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Tsunami source reconstructed from runup time-series

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The study of long wave runup is a classical problem in fluid dynamics, in both linear and nonlinear formulations. However, little attention has been given to the inverse problem, i.e. the reconstruction of the initial condition from a known runup time history.

According to the piston model of tsunami generation, the problem can be modelled as an initial value problem with assigned initial water surface displacement and zero velocity. In this framework, the solution of the linear problem, i.e. the runup as a function of time, can be written as the convolution of the initial water surface with an Abel kernel. This solution can be analytically and uniquely inverted, obtaining the initial wave surface as a functional of the runup function.

In this work, this solution is applied to analytically generated runup time series and its properties are analyzed. In particular, the robustness of the solution to added noise is verified and the effect of nonlinearity is investigated through the use of a Riemann transform of the coordinates.