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# Further effects of charged aerosols on summer mesospheric radar scatter

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## Abstract

In an earlier paper, we showed that charged aerosols play a crucial role in enhancing radar echoes from the summer polar mesosphere through reduced diffusion turbulent scatter and dressed aerosol scatter (Cho *et al.*, 1992a). Here, we explore the effects of charged aerosols on radar scatter through 'fossil' turbulence and electron density depletion layers. We find that the former can produce radar scatter even after the decay of neutral gas turbulence, while the latter, which are probably produced by the scavenging of free electrons by ice particles, are a candidate for causing partial reflection or Fresnel scatter. Furthermore, we examine the mutual aerosol interaction restriction on dressed aerosol scatter more

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closely. We find that a high ambient electron density and low aerosol number density are needed for effective dressed aerosol scatter to occur. We then show that very small (less than 1 nm radii), negatively charged aerosols enhance electron diffusivity, and thus inhibit radar scatter. Also, ice aerosol sedimentation, in the light of the reduced diffusion theory, leads us to conclude that the statistical peak in Polar Mesospheric Summer Echoes (PMSE) power should be located between the mean mesopause and the average noctilucent cloud (NLC) height, which agrees with observations. Finally, we invoke time lags in the ice particle formation cycle to account for the observed non-correlation between PMSE and NLC occurrence.

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