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Erodibility of fine sediment deposits in gravel bed rivers: investigation of the spatial variability

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Fine sediments exhibit various stages of deposition and erosion during their transport from hillslopes to the ocean. In mountainous environments, high fine sediment load during runoff or dam flushing events can lead to important amounts of deposits in gravel bed rivers. Massive deposits may lead to bar elevation, riparian vegetation growth and consequently to bar stabilization, which can increase flood risks. High amount of fine sediment deposits alters also aquatic life and habitat.

In order to better understand the dynamics of re-suspension of these deposits, and to accurately predict it with numerical modelling, field monitoring campaigns were performed to assess both the spatial variability and the controlling factors of the erodibility of fine deposits. The cohesive strength-meter (CSM) device, a pocket penetrometer and a pocket shear vane were used to evaluate the erodibility of fine sediments deposited in two rivers in the French Alps: The Isère and Galabre.

The results highlight the specificity of gravel bed rivers with an abundance of areas of deposition of fine sediments, which are discontinuous compared to estuaries and lowland rivers. A high spatial variability of the erodibility was observed and related to the spatial organization of the deposits. The location of the deposit and its elevation, the moisture and the grain sizes are inter-related and have important correlations with the erodibility. Measurements show that high altitude dry deposits and low altitude humid deposits are more easily eroded than intermediate deposits with medium moisture. The measured variables explain part of the variability of the erodibility but other processes such as the history or the origin of the deposit might also be important factors to consider.