Observing high flow with the Unmanned Aerial Vehicle: the case study from upper Nysa Klodzka basin (SW Poland)

Matylda Witek, Waldemar Spallek, Jacek Slopek, and Tomasz Niedzielski
University of Wroclaw, Wroclaw, Poland (tomasz.niedzielski@uni.wroc.pl)

Recent developments of the HydroProg system (research project no. 2011/01/D/ST10/04171 of the National Science Centre of Poland), which aims to issue warnings against floods, are associated with predicting inundation, and hence there is a need for verifying the prognoses of overbank flow extent. The progress in the Unmanned Aerial Vehicle (UAV) technology causes that UAVs are now easily available and – provided formal flight requirements are fulfilled – can be used for observing numerous features of the natural environment. This intrinsically concerns hydrological applications in which dynamics is a key issue. Hence, in order to observe true extent of water during flood, UAV can be used on demand. However, unanswered is the problem of the minimum size, understood in terms of flooded area, of water increment which is detectable when inferred from the orthophoto image. The present study aims to address the above-mentioned problem by applying the small-sample statistical inference methods to a sample of nine study sites observed during five UAV observational campaigns in the vicinity of the gauge in Gorzuchow, situated along the Scinawka river (SW Poland). Since November 2012 we have carried our regular flights using the swinglet CAM fixed-wing UAV, and the areas adjacent to the gauge itself have been monitored in detail. We produced a series high-resolution orthotphoto images, corresponding to low-, normal- and high-flow situations. We sketched shapes of terrain covered by water on a basis of the detailed analysis of the ortophoto images, and the judgment was supported by our geomorphological knowledge about the channel characteristics. The resulting data were subsequently presented as percentages, and later a logarithm transformation was applied. The assumptions of Student's t-test were found to be fulfilled, and thus we used the t-test and its Bootstrap version to detect significant increments of water, inside or outside the channel. We explicitly identified the high flow events which can be observed using UAV. This means that UAV is suitable for observing not only inundation but also high flows, and such an observation is statistically meaningful.