Geophysical Research Abstracts
Vol. 21, EGU2019-19191, 2019
EGU General Assembly 2019

The propagation of the Local Inertia Equations on dry bed

Luca Cozzolino (1), Giada Varra (1), Veronica Pepe (1), Luigi Cimorelli (2), Renata Della Morte (1), and Domenico Pianese (2)

(1)) Dipartimento di Ingegneria, Università degli Studi di Napoli Parthenope, Naples, Italy, (2) Dipartimento di Ingegneria Civile, Edile, e Ambientale, Università degli Studi di Napoli Federico II, Naples, Italy

Flood risk is increasing, due to the climate change and the increase of anthropic pressure on the environment. This observation drives the need of implementing robust and physically based models for the evaluation of flooded area extents and the evaluation of countermeasures efficiency. Recently, attention has increased towards a simplification of the complete Shallow water Equations (SWEs) called the Local Inertia Approximation (LInA). The one-dimensional version of the LInA model is

$$\begin{array}{l} \frac{\partial h}{\partial t} + \frac{\partial hu}{\partial x} = 0 \\ \frac{\partial hu}{\partial t} + \frac{\partial}{\partial x}\frac{gh^2}{2} = -gh\frac{\partial z}{\partial x} - ghS_f \end{array} \quad (1)$$

and it is obtained by neglecting the advection term in the momentum conservation equation of the SWEs, while retaining the local inertial term. In Eq. (**??**), the symbols have the following meaning: x and t are the space and time independent variables, respectively; h is the flow depth, while u is the vertically averaged flow velocity; g is the gravity acceleration; z is the bed elevation; and S_f is the friction slope.The theoretical study of the LInA model has concentrated on steady smooth flows or fast transients like the dam-break on horizontal frictionless bed. Based on these studies, it is commonly believed that the LInA model should only be applied in sub-critical flow conditions with gradually varying flow, where discontinuities are absent.

Until now, the theoretical study of the LInA model has not considered the transients where a smooth wave moves on dry bed. In the present study, it is shown that the propagation of smooth waves on dry bed causes the formation of a shock at the moving front, and that the height of this shock increases with the front velocity. This feature of the LInA model, which has never been highlighted before in the literature, constitutes an interesting characteristic to be considered in order to evaluate the physical soundness of the model.