Water waves over a rough bottom in the shallow water regime

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This is a study of free surface water waves in the case of varying bathymetry, in the shallow water scaling regime. In the case of rapidly varying periodic bottom, it is a problem of homogenization theory. In this setting, we derive a new model system of equations, consisting of the classical shallow water equations coupled with nonlocal evolution equations for a periodic corrector term. We justify the derivation of our model with a rigorous analysis of the scaling limit and the resulting error terms. The model equations and the error analysis are valid for both the two- and the three-dimensional problems. (This is a joint project with Walter Craig and David Lannes.)