

A new method to determine the boundary of magnetic clouds

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Magnetic clouds (MCs) are transient structures formed by magnetic flux ropes with low proton temperature and strongly enhanced magnetic field intensity (with respect to ambient values). The identification of the MC boundaries is an open question for some clouds, mainly because different proxies can provide different positions. In this paper we analyze the magnetic cloud observed by the spacecraft Wind on October 18-20, 1995, a cloud previously studied by several authors. The front of this cloud seems to be relatively well determined from plasma and magnetic data. However different authors set the rear boundary at different times. We present a new method that determines the centre and the rear boundary of a flux rope, when the front boundary is well known. It is based on the azimuthal magnetic flux conservation. We deduce that the leading flux of the analyzed magnetic cloud had reconnected with the overtaken solar-wind magnetic field. Then, we estimate the magnetic flux associated with the full cloud before it reconnects with the solar wind. Finally, we evaluate the sensitivity of our results using different models, methods and magnetic-cloud boundaries applied to the same magnetic cloud data.