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# A numeral model to simulate the chemical processing of volcanic ejecta in eruption plumes and clouds

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Volcanic eruptions inject tremendous amount of gases and particles into the atmosphere that can notably affect different components of the climate system. The scale of such impacts strongly depends on the eruption magnitude as well as the physicochemical properties of the erupted material, which are mainly shaped during the atmospheric transport within the eruption plume and cloud. For instance, the radiative forcing of an eruption through backscattering the incoming solar radiation depends on the amount and properties of the sulfate aerosols formed as the result of in-cloud processes including chemical conversion of volcanic $SO_2$ to sulfate. The rate, pathway and efficiency of this conversion can therefore significantly influence the radiative forcing posed by the eruption. Models that can simulate such in-plume and in-cloud processes are rare.

Here we present the framework and initial results of a numerical model that simulates the chemical interaction of gas, ash and aerosols within the volcanic eruption plumes and clouds. The chemical mechanism takes into account the gaseous and aqueous chemistry as well as the gas-aerosol partitioning within a fully-coupled scheme. In other words, it is capable of modeling the changes in the gas, liquid and solid phase separately as well as the interactions between phases. For instance, the results show that the ash dissolution reduces the acidity of its liquid coating and thus, enhances the scavenging of $SO_2$ and HCl. The potential application of the model in volcanology, geochemistry and atmospheric sciences are discussed.