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A VIS-RS spectroscopy-based warm season temperature reconstruction from the southern Chilean Andes (38.5° S) derived from the sediments of Laguna Escondida (1742m. a.s.l.) since AD 770

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Laguna Escondida is a remote, relatively high altitude lake in the southern Chilean Andes. It is situated just north of the region that experiences year-round influence of the Southern Hemisphere Westerlies. In our study area, currently the influence of westerly air flow primarily influences the winter season and depends on long term variability in the position and strength of the Westerlies. Although the region to the south (northern Patagonia) is relatively well-studied, only a few climatic reconstructions are available for the climatic transition zone in which our study site is located. This study thus aims to provide climatic reconstructions for a relatively poorly studied region of South America which lies in a climatically important transition zone. These reconstructions may also contribute to our current knowledge on latitudinal variations in the position of the Southern Hemisphere Westerly wind belt.

In this study, the sediments of Laguna Escondida (38°28'S; 70°58'W) were examined in detail with scanning methods (VIS-RS spectroscopy: spectral analyses within the visible light range, 380-730 nm; magnetic susceptibility) and carefully dated using 210Pb, 137Cs and 14C measurements. VIS-RS scanning provided a proxy for the amount of chlorins (chlorophyll-a derivates) in the sediment, which was verified by comparison to (HPLC) pigment analyses. In addition, classical methods (C:N, grainsize distribution) were applied, as well as detailed analyses of sedimentary chrysophyte stomatocysts. Calibration-in-Time (CIT) was used to detect whether any of these sediment properties reflected past temperature variability.

Our findings show that the chlorin content in the sediments of Laguna Escondida was highly and significantly correlated (r= 0.63, p= 0.039, 3-yearly filtered) with warm season temperatures back to AD 1940. Prior to that, meteorological data were increasingly sparse and the chronological error of the age-depth model was too large to be suitable for CIT. In this highly remote, oligotrophic lake with an ice cover that lasts 3-4 months, lake primary productivity is thought to depend on lake mixing (mixing occurs at least twice per year) and epilimnion (hence air) temperatures that follow these mixing episodes. The inverse regression model based on CIT for the period AD 1940-2008 was then applied back to AD 770 (RMSEPboot = 0.4 °C). Interestingly, there is an overall good agreement with long term climatic patterns in other records from central-southern Chile, showing a relatively warm Medieval Climate Anomaly and variable temperatures during the Little Ice Age chronozone.