2 PhDs: Long-Term Bed Degradation in Rivers: Causes & Mitigation

Faculty/department Civil Engineering and Geosciences
Level Master degree
Maximum employment 38 hours per week (1 FTE)
Duration of contract 4 years
Salary scale €2125 to €2717 per month gross

Civil Engineering and Geosciences

The Faculty of Civil Engineering and Geosciences of Delft University of Technology (TU Delft) provides leading international research and education, with innovation and sustainability as central themes. Research and education are closely interwoven and address societal challenges. The faculty consists of the departments of Transport and Planning, Structural Engineering, Geoscience and Engineering, Water Management, Hydraulic Engineering focuses on an improved understanding of physical processes in river, coastal, and estuarine systems and the design of sustainable interventions that increase safety. The main research themes of the department's Rivers group are: the prediction of (long-term) morphodynamic changes, sediment sorting, flow over groynes and obstacles, river bank processes, interaction between flow and vegetation, and uncertainties in fluvial modelling. Key components of our research are analytical and numerical modelling, laboratory experiments, and analysis of field observations.

Job description

The upstream Dutch Rhine is experiencing bed degradation at a rate of 2 cm per year. This erosion causes severe problems for navigation and river management: nonerodible reaches hamper navigation, and in-channel structures are destabilised. Such ongoing bed degradation is also observed in the German Rhine, the Elbe River, and the Danube River. German water management authorities have conducted sediment augmentation measures since 1978 to mitigate the bed degradation, and in 2016 Rijkswaterstaat will conduct a large-scale field experiment (at a cost of \in 15M) to investigate whether augmentations can counteract the degradation of the Dutch Rhine (one of the largest European rivers) and to constrain augmentation rates and sediment sizes for future augmentations.

The current research project focuses on the above bed degradation problems and consists of two PhD positions (A and B). Their objectives are

(A) to fully understand the causes of the ongoing bed degradation;

(B) to predict the short-term and long-term effects of mitigation measures on river longitudinal profiles.

In particular, we will focus on the characterisation of the equilibrium of the river longitudinal profile, i.e. a condition in which the longitudinal profile and the spatial variability of channel sediments do not change in time, as this is the state the river tends to achieve in the long term. Second, we will study the causes of the long-term degradation in terms of (a) narrowing and straightening measures conducted in the 19th and 20th centuries, and (b) extensive dredging in the past, (c) dam construction, and (d) coarse -compared to the transported sediment- augmentation measures performed on the German rivers. The final project objective is the identification of physically based design practices to mitigate long-term degradation with particular attention to design optimisation of smart augmentation and dredging measures. We anticipate that the project will aid the design of measures that counteract the degradation of the Rhine River, Elbe River, and Danube River.

Daily advisor of the project is Dr Astrid Blom. Co-advisors are Dr Enrica Viparelli (University of South Carolina, US) and Dr Roy Frings (University of Aachen, Germany). Short stays at the universities of South Carolina and Aachen are foreseen. A practitioner group, consisting of members affiliated with Deltares, as well as Dutch, German, and Austrian water management authorities and a US-based consultancy, will warrant a link to practice.

Requirements

The candidate is required to have an MSc degree in Civil or Environmental Engineering, Geosciences, Applied Mathematics, Physics, or a related field. In particular, the preferred candidate has a strong interest in a better understanding of fluvial processes. He/she is communicative, curious, eager to learn, and able to work in a multi-disciplinary team of scientists.

Conditions of employment

TU Delft offers an attractive, customisable compensation and benefits package, including a discount for health insurance and sport memberships, and a monthly work costs contribution. Flexible work schedules can be arranged. An International Children's Centre offers day care, before- and after-school care and an international primary school. Dual Career Services offers support to accompanying partners. Salary and benefits are in accordance with the Collective Labour Agreement for Dutch Universities. As a PhD candidate you will be enrolled in the TU Delft Graduate School. It provides an inspiring research environment, an excellent team of supervisors, academic staff and a mentor, and a Doctoral Education Programme aimed at developing your transferable, disciplinerelated and research skills. Please visit http://graduateschool.tudelft.nl/ for more information.

Information and application

For more information about the position, please contact Dr Astrid Blom, e-mail: <u>astrid.blom@tudelft.nl</u>. To apply, please send

(1) a letter of application (max 1 page), in which you also indicate your possible preference for position A or B;

(2) a Curriculum Vitae that includes (a) your educational record, (b) a list of publications (if any), (c) work experience (if any), and (d) names and email addresses of three persons from whom we may request a reference letter;

(3) an initial and concise indication of research questions and the methodology that you would propose for your preferred project (position A or B, in max 400 words).

Please email your application no later than **22 January 2016** to Dr. Astrid Blom, <u>astrid.blom@tudelft.nl</u>. When applying for this position, please refer to vacancy number CITG15-44.