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Beyond the image - assessing riverine morphology with UAVs: case studies from Austria, Germany, Norway, Russia and Thailand

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Unmanned aerial vehicles (UAVs) have become a state-of-the-art remote sensing tool for the geosciences. Commercial systems are largely autonomous and provide high resolution imagery at low cost. UAV-based imagery provides an efficient and effective means for the collection of environmental intelligence data. Due to advancements in small-scale digital processing, UAV imagery is useful for mapping topography, river bathymetry, vegetation and quantifying bed sediment distribution. Here we introduce several methods and experiences from selected projects in Austria, Germany, Norway, Russia and Thailand.

In the Austrian region of Tyrol, UAV are used for river monitoring since 2012, as high resolution orthoimagery are used to support planning processes and at the same time can be used to create high resolution topographical models which support hydraulic and habitat modeling. A new and important application of UAV imagery is reservoir management, where successful bathymetric surveys can be made during the controlled drawdown of reservoirs, as exemplified by the case study at the Gepatsch reservoir. Considering morphological processes, the use of UAVs has high potential for monitoring flushing operations, i.e. comparing initial situation with the one after a flushing events and calculating material transport.

In the German wetland “Havelland”, a large nature conservation area on the river Havel, a variety of small restoration projects were conducted. As the restoration sites are spread over a large area and are not easily accessible, the restored areas and their development were documented using a low-cost UAV approach.

In Norway for several rivers high resolution imagery as well as high resolution DEMs including river bathymetry were derived from UAV surveying for providing data on river morphology. The data are used for hydraulic modeling and assessing of salmon spawning areas in river substrate.

In Russia we conducted a pilot study in the headwaters of the Volga River, revealing the potential of photogrammetric analyses from the long-term perspective. Here we analyzed time series taken from a bridge upstream, providing a view on morphodynamics in a cross-section.

In the south of Thailand a series of green hydraulic structures, or “living weirs”, are built along river Tha Di. These measures were primarily constructed to enhance upstream water levels with the goal of gaining an additional harvesting period during the year. Influences of this water level increase in wetland areas and flood retention are assessed using a combination of photogrammetric methods. RGB and NIR photos are taken using a UAV and in combination with ground references, high resolution DEMs, orthophotos as well as NDVI maps were created. This data can be used for assessing morphological change and impacts on the vegetation.

UAV-based imagery was both lean and agile, delivering a new level of accuracy and sources of ecological intelligence data which can be used by a wide spectrum of public and private stakeholders.