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Abstract

We investigate the effect of storm-time substorms on the acceleration and transport of ions to the inner magnetosphere through a test particle simulation approach. Protons and oxygen ions with energies of the order of few keV, as typically observed in the plasma sheet, are launched from the near-Earth magnetotail under the influence of the large-scale convection electric field. The resulting ring current build-up is compared to the case of additional acceleration through impulsive induced electric fields, which are typically observed at substorm expansion onset. The results of our simulations partially confirm observational features of magnetic storms. The energization of oxygen ions is more pronounced than the energization of protons, as observed by many spacecraft. However, the dominance of oxygen ions is very limited in time, while spacecraft observations suggest that oxygen dominance is pronounced throughout storm maximum. The observed fast loss of energetic oxygen ions after storm maximum is reproduced by the simulations, but appears quicker than expected. We discuss the benefits and the shortcomings of our approach and suggest improvements to be implemented in the future.