Development of Two-Dimensional River Flow Analysis Model Using Godunov's Scheme and TVD Limiter

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(a) Purpose of study or research hypothesis
Since the existing river flow analysis should reflect river information of wide terrain, the flow analysis was performed through the one-dimensional flow analysis model. However, in the case of severe curvature of the river, such as the meandering river, the accuracy of the flow analysis is poor. So, in order to solve this problem, a two-dimensional flow analysis model that reflects the actual river shape is necessary. Therefore, this study aims to develop a two-dimensional flow analysis model that can analyze the transition and discontinuous flow in natural river.

(b) Key issue(s) or problem(s) addressed
The two-dimensional flow analysis model for river flow analysis has the advantage of reflecting the actual natural river shape, but at the same time, there are many considerations to ensure accuracy. In particular, it is an important point of the 2D flow analysis model to stably analyze wet/dry problems occurring in natural rivers and rapid flows occurring around structures.

(c) Methodology or approach used
Wet/dry problems in natural rivers generate discontinuous flow and have been solved through non-physical assumptions such as thin-film techniques. However, the flow rate calculation through Riemann's solution has been able to reliably and numerically analyze the physical phenomenon of discontinuous flow in natural rivers without nonphysical assumptions. Therefore, in this study, we apply the Godunov method, one of the Riemann's solutions, and apply the TVD limiter to perform the two-dimensional flow analysis in natural rivers stably and accurately.

(d) Results or conclusions derived from the project
Through the development of a two-dimensional flow analysis model applicable to natural rivers, it is possible to accurately analyze the transitions and discontinuous flows in natural rivers. Therefore, it is possible to analyze floods due to extreme rainfall, and solve the problem of transport and diffusion of harmful chemicals through river flow analysis.

(e) Implications of the project relevant to congress themes
Most of the water available to humans comes from rivers. Therefore, the first step to global water security and restoration is to accurately calculate the water provided by the streams, so accurate flow analysis is required, but the exact solution of most flow analyzes does not exist. Currently, we rely on computational fluid dynamics to interpret it numerically, and since the accuracy is different according to the analysis model, we want to help the world's water security and restoration by developing an accurate flow analysis model.

Keywords : Godunov's Scheme, TVD Limiter, two-dimensional flow analysis model, natural river, Riemann's solution