VULNERABILITY ANALYSIS ON PRECIPITATION PHENOMENA THROUGH DEDICATED INSURANCE OF URBAN ECOSYSTEM

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Abstract

The periods with precipitations surplus represent a risk that usually has a local prevalence, unlike the periods with precipitations deficit, where the areal spread is large, and the onset and evolution are slow. The perception in the case of periods with pluviometric surplus is a major risk, because of the violent and progressive way of manifestation, while droughts are perceived as being less dangerous phenomena. The complexity of the factors that determine the precipitations regime imprints the studied areal with special climatic characteristics that have an impact on landscape.

Together with the increase in the number of various threats posed to the urban ecosystems, it is important the need for protection through insurance mechanisms emerges. The starting point within the measures to initiate an integrated insurance system is grounded in the rural ecosystems both from the standpoint of the possible risks covered by the insurance, as well the functioning mechanisms of insurance.

Key words: pluviometric risk, insurance, vulnerability, flooding, droughts.

INTRODUCTION

The ensemble and unitary analysis highlights the relations that are being realized between precipitations and the other components of the geographic environment and underlines the local hallmark of urban ecosystems. This aspect makes the object of this study shows the effects of the pluviometric regime on the geographic environment of Sibiu area. The major imbalances that are being generated on the environment by the excess of precipitations or, on the contrary, by the lack of precipitations, justify the interest for these phenomena. This analysis has in view both the direct, determinant effect of precipitations on the components of the geographic urban environment, and the indirect effect, favoring or limitative, induced by precipitations.

The ensemble analysis of Sibiu area has as purpose the prominence of the unity and at the same time the individuality of the precipitations regime, but not under the aspect of uniformity and unalterableness, but on the contrary, analyzed both in terms of the pronounced diversity of manifestations, with ecological and socio-economic impact, and as a result of the relationships that are being formed between precipitations and the different components of the geographical environment.

That is why the analysis of precipitations implies the reference to all other geospheres, taking into consideration the interferences and interactions between them, within determinable limits. The analysis of the long data ranges offers an ensemble image regarding the succession of periods with pluviometric surplus and deficit for Sibiu area. This approach allows the identification of a possible cyclicity of the episodes with flooding and droughts.

MATERIAL AND METHODS

The statistical data come from meteorological stations, pluviometric posts and hydrometric stations that have been selected on the basis of the representativeness and homogenity of the data range. For Sibiu station, there have been used the monthly precipitations values from the interval 1851-2010 and the daily precipitations data from between 1970-2010. The chosen period benefits from a coherent observations program, in which the meteorological instruments and apparatus, as well as the locations of the points of measurement have remained almost the same.

Sibiu is an area exposed to deluges and flooding due to the excess of precipitations. The greatest deluges occur in the spring, when on the background of the increase in the quantity of precipitations, temperature escalation also intervenes, triggering the melting of the snow layer. Still, most of the deluges occur at the end of spring and beginning of summer. Sibiu area is sheltered from deluges and flooding neither during the winter, these being determined by the amplification of the circulation of cyclonic air masses of oceanic and Mediterranean nature. Except for the autumn months, when the air circulation is predominantly anticyclonic, through the rest of the year deluges and flooding might occur, generated by the excess of precipitations (Spânu Simona, 2008).

The monitoring of the episodes with pluviometric surplus or deficit must integrate informations that allow the warning of the decisional factors and of the population. The assessment of the risk that is associated to the periods with pluviometric surplus or deficit is done according to a methodology that takes into consideration economic, social and environmental factors.

The insured risks, which are usually covered by the majority of insurers through optional insurance contracts, are the action-result of natural factors of risk: hailstone; hoar-frost (late spring frost and early autumn frost, respectively); torrential rains; storms, hurricanes, tornadoes; landslides and the collapses of cultivated fields; fire induced by natural electrical discharge (thunderbolt and lightning).

These risks also represent a real threat for the urban ecosystems and can constitute an important element of the risk portfolio. Evaluating the risk and uncertainty within the ecosystems protection analysis is of great interest with respect to the decision making for the prevention of the negative consequences generated by various risk factors. The appearance of risk is reflected by weighing the unfulfillment coefficient of the potential production with the frequency coefficient of the unfavourable years, based upon the following relation:

$$R = K \times F/100$$

where: R – represents the risk coefficient;

K – represents the ratio between the sum of the unfulfilled products and the sum of potential products within a specific time frame, adjusted with the probable productivity increases resulted from the qualitative increase of the crop kind;

F – represents the ratio between the number of unfavourable years and the number of total number of year from the analysed time frame (Cistelcan L., 2002).

In rural ecosystems for example, determining the risk zones and the economically certain areas for a particular crop, is made depending on the average values of the incomes, expenditures and profit. The production and risk variation, within a particular area, also imposes the consideration of the standard deviation, which characterizes the differences between deviations (plus or minus) from the average levels of the analysed indicators.

RESULTS AND DISCUSSIONS

The great variability of the quantities of precipitations for different time intervals determines significant differences between the quantities corresponding to the different occurence probabilities. At Sibiu weather station, the difference between the annual quantities with occurence probabilities of 20% and 1% is of 204,9 mm, and during the warm season the difference is of 189,6 mm. June is the pluviometric maximum of the year. Once every five years (occurence probability of 20%), 144.8 mm are reached in June. With a comeback period of 20 years (occurence probability of 5%), 197.0 mm fall in June. Once every 100 years (occurence probability of 1%), 249.7 mm fall in June, in Sibiu.

The analysis of the annual regime of precipitations in Sibiu area for the interval 1961-2010 and that of the frequency with which precipitations have been registered on different risk classes denote that in Sibiu only a low risk of surplus and a medium risk deficit is manifested (Sorocovschi V., 2002).

The quantity of precipitations fallen in the area of Sibiu area has been grouped according to deviation classes (one normal class and five classes for each of the quantities that are higher and lower than the normal) and to pluviometric domains (where there have been gathered the values of all the classes with positive and negative deviations, comparing them to the normal domain). Then there have been established groups of pluviometric risk through surplus and deficit, to these being added the group with no pluviometric risk. The frequency of the years with pluviometric risk through surplus is low in the Sibiu Depression and plateau area. But the precipitations surplus signalled in the mountain region also spreads in the rest of the areal, especially in Sibiu Depression, generating hydrologic risk (Fig 1).

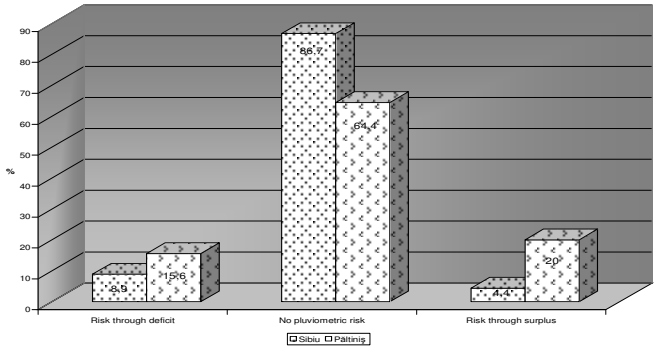

Fig. 1 Frequency according to groups with and without pluviometric risk in Sibiu and Păltiniş in the interval 1961-2010

From a spatial point of view, for Sibiu area, a regioning of the precipitations that fall during 24 hours cannot be established (Fig. 2).

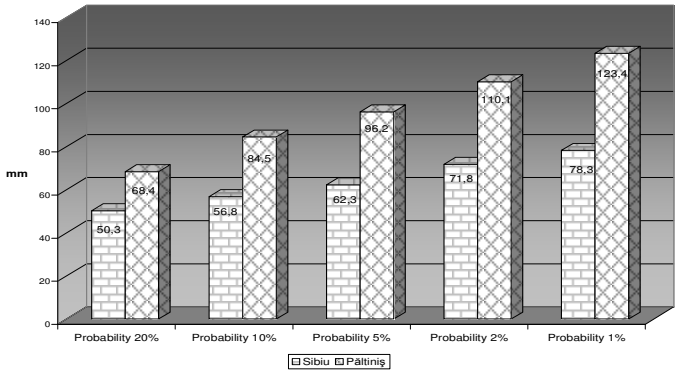

Fig. 2 The occurence probability of the maximal quantities in 24 hours

From a temporal point of view, the highest quantities of precipitations in 24 hours occur in the interval May-August. From the

analysis of the precipitations in 24 hours for the interval 1961-2010, it has been noticed that the highest quantities were produced in the interval 1971-1980, then 1961-1970 and 1991-2009 (Spânu Simona, 2008)

By applying this method, it was possible to obtain a synthetic estimation of the real analysed parameters, in their evolution in time and space. Based on these estimates a prognosis regarding the evolution of phenomena with pluviometric risk was elaborated. Sibiu area is among the areas with an average vulnerability to the quantity of precipitations.

The methods used in analysing the periods with pluviometric surplus or deficit, that represent phenomena with climatic risk allow, at the same time, finding a possible cyclicity of such situations, of the frequency with which they manifest and of their tendency in the studied area, has been taken into consideration.

The way in which the environment responds to the action of precipitations, either through pluviometric surplus or deficit, has allowed the introduction of some categories of vulnerability to precipitations for the analysed area, necessary in elaborating a risk management.

The main parameters that characterize the multiannual regime of the maximum annual thicknesses and which have a great importance for calculating the snow load upon constructions and spring flooding on the rivers that occur during the snow melting, are: the average of the maximum annual thicknesses, the absolute maximum thickness and the maximum annual thicknesses with different provisions. The absolute maximum thickness has a singular, local value. That is why, for practical purposes different parameters are used, as for example the reduced provisions (1-5%), which result from the multiannual distribution curve of these values (Fig. 3).

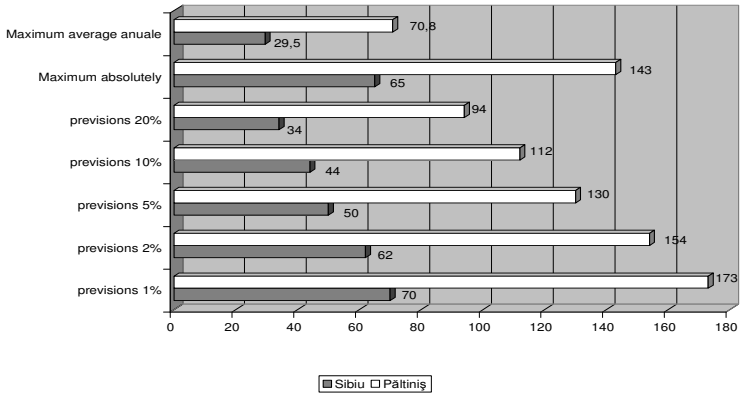

Fig. 3 The thickness of the snow layer corresponding to the previsions 1, 2, 5, 10, 20% in Sibiu and Păltiniş

CONCLUSIONS

The activity of prognosis, evaluation, attenuation and mitigation of the negative effects induced in the socio-economic environment by the regime with pluviometric surplus or deficit, is a complex, interdisciplinary activity. The efficient approach of this activity ensures the transition from crisis to planned action of risk management. The planning focuses on the monitoring, the risk assessment and the working out of mitigation measures, and the organizational structure reflects the special attention given to the communication between the different structures of the plan and the beneficiaries.

The characterization of the effects produced by long-term rains, as well as rain showers, was done from the point of view of the risk they induce in the natural and antropic environment. Knowing the way in which precipitations influence the components of the environment allows the prevention or at least the limitation of the negative effects that they can cause in an area that is rather vulnerable to such risks (Udrea N. M., 2011).

The insurance period is the strict concern of the insurance companies, the actual time between the entering into effect, commencement of liability and the termination of liability. Concerning the commencement of insurer's liability, the exact date differs from company to company, starting from a certain number of hours or days, counted from the end of the day in which the contract was concluded and the insurance premiums were paid.

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