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Modelling Jupiter's magnetosphere: Influence of the internal sources

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We present a new model to study Jupiter's magnetosphere and how it interacts with the solar wind. We derived a set of one-fluid MHD equations which consistently include the ion-neutral collisions in Jupiter's ionosphere, and the mass-loading in the Io torus. With this model, we can control two key parameters of the Jovian magnetosphere: the ionospheric conductance and the Io torus mass-loading rate. We present the results of four simulations where different mass-loading rates and ionospheric conductances are used. The results are compared with analytical models, in situ measurements and remote-sensing observations. Our azimuthal velocity profiles and the position of the corotation break-down are in good agreement with analytical model. The total current flowing into and out of the ionosphere is 39.6 MA, which is in agreement with estimates from measurements and analytical models. We find that our main auroral oval is associated, as expected, with the position of the corotation break-down. Our results suggest that the main oval is more axi-symmetric for high mass-loading rates. They also show that both the position of the corotation break-down as well as the location of the magnetopause influence the shape and the luminosity of the main oval.