



The 2011 eruption of Nabro: Evidence for direct injection of sulphate into the stratosphere

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The first recorded eruption of the Nabro volcano (Eritrea), which started on June 12, 2011, was also one of the largest volcanic events recorded in terms of sulphur dioxide emissions. Due to the large injection height of (parts of) the volcanic plume, sulphate aerosols could be detected in the stratosphere for several months following the eruption. According to common knowledge, the conversion of SO₂ to sulphate and the subsequent formation of aerosols occurs on time scales of days to weeks.

We here postulate that sulphate aerosols were injected into the lower stratosphere within hours of the onset of the eruption of Nabro. Evidence for our hypothesis 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 sulphate aerosols (via the nadir UV Aerosol Indices) and the determination of aerosol layer top height (from limb measurements). The findings are corroborated by measurements from other satellite instruments (GOME-2, OMI, and CALIOP) and ground-based lidar data.