

Interactive comment on “The increase of curvature radius of geomagnetic field lines preceding a classical dipolarization” by Osuke Saka

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I very much appreciate the review and comments of referees #1.

The role of fast earthward flows in our substorm onset scenario is briefly described.

We first assumed that the geosynchronous altitudes are earthward end of the flow penetration of fast earthward flows from the magnetotail. Because field lines passing through the geosynchronous altitudes stretched tailward at the substorm onset, the initial brightening of auroras triggered by the fast flows may occur at lower latitudes, 63 degrees N in geomagnetic coordinates [Saka, Ann Geophys., 37, 381-387, 2019]. This may represent the most equatorward latitude of the breakups.

Secondly, we note that substorm onset is a transitional state lasting 10 min after the Pi2

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onset followed by formation of the substorm current wedge by reduction of cross-tail currents. We can assume that DFs arrive in the transitional interval and the flow braking may occur afterwards in association with the reduction of cross-tail currents, viz., subsequent formation of the substorm current wedge. Of course, this scenario was deduced from the geosynchronous observation and cannot be readily applied to the onset scenario beyond the geosynchronous orbit. Nevertheless, if dawn-dusk expansion of the flux tubes in our scenario caused by the Ballooning instability is applicable to the formation of dipolarizing flux bundles (DFBs) propagating within fast earthward flows (BBFs) [Liu et al., JGR, 120, 2516-2530, 2015], the results from geosynchronous observations we presented can be extended further tailward in upstream.

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