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The ground magnetic response to upstream pressure variations with different temporal and spatial scales

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Solar wind, ion foreshock, and magnetosheath pressure variations drive magnetosphere-ionosphere current systems with different properties. The ground magnetic response associated with these current systems depends on several factors, including the temporal and spatial scale of the driver as well as ionospheric conductivity. We combine theoretical calculations with observations to test how the temporal and spatial scale of upstream pressure variations affects the ground magnetic response. In particular, we identify case studies with different drivers where it is possible to determine the temporal and spatial scale of the driver using multi-point satellite measurements, ground-based magnetometer measurements, and/or results from previous studies. During these events, we use data from a recently completed chain of magnetometers on the East Antarctic Plateau, combined with magnetically conjugate stations on the west coast of Greenland, to calculate the ratio of northern to southern hemisphere ground magnetic perturbation amplitude. Using estimates for ionospheric conductivity, we compare these ratios to predictions from (1) models that assume static currents and (2) models of time varying currents. Finally, we discuss differences in the predictions of (1) and (2), and how these differences affect the interpretation of ground magnetic perturbations driven by upstream pressure variations.