A MAGNETOSEISMIC INVESTIGATION OF SUBSTORM ONSETS AND ITS VALIDATION BY SATELLITE OBSERVATIONS

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We applied the travel-time magnetoseismic technique to the Pi 2 pulsations associated with the January 29, 2008 substorm to estimate the onset time and location in the magnetotail. The arrival time of Pi 2, which refers to the first peak in Pi 2 amplitude, observed by McMAC, THEMIS, and CARISMA ground magnetometers presents a strong function of latitude. Using the Tamao travel time as the forward model, the inversion from the observed Pi 2 arrival time estimates that the onset in the magnetotail took place at X = -17.9 Re at 0713:24 UT, or approximately one minute earlier than the auroral brightening and the ground Pi 2 onset time for the same substorm. In the magnetotail, THEMIS probes P3/4 at X= -11 Re saw clear dipolarization and earthward flows, implying that the source of onset was located farther in the magnetotail. Located at X = -18.5 Re, P2 observed magnetic field and plasma flow conditions that suggest a tailward expansion starting at ~0713 UT. These in situ observations provide a bracket that encloses the onset location and are consistent with the magnetoseismic results.

traveltime magnetoseismology, substorm onsets, Pi 2 pulsations

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