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Benefits from Hydrodynamic Simulations for Hydrology

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Hydrology as a general definition denominates the science related with all aspects of the element water. As such hydrodynamics is a subtopic of this general definition. Nevertheless hydrology is usually restricted to the dominant processes occurring in the water cycle and hydrodynamics is regarded as a separate field discipline. However it is obvious that water flows satisfy hydrodynamic conservation laws and that their application leads to a better and more precise description of many processes in hydrology. The present paper deals with such an aspect namely the numerical extrapolation of stage/discharge curves.

It is well known that classical gauging stations measure water levels and translate this information into a discharge by a stage/discharge curve. The relation is usually obtained by simultaneous measurements of water levels and flow discharges, the latter usually through interpolation of velocity measurements on a regular raster. In alpine rivers extreme floods can hardly be measured due to the high velocities and the danger associated with it and due to their rapid and hardly predictable occurrence. Therefore for higher flows the stage/discharge curve is extrapolated which is a source of major errors because a basically geometric extrapolation cannot represent the hydrodynamics adequately. In cooperation with the hydrological service of the state of Tirol, Austria, complex three-dimensional simulations of 17 gauging stations have been performed and stage/discharge curves have been adapted using the numerical results. Examples demonstrate the benefit of this procedure which also can, at least qualitatively, consider the influence of river bed changes during extreme floods.