

A model of river bank deformations under the simultaneous effect of waves from a hydropower plant and warming

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Abstract This paper presents a mathematical model of the river bed deformations in permafrost areas. The deformations are caused by the influence of waves of various origins under an increase of the ambient temperature. The model system consists of an unsteady hydrodynamic module, a thermal module and a bed deformation module. The hydrodynamic module is based on the two-dimensional shallow water equations. The bed deformation module is based on the sediment mass balance conditions. The thermal module is based on the Stefan equation, which defines the “water–ice” boundary movement. We present two applications of the model in which the bed deformation is calculated for the alluvial channels with melting bed under the influences of waves of different duration and intensity. We compared the model predictions with the laboratory data, generally obtaining a good agreement between the two.

Key words bed deformations; melting; waves; mathematical modelling