

## Global observations of high-m poloidal waves in the magnetosphere during the recovery phase of the June 2015 magnetic storm

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In this paper, we report global observations of high-m poloidal waves occurred during the recovery phase of the magnetic storm starting on 22 June 2015. The long lasting waves are observed by a constellation of widely spaced satellites from 5 missions including MMS, Van Allen Probes, THEMIS, Cluster, and GOES, covering L-values between 4 and 12 in a large range of local times. These observations have demonstrated that storm-time high-m poloidal waves can occur globally. High-resolution data from four MMS satellites enable us to detect the azimuthal phase shifts and determine the m number to be  $\sim 100$ . The mode identification suggests that the observed poloidal waves are associated with the second harmonic of the field line resonance. The wave frequencies range from 8 to 22 mHz and decrease as the L-value increases. Detailed examinations of instantaneous wave frequency show discrete spatial structures with step-like changes along the radial direction. In each discrete structure the wave has a steady frequency and spans about 1 Re in the radial direction. Our observations suggest that storm-time high-m poloidal waves are different from the single-frequency global poloidal mode waves that are common during periods of low-level of geomagnetic activities.

Keywords: Magnetospheric ULF Waves, High-m Poloidal Waves, Magnetospheric Multiscale Mission, Magnetic Storms