

Eruption of Nabro volcano, 2011: Evidence for early injection of sulfate into the stratosphere

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The eruption of the Nabro volcano (Eritrea), which started on June 12, 2011, caused the introduction of large quantities of SO₂ into the lower stratosphere. The resulting sulfate aerosols could be detected for several months following the eruption. It is generally assumed that the formation of sulfate aerosols in the stratosphere takes about a month, but in plumes from explosive eruptions, significant amounts of aerosols have been seen to form within a few hours. Neglecting such rapidly formed sulfate aerosols, e.g. in climate model simulations, causes an appreciable underestimation of the direct radiative effect of volcanic aerosols.

We here show that a significant amount of sulfate aerosols was present in the lower stratosphere within hours of the onset of the eruption of Nabro. Evidence comes from measurements by the SCIAMACHY instrument on ENVISAT, which was one of the first satellite instruments to capture the volcanic plume. Its unique combination of measurements in nadir and limb geometry allows the unambiguous discrimination between volcanic ash and sulfate aerosols (via the nadir UV Aerosol Indices) and the determination of aerosol layer top height (from limb measurements). The findings are in agreement with previously published ground-based lidar data.