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Estimation of sediment deposition in reservoir using one dimensional simulation models

Estimation du dépôt de sédiments dans le réservoir en utilisant des modèles de simulation à une dimension

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

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

Introduction

Storage reservoirs built across rivers or streams lose their capacity on account of deposition of sediment. Surveys indicate that world-wide reservoirs are losing their storage capacity, at an annual rate of about one percent, due to accumulation of sediments. The impacts of sedimentation on the performance of the reservoir project are manifold. Some of the important aspects are the following:

a) reduction in live storage capacity of the reservoir;

b) accumulation of sediment at or near the dam may interfere with the functioning of water intakes and hence is an important parameter in deciding the location and level of various outlets;

c) increased inflow of sediment into the water conveyance systems and hence to be considered in the design of water conductor systems, desilting basins, turbines, etc;

d) sediment deposition in the head reaches may cause rise in flood levels;

e) the location and quantity of sediment deposition affects the performance of the sediment sluicing and flushing measures used to restore the storage capacity.

Hence, prediction of sediment distribution in reservoirs is essential in the following:

a) feasibility studies during planning and design of various components of new projects;

b) performance assessment of existing projects.

The most simple and earliest models to predict the sedimentation processes in reservoirs are the empirical ones. The trap-efficiency curves derived from records of existing reservoirs are among the most commonly used empirical methods. Recently, due to better understanding of the fundamentals of reservoir hydraulics and morphology, along with the rapid growth of computational facilities, development and application of mathematical models have become a normal practice.

Compared to empirical methods, the mathematical approach of the sediment distribution enables more time and space dependent and more accurate modelling. A large number of mathematical models have been developed during the past few decades. Flow in the reservoir can be represented by the basic equations for conservation of momentum and mass of water and sediment.

Estimation of sediment deposition in reservoir using one dimensional simulation models

1 Scope

This Technical Report describes a method for estimation/prediction of sediment deposition within and upstream of a reservoir using numerical simulation techniques through one-dimensional flow and sediment transport equations.

Numerical simulation models for predicting sediment distribution are applicable for reservoirs, where the length of the reservoir greatly exceeds the depth and width and the reservoir has a significant through flow.

This Technical Report includes the theoretical basis and fundamental assumptions of the technique and provides a summary of some numerical methods used to solve the unsteady flow and sediment transport equations. Also provided are details on the application of the model, including data requirements, procedures for model calibration, validation, testing, applications and identification of uncertainties associated with the method. This Technical Report does not provide sufficient information for the development of a computer program for solving the equations, but rather is based on the assumption that an adequately documented computer program is available.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 748, *Hydrometry — Measurement of liquid flow in open channels using current-meters or floats*

ISO 772, *Hydrometry — Vocabulary and symbols*

ISO 1100-2, *Hydrometry — Measurement of liquid flow in open channels — Part 2: Determination of the stage-discharge relationship*

ISO 2425, *Hydrometry — Measurement of liquid flow in open channels under tidal conditions*

ISO 2537, *Hydrometry — Rotating-element current-meters*

ISO 3454, *Hydrometry — Direct depth sounding and suspension equipment*

ISO 4363, *Measurement of liquid flow in open channels — Methods for measurement of characteristics of suspended sediment*

ISO 4364, *Measurement of liquid flow in open channels — Bed material sampling*

ISO 4365, *Liquid flow in open channels — Sediment in streams and canals — Determination of concentration, particle size distribution and relative density*

ISO 4373, *Hydrometry — Water level measuring devices*

ISO 6416, *Hydrometry — Measurement of discharge by the ultrasonic (acoustic) method*

ISO 18365, *Hydrometry — Selection, establishment and operation of a gauging station*

ISO/TS 3716, *Hydrometry — Functional requirements and characteristics of suspended-sediment samplers*

ISO/TR 9212, *Methods of measurement of bedload discharge*

