**Title**

Lake and reservoir volume variability from satellite imagery data: An assessment of the usability of high-resolution digital elevation models to extract water levels

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**Abstract**

Recent research suggested that the digital elevation models can be considered, as an alternative to the altimetry data. However, the water prohibits the ability of monitoring the construction the waterbed, due to the loss of the returning signal. The elevation models have therefore a flat surface, which prohibits the extraction of the water level and volume variability.

The goal of this thesis was to develop a tool, that uses the elevations where no flatting had occurred, and create a linear representation of the shape of the lake or reservoir. The following research question was formulated:

What is the potential of applying elevation models to monitor the volume levels of lakes and reservoirs, when replacing the flat elevations with extrapolated depths?

The case study comprised of two parts. First, the validation of the water level extraction was conducted for pre-selected lakes and reservoirs. The results showed an average RMSE of 4.10 [m]. When analysing the distribution of lakes and reservoirs data, the RMSE was centred at 1.27 [m] (NED and ALOS) and 3.70 [m] (SRTM). The comparison between the three considered elevation models, showed a minor improvement regarding the relative water level. At the same time, it demonstrated that the number of waterbodies that can be monitored increases when applying the developed tool.

The second part of the case study aimed at providing an insight in the potential of applying the DEM for estimating the volume variability. An analysis of the USGS in-situ data compared to the results, showed that the overall RMSE decreased for each considered model. From the same analysis, the relative time-series could be determined for each model i.e., in case the minimum amount of surface area was available and in case the water level variation was significantly noticeable.

The results from this work indicated the potential of the global elevation models to monitor the volume levels of lakes and reservoirs. The developed tool demonstrated that elevations can be extrapolated, which would fit a more realistic shape of the reservoir at areas where the bathymetry was flattened or not found.

Accurate information for extracting the water level and assessing the volume variability of lakes and reservoirs currently depends on extensive hydrographic surveys. This work provides guidelines for an alternative method: the Linear Bathymetry for Digital Elevation Models tool.