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Volcano-tectonic deformation in the Kivu Region, Central Africa: Results from multi-year InSAR time series analysis and continuous GNSS observations of the Kivu Geodetic Network (KivuGNet)

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The Kivu Region in Central Africa is a topographic dome cut by the depression of the western branch of the East African Rift, where the Nubia plate and the Victoria micro-plate are diverging by approximately 2-3 mm/yr (Stamps et al. 2008). Two closely spaced and frequently active volcanoes, Nyiragongo and Nyamulagira, are located at the plate boundary. Here, deformation signals from transient deformation events (i.e. earthquakes, eruptions, rifting episodes, intrusions or other subsurface mass movements) are intertwined with the more perpetual nature of inter-seismic strain accumulation and gradual magma accumulation.

Here, we present deformation results from six years of operation of the 15- station KivuGNet (Kivu Geodetic Network) in the Kivu Region and multi-year InSAR time series of the region using the MSBAS approach (Samsonov & d'Oreye, 2012). Since 2009, KivuGNet has captured transient deformation from a) the 2010 eruption of Nyamulagira, b) the 2011-2012 eruption of Nyamulagira c) the Mw5.8 August 7, 2015 Katana earthquake at the western border of Lake Kivu. Importantly, the GPS data also show an ongoing deformation signal, which is most readily explained by long-term magma accumulation under the volcanic region. We use the GPS and InSAR deformation signals to constrain and compare source parameters of simplistic elastic models for the different time periods. Although not well constrained, most of the time periods indicate the presence of a deep ($\sim$15-30 km) magmatic source centered approximately under Nyamulagira or to the southeast of Nyamulagira, that inflates between eruptions and deflates during eruptions.