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Interactive comment on "Quasi-separatrix Layers Induced by Ballooning Instability in Near-Earth Magnetotail" *by* Ping Zhu et al.

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We are grateful to the anonymous referee for the positive remarks and the suggestive questions on our work and manuscript. Below we address each of the questions:

Question 1) Would the QSL method be applicable for particle-in-cell simulations of reconnection caused in the course of a kinetic ballooning instability?

Reply: Yes, it should. The QSL is purely a geometric feature of the magnetic field configuration. Thus QSL method only relies on the magnetic field geometry in order to identify the reconnection sites. It is independent how the plasma is modelled, be it fluid or particle. Therefore the QSL method should be applicable for particle-in-cell simulations of reconnection caused in the course of a kinetic ballooning instability.

Question 2) The authors showed that the reconnection sites identified with the QSL method were produced at the same x position and strictly periodically in the y direction. Thus, although the reconnection is three-dimensional, the resulting plasmoid, as far as I understand is essentially a two-dimensional structure. This is hardly possible in nature and could be discussed a little in the last section of the paper.

Reply: Similar to the magnetic island, the plasmoid presented in this work is identified in the x-z plane as a finite region of closed magnetic flux bounded by a separatrix with a single X-point [e.g. Otto et al 1990, Zhu and Raeder 2014]. It is a two-dimensional projection onto the x-z plane of three-dimensional magnetic field lines in regions of magnetic reconnection. Whereas the plasmoid structure itself appears out of a two-dimensional projection, its occurrence in x-z plane is periodic in the y direction in our simulations, which indicates that the overall reconnecting field line structure is intrinsically 3D. Such a relation between the 2D plasmoid and the 3D reconnection is indeed possible, as demonstrated in our simulations, and may be more quantitatively captured in the 3D structure and distribution of QSLs.

We have added the above discussion to the last section of the revised manuscript.

A. Otto, K. Schindler, and J. Birn, Quantitative study of the nonlinear formation and acceleration of plasmoids in the Earth's magnetotail, J. Geophys. Res. 95, 15023-15037 (1990).

P. Zhu and J. Raeder, Ballooning instability-induced plasmoid formation in near-Earth plasma sheet, J. Geophys. Res. Space Physics 119, 131-141 (2014).

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