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Supporting Information for

Jovian injections observed at high latitude

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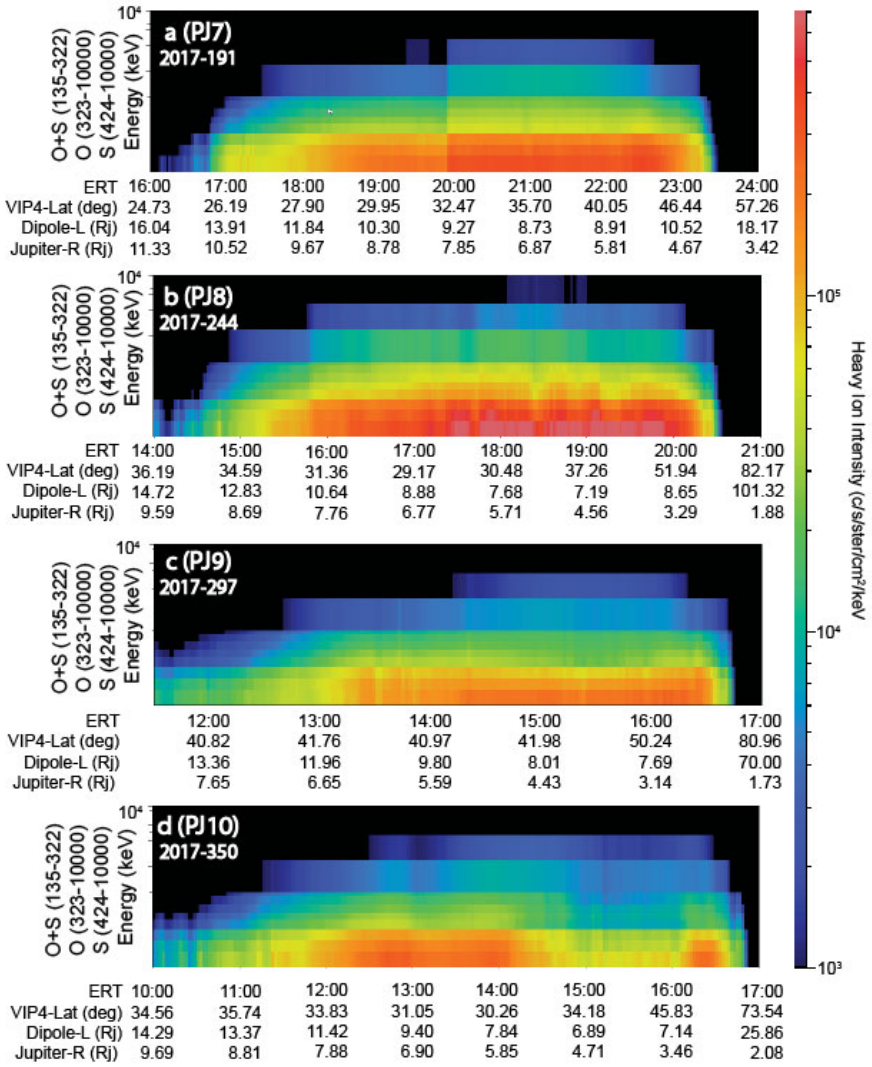

Figure S1. Heavy ion energy spectrograms during four different high-latitude periods prior to Juno entering Jupiter's northern auroral region (see Figure 1 for accompanying proton spectrograms). These spectrograms combine 3 lower energy oxygen + sulfur (o+s) channels, where the instrument cannot distinguish between the two species. The spectrograms also include three oxygen and three sulfur channels (higher in energy than the o+s) that are well resolved by JEDI. These figure show intensification during these periods, some of these appear aligned with the injections, specifically panel b. However, the poor energy resolution of these heavy ion channels precludes performing drift dispersion analysis on the recent injections (panel b). In addition, for the older injections (panels a, c, and d), there are no obvious remnant populations observed in these heavy ion channels, a condition that may also be caused by the poor energy resolution of the heavy ion channels. We leave the possible extraction of clear heavy ion injection observations to future work.

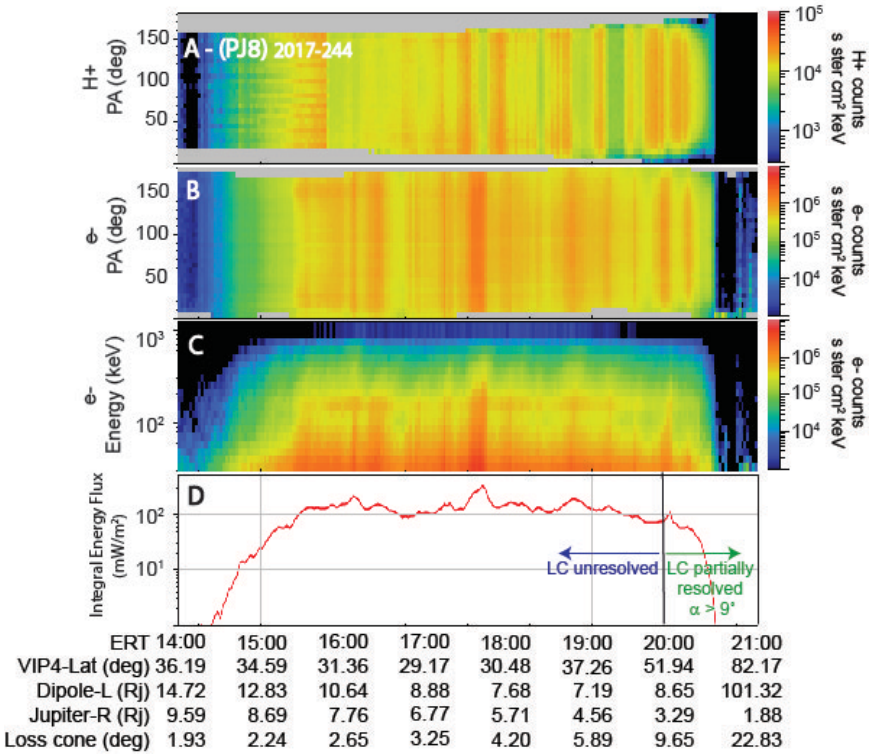

Figure S2. Proton pitch angle distribution (A), electron pitch angle distributions (B), electron energy spectrogram (C) and e- energy flux (D) for the condition that the centroid of the detector field of view had pitch angles between 167º and 180º (a range needed to get a complete trace from the time period shown). Grey areas near 180º and 0º in spectrograms A&B indicate the parts of the angular distributions not sampled by JEDI during this period. Indicated in panel (D) is the portion of the electron integral energy flux partially resolved by JEDI. In regions with a loss cone < 9º (see bottom row of annotations, calculated using section 3 of Mauk et al. (2017), JEDI cannot resolve the loss cone, and the energy flux calculation includes trapped particles that are not impinging on the atmosphere. In regions with the loss cone > 9º JEDI can partially resolve the loss cone (Mauk et al. 2017; Supplemental S6 of Mauk et al. 2018), and the energy flux calculation may have some relevance to auroral intensities there. Panel (D) indicates that the injection just before 20:00 was both well sampled, and close enough to Jupiter that the loss cone was at least partially resolved. The electron energy flux peak of ~10^2 (mW/m^2) just before 20:00 is sufficient to produce observable auroral UV responses (Mauk et al., 2017b, and references therein), and indeed the UVS instrument did observe emission that magnetically map to Juno's position at the time (Figure 2c).

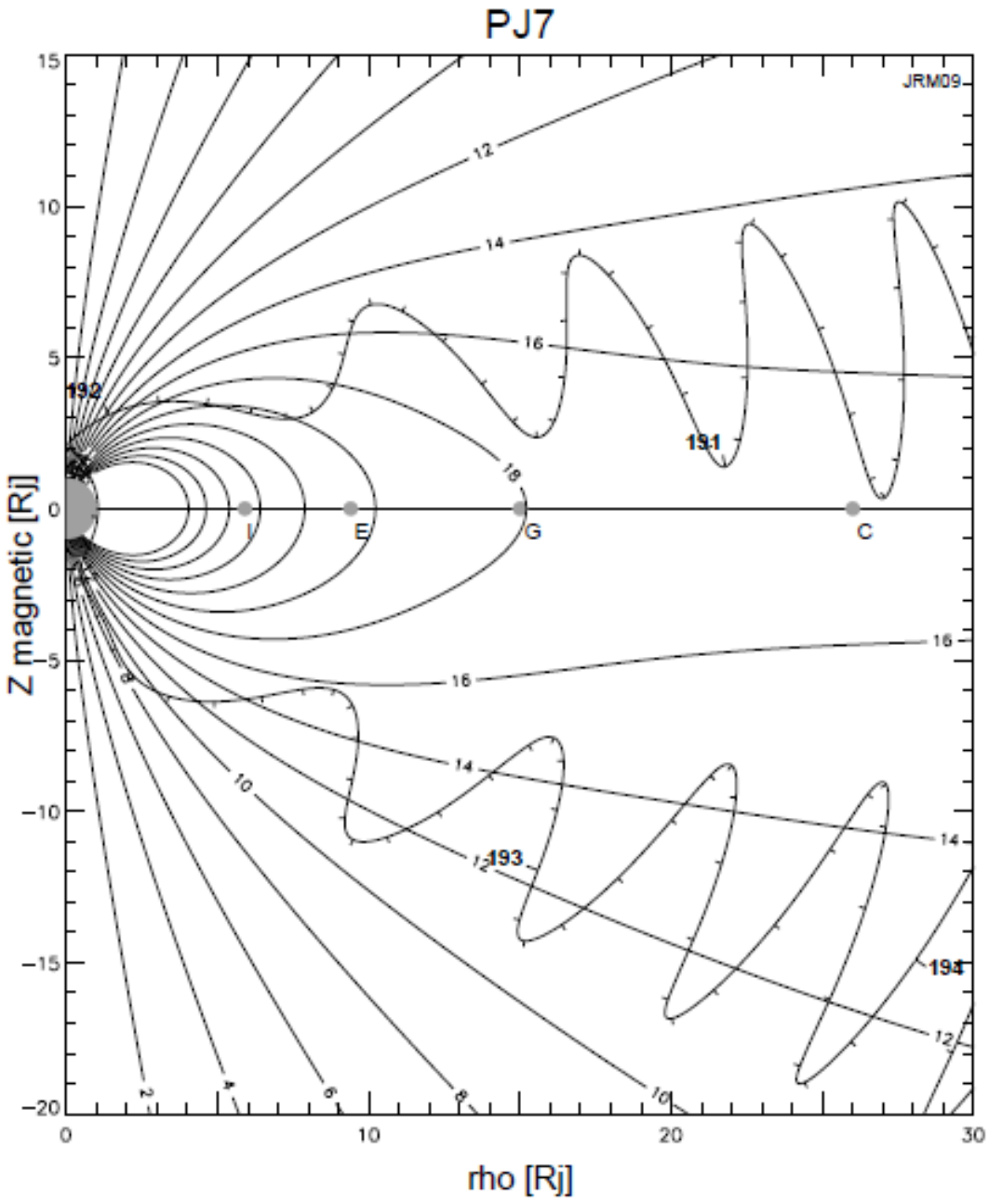

Figure S3a. Trajectory of Juno for PJ7 from a fixed magnetodisc with JRM09 contours. This plot shows the region of the northern magnetospheric regions covered by Figure 1a (Day 191, 1600-2400) where the injections were observed. These plots can be found in Connerney et al. (2018) supplemental section, and are also available for the entire Juno mission on the MOP website at:
http://lasp.colorado.edu/home/mop/missions/juno/trajectory-information/

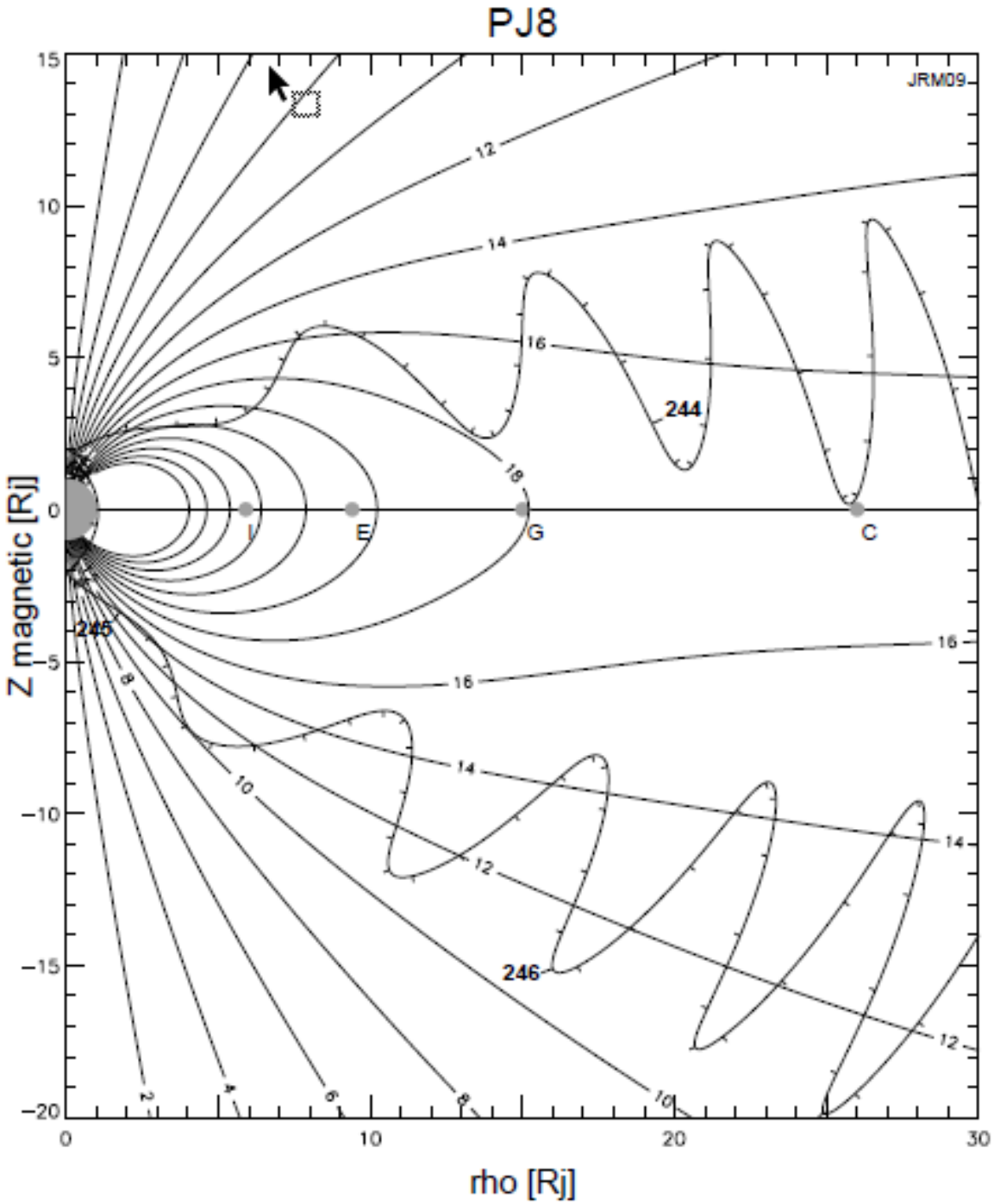

Figure S3b. Trajectory for PJ8 (Connerney et al., 2018 supplemental section) showing the northern magnetospheric regions covered by Figure 1b (Day 244 1400-2100)

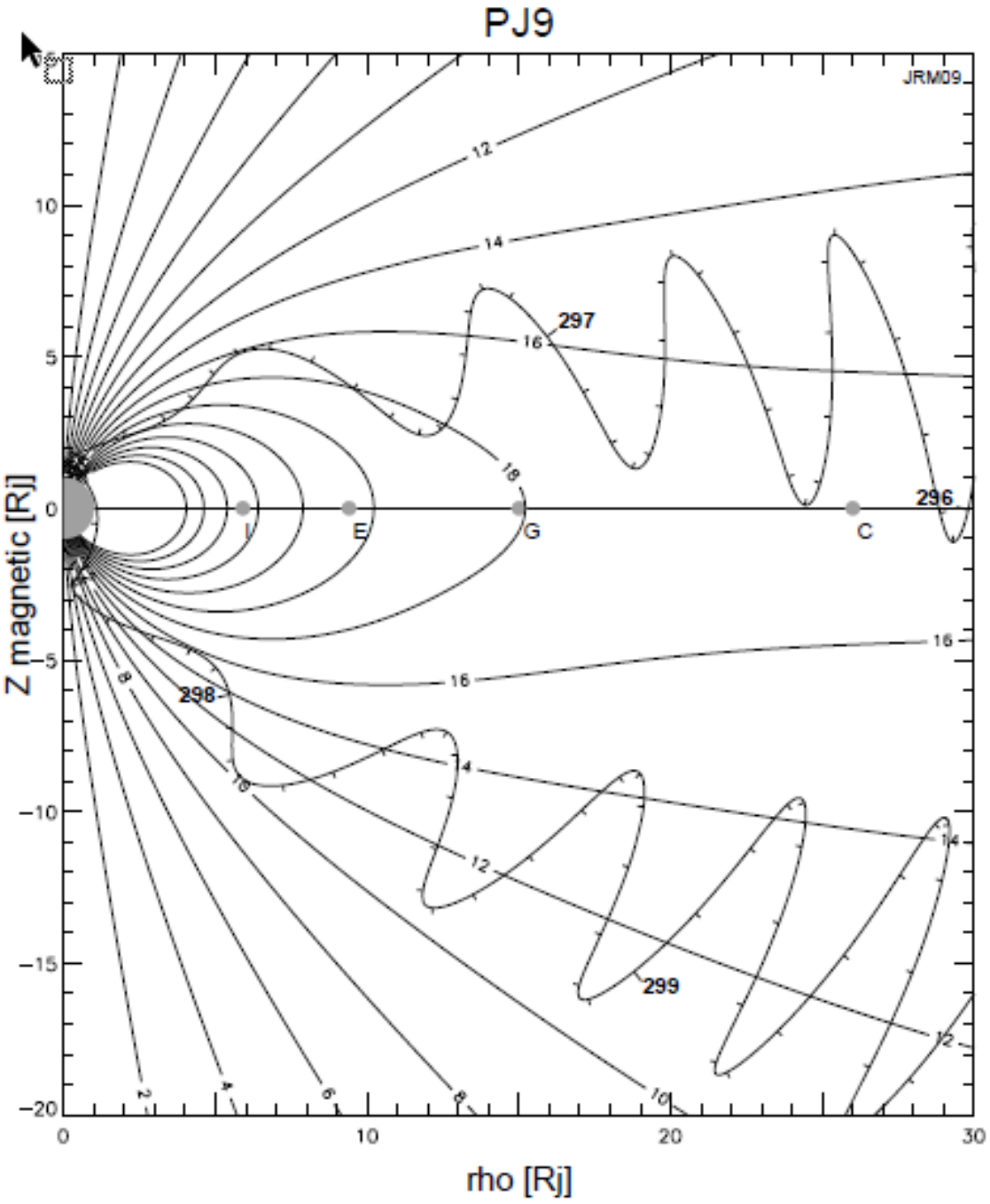

Figure S3c. Trajectory for PJ9 (Connerney et al., 2018 supplemental section) showing northern magnetospheric regions covered by Figure 1c (Day 297, 1100 to 1700).

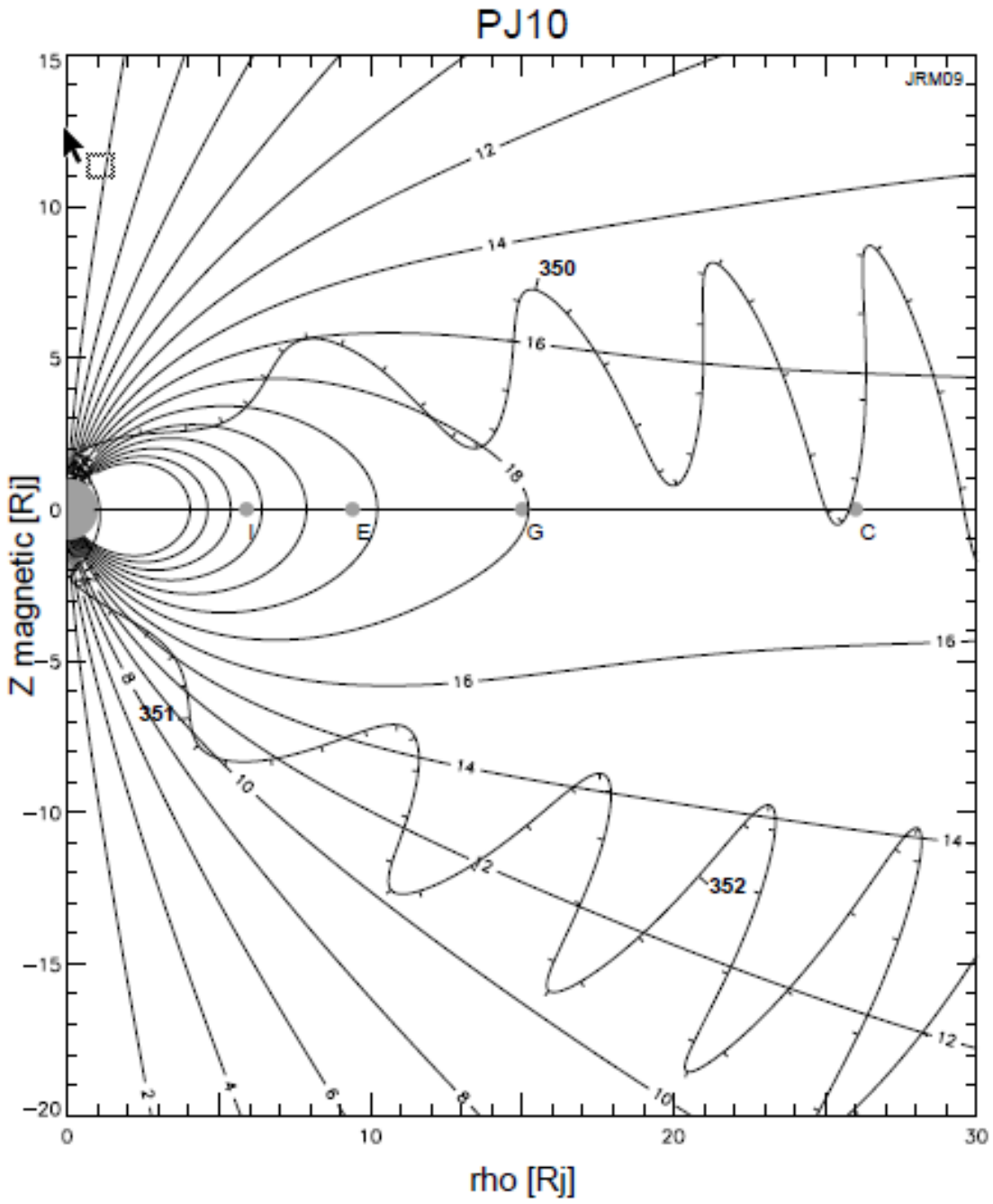

Figure S3d. Trajectory for PJ10 (Connerney et al., 2018 supplemental section) showing northern magnetospheric regions covered by Figure 1d (Day 350, 1000 to 1700).

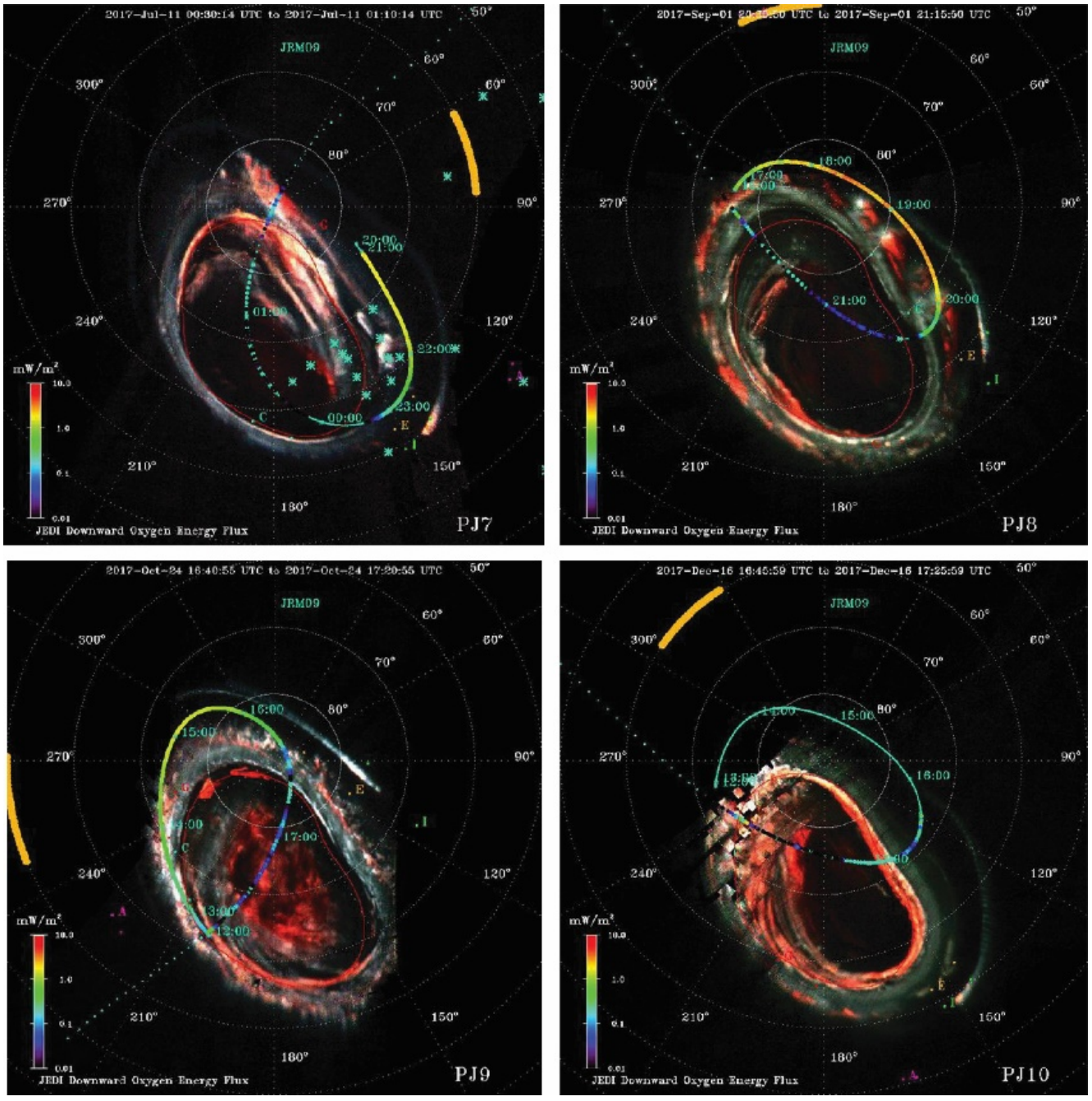

Figure S4. UVS images of the northern auroral region for each of the four perijoves discussed in the manuscript with the same format as Figure 2C. These images were provided by G. R. Gladstone.