New seismic hazard map for the Kivu rift region

D. Delvaux (1), H.-B. Havenith (2), F. Kervyn (1), N. D'Oreye (3, 4) B. Smets (1, 4, 5)

[1] Royal Museum for Central Africa, Tervuren, Belgium, damien.delvaux@africamuseum.be
[2] University of Liege, Belgium
[3] National Museum of Natural History, Luxemburg
[4] European Center for Geodynamics and Seismology, Luxembourg
[5] Vrije Universiteit Brussel, Dept. Geography, Brussels, Belgium

In the frame of the Belgian GeoRisCA project (Geological Risks in Central Africa) and also as a contribution to the IGCP project 601 "Seismotectonics and seismic Risks in Africa" and the compilation of the siemotectonic map of Africa, we performed a joint neotectonic and sismotectonic investigation in order to refine the seismic hazard map for the Kivu rift region.

We re-compiled a unique and homogeneous seismic catalogue using various local and global earthquake catalogues, as well as macroseismic epicenters determined from felt earthquakes. Our catalogue contains 984 events, since the beginning of the 20th century, thus spanning about 100 years. The magnitudes have been homogenized to Mw and the most obvious aftershocks removed.

In parallel, we compiled the neotectonic faults of the region using published documents, interpreting the SRTM DEM at 90 and 30 m resolution, and limited field check. We also made a new homogeneous cross-border geological and tectonic map for the region, integrating field-based and remotely sensed-based interpretations. We collected all available additional data on thermal spring and earthquake epicentral depth distribution. On this basis, we defined a relatively fine seismo-tectonic zonation in 10 seismic source zones considering the geological structure, neotectonic fault systems, basin architecture and distribution of seism epicenter and thermal springs.

Using the filtered seismic catalogue including only main shocks, Gutenberg-Richter Laws have been defined for the entire area and for each sub-zone. On the basis of this seismo-tectonic information and existing attenuation laws that had been established by Twesigomwe (1997) and Mavonga et al. (2007) for this area, seismic hazard has been computed with the Crisis 2012 (Ordaz et al., 2012) software. The outputs of this assessment clearly show higher PGA values (for 475 years return period) along the Rift than the previous estimates by Twesigomwe (1997), Midzi et al., (1999) and Mavonga (2009) while the same attenuation laws had been used. The main reason for these higher PGA values is likely to be related to the more detailed zonation of the Rift structure marked by a strong gradient of the seismicity from outside the rift zone to the inside.

Mavonga, T. (2007). An estimate of the attenuation relationship for the strong ground motion in the Kivu Province, Western Rift Valley of Africa. Physics of the Earth and Planetary Interiors 62, 13–21.

Mavonga, T. and Durheim, R.J. (2009). Probabilistic seismic hazard assessment for the Democratic Republic of Congo and surrounding areas. South African Journal of Geology 112, 3-4

Ordaz M, Martinelli F, Aguilar A, Arboleda J, Meletti C, D'Amico V. (2012). CRISIS 2012, Program for computing seismic hazard. Instituto de Ingeniería, Universidad Nacional Autónoma de México.

Twesigomwe, E. (1997). Probabilistic seismic hazard assessment of Uganda, Ph.D. Thesis, Dept. of Physics, Makere University, Uganda.

Midzi, V., et al. (1999) Seismic hazard assessment in Eastern and Southern Africa. Anali di Geofisica 42(6), 1067-1083.