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Poster Session Day 2

Triple δ^2H, $\delta^{17}O$ and $\delta^{18}O$ analyses in water by means of the cavity ring-down laser spectroscopy (CRDS): role of salinity and FRAME applications

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Isotopic composition in water is the basic tool to determine the origin of water, their circulation pathways, retention in the environment, mixing ratios (mass balance), water/rock interaction, evapo(transpi)ration. Relatively new analytical advances of $\delta^{17}O$ analysis serve with three-dimensional isotope tool which can often fill uncertainty gaps resulted from two-dimensional δ^2H - $\delta^{18}O$ observations.

Cavity ring-down laser spectroscopy (Picarro L2140-i CRDS) allows simultaneous and reliable three isotopic ratios analyses in water (δ^2H, $\delta^{17}O$, $\delta^{18}O$) without any pretreatment of samples (esp. removing salts). However. Analytical too is not all – understanding result usually requires statistical tools which are rarely applicable for isotopic data due to isotopic effects. Recently developed isotope evaluation tool - FRAME (FRactionation And Mixing Evaluation) modelling package [1], implements a powerful toll, based on Bayesian statistics, to provide quantitative estimations of isotope mixing and fractionation processes with advanced uncertainty analysis. The CRDS-FRAME method results with reliable information on contribution and evaporation progress as they are calculated by means of joint three isotopes signatures and are expressed as probability distribution of possible outcomes. We show on our poster that the CRDS analyses combined with FRAME are not susceptible for significant variations in salinity of analysed water.

References

[1] Lewicki, M.P., Lewicka-Szczebak, D., and Skrzypek, G. (2022) FRAME—Monte Carlo model for evaluation of the stable isotope mixing and fractionation. PLoS ONE 17, e0277204.