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Assessment of the vulnerability and the resilience of the population at risk of multi-hazard: a support to geo-risk management in Central Africa

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GeoRisCA is a project which aims at studying the geo-risk in the Kivu region (DRC, Rwanda, Burundi), in order to support risk management. The approach developed in GeoRisCA combines methodologies from various disciplines, which will allow the analyses of seismic, volcanic and mass-movement hazards and the vulnerability assessment of the threatened elements.

Vulnerability is a complex concept which is commonly defined as the susceptibility of the population, the infrastructures and the natural ecosystems to suffer from damages if a hazard occurs. The densely populated area extended from the North Kivu province in Democratic Republic of the Congo (DRC) to North Burundi and East Rwanda is vulnerable to several geohazards, such as landslides triggered by geodynamical processes (climate, seismicity, volcanism) and possibly worsen by anthropic actions. Located in the East African rift valley, the region is also characterized by a strong seismicity, with increasing people and infrastructure exposed. In addition, east DRC hosts the two most active African volcanoes: Nyiragongo and Nyamulagira. Their activity can have serious impacts, as in 2002 when Nyiragongo directly endangers the $\sim$800.000 inhabitants of Goma city, located $\sim$15 km to the south. Linked to passive volcanic degassing, SO_2 and CO_2 discharge may also increase the population vulnerability(morbidity, mortality).

Focusing specifically on this region, the vulnerability assessment methodology developed in GeoRisCA takes into account “exposure to perturbations” and “adaptive capacity or resilience” of the vulnerable systems. On one hand, the exposure is identified as the potential degree of loss of a given element or set of elements at risk; i.e. the susceptibility of people, infrastructures and buildings with respect to a hazard (social vulnerability). It focuses mainly on land use, and on demographic and socio-economic factors that increase or attenuate the impacts of hazards events on local populations. On the other hand, the resilience of the individual, the household, the community, is its adaptive capacity to absorb disturbance and reorganize into a fully functioning system by anticipation, response, adaptation and recovery. A key contribution of GeoRisCA project is to assess the vulnerability to different geohazards by integrating geographic and time variability. This methodology takes into account the specificities highlighted at the regional and the local scale (urban sites). And it also considers that the vulnerability evolves with time, e.g. due to improved education, increased income, denser social networks and evolution of coping mechanisms.

Using the above described methodology, one of the main objective of GeoRisCA is to developed vulnerability maps that, once associated with geohazards data, will provide decision making tools for existing preparedness and mitigation institutions.