



High suspended sediment concentration during extreme events: laboratory experiments for the determination of the hydraulic behaviour of hyperconcentrated flows.

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In the mountainous and marly catchments of the southern French alps, erosion processes during storm events are particularly intense and the sediment yields are very high. The sediments are transported both as bedload and suspension. In these badlands catchments, the suspended sediment concentration reaches very high values during flood events, frequently over 300 g/l, up to 800 g/l, as measured in the experimental basins of Draix. In this context, the calculation of discharge from the recorded level in the gauging stations is hazardous because the rating curves established with clear water may be no longer appropriated. Therefore, laboratory experiments were conducted in order to determine both the hydrodynamic parameters and rheologic parameters of heavily loaded and hyperconcentrated flows. Based on these parameters it becomes possible to build a 'reasonable' depth-discharge relationship.

The influence of sediment concentration and grain's size distribution on the bulk rheological behaviour of the flow has been evaluated at concentration ranging from 10 to 30 % in weight. The curve fitting for the different concentrations of sediment in suspension is described using the Bingham model.

The tilting flume (slope varying from 2 to 6%) experiments show the auto-similarity of the velocity profiles for the different sediment concentrations. We observe, as found in other studies on hyperconcentrated flows, a reduction of average turbulence inten-

sity T_u and an increase of the mean velocity with increasing sediment load. Finally, a standard f (friction factor) vs Re (a suitable Reynolds number) relation has been plotted in order to analyze hydraulic behaviours of fluid over a fixed bed.

In addition, these experiments proved the capability of UDV (Ultrasonic Doppler Velocimetry) method to measure the velocities of hyperconcentrated flows.