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Structure of Mercury's magnetosphere: three dimensional hybrid simulations

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We have carried out a self-consistent three dimensional global hybrid simulation study examining the interaction of the solar wind with Mercury's magnetosphere. We consider two cases: one with relatively high solar wind pressure, and another with relatively low solar wind pressure. With lower solar wind pressure, the subsolar magnetopause forms at about $1.7R_M$ (where R_M is the planetary radius) and well pronounced cusp regions are formed; also a closed ion ring forms around the planet. In the higher solar wind pressure case the magnetopause is pushed closer to Mercury's surface ($\sim 1.2R_M$) and the cusp regions are less pronounced; the ion ring in this case is confined to a region closer to the planet with a smaller radial extent. In both cases reconnection occurs at about $\sim 2.4\,R_M$ down the magnetotail and a plasma sheet is formed. In general the plasma within the magnetosphere is more energetic in the high solar wind pressure case and the ion foreshock contains hotter magnetosheath plasma. Particles originating from the planet disperse through the magnetosphere, with the greatest congregation occuring in the inner magnetospheric drift driven rings in both cases. These planetary particles can also leak upstream into the foreshock region.