Modeling X-ray Emissions near Earth Magnetosphere During a CME and Magnetopause Extraction from X-ray Image

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Résumé

We use the Dynamic LATMOS Test Particle (D-LaTeP) model to simulate soft X-ray emissions during the 19 October 2001 Coronal Mass Ejection (CME) event and compare the results with XMM-Newton observations. The simulation presents the evolution of X-ray emissions near Earth during the event and shows that multiply charged heavy ions can enter the magnetosphere, generating significant soft X-ray emission in the ring current region. Such emissions inside the magnetosphere should be physically plausible. Line of sight intensities of the simulated X-ray derived along the XMM-Newton viewing geometry agree well with the observations, indicating the reliability. To provide simulation-based support for the imaging missions, we calculate observation-like images from the simulation for the CME event, which reveal that ring current X-ray emissions may contribute substantially to global X-ray signatures. These results suggest that X-ray contributions inside the magnetosphere should be considered when interpreting soft X-ray observations and developing boundary detection techniques for imaging missions.
Furthermore, we present a method based on Tangent Fitting Analysis (TFA) and Hough transform to extract the location of magnetopause from the X-ray image. Specifically, it finds the optimum match of tangent curves of parameterized magnetopause function and brightest arc in the X-ray image.

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