Is plastic dust different from mineral dust? Results from idealized wind tunnel experiments

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Abstract

Atmospheric transport has been shown to effectively disperse microplastic particulate matter to virtually every environment on the planet. Despite this efficient long-range transport, only few studies have examined the fundamental mechanisms of the atmospheric transport of microplastics. Here, we present the results of wind tunnel experiments, examining the detachment behavior of plastic particles ranging from 38 to 125 μm in diameter from idealized substrates. Detachment was achieved solely by aerodynamic forces of the turbulent airflow. The detachment behavior of spheric microplastic particles (Polyethylene) and spheric glass microparticles (Borosilicate) of nominally the same diameter (63-75 μm) are contrasted across substrates with hydrophilic to hydrophobic surface coatings. We further examine the effect of particle-particle collisions on the detachment behavior of both PE and glass spheres. The critical friction velocity (u_{*,th}), which is defined as the value at which 50 % of all microparticles detach, was smaller for PE particles compared to glass particles on a hydrophilic substrate (0.22 and 0.3 msˆ-1), with a smaller difference on a very hydrophobic substrate (0.24 and 0.26 msˆ-1). Particle-particle collisions reduced the u_{*,th} of glass, but not that for PE.

Keywords: microparticles, erosion, wind tunnel, JKR

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