A HIDRODYNAMICAL MODEL FOR CORONAL MASS EJECTIONS IN THE INTERPLANETARY MEDIUM AND SOME DATA COMPARISON

Andrea I. Borgazzi (1), M. VIRGINIA ALVES (1), Alejandro Lara (2), Ezequiel Echer (1)

(1) Instituto Nacional de Pesquisas Espaciais, INPE, Av. dos Astonautas, 1758, 12227-010, S. J. dos Campos, SP, Brazil
(2) Instituto de Geofísica, UNAM, C.U. México, D.F. 04510

We present a model to describe the interplanetary coronal mass ejections (ICMEs) dynamics in their travel from Sun to Earth. The model is based on the assumption of momentun transfer between ICMEs and the surrounding solar wind that decelerate the fast ICMEs (Vcme > Vsw). In this case, the deceleration involves viscous forces acting between the ICME and the surrounding medium. In our model we include the variability of the mass density of the medium as well as the variability of the CME radius. The obtained result is the speed behavior of the ICMEs versus traveled distance. The solution of the differential equations is found considering different expressions for the viscous force. In this work we present the analytical solutions and compare them with observed parameters for a selected group of events. The observed parameters we consider in our analyses are: initial speed of CMEs, final speed of ICMEs, travel time from Sun to the observation point, and solar wind speed. We also consider the ICME mass, the variation of the interplanetary density, the exponent of radial expansion of the ICME, and the drag coefficient (or the kinematic viscous coefficient). The best values for the latest parameters are obtained trough an iterative procedure, where only one parameter is varied until a valid solution is found. We also show that our model qualitative agrees with observations of Type II bursts as well as with existing empirical models.

coronal mass ejections; transport in the interplanetary medium; drag force

M. Virginia Alves, INPE, virginia@plasma.inpe.br, voice: +55-12-3945- 6049; FAX: +55-12-3921-6455