Geophysical Research Abstracts
Vol. 18, EGU2016-11339, 2016
EGU General Assembly 2016

On temporal variation of reconnection rate and X-line electric field structure

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We have inspected how reconnection rate and the electric field structure around an X-line vary in response to macroscopic circumstances surrounding the X-line. In a very simple simulation of two-dimensional collisionless magnetic reconnection, where reconnection is initiated in a thin current sheet with anti-parallel magnetic field bounded by a periodic boundary, reconnection rate explosively increases, hits a peak, slowly declines, and then reconnection terminates. This temporal variation of the reconnection rate at the X-line is affected by the condition outside the X-line but it has not been clear how the X-line senses the external condition. By inspecting the associated variation of the spatial structure of out-of-plane electric field, we found that the out-of-plane electric field at the outer-edge of the outer Electron Diffusion Region (oEDR) plays a key role in regulating the reconnection rate according to the conditions beyond the oEDR. We also show that behavior of reconnection rate in more complicated situations can be explained from the same perspective.