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## SuperDARN radar estimates of thermospheric neutral density

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Using the ion-momentum equation in the F-region ionosphere, simplified for field-perpendicular ion motion only, we derive an expression for the ion-neutral collision frequency that depends primarily on the temporal and spatial variability of the ion velocity. The ion-neutral collision frequency is primarily a function of neutral density in the thermosphere. SuperDARN radars are very suited to this type of observation because of their large coverage of the F-region ionosphere, mesoscale range resolution and frequency agility. Multi-frequency observations at one second integration have been performed by the UNIS Longyearbyen radar using natural backscatter, and the University of Leicester CUTLASS-Hankasalmi radar using EISCAT Heater-generated artificial striations. Both show that realistic estimates of thermospheric neutral density, compared to the MSIS model, can be obtained with minute cadence or less. Since HF radio wave propagation refracts in the F-region ionosphere, a functional comparison is only possible with ray tracing. This works well, at least for low geomagnetic activity.

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