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**Please forward to appropriate candidates**

# TOPIC: Experimental an numerical investigations of the behaviour of artificial cohesive sediments

## Advisors

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## Keywords

Artificial cohesive sediments, incipient of motion, sediment transport, experimental work, numerical work

## Introduction and background

The behaviour of cohesive sediments is of complex nature since it is not only governed by physical but also by biological and chemical processes. However, for gaining new knowledge of these complex interactions it is necessary to obtain basic research on homogenous and reproducibly samples with thorough knowledge regarding the sediment characteristics. This work focuses on deepening the understanding of the behaviour of cohesive sediments (incipient of motion and transport) on one side by experimental research and on the other side by numerical work based on artificially manufactured cohesive sediment samples.

## Methods to be used

First, the PhD candidate shall review key and state-of-the-art literature about cohesive sediments to become familiar with this research area. Simultaneously, a literature review on potential methods for the manufacturing of artificial cohesive sediments shall be conducted. Based on the findings from the literature reviews, a suitable method for the production of artificial cohesive sediments with pre-defined characteristics shall be established. Apart from that, the PhD candidate needs to get familiar with the SETEG-flume and the associated

measuring techniques (including further development of the already existing devices and methods) of the hydraulic laboratory at IWS. In a next step a set of samples with different pre-defined sediment characteristics shall be investigated in the laboratory (e.g. incipient of motion within the SETEG-flume). Extensive post-processing of the obtained data, including the use of statistical methods, will be required to derive relationships between cohesive sediment characteristics and their behaviour. These findings will finally be implemented in a CFD code and the laboratory experiments will be modelled with the numerical program.

**Research goals**

The main objective of this work is to establish a method to produce artificial cohesive sediments with known characteristics. With these samples further analyses within the SETEG-flume shall be conducted and compared to data given in literature. Among these are: (i) the evaluation of erosion stability, (ii) the derivation of initiation of motion, (iii) the measurement of the vertical velocity profile with a Vectrino Profiler, and (iv) the time dependent measurement of erosion rates by means of an optical measuring technique for erosion rate detection. These finding shall in a final step be implemented in a numerical model and tested against the in the laboratory obtained data. The findings from this study shall improve the general understanding of cohesive sediment transport behaviour.

**References (incomplete)**

Noack, M., Gerbersdorf, S.U., Hillebrand, G. and Wieprecht, S., 2015. Combining Field and Laboratory Measurements to Determine the Erosion Risk of Cohesive Sediments Best. Water 7 (2015) 5061-5077.

Lau, Y.L. and Droppo, I.G., 2000. Influence of antecedent conditions on critical shear stress of bed sediments. Water Research 34, 663–667. doi:10.1016/S0043-1354(99)00164-5

Panagiotopoulos, I., Voulgaris, G. and Collins, M.B., 1997. The influence of clay on the threshold of movement of fine sandy beds. Coastal Engineering 32 (1997) 19-43.

**Research environment**

The PhD candidate will conduct experiments in the hydraulic laboratory at IWS as well as numerical work (including development and coding of new algorithms). Besides, the student will become part of an interdisciplinary working group consisting of post-docs and doctoral students that conduct research on cohesive sediments from both rivers and reservoirs.

**Prerequisites**

Good knowledge in fluid mechanics, statistics, sediment transport and programming is required. Moreover, experience in experimental as well as computational fluid dynamics is recommended.

**Contact for questions**

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