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A global picture of the temporal response of surface atmospheric pressure to the passage of the heliospheric current sheet

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The meteorological response (e.g., of surface pressure) in the polar regions to fluctuations in the interplanetary magnetic field (IMF) B_y component (the 'Mansurov effect') has been proposed to occur via superimposed changes of the ionospheric potential on the global atmospheric electric field. Previously we have shown, in a time-averaged study, that the Mansurov effect also results in mid-latitude ($40°$-$70°$) changes to the latitudinal pressure gradient (and the zonal wind field), and thereby the atmospheric Rossby wave field. Since the evolution of storm tracks can be highly sensitive to Rossby wave dynamics, the IMF can in principle also significantly influence the evolution and distribution of atmospheric vorticity. Over the last 40 years, convincing evidence has accumulated for the 'Wilcox effect' - the correlation between the time of reversals in polarity of the IMF (crossings of the heliospheric current sheet) and decreases in the winter tropospheric low-pressure vorticity at mid to high latitudes. It has been suggested that such changes to storm vorticity are due to the occurrence of reductions in the relativistic electron flux during HCS crossings, and associated changes in the ionosphere-Earth current density. To investigate further possible mechanisms for the Wilcox effect, we conduct a superposed epoch analysis (SEA) of the global atmospheric pressure at the Earth's surface using NCAR/NCEP reanalysis data ordered according to HCS crossings. We use a similar SEA of solar wind data (including both IMF B_y and B_x) to investigate the role of the high-latitude Mansurov effect (and other mechanisms) in the mid-high latitude Wilcox effect. We discuss our results in the context of our previous time-averaged global study.