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The effect of South Atlantic Anomaly on ring current dynamics

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The South Atlantic Anomaly (SAA) affects the particle evolution and loss processes in the inner magnetosphere. However, most existing inner magnetosphere models average the north-south loss cone to simplify precipitation calculations, neglecting the SAA's impact. Based on the Storm-Time Ring Current Model (STRIM) accounting for the SAA effect, we simulate a storm event to analyze electron precipitation in both hemispheres. Results show that electron loss near the SAA is more pronounced than other local times around L = 4. Previous averaging methods underestimated electron precipitating fluxes in the southern hemisphere while overestimating them in the northern hemisphere. Furthermore, we find that SAA significantly promotes low-energy (several keV) electron precipitation compared to high-energy (hundreds of keV) electrons. Comparisons with in-situ observations demonstrate that simulations considering the SAA effect capture both the intensity and variations of electron precipitation. This study emphasizes the necessity of including the SAA effect in models for accurately interpreting ring current electron dynamics and the north-south asymmetry of electron precipitation.