EGU21-10266
https://doi.org/10.5194/egusphere-egu21-10266
EGU General Assembly 2021

Denoising of river surface photogrammetric DEMs using deep learning

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Unmanned Aerial Vehicles (UAVs) can be an excellent tool for environmental measurements due to their ability to reach inaccessible places and fast data acquisition over large areas. In particular drones may have a potential application in hydrology, as they can be used to create photogrammetric digital elevation models (DEM) of the terrain allowing to obtain high resolution spatial distribution of water level in the river to be fed into hydrological models. Nevertheless, photogrammetric algorithms generate distortions on the DEM at the water bodies. This is due to light penetration below the water surface and the lack of static characteristic points on water surface that can be distinguished by the photogrammetric algorithm. The correction of these disturbances could be achieved by applying deep learning methods. For this purpose, it is necessary to build a training dataset containing DEMs before and after water surfaces denoising. A method has been developed to prepare such a dataset. It is divided into several stages. In the first step a photogrammetric surveys and geodetic water level measurements are performed. The second one includes generation of DEMs and orthomosaics using photogrammetric software. Finally in the last one the interpolation of the measured water levels is done to obtain a plane of the water surface and apply it to the DEMs to correct the distortion. The resulting dataset was used to train deep learning model based on convolutional neural networks. The proposed method has been validated on observation data representing part of Kocinka river catchment located in the central Poland.

This research has been partly supported by the Ministry of Science and Higher Education Project “Initiative for Excellence – Research University” and Ministry of Science and Higher Education subsidy, project no. 16.16.220.842-B02 / 16.16.150.545.