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Advanced Particle Characterisation of Suspended Sediment in the Danube River Using Automated Imaging and Laser Diffraction

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Abstract : A harmonized monitoring of the suspended sediment transport along such a large river as the world's most international river, the Danube River, is a rather challenging task. The traditional monitoring method in Hungary is obsolete but using indirect measurement devices and techniques like optical backscatter sensors (OBS), laser diffraction or acoustic backscatter sensors (ABS) could provide a fast and efficient alternative option of direct methods. However, these methods are strongly sensitive to the particle characteristics (i.e. particle shape, particle size and mineral composition). The current method does not provide sufficient information about particle size distribution, mineral analysis is rarely done, and the shape of the suspended sediment particles have not been examined yet. The aims of the study are (1) to determine the particle characterisation of suspended sediment in the Danube River using advanced particle characterisation methods as laser diffraction and automated imaging, and (2) to perform a sensitivity analysis of the indirect methods in order to determine the impact of suspended particle characteristics. The particle size distribution is determined by laser diffraction. The particle shape and mineral composition analysis is done by the Morphologi G3ID image analyser. The investigated indirect measurement devices are the LISST-Portable|XR, the LISST-ABS (Sequoia Inc.) and the Rio Grande 1200 kHz ADCP (Teledyne Marine). The major findings of this study are (1) the statistical shape of the suspended sediment particle - this is the first research in this context, (2) the actualised particle size distribution – that can be compared to historical information, so that the morphological changes can be tracked, (3) the actual mineral composition of the suspended sediment in the Danube River, and (4) the reliability of the tested indirect methods has been increased – based on the results of the sensitivity analysis and the previous findings.

Keywords : advanced particle characterisation, automated imaging, indirect methods, laser diffraction, mineral composition, suspended sediment
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