11th July 2005

Fourth Inter-Celtic Colloquium on Hydrology and Management of Water Resources

WISKI

Quality Assurance for Hydrometric Network Data as a Basis for Integrated River Basin Management

Frank Schlaeger
Michael Natschke
Daniel Witham

KISTERS

German Celts?

- Cooperation with agencies in UK, Ireland
- Biggest partner is Environment Agency of England and Wales
- Hydrometric archive replacement project (HARP)
- Selected hydrometric archive → WISKI
- Software development driven by EA
- Major aspect was data quality control

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Contents

- Introduction
- Handling of hydrological data
- Quality assurance
- Conclusions

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Handling hydrological data

- Demand on hydrological network data by hydrologists, engineers, decision makers and the public is increasing in quantity, quality and time to delivery
- For us, this means, that we have to process the raw data to value added products and information in an efficient way
- Standardized quality assurance procedures can help to fulfill this requirement
- Standardized data formats and data exchange
- For best results such tools are needed in the whole chain:
  measurement → data acquisition → validation and correction → dissemination → use
- Support of these processes with different tools and functions

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Data quality assurance

Quality assurance

- QA on data level
- QA on workflow level
- QA on system level
- QA on IT level

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QA on data level

- Securing the raw data before processing
  → original and production time series

- Standardized procedures for data validation, correction and evaluation
  → plausibility checks
  → standardized correctors

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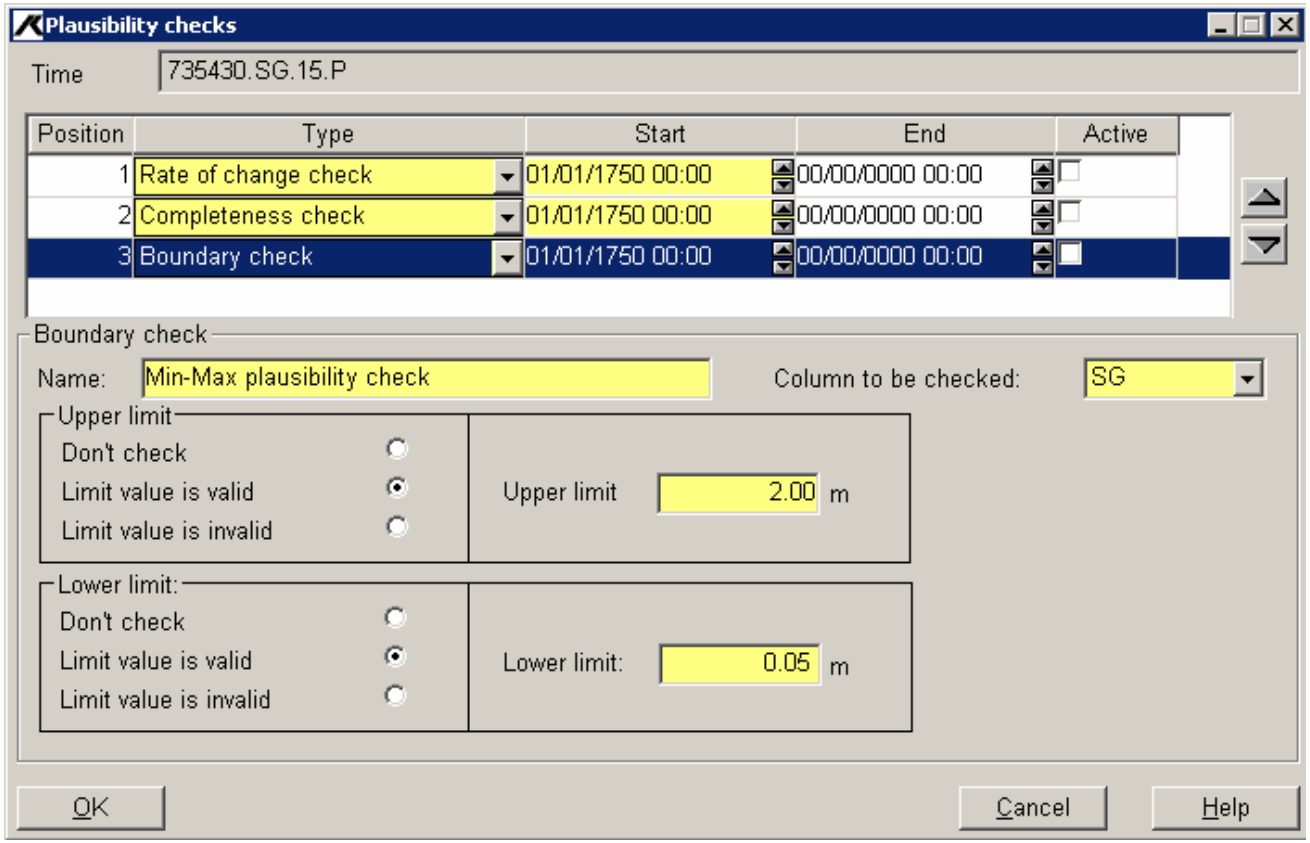
Automatic plausibility checks



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QA on data level

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- Standardized procedures for data validation, correction and evaluation.
  → plausibility checks
  → standardized correctors

- If available, use of national and international standards or agreed organization wide standards
  → e.g. ISO 748, British BFI, standard frequency analysis

- Continuous quality marking of the data by users or automatically by the system
  → Quality flag and remark system

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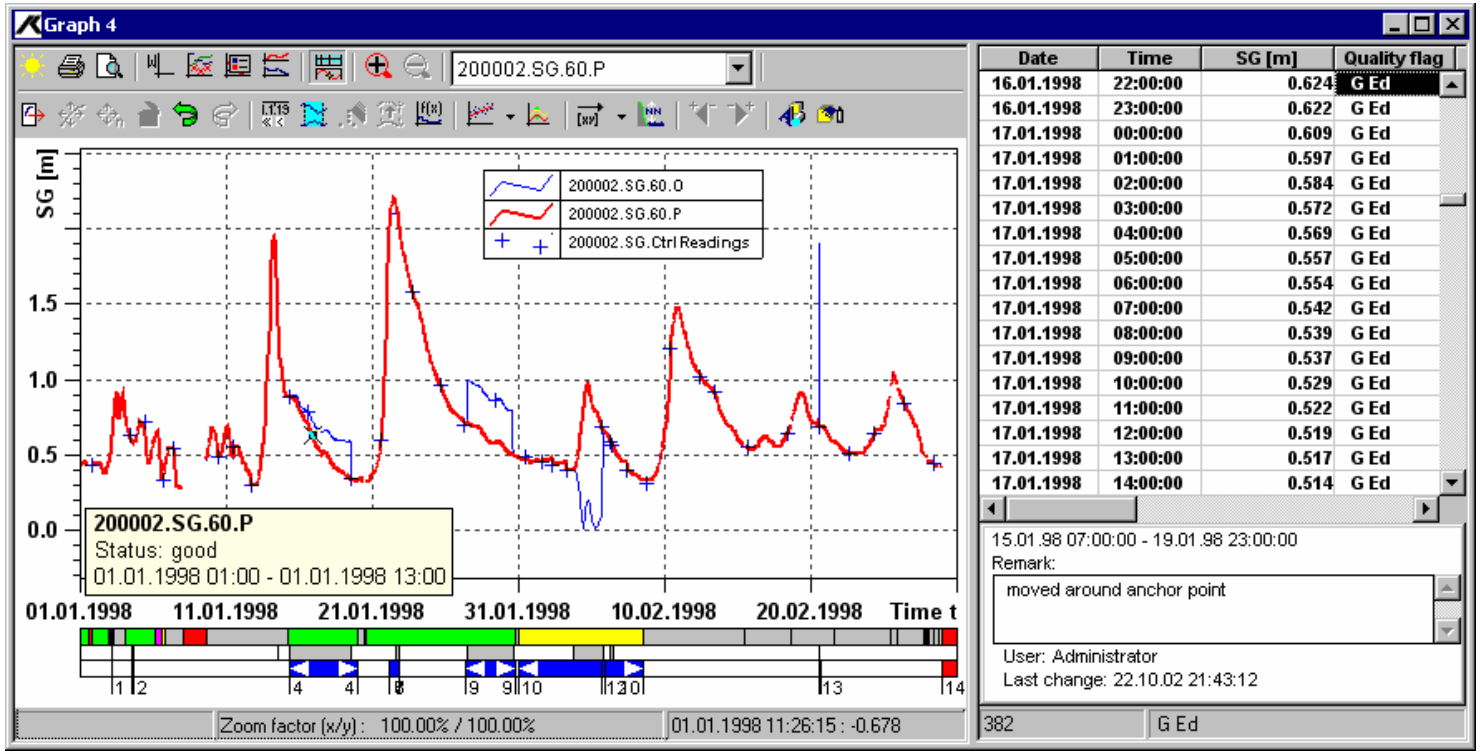
Quality flag and comment system



Date	Time	SG [m]	Quality flag
16.01.1998	22:00:00	0.624	G Ed
16.01.1998	23:00:00	0.622	G Ed
17.01.1998	00:00:00	0.609	G Ed
17.01.1998	01:00:00	0.597	G Ed
17.01.1998	02:00:00	0.584	G Ed
17.01.1998	03:00:00	0.572	G Ed
17.01.1998	04:00:00	0.569	G Ed
17.01.1998	05:00:00	0.557	G Ed
17.01.1998	06:00:00	0.554	G Ed
17.01.1998	07:00:00	0.542	G Ed
17.01.1998	08:00:00	0.539	G Ed
17.01.1998	09:00:00	0.537	G Ed
17.01.1998	10:00:00	0.529	G Ed
17.01.1998	11:00:00	0.522	G Ed
17.01.1998	12:00:00	0.519	G Ed
17.01.1998	13:00:00	0.517	G Ed
17.01.1998	14:00:00	0.514	G Ed

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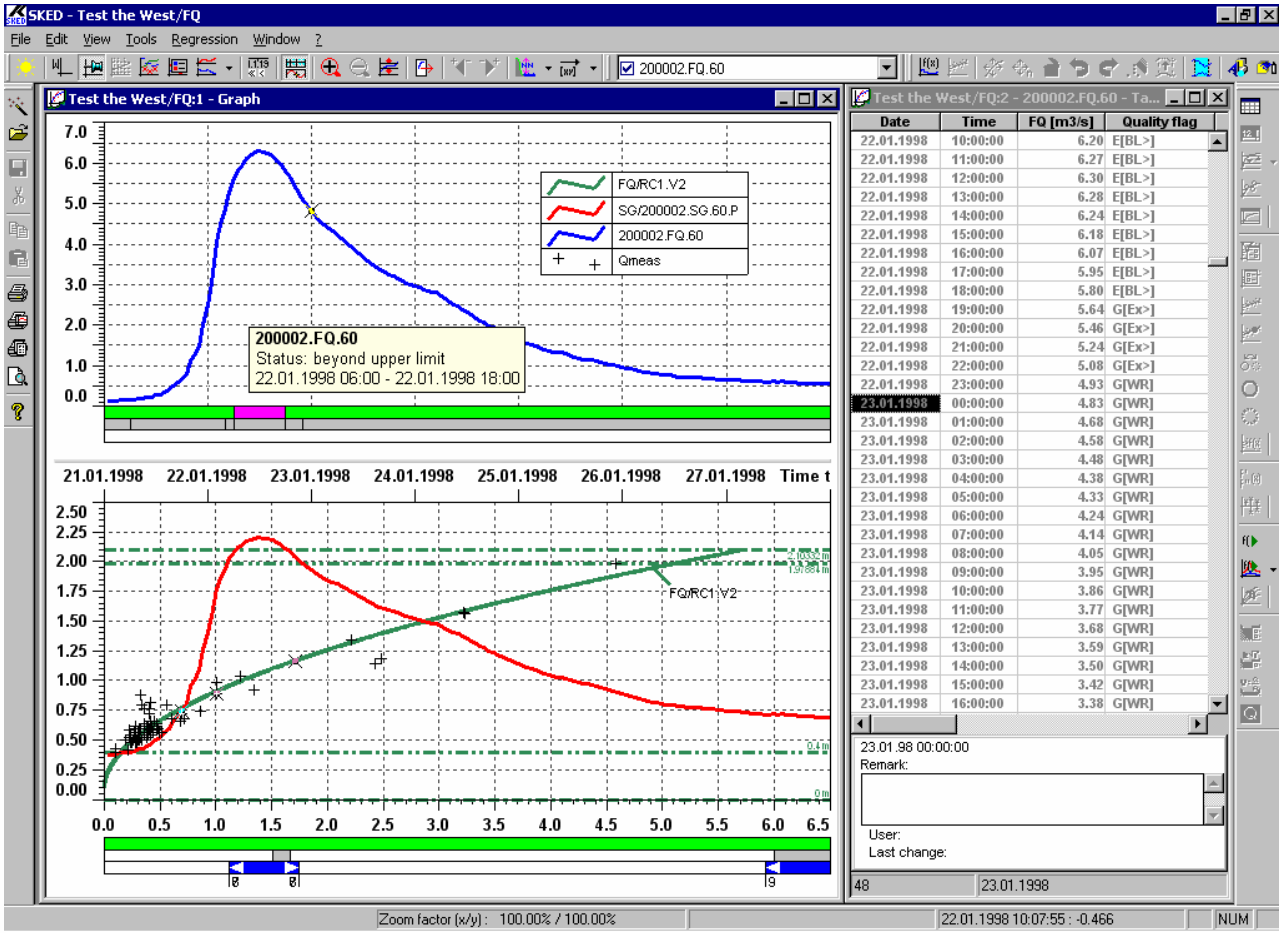
QA on data level

Quality flag and comment system



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- Use of audit trail tools for logging and evaluating data changes
  “who worked on which data at what time and what was the reason the results?”

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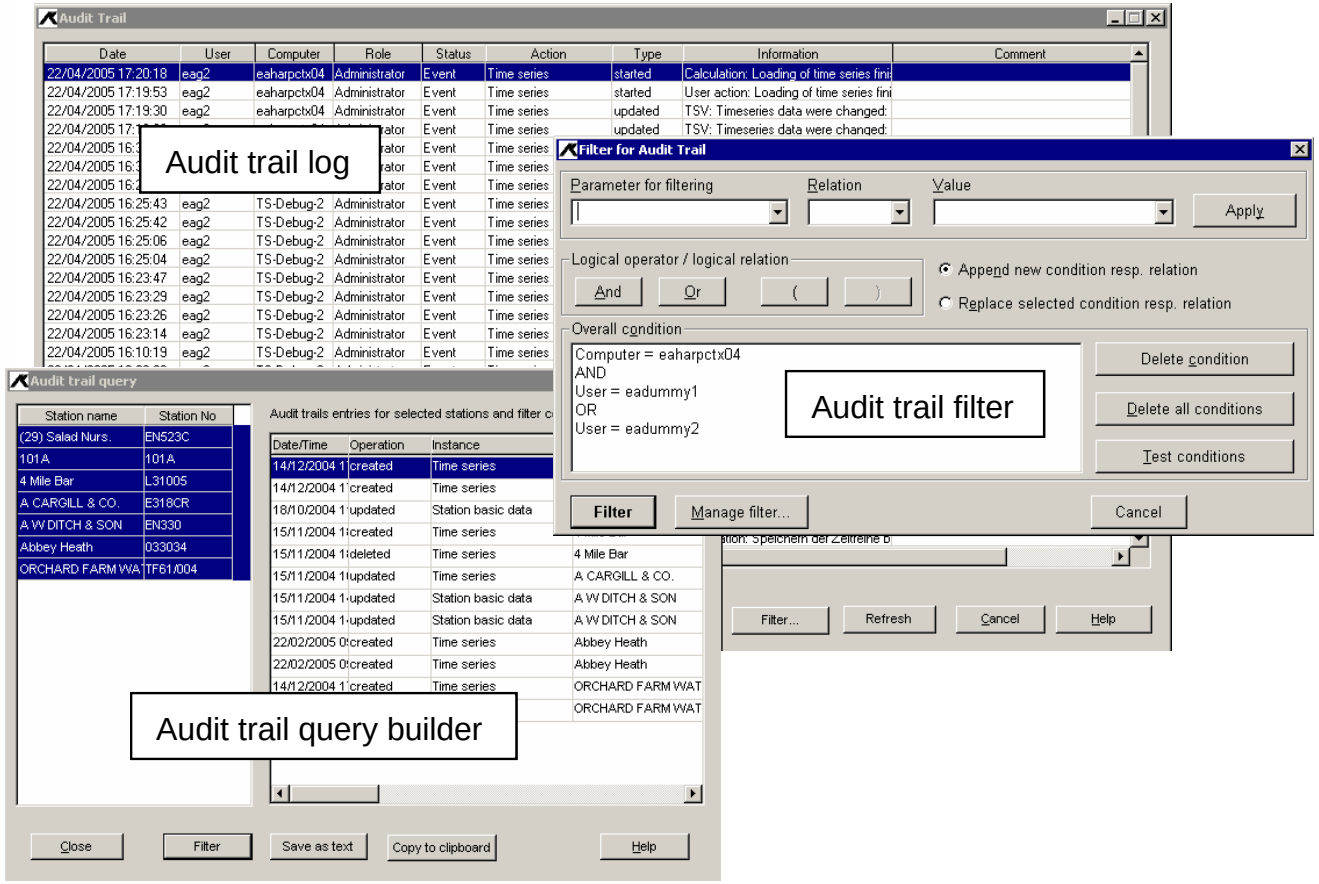
QA on data level

The Audit trail



QA on workflow level

- Clear definitions and policies

  → Guidelines

- Adoption to the requirements of the individual organization

  → WISKI wizards

  → Use Case

  → Best Practice Guides

- Regular training of the users

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QA on system level

The hydrological network

- Spatial analysis in GIS environment

  → WISKI ArcGis Extension

- Optimization of number and location for the gauges

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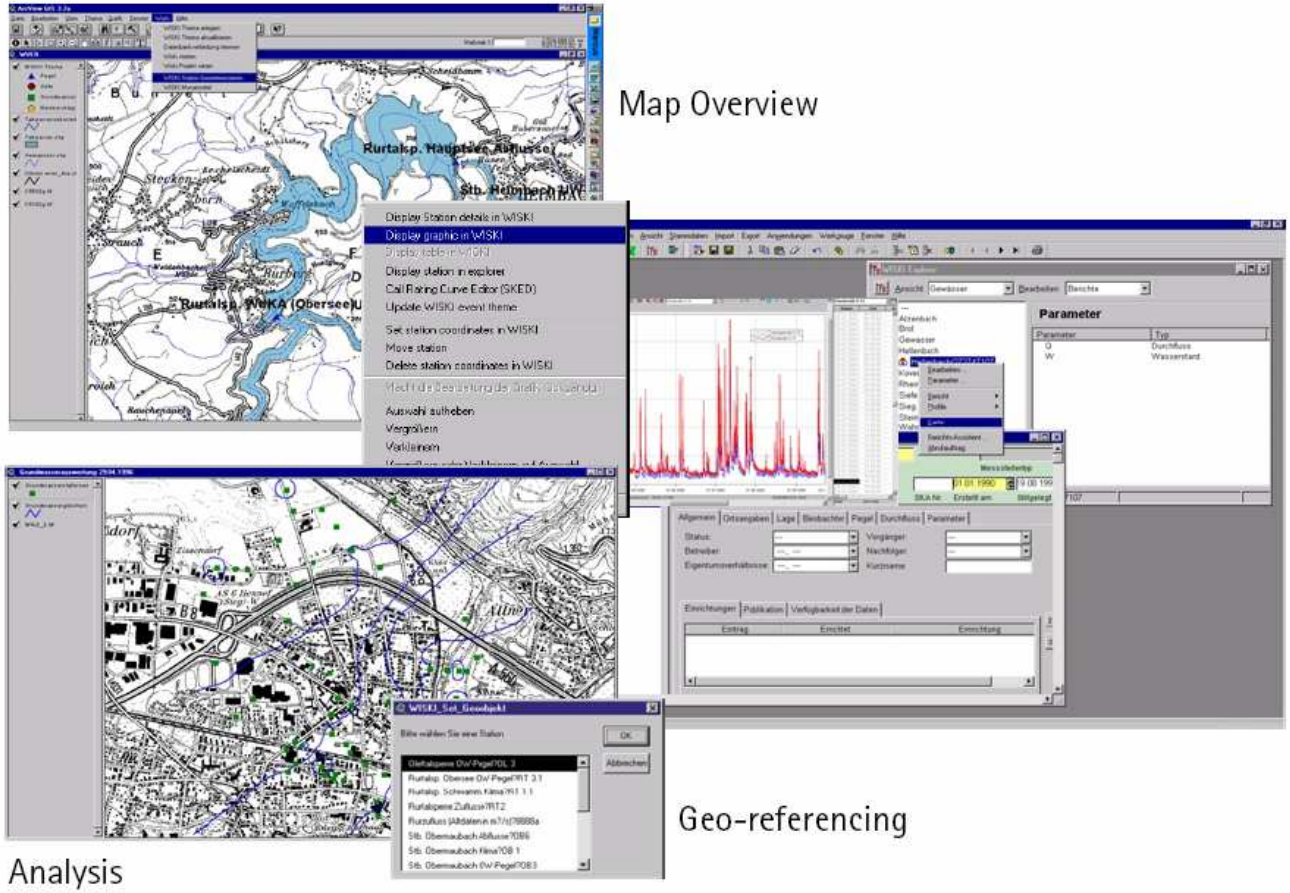
QA on system level

Spatial analysis



QA on system level

The hydrological network

- Spatial analysis in GIS environment

  → WISKI ArcGis Extension

- Optimization of number and location for the gauges

- Validation of rating curves in a catchment by calculation of the annual water balance

  → WISKI formula / KiBasic

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QA on system level

The archive

- Overall analysis about trends in number and length of gaps in the records
- Overall analysis about trends in data quality
- Overall analysis about trends in time to publish the data
- Comparisons between these indicators between different regions, directorates or departments

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QA on IT level

IT infrastructure

- Standardized methods and policies for data base back-up and maintenance
- Back-up strategy for data base and software servers, multiple network lines
- Regular data base maintenance (statistics etc.)
- Regular checks of hardware and backup systems

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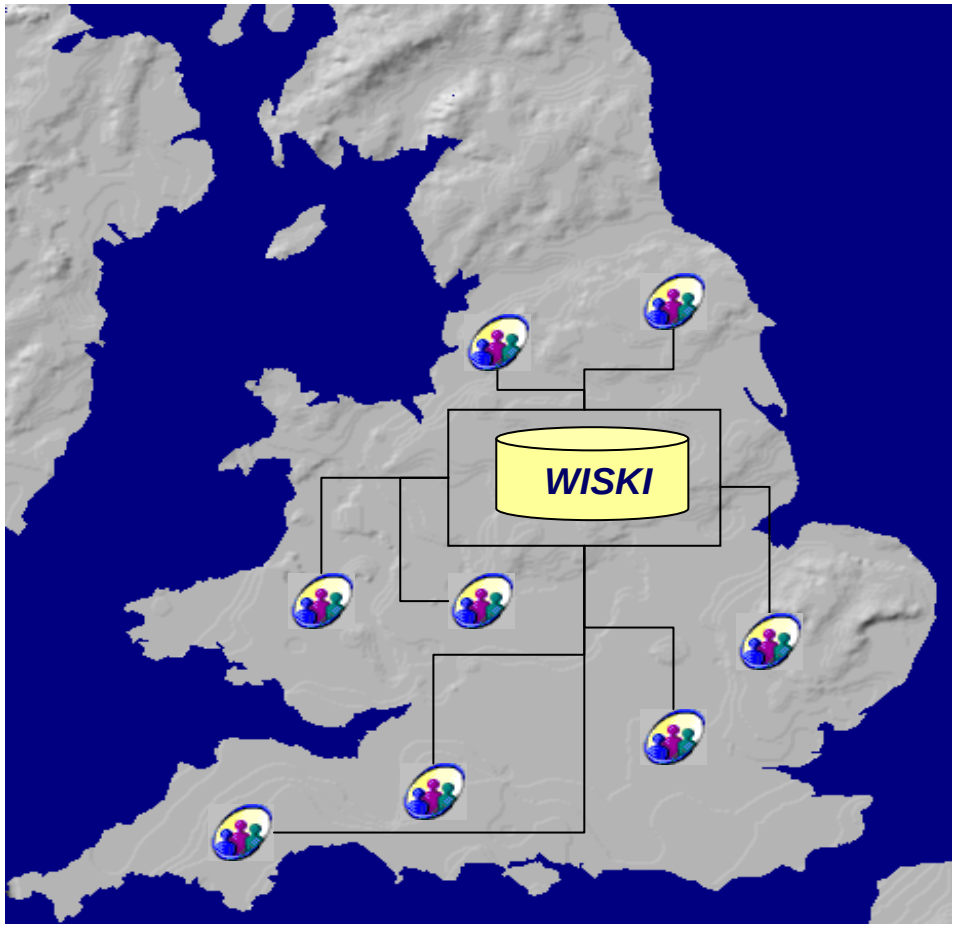
QA on IT level

IT Infrastructure of the Environment Agency



National Archive
38,000 Stations
2.6 Billion data points
> 200 GB database

300 concurrent user
600 in total

CITRIX
ORACLE

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Conclusions

- The WISKI system was introduced to provide a reliable and flexible archive enabling a central, consolidated source of information
- It can provide a modern software platform with sufficient flexibility to encompass future business change and data demands
- Its implementation in different authorities reduces costs for support and maintenance
- It frees up staff resources to improve data quality, undertake more comprehensive analysis and to convert data into information for managing the environment
- On all QA levels ideas, strategies or tools exist to increase the quality of data and information
- Due to the never ending process of increasing quality continuous discussion on this topic is needed

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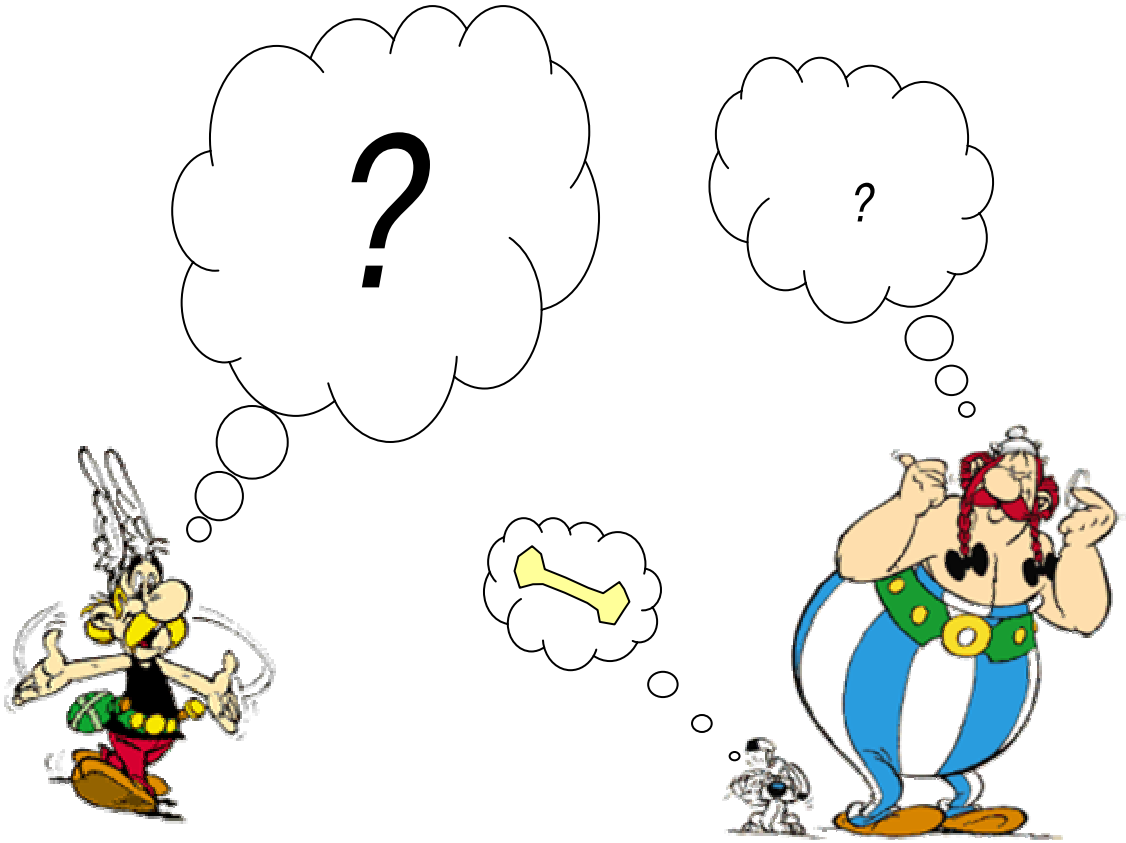

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Hydrometric archive WISKI

Graphical strip chart recorder interface

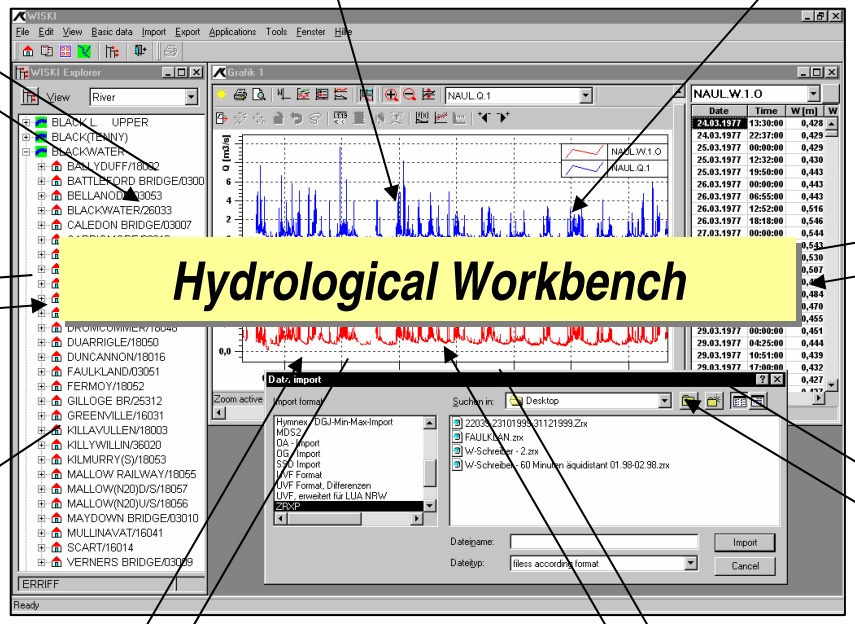
DIGIT

Telemetry system

SODA

Discharge measurement and evaluation

BIBER



WAVE

ArcView Extension

Water quality management

WQM

SKED

Rating curve editor

WEB

Web reporting module

WCS

Calculation Server

WSP

Automatic data posting and report service

ORACLE

Microsoft SQL Server

SYBASE

Informix

Ingres

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Topic

How to achieve quantity and quality goals of the Water Framework Directive in the Celtic countries ?

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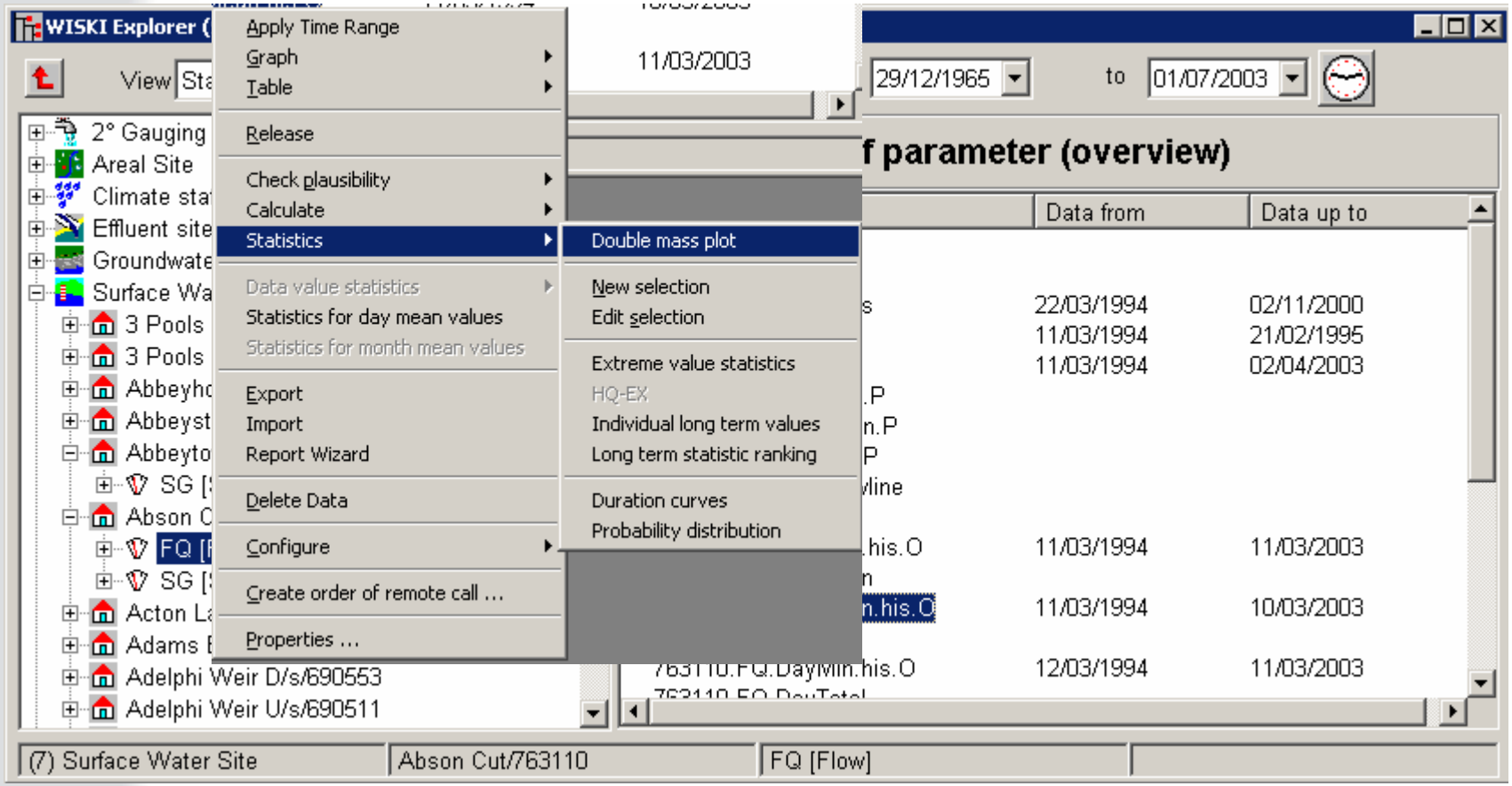
WISKI Explorer (
View
Apply Time Range
Graph
Table
Release
Check plausibility
Calculate
Statistics
Data value statistics
Statistics for day mean values
Statistics for month mean values
Export
Import
Report Wizard
Delete Data
Configure
Create order of remote call ...
Properties ...
Double mass plot
New selection
Edit selection
Extreme value statistics
HQ-EX
Individual long term values
Long term statistic ranking
Duration curves
Probability distribution
11/03/2003
29/12/1965
to
01/07/2003
f parameter (overview)
Data from
Data up to
22/03/1994
02/11/2000
11/03/1994
21/02/1995
11/03/1994
02/04/2003
11/03/1994
11/03/2003
11/03/1994
10/03/2003
12/03/1994
11/03/2003
2° Gauging
Areal Site
Effluent site
Groundwate
Surface Wa
3 Pools
3 Pools
Abbeyho
Abbeyst
Abbeyto
Abson C
Acton La
Adams E
Adelphi Weir D/s/690553
Adelphi Weir U/s/690511
(7) Surface Water Site
Abson Cut/763110
FQ [Flow]

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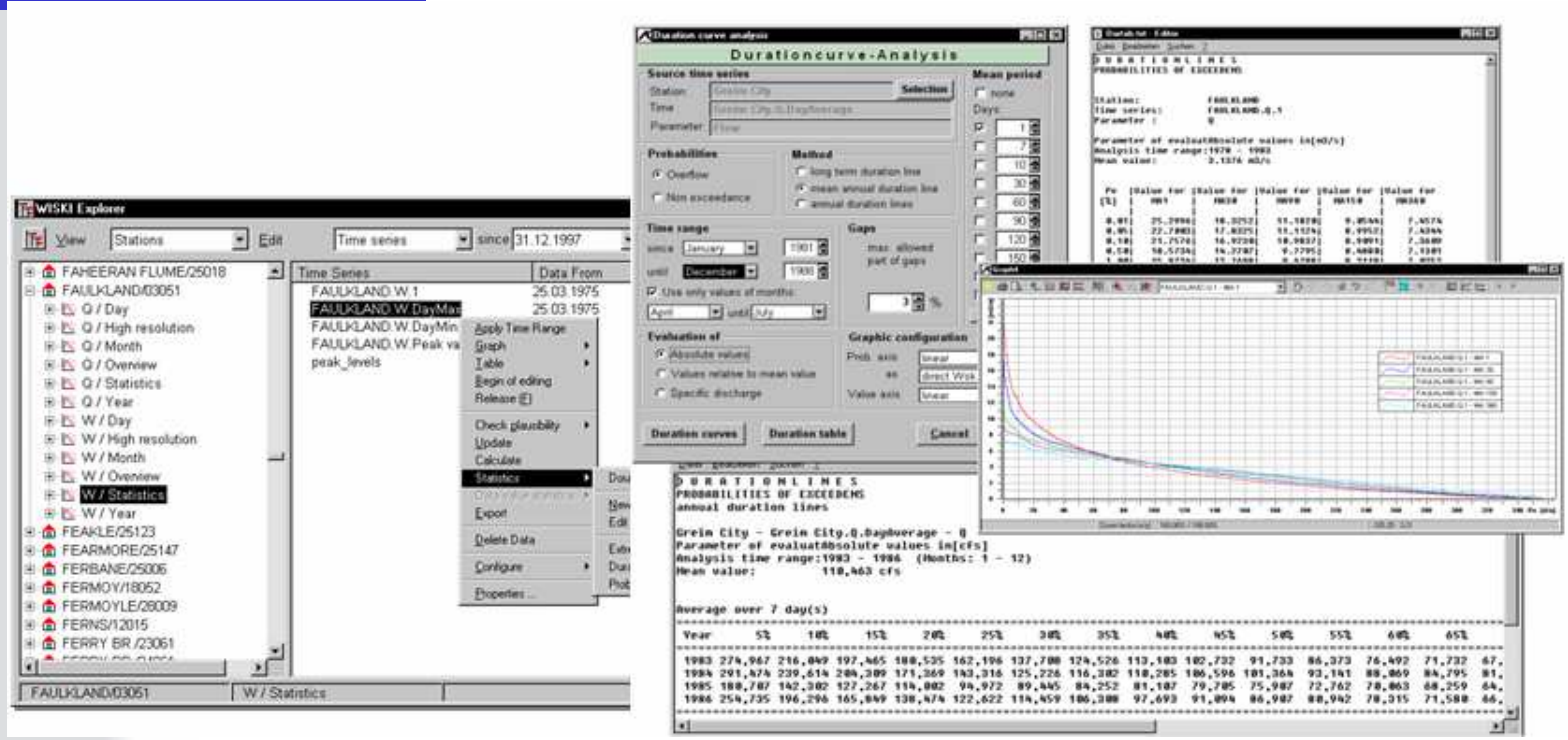
WISKI Explorer
View
Stations
Edit
Time series
since 31.12.1997
FAHEERAN FLUME/25018
FAULKLAND/03051
Q / Day
Q / High resolution
Q / Month
Q / Overview
Q / Statistics
Q / Year
W / Day
W / High resolution
W / Month
W / Overview
W / Statistics
W / Year
FEAKLE/25123
FEARMORE/25147
FERBANE/25006
FERMOY/18052
FERMOYLE/28009
FERNS/12015
FERRY BR /23061
Time Series
Data From
FAULKLAND.W.1
25.03.1975
FAULKLAND.W.DayMax
25.03.1975
FAULKLAND.W.DayMin
FAULKLAND.W.Peak va
peak_levels
Apply Time Range
Graph
Table
Begin of editing
Release
Check plausibility
Update
Calculate
Statistics
Export
Delete Data
Configure
Properties ...
FAULKLAND/03051
W / Statistics
Duration curve analysis
Durationcurve-Analysis
Source time series
Station:
Time:
Parameter:
Selection
Mean period
none
Days:
Probabilities
Overflow
Non exceedance
Method
long term duration line
mean annual duration line
annual duration lines
Time range
since
January
1981
until
December
1990
Use only values of months:
April
until
July
Gaps
max. allowed part of gaps
Evaluation of
Absolute values
Values relative to mean value
Specific discharge
Graphic configuration
Prob. axis
linear
as
direct Weibull
Value axis
linear
Duration curves
Duration table
Cancel
DURATIONLINES
PROBABILITIES OF EXCEEDENS
annual duration lines
Grein City - Grein City.Q.Dagdverage - Q
Parameter of evaluat@bsolute values in[cfs]
Analysis time range:1983 - 1986 (Months: 1 - 12)
Mean value: 110,463 cfs
Average over 7 day(s)
Year 5% 10% 15% 20% 25% 30% 35% 40% 45% 50% 55% 60% 65%
1983 274,967 216,049 197,465 180,535 162,196 137,708 124,526 113,103 102,732 91,733 86,373 76,492 71,732 67,
1984 291,474 239,614 204,389 171,269 143,316 125,226 116,382 110,285 106,596 101,364 93,141 88,869 84,795 81,
1985 188,787 142,302 127,267 114,002 94,972 89,445 84,252 81,187 79,705 75,987 72,762 70,863 68,259 64,
1986 254,735 196,296 165,849 138,474 122,622 114,459 106,388 97,693 91,094 86,987 80,942 78,315 71,588 66,

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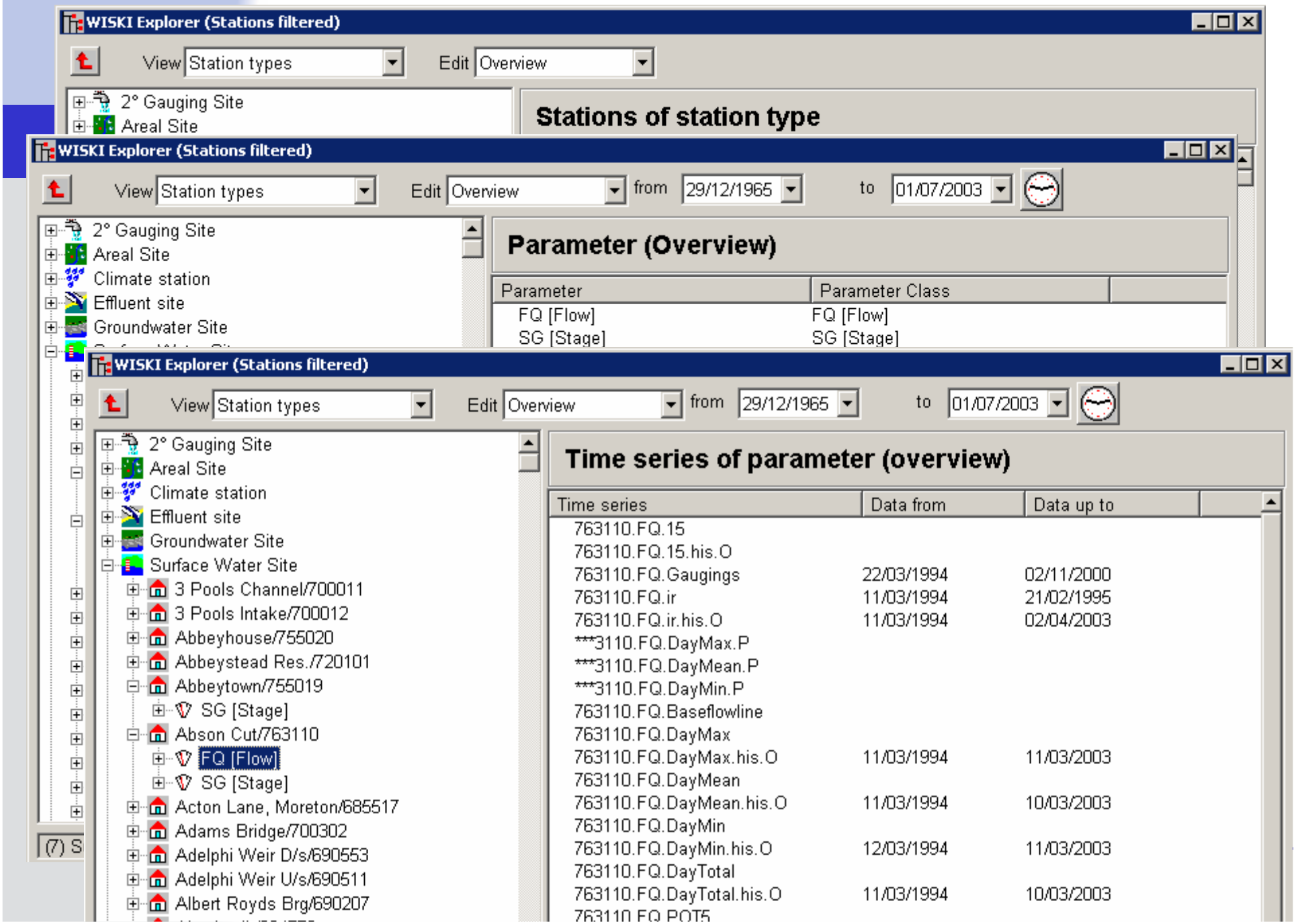
WISKI Explorer (Stations filtered)
View Station types
Edit Overview
2° Gauging Site
Areal Site
Stations of station type
WISKI Explorer (Stations filtered)
View Station types
Edit Overview
from 29/12/1965
to 01/07/2003
2° Gauging Site
Areal Site
Climate station
Effluent site
Groundwater Site
Parameter (Overview)
Parameter
Parameter Class
FQ [Flow]
FQ [Flow]
SG [Stage]
SG [Stage]
WISKI Explorer (Stations filtered)
View Station types
Edit Overview
from 29/12/1965
to 01/07/2003
2° Gauging Site
Areal Site
Climate station
Effluent site
Groundwater Site
Surface Water Site
3 Pools Channel/700011
3 Pools Intake/700012
Abbeyhouse/755020
Abbeystead Res./720101
Abbeytown/755019
SG [Stage]
Abson Cut/763110
FQ [Flow]
SG [Stage]
Acton Lane, Moreton/685517
Adams Bridge/700302
Adelphi Weir D/s/690553
Adelphi Weir U/s/690511
Albert Royds Brg/690207
Time series of parameter (overview)
Time series
Data from
Data up to
763110.FQ.15
763110.FQ.15.his.O
763110.FQ.Gaugings 22/03/1994 02/11/2000
763110.FQ.ir 11/03/1994 21/02/1995
763110.FQ.ir.his.O 11/03/1994 02/04/2003
***3110.FQ.DayMax.P
***3110.FQ.DayMean.P
***3110.FQ.DayMin.P
763110.FQ.Baseflowline
763110.FQ.DayMax
763110.FQ.DayMax.his.O 11/03/1994 11/03/2003
763110.FQ.DayMean
763110.FQ.DayMean.his.O 11/03/1994 10/03/2003
763110.FQ.DayMin
763110.FQ.DayMin.his.O 12/03/1994 11/03/2003
763110.FQ.DayTotal
763110.FQ.DayTotal.his.O 11/03/1994 10/03/2003

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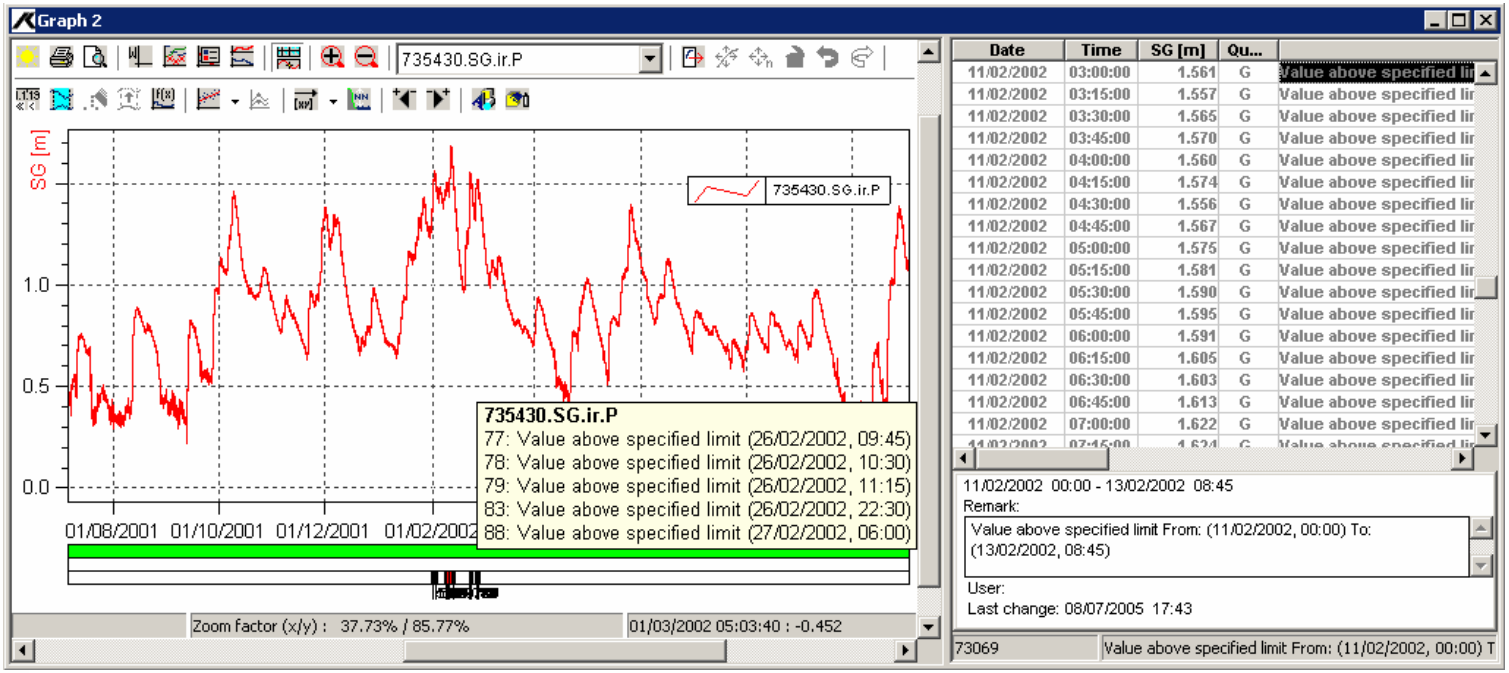
Graph 2
735430.SG.ir.P
SG [m]
1.0
0.5
0.0
01/08/2001
01/10/2001
01/12/2001
735430.SG.ir.P
77: Value above specified limit (26/02/2002, 09:45)
78: Value above specified limit (26/02/2002, 10:30)
79: Value above specified limit (26/02/2002, 11:15)
83: Value above specified limit (26/02/2002, 22:30)
88: Value above specified limit (27/02/2002, 06:00)
Zoom factor (x/y) : 37.73% / 85.77%
01/03/2002 05:03:40 : -0.452
Date
Time
SG [m]
Qu...
11/02/2002 03:00:00 1.561 G Value above specified lir
11/02/2002 03:15:00 1.557 G Value above specified lir
11/02/2002 03:30:00 1.565 G Value above specified lir
11/02/2002 03:45:00 1.570 G Value above specified lir
11/02/2002 04:00:00 1.560 G Value above specified lir
11/02/2002 04:15:00 1.574 G Value above specified lir
11/02/2002 04:30:00 1.556 G Value above specified lir
11/02/2002 04:45:00 1.567 G Value above specified lir
11/02/2002 05:00:00 1.575 G Value above specified lir
11/02/2002 05:15:00 1.581 G Value above specified lir
11/02/2002 05:30:00 1.590 G Value above specified lir
11/02/2002 05:45:00 1.595 G Value above specified lir
11/02/2002 06:00:00 1.591 G Value above specified lir
11/02/2002 06:15:00 1.605 G Value above specified lir
11/02/2002 06:30:00 1.603 G Value above specified lir
11/02/2002 06:45:00 1.613 G Value above specified lir
11/02/2002 07:00:00 1.622 G Value above specified lir
11/02/2002 00:00 - 13/02/2002 08:45
Remark:
Value above specified limit From: (11/02/2002, 00:00) To: (13/02/2002, 08:45)
User:
Last change: 08/07/2005 17:43
73069
Value above specified limit From: (11/02/2002, 00:00) T

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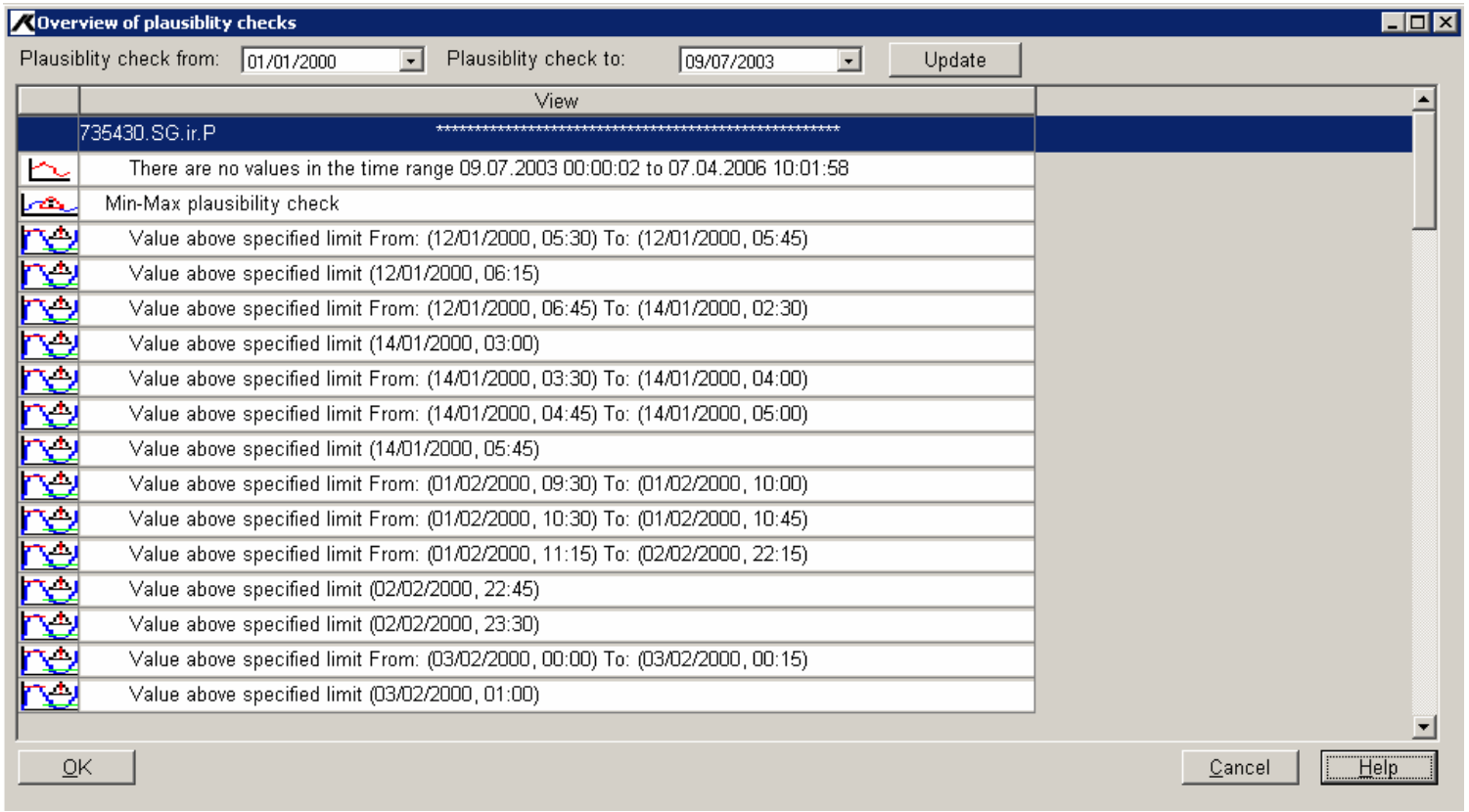
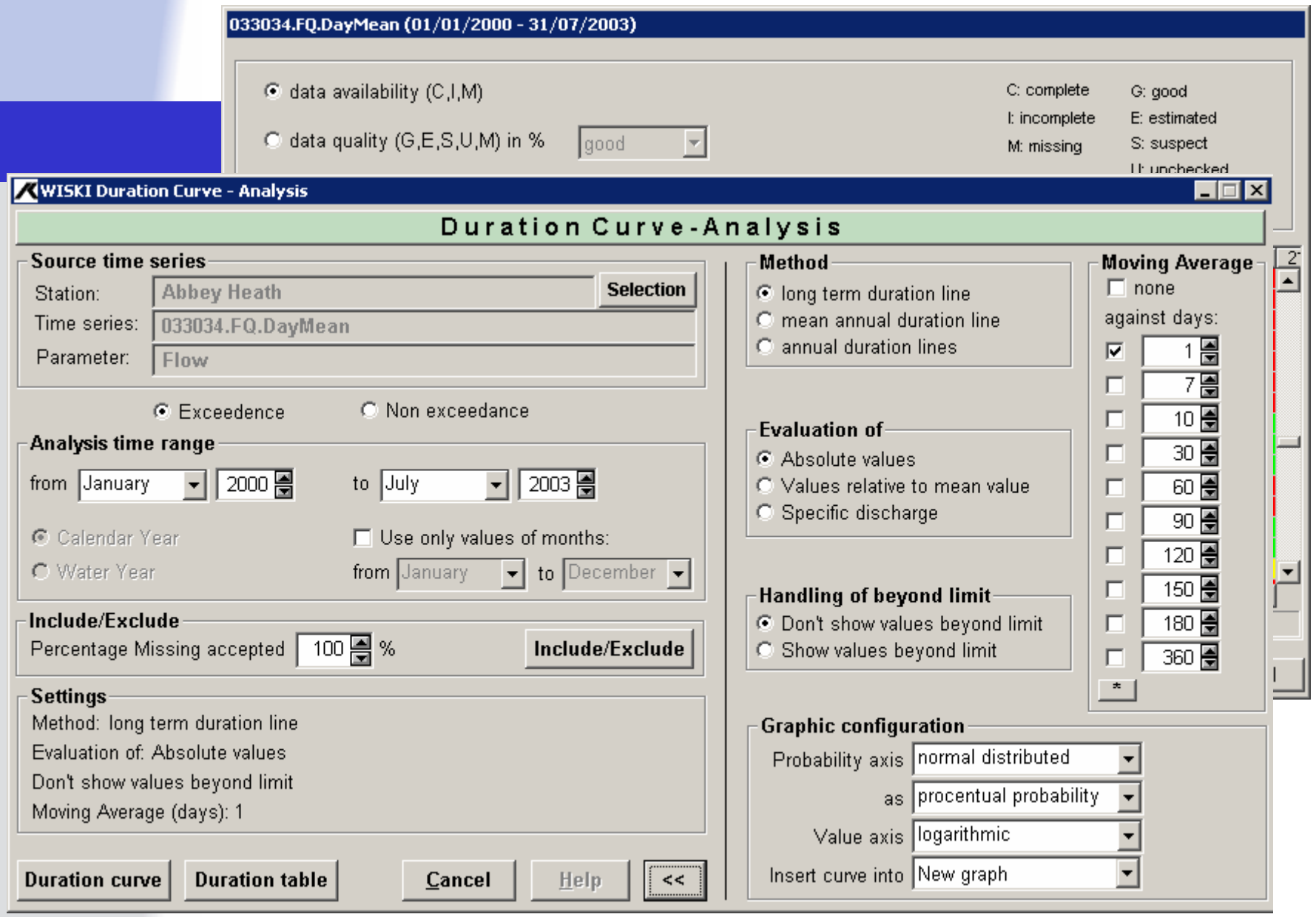

Overview of plausiblity checks
Plausiblity check from: 01/01/2000
Plausiblity check to: 09/07/2003
Update
View
735430.SG.ir.P **********
There are no values in the time range 09.07.2003 00:00:02 to 07.04.2006 10:01:58
Min-Max plausibility check
Value above specified limit From: (12/01/2000, 05:30) To: (12/01/2000, 05:45)
Value above specified limit (12/01/2000, 06:15)
Value above specified limit From: (12/01/2000, 06:45) To: (14/01/2000, 02:30)
Value above specified limit (14/01/2000, 03:00)
Value above specified limit From: (14/01/2000, 03:30) To: (14/01/2000, 04:00)
Value above specified limit From: (14/01/2000, 04:45) To: (14/01/2000, 05:00)
Value above specified limit (14/01/2000, 05:45)
Value above specified limit From: (01/02/2000, 09:30) To: (01/02/2000, 10:00)
Value above specified limit From: (01/02/2000, 10:30) To: (01/02/2000, 10:45)
Value above specified limit From: (01/02/2000, 11:15) To: (02/02/2000, 22:15)
Value above specified limit (02/02/2000, 22:45)
Value above specified limit (02/02/2000, 23:30)
Value above specified limit From: (03/02/2000, 00:00) To: (03/02/2000, 00:15)
Value above specified limit (03/02/2000, 01:00)
OK
Cancel
Help

KISTERS


033034.FQ.DayMean (01/01/2000 - 31/07/2003)
data availability (C,I,M)
data quality (G,E,S,U,M) in %
good
C: complete
I: incomplete
M: missing
G: good
E: estimated
S: suspect
U: unchecked
WISKI Duration Curve - Analysis
Duration Curve-Analysis
Source time series
Station:
Abbey Heath
Selection
Time series:
033034.FQ.DayMean
Parameter:
Flow
Exceedence
Non exceedance
Analysis time range
from
January
2000
to
July
2003
Calendar Year
Water Year
Use only values of months:
from
January
to
December
Include/Exclude
Percentage Missing accepted
100
%
Include/Exclude
Settings
Method: long term duration line
Evaluation of: Absolute values
Don't show values beyond limit
Moving Average (days): 1
Duration curve
Duration table
Cancel
Help
<<
Method
long term duration line
mean annual duration line
annual duration lines
Evaluation of
Absolute values
Values relative to mean value
Specific discharge
Handling of beyond limit
Don't show values beyond limit
Show values beyond limit
Moving Average
none
against days:
1
7
10
30
60
90
120
150
180
360
*
Graphic configuration
Probability axis
normal distributed
as
procentual probability
Value axis
logarithmic
Insert curve into
New graph

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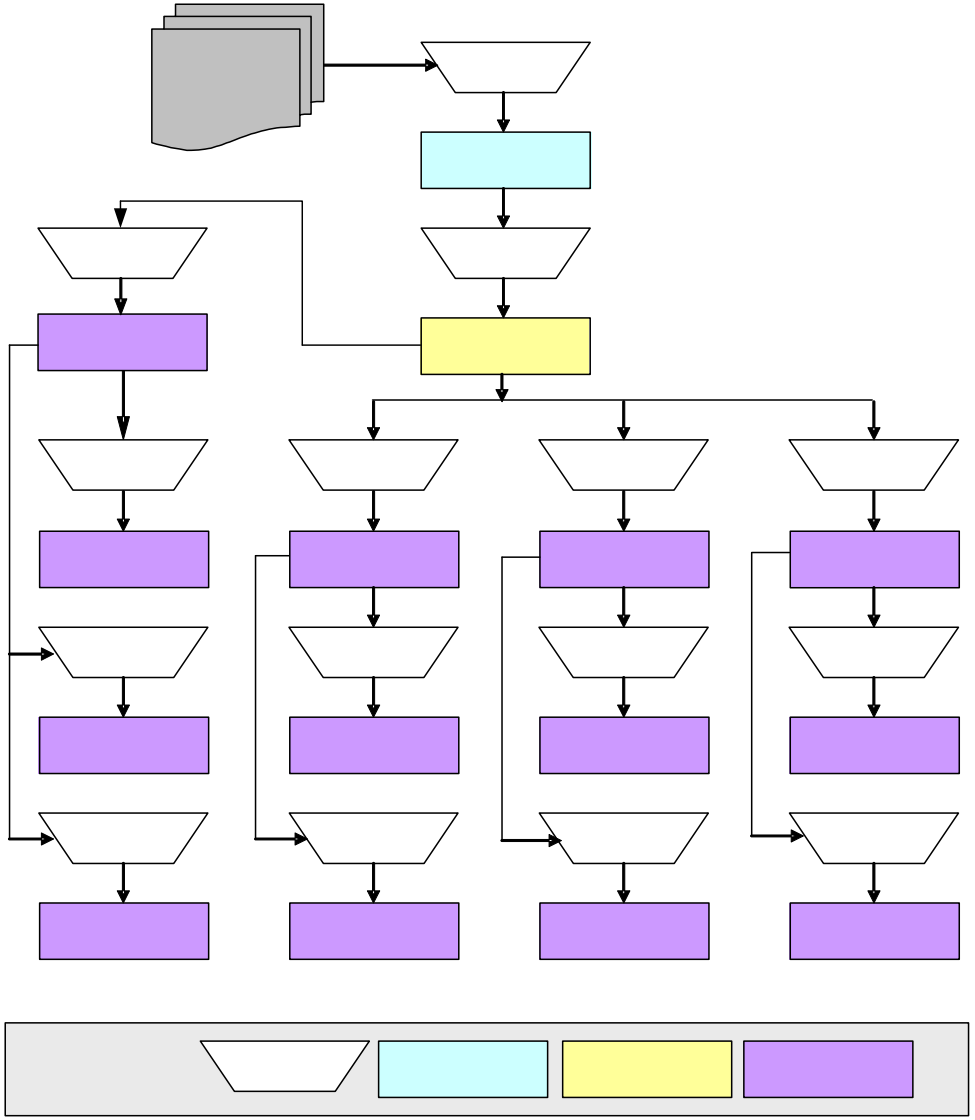

Files from
Water
Companies

formula

EDQ.15.Vol

calculation of
main values

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EDQ.DayTotal

Summary

- Requirements of EU-WFD lead to need of software for integrated data management
- Existing software WISKI for water quantity management
- Extension by Water Quality Module WQM
  - Data management
  - Data monitoring
  - Data analysis
  - Data assessment
  - Data presentation
- Complete solution for decision support and data management
- Useful tool to meet requirements of WFD

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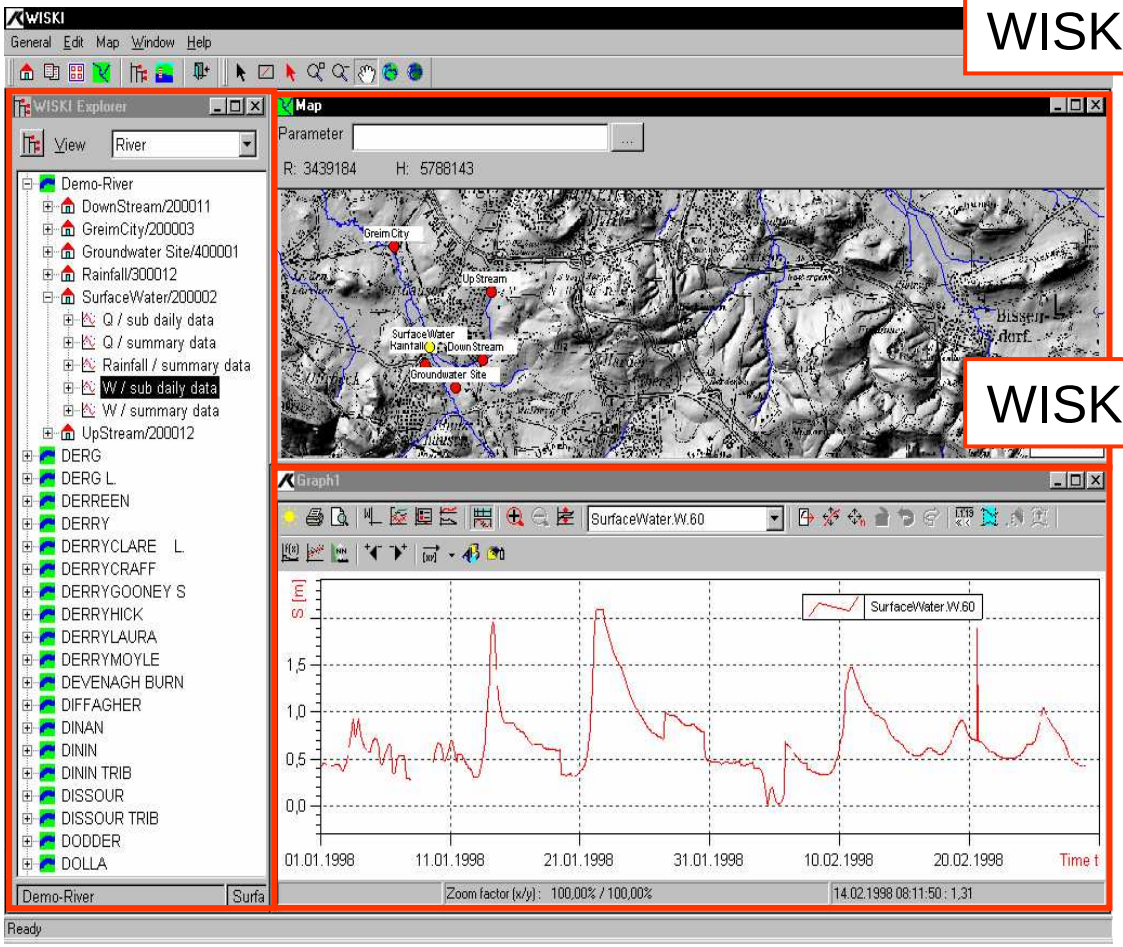
Handling hydrological data

WISKI-Key features

WISKI-Map



WISKI-Explorer

WISKI-Graph

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EU - WFD

Complex management tasks:

- water quality data management
- monitoring of all water bodies
- combined water quality and quantity data

analysis

- assessment of current water body status
- presentation of results

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WISKI-Package

- Client-Server-Architecture (RDBM Systems)
- Complete Windows 32-bit application
- Hydrological work bench with data stream from telemetry to final report in one system
- Hydrological data are stored in time series
- Analysis tools based on international standards
- Automatic processing tools for data exchange to other systems, export or reports

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