Long-term Correlative Study of the Geomagnetic Activity and Interplanetary Parameters on 27- Day Average Basis

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In-situ measurements of interplanetary plasma and magnetic field parameters began in late 1962, which by now cover more than four solar cycles. These observations, including the most commonly used solar activity index Rz(the sunspot number), have helped in establishing several useful statistical relationships between them. The product of V and B (VB) has recently been reported to be the most effective interplanetary parameter yielding the highest correlation with geomagnetic field disturbance indices such as Ap, even though earlier studies covering different intervals of time had either advocated for V, or for some other combinations. For the reported very long-term correlative study, we have used the 27-day average values of the interplanetary indices (V, B, Bz, T, and N), as well as that of the Ap index, for the years 1965 to 2008. The averages have been calculated by choosing only those days for which simultaneous data is available for all these parameters (V, B, Bz, T, N and Ap). The statistical results so obtained for the whole period, can be summarized as: (1) that the sunspot number Rz is strongly correlated only with the IMF magnitude B. Even the product VB is only marginally associated with Rz. (2) that only solar wind speed V is strongly associated with its temperature, whereas even marginal correlations are not observed amongst other interplanetary parameters either for the whole period or for the individual solar cycles. (3) that the Ap index is found to be equally affected by the parameters V, B and T ($r \approx 0.67 \pm 0.03$) for the whole period, as well as for many of the individual solar cycles. (4) that the Ap index is always very strongly correlated with the product VB, with the correlation coefficients as high as 0.86±0.01, for the solar cycle 23. As such our results indicate that the product VB is the most effective parameter in generating geomagnetic disturbances, even when considered on 27-day average basis. Similar results were reported earlier on a day-to-day basis, as well as on the yearly average basis.