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Hydrology and Earth System Sciences Discussions

Interactive comment on "Mapping mean and variance of runoff in a river basin" *by* L. Gottschalk et al.

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1. Proceding to the study of runoff mapping, first of all it is necessary to investigate the river network structure. The genetic equation can be written for the runoff along the one main river bed Q(l,t), where l varies from 0 in the river head to L (river length) in the river mouth, and t is the time. According to the genetic formula of Befany, Velikanov, Alekseev, ets. being under discussion in the 40-50, the runoff is equal to the integral of the inflow over the lag time. To begin the discussion of the problem, it is necessary to introduce the concepts of a hillslope and of an elementary watershed having for example, one riverbed and two adjoining hillslopes (Fig. 1). After this, we can introduce the concept of the inflow into the river network (q(t)) as the runoff from the hillslope having the width of 1 meter (or any other elementary width). In this case, it is (q(t)) that is the IPR-process, because more detailed models are impractical in this problem. Apparently, for (q(t)) it is possible to introduce the covariance function (in space and

time). However, for its approximation, it is necessary to have the observation data that is usually absent. In the paper, the type and parameters of the covariance function are introduced without any substantiation.

Further, passing on to large-size watersheds, one should introduce the concepts of river network density and river bed isochrones. River bed isochrones are the lines that connect points on the surface of the basin having the same time lag. On Fig.2 they are represented by dotted lines. River network density can be estimated by the formula 1/2B, where B is the elementary hillslope length (Fig.2). Hence, each isochrone crosses N = Y/2B of elementary hillslopes where Y is the isochrone length.

When writing the runoff equation in the projection onto the main riverbed, it is necessary to take into account the runoff from all of the 2*N elementary watersheds lying at a range of l from the mouth of the entire watershed, i.e. of those lying on the isochrone. Only in such a way we can turn from the three-dimensional representation (x, y, t) to the two-dimensional one (l, t). Thus, under the integral over the lag time in the formula (6) there should be the sum of different number of terms (the runoff from N of elementary watersheds). N obviously is the function of l, because the isochrone length varies along the coordinate l.

In the paper, the scheme of the runoff formation and the corresponding basic concepts are not determined accurately. This makes the text difficult for understanding and substantially incorrect.

2. As the authors impartially mention, the most important task of the hydrological analysis is to receive the values of the inflow (q or IPR) using the observation data or by solving the inverse problem. In the works of East-European hydrologists this is called the runoff retransformation. In most of the cases, this problem is an incorrect one (in mathematical sense), and it always requires searching for some simplification allowing to solve it. In the paper under review, the authors do not explain how did they solve the inverse problem, how did they manage to avoid the loss of the stability when solving the

problem. In the paper, there is no any hydrological analysis at all, mechanisms of the runoff formation are not discussed, the role of the underground runoff component is not studied though it is very important when studying the dependence of the runoff from the watershed area, especially when mapping of the runoff norm. The dependence of the runoff from the watershed height being very important in mountainous regions is not concerned; water exchange between the river bed and the flood-plain that influence the time lag and other elements of runoff formation is not discussed.

Not taking into consideration real mechanisms of runoff formation makes the received results formal and uninteresting both theoretically and practically.

3. Intraannyal runoff fluctuations are obvious to have clearly non-stationary character; periods of stable regime are followed by drastic changes of runoff during floods and high water periods. Mechanisms of the inflow to the river network (probability ones as well) during these periods are absolutely different. Formal normalization by division by the average does not solve any problem. The result represented on Fig.2 in the paper is only a fragment not allowing the hydrologist to estimate the role of different runoff components in the feeding of the given river. Instead of genetically clear values, the paper deals with the estimations of the runoff average and the variation coefficient for an hour, a day, a pentad, a month, etc. Without relation of these parameters to the corresponding phases of the hydrological regime, these results make no sense. The map of the variation coefficient of the runoff for the day estimated for long-term period without taking into account seasonal variations has no any practical or theoretical sense.

Model results (Fig.7) do not correspond to estimates received with the help of observation data.

Conclusions

The authors of the paper made an attempt to receive the solution of rather complicated hydrological problem without taking into account peculiarities of the runoff formation, by particularly statistical methods.

The principal positions of the authors are not discussed in the paper in details enough for understanding of the results.

Such an approach has leaded the authors to formal and hardly interpreted results having no any scientific sense.

The reviewer The prof., d.t.s. M. Bolgov

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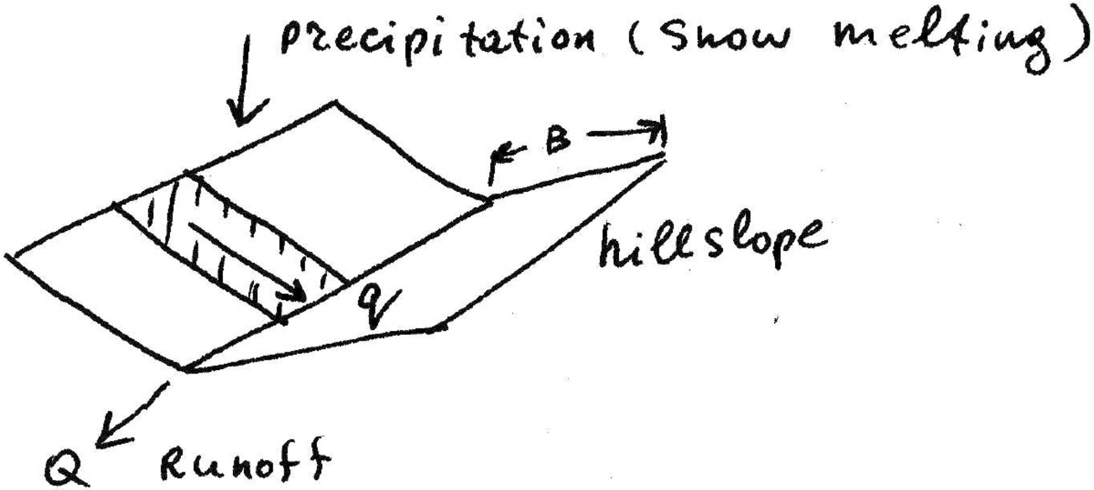

Figure 1: Sketch of elementary basin.

HESSD
3, S163–S168, 2006

EGU

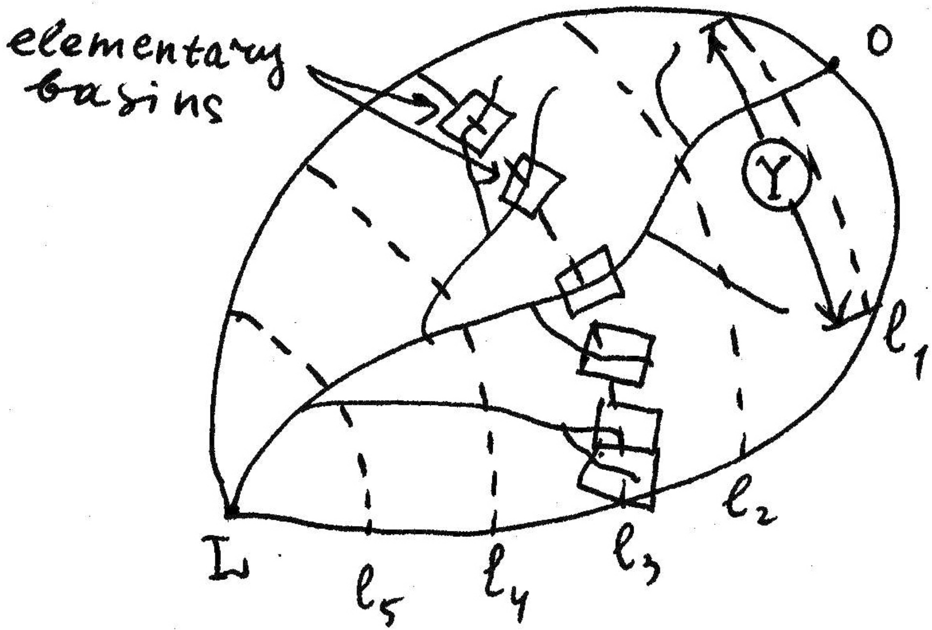

Figure 2: Sketch of basin.

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3, S163–S168, 2006

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