

# Third newsletter – August 2021 / September 2022

(Family photo during the HARISSA workshop organised at the Official University of Bukavu in November 2021; © MRAC, 2021)

### Dear reader,

Taking the time to write this third newsletter, to look back and see how far we have come since the last edition, leads us to realise how much work has been done by all of you, the partners of the HARISSA project. It is therefore with words of encouragement and congratulations that I wish to introduce this newsletter.

Almost a year ago, at the end of November 2021, we met in Bukavu for a workshop to take stock of the progress of the activities at the halfway point; it was an opportunity for us all to meet and share our experiences, the problems we encountered, propose solutions, suggest improvements, and adapt the initial objectives to the reality on the ground.

The twelve months that separate us from the end of the HARISSA project will be intense for all the teams, with as many challenges to be met. In a year's time, our doctoral students will have completed or already defended their thesis; colleagues Théo Mana and Théo Tambala from the CRSN will have completed their Masters in Bukavu; the teams from the IGC branches will have published dozens of maps, while their colleagues in Kinshasa who have completed the inventories of their archival collections will be on the threshold of the digital era. For their part, colleagues from the Civil Protection will have raised awareness among an ever-growing audience during the intense debates raised during the HAZAGORA sessions and its newly arrived little brother: CHUKUWA. Karibu ku kazi!

And during all these months, while you will be busy achieving your objectives, our friends, the Citizen Observers, will continue to watch over and transmit information that we would prefer not to receive on the sometimes tragic events that affect families, villages and loved ones... But we scientists know how essential it is to learn from these events, to process this information scientifically, and to contribute, humbly but surely, to a better understanding of the threats, to anticipating natural disasters and reducing their consequences.

We are already working today on the preparation of the project's closing workshop, which will hopefully be held towards the end of 2023. Until then, and on behalf of all my colleagues, I wish you a good end of 2022.

Dr. François Kervyn Coordinator of the HARISSA project



## **CURRENT ACTIVITIES**



The *Centre de Recherche en Sciences Naturelles de Lwiro (CRSN)*, together with the departments of Geophysics and Environment, is pursuing its activities in HARISSA in three main areas:

- Master in Environmental Sciences and Natural Resource Management at UOB: Théophile Tambala and Théophile Mana, researchers in the Geophysics and Environment departments respectively, are continuing their training. They

have collected the data necessary for the preparation of their Master's thesis, which they will defend in March 2023.



Figures 1 (a) and (b): Théo Tambala visited the site of the UOB university clinics, as part of the seismic measurements in the city of Bukavu (South Kivu, DRC). The Nanometrics Trillium Compact Horizon seismometer was acquired by CRSN-Lwiro through the HARISSA project. Figure 1a shows a seismic noise measurement session. Figure 1b shows the result of the H/V spectral ratios of the seismic noise (© CRSN, 2022).





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Figures 2 a and b: Théo Mana's thesis focuses on the management of hydrological disasters in Kivu and more specifically on the case of the floods in Uvira and Masisi, D.R. Congo. Data collection involved visiting affected sites and conducting interviews to analyse the state's response to the victims in the management of the Uvira floods of 16-17 April 2020; above interviews with (a) the deputy mayor of the city of Uvira and (b) the chiefs of Majengo and Hewa Bora avenues, Kasenga district, Mulongwe commune in Uvira (© CRSN/MRAC, 2022).

- **Maintenance and data collection of seismological and rainfall measurement stations**: As a reminder, the 12 rain gauges spread out to the west of lakes Kivu and Tanganyika (DRC), from Matanda in the north to Uvira in the south, provide unique data for the region. These measurements feed into research carried out by CRSN researchers and others. As regards the stations of the KivuSnet and KivuGnet networks, their maintenance is no longer assured since June 2022 and some stations will be dismantled.

- **Supervision of the network of** <u>22 Kivu Citizen Observers</u> (COs) continued throughout this period. As a reminder, this network, supervised by Théo Mana of the Environment Department, collects data on disasters associated with natural hazards (floods, storms, earthquakes, landslides, lightning), which occur in North and South Kivu provinces. Between October 2021 and June 2022, over 180 events, mainly landslides (63) and floods (53), were reported. At the end of 2021, refresher training was organised in Goma for the COs of North Kivu and in Bukavu for the COs of South Kivu respectively (Fig. 3).





Figures 3 a and b: Refresher training with (a) North Kivu COs in Goma in October 2021 and (b) South Kivu COs in Bukavu in November 2021 (©MRAC, 2021).

In the first quarter of 2022, Théo Mana had the opportunity to travel to Uganda to Mbarara University of Science and Technology (MUST) to meet his Ugandan counterpart David Mubiru (Fig. 4). They exchanged views on the functioning of the two CO networks (the status of the COs, their role, their area of intervention, the monitoring and validation of data, as well as the role of the supervisor), and also on the strengths, weaknesses and future prospects of these networks (visibility of the COs, technical and logistical aspects, contacts with the authorities for the sustainability of these networks).



Figure 4: Working session between Theo Mana (left) and David Mubiru (right), at Mbarara University (© CRSN/MUST/MRAC, 2022).



Data collection by the network of 15 citizen observers continued smoothly under the supervision of David Mubiru of MUST. This network, which is operational in the districts of Kabale, Kisoro and Rubanda in Uganda, collects information similar to that of Kivu in D.R. Congo. During 2021, 54 events were recorded and validated. In early 2022, the Ugandan COs participated in a refresher training (Fig. 5). Then, in March, David Mubiru hosted his

Congolese counterpart Theo Mana to discuss the functioning and prospects of citizen observer networks in the region (Fig. 4). The CO network and associated research was highlighted in a scientific paper in the American Geophysical Union's Eos magazine. This paper follows Violet Kanyiginya's participation in a conference in Vienna (see below).



Figure 5: Refresher training for Ugandan COs in January 2022 in Kabale district (©MUST/MRAC, 2022).



During this period, the Institut Géographique du Congo Nord-Kivu (IGC-NK) also continued its activities, while continuing to benefit from a reinforcement of skills in Geographic Information Systems, and from technical and scientific monitoring by the RMCA; the South Kivu and INSTITUT GEOGRAPHIQUE DU CONGO Maniema branches also benefit from this support by the RMCA through online work sessions.

Among the cartographic applications developed by the IGC-NK (Fig. 6 and 7), we note here the administrative and road map of the city of Goma, as well as the 18 maps of the city's districts. The production of administrative maps of the province of North Kivu has continued and maps at the scale of the province and of the different territories (6) of this province have been produced.





Figure 6: Administrative and road map of the city of Goma (© IGC-NK/MRAC, 2022)



Figure 7: Administrative map of North Kivu province (© IGC-NK/MRAC, 2022)

In addition, the IGC-NK team organised a **workshop to sensitise local authorities on the need for cell boundary mapping**, and was able to carry out the fieldwork for the mapping of all the cells in the city (data currently being processed ; Fig. 8 et 9).



Figure 8: Awareness-raising workshop for local authorities (© IGC-NK/MRAC, 2022)



Figure 9: Identification of the streets on the map of the Keshero district in order to delimit the cells ( $\Circle{O}$  IGC-NK/MRAC, 2022)

Currently, the IGC-NK is preparing to develop **an atlas of the city of Goma**, an activity that has begun with the collection of geolocalised data in the urbanised areas of the Nyiragongo territory bordering the commune of Karisimbi.

The Bukavu and Kindu offices, for their part, mainly worked on **administrative maps at the provincial and territorial levels** (respectively South Kivu, with 8 territories, and Maniema with 7 territories ; Fig. 10 et 11).





Figure 10: Administrative map of South Kivu province (© IGC-NK/MRAC, 2022)



Figure 11: Administrative map of Maniema province (© IGC-NK/MRAC, 2022)



In Kinshasa, within the *IGC* - *General Direction (IGC-DG)*, the staff finalised the administrative boundaries of the provinces of Central Kongo, Kinshasa, Kwango, Kwilu, Maï-Ndombe, Tshuwapa, Mongala, Equateur and Sud-Ubangui (province, territories and sectors/chefferies). The production of maps at the provincial and territorial levels is underway; the work continues.

On the other hand, the IGC-DG is **continuing its inventory**: in cartography, to date, more than 8,000 maps and 545 flight plans have been inventoried. Comparison with the inventories of the RMCA will soon be feasible and will make it possible to build up



a unique collection; as far as the collection of aerial photographs is concerned, 316 "blocks" have been inventoried comprising 65,580 identified photographs.



In April 2022, the <u>Volcano Museum (*Centre d'Informations sur les Volcans*)</u> was installed in the premises of the **Goma Volcano Observatory (GVO)**. Developed in collaboration with the Civil Protection of North Kivu and the RMCA, it is based on a simple scenography, relying mainly on informative panels, documentaries and an animated 3D model of the Virunga volcanic chain. The museum aims to inform pupils, students, civil society and other stakeholders in the province of North Kivu, as well as tourists visiting the region, about volcanoes and Disaster Risk Reduction measures

in general, as well as about Virunga's volcanic activity and the GVO's monitoring systems in particular (Fig. 12). Since its opening, it has received over 4,000 visitors.



Figure 12: Panoramic view of the volcano museum at the Goma Volcano Observatory (© OVG/MRAC, 2022)





After dealing with the management of the response to the eruption of the Nyiragongo volcano on 22 May 2021, which lasted for more than a year, the *Civil Protection of North Kivu (PC-NK)* relaunched its **awareness-raising activities** with a review of the use of the HAZAGORA tool, the organisation of SEMAFOR with geography teachers, and the relaunching of animations in the 20 partner schools (Fig. 13 a and b). In addition, based on a tool (card game) developed in *La Réunion* island, the RMCA and PC-NK worked on contextualising it and tested it with pupils in a

primary school class in one of the partner schools. This new tool, called CHUKUWA, was then revised and will soon be distributed to several schools in Goma (Fig. 14 et 15).





Figures 13 a and b: On the left, Sernafor organised with geography teachers from partner schools in May 2022 (© PC-NK/MRAC, 2022)



Figure 14: Testing the Chukuwa card game with primary school pupils from a partner school (© PC-NK/MRAC, 2022)



Figure 15: Chukuwa card game (© PC-NK/MRAC, 2022)



Discussions between the University of Burundi (UB) and the Official University of Bukavu (UOB) have continued, with a view to establishing an inter-university master's degree in natural hazard risk. A workshop to validate the training offer was held before the UB board of directors in March 2022 (Fig. 16). Although an agreement

could not be reached, the master could nevertheless start in 2024 according to modalities still to be defined.

Figure 16: Validation workshop of the UB Board of Directors, with the representative of UOB, Professor Charles Nzolang on the left ( $\[ UB/MRAC, 2022 \]$ )





The Department of Geology of the *Official University of Bukavu (UOB)* has developed and inaugurated, on the Karhale campus in November 2021, the <u>Centre d'Information et de Recherches sur les Risques d'origine</u> <u>Naturelle (CIRRINa)</u>, with the support of the HARISSA project and the contribution of scientists from UOB, RMCA, MNHN/EGS, CRSN/Lwiro, CRGM, UNIKIN, KU Leuven and the South Kivu Civil Protection (Fig. 17). The mission of the CIRRiNa is to conduct research on geological hazards and associated risks in the East African Rift region and

to communicate the results of their research to the local community using appropriate scientific information delivery tools. The CIRRiNa has received several visits since its launch: in addition to the participants in the launch ceremony, the Director General of the National Geological Survey of the D.R. Congo (Prof. Dona Kampata), Prof Johny Wüest from Lausanne, the participants in the official handover ceremony of the Geotechnical laboratory equipment at UOB by the Swiss cooperation, and the first year undergraduate students in Geology (Bac+4) from UOB in the framework of the Natural Hazards course (Fig. 18). Several other non-guided visits are not included in this list.





Figure 17: The CIRRINa equipped with didactic posters, a projector and a 3D model of the East African Rift (© UOB/MRAC, 2022)



Figure 18: Visit of the students of L1 Geology (Bac +5) UOB to the CIRRiNa on 30 August 2022 (© UOB, 2022)

### **RECENT ACTIVITIES OF HARISSA PhD STUDENTS**



Blaise Mafuko (MRAC/VUB/UNIGOM): "My stay at the RMCA in 2022 was decisive for my PhD training. During a period of 4 months, I processed data and prepared a paper on risk perception and motivation of the population to reduce risk. My work was also presented at two international conferences: EGU 2022 and 11th Cities on volcanoes. The next step is to carry out the evaluation survey



Cities on volcanoes. The next step is to carry out the evaluation survey of the awareness tools implemented in Goma."

Violet Kanyiginya Twagira (MRAC/VUB/MUST): "In some of the monitored catchments, I conducted interviews and focus group discussions with 104 older people to understand how the landscape has changed over time in response to natural hazards. I also presented the results of my preliminary research at two international conferences in May 2022 (physically at EGU 2022 in Vienna, Austria, and virtually at the Joint Aquatic Scientific Meeting (JASM) in Grand Rapids (Michigan, USA))."





**Toussaint Mugaruka Bibentyo (MRAC/UGent/UOB)**: "*My recent research activities have focused on the link between landslides, river incision, environmental changes, weathering and lithology in the Ruzizi Gorge located in the Kivu Rift. The results of part of this research were presented (1) in October 2021 at the XIth Scientific Days on "Natural hazards: their knowledge, environmental and societal impact in D.R. Congo" organised by the Centre de Recherches Géologiques et Minières in Kinshasa, and (2) in May 2022 at the EGU22 in Vienna (Austria).*"



Jean Nsabimana (MRAC/UNamur/UB): "In order to assess the territorial vulnerability of the city of Bujumbura, I conducted extensive data collection on the issues in November and December 2021, and also in February and March 2022. I also had the opportunity to present the preliminary results of my research at the EGU 2022 organised in Vienna (Austria) in May 2022."



Figure 19: Destruction of the Gikoma bridge on the RN9 in Bujumbura



the European Centre for Geodynamics and Seismology (ECGS, Luxemb.)."

Jos Subira (MRAC/ULiège, OVG): "The Kivu Rift region is affected by volcanic and seismic hazards. Accurately locating earthquakes in this region is essential for volcano monitoring, as their occurrence is one of the early warning signs of a developing eruptive crisis. During my stay in Belgium in 2022, I had the opportunity to work on the analysis of a large database of data from the automatic location of about 815 earthquakes that occurred between 2015 and 2021 with the seismologists of

Missions and conferences (past and coming)

- 2021/09-2022/06: Several AfricaMuseum geo-webinars have been organised during this period; do not hesitate to contact Caroline Michellier if you wish to present your activities from January 2022 (<u>caroline.michellier@africamuseum.be</u>)
- 2021/11: The HARISSA workshop brought together all the northern and southern partners of the HARISSA project; it took place over two days at the Horizon Hotel and on the Karhale campus of the Official University of Bukavu (South Kivu, D.R. Congo). It provided an opportunity to take stock of the project's mid-term activities.
- 2022/05: The annual <u>EGU 2022</u> General Assembly in geosciences welcomed more than 7,000 participants in Vienna (Austria), and as
  many online. HARISSA PhD students, as well as several RMCA researchers, actively participated. The abstracts of their papers are
  available on the conference website.
- 2022/06: PhD students Blaise Mafuko and Jos Subira participated in the international conference <u>Cities on volcanoes 11</u> in Heraklion, Crete. Researchers from the RMCA also presented the results of their research at this conference.
- 2023/04: Abstracts can already be submitted to the next EGU 2023 conference (until 10 January 2023).

#### Publications

- Smittarello, D., Smets, B., Barrière, J., Michellier, C., Oth, A., Shreve, T., Grandin, R., Theys, N., Brenot, H., Cayol, V., Allard, P., Caudron, C., Chevrel, O., Darchambeau, F., de Buyl, P., Delhaye, L., Derauw, D., Ganci, G., Geirsson, H., Kamate Kaleghetso, E., Kambale Makundi, J., Kambale Nguomoja, I., Kasereka Mahinda, C., Kervyn, M., Kimanuka Ruriho, C., Le Mével, H., Molendijk, S., Namur, O., Poppe, S., Schmid, M., Subira, J., Wauthier, C., Yalire, M., d'Oreye, N., Kervyn, F., Syavulisembo Muhindo, A. (2022). Precursor-free eruption and lateral dike migration triggered by edifice rupture at Nyiragongo volcano. *Nature* 609, 83–88 (2022). https://doi.org/10.1038/s41586-022-05047-8 [I.F. 69.504]
- Sekajugo, J., Kagoro, G. R., Mutyebere, R., Kabaseke, C., Namara, E., Dewitte, O., Kervyn, M., Jacobs, L., 2022. Can citizen scientists provide a reliable geo-hydrological hazard inventory? An analysis of biases, sensitivity and precision for the Rwenzori Mountains, Uganda. *Environmental Research Letters* 17, 045011. <u>https://doi.org/10.1088/1748-9326/ac5bb5</u> [I.F. 6.947]
- Kubwimana, D., Ait Brahim, L., Nkurunziza, P., Dille, A., Depicker, A., Nahimana, L., Abdellah, A., Dewitte, O., 2021. Characteristics and distribution of landslides in the populated hillslopes of Bujumbura, Burundi. *Geosciences* 11, 259. https://doi.org/10.3390/geosciences11060259
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- Dewitte, O., Dille, A., Depicker, A., Kubwimana, D., Maki-Mateso, J.-C., Mugaruka Bibentyo, T., Uwihirwe, J., Monsieurs, E., 2021. Constraining landslide timing in a data-scarce context: from recent to very old processes in the tropical environment of the North Tanganyika-Kivu Rift region. *Landslides* 18, 161-177. <u>https://doi.org/10.1007/s10346-020-01452-0</u> [I.F. 6.153]
- Website GeoRiskA: Visit its News webpage regularly to keep up to date with the latest activities!

#### Acknowledgements

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