An Application of the LPI Solution Technique in the NWS FLDWAV Model

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ABSTRACT

When modeling unsteady dambreak flows with the complete conservation of mass and momentum (Saint-Venant) equations, the dynamic routing technique tends to be less stable numerically than the diffusion routing technique (which eliminates the inertial terms in the momentum equation) for certain mixed flows, especially in the near critical range of the Froude number. Omission of the inertial terms produces stable numerical solutions for flows where the Froude number is near critical while introducing negligible solution error for such flows. By applying a simple numerical filter (σ) to the inertial terms, the momentum equation may be manipulated to fluctuate between the fully dynamic and diffusion techniques. The σ filter, which is a function of the Froude number, may have a shape which ranges from a linear function to the Dirac delta function. Since the Froude number is determined at each computational point, σ is a **local** parameter. Therefore, portions of the routing reach with low Froude numbers will be modeled with essentially all of the inertial terms included, while those portions with Froude numbers in the vicinity of critical flow will be modeled with little or no (**partial**) **inertial** terms included. This is known as the **local partial inertia** (LPI) solution technique.

The NWS generalized flood routing model (FLDWAV) is applied to a river in which a dambreak flood is routed through a 10-mile, steep river reach (slope > 100 ft/mi) and then through a 20-mile reach where the slope becomes increasingly milder (50 - 10 ft/mi). At several locations throughout the routing reach, the river system experiences "mixed" (subcritical and/or supercritical) flow and the dynamic routing technique experiences difficulty obtaining a solution. In this paper, the LPI solution technique is applied to this dambreak flood routing situation and the results are discussed.