

SO₂ emissions from the Villarrica volcano (Chile) period 2009 - 2015: relationship with the dynamics of lava lake.

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Villarrica Volcano is a basaltic andesite stratovolcano located in the Southern Andean Volcanic Zone of the Andes (39.42°S, 71.95°W; 2.847 m.s.n.m) and an open-crater system being one of the most frequently active volcanoes in this region. The permanent active degassing is related with the lava lake dynamics, which controls the persistent Strombolian activity recorded along the last century. Here, we present a time series (2009-2015) of SO₂ fluxes estimated with Differential Optical Absorption Spectroscopy (DOAS) instrument, that we compare with the Volcanic Radiative Power obtained from MODIS satelital sensor in order to track level changes of the lava lake. Five stages were defined with a trend of increasing SO₂ fluxes with lake level rise. However, two months before the eruption of March 3, 2015, the fluxes were the highest with ca. 630 t d⁻¹ on average and a maximum of ca. 2400 t d⁻¹, although no record of a visible lava lake or thermal anomaly were perceivable for such period. The SO₂ fluxes returned to background levels the days before the eruption. Thus, we find long-term annual-scale variations of SO₂ fluxes that roughly correlate with level changes of the lava lake and the subsequent Strombolian activity and also week/month-scale variations that could represent the slow recharge with a low-volume fresh gas-bearing batch, that destabilizes the upper magma chamber promoting mild to moderate protracted Strombolian activity.