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Innovation The Research Concept

Study of solar features and transients in association with geomagnetic storms

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Abstract

Fifty nine geomagnetic storm sudden commencement (SSCs) with planetary index (Ap) ≥20, peak value of disturbance storm time (DST) index < -50 n T and horizontal component of Earth magnetic field (H)≤250γ have been identified for the period 1978-1994 and their possible solar causes are looked upon. It is noticed that the coefficient between II, IV radio spectral burst, radio flux with sun spot number have been found to be >0.7 for study period of each solar cycle. Further, it is found that the GMSs and SSNs are high **correlated during** 22nd Solar cycle. Solar features e.g. Hα, X-ray solar flares and active prominence and disappearing filaments (APDFs) have been found to occur more in lower helio latitude regions and produce interplanetary shocks that may lead to the occurrence of SSCs at the Earth. The major SSCs (66% of the fifty nine SSCs) are caused by coronal mass ejections (CMEs) and the shocks that they generate. The **ejecta** is intercepted only when the solar event (Hα, X ray solar flares) originates with the 40° of the Sun's central meridian (helio latitude range). Further, it is found that, there is an symmetry in the distribution of APDFs in both northern and southern helio latitude regions. The transit time of solar event from the sun to the near Earth space lies in between 53 to 126 Hrs.

Key Words : Sun spot Numbers, geomagnetic storms, Solar flares, coronal **mass ejection, Π,** IV radio burst, radio flux, solar cycle.
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Introduction

Solar research of the last few years has revealed the kind of flares most closely associated with phenomena occurring in the high corona and the interplanetary medium namely soft x ray long duration events. They are found to be associated with optical ≥ 1 flares, coronal mass ejections [1], metric type II and type IV burst [2]. Although the physics of long duration events has yet to be understood, the empirical results are useful in identifying the kinds of solar flares responsible for interplanetary shock my lead to the occurrence of geomagnetic storms. CMEs from the Sun derive solar wind disturbances in terms of magnetic field, speed, density which in turn cause magnetic disturbances at the Earth. In early studies, interplanetary solar wind data, particle data have been used to indirectly infer the nature of solar sources of geomagnetic storms [3, 4, 5, 6]. There are in general two kinds of solar sources namely, CMEs and co rotating interaction regions (CIRs). The CMEs counter parts in interplanetary space can be verified by various solar wind signatures including magnetic clouds [7] and bidirectional electron fluxes [8]. Interplanetary CMEs are geoeffective because of either the enhancement of an interplanetary magnetic field compressed by CME driven shock or the presence of strong magnetic fields carried by CMEs themselves or both [9]. The CIRs are compressed solar wind structures that occur when a fast speed stream originating in open magnetic **field** coronal holes catches up with a preceding slow speed stream originating from a relatively closed **magnetic** structure [10].

Geomagnetic **disturbances** are generally represented by geomagnetic storms (GMSs) , sudden ionospheric disturbances (SIDs) and ground level enhancement (GLEs). GMSs can **be** classified in two ways;such as storm gradual commencement (SGCs) and SSCs. SGSs arise from magnetically open long lived, high speed solar wind streams (HSSWs) emitted from coronal holes and are usually small in magnitude. SSCs are associated with flare generated stream and are