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Hydrometry — Suspended sediment in streams and canals — Determination of concentration by surrogate techniques

Hydrométrie — Sédiments en suspension dans les cours d'eau et dans les canaux — Détermination de la concentration par des techniques de substitution

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Foreword

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The committee responsible for this document is ISO/TC 113, *Hydrometry*, Subcommittee SC 6, *Sediment transport*.

Introduction

Sedimentation and sediment transport in streams, rivers, reservoirs and estuaries are key parameters in many scientific, environmental, engineering, and agricultural problems. Success in managing and solving sedimentation problems requires comprehensive knowledge of sediment movement. This requires reliable methods of estimation of sediment load with high-quality data. The amount of sediment transport data being collected, however, has steadily declined in recent decades largely due to difficulty and costs associated with field methods used for data collection. High temporal resolution data of high quality are needed to better understand and more adequately describe many sedimentation processes.

The bed load and suspended load broadly constitute total sediment load. However, the scope of this International Standard is confined to the measurement of suspended sediment. Conventional methods for measurement of suspended sediment concentrations in streams rely on the principle of collecting samples of water-sediment mixture at various points in time and space using suitable sampling equipment and deployment methods and analysing the samples in laboratory for estimating the sediment concentration. These methods are labour intensive, expensive and can be hazardous. Moreover, the accuracy of these methods in estimating the sediment concentration of rivers and streams over a period of time may not be dependable due to the large spatial and temporal variability associated with the transport of suspended sediment.

Continuous and accurate estimation of suspended sediment concentration is essential in certain situations such as:

a) in hydropower projects for the safety of the turbines and other machinery, reservoir silting and flushing;

b) water-supply projects for monitoring water quality;

c) storm water run-off from urban areas;

d) silting of wetlands; and

e) long-term monitoring of sediment transport in rivers and streams, in order to obtain reliable base lines that can be used for decision making.

In such situations, automatic and cost-effective techniques are essential to collect high-quality data on suspended sediment concentrations and particle sizes.

Recent technological advances in the fields of optics and acoustics have provided new sediment-surrogate technologies and methods to determine suspended sediment fluxes and characteristics. Some of these methods can be used to measure suspended sediment concentration at higher resolution, with greater automation and potentially lower cost than traditional methods. These methods involve surrogate technologies that derive the suspended sediment concentration from measurements of optical backscatter, laser diffraction and acoustic backscatter.

The measurement of suspended sediment concentration (SSC) in the water samples can be carried out with the help of nephelometry, transmission, laser diffraction and acoustic back scatter techniques. The working principles, applications, advantages and disadvantages, limitations and usable instruments of the above techniques are elaborated in this International Standard. The optical backscatter technique is readily available and relatively inexpensive. Optical backscatter sensor sensitivity depends on grain size, colour and composition. The advantages are small size and small sample volume, linear and high frequency response, insensitive to ambient light, large measuring range and low cost. The laser diffraction (LD) technique is also readily available and cost effective. The acoustic backscatter is another technique for measurement of SSC in the aquatic ecosystems. Measurements are possible for a range of sediment sizes that is dependent on the acoustic frequency. The available maximum sampling depth will be limited at high concentrations.