

Pattern formation on sandy bottom: front propagation into sand ripples under the action of regular surface waves

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Pattern formation on a bottom under the action of surface waves is a manifestation of instability caused by relative motion of sand and water. The morphological characteristics of sand ripples patterns are important for the prediction of the dissipation of waves energy, and for the sediment transport. They also influence the biological processes occurring on the bottom and the dispersion of pollutants. We report our results of an experimental study of pattern formation on sandy bottom under the action of regular harmonic surface waves. It was found that two modes of pattern formation occurred: either from localized nucleation sites or from everywhere on the bottom as a uniform pattern. In the first regime sandy ripples appeared in the isolated regions of bottom (patches) increasing in size and front propagation speed was measured. Simple dynamical model based on Ginzburg-Landau equation was proposed to explain characteristics of patches. We have found that the propagating front characteristics depend on the direction of surface waves which generate ripples. If the velocity of front is co-directed with the surface waves propagation, the front has a larger celerity, is steeper and more irregular than the front which propagates in the opposite direction of surface wave.