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Spatial Patterns of Stable Water Isotopes in Swedish Lakes

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Stable water isotopes are powerful tracers of hydrological processes, yet spatially distributed isotope observations are sparse in Sweden. With the exception of a few Critical Zone Observatories providing small scale long-term records, isotope data are largely lacking at the national scale. This scarcity contributes to substantial uncertainties in hydrological modelling, water balance assessments, and climate impact forecasting. While many countries contribute data to the Global Network of Isotopes in Precipitation (GNIP) and the Global Network of Isotopes in Rivers (GNIR), Sweden is not systematically represented. To date, the only nationwide spatial depiction of precipitation $\delta^{18}O$ remains a hand-drawn isohyetal map by Burgman et al. (1987), which still constitutes the sole country-wide reference.

Each year, more than 800 lakes are sampled at the beginning of the hydrological year (October to November) within the national monitoring programme. While these samples are routinely analysed for chemical parameters and subsequently discarded, we retrieved aliquots prior to disposal and analysed 150 lakes for stable water isotopes ($\delta^{18}O$ and $\delta^{2}H$). The resulting dataset is presented in dual-isotope space and as isoscape of Sweden. Our results reveal a pronounced latitudinal gradient and a clear west–east isotopic pattern, reflecting large-scale climatic and moisture source controls. Most lakes exhibit only minor evaporative enrichment, indicating strong coupling to meteoric inputs and limited evaporative modification at the national scale. However, a subset of lakes—including some located in sub-Arctic regions—shows enhanced evaporation signatures, highlighting spatial heterogeneity in hydrological processes. This dataset establishes an improved national isotope baseline for Sweden.