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

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In June 2007 and July 2010 spectroscopic measurements and chemical in-situ studies were carried out at Nyiragongo volcano located 15 km north of the city Goma, North Kivu region (DRC), both at the crater rim and within the crater itself, next to the lava lake. Nyiragongo volcano belongs to the Virunga volcanic chain and it is associated with the Western branch of the Great Rift Valley. The volcanism at Nyiragongo is caused by the rifting of the Earth's crust where two parts of the African plates are breaking apart. Niyragongo crater contains the biggest lava lake on Earth and it is considered one of the most active volcanoes in the world.

The ground-based remote sensing technique MAX-DOAS (Multi-Axis Differential Optical Absorption Spectroscopy) using scattered sunlight has been applied during both field trips at the crater rim of the volcano to measure sulphur dioxide, halogen oxides and nitrogen oxide. Additionally filter pack and spectroscopic in-situ carbon dioxide measurements were carried out, as well as SO_2 flux measurements by a scanning DOAS instrument from the NOVAC project at the flank of the volcano.

Nyiragongo is the first rift volcano where halogen oxides have been observed in the plume.

Observations indicate that the gas composition of Nyiragongo might change with a changing lava lake level in short and long-term time scales. Before and during an overflow of the lava lake the molar ratios of BrO/SO_2 were decreasing in 2007 and 2010 from about $3{\cdot}10^{-5}$ to about 0 (below the detection limit). Such a decreasing trend was also observed before and during the eruption of Mt. Etna 2006 and 2008.

In a larger timescale between 2007 and 2010 the molar ratios of S/Cl and CO_2/SO_2 generally decreased from 6.7 - 16.5 to 0.7 – 2.1, from 5 -10 to 1 - 5, respectively. The lower S/Cl and CO_2/SO_2 could lead to the conclusion that the magma reservoir below Niyragongo has had no new input from a deeper source.

The chemical composition as well as its temporal variability within the volcanic plume from the lava lake will be discussed, as well as its implication on the understanding of the dynamics of the plumbing system of this volcano.