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Analysis on edge conglutination between particles in cloud and the contribution to radar brightness band

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ABSTRACT Taking two small, spherical particles for example, the backscattering cross-section as a whole during the stage of edge conglutination between them would be greatest as compared with that before they contact with each other and that after they fuse and coalesce into a single spherical particle, especially the conglutination and coalescence process starts from two small, spherical ice particles. The paper studies the contribution of this phenomenon to radar bright band. DDA is used to calculate σ_{DDA}, the backscattering cross-section of the edge-conglutinated particles. It has been found that σ_{DDA} in case the conglutination is along the direction of radar wave polarization may be 1.5 times greater than σ_{mie}, the backscattering cross-section of the equal volume, spherical particle at a certain size though the ratio may decrease to even less than 1 and fluctuate as the particle size increases because of resonance for large particles. Applying these results into simulating radar bright band, it has been shown that, for a normal intense cloud echo such as 37.69dBZ (5874mm^6/m^3), radar reflectivity factor can increase by $\sim$4.09dBZ in case the conglutination percentage$p$=33%, $\sim$5.18dBZ in case$p$ =50%, and $\sim$7.48BZ in case$p$ =100%, respectively, while the increase is only $\sim$3.82dBZ if the conglutination is not considered. Therefore, conglutination on the edge of two spherical particles along radar wave polarization direction can effectively increase the radar reflectivity factor and benefit the formation of bright band.

Key words: conglutination on the edge of particles, backscattering cross-section, reflectivity factor, radar bright band

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