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Measuring depth of a clear, shallow, gravel-bed river by through-water photogrammetry with small format cameras and ultra light aircrafts

D. Feurer, **J.-S. Bailly** and C. Puech

Cemagref, UMR TETIS, Maison de la Télédétection, 500 rue Jean François Breton, 34093 Montpellier Cedex 5, France (bailly@teledetection.fr)

Measurement of very shallow rivers topography raises serious issues for active remote sensing techniques : sonar cannot be used from classical crafts, operational lidars cannot manage small water thickness at the present time [Lesaignoux et al., in press].

On the other hand, methods based on water color have been widely used to produce depths maps. The main drawbacks of these spectral techniques are (i) the need of additional data for model calibration or training sets ; (ii) lack of absolute topographic reference, in other words, measuring depth is not measuring positions and slopes.

As a consequence, we developed a method of immersed topography measurement by through-water photogrammetry. Two specific and original aspects of the proposed method are, on one hand, the use of light logistics : drone or ultralight aircraft and small format non metric cameras. On the other hand, in order to compensate the acquisition geometrical imprecision, we integrated hydraulic constraints in the process of refraction correction.

In this paper, we present this method and an application upon the Durance river, France. This test site concentrates the mains issues of regulated rivers (hydroelectricity, agriculture, biodiversity conservation). The results are compared to an independent validation data set constituted by a river-specific [Le Coarer and Dumont, 1995] ground survey. We showed that obtaining a map of the river topography and an image of the water surface is possible using low-cost sensors and platforms within certain

conditions. The potential and limitations of such a method are discussed.