

## Morphology and possible origins of close-range echoes

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High frequency (HF, 10-20 MHz) radar echoes from very close ranges of <300-400 km are generally attributed to at least three sources: (i) backscatter/reflection from meteor trails, (ii) polar mesospheric summer echoes, PMSE, and (iii) non-field-aligned E-region irregularities which are confined to the auroral electrojet and produce high-aspect ionospheric returns, HAIR. To distinguish between different mechanisms, we used several years of data from Super Dual Auroral Radar Network, SuperDARN, to perform statistical analysis of the seasonal-diurnal variability in major echo parameters. The dataset covered mid, auroral and polar latitudes, and all observed close-range echoes were processed without any pre-selection. The most common morphological feature observed at all magnetic latitudes is a daytime echo population centred at midsummer. These echoes originate from the bottom of the E-region, and they seem to be generated by some unspecified non-aspect mechanism. Furthermore, the meteor returns are easily distinguishable at auroral and sub-auroral latitudes near the local dawn, while PMSE signatures do not seem to be statistically significant in our dataset.