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# InSAR and GPS measurements along the Kivu segment of the East African Rift System during the 2011-2012 Nyamulagira volcanic eruption.

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Along the East African Rift System (EARS), magma intrusions represent a major component in continental rifting. When these intrusions reach the surface, they cause volcanic eruptions. This is the case of the last flank eruption of Nyamulagira, which occurred from November 6 2011 to April 2012.

Nyamulagira is an active shield volcano with a central caldera, located in the eastern part of the Democratic Republic of Congo, along the Kivu segment of the East African Rift System. From 1948 to 2012, Nyamulagira mostly showed a particular eruptive cycle with 1) classical short-lived (i.e. 20-30 days) flank eruptions, sometimes accompanied with intracrateral activity, which occurred every 1-4 years on average, and 2) less frequent long-lived (i.e. several months) eruptions usually emitting larger volumes of lava that take place at larger distance (>8 km) from the central caldera. The 2011-2012 Nyamulagira eruption is of that second type. Here we used InSAR data from different satellite (Envisat, Cosmo SkyMed, TerraSAR-X and RADARSAT) to measure pre-, co and post-eruptive ground displacement associated with the Nyamulagira 2011-2012 eruption. Results suggest that a magma intrusion preceded by two days the eruption. This intrusion corresponded to the migration of magma from a shallow reservoir (∼3km) below the caldera to the two eruptive fissures located ∼11 km ENE of the central edifice. Available seismic data are in agreement with InSAR results showing increased seismic activity since November 4 2011, with long- and short-period earthquakes swarms. Using analytical models we invert the measured ground displacements during the first co-eruptive month to evaluate the deformation source parameters and the mechanism of magma emplacement for this eruption. GPS data from permanent stations in the KivuGNet network are used to constrain the temporal evolution of the eruption and evaluate far-field deformation, while the InSAR data is more sensitive to the near-field deformation. Overall, GPS, InSAR and seismic datasets suggest the presence of a deep magmatic source that possibly fed the shallower magmatic system. This mechanism, involving a deep source for this large eruption, contrasts with the usual shallow plumbing system identified during the classical flank eruptions.