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The Baltic Sea in Transition

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Preface

The scope of this second Baltic Earth Conference is “The Baltic Sea region in transition”. This refers to the geographical location of the conference, as Helsingør is located in the transitional waters between the North Sea and the Baltic Sea, but the title of the conference also refers to the environmental changes, which currently take place in the region, due to climate change and other anthropogenic pressures. Consequently, a major focus for Baltic Earth research in the coming years will be on the impact of multiple drivers of Earth system changes in the region, to estimate and describe the various individual pressures, and assess their dependencies and interrelations.

Baltic Earth has existed now for 5 years. What have we achieved? We could name the numerous workshops, outreach events, summer schools and conferences, as well as research projects and publications, which Baltic Earth has initiated or organized together with partner institutions in the region, and which are available at the Baltic Earth website. An envisaged initiative for the next future is the production of dedicated assessment reports on the Grand Challenges, including climate change and its impacts as overarching topic.

The sessions of this conference reflect the Baltic Earth Grand Challenges and topics:

• Salinity dynamics

• Land-Sea-Atmosphere biogeochemical linkages

• Natural hazards and high impact events

• Sea level dynamics, coastal morphology and erosion

• Regional variability of water and energy exchanges

• Multiple and interrelated drivers of environmental changes

• Regional climate system modeling

130 participants from 14 countries have registered for this second Baltic Earth conference, among them also countries outside the Baltic Sea region, and 126 presentations will be given (65 orals, 61 posters). We are happy to be able to avoid parallel sessions, allowing for a true interdisciplinary exchange between scientists. This has been the principle from the very beginning of the BALTEX era. As usual, no discrimination is made in this volume regarding poster or oral presentation; they are all sorted alphabetically within topics.

We sincerely hope that this conference will be a fruitful and joyful experience for all participants, and that it may foster the international and interdisciplinary scientific exchange in the Baltic Sea region.

Markus Meier and Marcus Reckermann

On behalf of the Conference Committee and the Baltic Earth Science Steering Group

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The maximum runoff of small rivers of the Mountainous Crimea flowing into the Black Sea in modern climatic conditions

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1. Introduction

Crimea is located within the 44^0 23 '(Cape Sarich) and 46^0 15' (Perekopsky earth trench) north latitude and 32^0 30 '(Cape Karamrun) and 36^0 40' (Cape lantern) east longitude. Mountain Crimea occupies the southeastern and southern parts of the Crimean peninsula. The mountains stretch along the Black Sea coast at 150-160 km from Sevastopol in the west and in Feodosia in the east. Their maximum width is 50-60 km (Fig.1).

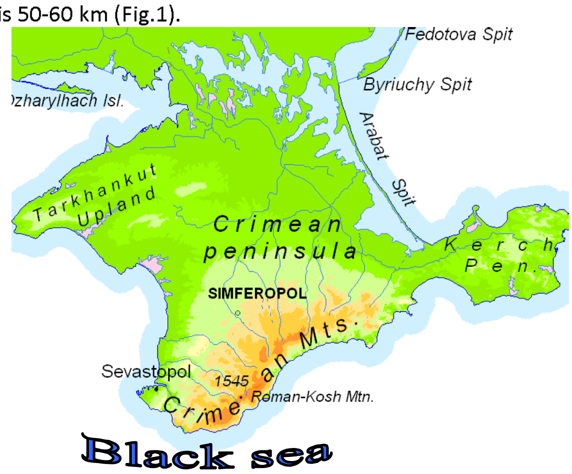

Fig. 1. Location map of Crimea

This study has been examined maximum runoff of the rivers of the Crimean Mountains. This rivers that flow through the western and eastern part of the northern slope Crimean Mountains and on its southern coast. The largest of them - Belbek, Alma, Salgir, Su-Indol and others.

In Crimea, 80-85% of the annual precipitation falls as rain. The characteristic features of the hydrological regime of rivers of the studied area are rain floods. On the catchments areas of the Mountain Crimea, the most frequent maximal daily rainfall is observed, forming floods, within the range of 71-90 mm (27,3%), precipitation is within the range of 31-70 mm (in the sum of the frequency of their occurrence is 40.9%) also typical for the formation of floods of the warm period[1].

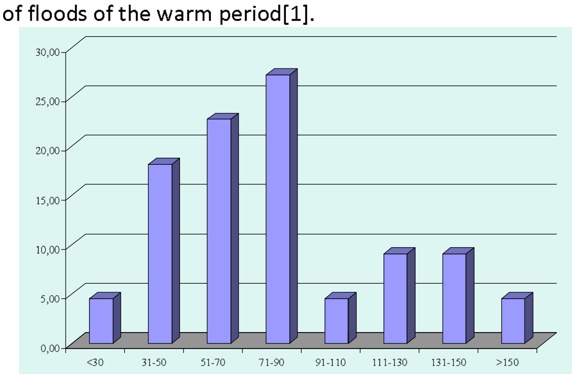

Fig. 2. The distribution of rainfall floods warm period, abscissa - precipitation layer, mm; the vertical axis - the percentage of the total

One of the factors that significantly influences the water regime of the Crimean rivers is the karst, which causes the redistribution of runoff between the catchment and leads to a violation of zonation in the distribution of surface runoff of the rivers[2,3].

2. Methodology and data

To characterize the maximum runoff of rain floods (the layers of rain floods and maximum discharge of water) on the rivers of the Crimean Mountains were used materials of observations for long-term period (from the beginning of observations to 2010 inclusive) on 54 of streamflow station. The range of watersheds - from 0.32 to 3540 km2, the average height of watershed range from 340 to 980 m, maximum duration of observation - '82 .

The study is devoted rationing characteristics of maximum runoff rain floods of warm period for rivers Mountain Crimea based on a modified reduction structure that was derived directly from the model isochronous channel.

According to the authors [1], the advantage of this structure is its simplicity and a small number of calculation parameters. On the other hand, in contrast to the standard formulas of the reduction form, in the justification of structure (1), the method of isochrons used, which allows more fully to take into account all the runoff factors which in this formula are represented by the constituents of the slope modulus q'_m :

$$q_m = \frac{q'_m}{(A+1)^{n_1}}, \qquad (1)$$

Where A - catchments areas, km2 q'_m – maximal slope modulus that is equal to

$$q'_m = 0.28\frac{n+1}{n}\frac{1}{T_0}Y_{1\%}, \qquad (2)$$

Where $\frac{n+1}{n}$ is a coefficient of time nonuniformity of slope inflow, T_0 - duration of slope influx, hours. $Y_{1\%}$ - runoff depths, mm.

3. Results

In order to justify the calculation parameters, a standard statistical processing of the initial information on the maximum runoff of floods of rivers of the given territory was carried out. As a result, we obtain the average long-term values of maximum water discharges and runoff depths, as well as the corresponding coefficients of variation and asymmetry. Were determined water discharges and runoff depths of rare probability of exceedence (P = 1, 3, 5, and 10%).

Based on the data of statistical processing, as well as on the analysis of conditions for the formation of a flood of warm period, for the considered territory, all parameters in the form of the calculated dependences are determined and summarized.The runoff depths (Y1%), as well as the duration of the slope influx, are summarized as dependencies on the average height of the catchments. The unevenness factor is averaged for the year of the Mountain Crimea at the level of 16.0.

Using formula (2), the calculated maximal slope modulus of 1% for the territory of the Crimean Crimea are summarized and summarized in the form of a map diagram (Fig. 3).

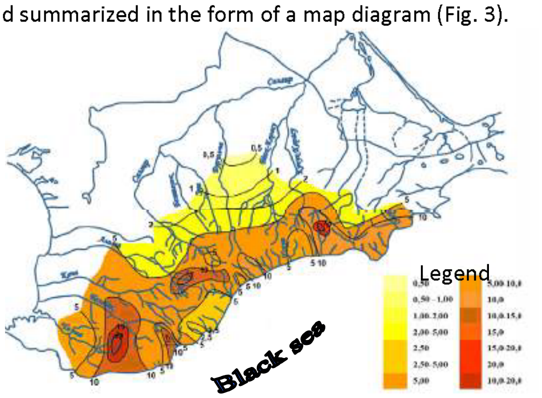

Figure 3. Distribution of maximum slope modulus 1% probability of exceedance in the territory of the Crimean Mountains, m³ / (c · km²).

Analyzing the map it can be noted that the calculated boundary modules of the sloping tributary in general increase from north-east to south from 0.5 m³ / (c · km²) to 10-15 m³ / (c · km²). Local maxima 20 m³ / (c · km²) are observed on the rivers Chorna and Raven. Within the catchment areas of these rivers there is an active unloading of karst waters. On the other hand, the minimum values of the maximum modulus of the slope influx (from 0.5 m³ / (c · km²) to 2.5 m³ / (c · km²) are confined to the karst feeding zone.

In the second variant in the calculated formula introduced factor of underlying surface, which includes the effect of karst and a maximum slope influx module which determined by the altitude.

For the rivers where absence of observational data the coefficient of underlying surface are presented in the form of map (Fig. 4).

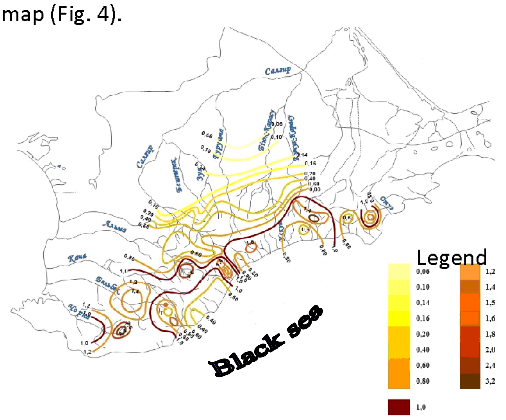

Figure 4. Distribution of the coefficient of the underlying surface for the territory of the Crimean Mountains.

The values obtained vary in the range from 0.06 to 3.20, and in our opinion, reflect the integral effects of karst and features of the underlying surface, which may be related to water management in the catchment; Approximately 1.0 coefficients indicate that there is no influence of the underlying surface on the investigated value.

Comparison of the calculated maximum water discharge (P=1%) shows good convergence as with the original information, and so with the largest maximum water discharge of observation period.

4. Conclusions

• Study of the conditions of the flood formation on the rivers of the Mountain Crimea has confirmed the fact that one of the factors that significantly influences the water regime of the Crimean rivers is karst. The formation of floods is associated with storm rainfall, which covers relatively small areas of the territory, but can lead to catastrophic consequences.

• Analysis of the initial hydrological information on the maximum runoff of the floods, showed that despite global and regional climate change, the number of incidents of catastrophic floods on the rivers of the Mountain Crimea in recent years has not increased.

• Two variants of the calculation model of the formation of the maximum drainage of rain flood in the warm period of year in the Mountains of the Crimea are proposed in the work. In the first variant, the main calculation parameter of the technique is the maximal slope modulus , which is generalized in the form of a map. According to the second, in the calculated formula introduced a coefficient of the underlying surface, taking into account the influence of karst, and the maximum module of the sloping tide is determined taking into account the height of the terrain.

• The average accuracy of the calculation in two variants is ± 21.3%, with the accuracy of the initial information ± 21.6%, which allows to recommend a technique developed for the mountains of the Crimea for practical application

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