Deutscher Tropentag 2003

Security, Natural Resource Management and Rural Development

Technological and Institutional Innovations for Sustainable Rural Development

Georg-August-University Göttingen, October 8 - 10, 2003

THE ROLE OF PLAN FORM OF VALLEY-RAVINE NET IN THE PROCESS OF MUD FLOW FORMATION

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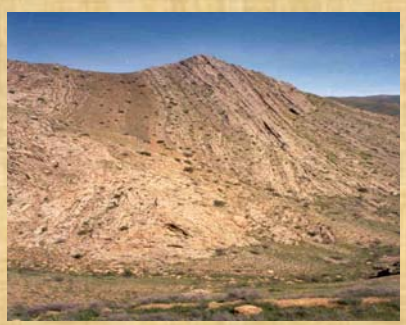
Introduction



This "classic anticline" provides raw material for mud-flow in Southern Armenia

Republic of Armenia is a mountainous country, where the height difference constitutes 3700m on 30 000 km^2. The horizontal ruggedness over 70% of country surface is 1-1.6 and more km/km^2. The amount of talvegs range between 30-50 on 1 km^2, and about 100 in Pambak valley, Gugarac, Miaphor mountains, Vedi, Arpa watersheds and in Zangezur. Such a mountainous relief is necessary for mudflow formation.

The 75% of all mudflow events over Armenia occurred on 1800-2000 m heights. The reason for this are:

1) the large surfaces of those heights,
2) the centralization of flow on those heights from above situated areas,
3) the essential impact of anthropogenic factor over those heights.

The mudflow formation consisted of five factors:

1) local topographical particularities, 2) Geological-geomorphologic state,
3) hydro meteorological conditions, 4) soil-vegetation cover features and
5) human impact.

The 20.8% of country surface has 3^0 steepness and serves as an accumulation zone for mudflow's hard component. On 44.7 % of area, the steepness is 12^0, on 26.5%- 20-30^0 and somewhere –along tectonic folders or cliffs- close to vertical.

Research Objective

The objective of current study is to present the importance of plan form of valley-ravine in the process of mudflow formation.

Methodology:

The applied methodology of assessing the relation between form of mudflow watershed (K) and perimeter (C) and line connecting mouth and spring (D) is based on the following formula: **K = C/D.**

For the S surface watershed of fan-shaped or semi-circle valley the length of perennial stream will be:

$$R = \sqrt{\frac{2S}{\pi}}$$

and the mean distance from the whole surface (D) will be

$$Lav = \frac{1}{S}\iint rds = \frac{r}{3}R = \frac{2\sqrt{2}}{3\sqrt{3}}\sqrt{S} \approx 0.532\sqrt{S}$$

Linear erosion and cone of eroded materials from southern Armenia

Eroded ravine in Southern Armenia

Analysis and Results

For the centralization of mudflow, the relief conditions and plan form of valley-ravine net play an essential role. Our investigations show that mudflow watersheds with fan-shaped net usually have K (form coefficient) more than 2.8 values, which is close to π.

In case of fan-shaped valley net K is not greater than 2.5. In the case of transition or mixture nets K value ranges between 2.5-2.8. In the case of fan-shaped net, when K is more than 2.8 flows, centralization conditioned are more favorable. Mudflows form in short time interval. The time for flow centralization is small.

These kinds of mudflows are Phambak, Lake Sevan Basin, Daranak (Dara), Gjumriget, Artanish, Tsapatagh (Babajan), Erakh, Erakhajur, Sulema.
In plumose-type (oblong, K is less then 2.5) hydrographical network flow centralization is gradual and comparatively slow. The mudflows from this type are: Shamkhut, Urtsajur, Garnhovit, Eghegis, Herher and others.
In mudflows with transition or mixture hydrographical net (K is 2.5-2.8) flow centralization is slower than in the case of fan-shaped or plumose-type.
This kind of hydrological network have Yelphin, Aratsoget, Jajurget, Amasia, Meghriget, Geghi and other mudflows.
In case, when watershed constitutes 2α corner and S surface circle-sector, a point- with τ and φ polar coordinates- remoteness from sector central part
will emerge. Particularly, 1) For transition watershed type (α= π/4), 2) For the plumose-type watersheds (α= π/6).
In case of more complicated hydrographical watersheds, it's possible to take account different sectors' net and do calculations.
The relation between L average and velocity gives a possibility to calculate flow reach (t_{fr}) time period.
The mudflow bed profile is another important mudflow-forming component in the case if the other components have the same meaning. From this point of view it's worthy to classify direct, concave and step-type profiles.
The flow beds with direct profiles usually have great incidence and major part of mudflow hard components reach debris cone causing damages (Southern slopes of Yerakh, Urts, Areguni mountains mudflows).

The flow bed with concave profiles provides the accumulation of hard component gradually starting from middle flow (Shaghaph, Marciget, Ayriget, Karkachun and other mudflows).
The step-type bed structure is characteristic especially for volcanic regions' rivers. Here, hard mudflow components do not reach debris cone. Some part of it accumulates in low parts of lava's surfaces decreasing expected damages in lower part of flows (Mantash, Mastara, Gettar and other flows).

Conclusion

For the mudflow formation, the best condition is found in southern and southern prone slopes, which are characterized with insufficient humidity, big thermal differences, scarce vegetation cover and with the most favourable conditions for hard component creation. In northern parts, mudflow events are scarce due to forest and meadow reach vegetation cover.

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