

Supporting Information for

**The contribution of plasma sheet bubbles to stormtime ring current buildup and evolution of the energy composition**

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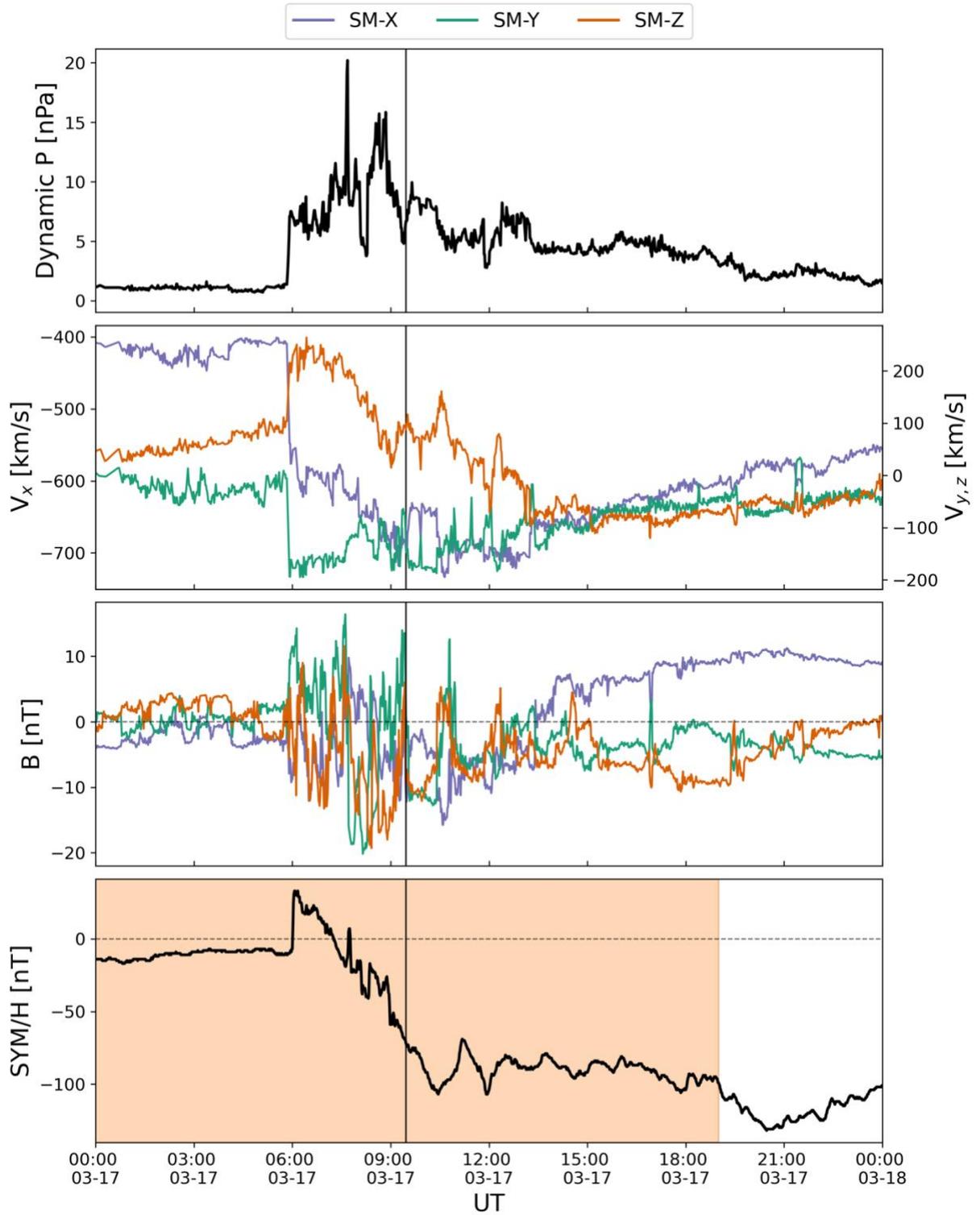
Figure S1

**Additional Supporting Information (Files uploaded separately)**

Captions for Movies S1 and S2

**Introduction**

The Supporting Information includes a figure of the solar wind parameters used to drive the MHD simulation (Figure S1). Movie S1 shows an animation of Figure 4 in the main manuscript, visualizing bulk flows and field line topology in the dusk to post-midnight sector. Movie S2 shows an animation of Figure 7, visualizing the buildup and evolution of the pressure in the Rice Convection Model (RCM) alongside data-model comparisons of proton intensity and the perturbation magnetic field.



**Figure S1.** Solar wind boundary conditions used to drive the MHD simulation. The black line is drawn at 2013-03-17 09:28:00, corresponding to the time shown in Figure 1. The orange shaded region on the SYM/H panel indicates the simulated period of the storm.

**Movie S1.** Spherical slices through the MHD solution of the dusk to post-midnight sector. The slices span 6-14  $R_E$ , spaced 2  $R_E$  apart, and are centered in Z on the XY-plane. The color contours on the slices show the radial component of the bulk velocity perpendicular to the magnetic field  $(v_{\perp})_r$ . The darker regions on the slices denote regions that are on non-closed field lines (either open or fully IMF field). Semi-transparent vectors follow the 3D flow direction and magnitude and are colored by  $(v_{\perp})_r$ . The Earth is also shown, with the downward and upward field-aligned currents shown in purple and green, respectively. The red line in the ionosphere marks the open-closed boundary determined via field line tracing.

**Movie S2.** Comparison of proton intensities between **(a)** RBSPICE and **(b)** RCM for the full energy spectra between 10 and 200 keV. **(c)** Comparison between the Observed Sym-H (blue), that calculated from the simulation (orange), and the DPS-*Dst* evaluated in the model within 6  $R_E$  (green), the same as in Figure 1. **(d)** RCM pressure and RBSP-B's full trajectory (orange line) and current position (white circle with orange border) mapped along field lines to the equatorial plane. The vertical lines in panels (a), (b), and (c), and pressure and spacecraft location in panel (d), all correspond to the time indicated in panel (d). The thin colored bar below panel (b) shows the RCM pressure at the spacecraft location for a given time, with the same colorbar as panel (d).