

Stromboli volcanic activity variations inferred from observations of volatiles degassing: 20 years of continuous monitoring of summit soil CO₂ fluxes (2000-2019)

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Abstract

Stromboli volcano is characterised by a persistent strombolian activity that was interrupted by effusive eruptions in 1985, 2002-2003, 2007, and 2014. The considerable amount of soil CO₂ flux data acquired by the continuous geochemical network installed in the summit and peripheral areas of Stromboli island have allowed us to thoroughly investigate and to model the plumbing system. This study analyzed 20 years of soil CO₂ fluxes (2000 to 2019) from the summit area, which showed a wide range of values (from 2,000 to 85,000 g m⁻² day⁻¹). The four selected sub-periods (2000–2004, 2005–2010, 2011–2015 and 2016-2019) were characterized by considerable increases in soil CO₂ degassing coinciding with the periods of effusive eruptions, indicating volatiles overpressure and disequilibrium of the volcanic system. The last increased volcanic activity of Stromboli volcano, from 2016 to 2018, was characterized by increases in number and frequency of crater explosions and by episodes of lava overflow. The data in this last period confirm a long growing trend of CO₂ summit degassing, already timing of observed in the previous years since 2005 (reaching 23,000 g m⁻² d⁻¹). Moreover, within this increasing trend, episodes of sudden and sharp increases in the degassing rate, up to 24.2 g m⁻² d⁻² were recorded, which are correlated with the observed paroxysmal activity (increased summit explosions and overflow).