ISSN 2181-9408

Scientific and technical journal

Sustainable Agriculture

№3(7).2020

Founder: Tashkent Institute of Irrigation and Agricultural Mechanization Engineers
Our address: 39, Kari-Niyaziy str., Tashkent 100000 Uzbekistan , www. sa.tiiame.uz

The journal “Sustainable Agriculture” is registered in the Press Agency of Uzbekistan on the 12th of February in 2018 (license № 0957).

In 2019, the journal is included in the list of recommended scientific publications by the Higher Attestation Commission of the Republic of Uzbekistan.

ASSESSMENT OF WATER CONTENT IN HYDROLOGIC TIME SERIES BY USING DIFFERENCE INTEGRAL CURVES (IN THE EXAMPLE OF PSKEM RIVER)

S.M.Kodirov, S.R. Mansurov
Tashkent institute of Irrigation and Agricultural Mechanization Engineers, Tashkent, Uzbekistan

Abstract

The Pskem River (mean annual flow rate 79.6 m3/s) is one of the biggest tributaries of The Chirchik River. The Chirchik River is the biggest right tributary of The Sirdarya River in the territory of Uzbekistan. On the basis of long-term data from hydrological and station (The Pskem River, at hydrological station Mullala, 85 years of observation), long-term fluctuations was evaluated in terms of watery of the year i.e. how changes mean annual flow rate from year to year. The data set of statistical characteristics and their standard errors are estimated, for average flow rates statistical error does not exceed 2.5 %, for the coefficient of variation; the error does not exceed 6 %. To describe long-term fluctuations in water content for a given period method of normalized values appied.

Key words: The Pskem River, The Chirchik River, hydrology, long-term fluctuations, average flow rate.

Introduction. *General information about focusing area.* The article considers feature of the hydrological regime of the Pskem River which is located in the territory of Uzbekistan. Pskem – is a mountain river and it begins from Talas Alatau Mountains in Kazakhstan [1]. It flows mainly to the south-west between Pskem and Ugom Mountain Ranges. Near to the Mullala village (Tashkent region, Uzbekistan), it flows into The Charvak reservoir. The length of the river is 70 km and catchment area is 2540 km 2. The study of the hydrological regime of The Pskem River is important for rational regulation of water resources of the region. The objective of the research is to overview the hydrological regime of The Pskem River and to evaluate the long-term fluctuations in the hydrological time series in terms of watery.

As initial data, we used a series of hydrological dataset for 85 years of observations. The place where our hydrological station located is considered to be high mountain stations in terms of altitude.

General nature of atmospheric circulation in the mountains of study area remains similar to relevant processes specific for plains and foothills in Central Asia, nevertheless the distribution pattern of climatic elements in conditions of rugged terrain considerably changes. Thus, mount ridges located on the way of humid air masses transportation produce sharpening of fronts and create spaces of intensive moisture on leeward slopes while the parts exposed to the wind remain weakly moistened [4]. Distribution patterns of other climatic elements depend on varieties of terrain elevations and exposure peculiarities of slopes. Local circulation also produces considerable impacts on formation of climate. This type of circulation is determined by a complex system of mountain-plain winds, fan draughts and fan-like winds. Temperature inversions are also should be considered, since in some places this phenomenon induces rise in temperature in winter and at night [7].

Snow cover appears in the foothill zone mainly in the second decade of November. At higher altitudes snow cover appears in the mountains earlier. At the altitude of 2000 m (the Angren plateau) snow cover appears in the middle of October. Dates when appearance of snow cover is registered deviate notably from year to year. Formation of sustained snow cover usually takes place in December; at the altitude of about 1000 m in the northern part of the area this development is registered in the second decade of December. At higher altitudes sustained snow cover appears in early December or in the end of November. At the altitudes higher than 2000 m sustained snow cover is formed as early as by the end of October. Analysis of observation series with regard to snow cover shows that for the last 10-15 years the tendency towards its diminution has taken shape. At that, synchronous changes are registered as to numbers of days with snow cover and its maximum depth [6].

Materials and Methods.

Initial data and methods.

To estimate long-term fluctuations of the annual flow rates of analyzing rivers, the difference integral curves are plotted (DIC).

In order to plot the curves, at very beginning of the dataset we need to add one more years and indicate it as a first serial number 0-zero. Because curve is always starts with zero and ends at zero. For example, assuming for a certain year, the annual stream flow is higher than the expected value, then the DIC rises. If lower than the average value, then it decreases respectively [2].

Afterwards mean annual flow rate and its standard deviation of the hydrological dataset must be determined.

The following equation is used to calculate normalized annual flow rates:

$$t = Q_i - \bar{Q}/\delta \quad (1)$$

Where: t - normalized values of mean water discharge; Q_i - annual flow rates; $\bar{Q}$ - mean long-term flow rates; δ - standard deviation of hydrological time series.

The values for δ - are calculated as the square root from variances:

$$\delta = \sqrt{D} \quad (2)$$

Results. The evaluation of the long-term fluctuations Figure 1 depicts the average annual flow rates from 1934 to 1940 rises relatively to the average value-0, and from 1940 to 1957, the DIC remains stable that refers during this period is close to mean flow rates (annual flow rates are relatively close to the expected value). And from 1958 till 1974, the average annual water discharge rises again relatively to the average value. And, consequently, this considered as a high water period.

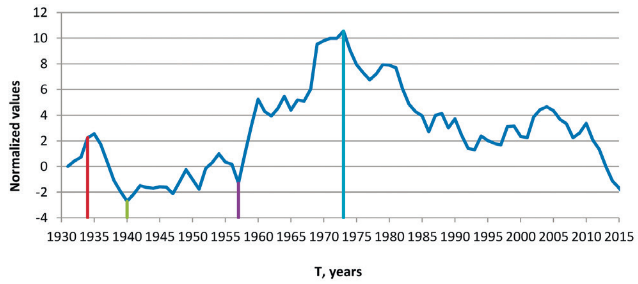

Figure 1. Difference integral curves of annual flow rates of The Pskem River- at Mullala hydrological station

However, from 1975 till nowadays we are observing long duration of low watery interval. The intra-annual distribution of precipitation is shown in Figure 2. As can be seen from this figure, 64-65% of the annual amount of precipitation falls from January to May, the smallest part (5-6%) falls during the period of June-September months [3]. This figure provides the information relating watershed characteristics such as elevation influences to formation of more liquid precipitation. The analysis of seasonal patterns of precipitation for a period of 1981-2010 at lower stations Yangikurgan and Brichmull shows the increase during spring months.

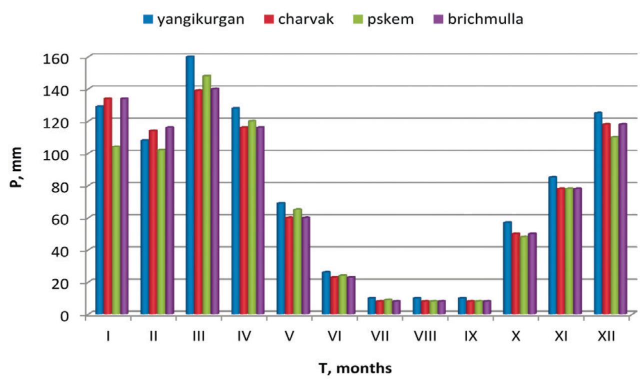

Figure 2. Average long-term monthly precipitation at Pskem meteorological station

The average long-term amount of annual precipitation for each meteorological station is presented in the table 1.

Table 1

Average long-term annual precipitation, mm.

№	Meteorological station	Precipitation, mm	
		For a period of 1961- 1990	For a period of 1981- 2010
1	Chatkal	555	574
2	Chimgan	533	559
3	Pskem	546	572
4	Oigaing	523	538

For all the stations during 1981-2010 precipitation is increasing in the hot season (May-August). But this growth is within 3-5%, which does not exceed 9% statistical error. It was also determined about 44% of the annual amount of precipitation falls in liquid form, 26% mixed precipitation and 30% in the form of snow.

Conclusions. Difference integral curves provide a compact graphical summary of long-term streamflow variability. It is simple and effective way of evaluating long-term hydrological time series. For example, they illustrate how watery of the time interval for a taken period. For our focusing area starting from 1975 till 2016 low water content period is observing. This can be explained with precipitation characteristics i.e. during this time the overall amount of precipitation is changing statistically insignificant (3-5 %) however alteration of type of the precipitation is occurring. This refers to observation of more rainfall than snowfall processes. Hence less snow cover remains in catchment area and it corresponds to shift of the type of the river from snow-glacier nourishment to snow (mostly seasonal not permanent) nourishment by classification of Shultz V.L. [5]. The analysis of long-term precipitation patterns show the change of precipitation form from snow to liquid which is rain due to climate change process.

References:

1. Information Portal of Wikipedia [Electronic resource]. URL:https://en.wikipedia.org/wiki/Pskem_River (The last date of access on 14.05.2018).
2. Sikan A.V., Malisheva N.G., Vinokourov I.O. Statistical methods of analyzing Hydrometeorological information. Laboratory practices. For fields «Hydrology». Specialty «Hydrometeorology». – Saint-Petersburg.: Publishing House of RSHU. 2014.–pp. 75. (in Russian).
3. Sikan A.V. Methods of statistical processing of hydrometeorological information. Tutorial. For fields «Ecology and Environment». Specialty «Geoecology». – Saint-Petersburg.: Publishing House of RSHU. 2007, – p. 278. (in Russian).
4. Orlov V.G., Sikan A.V. Basics of engineering hydrology. Tutorial. For fields «Ecology and Environment». Specialty «Geoecology». – Saint-Petersburg.: Publishing House of RSHU. 2003, – pp. 187. (in Russian).
5. Shults V.L. The rivers of the Central Asia. – Leningrad: Publishing House of Hydrometeorology, 1965. – pp.691. (in Russian).
6. Glacier Catalogue of USSR. Volume 14, the Central Asia, Edition 1. The Chatkal River basin. – Leningrad: Publishing House of Hydrometeorology, 1970. – 41 pp. (in Russian).
7. Gulomov P.N., Vakhobov H., Barotov P., Mamatkulov M. «Physical geography of Uzbekistan and The Central Asia», Publishing and polygraph creative house «O'qituvchi», Tashkent – 2013. – 160 pp. (in Uzbek)

REQUIREMENTS ON REGISTRATION OF ARTICLES FOR PUBLICATION IN THE JOURNAL "SUSTAINABLE AGRICULTURE"

• There are published original experimental scientific articles in the journal "Sustainable Agriculture"They are about the sustainability of agriculture during a period of significant decline in water situation and increase of water sources pollution in anthropogenic climate change in the short and long term.

• There are not published articles that expound individual stages of research, which do not allow us to draw certain conclusions.

• All articles are published in English.

• All data must be accompanied by covering letter, which consists of 500 or fewer words, a summary of the significance of research, author's consent to publication, a number of pictures and tables, support for manuscripts (articles) and additional information. In addition, it should be indicated the current telephone and fax numbers, postal address and e-mail address of the respective author to keep in touch.

• For submitting documents (articles), you must send an electronic version to the editorial office, Brussels classification is necessary. The data should follow the recommendations "requirements for registration…" The authors are fully liable for the originality of the article and its subjective and formal correctness.

• Articles are presented carefully edited, typed in Microsoft Word and Times New Roman Font (Eurotimes font will not be accepted). (*.doc or *.rtf files) in the font size of 12 Times New Roman with A4 sheet format, after 1.15 interval, the size of the text restrictions: the margins at the top and bottom are 2.0 cm, on the left is 3.0 cm, on the right is 1.5 cm. Manuscripts of articles must be signed by authors and have a stamped reference from the institution where the work is done. It confirms that the materials are published for the first time. Moreover, all authors must submit a certificate (from each scientific institution in which the research was carried out).

• Abstract (summary) is a brief overview of all work, including the scheme, objectives, methods, result, and conclusions from the article. It should describe all significant facts of a scientific article and basic numerical data, including any statistical evaluation.

• Abstract (summary) should not exceed 300 words (1-1.5 pages), it should be used as the standard nomenclature. There are not recommended to use any abbreviations in the title of the article or in the abstract. Keywords should be included.

• When you prepare articles containing experimental data, the following scheme should be adhered to literature review, research objective, methodology, results, and conclusions. A Capacity of experimental articles is 15 pages, including a list of references, pictures, photographs, and tables. The title of the article should be short and understandable.

• About the text: the introduction should contain the main reasons for research, review and analysis of the appropriate literature on the subject of research and the proposed approach or solution.

• The title of the section should be accompanied by some text preceding any heading of the subsection. All headings and subheadings in the article should be on the same level. There should be short headings for each section and subsection. Section headings should be in bold, subsections - in italics.

• Data and methods. There all preliminary data, conducted experiments, their degree and conditions of carrying out should be described in detail in this section. All original procedures that were used for the processing of experimental material and all analytical methods used for the evaluation should also be detailed. The whole methodology should be described if it is original. In other cases, it is sufficient to show the author of the method and mention some special differences. You should also indicate the methods of statistical processing, including the used software.

• Results and discussion. The results obtained from the experiments, including their statistical evaluation and commentary, should be presented graphically or in tabular form, the author must comment on the results and compare them with data published at other places (other authors), results should be written in the past tense. Results and discussion can be combined or given in a separate section. Detailed interpretation of the data should be included in the discussion section, not in the results section.

It is necessary to clearly use capital (uppercase) and lowercase letters and also upper and lower indices in formulas, equations, dependencies, etc. This prevents errors. Mathematical formulas are created as separate objects in the formula editor and placed on center. Formulas referenced in the text must have continuous numbering. The formula number is placed in parentheses near the edge of the right margin. The size of the symbols in the formulas is normal is 14 pt, large is 18 pt, small is 7 pt, small index is 5 pt.

• References: only published or accepted manuscripts (articles) should be included in the list of references. Do not refer to abstracts, conferences or documents that were submitted but have not accepted yet. References should be listed and numbered in the order in which they appear in the text. Also, they should be indicated by a reference number in square brackets, multiple references in one set of parentheses must be separated by commas, for example: [1,5,7,28]. The list of references must be at least 20 names. It should be indicated the surnames and initials of all authors separated by comma. After they follows the year of publication in parentheses, the title of the article, the full title of the journal, the volume and page numbers. The names of the author (s) and year of publication should be listed by including them in the text directly, for example: "… as published by Chertovitsky A.S. (2017) or indirectly with the reference on the name (names) and on the year of publication in brackets (Chertovitsky A.S. and Ramazanov A. 2017), (Mirsaidov M.M. and others 2016). Below you can observe the rules and examples of the design of the list of literature in English. The list of references at the first time serves for tracking the authors' and journals' quotations. A correct description of the used sources at the list of literature is a guarantee that quoted publication will be taken into account at the assessment of its authors' scientific activities, and therefore organization, region, state. By quoting, the journal there is determined its scientific level, credibility, the effectiveness of its editorial council, etc.

The structure of the list of literature n English differs from that prescribed by the Russian GOST. A dash, as well as a symbol // are not used in the description in English.

• Tables and pictures should be presented separately to the text, on a separate page at the end of the article, including their names and used units. The units of physical quantities are given in accordance with the International SI system. The names of chemical compounds, taxonomic names are given in accordance with the international nomenclature. Enables should be made in MS Word format (format. Doc), graphics in MS Excel files (data files, xls), photos in jpg / .tiff format (resolution is not less than 300 dpi), all graphics and photos must be numbered, according to the order in which they are included in the text, using Arabic numerals. If any abbreviations are used in the articles first time, they should be explained accordingly.

Each table and picture must have a legend. It means the name along with a description that the reader can find useful for understanding the content. The legends for the tables are placed at the top of the table, the legends for the pictures are at the bottom. The headings of the tables and pictures should be completely descriptive, hidden to the left and bold. For the legend of the table, the first letters in each main word are written with the capital letter, for the legend of the picture the capital letters are written only for the first letter of the first word together with own nouns and adjectives. For example Table 1. Total natural river runoff in the Aral Sea basin (average annual runoff, km3 per year is SIC ICWC estimate) from 2001 to 2016. Picture 1. Areas of irrigated land suspended from the South Fergana Channel. In the text, there are used a small letter for the words "table" and "figure" if they do not appear at the beginning of the sentence.

Tables should be numbered according to the order of the reference and refer to them in the text. The tables should not contain empty graphs, dashes or abbreviated words. The digest of the table is typed in Times New Roman font is 9 pt, the head of the table is 8.5 pt. The digital material in the tables is printed at double intervals, the text of the head and outset is with a single one.

• Footnotes for tables. There are used small English letter for attaching footnotes to certain elements of the table, footnotes are placed below the bottom line of the table in the form of a paragraph (without indents). For general explanatory notes, you must use the "Note" header.

The parameter "Note" can identify the use of an asterisk (for example, one asterisk (*) is in the Syrdarya region (1970) and a double asterisk (**) is for some notations according to CANIIRI (Central Asian Research Institute of Irrigation), from 1980 to 1983.

Color images, figures can be played only in color mode (with a black and white printed version). If during the presentation of the article the author knows that color on the Internet is the preferred method of publication, in this case, there must be presented two files with figures: the black and white version must be marked for printing, and the color version must be marked online in the picture name file.

• Through separate application, there must provide information about the full names of all manuscript's authors, address (telephone, fax, and e-mail), the official name of the institution. The editorial staff reviews all received articles and the period of consideration of the article is 6 months.

• It is expected that the article is written in literate and well readable English. If it is necessary, authors should consult with the interpreter before sending an article. The article will not be checked in detail by the editorial board for the existence of linguistic mistakes. At the same time, the editors reserve the right to reject the article if there is a great number of linguistic mistakes.

• Each article that comes to the editorial office of the journal is sent for consideration to experts of the appropriate profile. As a rule, two experts are appointed for each article. The experts report their conclusions and assessments to the editor-in-chief of the journal, besides that, at least two conclusions must come to every article. Remarks and suggestions of experts are brought to the attention of the article author, after that he makes all necessary changes.

• A copy of the journal with the published article is not sent to the authors and this journal is distributed only by subscription, the fee is not paid.

«Note: Only the author of the article is responsible for the content and information of the article. Editorial staff does not respond to the content of the article!»

Editorial address: 100000, Tashkent, Kary-Niyazov Street, 39. Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, telephone number is (998 71) 237-19-78, (998 71) 237-19-58 E-mail: admin@tiiame.uz, tohir-zs@mail.ru.