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Height Connections and Land Uplift Rates in West-Estonian Archipelago

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Land uplift rates are largest in the western part of Estonia. The uplift is due to post-glacial rebound. In 2001-2011, the Estonian national high-precision levelling network was completely renewed and levelled. This was the third precise levelling campaign in the re-gion. The first one had taken place before the Second World War and the second one in the 1950s.
The Estonian mainland was connected with the two largest islands (Saaremaa and Hiiumaa) in the west–Estonian archipelago using the water level monitoring (hydrody-namic levelling) method. Three pairs of automatic tide gauges were installed on opposite coasts of each waterway. The tide gauges were equipped with piezoresistive pressure sen-sors. This represented the first use of such kind of equipment in Estonia. The hydrodynamic levelling series span up to two calendar years. Nevertheless, the obtained hydrodynamic levelling results need to be additionally verified using alternative geodetic methods. The obtained results were compared with the previous high-precision levelling data from the 1960s and 1970s. As well, the new Estonian gravimetric geoid model and the GPS survey were used for GPS-levelling. All the three methods were analyzed, and the preliminary results coincided within a 1-2 cm margin. Additionally, the tide gauges on the mainland and on both islands were connected using high-precision levelling. In this manner, three hydrodynamic and three digital levelling height differences formed a closed loop with the length of 250 km. The closing error of the loop was less than 1 cm.
Finally, the Fennoscandian post-glacial rebound was determined from repeated levelling as well as from repeated GPS survey. The time span between the two campaigns of the first-order GPS survey was almost 13 years. According to new calculations, the relative land uplift rates within the study area reached up to +2 mm/year. This is an area with a rela-tively small amount of input data for the Nordic models. In addition, a comparison with the Fennoscandian land uplift model NKG2005LU is presented. The results coincided with this model within a 1-mm range.

Keywords: hydrodynamic levelling, post-glacial land uplift, GPS-levelling, West-Estonian archipelago.