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A Boussinesq-type model simulating wave and wave-induced current fields

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A two-dimensional high order Boussinesq-type model is developed able to simulate wave propagation in the coastal zone. The model reproduces very accurately the linear dispersion up to the traditional limit of deep water, kd $\approx$ 3, and it is derived to embed enhanced nonlinear characteristics compared to its weakly nonlinear counterparts. In particular the description of the nonlinear amplitude dispersion is improved over the entire depth range.

In order to form an integrated tool the model was extended to the surf and swash zones. The model is also capable of estimating satisfactorily the wave-induced depth-averaged current field. Due to its nonlinear character, this estimation is possible without the need to decouple the wave and current motion as imposed by the traditional spitting method. This capability is of great importance, not only because of the saving of computational time, but also because the wave-current interaction can be also taken into account. In addition, the undertow effect is included in the cross-shore current computations.

The model's response to the wave-current interaction is checked through the simulation of a demanding test including a rip channel. In addition, both 1DH and 2DH model's versions were validated against a variety of experimental tests including plane beaches and submerged bars. The agreement, in general, is found fairly good and most of the nearshore phenomena are adequately described.