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Two- and three-dimensional computation of solitary wave runup on non-plane beach

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The solitary wave runup on the non-plane beach is studied analytically and numerically. For theoretical approach, nonlinear shallow-water theory is applied to obtain the analytical solution for the simplified bottom geometry such as the inclined channel whose cross-slope shape is parabolic. This generalizes the Carrier-Greenspan approach for long wave runup on the inclined plane beach actively used now. For numerical study, the Reynolds Averaged Navier - Stokes (RANS) system is applied to study the soliton runup on the inclined beach and the detailed characteristics of the wave process (water displacement, velocity field, turbulent kinetic energy, energy dissipation) are analyzed. In this study, it is theoretically and numerically proved that the existence of parabolic cross-slope channel on the plane beach causes the runup intensification, which is often observed in the post-tsunami field survey.