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The phase lead of shear stress in shallow-water flow over a perturbed bottom PAOLO LUCHINI, DIM, Universita di Salerno, 84084 Fisciano (SA), Italia, FRANCOIS CHARRU, IMFT, Universite de Toulouse, France — Analysis of the flow over a slowly perturbed bottom (when perturbations have a typical length scale much larger than water height) is often based on the shallow-water (or Saint-Venant) equations, with the addition of a wall-friction term which is a local function of the mean velocity. By this choice small sinusoidal disturbances of wall stress and mean velocity are bound to be in phase with each other. In contrast, studies of shorter-scale disturbances have long established that a phase lead develops between wall stress and mean velocity, with a crucial destabilizing effect on sediment transport over an erodible bed. Our purpose here is to calculate the wall-stress phase lead under large-length-scale conditions, using asymptotic matching techniques for turbulent flow. This calculation provides significant corrections to the shallow-water model.

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