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# Lateral and vertical heterogeneity of flow and suspended sediment characteristics during a dam flushing event, in high velocity conditions

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The dynamic of suspended sediments in highly turbulent and concentrated flow is an important issue to better predict the sediment propagation along mountain rivers. In such extreme environments, the spatial and temporal variability of hydraulic and sediment parameters are difficult to measure: the flow velocity and the suspended sediment concentration (SSC) could be high (respectively several m/s and g/l) and rapidly variable. Simple methods are commonly used to estimate water discharge and mean or punctual SSC. But no method has been used successfully in a mountain river to estimate during a whole event the spatial distribution of flow velocity and SSC, as well as sediment parameters like grain size or settling velocity into a river cross section. This leads to these two questions: in such conditions, can we calculate sediment fluxes with one sediment concentration measurement? How can we explain the spatial heterogeneity of sediment characteristics?
In this study, we analyze sampled data from a very well instrumented river reach in the Northern French Alps: the Arc-Isère River system. This gravel-bed river system is characterized by large concentrations of fines sediments, coming from the highly erodible mountains around. To control the hydraulic, sedimentary and chemical parameters from the catchment head, several gauging stations have been established since 2006. Especially, several measurements are usually done during the flushing of the dams located on the upper part of the river. During the flushing event of June 2014, we instrumented the gauging station located just upstream the confluence between the Isere and the Arc River, at the outlet of the Arc River watershed.
ADCP measurements have been performed to estimate the spatial distribution of the flow velocity (up to 3 m/s), and turbidimeters and automatic samplers have been used to estimate the spatial distribution of the SSC into the cross section (up to 6 g/l). These samples have been directly analyzed to measure the grain size distribution with a LISST Portable XR, as well as the settling velocities of the suspended sediments with the SCAF device (Wendling et al., 2013). Even if the measurements were difficult due to the flow conditions, some observations are relevant.
For example, we observed a spatial heterogeneity of the settling velocity and the grain size of the suspended sediments into the cross section, whereas the SSC was almost homogeneous at the same time. In particular, these measurements show that the sediment flux can be calculated from the single turbidimeter located on the left bank. Moreover, the hydrodynamic measurements highlight the heterogeneity of the settling velocity due to the flow conditions. The first conclusions of these field measurements could be of great importance to assess numerical models, when they are used to estimate sediment deposits in river.

V. WENDLING, N. GRATIOT, C. LEGOUT, I.G. DROPPO, A.J. MANNING, G. ANTOINE, H. MICHALLET, M. JODEAU : A rapid method for settling velocity and flocculation measurement within high suspended sediment concentration rivers. INTERCOH 2013, Gainesville, Florida.