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In this study we consider a non-physical growth of numerical solutions to the shallow water equations, which can be observed in the cases when the choice of the boundary conditions appears to be physically justifiable and the initial-boundary value problem for the primitive differential system is well posed. This growth can happen in both conditionally and absolutely stable numerical schemes and it can not be eliminated by reducing the time step. Since the corresponding numerical problem with the periodic boundary conditions is conditionally or absolutely stable, such instability is related to the specific non-periodic boundary conditions. The analytical study of such behavior is performed for a simple model of one-dimensional gravity waves, which allows us to reveal the causes of such instability. Based on the performed analysis and numerical experiments, some recommendations for choosing the boundary conditions are given to avoid the non-physical behavior of numerical solutions. (Received August 26, 2010)