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Sediment fingerprinting in Northern Jordan - approaching sediment comparability

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Jordan has a quantitative and qualitative water problem in combination with a growing demand by population increase. Around 65% of the freshwater used in Jordan is reported to originate from surface waters and reservoirs. Sediment loads harm the quality of these water bodies and fill up dams. A sediment fingerprint pilot study was implemented in an exemplary catchment in the NW of Jordan to investigate the possibility of geochemical differentiation between 6 sediment sources and calculate their relative contribution to the sink, the Wadi Al-Arab reservoir.

The sediment fingerprint method relies on the comparability of sediment properties of the sources and the sink. However, selection processes during transport, preferential adsorption of elements on fine particles, and differences in inorganic carbonate content prevent a direct comparison. In previous studies this has been solved through selective sampling and analyzing certain grain size fractions or the mathematical derivation of correction factors. As no pre-knowledge existed in the Wadi Al-Arab catchment, selective grain size sampling would have implied the risk of neglecting important information already during the sampling process. Hence, a method was established that includes several steps to identify influential parameters (IPs), eliminate their impact and take account of their interrelations. It is based on a stepwise multiple regression analysis model (SMRAM) and generates element specific correction factors that take account for possible interdependencies between influential parameters as clay percentage and total organic and inorganic carbonates.

In the further selection process of suitable elements for the fingerprint, we complemented the common used methods by a solubility analysis. Therefore, water profiles were physicochemical investigated in the dam lake. Differences in the chemical milieus during transport and sedimentation that affect the conservativeness of the chosen elements could be detected and taken account for.

The study showed that common fingerprint elements and practices would have led to misinterpretations in the Wadi Al-Arab catchment and calls for a sound knowledge on catchment characteristics before the implementation of such a method.