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On the generation of electrostatic solitary waves observed by Cluster in the magnetosheath

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The Wideband (WBD) Plasma Wave Receiver aboard the four Cluster spacecraft almost always observes Electrostatic Solitary Waves (ESW) in all regions of the magnetosheath from about 10 Earth Radii to 19.5. We explore the characteristics of the ESW in the magnetosheath and at the bow shock (a possible source region) considering the differing upstream and downstream environments for several events. WBD is particularly well-suited for carrying out this study since it has available both relatively narrow (9.5 kHz) and wide (77 kHz) frequency bandwidth modes. This allows for the detection of pulse widths ranging from a few tens of microseconds to several milliseconds which is essential for detecting the broad range of pulse widths associated with the ESW in the magnetosheath and at the bow shock. We show that in the magnetosheath the ESW pulse amplitudes are typically smaller and the time durations frequently much shorter than for those ESW pulses observed at the bow shock. Further, we show that the ESW amplitudes and pulse widths typically do not vary across the magnetosheath. These results lead to the conclusion that the magnetosheath ESW are locally produced, rather than being created at the bow shock and propagating far into the magnetosheath. We discuss several possibilities for the generation of the magnetosheath ESW.