Supplementary Material for Article titled: Explaining the ``Missing Loss'' Process in Earth's Magnetosphere

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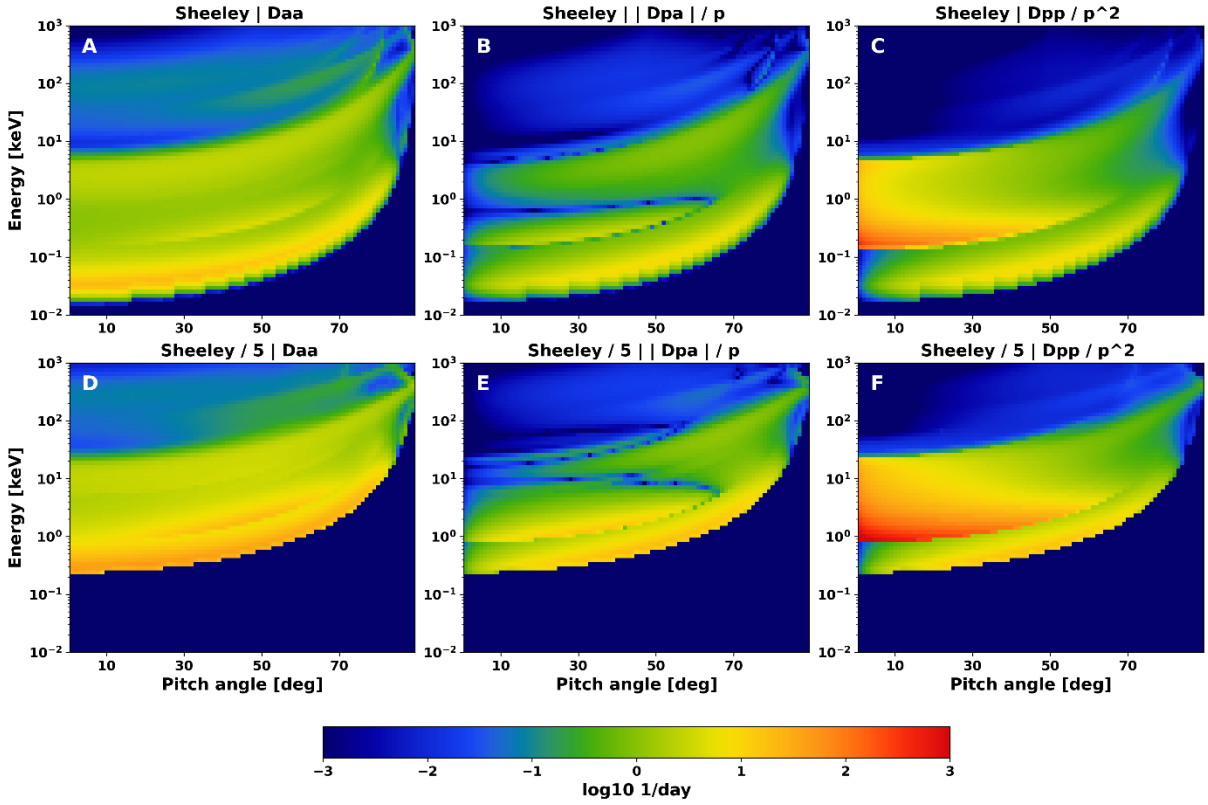


Figure S1: Diffusion coefficients of electrons due to interactions with lower and upper band chorus waves at MLT = 21, L = 3, Kp = 4. **A** Pitch-angle diffusion coefficients assuming the statistical density model (Sheeley). **B** Mixed diffusion coefficients assuming the statistical density model (Sheeley). **C** Momentum diffusion coefficients assuming the statistical density model (Sheeley). **D-F** Same as A-C but assuming depleted density (Sheeley / 5)

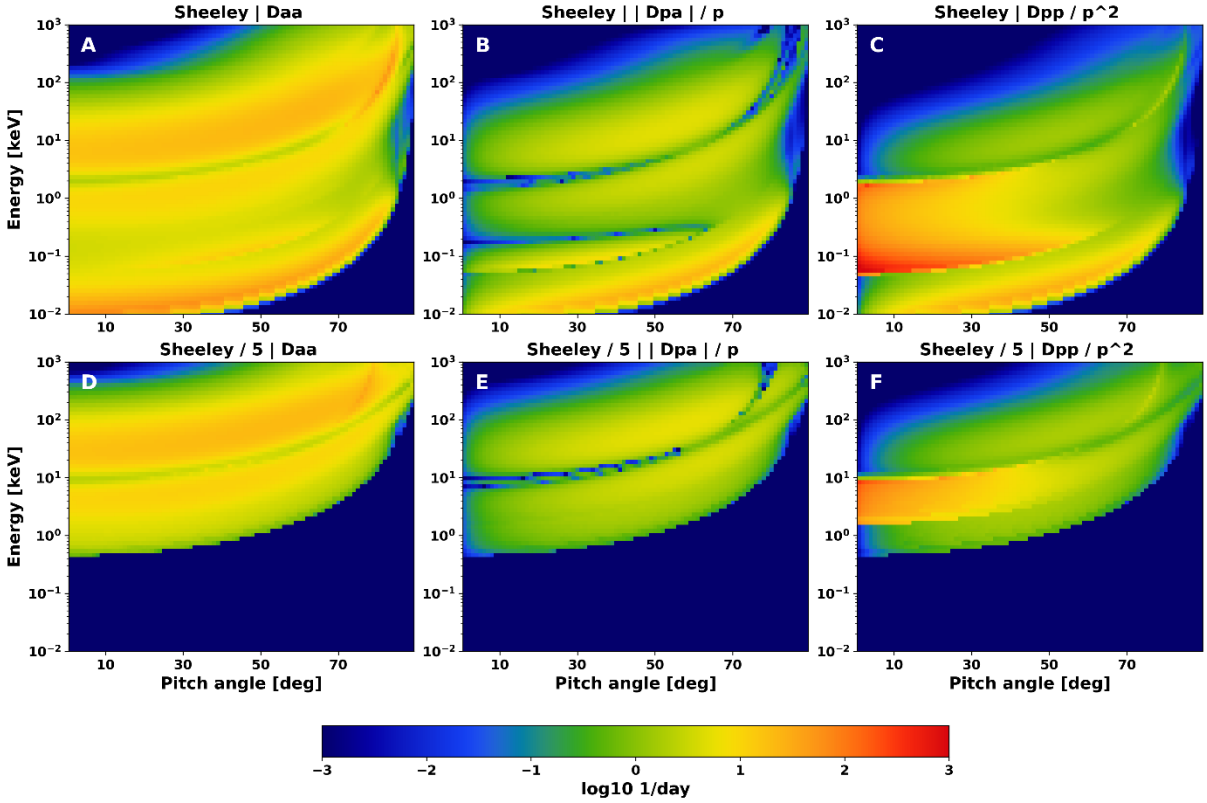


Figure S2: Same as Fig. S1 but for L = 6.

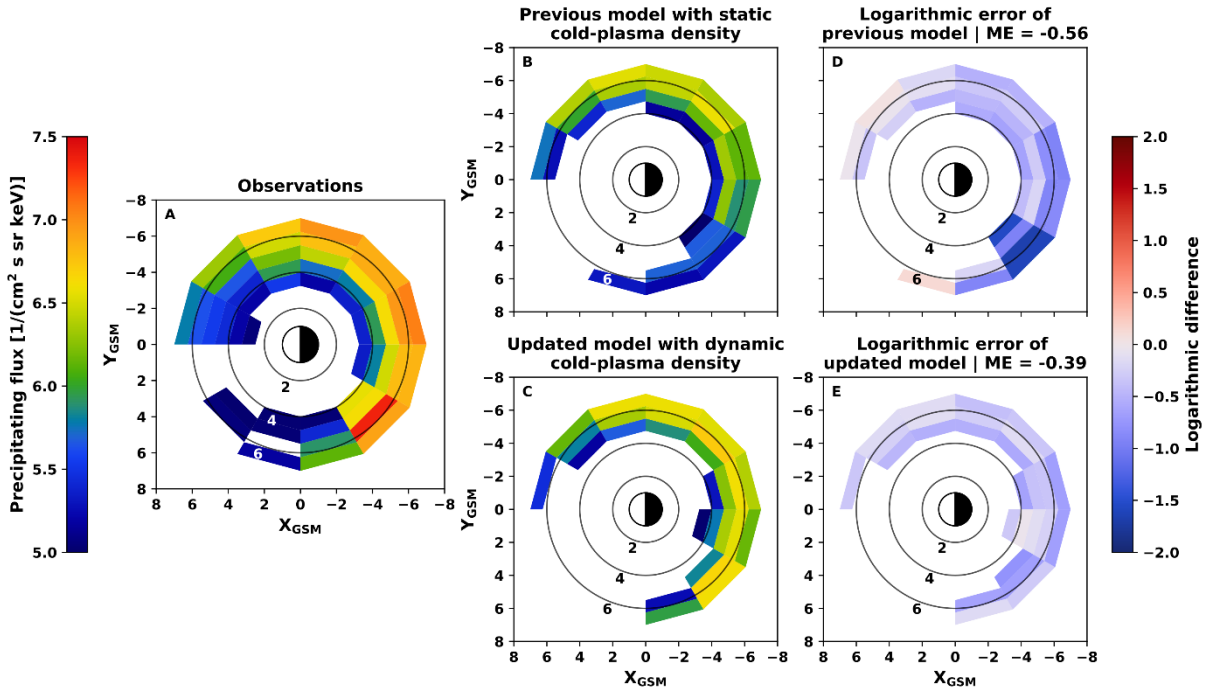


Figure S3: Validation of predicted precipitating flux against low-earth-orbit observations for 2.6 keV. **A** POES TED particle flux observations of the T0 telescope mapped to the equatorial plane, spatially binned, and averaged over the main phase of the storm. **B** Predicted particle flux by the model assuming static cold-plasma density. **D** Predicted particle flux by the model assuming dynamic cold-plasma density. **C, E** Logarithmic difference between model results and observations.

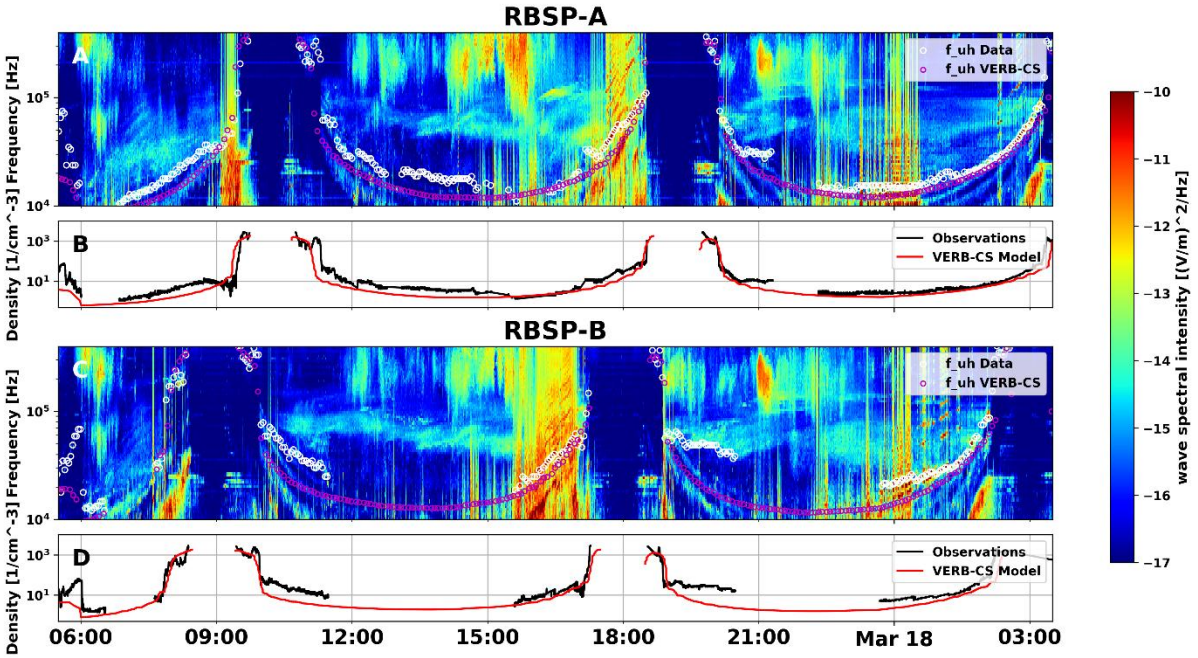


Figure S4: Validation of predicted cold-plasma density by VERB-CS. **A** Magnetic field spectrum as measured by the EMFISIS instrument on board of RBSP-A and inferred upper hybrid frequency from the data and from the predicted density by VERB-CS. **B** Cold-plasma density as observed by RBSP-A and predicted by the model. **C, D** Same as A, B, but for RBSP-B.

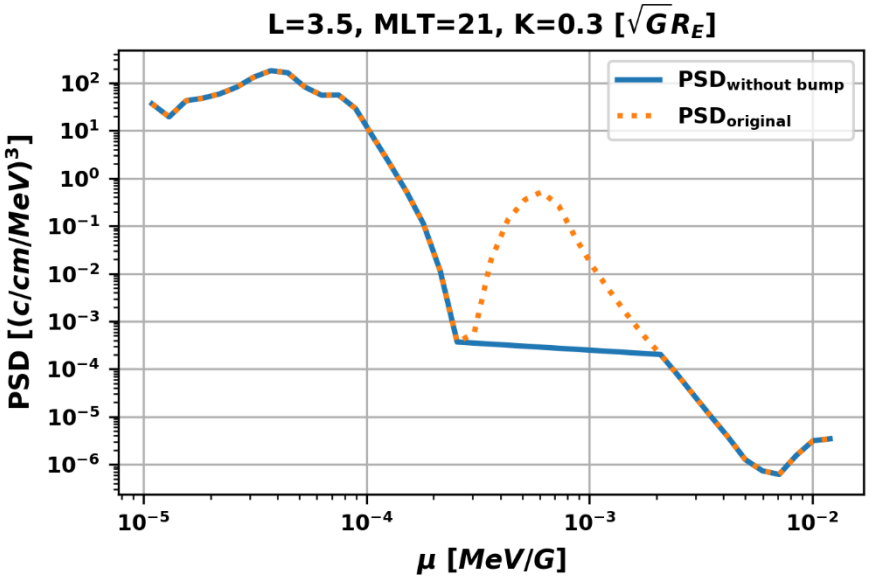


Figure S5: An example of the removal of a bump-on-tail instability.

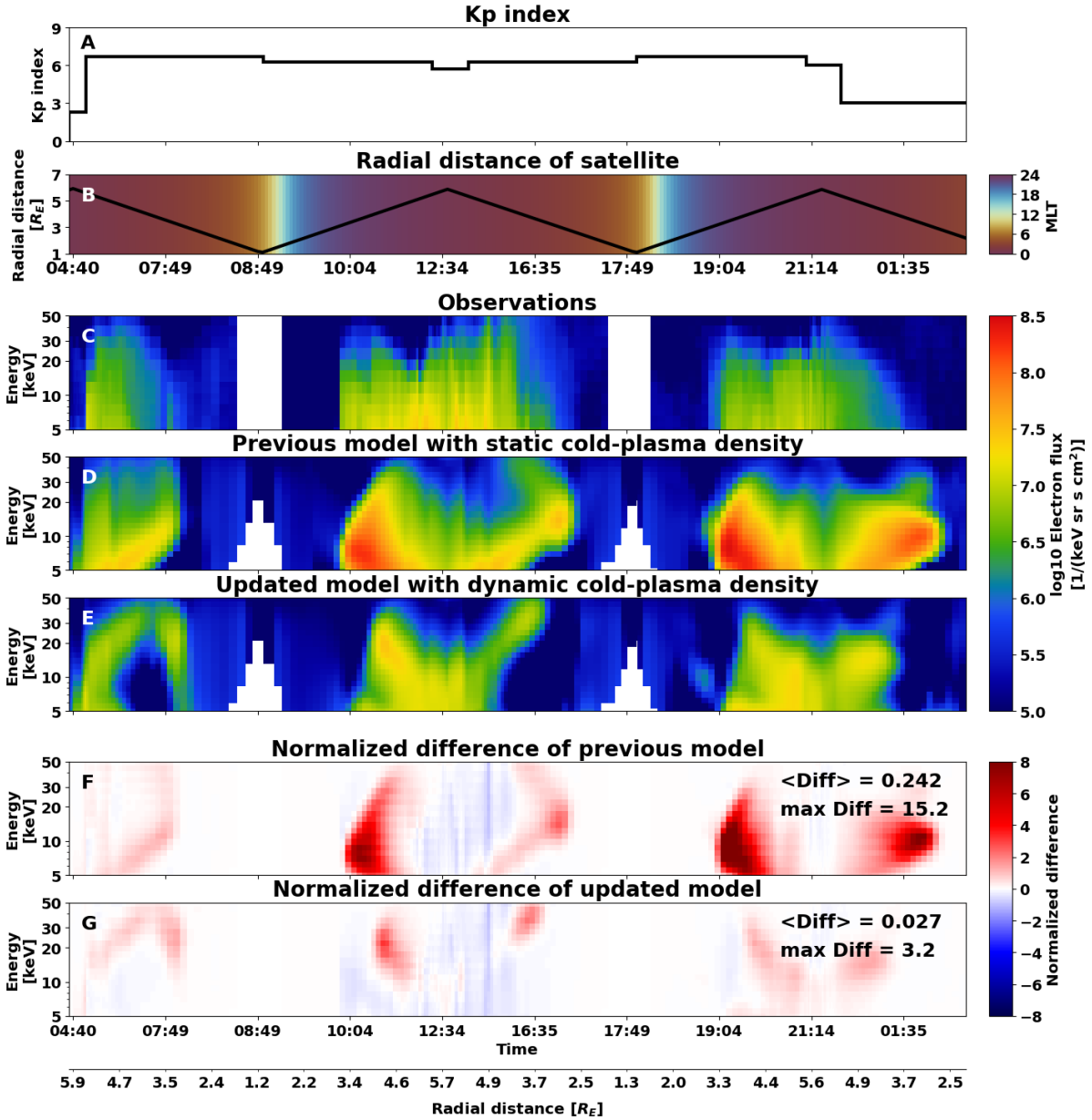


Figure S6: Same as Fig. 4 but without the removal of bump-on-tail instabilities for the simulation including dynamic density. **A** Kp index derived from ground observations and showing the level of geomagnetic activity throughout the storm. **B** Radial distance and magnetic local time of the RBSP-B satellite normalized to Earth radii. **C** RBSP-B HOPE observations of electron flux at 50° local pitch angle and 5 to 50 keV. **D** Simulated electron flux along the satellite orbit by the model with static background density. **E** Simulated electron flux along the satellite orbit by the model with dynamic density predicted by a physics-based model. **F** Normalized difference between C and D. **G** Normalized difference between C and E.