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A reassessment of SuperDARN meteor echoes from the upper mesosphere and lower thermosphere

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The Super Dual Auroral Radar Network (SuperDARN) is a network of versatile HF radars with the capability for studying phenomena in the Earth's magnetosphere, ionosphere, and upper atmosphere. Upper atmospheric phenomena in the upper mesosphere and lower thermosphere (MLT) can be studied as the SuperDARN radars act effectively as meteor radars at near ranges. However, SuperDARN meteor echo measurements from all heights have typically been combined together to give a height-averaged picture of the characteristics and dynamics of the MLT. This is in part due to the uncertainty in the measurement of individual meteor echo heights, often due to the lack of reliable (and for some radars, the lack of any) interferometric information. Consequently, occurrence distributions of SuperDARN meteor echo heights are rarely measured. Here, we present a method for calibrating SuperDARN interferometer data which reduces the uncertainty in meteor echo height determinations. Using 9 years of SuperDARN data we then determine occurrence distributions of SuperDARN meteor echo heights. The distributions are approximately Gaussian with height, extending from $\sim$80 to $\sim$125 km and peaking around $\sim$102-103 km. In addition, we investigate whether the Doppler spectral width measured by the SuperDARN radars, which is related to the ambipolar diffusion coefficient, can be used as a proxy measurement for meteor echo height. Due to the large spread of spectral width measurements that have been measured at specific altitudes we conclude that this proxy measurement is not practical and that the height of SuperDARN meteor echoes cannot be accurately determined without interferometric information. We also show how accurate height information can potentially be used to study the height variation of neutral wind velocities and the ambipolar diffusion coefficient across this altitude range, which significantly extends the altitude range of meteor observations from VHF radars.