Geophysical Research Abstracts
Vol. 16, EGU2014-5983, 2014
EGU General Assembly 2014
© Author(s) 2014. CC Attribution 3.0 License.

Numerical modeling of water flow spreading out over the land surface due to flash flood/debris by methods of nonlinear fluid dynamics and GIS-technologies - a flood zone distribution in time

Sergey Abrakhin
Russian Federation (abrahin_s@vlsu.ru)

1. The problem of forecasting, both in time and space, for the flood zones due to catastrophic flash water events is considered in the frames of dynamic model for the water flow movement on the land surface. The analysis is carried out in analogous with sudden dam destruction on the river channel.
2. To solve the problem, a mathematical apparatus has been used to describe the processes of water flow motion in approximation of one-dimensional equation for kinematic wave. In the case, the change of depth for water flow in time is associated with a change in the water flow discharge along the propagation coordinate. The model takes into account both the slope of the river bottom and the surface roughness coefficient resulting in resistance by friction. Because the proposition is that catastrophic events already occurred, and flow speed is sufficiently high, we do not take into account the precipitation and filtration processes. By setting the initial and boundary conditions in spatial-time domain the solution of the problem gives a complete picture of the water flow spreading dynamics for breakthrough wave.
The procedure of explicit difference scheme with the use of an uniform grid and a three-point template has been used to find the solution, for a first order approximation. The condition of stability for the solution was obtained.
3. In the model we introduced some database on the land surface parameters being control parameters for the water flow. Forecasting technology is the following: for prediction of the breakthrough wave spreading over the land surface, the river downstream areas divide on the sections, being perpendicular to the riverbed. To estimate the parameters of breakthrough wave we calculate a maximum flood level in each cross-section of the river channel. Next, a flood zone for each section builds as a surface corresponding to the maximum level of flooding.
All operations, i.e. on initial database collection as well as construction of the flood zones themselves, were automated. An original method to obtain the initial data for modeling of the breakthrough wave travelling and display the results in 3D-image has been used by GIS technology development.
4. The quantitative characteristics of the parameters for the breakthrough wave in each section, and visual 3D-images in dynamics for it motion are the final result of carried out forecasting.