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Temporal variability of bedload transport at tributary junctions in a medium sized river influenced by hydropeaking

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Tributary junctions are key elements of dendritic drainage networks. They are known to have a very specific bed morphology. Field and experimental studies have shown that the associated river bed geometries are likely to reflect erosion and deposition patterns linked to the specific fluid circulation that occurs in the junction zone. The main zone of erosion is thought to be the junction 'scour hole' zone, and reflected in studies that suggest that the main sediment paths move around the flanks of this zone, prevented junction scour from being filled. That said, there are almost no studies of bedload movement in and through river junctions in medium (>50 m wide) and large (>500 m wide) rivers. This is not surprising because monitoring such sediment paths is challenging, even in small streams.

Here, we use an acoustic Doppler current profiler (aDcp) to monitor sediment paths in a 'non-intrusive' way in Alpine tributary junctions. Ultrasonic waves emitted from the water surface and the echoes received from the bed (Bottom-Track feature) are analyzed to determine the apparent bed velocity which has been shown to indicate the presence of moving sediment. Two approaches have been applied in the field: (1) 'stationary measurements' (within a couple square meters area) at specific locations within the confluence, which allows the analysis of bed velocities time series in relation to hydrological changes, and (2) 'spatial surveys' allow the localization of sediment paths within the junction area.

This paper focuses upon temporal variability at fixed monitoring locations, over long time periods (> 10 hours). The results show that sediment transport switches on and off in response to hydropeaking. This regular on-off behavior implies that there must be regular erosion and deposition within the junction zones. Spatial survey identify where this erosion and deposition is likely to be found, suggesting that it is not in the scour zone, but as a result of the associated transport paths, on distal parts of the junction.