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Effects of different forms of inhomogeneity on light scattering by mineral dust particles

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We investigate how different inhomogeneous features affect light scattering by realistic model dust particles. It is well known that inhomogeneity affects light scattering significantly, but so far there has not been many detailed studies. In this work we have generated discrete-dipole approximation model dust particles with realistic mineral compositions and shapes, and study how their light-scattering properties change if the light-scattering calculations are done for the inhomogeneous particles or their homogenized versions, where the effective refractive index has been calculated taking into account the mineral composition via an effective-medium approximation (EMA).

We see that for particles with either strongly scattering or absorbing minerals, such as hematite, or internal pores, the effects of EMA are significant. Moreover, the effects are qualitatively different depending on if hematite is present in nodes or in the coating material of the particle. We see that particle albedo, linear depolarization ratio and lidar ratio are especially affected by not taking inhomogeneity properly into account. This suggests that using homogeneous model particles for studying hematite-rich or porous particles is problematic and can easily lead to errors in simulations or retrievals.