



New approach to mudflow formation as a 3D-process of interaction for surface water and groundwater due to base alimentation in the river basin

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1. The paper suggests an original approach for explaining the processes of a flood and/or mudflow formation and spreading out in mountain conditions under the suddenly increase of water masses involved, being strongly above the precipitations power deposition.

The focus is made on interconnection between different water resources (both surface and ground) in the river drainage basin taking into account fundamental processes of crack formation in the mountain massif.

We suggest a mathematical model of the mudflow arising and spreading out based on the conception of non-linear hydrodynamics of the wave processes development with forming of solitons in streamflow.

2. The principal question under our study is to explain why a heavy downpour results in abrupt catastrophic flood and/or mudflow but not for any case. To solve the problem it necessary to take into account the fundamental coupling and interaction between surface and ground water in the frame of the indivisible river watershed.

The following conditions are the necessary ones for flood/mudflow developing: the availability of deep cracks in the mountain river channel, level difference between different zones of river channel, the availability of water mass pool (usually, over the area of a future mudflow arising) which provides a required hydrostatic pressure drop. Another group of obvious conditions is, the precipitations in the form of heavy rains, melting snow, etc potentially provoking mudflows from the very beginning.

3. The main idea of the concept is the following: river/channel cracks appear in the rock as a result of relaxation of tension accumulated there; the cracks extending from the water intake (the river mouth) along the slope to the source ("from below to the top"). At the end of such a crack there appears a tension area and a collecting funnel. An important fact is that the crack being formed in the rock extends not only across the surface but reaches big depths (hundreds and more meters). Ground water is accumulated in the crack area; the mechanism of this 3D-process is connected with the inner (deep) pressure, as well as with capillary forces. For that, a certain area, called a mudflow gate, is being created in the river channel. This zone is the origin of an intensive ground feeding of the mudflow pulse (due to the pressure difference).

It results in a sudden release of the ground water bringing in essential contribution to the surface phenomena. These processes are basic for forming a river basin, and have a permanent influence on the drainage network functioning.

4. Within the framework of this conception, as an example, we give a brief analysis of the possible reasons for the recent catastrophic flood in the town of Krimsk, Russia (July, 2012).