A combined analysis of the magnetic cloud on 15-16 May 1997 and its solar source region

M.S. Nakwacki[1], G. Attrill[2], S. Dasso[1,3], C.H. Mandrini[1], L. van Driel-Gesztelyi[2,4,5], L.K. Harra[2], and J. Wang[6].

(1) Instituto de Astronomía y Física del Espacio (IAFE), Argentina
(2) University College London, Mullard Space Science Laboratory, U.K.
(3) Departamento de Física, Facultad de Ciencias Exactas y Naturales, UBA, Argentina
(4) Observatoire de Paris, LESIA, France
(5) Konkoly Observatory of the Hungarian Academy of Sciences, Hungary
(6) National Astronomical Observatory, Chinese Academy of Sciences, Beijing, China

Coronal Mass Ejections (CMEs) are the most important short-lived agents that transport magnetic flux from the Sun to the interplanetary medium. Thus, detailed studies of the solar sources of CMEs and the associated magnetic clouds (MCs) are an important key to understand and constrain solar and interplanetary models. We analyze the magnetic structure of the MC observed on 15-16 May, 1997, by the spacecraft Wind, and its associated solar event, a C1.3 long duration event that occurred on 12 May, 1997, in AR8038. Two main dimming regions that exhibit an asymmetric temporal and spatial evolution were observed in association with this event. We compute the magnetic flux in the dimmings and follow its evolution using magnetograms from the Michelson Doppler Imager (SoHO/MDI). The MC structure is inferred using three different helical cylindrical models with a significantly different radial twist distribution. We also take into account the asymmetry observed between the front and the rear part of the cloud. We fit the free parameters of each model, comparing models with in situ observations. Then, we estimate the flux across the surface perpendicular to the axis of the cylinder and the flux across the surface formed by this axis and the cloud radial direction. Finally, we compare the MC total flux with that corresponding to both observed dimmings. By combining our interplanetary measurements and the dimmings flux evolution, we propose a topological model for the 12 May eruptive event. We discuss the constrains set by solar observations on MC models and unknown dimensions and, viceversa, how our interplanetary analysis supports our proposed solar scenario.