A cross-sectionally averaged one-dimensional long-wave model is developed. Three-dimensional equations of motion for inviscid and incompressible fluid are first integrated over a channel cross-section. To express the resulting one-dimensional equations in terms of the cross-sectional-averaged longitudinal velocity and spanwise- averaged free-surface elevation, the characteristic depth and width of the channel cross-section are assumed to be smaller than the typical wavelength, resulting in Boussinesq-type equations. Viscous effects are also considered. The new model is, therefore, adequate for describing weakly nonlinear and weakly dispersive wave propagation along a non-uniform channel with arbitrary cross-section. More specifically, the new model has the following new properties: (i) the arbitrary channel cross-section can be asymmetric with respect to the direction of wave propagation, (ii) the channel cross-section can change appreciably within a wavelength, (iii) the effects of viscosity inside the bottom boundary layer can be considered, and (iv) the three-dimensional flow features can be recovered from the perturbation solutions. Analytical and numerical examples for uniform channels, channels where the cross-sectional geometry changes slowly and channels where the depth and width variation is appreciable within the wavelength scale are discussed to illustrate the validity and capability of the present model. With the consideration of viscous boundary layer effects, the present theory agrees reasonably well with experimental results presented by Chang et al. (J. Fluid Mech., vol. 95, 1979, pp. 401–414) for converging/diverging channels and those of Liu et al.

(Coast. Engng, vol. 53, 2006, pp. 181–190) for a uniform channel with a sloping beach.

The numerical results for a solitary wave propagating in a channel where the width variation is appreciable within a wavelength are discussed.

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