### Natural Hazards and Environmental Decision Making

# **Basic Conditions for the Formation of Landslides in the Mountainous Part of the Chechen Republic**

## Rustam Gakaev

Chechen State University, 32, A. Sheripov Str., 364907, Grozny, Russia

doi: https://doi.org/10.21467/abstracts.93.39

# ABSTRACT

The mountainous part of the Chechen Republic, despite its small territory, is characterized by a large degree of diversity of landscapes. By natural conditions, the mountainous part of the republic is divided into four main zones; mountain forest, subalpine, alpine and nival. According to the type of landscapes on: mountain forest, mountain meadow, mountain steppe, subnival and nival types and subtypes. The manifestation of slope processes in the mountainous part of the Chechen Republic depends on a number of conditions, the main of which are: geomorphological, climatic, hydrogeological and anthropogenic factors and conditions. Analyzing the course of the slope processes in various natural conditions, one can see that some of the conditions are determined by the regional features of the weathering processes, the nature and mode of precipitation, evaporation, etc.

The main geomorphological features that contribute to the active manifestation and widespread development of landslides are the presence of thick strata of clayey rocks, strong ruggedness, an abundance of steep slopes with elevated and uneven gravitational stresses in the rocks composing them, and the mode of their moistening. The latter factor depends not only on hydrogeological conditions, but also on the intensity of precipitation. The greatest connection between the manifestation of landslides and the precipitation is traced by two peaks of their activity: autumn-winter and spring. In both cases, the total precipitation ranges from 63 to 82% of the annual. Moistening of the rocks increases their mass and, accordingly, the effect of gravitational forces on them, which is accompanied by a weakening of the strength of the structural bonds in them, a change in the consistency of soils to plastic and even fluid. This all leads to a decrease in the strength (friction and adhesion) of the rocks on the slope. Relatively young, actively forming relief in the confrontation of intense modern uplifts and progressive erosion provides its high energy (altitude difference reaches 400-600 m). Deep landslides in the mountainous part of the Chechen Republic are formed with an average steepness of the slope of about 8-12°. In its upper part, where landslides arise, the slopes are somewhat steeper, up to 20-25°. For sliding landslides, the steepness range from 10 to 20° is most characteristic (at a slope height of 100-250 m). The largest landslides-flows (up to 3 km long) are confined to ancient landslide troughs with slopes of 6-10 ° (sometimes up to 25°), with a loose accumulation capacity of up to 10 m.

These circumstances constantly prepare the instability of the slopes of the massifs, periodically occur in landslide displacements that intensively process the primary relief. The territory of the Chechen Republic is characterized by two peaks in the activity of landslides: autumn-winter and spring. Moreover, the second is the most pronounced. In both cases, precipitation of the warm period (April-October), during which 63 to 82% of the annual precipitation falls, is of no small importance. However, in hot years, it can be assumed that most of them, and sometimes completely, are spent on surface runoff and evaporation. Obviously, in years with cold summers, much less rainfall is spent on evaporation and the saturation of the slopes will be more abundant. During years of abnormal activation in six out of seven cases, the average air temperature



© 2020 Copyright held by the author(s). Published by AIJR Publisher in "Abstracts of The Second Eurasian RISK-2020 Conference and Symposium" April 12- 19, 2020, Tbilisi, Georgia. Jointly organized by AMIR Technical Services LLC, Georgian Technical University, Institute of Geography (Kazakhstan) and Russian Institute of Petroleum Geology and Geophysics. DOI: 10.21467/abstracts.93

### The Second Eurasian RISK-2020 Conference and Symposium

in the warm period was below normal. Moreover, during the years of abnormal activations, the number of months of the warm period with a total precipitation of  $\geq 100$  mm and an average monthly temperature below normal is 95% of their total number. In other years, their number was 48%. It is in the warm period that the structural bonds of clay rocks are weakened as a result of their alternate wetting and drying, their strength can decrease by 30-40 times. Thus, humidification conditions in the warm period are important for both autumn-winter activation and spring.

Spring activation is possible during the cold autumn-winter season, when precipitation accumulates in the form of snow, initially falling on unfrozen land. In this case, during spring snowmelt, almost all the melt water will be filtered into the ground (a similar situation was noted in the spring of this year). The precipitation of snow on frozen ground will determine the predominance of surface runoff over infiltration during its spring thaw.

It has been established that the pressure water of seasoned strata of sandstones and fracture-vein waters of zones of tectonic disturbances play a large role in the formation and subsequent development of landslides. Unloading under the thickness of cover and landslide accumulations, underground waters soak soils, which contributes to landslide formation processes. At the same time, snowfall on frozen ground increased slope loads. The sharp transition of negative air temperatures to positive in late February - early March causes violent snowmelt, which leads to overmoistening of the slope massifs and serves as a "trigger" for massive landslide activation.

One of the main reasons for the formation and development of landslides is the progressive pruning of slopes as a result of bottom and lateral erosion of watercourses in rivers and ravines. Everywhere there is an incision of riverbeds and ravines into bedrocks and the absence of any signs of accumulation of modern alluvium in river valleys. This circumstance leads to the fact that modern landslides are developed on the slopes, which are active in relative activity and increase or decrease in activity, depending on the influence of various local, local factors (the nature of water infiltration into species, destruction of woody vegetation). Among the most important measures to reduce natural risks include rational development of territories and economic use, taking into account their resistance to external hazards. Different parts of the territories, due to the great diversity of their geological structure, geomorphological, hydrogeological, landscape and other conditions, may unevenly respond to natural hazards and be exposed to them with different intensities.

To fix the landslide slopes and protect them from erosion, you can use sperniferous annual and perennial grasses, whose root system protects the soil well from erosion. As anti-landslide measures of an organizational and economic order, the prohibition of felling of trees and shrubs, the prohibition of grazing and overgrazing of cattle, dredging near landslide massifs, and also all kinds of construction are recommended. Reclamation measures include planting protective forest belts.