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Mathematical modeling of mixing and dispersion effects in the shallow waters of the coastal zone

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Brief information of the INTAS funded project is given. The project focuses on the mathematical description of the breaking-wave-induced mixing of coastal waters. The analysis involves both tackling a number of theoretical issues (characterization/modeling of breaking waves, of the generation/evolution of large-scale vertical structures, of the interaction of macrovortices with the background flow and evaluation of the induced flow mixing) and practical problems (construction of suitable synthetic mixing parameters, prediction of spatial area influenced by the mixing). The scope of this project will be pursued by means of the following tasks specifically aimed at developing: i) a suitable theoretical framework to describe/represent the horizontal mixing of shallow coastal water and theoretical/numerical support to analyse frequency dispersive effects on horizontal mixing and circulation induced by wave breaking over complex topographies (e.g. submerged breakwaters) in coastal waters; ii) an appropriate description of the evolution of breaking waves propagating towards the shore and more specifically the run-up phase over the swash-zone; iii) asymptotic and numerical studies of nonlinear dispersive wave models for the description of large amplitude internal waves in the shelf zone. Theoretical study of the energy transfer from long internal waves to small-scale high-amplitude waves in coastal waters; iiii) a development of computational algorithms and methods of constructing of difference adaptive grids, and also realization of computational experiments for investigation of shallow water mixing and dispersion effects in coastal zone.