Geophysical Research Abstracts
Vol. 18, EGU2016-9720-1, 2016
EGU General Assembly 2016

Identifying hydrological pathways in the north basin of Lake Kivu using stable isotope ratios of meteoric recharge and surface water

Charles M. Balagizi (1,2), Marcellin M. Kasereka (1), Stefan Terzerand (3), Emilio Cuoco (2), Marcello Liotta (2,4)

(1) Goma Volcano Observatory, Goma, The Democratic Republic of Congo (balagizi.charles@gmail.com), (2) Seconda Università degli Studi di Napoli, Caserta, Italy, (3) International Atomic Energy Agency, Vienna, Austria, (4) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Palermo, Palermo, Italy

A rain-gauge network of 12 stations was installed at different altitudes at Nyiragongo volcano (DR Congo) and surroundings and sampled on monthly basis between December 2013 and June 2015 to evaluate the isotopic signature of the meteoric recharge. Additional samples were collected on monthly basis from 5 rivers, 7 springs, 3 profiles in Kabuno bay and 2 others in the Main Basin of Lake Kivu to determine their water isotope compositions (δ^{18}O and δ^{2}H). The precipitation, surface and groundwater δ^{18}O and δ^{2}H values were thereafter used to estimate the groundwater recharge area, surface and groundwater inflow level to Lake Kivu, and for modeling water circulation in the north basin of Lake Kivu. The monthly precipitation isotope composition varied in a large range, whereas mean precipitation-weighed values ranged between -12.39‰ and 6.52‰ for δ^{2}H, and from -4.02‰ to -0.91‰ for δ^{18}O. Monthly values allowed to define a Local Meteoric Water Line of equation δ^{2}H=7.96δ^{18}O + 16.96. Our dataset, the first time series in the Virunga, implies that the δ^{18}O and δ^{2}H of precipitation are predominantly determined by the recycled moisture source area, while their clearly defined seasonality is driven by wind direction and precipitation amount changes. The δ^{18}O, δ^{2}H and deuterium-excess values revealed a convergence zone around Nyiragongo where the N-NE and S-SW trade winds come together. Moisture from the Nile River basin brought by the N-NE originating winds yielded depleted precipitation at local highlands, while that from the Congo River basin brought by the S-SW wind yielded enriched precipitation at lowlands. Rivers and springs monthly are included in the range of monthly precipitation values, and are thus indicative of lack of significant evaporation during aquifer recharge. The mean rivers and springs δ^{2}H and δ^{18}O, and the mean precipitation-weighed values revealed the presence of shallow groundwater recharged between 2100 and 2700m a.s.l., and deep groundwater recharged at up to 3100 m. Both Kabuno Bay and the Main Basin of the CO_2- and CH_4-rich permanently stratified Lake Kivu (485m maximum depth) showed highly enriched surface waters. However the values significantly decrease with depth and were thus lower at the bottom. The δ^{2}H and δ^{18}O data revealed that subaerial rivers and shallow groundwater discharge in the upper layer of Lake Kivu, while the deep groundwater reaches the lake as lateral cold and hot springs inflows to the water column as well as hydrothermal water at the floor. Water of the upper layer of Lake Kivu is highly enriched by intense surface evaporation, whereas the intense water-rock interactions and hydrothermal activities within the aquifers could be responsible for the enrichment of waters transferred to the deep permanently stratified layer of Lake Kivu