Coronal Mass Ejections may increase ozone hole

S. MUKHERJEE, A. MUKHERJEE

School Of Environmental Sciences, Jawaharlal Nehru University, New Delhi-110067, India

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Abstract. Coronal mass ejection (CME) is being correlated with the increase in ozone hole in the upper part of the atmosphere. In most of the times earth directed CMEs produces auroras, which are visible in Polar Regions of the earth. During the Solar Maximum it has been observed that the ozone holes are increasing continuously. Intermittent earth directed CMEs were observed with the fluctuation in solar flux. Actual measurements show a linear relationship in between CMEs and increase in Solar UV. It was discovered that UV increases on earth on those days when the CMEs are earth directed. Data of UV-A and UV-B irradiance of various parts of Delhi were correlated with CME for a span of more than one year. It can be inferred that increase in UV is due to effect of CME on stratospheric ozone layer, which protects earth from UV radiation.

Key words: solar-terrestrial relations – ozone hole

1. Introduction

Catastrophic Weather and Climatic Change, considers the violent meteorological events that seem to be occurring with the increase in Sunspots and earth-directed Coronal mass ejection. Ozone hole increase and increase in UV-B on different parts of the earth being correlated since decades. The observation that the electron flux due to CME and temporary destruction of ozone layer resulting increase in UV-B reaching on earth is a matter of great concern. Anthropogenic activities are also aggravating the destruction of ozone layer. The cumulative effect of anthropogenic activities and anomalous irradiance from Sun during earth directed CME are responsible for the fast depletion of the ozone layer during solar maximum. During the prolonged phase of low electron flux from the Sun due to absence of earth directed coronal mass ejection the reversible reaction takes place. Ozone layer again forms ,or in other words nature heals up the ozone holes. Occurrence of sunspots, earth directed CME and latitudinal differences of ozone hole and UV irradiance were studied in Russia (Garadzaha,1987), Malayasia (Ilyas,1987) Turkey (Dihmac et.al., 1996) and New Zealand (Zheng,1993). Geographical variations of ground-level UV-radiation has been studied by Scotto (1998) and Cotton (1990).

Correspondence to: dr.saumitramukherjee@usa.net

2. Correlation of electron flux during CME and increase in UV

There are two types of solar events which affect the magnetosphere by sending a shock front through the solar wind. One is called a solar flare and the other a CME. We do not know the relationship between them, but they both send out a shock front and particles that are accelerated in the solar wind. 2 to 5 days later, the effect is felt at the magnetosphere when the magnetic field lines in the solar wind are distorted and connect with the magnetic field lines of the Earth. This connection and the motion of the particles across the field sets up an electric field and generates electrical currents that are closed through the ionosphere, which is the load in the circuit. The magnetic field associated with the current flowing in the ionosphere in the disturbance field. Kp is a measure of that disturbance. We do not know the processes well enough to be able to calculate the Kp we expect from any configuration of the solar wind when it reaches Earth. Generally speaking, the larger the solar event, described by the initial shock velocity, and the duration of the event, the larger and longer lasting the disturbance to the magnetosphere and the larger Kp is measured.

The cause and mechanisms of ozone depletion are therefore a topic of intense scientific research .Molecular compounds involved atmospheric heights using NASA solar flux data (Pathak,S.K. and Mason N.J , 2002)

References

Cotton, G.F. (1990): Robertson-Berger UV-B meter. In : Summary Report 1989, Climate Monitoring and Diagnostics Laboratory Report No.18. National Oceanographic and Atmospheric Administration, Boulder, Colorado, December1990.

Dihmac, S., Topcu, S. and Akman, M.S. (1996): A study of solar ultraviolet radiation at Istambul. Energy, 21, 189-195.

Garadzha, M.P. and Nezvel, Ye.I. (1987): Ultraviolet radiation in large cities and possible ecological consequences of its changing flux due to anthropogenic impact. In: Proc. Symp. On Climate and Human Health. World Climate Programme Applications, WCPA Report No.2, Leningrad, 64-68

Ilyas, M. (1987): Effect of cloudiness on solar ultraviolet radiation reaching the surface. Atoms. Env. 21, 1483-1484.

Pathak, S.K., and Mason , N.J., (2002) . Modelling studies of ozone depletion compounds and atmospheric sink compounds. Proc. ICPEP-2 4-9 February 2002, pp10.

Scotto, J., Cotton, G., Urbach, F., Berger, D, and Fears, T. (1988): Biologically effective ultraviolet radiation: Surface measurements in the United states, 1974 to 1985, Science, 239,762-764.

Singh, B.K. (1997). UV levels and estimation of aerosols in the ambient environment of Delhi. Unpublished Ph.D . Thesis pp59-60.

Zheng, X. and Basher, R.E., (1993): Homogenisation and trend detection analysis of broken series of solar UV-B data. Theo.Appl. Climatol. 47, 189-203.