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Nearshore dynamics of breaking waves

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The evolution of breaking waves propagating towards the shore and more specifically the run up phase over the swash-zone for surface as well as for internal waves is considered. The mathematical model, which is an extension of the Green-Naghdi model and includes the upper turbulent layer, has been developed to find the criterion of wave breaking in the steady-state flow over a topography. Preliminary analysis shows that this mathematical model can be used to describe the evolution of a surface turbulent layer generated by a Kelvin-Helmholz-type instability, which develops at the toe of a breaking wave (spilling breaker). The maximal amplitude of both soliton-like waves and "smooth" bores, at which the waves begin to break, can be suitably predicted by the model.

This model and its hyperbolic approximation are adopted to unsteady run up problems for surface and internal waves. The topic of internal waves is studied in the context of wave breaking, vortex formation and mixing in coastal waters. Nonlinear internal waves generated by tides, as well as by interaction of flows with topography, play an important role in the energy transfer from the large-scale motion to small-scale mixing. The analogy with the breaking mechanisms of surface waves is very useful to simulate the dissipation processes on shelf.

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