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Urban hydrology and flood mapping using UAV imagery

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Unmanned Aerial Vehicles (UAVs) are a very effective means to map river beds and flood extent accurately across a wide area, even while the flood is happening or shortly thereafter. Flood mapping information is also very valuable in a long-term context, for drainage infrastructure planning and management. Here, we will present three applications: UAV-based information for hydrologic modelling of the urban drainage system, for flood extent mapping and for identification of bottlenecks in the system that can cause urban flooding.

UAV flights were conducted in Kumasi, the second biggest and fastest growing city in Ghana, where urban flooding has become more frequent due to changes in the climate and have a more negative impact due to rapid urbanization and population growth. Not only are the natural flood plains increasingly being used for anthropogenic purposes, the increased population growth also brings along more solid (plastic) waste on the streets and into the riverbeds and riverways. This creates blockages in drains and riverways, which reduces its drainage capacity and adds to the flooding problems. UAVs were used to collect elevation information (DEM), river bed dimensions and land-use. This information was used to construct a hydrological model to predict river flows and flooding. In addition, using thermal imagery from UAV flights over partially flooded agricultural fields near the town of Kianjai, Kenya, we will demonstrate that UAV imagery can identify flooded areas even when cross-cut by vegetation or other obstacles.

We will present the three applications and discuss the promises and challenges of deploying UAVs for the purpose of urban hydrological modelling and flood mapping.