



Impact of the climate change on hazardous natural processes in the Northern Caucasus

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Introduction

North Caucasus is one of the most dangerous places in Russia. In recent years more than 30% of all the natural catastrophes have happened on the territory of Russia. The last changes of climate have caused the increase of south cyclone outlet frequency [Kononova, 2003; Kononova, Malneva, 2003]. The majority of extremes in Northern Caucasus region (whirlwinds, rainstorms hail, floods, slope of avalanches, mudflows, landslides and others) are bound with the cyclone outlets of the Mediterranean Sea. The purpose of this work is to show the relationship between the atmosphere circulation change of the Northern Hemisphere and the activity of the natural hazardous processes in the Northern Caucasus.

Methods and data

The classification of the Northern Hemisphere atmosphere circulation processes developed by B.L. Dzerdzeevskii, [Dzerdzeevskii, at al., 1946; Dzerdzeevskii, 1968], the data of the long term expeditionary observations for mudflows [Landslides and mudflows, 1988] and information on extreme phenomena, monthly published by Hidrometcentre of Russia since 1991 [Belinsky, at al., 1991-2002; Grechikha, at al., 2002-2004] were used in this work. The Analysis was based on the collation of the dates of the shaping the dangerous natural processes, Calendar of the consequent change of the elementary circulation mechanisms (for short ECMs) and daily data given by the nearest meteorological station [Kononova, Kharlamova (Malneva), 1982].

Discussion

Since the majority of the dangerous natural processes in North Caucasus region is connected with fallout of the ample precipitation, the ECMs were chosen for different regions, under which the probability of the fall out of the precipitation forms not less than 60%, and the total rainfall turns out to be not less than 50% of the general sum. Such ECMs were named “precipitation forming”. The time-series of total duration of precipitation forming ECMs for the period 1899-2003 and the monthly, seasonal and annual precipitation sums for the whole period of the observations have been analysed in this work. The significant increase of these ECMs duration and the sums of the precipitation for the last years that caused the increase of the activity of the dangerous processes has been installed. So, in the low and middle mountain of East Caucasus sum total precipitation forming ECM during the period from 1983 to 2003 has increased from 57 to 177 days for a year (The average is 72, 5 days). The Annual sum of the precipitation for this time has increased from 247 mm to 564 mm. The similar changes have occurred in the other region. The Floods are noted nearly annually. The most disastrous floods occurred in the winter of 2001-2002 and the summer of 2002 [Kononova, Malneva, 2004].

The forming of mudflows is the result of the weather with ample precipitations and considerable fluctuations of the temperature of the air [Malneva, Kononova, 2001]. Such weather is most often noted under ECM 13s (summer). So, 60 events of strong mudflows activation have been noted for 1953-2000 in Central Caucasus [Seinova at al., 1998; Seinova, Zolotarev, 2001]. And 35 of them (58%) account for ECM 13s.

Avalanche danger increases under strong snowfall in a cool half-year. Such weather is typical for ECM 13w (winter), among which more than 20% of the avalanches on the whole Northern Caucasus happen. Besides, the ECMs are revealed for each region, where more than 60% of the avalanches are connected with these ECMs.

Conclusion.

The mechanism of relationship of different hazardous natural processes in Northern Caucasus with circulation processes over the Northern Hemisphere has been revealed during this research. The ECMs, responsible for this or that natural catastrophe in a concrete region have been also chosen. Since the Calendar of the consequent change of the ECMs counts 105 years, it is possible to define on the base of the installed relationships the trend of the change of the activities of the concrete dangerous process in those regions, where observations for them are episodic ones.

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