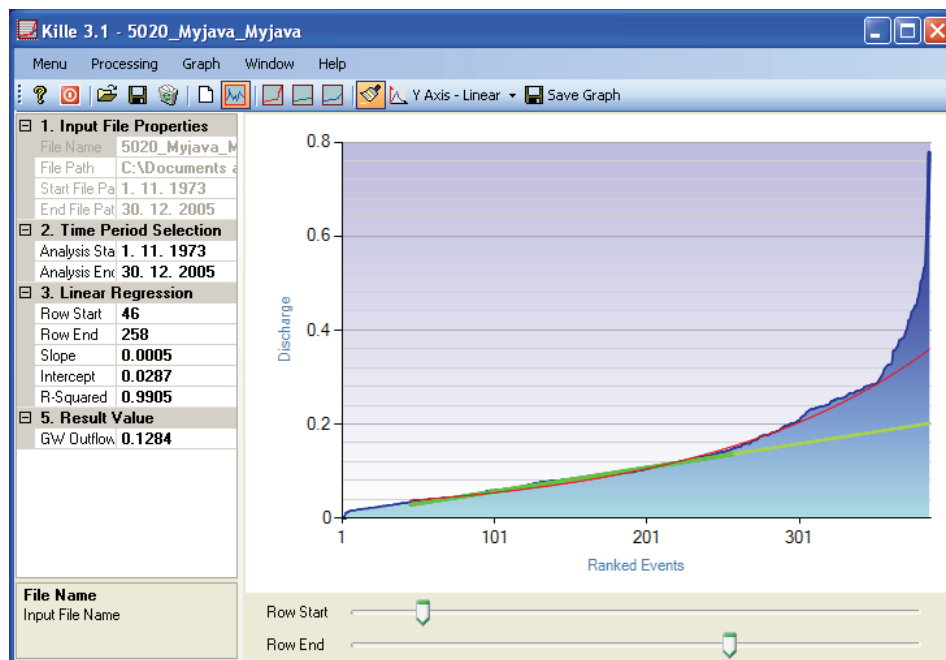


# Kille 3.1

## User's Manual



By Miloš Gregor and Marian Fendek

2012

## **Warning!**

**This manual has not undergone language correction. If you want to help me with this, look at the possibilities of cooperation on a page (section About – Cooperation) or contact me via email.**

**Product Name: Kille 3.1**

**Version: 3.1**

**Build: 7**

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## 1 INTRODUCTION

This manual was prepared for the use of the Kille 3.1 tool (build 7). The manual describes the functionality and limitation of tool usage. After studying this manual, you should be able to use the full functionality of the tool.

The program Kille 3.1 serves for the calculation of long-term average groundwater runoff from the catchment, using minimally 10-years long time series of river discharges.

The methodology is based on method of Kille (1970). The program automatizes this method.

To prepare the input file of river discharge time series is necessary to study the manual – **How to prepare input data for modules**. This manual briefly describes the preparation of input data for individual tools. The great advantage of HydroOffice 2010 is that all the tools use the same structure of input data. Therefore, prepared data for one tool is possible use also in other tools.

Individual tools of HydroOffice 2012 software use the same structure of the graphical user interface, so if you learn how to use a one tool, then the transition to the next one tool is greatly simplified.

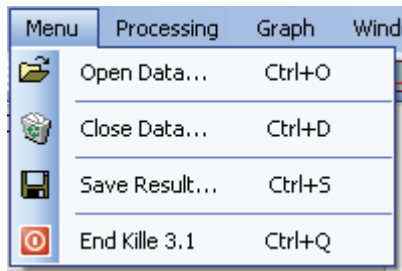
I hope that the tool help you in daily work. For further study of the use of tools can be used videotutorials, located on the HydroOffice.org website. In the case you find a bug in the tool, you have an idea for improving it, or any other question, please use the user forum on the site, because of other users can also have the same problem. If you know the solution to the problem of another user, do not hesitate to help him. The more you can help me on the forums, the sooner can be issued the next new modules for you.

If you are using the HydroOffice tools, please quote them. If you do not know what you can cite, you can find this on the web in section **About – Behind the Opone - Publications**. If you quoted something, you can send me a citation to your work and I will add this information with the reference to the website.

**Miloš Gregor**

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(hydrogeologist, HydroOffice developer)

## 2 MAIN FUNCTIONS

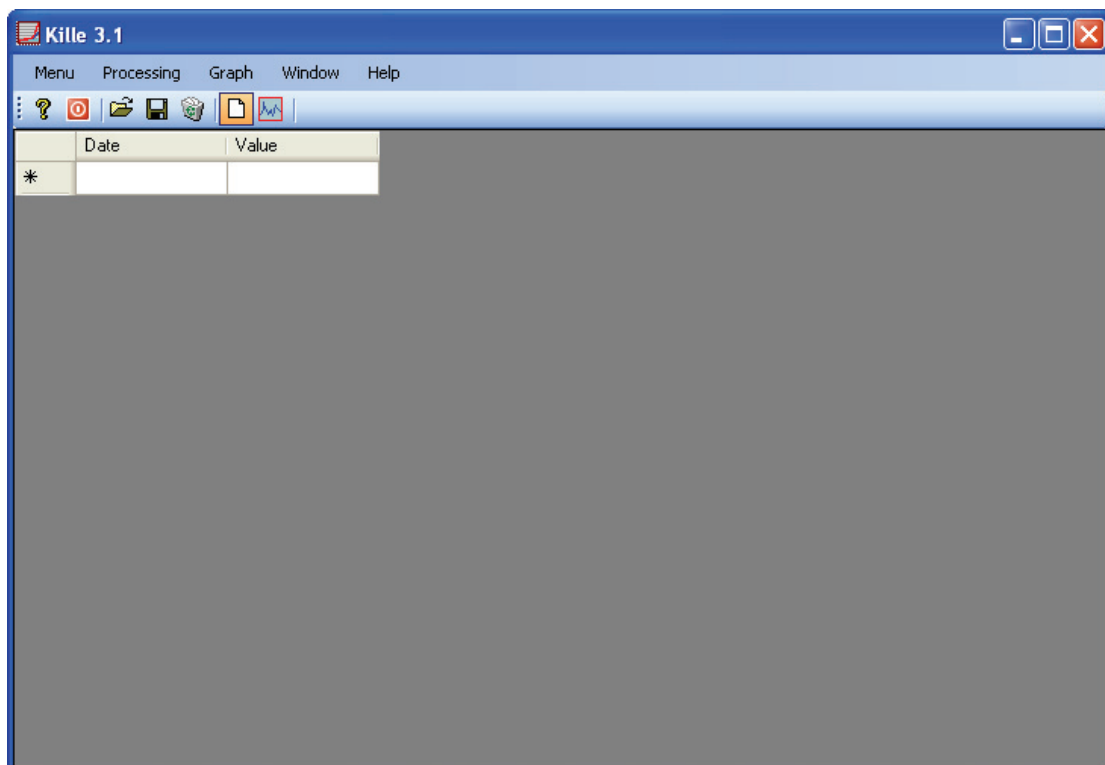


**Fig. 1.** Basic commands in Kille 3.1 tool

The basic functions of program are under main – **Menu** item (Fig. 1) or in application toolbar. The command **Open Data** serves for importing the input file of prepared data into application. The imported data from input file are stored in input data table (Fig. 2).

If the input file is formatted correctly, the date and value are automatically divided into separate columns. At the end of this table should not be more than one empty row. In the case here is more than one, select them and delete using the **Delete** key. Prepared data in table is possible to use for the next processing that is described in next chapters.

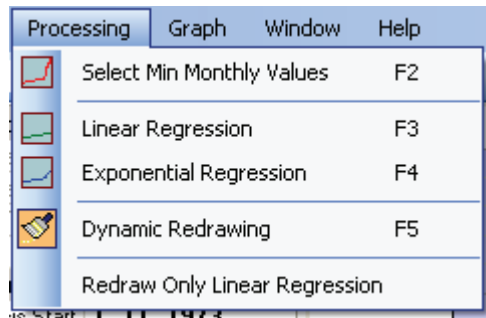
In addition to described functions are in **Menu** located also other three functions. Command **Close Data** serves to complete deletion of all data from application (table and graph presentation). The second command, named **Save Result**, is for saving the calculated results. The form of results for saving will be described later. Program allows to store the result into four types of files (\*.txt, \*.xls, \*.doc, \*.rtf). Due to problems with the compatibility of individual versions of programs (MS Office) the results are not stored into real formats (e.g. \*.xls). It is always basically just a text file that is automatically opened and processed in associated program. The last command (**End Kille 3.1**) terminates the tool.



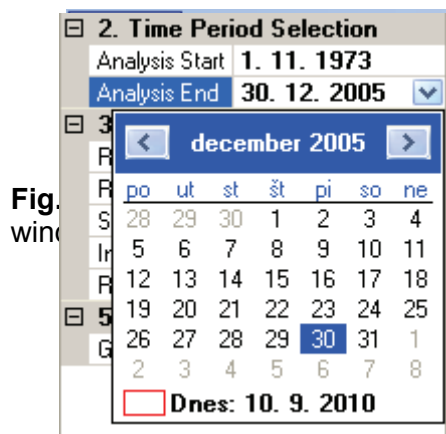
**Fig. 2.** The input data window of Kille 3.1 tool

Within the application window is possible to display two main parts. These parts is possible to show using the commands in **Window** menu item (Fig. 3). The **Input Data** command shows input data table (Fig. 2). Command **Processing** shows the second part of window, in which the calculation is processed. In addition to commands in menu items is possible to use also the same functions from application toolbar.

### 3 DATA PROCESSING



**Fig. 4.** Processing commands in Kille 3.1 tool



**Fig. 5.** Time period selection for processing from the imported time series of river discharges

All the processing and calculations is done in separate part of the window after importing the river discharge time-series.

The input data we can import into the application by the function **Open Data (Ctrl + O)**. Then we can show the next part of window (**Window – Processing**) for method processing.

For the processing of calculation are used functions in **Processing** menu item (Fig. 4). Before using the individual functions

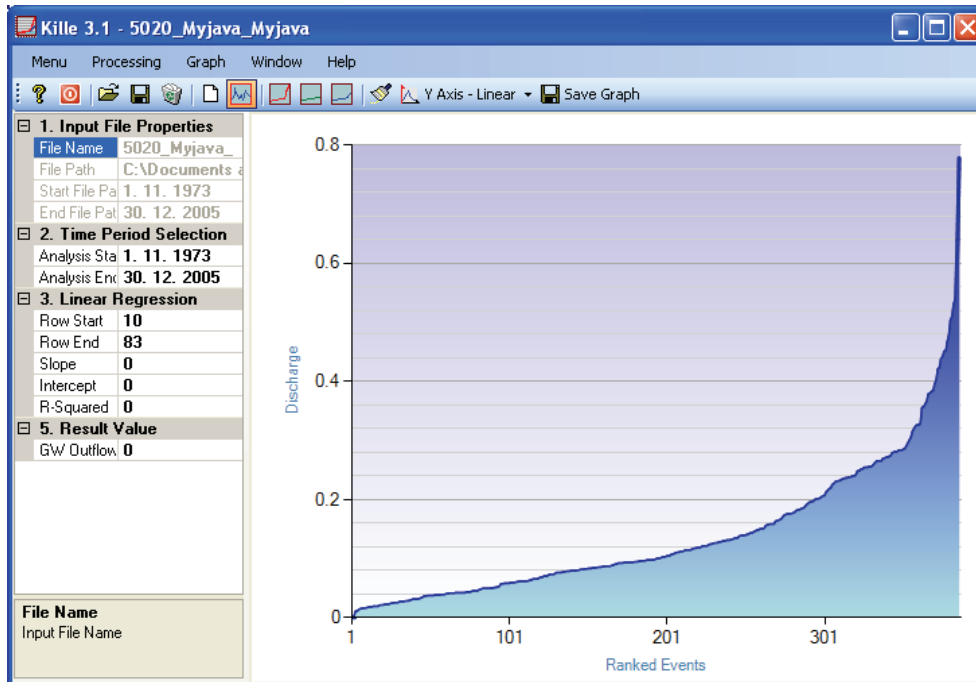
must be set some parameters in Property Grid. The first step of this method consists from the selection of time period, in which we calculate the long-term average groundwater runoff. This is defined in the Property Grid section **Time Period Selection** (Fig. 5).

The method of Kille for the calculation requires **at least 10 years long time-series!** Maximum length of the evaluation period is not limited and according to author with the length of the evaluation period increases the accuracy of calculation. In this step we define the start and end of selected period. These values can be defined in a Property Grid manually or by using the built-in

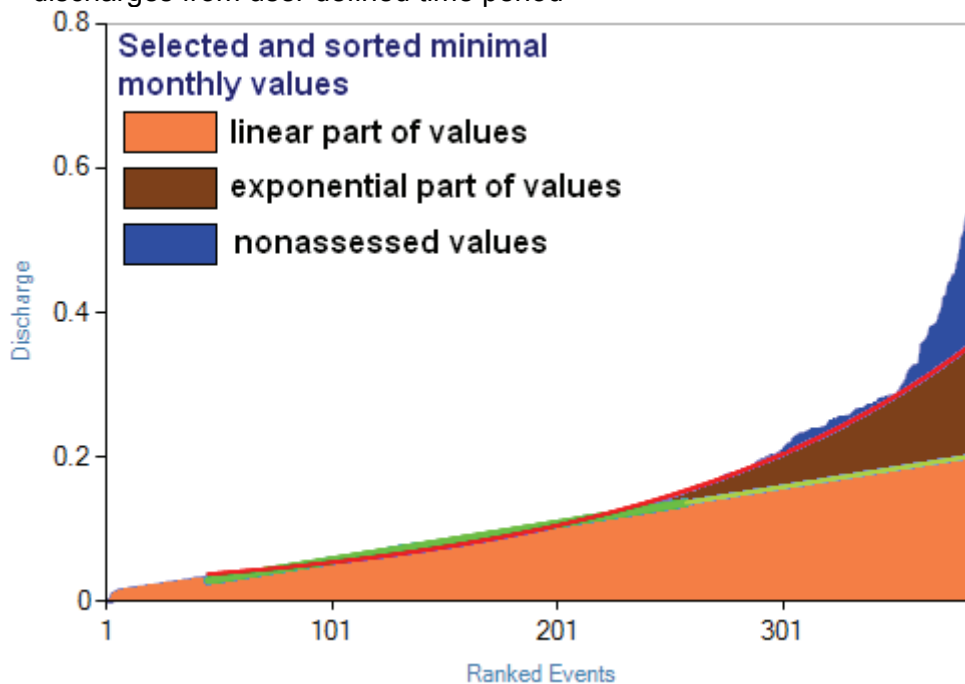
calendar.

After selecting the time period, program automatically selects in defined period the minimum monthly discharges. For this purpose, we click on the function in menu **Processing - Select Min Monthly Values** (Fig. 4). After running this command, the program selects in defined period minimum monthly values. Then there values are ranked from the lowest to the highest and drawn on a graph (Fig. 6).

After selecting of these values comes an important part, which is performed according to the method of Kille (1970). Under to this method can be defined as the average groundwater runoff the values forming a linear part of data (light brown area) and the exponential part of data (dark brown area - Fig. 7).



**Fig. 6.** Time period selection and drawing of sorted minimal monthly discharges from user defined time period



**Fig. 7.** The explanation of method of Kille, used for calculating of long-term average groundwater runoff

The next task consist from the manually selection of linear and exponential parts in the chart. At first the user must select linear field of values. To set this section are used the settings and parameters in the **Linear Regression** section on Property Grid (Fig. 8). The most important parameters in this section are the **Start Row** and **End Row**. According to these parameters is selected the linear part on the graph (Fig. 7 - thick green line). The X axis in the chart is the rank number of the sorted

minimum monthly discharges. Now we select the linear section of data. After entering these values, we run **Processing - Linear Regression** function in menu. Program calculates the linear regression coefficients for selected values and the calculated

<b>1. Input File Properties</b>	
File Name	5020_Myjava_Myj
File Path	C:\Documents and
Start File Path	1. 11. 1973
End File Path	30. 12. 2005
<b>2. Time Period Selection</b>	
Analysis Start	1. 11. 1973
Analysis End	30. 12. 2005
<b>3. Linear Regression</b>	
Row Start	46
Row End	258
Slope	0.0005
Intercept	0.0287
R-Squared	0.9905
<b>5. Result Value</b>	
GW Outflow	0.1284
<b>GW Outflow</b> Average Groundwater Outflow for Selected Period	

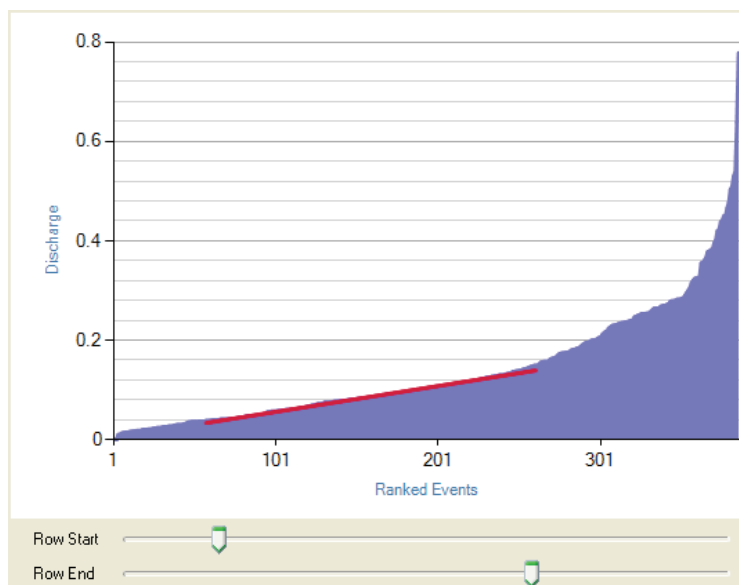
**Fig. 8.** Property grid in Kille 3.1 program

regression coefficients writes into Property Grid. Into the chart is then added new series with the linear regression values (Fig. 9).

The role of user in this step is to select the as longest as possible linear part of data with the best **R-Squared** value (the best = 1). An example of such a procedure is Figure 9, where the selected section of data for linear regression starting with rank number 46 and ending with the rank number 258 and the **R-squared** value is 0.9905.

Because of this described process should not be time effective, a tool for this process accelerating was created. This tool can be showed by function in menu **Processing - Dynamic Redrawing**. After its launch below the chart two sliders are displayed (Fig. 9).

The top slider is used to defining the parameter **Row Start** and bottom for the parameter **Row End**. When user moves the sliders, these parameters are automatically overwritten in Property Grid and also are recalculated and redrawed the values in the graph. When you change these parameters, you will see that it is also a new line of exponential regression added into the graph. The setting of this line will be explained later in the text. To disable the exponential regression in the chart can user use



**Fig. 9.** Linear regression of selected range of data in chart

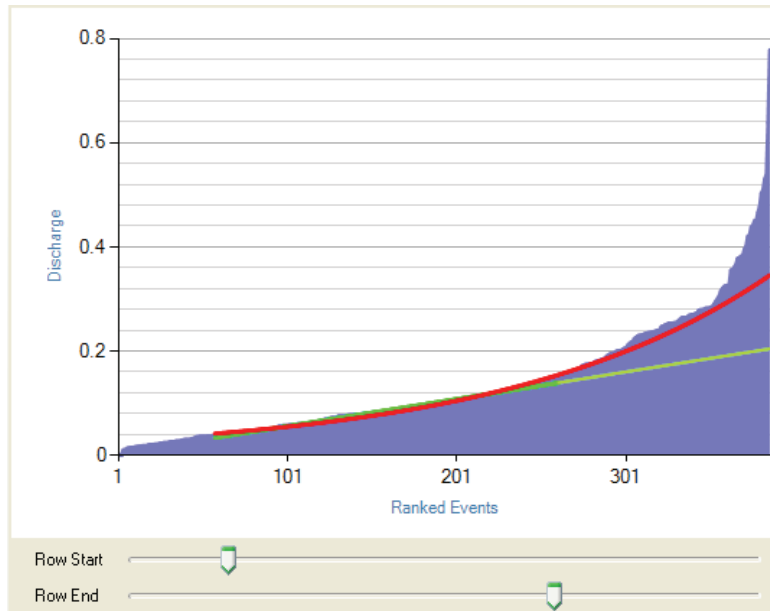
function in the menu **Processing - Redraw Only Linear Regression** (Fig. 4).

When you change the range of linear regression, always is changed the value of the **GW Outflow in Result Value** section of the Property Grid. In this step, program calculates average value for the linear part of data (Fig. 7).

If we find a linear section with sufficient length and the best **R-Squared** value, we can



move to the next step. In this step is calculated exponential regression (Fig. 10). For the exponential regression we don't set any parameter. This regression is calculated from the same field of data that is used for the previous linear regression. For the calculation of exponential regression we use function **Processing - Exponential Regression** in menu.



**Fig. 10.** Exponential regression of the same range data as in the case of linear regression and its extrapolation to the end of the chart

The program calculates the regression coefficients and renders the exponential curve in the graph with its extrapolation to the end of the selected data in graph. After rendering the program calculates the value of long-term average groundwater runoff and writes it into the cell **GW Outflow** in Property Grid. After the rendering of resulting exponential curve the value of the **GW**

**Outflow** is the result value of long-term average value of groundwater runoff for the selected time period.

Min_Month	Lin_Reg	Exp_Reg
0	0.0042	0
0.001	0.0048	0.001
0.001	0.0053	0.001
0.01	0.0058	0.01
0.01	0.0063	0.01
0.013	0.0068	0.013
0.014	0.0074	0.014
0.014	0.0079	0.014
0.015	0.0084	0.015
0.015	0.0089	0.015
0.016	0.0094	0.016
0.016	0.01	0.016
0.017	0.0105	0.017
0.017	0.011	0.017
0.018	0.0115	0.018
0.018	0.012	0.018
0.018	0.0126	0.018
0.018	0.0131	0.018
0.02	0.0136	0.02
0.02	0.0141	0.02
0.02	0.0146	0.02
0.021	0.0152	0.021
0.021	0.0157	0.021
0.021	0.0162	0.021
0.022	0.0167	0.022
0.023	0.0172	0.023
0.023	0.0178	0.023
0.024	0.0183	0.024
0.024	0.0188	0.024
0.024	0.0193	0.024
0.025	0.0198	0.025

**Fig. 11.** Example of exported data that are used in chart for

At the rendering and extrapolating of the exponential curve it is important that the exponential curve in extrapolated (end) section does not be significantly higher than the sorted minimal monthly values, otherwise we get a incorrect result value.

If this exponential curve is higher than the selected discharges, we must changing the range of data for linear regression until the extrapolated section of exponential regression curve is lower than the sorted minimal monthly discharges. If you want to calculate the linear and exponential regression at once, you must again click in the menu on **Processing - Only Draw Linear Regression** item. Then are immediately plotted both regressions curves, together with the calculation of the final value of the groundwater runoff. After calculation, can be all data exported from application. These functions are discussed in following chapters.

#### 4 TABLE RESULT

The program doesn't include any tool to browse the

calculated data in tabular form. After calculations but, it is possible to export them from the program.

Figure 11 shows an example of exported data from program that was used in the previous chapter.

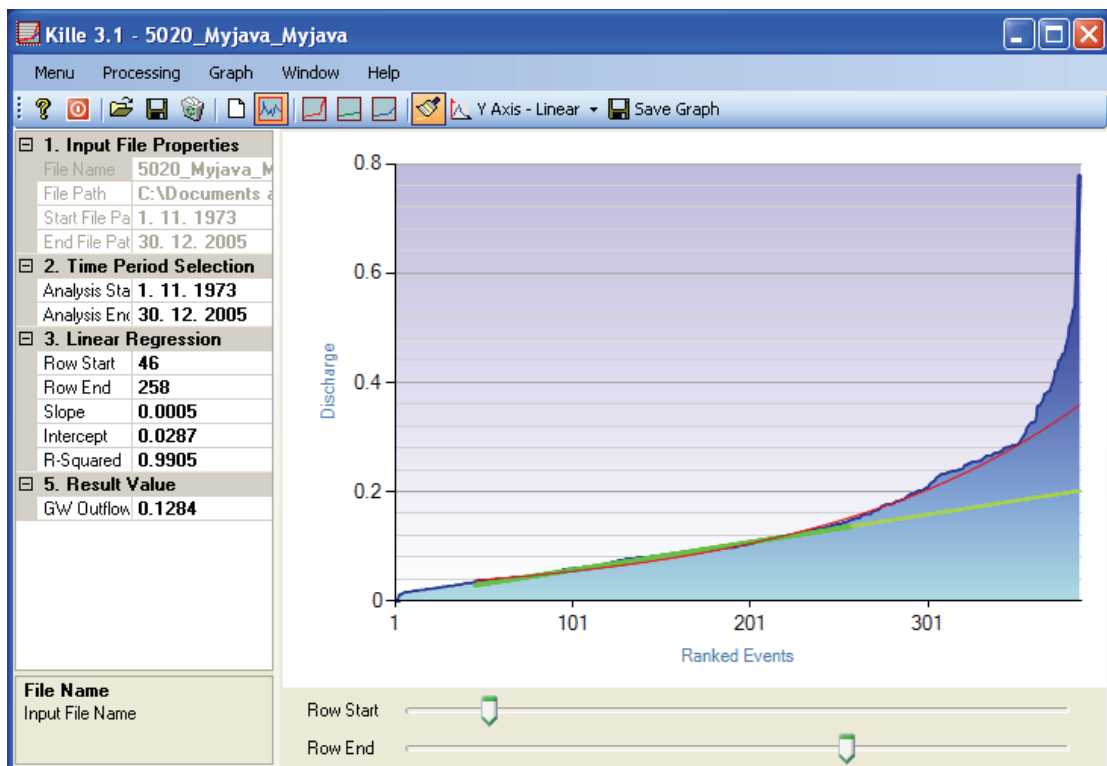
Exported data are displayed in three columns. The first column contains selected and sorted minimum monthly river discharges from defined time period.

The second column contains the values of the linear regression in the defined range. Outside of this range, these values are extrapolated. The last column contains values from which is by averaging obtained the long-term average groundwater runoff.

From the first row to row defined by parameter **Row End** contains the real minimum monthly discharges. From this row to end the column contains the values obtained by extrapolating of the exponential regression model. Calculating the average value from this column, we obtain the required groundwater runoff, as it is defined on Figure 7.

## 5 GRAPH RESULT

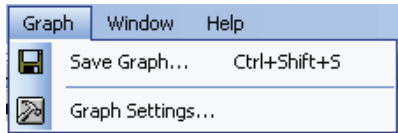
In processing the method of Kille the chart is changed using selected commands. Predefined graph have visual form as in the example on Figure 12.



**Fig. 12.** Example of graphical result of long-term average groundwater runoff calculation, using the method of Kille

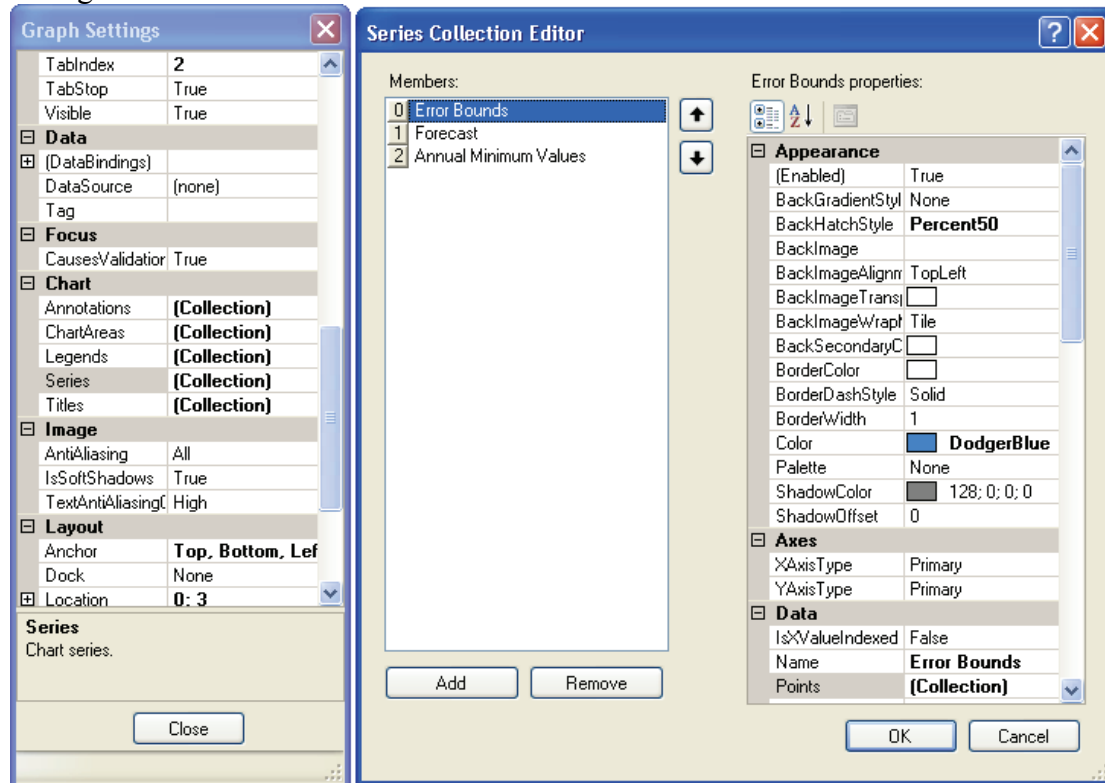
The advantage of the program is that the user can the graph visually adjust, before its exporting. The graphical tools used in program are under the menu item **Graph** (Fig. 13).

This menu contains a feature **Save Graph** that export the generated chart from program in one of the six image formats (\*.bmp, \*.emf, \*.gif, \*.jpeg, \*.png, \*.tiff).

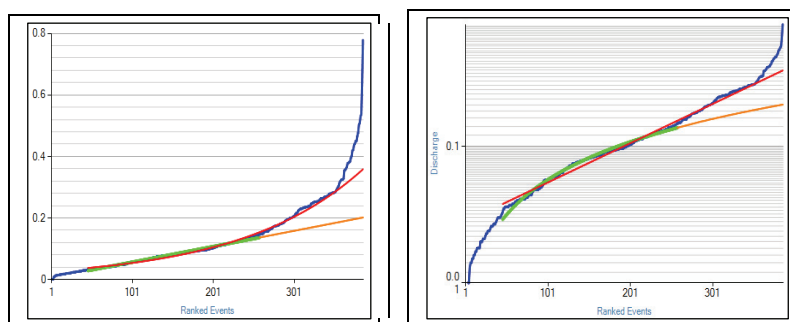


**Fig. 13.** The commands for graph processing on Figure 15.

The second function **Graph Settings** serves for the visual adjustments of automatically generated chart. For the adjustments a window is shown. In this property window can be set everything that is visible in the graph (legend, lines, chart area, axis, chart title, etc.). Examples of this graph are shown



**Fig. 14.** Tools for chart visual adjustments



**Fig. 15.** Examples of various settings of chart display

## 6 CONCLUSION

This manual describes the functionality and usability of the Kille 3.1 tool. This tool serves for quick calculations of long-term average groundwater runoff, using the river discharge time series.

Application has several features that are in detail described in the text of this manual. In case of problems with the module can be use user's forum in

[HydroOffice.org](http://HydroOffice.org). To further study of the module functionality can be used videotutorials. These can be freely downloaded in the **Downloads section** of HydroOffice web.

If in program absence any function or feature, you can inform me about it in forum on the web. If you find a bug in the program, I will be grateful if you inform me about it. You can contact me via forum or via email. If you use this tool, it would be good to cite it in your work. If you do not know what to cite, on web you can find the publications focused to HydroOffice software and its tools. If you cite something, I'll be happy if you inform me about it. I can add a link to your work or website on my HydroOffice web.

## **7 REFERENCES**

Kille K (1970) Das Verfahren MoMNO, ein Beitrag zur Berechnung der mittleren langjährigen Grundwasserneubildung mit Hilfe der monatlichen Niedrigwasserabflüsse. *Z. deutsch. Geol. Ges., Sonderh. Hydrogeol. Hydrogeochem.*, Hannover, pp. 89-95