Wave-speed–discharge relationship from cross-section survey

D. W. Knight, X. Tang and P. G. Samuels

M. Perumal, *Centre for Continuing Education, Indian Institute of Technology, Roorkee*

The authors' study in establishing the wave-speed–discharge relationship using a simple conceptual model of river geometry has strengthened the usefulness of the approximate flood routing methods for field applications. The writer agrees with the authors that for developing a conceptual model of river geometry, it is sufficient to use a simple schematic cross-section as the representative cross-section. The writer and his co-workers have used such an approach implicitly³⁵ for the development of the wave-speed–discharge relationship required for routing floods in a specified stream network segment of the River Tyne in the United Kingdom using the variable-parameter Muskingum (VPM) flood routing method proposed by the writer.^{36,37} While developing the wave-speed–discharge relationship using equation (1), Perumal *et al.*³⁵ used a uniform channel width B assuming a simple rectangular channel cross-section. The acceptable routing results obtained at the outlet point of the considered river segment, for many of the flood events studied, confirm the authors' viewpoint that the use of a simple schematic cross-section for the development of wave-speed–discharge relationship may be sufficient for many of the field flood routing problems.

The same approach of using a simple representative cross-section consisting of two rectangular compound cross-sections, one for the main channel flow and the other for the floodplain flow, was employed by Perumal *et al.*³⁵ for studying flood wave movement in three Australian rivers using the wave-speed–discharge relationship developed by Wong and Laurenson (1984). Practically acceptable results were obtained for many of the events studied for these rivers also.

The study by Perumal *et al.*³⁵ demonstrates that the use of simple representative cross-section such as a rectangular section is sufficient in the development of a wave-speed–discharge relationship so long as it is able to effectively simulate the macrolevel characteristics of the wave speed and

attenuation of a flood wave in a given reach. Of course, the characteristics of the flood wave to be routed should satisfy the applicability criterion of the approximate flood routing method employed in the study.

The authors have questioned whether the use of equation (1) is appropriate for developing the wave-speed–discharge relationship when the flood wave is characterised by a looped rating curve. The approach adopted by the writer^{36,37} in the development of a VPM method allows the use of the wave-speed–discharge relationship under discussion for routing flood hydrographs, which are characterised by a narrow looped rating curve. The description of the development of this VPM method, the philosophy behind it and its application to field problems is beyond the scope of this discussion and is described in detail elsewhere.^{1–3,5}

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Authors' reply

The author declined to reply to this discussion.