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Hydroclimatic variability in the Lake Mondsee region and its relationships with large-scale climate anomaly patterns

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Flood triggered detrital layers in varved sediments of Lake Mondsee, located at the northern fringe of the European Alps (47°48'N,13°23'E), provide an important archive of regional hydroclimatic variability during the mid- to late Holocene. To improve the interpretation of the flood layer record in terms of large-scale climate variability, we investigate the relationships between observational hydrological records from the region, like the Mondsee lake level, the runoff of the lake's main inflow Griesler Ache, with observed precipitation and global climate patterns. The lake level shows a strong positive linear trend during the observational period in all seasons. Additionally, lake level presents important interannual to multidecadal variations. These variations are associated with distinct seasonal atmospheric circulation patterns. A pronounced anomalous anticyclonic center over the Iberian Peninsula is associated with high lake levels values during winter. This center moves southwestward during spring, summer and autumn. In the same time, a cyclonic anomaly center is recorded over central and western Europe. This anomalous circulation extends southwestward from winter to autumn. Similar atmospheric circulation patterns are associated with river runoff and precipitation variability from the region. High lake levels are associated with positive local precipitation anomalies in all seasons as well as with negative local temperature anomalies during spring, summer and autumn. A correlation analysis reveals that lake level, runoff and precipitation variability is related to large-scale sea surface temperature anomaly patterns in all seasons suggesting a possible impact of large-scale climatic modes, like the North Atlantic Oscillation and Atlantic Multidecadal Oscillation on hydroclimatic variability in the Lake Mondsee region. The results presented in this study can be used for a more robust interpretation of the long flood layer record from Lake Mondsee sediments in terms of regional and large-scale climate variability during the past.