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Multi-temporal UAS surveys for reconstructing soil water content of ploughland plots through multispectral and thermal infrared imagery

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Soil water content (SWC) estimation is a crucial issue of agricultural production, and its mapping is an important task. We aimed to study the efficacy of UAS-based thermal (TH) and multispectral (MS) cameras in SWC mapping.

The study area for the analysis is situated at NE-Hungary near the town of Tépe. the plot is a part of a larger area of intensive agriculture, where the arable crop at the year of surveys was maize. The experimental AOI was set to a maximum size of 200 x 200 meters due to the time-demand and limitations of the multi-sensor surveys. On the plot 3 major soil types are found meanwhile relative relief differences are also notable. Soil samples were collected at the time of surveys to measure the reference SWC rates in laboratory conditions using the gravimetric method.

The aerial mapping tasks were carried out using a DJI Matrice M210 payloads: 1) Micasense RedEdge-MX Dual, 2) Zenmuse XT2. High resolution DEM of the initial surface were mapped by a DJI Matrice M210 RTK v2 + a Zenmuse X7 lens. All imagery were processed in Pix4D Mapper. Machine Learning algorithms were then utilized to model the relationship between reflectance values, land surface temperature and the reference SWC values.

Our surveys were dedicated to a sensitivity analysis on the different settings of Pix4D regarding the downscaling to different pixel resolution of the multispectral data and spectral reflectance calibration too. We have analyzed the differences on the SWC modeling accuracies on the different soil types and relief conditions to develop a more robust estimation for precision drainage designs.

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