
UAV REMOTE SENSING OF HYDROLOGICAL PROCESSES AND FLUVIAL
DYNAMICS

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Abstract

Using drones and machine or deep learning algorithms (ML or DL) for environmental monitoring offers several advantages over traditional methods, including gathering high spatial resolution data quickly and non-invasively, acquiring real-time data, and covering large and remote areas. This dissertation focuses on snow cover, river granulometry, river sustainability, river bathymetry, and peatland dynamics based on approaches of drone-based imagery that are critical for understanding fluvial processes in mid-mountain regions and their implications for streamflow patterns and ecosystem health. Measuring Snow Depth (SD) and vegetation characteristics like Leaf Area Index (LAI) accurately is essential for effectively predicting snow cover and snowpack persistence across study sites ([papers I and III](#)). A further aspect of the fluvial process mediator involves the reproducibility of drone data. This allows for seamless coverage of riverbeds and the determination of ideal parameters for sediment surface cover detection. This can be done through photo-sieving or DL technique, which can analyze Particle Size Distributions (PSDs) of an entire river point bar from top-view UAV images (as described in [papers II and V](#)).

Similarly, studying river sustainability with drones provides a unique opportunity to assess the effectiveness of stream restoration projects and inform management practices to ensure the long-term health and sustainability of fluvial systems ([paper VI](#)). Drone bathymetric data provide critical information about river channel morphology, sediment transport, and habitat availability ([paper VII](#)). Finally, studying peat bog complexes as an essential side component of fluvial processes makes accurate drone monitoring crucial for effective management and conservation efforts ([paper IV](#)). However, further research is necessary to apply these methods to other regions and ecosystems, as environmental conditions and characteristics can vary significantly across different locations.

Keywords: environmental research, UAV, UAS, drones, sensors, snow cover distribution, SD, LAI, CNN, DL, PSD, peatland dynamics, ML, groundwater level, soil moisture, river restoration, river bathymetry