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Flapping current sheet with superposed waves seen in space and on the ground

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A wavy current sheet event observed on 15th of October 2004 between 1235 and 1300 UT has been studied by using Cluster and ground-based magnetometer data. Waves propagating from the tail centre to the duskside flank with a period ∼30 s and wavelength ∼1 RE, are superimposed on a flapping current sheet, accompanied with a bursty bulk flow (BBF). Three Pi2 pulsations, with onset at ∼1236, ∼1251 and ∼1255 UT, respectively, are observed at the Tixie (TIK) station located near the foot-points of Cluster. The mechanism creating the Pi2 (period ∼40 s) onset at ∼1236 UT is unclear. The second Pi2 (period ∼90 s, onset at ∼1251 UT) is associated with a strong field-aligned current, which has a strong transverse component of the magnetic field, observed by Cluster with a time delay ∼60 s. We suggest that it is caused by bouncing Alfvén waves between the northern and southern ionosphere which transport the field-aligned current. For the third Pi2 (period ∼60 s) there is almost no damping at the first three periods. They occur in conjunction with periodic field-aligned currents one-on-one with 72s delay. We suggest that it is generated by these periodic field-aligned currents. We conclude that the strong field-aligned currents generated in the plasma sheet during flapping with superimposed higher frequency waves can drive Pi2 pulsations on the ground, and periodic field-aligned currents can even control the period of the Pi2s.