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Characteristics of magnetised plasma flow around stationary and expanding magnetic clouds

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Studies of interplanetary magnetic clouds have shown that the characteristics of the region ahead of these objects, which are moving away from the Sun in the solar wind, play a role in determining their geo-efficiency, i.e. the kind and the degree of their effects on the Earth environment. Therefore, our main goal is to model and study the plasma parameters in the vicinity of interplanetary magnetic clouds. To this end we present a model in which the magnetic clouds are immersed in a magnetised plasma flow with a homogeneous magnetic field. We first calculate the resulting distortion of the external magnetic field and then determine the plasma velocity by employing the frozen-in condition. Subsequently, the plasma density and pressure are expressed as functions of the magnetic field and the velocity field. The plasma flow parameters are determined by solving the time-independent ideal MHD equations for both the stationary regime and for the case of an expanding cylindrical magnetic cloud, thus extending previous results that appeared in the literature.