Multispectral orthomosaic produced using a MicaSense RedEdge-M (UAS)

mDRONES4rivers	The data was produced within the scope of the project “mDRONES4rivers“funded by the Modernity Fund („mFUND“, 19F2054A-D) of the German Federal Ministry for Digital and Transport (BMDV).
Short description	Georeferenced multispectral orthomosaics of selected sites in riparian zones, which are situated along federal waterways in Germany with focus on the river Rhine.
Aims	The multispectral data provides the basis for the calculation of spectral indices und GLCM-textures, which are then used for object-oriented image classification.
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Input data / Data acquisition	The acquisition of multispectral data was implemented using a MicaSense RedEdge-M camera, which was mounted on the DJI Phantom 4 Pro drone. With a flight altitude of 70 m the camera takes images in a regular interval of 2 s in 5 bands (center: blue/475 nm, green/560 nm, red/668 nm, red-edge/717 nm und NIR/840 nm). With every shot a Downwelling Light Sensor (DLS) sensor mounted on the upper side of the drone measures the incident light. Those values can be extracted from the metadata of the images and can be used for the conversion of digital numbers (DN) to reflectance.
Processing / Methods	Radiometric calibration is an essential step in the processing chain of multispectral data. Therefore, the images are firstly converted from DNs in reflectance, wherefore a calibrated reflectance panel is used, which is recorded previous to every flight. Depending on the illumination conditions at the day of data acquisition DLS-values are used additionally for the conversion (sunshine = DL-Sensors is not used; cloudiness = DL-Sensors is used). Radiometric calibration is performed in Python 3 based on a workflow published on GitHub. The pre-processing of the single images is followed by photogrammetric processing and georeferencing with the aid of Ground Control Points using Agisoft Metashape. The resulting orthomosaic finally undergoes a stepwise Empirical Line Correction (based on a greyscale (GK), which was measured under laboratory conditions in advance and which is placed in the field during the flight) and pixels with an invalid value (< 0 oder > 1) are interpolated. During this process of the orthomosaic a sixth band is generated (Flag-Band), which describes each pixel individually. The resulting orthomosaics are rescaled to a common raster with a resolution of 25 cm/pixel and masked with a uniform outline. The raster values of the new 25 cm cells represent the mean of the original values. After rescaling Flag-Bands are not applicable anymore.

Limitations	• Shadows in general and from clouds (esp. Cumulus) cannot be corrected and variations in illumination due to changing cloudiness causes problems • At sites with large areas the flight period is elongated. In those cases, changing illumination caused by the diurnal cycle of the sun should ideally be considered. • Pollution of the greyscale in the field can influence data quality. • Bright material within the area of interest (esp. sandy ground) are often overexposed and pixel values need to be interpolated.
Data format	• GeoTiff • resolution: 25 cm (based on an original resolution of 3-5.5 cm/pixel) • CRS: ETRS89 / UTM Zone 32N (EPSG:25832) • NA value: -1 • Band description: B1: 475 nm, B2: 560 nm, B3: 668 nm, B4: 717 nm, B5: 840 nm, B6: Flag-Band * except for the project site Reitwein, here the suitable reference system is: UTM Zone 33 N (EPSG: 25833)
Example	 Figure 3: Orthomosaic (MicaSense RedEdge-M, 25 cm/pixel) visualized as false-colour image (B5-B3-B2), Emmericher Ward, July 2019.
Further Information	• MicaSense RedEdge-M Camera informationen: https://support.micasense.com/hc/en-us/articles/360001485134-Getting-Started-With-RedEdge-M • MicaSense RedEdge-M workflow describing radiometric correction procedure: https://github.com/micasense/imageprocessing • For images with original resolution of 3 -5.5 cm please contact Dr. Björn Baschek, +49 (0)261 1306 5395, baschek@bafg.de