Hydro-sedimentary processes of a plunging hyperpycnal river plume revealed by synchronized remote imagery and gridded current measurements

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Most present conceptualizations of plunging river plumes are based on laterally confined laboratory experiments (representative of river-dammed reservoirs). Plunging in unconfined settings (typical for lakes) is understudied, especially in the field. Here, the dominant hydro-sedimentary processes of the Rhône River inflow into Lake Geneva were elucidated by synchronized time-lapse camera and boat-towed ADCP measurements. Hydrodynamic processes comply with laterally confined experiments in longitudinal direction. Contrarily, several hydrodynamic processes were measured for the first time in the lateral direction: lateral slumping due to excess density driving secondary flow cells, lateral convergence due to vertical divergence and a resulting sediment-rich triangle-shaped pattern at the surface near the inflow. An increase of the sediment concentration and flux in longitudinal direction indicates net sediment erosion under the investigated high discharge and sediment load conditions, suggesting transient storage of sediment under low discharge and sediment load conditions, and high morphological activity in the plunging area.