PLANETARY SCIENCE

Effect of Sunspot Activity on F-region Drift Speed at Waltair

BRIGGS[1] has reported the variation of the night-time north–south component of F-region drift at Cambridge (52° N., 0° E.) from a southward direction during a sunspot maximum to the northward direction during a minimum. This result highlights the importance of a study of long-term variations of drift parameters with a view to studying the effect of solar activity and verifying existing theories. Morriss and Lyon[2] at Ibadan (7° N., 4° E.) reported a general decrease in wind speed with decreasing solar activity and showed that there was no marked change from the International Geophysical Year (IGY) to the International Year of the Quiet Sun (IQSY) in the diurnal variation of the east–west component. Results from Waltair show a decrease in the wind speed with decreasing solar activity. All the investigations mentioned were carried out using similar fades analysis.

This communication gives the results of a correlation analysis of F_2-region drifts for 6 years from IGY to IQSY. Drift records from a spaced receiver equipment on 4·2 to 5·6 MHz for winter months were analysed and included 2·4 MHz night-time reflexions. Round the clock observations were taken for about 6 days, including the world days in each month. Care was taken that the height of reflexion was the same throughout the observations. The results were obtained by the complete correlation technique originated by Briggs *et al.*[3] and subsequently modified by others; the correlation matrices were obtained on the *CDC*-3600 digital computer.

In Fig. 1 the average values of drift speeds V_a, V and V_c are plotted for the decreasing solar cycle from 1957 to 1964. The apparent velocity V_a (Fig. 1*a*) shows an initial decrease with solar activity, as was also the case with the values obtained by similar fades analysis at this station, but as the IQSY is approached there is evidently a marked increase in this parameter. The true velocity V (Fig. 1*b*) increases continuously with decreasing solar activity, and the same is the case for the random velocity V_c (Fig. 1*c*), the increase from IGY to IQSY being greater for the latter. The difference between the true and apparent directions $|\varphi - \varphi_a|$ (not reported here), which serves as a discrepancy factor between the true and apparent velocities, is considerably higher during the IGY and seems to be partially responsible for the difference in the behaviour of V_a and V at that time. Considering the overall behaviour of V, V_c and V_a there is a definite increase in the velocity during years of low solar activity, a result which is just the opposite to that in the E-region, where there is a continuous decrease in drift speed from IGY to IQSY.

This increase in the horizontal drift in the F-region during low solar activity is explicable if we identify the observed drift with the movements considered by Kohl and King[4], with ion-drag as the main retarding force. According to them, if the driving force remains constant, atmospheric winds will have greater velocities at sunspot minimum when there will be a small ion-drag opposing the movements. As an illustration they cite the observation made by King-Hele[5] that the atmosphere rotates with an angular velocity increasing from 1·2 to 1·4 times that of the Earth from IGY to IQSY. Further evidence comes from the behaviour of F-region drift at low and high latitude stations during a magnetic storm. In a recent survey, Rao[6] observes that at low latitudes there is a decrease in drift speed with increasing magnetic activity accompanied by an increase in the sub-peak electron concentration. At high latitudes, however, the drift increases with increasing magnetic activity when a simultaneous decrease in electron concentration is reported. The marked reduction in air densities observed from satellite data by King-Hele and Quinn[7] from IGY to

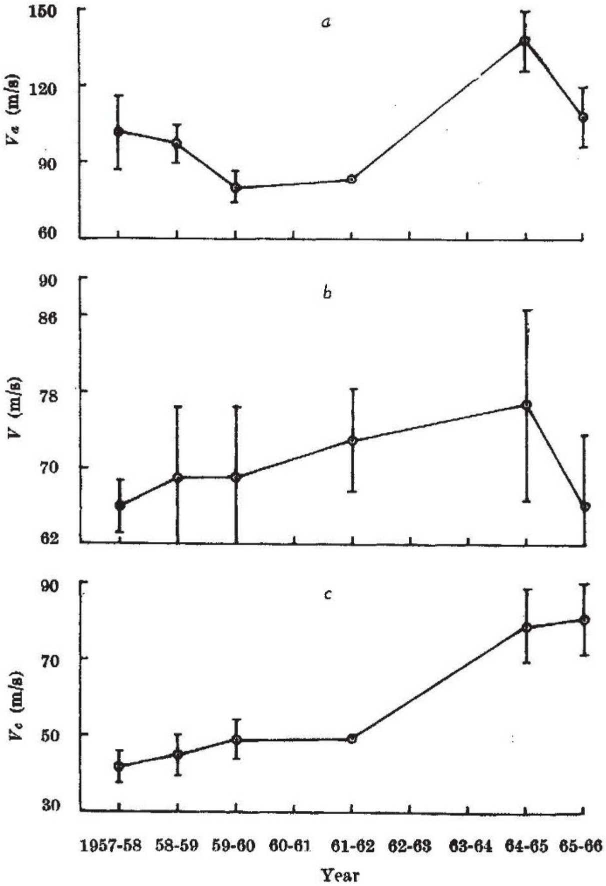

Fig. 1. Sunspot variation of V_a (*a*), V (*b*) and V_c (*c*) for F-region.

IQSY also supports this view. A detailed paper embodying the results of long-term variations of drift parameters and their theoretical interpretations will be published elsewhere.

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New Value for the Solar Constant of Radiation

THE solar constant of the Earth is the extraterrestrial flux of the Sun's energetic radiation integrated over all emission wavelengths and referred to one astronomical unit (AU). An accurate knowledge of this quantity and of its spectral components is an important requirement in the design of spacecraft, where the problems of maintaining the desired radiative equilibrium temperatures are especially difficult in voyages differing considerably from those of Earth-orbiting satellites. A related problem is the testing of these vehicles in space simulation systems.