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Basic equations of horizontal two dimensional debris flow analysis in general coordinate system

Hiroshi Takebayashi (1) and Masaharu Fujita (2)

(1) Disaster Prevention Research Institute, Kyoto University, Japan (takebayashi@sabom.dpri.kyoto-u.ac.jp), (2) Disaster Prevention Research Institute, Kyoto University, Japan (fujita@sabom.dpri.kyoto-u.ac.jp)

Horizontal two dimensional debris flow models are developed by many researchers and all of those equations are written in Cartesian coordinate system. Basic equations in Cartesian coordinate system are simple and are easy to be used. However, numerical frictions are happened at the side edges of the debris flow when the channel geometry is not a straight channel. We can find many meandering channels in mountainous rivers and, in general, width-depth ration is smaller in the mountainous rivers. Hence, the numerical frictions at the side edge of the debris affect on the flow characteristics of debris flow very well and basic equations in the boundary fitted coordinate system can reduce the numerical friction at the side edge of the debris flow in meandering channels. In this study, basic equations of horizontal two dimensional debris flow analysis are written in general coordinate system and simulate the debris flow in the meandering channels by use of the basic equations of horizontal two dimensional debris flow analysis in general coordinate system. Furthermore, the debris flow in the meandering channels is simulated by use of the basic equations in Cartesian coordinate system and the difference of the flow velocity and flow depth between them discussed. Results show that the depth and the velocity of the debris flow simulated by use of the basic equations in general coordinate system is smaller and faster than those by use of the basic equations in Cartesian coordinate system, respectively. Underestimation of the flow velocity indicates that the underestimation of fluid power of debris flow on the river structures, houses and son. Furthermore, the escape time of people tends to be overestimated, when the basic equations in Cartesian coordinate system are used.