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Survey of ionospheric Pc3-5 ULF wave signatures as seen by SuperDARN radars at middle, high, and polar latitudes

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Ionospheric ultra-low frequency (ULF) wave signatures in the Pc3-5 band (1.7-40.0 mHz) were surveyed using seven years' high time resolution (∼6 s) data from Super Dual Auroral Radar Network (SuperDARN) radars at middle, high, and polar latitudes in the northern hemisphere. Numerical experiments were conducted to derive wave period dependent thresholds for automated detection of ULF waves using the Lomb-Scargle periodogram technique. The spatial occurrence distribution, frequency characteristics, seasonal effects, solar wind condition and geomagnetic activity level dependence have been studied. Pc5 wave events were found to dominate at high and polar latitudes with a most probable frequency of $\sim$ 2 mHz while Pc3-4 waves were relatively more common at midlatitudes on the nightside with a most probable frequency of $\sim$ 11 mHz. At high latitudes, the occurrence rate of poloidal Pc4-5 waves maximizes in the dusk sector and during winter. These events tend to occur during low geomagnetic activity and northward interplanetary magnetic field (IMF), which implies an internal wave-particle interaction source. At midlatitudes, the poloidal Pc3-4 occurrence rate maximizes premidnight and during equinox. This tendency becomes more prominent with increasing auroral electrojet (AE) index and during southward IMF, which suggests many of these events are Pi2 and Pc3-4 pulsations associated with magnetotail dynamics during active geomagnetic intervals. The overall occurrence rate of toroidal Pc3-5 wave events increases from summer through equinox to winter, which suggests that the ionospheric conductivity plays a role in controlling ULF wave occurrence.