

Linking hydro-climate to the sediment archive: a combined monitoring and calibration study from a varved lake in central Turkey

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Hydro-climatic reconstructions from lake sediment proxies require an understanding of modern formation processes and calibration over multiple years. Here we use Nar Gölü, a non-outlet, monomictic maar lake in central Turkey, as a field site for such a natural experiment. Fieldwork since 1997 has included observations and measurements of lake water and sediment trap samples, and automated data logging (Jones et al., 2005; Woodbridge and Roberts, 2010; Dean et al., 2015). We compare these data to isotopic, chemical and biotic proxies preserved in the lake's annually-varved sediments. Nar Gölü underwent a 3 m lake-level fall between 2000 and 2010, and $\delta^{18}\text{O}$ in both water and carbonates is correlated with this lake-level fall, responding to the change in water balance. Over the same period, sedimentary diatom assemblages responded via changes in habitat availability and mixing regime, while conductivity inferred from diatoms showed a rise in inferred salinity, although with a non-linear response to hydro-climatic forcing. There were also non-linear shifts in carbonate mineralogy and elemental chemistry. Building on the relationship between lake water balance and the sediment isotope record, we calibrated sedimentary $\delta^{18}\text{O}$ against local meteorological records to derive a P/E drought index for central Anatolia. Application of this to the longer sediment core isotope record from Nar Gölü (Jones et al. 2006) highlights major drought events over the last 600 years (Yiğitbaşıoğlu et al., 2015). Although this lacustrine record offers an archive of annually-dated, decadal-averaged hydro-climatic change, there were also times of non-linear lake response to climate. Robust reconstruction therefore requires understanding of physical processes as well as application of statistical correlations.

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