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## The digital zenith camera as an additional technique for quasi-geoid model determination of Latvia

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The digital zenith camera VESTA (VERTical by STArs) was designed by the Institute of Geodesy and Geoinformatics (GGI) of the University of Latvia and completed in 2016. By 2020 more than 400 terrestrial vertical deflection measurements were observed in the territory of Latvia. These observations were post-processed by the GGI developed software and the accuracy was evaluated at 0.1 arc seconds. In 2019 two new cameras have been developed, which will be used in future projects, e.g., in determination of properties of local geological structure or Earth crust movement monitoring. Measurement control software corrections and complements, data processing improvements and automation and transition to GAIA data release 2 star catalog were done. The accuracy of the measurements of improved camera was evaluated at 0.05 arc seconds.

Terrestrial vertical deflection observations were compared with global geopotential models, e.g. GGM+ and EGM2008. The results show a better correspondence with GGM+ model by evaluating the standard deviation: 0.314 and 0.307 arc seconds for  $\xi$  and  $\eta$  components respectively in comparison to 0.346 and 0.358 arc seconds for  $\xi$  and  $\eta$  components for EGM2008 model. The comparisons of average and minimum/maximum differences are introduced in this study for better evaluation of the results. Moreover, vertical deflections have been used as additional terrestrial data in DFHRS (Digital Finite-element Height Reference Surface) software v. 4.3 in combination with GNSS/levelling data (B, L, hH) and global geopotential model EGM2008 for gravity field and quasi-geoid improvement ([www.dfhbf.de](http://www.dfhbf.de)). This approach is based on parametric modelling and computation of height reference surfaces (HRS) from geometric and physical observation components in a hybrid adjustment approach. The results of the computed quasi-geoid models using different types of data are introduced in this research, representing several solutions, as well as these solutions are compared with the national quasi-geoid model LV'14.