Solar wind re-acceleration in local current sheets and their diagnostics from observations

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We explore solar wind re-acceleration during their passage through reconnecting current sheets in the interplanetary space using the particle-in-cell approach. We investigate particle acceleration in 3D Harris-type reconnecting current sheets with a single or multiple X-nullpoints taking into account the ambient plasma feedback to the presence of accelerated particles. We also consider coalescent and squashed magnetic islands formed in the current sheets with different magnetic field topologies, thickness, ambient density, and mass ratios. With the PIC approach, we detected distinct populations of two groups of particles, transit and bounced ones, which have very different energy and asymmetric pitch-angle distributions associated with the magnetic field parameters. We present a few cross-sections of the simulated pitch-angle distributions of accelerated particles and compare them with the in-situ observations of solar wind particles. This comparison indicates that locally generated superthermal electrons can account for the counter-streaming ‘strahls’ often observed in pitch-angle distribution spectrograms of the satellites crossing heliospheric current sheets.