テミス衛星による多重サブストームの事例解析

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THEMIS satellite observations of a multiple-onset substorm

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A multiple-onset substorm with stepwise poleward expansions is studied. Five successive auroral brightenings were identified in all-sky images roughly every 10 minutes starting at 0213 UT on 27 February 2009. The first brightening was weak and the second brightening was the substorm initial brightening. Other brightenings expanded poleward thus were auroral breakups. The breakups occurred stepwise, i.e., later breakups initiated near the latitude where the previous poleward expansion has reached. Corresponding reconnection signatures are studied using THEMIS satellites observations between 8 and 24 Re down the tail. The initial brightening was not accompanied by clear reconnection signature at 8, 10, and 24 Re down the tail. On the other hand, subsequent three auroral breakups were simultaneous with three fast flows at 24 Re, thus are associated with reconnection. The three fast flows were a tailward flow and subsequent two earthward flows. The flow reversal simultaneous with the second breakup indicates that the tailward retreat of the reconnection site occurred in a stepwise manner, because another tailward retreat is expected at the third breakup. We interpret that the stepwise characteristic in the tailward retreat and poleward expansion is caused by possible stepwise magnetic flux pileup.