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Response of nightside terrestrial magnetosphere to IMF variation

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The response of nightside terrestrial magnetosphere to the variation of the interplanetary magnetic field (IMF) was examined by using magnetic field, particle and auroral observations from space to the ground during 00-06 UT on 15 September 1999. There were two distinct groups of consecutive bursts of Pi2 pulsations on the ground during the time of interest. The onset time of ground Pi2s maps to the same variation sequence in the IMF structure seen propagating to the Earth in multiple satellite observations in the upstream region. The comparison of auroral and energetic particle data with IMF observations shows that a sequence of two multiple-onset substorms appears in a period of the southward IMF intervened by occasional northward excursions of which two are accompanied by increasing IMF By magnitude. Moreover there is the one-to-one relationship between the ground Pi2 onset and decreasing of IMF By magnitude. At the geosynchronous orbit, magnetic disturbances like those affected by the substorm current wedge are not consistent with energetic particle injections presumably resulting from the field dipolarizations due to the current disruptions. In contrast, the two-neutral-point-model is more plausible to interpret this event. Reconnection at the distant neutral point stops when the IMF turns northward. Reconnection at the near-Earth neutral point keeps going to the lobes and results in substorm onset due to the unchanged pressure between the closed field lines in the plasma sheet and those in the tail lobes. When the IMF turns southward, the supply of new magnetic flux and plasma to the tail for the situation with an increasing IMF By magnitude is less than that with a decreasing one. Thus while the IMF remains southward, the decreasing By component could more easily affect the pressure condition than increasing one be-

tween the closed field lines in the plasma sheet and those in the tail lobes to become unstable to create the substorm-related activation. Consequently besides northward turning, the IMF By variation could affect magnetotail convection to evoke (or lessen) the activation of substorm onset when the IMF turns southward.