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Model of solar wind in the heliosphere at low and high latitudes

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The spatial distributions of the magnetic field, plasma density, and current at distances of (20-400)RS from the Sun (where RS is the solar radius) are investigated within a stationary axisymmetric MHD model of the solar wind (SW) at all latitudes in the inertial frame of reference with the origin at the center of the Sun. The model takes into account differential (with respect to the heliolatitude) rotation of the Sun and full corotation of plasma inside a boundary sphere of radius 20RS, which breaks down beyond this sphere. Self-consistent distributions of the plasma density, current, and magnetic field in the SW are obtained by numerically solving a set of time-independent MHD equations in spherical coordinates. It is demonstrated that the calculated results do not contradict observational data and describe a gradual transition from the fast SW at high heliolatitudes to the slow SW at low heliolatitudes, as well as the steepening of the profiles of the main SW characteristics with increasing distance from the Sun. The obtained dependences extend understanding of the SW structure at low and high latitudes and agree with the well-known Parker model in the limit of a small Ampère force.