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Surface area and volume measurements of volcanic ash particles by SEM stereoscopic imaging

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Surface area of volcanic ash particles is of great importance to research including plume dynamics, particle chemical and water reactions in the plume, modelling (i.e. plume shape, particle interactions , dispersion etc.), remote sensing of transport and SO_2, HCl, H_2O, CO_2 levels, forecasting plume location, and transportation and deposition of ash particles. The implemented method presented in this study offer new insights for surface characterization of volcanic ash particles on macro-pore regions. Surface area and volumes of volcanic ash particles were measured using digital elevation models (DEM) reconstructed from stereoscopic images acquired from different angles by scanning electron microscope (SEM). The method was tested using glycidyl methacrylate (GMA) micro-spheres which exhibit low spherical imperfections. The differences between measured and geometrically calculated surface areas were introduced for both micro-spheres and volcanic ash particles in order to highlight the probable errors in modelling on volcanic ash behaviour. The specific surface areas of volcanic ash particles using this method are reduced by half (from mean values of 0.045 m^2/g to 0.021 m^2/g) for the size increment 63 μm to 125 μm. Ash particles mostly have higher specific surface area values than the geometric forms irrespective of particle size. The specific surface area trends of spheres and ash particles resemble for finer particles (63 μm). Approximation to sphere and ellipsoid have similar margin of error for coarser particles (125 μm) but both seem to be inadequate for representation of real ash surfaces.