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ULF wave power features in the topside ionosphere revealed by Swarm observations

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Recently developed automated methods for detecting and deriving the characteristics of ultra low frequency (ULF) waves are applied to the Swarm data sets in order to retrieve new information about the near-Earth electromagnetic environment. Here, we present the first ULF wave observations by Swarm, by performing a statistical study on the occurence and properties of Pc3 waves (20–100 mHz) for a time period spanning two years. We derive distributions for various properties of the detected wave events (amplitude, peak frequency, duration, bandwidth) and examine evidence for the decay of the amplitude of the Pc3 signal with altitude, as predicted by theoretical models of wave propagation. We show that the major characteristics of the Swarm ULF power maps generally agree between observations made by the upper satellite and the lower pair of satellites, when the power spectrum of the upper satellite is shifted in local time, to account for the angular separation between their orbital planes. Moreover, a puzzling enhancement, not predicted by current ULF wave theories, of compressional Pc3 wave energy was revealed by Swarm in the region of the South Atlantic Anomaly.