

Measurements of stable isotopes in precipitation sampled on monthly and high frequency basis: what have we learned?

TAMARA MARKOVIĆ¹, IGOR KARLOVIĆ¹, TATJANA VUJNOVIĆ² AND NIKOLINA NOVOTNI-HORČIČKA³

¹Croatian Geological Survey

²Croatian Meteorological and Hydrological Service

³Varkom d.o.o.

Presenting Author: tmarkovic@hgi-cgs.hr

Stable isotopes of hydrogen and oxygen represent the powerful tool to determine climate change impact based on precipitation patterns and mechanisms. Nowadays, change in precipitation pattern includes prolonged drought phases interrupted by heavy rainfall events, where a significant portion of annual rainfall can occur within a couple of hours. Such heavy events affect the water cycle, cause excess overland flow, soil erosion, and flooding. Within the scope of IAEA (International Atomic Energy Agency) the coordinate research project (CRP) Convective Rain Events impact on ground and surface waters recharge and water quality in depended ecosystems with intergranular porosity, high frequency and monthly sampling of precipitation have been carried out in the upper catchment of the Česma River during the year 2023. In the study area, monthly stable isotopes data in precipitation samples exist for period 2007-2010 (Hunjak et al, 2015) and current measurements are still ongoing from 2020.

By comparing old data set with new, it is observed that equation of Local Meteoric Water Line (LMWL) and *d*-excess values have been changed. Older LMWL had values $y=7.451x + 1.564$ while new has $y=7.8x + 8.9$ and average *d*-excess values changed from 8.7 to 10.9. In meteorological sense, the year 2023 in the study area was untypical. The winter was marked by periods of above-average air temperature and occasional intrusion of unstable air with abundant precipitation, mostly heavy rain (Plačko Vršak et al., 2023). Measurements of d^2H and $d^{18}O$ in high frequency samples showed nice marking of these changes. However, they were masked in monthly samples, except in February where samples from two-days event marked the changes on the composite monthly sample. Both sampling techniques showed strong Mediterranean air mass effect during colder periods and strong convective rain effect during summer/autumn periods. However, during high frequency sampling, timeline of changes is visible.

Reference:

Hunjak, T., Lutz, H. O., Roller-Lutz, Z. Stable isotope composition of the meteoric precipitation in Croatia. *Isot. Environ. Health Stud.* 2013, 49, 336–345.

Plačko-Vršak, D., Hojsak, T., Mikec, K. Analysis of winter 2022-2023, spring 2023, summer 2023 and autumn 2023. DHMZ reports, 2023, available on-line https://meteo.hr/klima.php?section=klima_pracenje¶m=k2_4&Godina=2023 in