



## **Virtual nature systems for debris flows evaluation**

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The Actual Nature Systems (ANS), River Basins, Coastal Zones, and others, continually turn endogenous (Tectonics) and exogenous (Meteorology) influences to environmental processes. The problem is to parallel evaluation of the processes by use the same external drivers. For the purpose were worked out several Virtual Nature Systems (VNS) which continually reform external influences to virtual processes in similarity to actual ones. The each VNS is a computer double for an one or several natural systems. The virtual double for the ANS allows independent digital estimation of water related hazards (floods, debris flows, et al.) in actual systems. The VNS is a program complex with the following properties: regular input of external influences; their quick reforming to virtual processes in satisfactory similarity to actual ones; analogous computer mapping of an area. The VNS looks like a multilayer digital Matrix, including many layers of variables, parameters, external influences, and being provided by algorithms of the Digital Systems Analysis (DSA). The Matrix includes timely information on a current state of a system. The VNS were preliminary implied for the two (plain and mountainous) river basins and was satisfactory validated by compare of computed and observed floods and debris flows, by use 20 years' meteorology and hydrology records with a daily step. The necessary condition for the VNS imply is a necessity to provide input of real-time 2D data from land based and remote sensing sources. Then, the VNS will take a valuable property to estimate the nearest future of actual systems, to recognize both sites and powers of all hazardous events ahead of their initiation. The VNS based outstripping monitoring may be useful for human's urgent response under trends for increasing power and frequency of water related disasters. It is reliable because of the following: well known retard of nature systems on external influences; join of the DSA-VNS with remote information sources; quick communications; and quick computing. The 'view' the nearest Future

of any area on display facilitates urgent warning, automatic response, and other human's activities. It should be a tool to anticipate disasters. Reference: Klenov, Valeriy (2006). The Moving Digital Earth Technology (MDE) for monitoring of Forthcoming Disasters, Proceedings of the 3rd International ISCRAM Conference (B. Ban de Walle and M. Turoff, eds.), Newark, USA, p.p. 17-23.