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Importance of the magnetic field cone angle in magnetic clouds

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The properties of magnetic clouds (MCs) observed by either ACE or Wind in L1 from 2000 to 2014 are investigated. The results obtained for their basic properties, such as the average density, velocity and magnetic field intensity, are consistent with previous studies. We then focus on the orientation of the magnetic field inside MCs. We find that in most cases the direction of the MCs' magnetic field departs from that of the Parker-spiral interplanetary magnetic field usually encountered during quiet times. As a consequence, the position of the quasi-parallel and quasi-perpendicular regions of the Earth's bow shock will differ from the textbook picture (quasi-parallel on the dawnside, quasi-perpendicular on the duskside). The distribution of the different shock geometries along the shock's surface can have a strong impact on the solar wind-magnetospheric coupling (e.g. asymmetries in the magnetosheath, modification of the MCs' magnetic structure...). Using events during which observations inside the magnetosheath are available and with the help of a magnetosheath model, we obtain an estimate of the Θ_{Bn} angle, between the shock normal and the upstream magnetic field, encountered upon entering the magnetosheath. We show that for a given cone angle, the magnetosheath observations are associated with only a limited range of Θ_{Bn} values. Therefore, it appears that the cone angle gives a good approximation of the encountered shock configuration. In the context of space weather forecasting, we discuss the importance of predicting not only the Bz component of the magnetic field inside MCs, but also the other components and in particular the Bx component, as they affect the position of the quasi-parallel and quasi-perpendicular regions of the terrestrial bow shock, which in turn influences the driving of the magnetosphere.