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Green's function approach to nonlinear initial-value problem of long wave runup in inclined channels

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We provide a Green's function formulation of the initial-value problem for the shallow-water equations in U-shaped and V-shaped bays of in_nite length with constant longitudinal slope, under the Carrier-Greenspan transformation. We apply our formalism to write the solution to the initial-value problem for U-shaped and V -shaped bays with far-offshore initial displacements and a nonzero initial velocity profile with bounded gradient. We analyze run-up in parabolic bays, wherein our solution integrals may be evaluated analytically; the general solution for parabolic bays with both zero and nonzero initial velocity is determined. Our results show that the longstanding problem of applying the Carrier-Greenspan transformation to run-up problems with nonzero initial velocity may be addressed successfully in the context of narrow bays, and that such bathymetries lend new analytical traction to the Green's function method for tsunami run-up.