



## **Large scale ducting of Pc1 pulsations observed by Swarm satellite and multiple ground networks**

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Low earth orbit satellites frequently encounter Pc1 pulsations, but most have been observed with limited latitudinal extent or short lifetime. In this study we analyze two large-scale Pc1 pulsations (both latitudinally wide and long-lasting) generated by ionospheric ducting effect using Swarm and ground magnetometers on 25 June and 3 September 2015. Swarm observed the 25 June pulsations on both dayside and nightside during the storm-time substorm (a strong geomagnetic storm on 23 June with  $D_{st} = -204$  nT). We found the Pc1 pulsations were prevalent in both MLT sectors of dayside and nightside for at least 2 hours. Another large Pc1 pulsation on 3 September was observed during a non-storm substorm period. We conclude that (1) ionospheric ducting can transmit Pc1 waves to a wide range of L shells, (2) geomagnetic storm is not a prerequisite for such large scale ducting, and (3) wave intensity can abruptly decrease across sharp gradients in the ionospheric plasma density.