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Sediment sampling and processing methods in Hungary, and possible improvements

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The importance of the monitoring of sediment processes is unquestionable: sediment balance of regulated rivers suffered substantial alterations in the past century, affecting navigation, energy production, fish habitats and floodplain ecosystems alike; infiltration times to our drinking water wells have shortened, exposing them to an eventual pollution event and making them vulnerable; and sediment-attached contaminants accumulate in floodplains and reservoirs, threatening our healthy environment. The changes in flood characteristics and rating curves of our rivers are regularly being researched and described, involving state-of-the-art measurement methods, modeling tools and traditional statistics. Sediment processes however, are much less known. Unlike the investigation of flow processes, sediment-related research is scarce, which is partly due to the outdated methodology and poor database background in the specific field. Sediment-related data, information and analyses form an important and integral part of Civil engineering in relation to rivers all over the world. In relation to the second largest river of Europe, the Danube, it is widely known in expert community and for long discussed at different expert forums that the sediment balance of the river Danube has changed drastically over the past century. Sediment monitoring on the river Danube started as early as the end of the 19th century, with scattered measurements carried out. Regular sediment sampling was developed in the first half of the 20th century all along the river, with different station density and monitoring frequencies in different countries. After the first few decades of regular sampling, the concept of (mainly industrial) development changed along the river and data needs changed as well, furthermore the complicated and inexact methods of sampling bed load on the alluvial reach of the river were not developed further. Frequency of suspended sediment sampling is very low along the river, best organized in the upstream countries, where also on tributaries like the Drau/Drava monitoring stations are in operation. Sampling frequency of suspended load is 3 to 7 per year in Hungary, and even lower downstream. Sediment management is a major challenge, as most methods developed until now are unsustainable, require continuous intervention and are expensive as well. However, there is a new focus on the subject in the 21st century, which still lacks uniform methodological recommendations for measurements and analyses, and the number of engineers with sediment expertise and experience is alarmingly low. Data related to sediment quantity are unreliable and often contradictory. It is difficult to produce high quality long-term databases that could support and enable the mathematical calibration of sediment transport models. Sediment measurements are different in different countries in Europe. Even in Hungary, sampling and laboratory techniques have changed several times in the past. Also, sediment sampling was never really systhematic, and the sampling campaigns did not follow the hydrological processes. That is how sediment data can hardly be compared; and the data series are inhomogeneous and they cannot be statistically analysed. The majority of the existing sediment data in Hungary are not suitable for the data supply needs of state-of-the-art numerical modeling. It is even problematic to describe the connections between water flow (discharge) and sediment transport, because data are scarce and irregular. Even the most modern measurement methods (Acoustic Doppler Current Profiler [ADCP], or Laser In Situ Scattering and Transmissometry [LISST]) need calibration, which means field sampling and laboratory processing. For these reasons we need (both quantitatively and qualitively) appropriate sampling of sediment. In frame of projects and programs of the Institute for Hydraulic engineering and Water management of Eötvös József College, we developed the methodology of field-data collection campaigns in relation to sediment data in order to meet the calibration and verification needs of state-of-the art numerical modeling, and to be able to collect comparable data series for statistical analyses.