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# Propagation of electrostatic solitary waves in the magnetosheath: multispacecraft observations and simulations

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We present the first observations of Electrostatic Solitary Wave (ESW) propagation in the magnetosheath over a distance as great as 30 km using data from the Wideband (WBD) plasma wave receivers mounted on the Cluster spacecraft. These data show the characteristic signature of ESWs located in the magnetosheath about an hour in advance of magnetopause crossing, namely a set of bipolar pulses with time durations on the order of 600 microseconds and amplitudes of a few tenths of mV/m. These ESWs are propagating away from earth at 1,334 km/s and have a size along the magnetic field of 0.8 km and a size cross field of at least 40 km. Thus, these solitary structures are pancake-shaped which is in keeping with the characteristics of similar structures observed in the cusp and plasmasheet, but not with those observed in the auroral acceleration region, which are reported to be nearly spherical. Although there is more than one possible method for generation of ESWs through nonlinear processes, we explore here only one method, that being the electron acoustic instability. For our analysis a fluid model has been assumed with the plasma consisting of hot, energetic, multi-ion species and warm electrons with a warm electron beam parallel to the magnetic field as measured by the particle instruments on Cluster. Positive and negative potential solitary waves are shown to be generated in such a plasma. We compare the results of the model to the observational results.