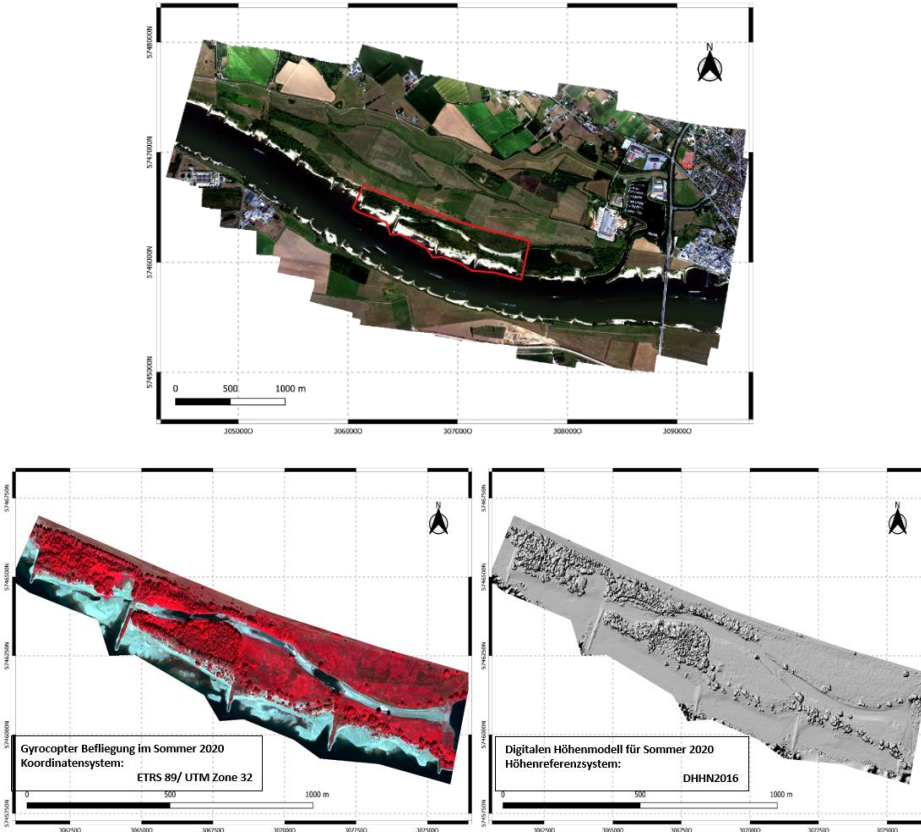


## Multispectral orthomosaic and digital surface model (Gyrocopter)

	<p>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).</p>
<p><b>Short description</b></p>	<p>A carrier system and two different multispectral camera systems (PanX) were developed for the gyrocopter. The camera systems were used to produce georeferenced orthomosaics and digital surface models (DSM) of selected sites in riparian zones, which are situated along federal waterways in Germany with focus on the river Rhine.</p>
<p><b>Aims</b></p>	<p>The multispectral data provides the basis for the calculation of spectral indices und GLCM-textures, which are then used for object-oriented image classification.</p>
<p><b>Producer</b></p>	<p>Hochschule Koblenz RheinAhrCampus Remagen Joseph-Rovan-Allee 2 53424 Remagen Maryam Asgari</p> 
<p><b>Contact partner</b></p>	<p>Prof. Dr. Jens Bongartz, +49 (0) 2642 932 427, bongartz@hs-koblenz.de</p>
<p><b>Input data / Data acquisition</b></p>	<p>The PanX camera system is a multispectral camera system with 4 cameras (12 mm focal length). With the PanX-system it is possible to acquire optical data with 4 spectral bands (center: blue/475 nm, green/550 nm, red/650 nm and NIR/875 nm). During the project a new multispectral camera system (PanX 3.0) was developed, whereby the spatial resolution was increased from a resolution of 4 megapixels (PanX 2.0) to 12 megapixels (PanX 3.0) for each band. The new camera system also covers 4 spectral bands, but centering was slightly adjusted (center: blue/470 nm, green/532 nm, red/630 nm, NIR/810 nm). The development of the PanX 3.0 system was completed in the end of the project period, which is why most of the gyrocopter data was collected with the PanX 2.0 camera system. Flight altitude was approximately 650 m at a flight speed of 100 km/h. The cameras are controlled by an autonomous GPS waypoint guided computer-system which triggers the cameras and stores the images (90% overlap). Exposure time of the cameras is fixed and under usual sunlight conditions in the range of some milliseconds.</p>
<p><b>Processing / Methods</b></p>	<p>Processing of the raw images included the following steps:</p> <ul style="list-style-type: none"> <li>• Flatfield Correction (Integrated sphere in the lab + Python script)</li> <li>• Radiometric calibration (Zenith® white panel at site + Python script)</li> <li>• Georeferencing (Post-Processing-Kinematik + GCP based correction)</li> <li>• photogrammetric processing using Agisoft Metashape and export of results</li> </ul> <p>After the pre-processing the following superior products were generated:</p> <ul style="list-style-type: none"> <li>• Calculation of spectral indices: NDVI, SR, NDWI, GNDVI, GVI, NRBI, SAVI</li> <li>• Calculation of texture parameters: Homogeneity, Entropy, Variance, Dissimilarity, Mean, Correlation</li> </ul>
<p><b>Limitations</b></p>	<ul style="list-style-type: none"> <li>• Shadows in general and from clouds (esp. Cumulus) and variations in illumination due to changing cloudiness causes problems (an illumination monitoring device for correction is under development)</li> </ul>

	<ul style="list-style-type: none"> <li>Noise in the area of water surfaces due the absence of a relief/textures and disturbances such as sunglint, movement of the water surface and variation in optical properties of water</li> </ul>
<p><b>Data format</b></p>	<p>Orthomosaic:</p> <ul style="list-style-type: none"> <li>GeoTiff</li> <li>Spatial resolution (PanX 2.0): 28 - 32 cm</li> <li>Spatial resolution (PanX 3.0): 16 cm</li> <li>Reflectance with precision Float32</li> <li>Coordinate Reference system: ETRS89 / UTM Zone 32N, EPSG:25832</li> </ul> <p>Digital Surface Model:</p> <ul style="list-style-type: none"> <li>GeoTiff</li> <li>Spatial resolution (PanX 2.0): 28 - 32 cm</li> <li>Spatial resolution (PanX 3.0): 31 cm</li> <li>Coordinate Reference system: ETRS89 / UTM Zone 32N, EPSG:25832</li> <li>Vertical Reference System: DHHN2016</li> </ul>
<p><b>Example</b></p>	 <p>Figure 1: Orthomosaic (top, bottom left: masked and visualized as false color composite image) and Digital Surface Model (bottom right) of Emmericher Ward, produced with the aid of the gyrocopter, August 2020.</p>