KWR 2014.087 | November 2014

Roaming CFPD tool for Windows Reference Manual

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Project number
400137

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Sent to
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Year of publishing
2014

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Contents

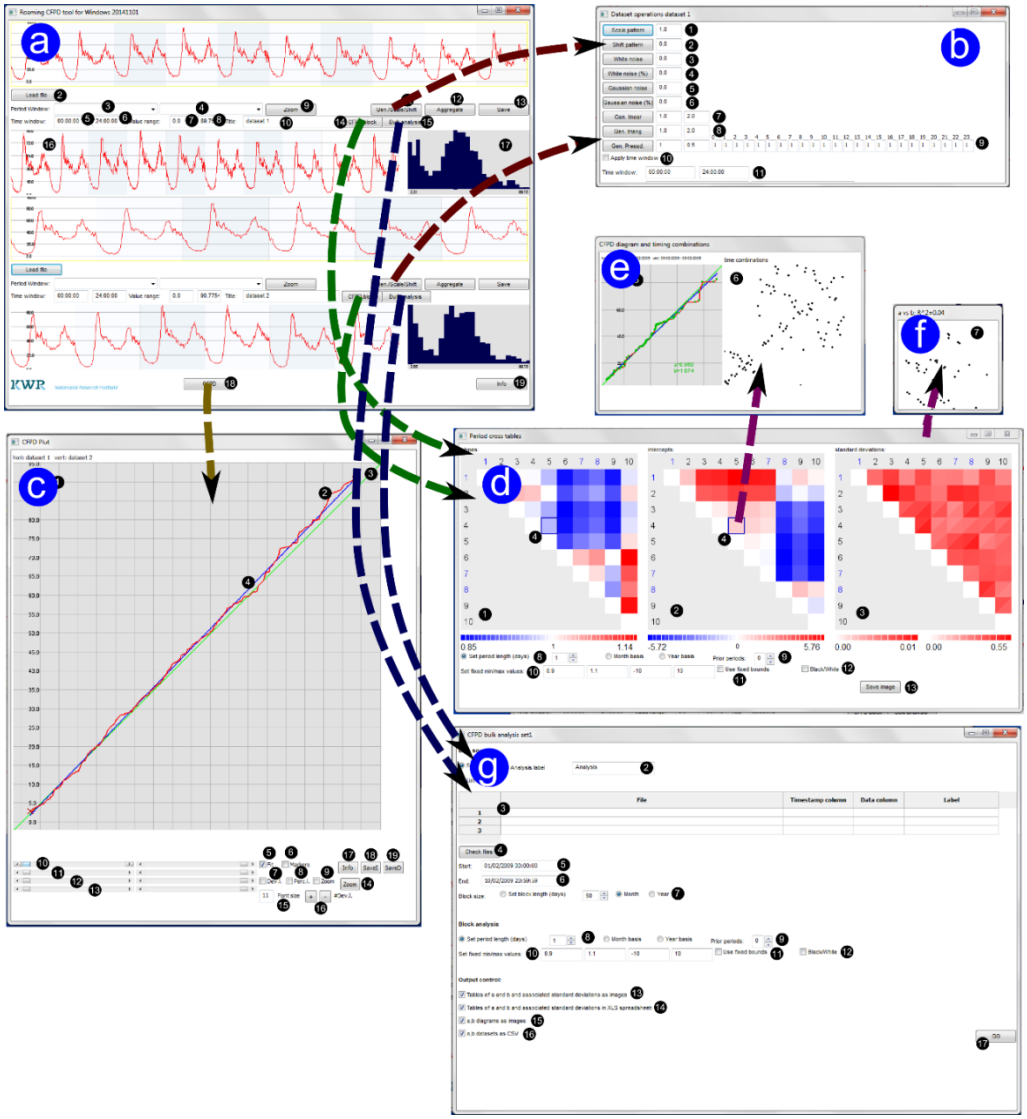
1 Introduction

The CFPD (Comparison of Flow Pattern Distributions) method has been implemented in the Network Flow Performance tool, but since this tool is web based, it is not suitable for application under conditions without a reliable and sufficiently fast web access. The *Roaming CFPD tool for Windows* was developed for these conditions. It is based on the original CFPD research tool (running on Linux). This document concisely describes the functionality of the tool. For a more elaborate introduction to the method, the reader is referred to the original CFPD research papers (Van Thienen, 2013, Van Thienen et al., 2014) and the manual of the NFP tool (Pieterse-Quirijns, 2014).

2 Functionality

2.1 Overview

This section gives an overview of the functionality. All items are explained in more detail in the following sections.



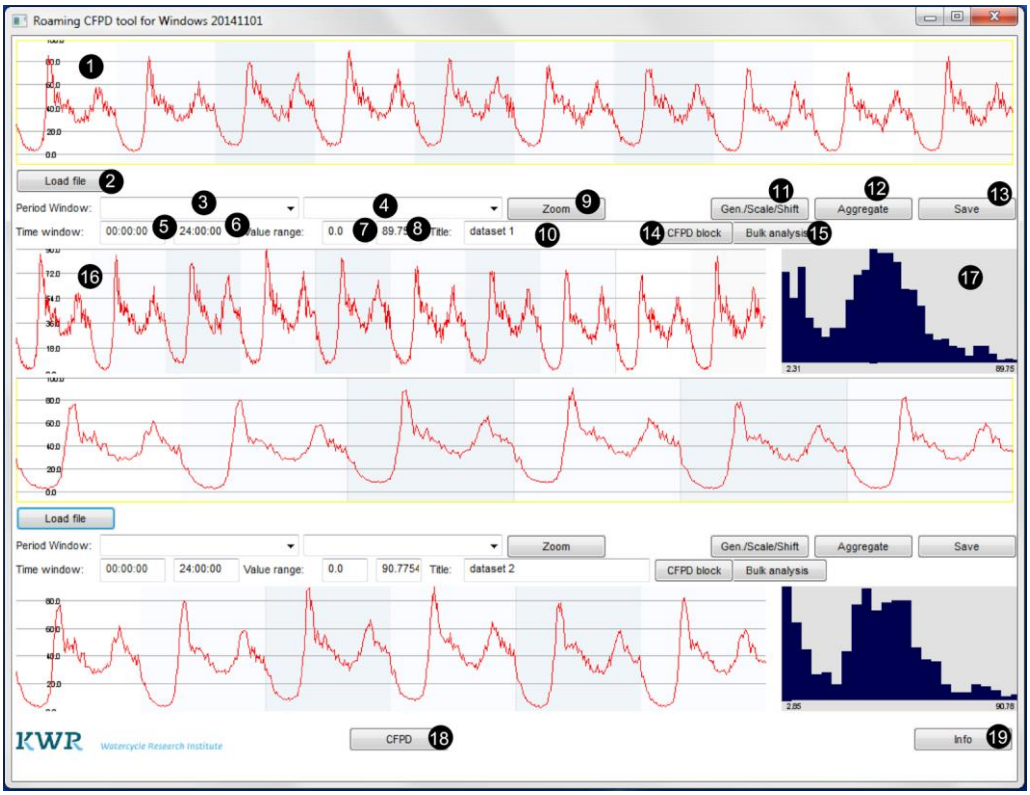
Label	Window	Purpose
a	Main window	- Data input/output - Data selection/filtering - Data inspection - Access to other functionality
b	Dataset manipulation	- Addition of artificial features (leaks, noise, etc.)
c	CFPD analysis	- CFPD curve comparing two datasets
d	CFPD block analysis	- Elaborate CFPD block analysis of a single dataset
e	Block info	- Inspection of individual blocks in block diagram
f	a,b plot	- Quality assessment of block diagram
g	Bulk analysis	- Perform CFPD block analyses in bulk for multiple time frames and/or multiple datasets - Generate output for these analyses (csv, xls, png) - Generate reports for these analyses (html)

2.2 Main screen

The main screen shows two identical sets of controls, described below, and some global buttons. The two identical sets allow the user to read in and manipulate two datasets independently, before comparing them to each other in a CFPD analysis.

label	*object*	*description*
1	Full time series view	The complete time series as read from file is displayed here.
2	Load file	Gives the user a file dialog, which allows the loading of a new dataset. The file can be either a csv file or an xls file. For a csv file, a 2 column file is interpreted as the first having the timestamp (excel datetime numerical format) and the second the flow data. A csv with more than 2 columns brings up dialogs which allow the user to select the appropriate columns for the timestamp and the data. For an xls file, dialogs are given which allow the user to select the appropriate worksheet and columns.
3	Date/time window start	Starting date and time for the analysis period. A value can be selected (combobox) or typed in the same format as the predefined values.
4	Date/time window end	Ending date and time for the analysis period.
5	Time of day start	Starting time for time filter, allowing the analysis to be performed on certain parts of each day only.
6	Time of day end	End time for time filter.
7	Minimum flow value	Minimum flow value to be considered in the analysis. This provides a simple outlier filter.
8	Maximum flow value	Maximum flow value to be considered in the analysis.

9	Zoom button	Zooms into part of the dataset defined with fields 3 and 4, applying the filtering of fields 7 and 8. The resulting dataset is shown in field 16.
10	Dataset name	Is set based on the file name, but can be edited by the user.
11	Manipulate dataset	Brings up a dialog which allows the user to manipulate the data, e.g. adding or scaling values. This feature can be used e.g. to introduce artificial leaks in the dataset.
12	Aggregate data	Aggregates data to a user defined time interval. Note that this is applied to the full dataset, as shown in field 1.
13	Save selection data	Saves the zoomed and filtered data displayed in field 16.
14	CFPD block analysis	Performs a CFPD block analysis on the selected and filtered data of field 16. This brings up a new window, which is explained below.
15	Bulk analysis	Allows the user to perform a series of analyses on this or a number of datasets, including report generation. This brings up a new window, which is explained below.
16	Selected and filtered data	Displays the data as selected in fields 3 and 4 and filtered as defined in fields 7 and 8.
17	Flow rate histogram	Displays a histogram of the flow values as displayed in field 16.
18	CFPD analysis	Performs a CFPD analysis of dataset 1 (top half of main window) against dataset 2 (bottom half of main window). This brings up a new window, which is explained below.
19	Info button	Brings up a dialog which displays information about the libraries used in the program, including relevant associated license information, and license information about this copy of the software.


Roaming CFPD tool for Windows 20141101
1
Load file
2
Period Window:
3
4
Zoom
9
Gen./Scale/Shift
11
Aggregate
12
Save
13
Time window:
00:00:00
5
24:00:00
6
Value range:
0.0
7
89.75
8
Title:
dataset 1
10
CFPD block
14
Bulk analysis
15
16
17
2.31
89.75
Load file
Period Window:
Zoom
Gen./Scale/Shift
Aggregate
Save
Time window:
00:00:00
24:00:00
Value range:
0.0
90.7754
Title:
dataset 2
CFPD block
Bulk analysis
2.85
90.78
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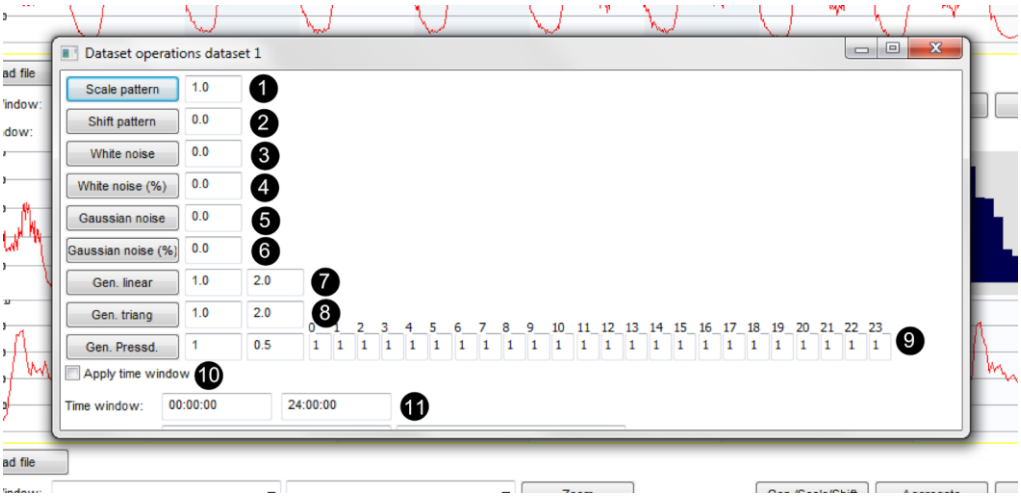
Watercycle Research Institute
CFPD
18
Info
19

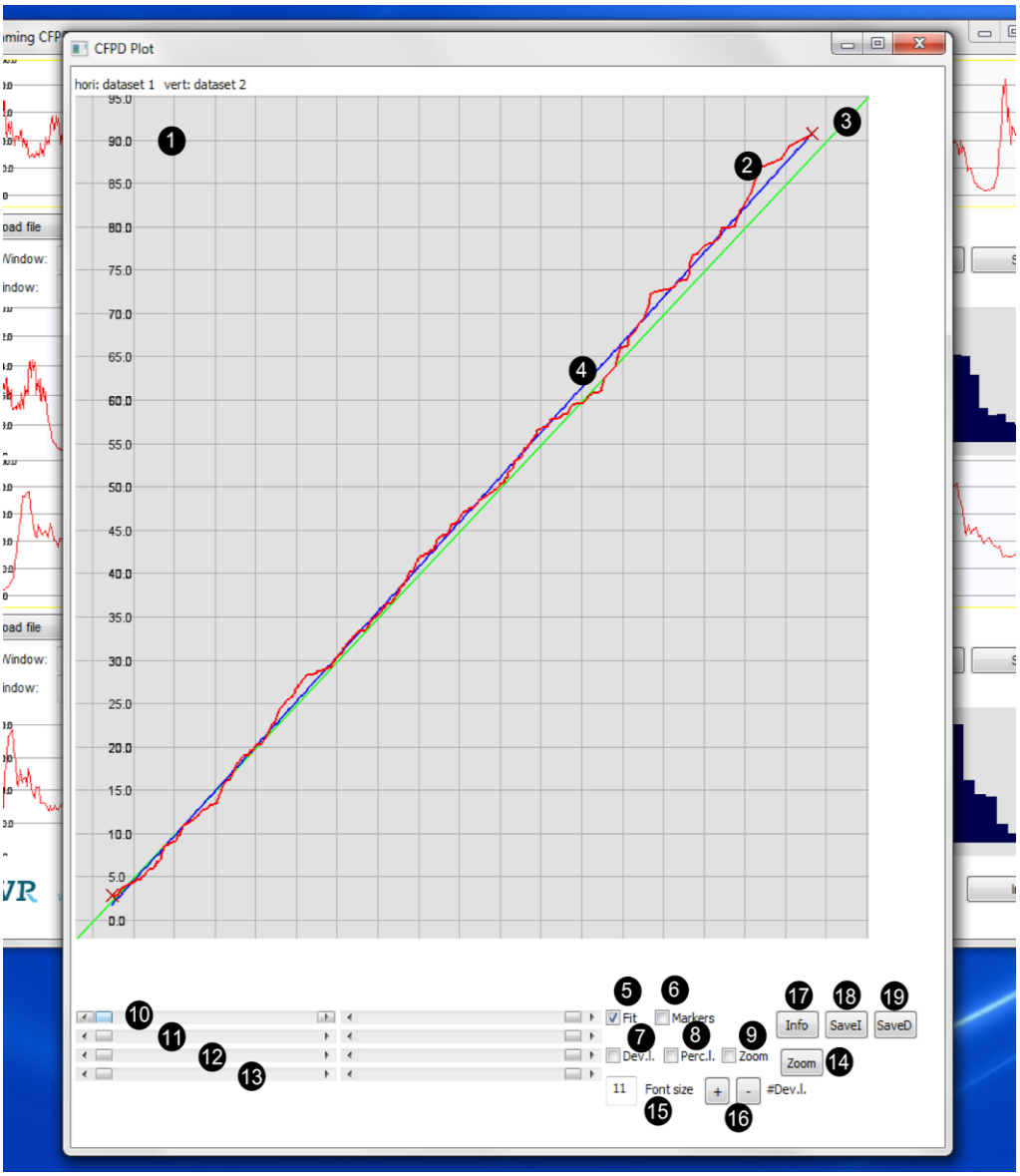
2.3 Dataset manipulation

label	*object*	*description*
1	Scale pattern	Scales the selected part of the pattern by the given factor.
2	Shift pattern	Shifts the selected part of the pattern by the given factor.
3	White noise (absolute)	Adds white noise to the selected part of the pattern by the given amount.
4	White noise (%)	Adds white noise to the selected part of the pattern by the given percentage of the local values..
5	Gaussian noise (absolute)	Adds Gaussian noise to the selected part of the pattern by the given amount.
6	Gaussian noise (%)	Adds Gaussian noise to the selected part of the pattern by the given percentage of the local values..
7	Generate linear increase	Generates a linear pattern with indicated minimum and maximum values.
8	Generate triangular pattern	Generates a triangular pattern with indicated minimum and maximum values.
9	Generate pressure dependent leakage signal	Adds a pressure dependent leakage signal to the data. The base magnitude is the first number to be given, the second is the leakage exponent. The remaining 24 numbers are pressure factors throughout the day.
10	Apply time window	When set, the manipulations are applied only to the time window set below.
11	Date and time window	Allow the user to set a date and time window in which the manipulations are performed.



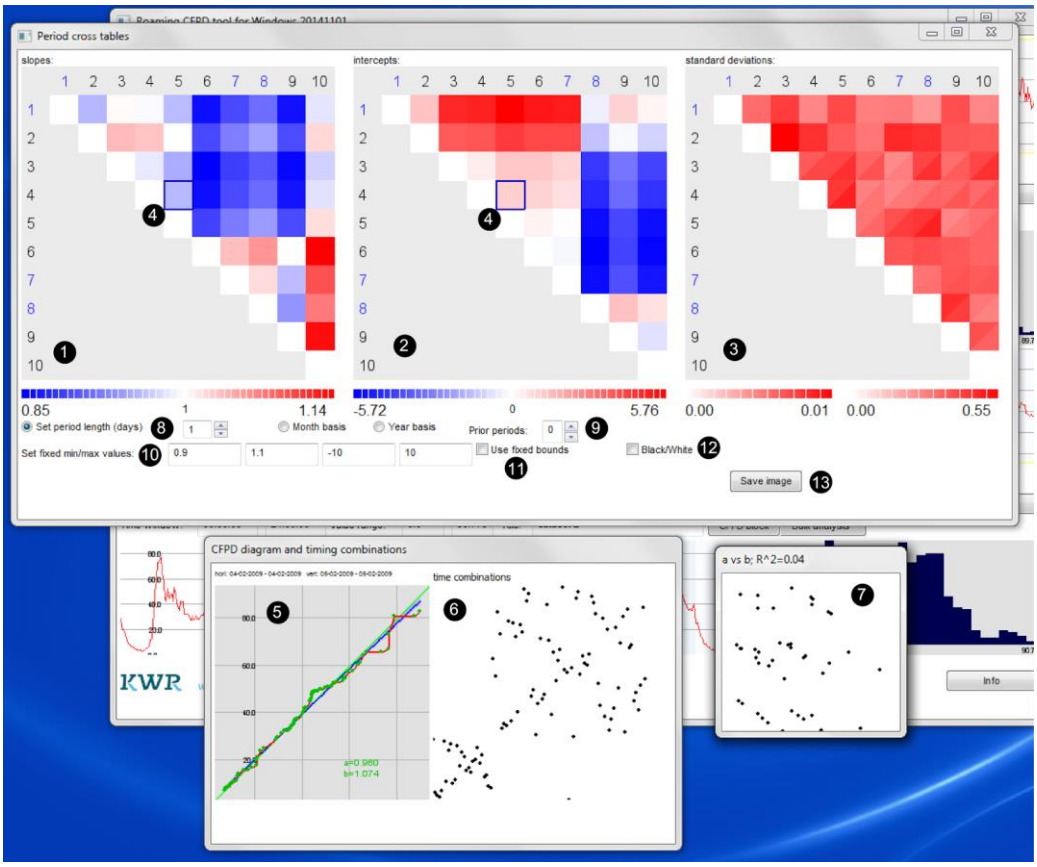
2.4 CFPD analysis

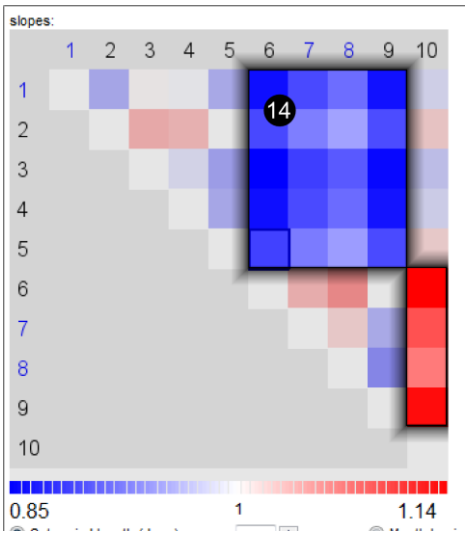
label	*object*	*description*
1	CFPD diagram	Shows a CFPD diagram of the comparison of dataset 1 with dataset 2.
2	CFPD curve	Showing the actual data.
3	1:1 curve	Showing the 1:1 curve (a=1, b=0).
4	best fit	Showing the linear best fit curve for the selected part of the data.
5	Fit	Show best fit line.
6	Markers	Show data markers.
7	Shift lines	Show background lines parallel to the 1:1 line with a regular interval.
8	Scale lines	Show background lines at different slopes to the 1:1 line with a regular interval.
9	Zoom	Show zoom marker bands.
10	Flow range for dataset 1	Select the minimum and maximum flow values for dataset 1 between which the linear best fit is determined.
11	Flow range for dataset 2	Select the minimum and maximum flow values for dataset 2 between which the linear best fit is determined.
12	Zoom range for dataset 1	Select the minimum and maximum flow values for dataset 1 for the zoom range.
13	Zoom range for dataset 2	Select the minimum and maximum flow values for dataset 2 for the zoom range.
14	Zoom button	Show the time series with markers for the data selected in the CFPD diagram.
15	Font size	Font size for support line markers (fields 7 and 8).
16	Increase/decrease	Increase/decrease number of support lines (fields 7 and 8)
17	Info	Show numerical info on the CFPD curve and fit.
18	Save image	Save the CFPD diagram to image file.
19	Save data	Save the data of the CFPD diagram to file.


CFPD Plot
hori: dataset 1 vert: dataset 2
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Fit
Markers
Dev.l.
Perc.l.
Zoom
Info
SaveI
SaveD
Zoom
11
Font size
+
-
#Dev.l.

2.5 CFPD block analysis

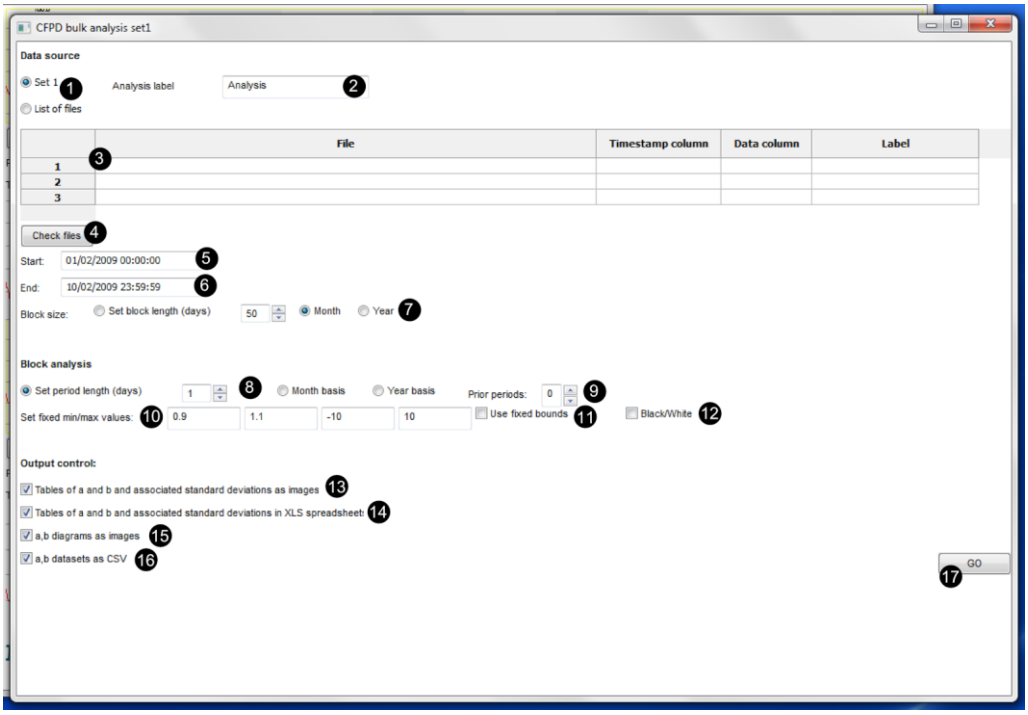
label	*object*	*description*
1	Consistent changes / slopes table	Shows the consistent changes (slope factors) for comparisons of the periods associated with the rows and columns.
2	Inconsistent changes / intercepts table	Shows the inconsistent changes (intercept factors) for comparisons of the periods associated with the rows and columns.
3	Standard deviations table	Shows the standard deviations associated with the elements of the above two tables, the upper left triangle corresponding to the consistent factor and the lower right to the inconsistent for each block.
4	Block selection cursor	Indicates the selected block, for which additional information is shown in fields 5 and 6.
5	CFPD diagram	Diagram showing the CFPD curve with 1:1 line and best fit for the selected block (combination of periods).
6	Timing correlation diagram	Diagram showing the timing correlation associated with the CFPD curve of field 5.
7	a,b diagram	Displays all a and b values of the tables plotted against each other.
8	Period length	Allows the user to select the length of an individual block.
9	Prior periods	Number of periods (depending on what is selected in field 8) prior to the analysis period to be included in the diagram. The purpose of this is e.g. to include the last 3 days of the previous month in a monthly analysis.
10	Fixed bound values	Explicitly set the value range of the slope and intercept tables.
11	Fixed bounds	Apply the bound values of field 10.
12	Black and white	Generate black and white instead of color figures.
13	Save image	Save the three tables in a single image.
14	Block highlighting	By left clicking and dragging, features can be highlighted in the tables. By clicking outside the selected feature, the highlighting is removed.


Period cross tables
slopes:
intercepts:
standard deviations:
1 2 3 4 5 6 7 8 9 10
0.85 1 1.14
-5.72 0 5.76
0.00 0.01 0.00 0.55
Set period length (days) 8
Month basis
Year basis
Prior periods: 9
Set fixed min/max values: 10
0.9
1.1
-10
10
Use fixed bounds 11
Black/White 12
Save image 13
CFPD diagram and timing combinations
time combinations
a vs b; R^2=0.04
KWR
Info


slopes:
1 2 3 4 5 6 7 8 9 10
14
0.85 1 1.14

2.6 Bulk analysis

label	*object*	*description*
1	Dataset selection	Allows the user to select to which data a bulk analysis is to be applied, either dataset 1 from the main window or a list of files.
2	Analysis label	Output label of the analysis (in report and file names)
3	File list	List of files to be analyzed, with timestamp and data columns as well as individual output labels for individual files.
4	Check files	Check the files in the list of field 3 and find start and end times.
5	Start date	Set start date for bulk analysis
6	End date	Set end date for bulk analysis.
7-12	Block analysis control	See identical controls in block analysis
13-16	Output control	Allows the user to indicate which type of output is required for the bulk analysis
17	Go	Brings up a file dialog for the output location and starts the bulk analysis.



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Van Thienen, P. (2013) A method for quantitative discrimination in flow pattern evolution of water distribution supply areas with interpretation in terms of demand and leakage. *Journal of Hydroinformatics*, Vol. 15, No. 1, pp. 86-102.

Van Thienen, P., E.J. Pieterse-Quirijns, J. Vreeburg, K. Vangeel, and Z. Kapelan (2013) Applications of discriminative flow pattern analysis using the CFPD method. *Water Science & Technology: Water Supply*, Vol. 13, No. 4, pp. 906-913.