The magnetic field draping direction at Mars

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Unlike the Earth, Mars has no inner dynamo to create a major global magnetic field. This, however, does not mean that Mars does not have a magnetosphere; simply the magnetosphere of Mars is far less extensive than that of the Earth. The Martian magnetosphere is formed through the interaction of its atmosphere with the solar wind. Since the magnetic field lines carried by the solar wind cannot pass through electrically conductive objects, they drape themselves around the planet's ionosphere, creating a magnetosphere. The draping direction around the planet depends on the direction of the Interplanetary Magnetic Field (IMF), which in turn controls the direction of the electric field in the solar wind. As a result, the draping direction of the magnetic field can tell us about the direction in which planetary charged particles move or escape. Using data from the magnetometer and electron reflectometer instruments (MAG/ER) on the Mars Global Surveyor spacecraft (MGS) and the Magnetometer (MAG) on the Mars Atmosphere and Volatile EvolutioN spacecraft (MAVEN), we study the draping of the magnetic field at Mars. Since the spacecraft are not always out in the undisturbed interplanetary magnetic field (IMF), we use the draping of the magnetic field direction as an indication to tell us about the direction of the IMF. We derive the draping direction by computing the azimuth angle of the horizontal component of magnetic field above a specific region in the northern hemisphere dayside. We explore derivation of the draping angle in two different coordinate systems tied to the planet and the Sun. We show that the draping angle in both coordinate systems is affected by the 'wobbling' of Mars rotation axis with respect to the Sun over the course of a Martian year. We find also that using a coordinate system tied to the Sun gives the best indication about the IMF direction. Furthermore, we compute the error bars in draping direction for each orbit to show which orbits provide reliable estimates.