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KivuSNet: A broadband seismic network for the Lake Kivu & Virunga Volcanic Region, Democratic Republic of the Congo

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The Kivu Basin is located in the bordering region of the Democratic Republic of Congo (DRC) and Rwanda, in the Western branch of the East African Rift. Here the active volcanoes Nyamulagira (the most active in Africa) and Nyiragongo (host to the largest persistent lava lake on Earth) threat the city of Goma (DRC) and neighbouring agglomerations such as Sake to the West, or Rubavu to the East (in Rwanda). For many years already, urbanisation in that region undergoes sustained rapid growth, and Goma alone counts now 1 million inhabitants. In 1977 and 2002, eruptions of Nyiragongo caused major disasters. Destructive earthquakes can also affect the region, as was the case in 2002 in Kalehe (Mw 6.2) along the western shore of Lake Kivu, or in 2008 in Bukavu (Mw 5.9), south of Lake Kivu. At the same time, until recently modern seismic monitoring infrastructure was lacking in the area, leaving many aspects about the volcanic activity and seismicity up to speculations.

In the framework of several Belgo-Luxembourgish collaborative research projects (the most recent one being RESIST: "Remove Sensing and In Situ Tracking of geohazards", funded by the Belgian Science Policy and the Luxembourg National Research Fund), we deployed the first dense real-time telemetered broadband seismic network in the region, with the first two stations in 2012 and 2013, followed by six additional stations in 2014. Since October 2015, it is now a network of 13 stations that is running in the region. The stations sites were constrained by practical and security criteria and chosen such as to provide the best possible azimuthal coverage around the Virunga volcanoes, yet also allow for robust detection and location of seismic events in and around Lake Kivu. The stations are all equipped with either Guralp 3ESPC 60 s or Nanometrics Trillium Compact 120 s sensors. Data streams are both stored locally on disk and transmitted in real-time via Edge/3G cellular network using a SeisComP3 server and the seedlink protocol.

The operation of this network opens a new window for the seismological state of knowledge in this highly active rifting region. It provides for instance unprecedented insights into tectonic and volcanic seismicity as well as volcanic tremor patterns, and the data will also be used for structural investigations in the area. Together with the often co-located GNSS sensors of the KivuGnet geodetic network, KivuSnet closes a dramatic observational gap in this highly threatened region. We will provide an overview of the key features of the network, discuss technical aspects and pitfalls and present an overview of first results obtained using the thus far acquired data.