Geophysical Research Abstracts
Vol. 20, EGU2018-18298, 2018
EGU General Assembly 2018

A critical introspection into the kinematic wave theory

Muthiah Perumal
Indian Institute of Technology Roorkee, Indian Institute of Technology Roorkee, Hydrology, India (p_erumal@yahoo.com)

This study focuses on the logicalities behind the well-known Kinematic Wave (KW) theory initially established by Lighthill and Whitham in 1955 which has been applied for solving various hydrological problems, especially related to flood wave movement in mountainous and steep river reaches and overland flow movement on land surface. However, a critical introspection of the KW theory reveals that the water surface gradient of the kinematic wave remains parallel to the bed surface at any instant of time which implies that the water surface varies vertically to model the unsteady flow. This is a practically impossible proposition. This logically incorrect reasoning of the KW theory resulted in the incorrect interpretations of the well known Muskingum method theory originally proposed as a conceptual model by McCarthy in 1938 in USA. Also the theory behind the success of the Jones formula for converting stage hydrograph into discharge hydrograph was considered as logically incorrect approach by F.M.Henderson in 1964.
The search for the correct theory behind the non-attenuating flood wave movement as theorized by KW theory can be obtained based on approximate diffusive wave theory. This theory can overcome the incorrect interpretations of the Muskingum method, proposed as a conceptual flood routing model. Also the correct logic behind the success of the Jones formula can be established. Further the success for the use of this theory for overland flow can be established. The paper discusses all these details.