Gas emission measurements of the active lava lake of Niyragongo, DR Congo

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Between 2007 and 2011 four measurement campaigns (June 2007, July 2010, June 2011 and December 2011) were carried out at the crater rim of Nyiragongo volcano, DR Congo. Nyiragongo is considered one of the most active volcanoes in Africa. The ground based remote sensing technique Multi Axis Differential Optical Absorption spectroscopy (MAXDOAS) using scattered sunlight and a Multigas instrument have been simultaneously applied during all field trips and among others bromine monoxide/sulphur dioxide (BrO/SO2) and carbon dioxide/sulphur dioxide (CO2/SO2) ratios were determined. At the various field trips lava lake level changes were observed (in the order of minutes up to days and also between the years). The measured gas ratios varied as well for CO2/SO2 ratios between 1.2 and 16.2 and between 0.2 and 1.6 x 10^{-5} for BrO/SO2 ratios. BrO/SO2 ratios showed similar behavior as CO2/SO2 ratios. Higher CO2/SO2 ratios and BrO/SO2 levels were generally observed at higher lava lake levels and a decrease of the lava lake was accompanied by a decrease in the BrO/SO2 as well as CO2/SO2 ratio. During all campaign also Cl/S ratios have been determined by filterpack sampling. Overall the Cl/S ratio shows an increase with time from earlier literature data of 0.05 to up to 0.55 in 2011, which is accompanied by a decreasing sulfur dioxide flux.

A model is proposed, which assumes various convective magma cells inside the conduit and the possible temporary interruption of part of the cycling. This model is able to explain our data set as a whole.