Interplanetary shocks and sudden impulses in solar maximum (2000) and solar minimum (1995-1996)

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In this work a study is presented on the correlation between fast forward interplanetary shock parameters and sudden impulse (SI) amplitude in the H-component of the geomagnetic field, for periods of maximum (2000) and minimum (1995-1996) solar activity. Solar wind temperature, density and speed, and total magnetic field, as well static (thermal and magnetic) and dynamic pressures, were calculated in the upstream and downstream sides of the shock. The variation of the solar wind parameters and pressures was then correlated with SI amplitude. For the solar wind pressures, the difference between upstream and downstream square root values was taken, because in the balance pressure expression, the solar wind pressures are equal to the geomagnetic magnetic field pressure, that is proportional to the square magnetic field (and squared SI amplitude). The solar wind speed have showed good correlations with sudden impulse, with correlation coefficients higher than 0.70 both in solar maximum and solar minimum, whereas the solar wind density presented a poor correlation. The better correlated parameter with SI was the square root dynamic pressure variation, showing a higher correlation in solar maximum (r = 0.82) than in solar minimum (r = 0.77). The correlations of SI with square root thermal and magnetic pressure was lower than with the dynamic pressure, but they also present a good correlation, with r > 0.70 both in solar maximum and minimum. Multiple correlation anaylsis of SI in terms of the three pressure terms resulted in that 78% and 85% of the variance in SI at solar maximum and minimum, respectively, are explained by the three pressure variations. Average sudden impulse amplitude was 25 nT in solar maximum and 20.9 nT in solar minimum, while square root dynamic pressure variation is 1.2 nPa1/2 at solar maximum and 0.9 nPa1/2 at solar minimum. Thus on average, fast forward interplanetary shocks are 33% stronger (in therms of squared root dynamic pressure variation) in solar maximum than in solar minimum, and the magnetospheric SI response had an amplitude 20% higher in solar maximum than in solar minimum.

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