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Limitations and perspectives of sublacustrine paleoseismology: a Swiss example

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In regions with moderate seismicity and large intervals between strong earthquakes, paleoseismological archives that exceed the historical and instrumental timescale are required to establish reliable estimates of earthquake recurrence for long return periods. In several regions, studies have shown that lake sediments are very suitable for paleoseismological studies by causally linking characteristic sedimentological features to historic earthquakes. Studies on single sites, however, do neither allow determining the paleoepicentre nor the paleomagnitude for the potential paleoearthquakes.

Here we compile the sedimentary paleoseismic record of 11 lakes from Switzerland over the last 10000 years using shaking-induced mass movements and microdeformations. The large dating uncertainty attributed to such deposits does not allow a unique interpretation between single vs. multiple-clustered earthquakes in this multi-lake dataset. However, we propose a new approach that assesses the frequency and allows determining periods of enhanced mass-movement occurrence likely related to earthquakes. In a second part of this study, the area of epicentres and ranges of magnitudes of the historical Unterwalden 1601 AD earthquake could be reconstructed with a model using the geographical distribution of the recorded earthquake-related sedimentary impacts. This method allows us to propose scenarios for possible paleoearthquakes with areas for epicentre locations and ranges of magnitudes based on the lacustrine dataset. Although this study deals with lake sediments, we believe that the outcomes are also interesting for the marine community.