



Magnetosheath propagation time for solar wind discontinuities: MHD simulations and observations

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The ambient plasma flow sweeps interplanetary magnetic field (IMF) tangential discontinuities through the solar wind and magnetosheath towards the Earth. We recently predicted that the propagation time for a typical solar wind discontinuity through the subsolar magnetosheath is 14 minutes, i.e. larger than that usually assumed. Here we use global MHD simulations to calculate how the propagation time through the magnetosheath depends on the solar wind speed and the IMF magnitude. In addition to these external solar wind parameters, we also introduce one internal parameter, namely the cut-off speed at the nose of magnetopause. Changing the input parameters causes the magnetosheath propagation times to vary from several minutes to tens of minutes. Our numerical results explain the time delays observed in the ionospheric response to northward/southward IMF turnings. Statistically, we find that the average time delay from IMF discontinuity contact with the subsolar bow shock to the ground response is 13 min. Although there is a large scatter, this estimate agrees with previously published results.