role.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW OF STUDY

Geomagnetic storms is a temporary disturbance in the Earth's magnetic field caused by coronal mass ejections (CMEs) or solar flare from the Sun. CME is a giant bubble emitted from the Sun to surroundings. Solar flare will increase the magnitude of solar wind tremendously. The increase in the solar wind pressure will compresses the magnetosphere and the solar wind's magnetic field will interact with the Earth's magnetic field and transfer an increased amount of energy into the magnetosphere [1]. Geomagnetic storms can cause damage to technology on Earth including satellite navigation signals and aircraft communication. The solar wind carries with it the magnetic field of the Sun and when it enters to the interplanetary medium is called as interplanetary magnetic field (IMF)

The storms generally occurred due to abnormal conditions in the interplanetary magnetic field (IMF) and solar wind plasma emissions caused by various solar phenomenons [2]. The Bt value of the IMF indicated the total strength of the IMF. The higher this value, the better it is for enhanced geomagnetic conditions [3]. The IMF is a vector quantity with a three axis component, two of them are (Bx and By) are orientated parallel to the ecliptic. The third component, the Bz value is perpendicular to the ecliptic and is created by waves and other disturbances in the solar wind. Several authors have pointed out the high probability of intense storms being triggered during the southward interplanetary magnetic field (IMF) [4]. It is usually assumed that the peak value of the storm, as measured by Dst index, is obtained after the southward component of IMF, Bz has also reached peak value [5].