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Supporting Information for

Spinning, Breathing, and Flapping: Periodicities in Saturn's Middle Magnetosphere

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Additional Supporting Information (Files uploaded separately)

Introduction

The supplementary information for this manuscript includes one figure and one animation. Both were created using data extracted from an MHD simulation and are used to show how Saturn's magnetosphere changes in size and shape over one full rotation period.

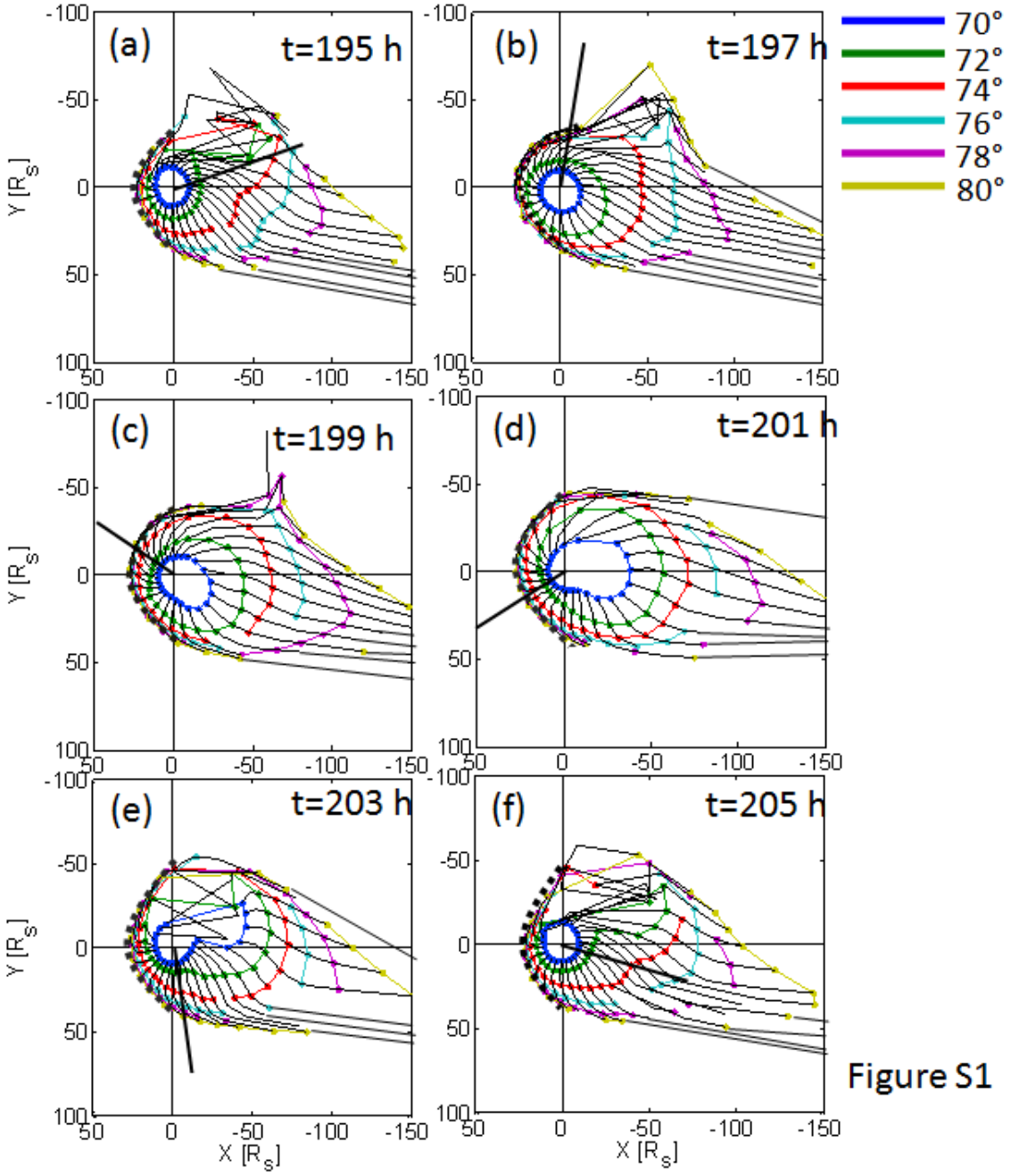

Figure S1. The changing size and shape of the equatorial magnetosphere in the simulation described by *Jia et al.* [2012]. As for Figure 8, but with invariant latitude range from 70° to 80°, with every other degree plotted. Gaps in the colored lines occur where the traced

field line does not cross the equatorial plane inside the limits of the graph, implying extremely stretched flux tubes. The heavy black dots mark the magnetopause location extracted from the simulation.

Movie S2. Colored dots mark the intersection with the equatorial plane inside of 15 R_S of field lines emerging from the southern ionosphere at every latitude from 65° to 72° at increments of 15° in local time. Dots and lines of the same color emerge from the same latitude, and black lines connect dots originating at the same local time. Colors of the invariant latitude shells follow the legend in Figure 8. Noon is towards the left. The movie starts at T=hour 195 and each frame is separated by 30 minutes over a complete cycle.