

## On the timing issue of substorms

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The issues of the Near-Earth Neutral Line (NENL) model of substorms have been discussed in the proceeding paper of ICS-5 by Lyons [2000]. He discussed on our results of superposed epoch analysis of Geotail data (Machida et al. [1999], Miyashita et al. [1999, 2000, 2001]). The point of his argument is that the propagation time of the variations associated with a substorm from the NENL to the low latitude Pi2 on the ground is approximately 5 min, which is not consistent with our result. In contrast, our point is that the dipolarization at  $X \sim -12R_E$  and the plasmoid formation at  $X \sim -28R_E$  start almost simultaneously implying that the magnetic merging first occurs in the middle of these locations, i.e.,  $X \sim -20R_E$ . It is of interest that the Pi2 onset and the initial auroral brightening also occur simultaneously with the dipolarization and plasmoid formation in our superposed epoch analysis results which allow us to resolve the events with 1 min time resolution. We will summarize the arguments and clarify our point to understand the results of superposed epoch analysis.