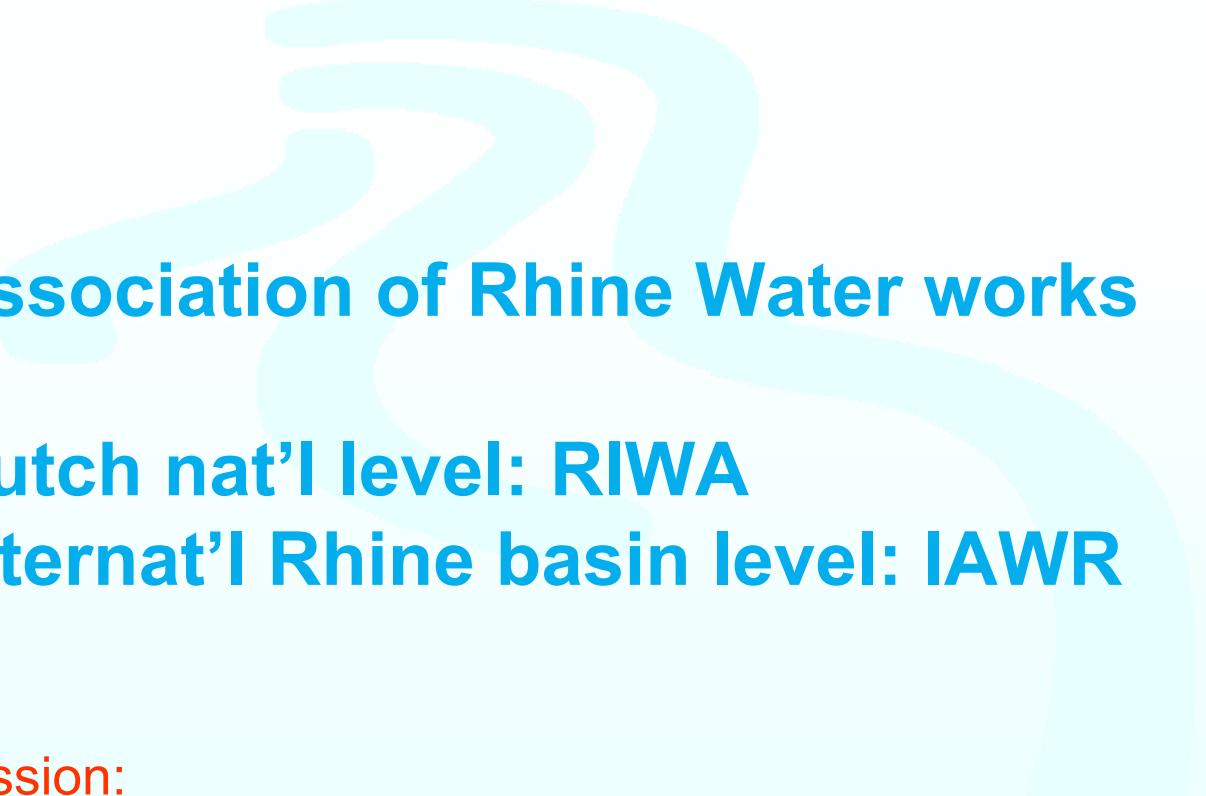




A graphical presentation of WQ data in time and space

Dr Peter G Stoks
RIWA/IAWR



Association of Rhine Water works

Dutch nat'l level: RIWA

Internat'l Rhine basin level: IAWR

Mission:

Source water quality should allow drinking water production
using simple treatment only!

IAWR

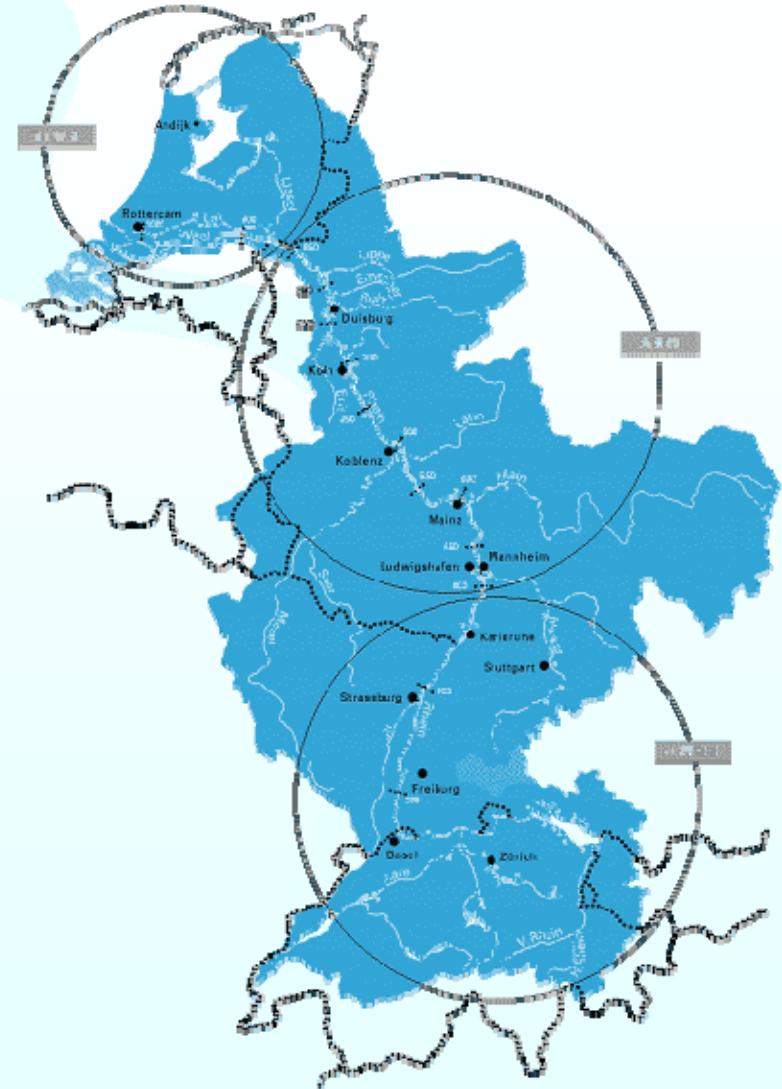
Umbrella organization
of 3 Associations

RIWA: Netherlands

ARW: lower Germany

AWBR: upstream Germany,
Switzerland

120 utilities
30 million consumers



RIWA WQ monitoring network

(part of IAWR basinwide network)

- Cooperation with Nat'l Dutch and German water authorities
 - *Harmonized program (WQ variables, methods, data exchange,...)*
- Five locations in the Dutch part of the Rhine basin
 - *German-Dutch border, intake sites*
- Trend detection and compliance testing
 - “*legal standards*” & “*emerging contaminants*”
 - *Chemical & biological*

WQMN Data presentation

- Historically as annual WQ reports
 - *Text, graphs, tables*
 - *Executive summaries containing demands and/or recommendations*
- Shift observed in target group's WQ background

Management is usually not too bright...



...and has the attention span of a hamster



So this does not work any more

Trend for ammonia at lake intake site 1980 - 2005

| sp | par | year | tr95 | tr95w | tr80 | tr80w |
|-----|------|------|-------|----------|-------|----------|
| AND | 0270 | 1980 | false | -0.02176 | false | -0.02176 |
| AND | 0270 | 1981 | false | -0.01926 | true | -0.01926 |
| AND | 0270 | 1982 | true | -0.02004 | true | -0.02004 |
| AND | 0270 | 1983 | true | -0.0819 | true | -0.07326 |
| AND | 0270 | 1984 | false | -0.01713 | false | -0.01399 |
| AND | 0270 | 1985 | false | 0.011582 | true | 0.01175 |
| AND | 0270 | 1986 | false | 0.020775 | true | 0.024748 |
| AND | 0270 | 1987 | true | 0.033502 | true | 0.033502 |
| AND | 0270 | 1988 | false | 0.016987 | false | 0.016987 |
| AND | 0270 | 1989 | false | -0.00451 | false | -0.00451 |
| AND | 0270 | 1990 | false | -0.01785 | false | -0.01651 |
| AND | 0270 | 1991 | false | -0.01476 | false | -0.01476 |
| AND | 0270 | 1992 | false | -0.005 | false | -0.005 |
| AND | 0270 | 1993 | false | -0.0085 | false | -0.0085 |
| AND | 0270 | 1994 | false | -0.00875 | false | -0.00875 |
| AND | 0270 | 1995 | true | -0.01425 | true | -0.01425 |
| AND | 0270 | 1996 | false | -0.0045 | false | -0.0045 |
| AND | 0270 | 1997 | false | -0.0065 | false | -0.0065 |
| AND | 0270 | 1998 | false | -0.005 | false | -0.005 |
| AND | 0270 | 1999 | false | -0.002 | false | -0.002 |
| AND | 0270 | 2000 | false | -0.00475 | false | -0.00475 |
| AND | 0270 | 2001 | false | -3.1E-08 | false | -3.1E-08 |
| AND | 0270 | 2002 | false | 0.0035 | false | 0.0035 |
| AND | 0270 | 2003 | false | 0.008501 | true | 0.008501 |
| AND | 0270 | 2004 | false | -0.00125 | false | -0.00125 |
| AND | 0270 | 2005 | false | -0.00498 | false | -0.00605 |

Combine compliance testing and trend detection

**Compliance testing based on maximum values
(can also be based on other criteria)**

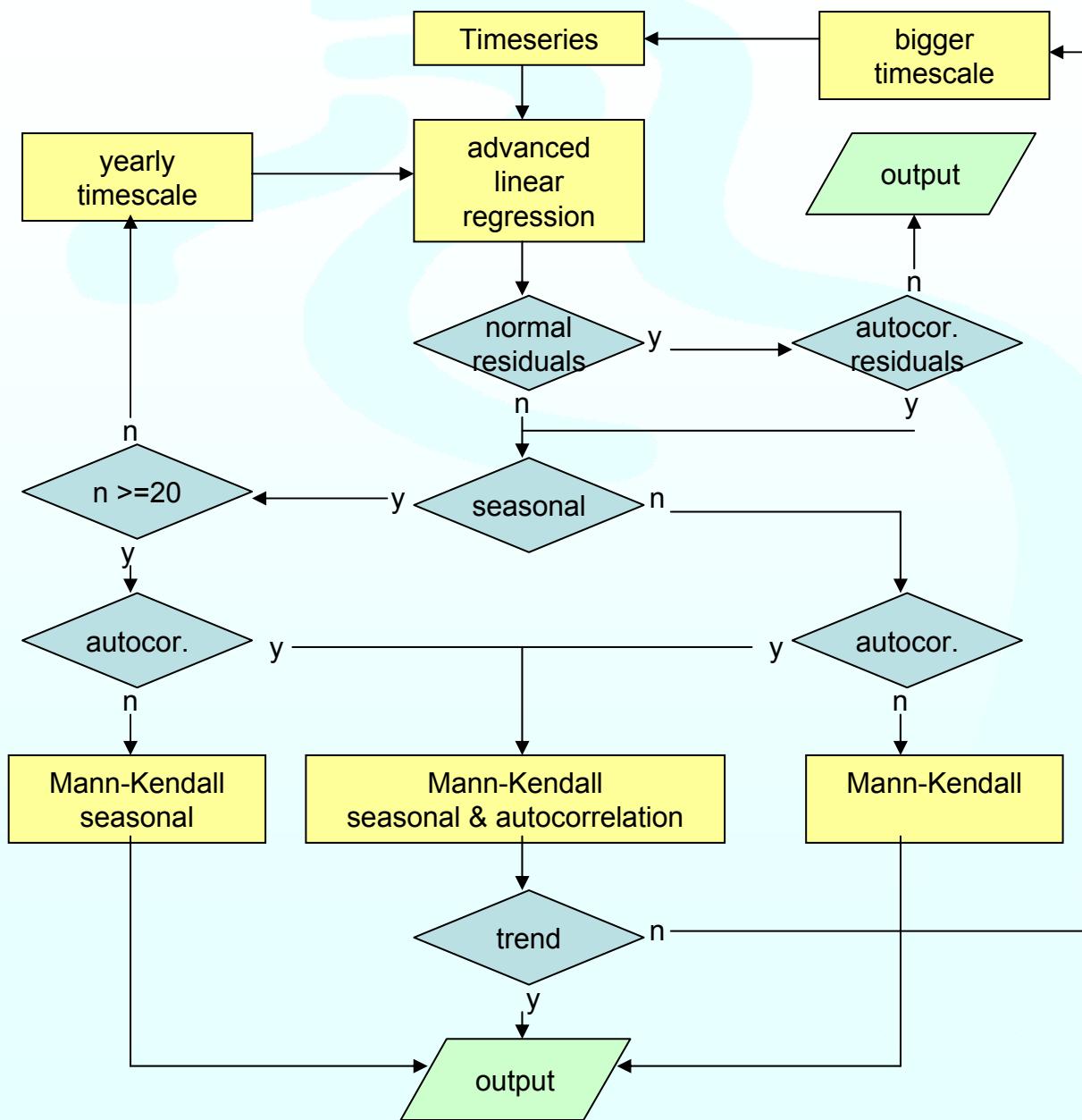
- *value above standard = non-compliance (except for O2)*
- *value below $0.8 \times$ standard = compliance*
- *value between $0.8 \times$ standard and standard = OK but look out!*

Combine compliance testing and trend detection

Trend detection based on 5 year period

- commercially available STAT package using parametric as well as non parametric statistics
- 13 data points / year minimum, reduced to quarterly averages

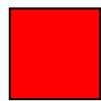
Trend detection statistics



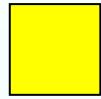
parametric

non parametric

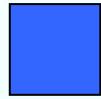
How it's done...



above standard



0.8-1.0 of standard



below 0.8 of standard



uptrend



downtrend



no trend or not detectable



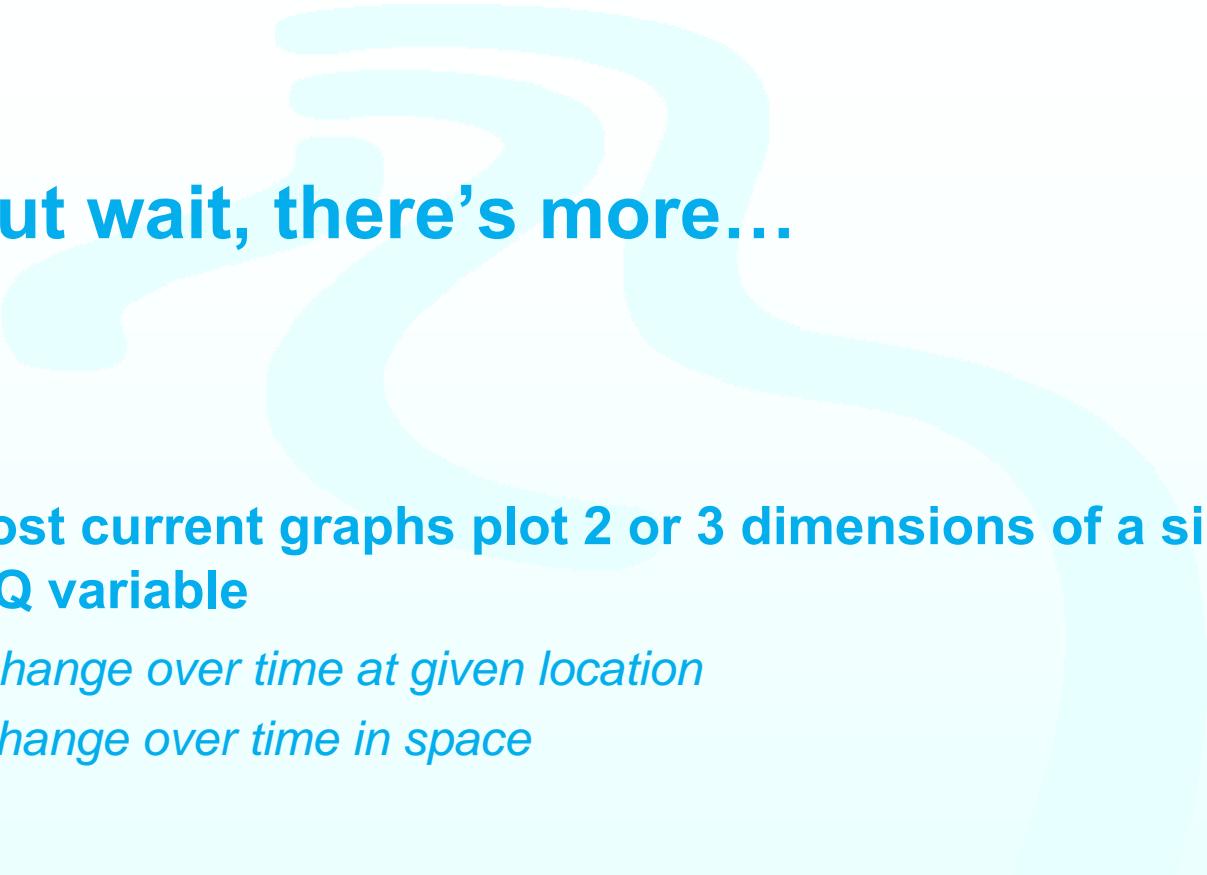
$n \geq 20$



$20 > n \geq 10$



$n < 10$

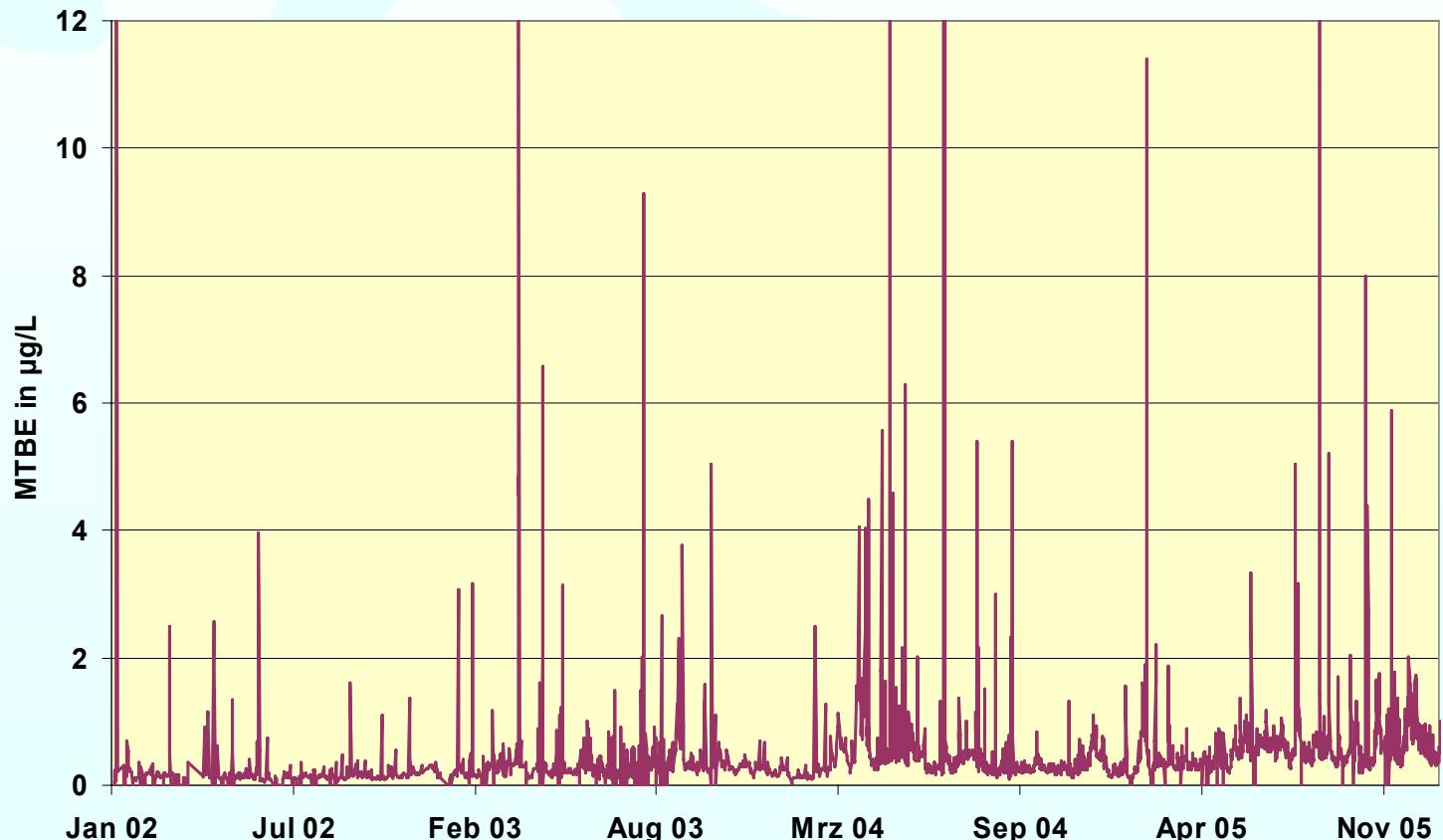


But wait, there's more...

Most current graphs plot 2 or 3 dimensions of a single WQ variable

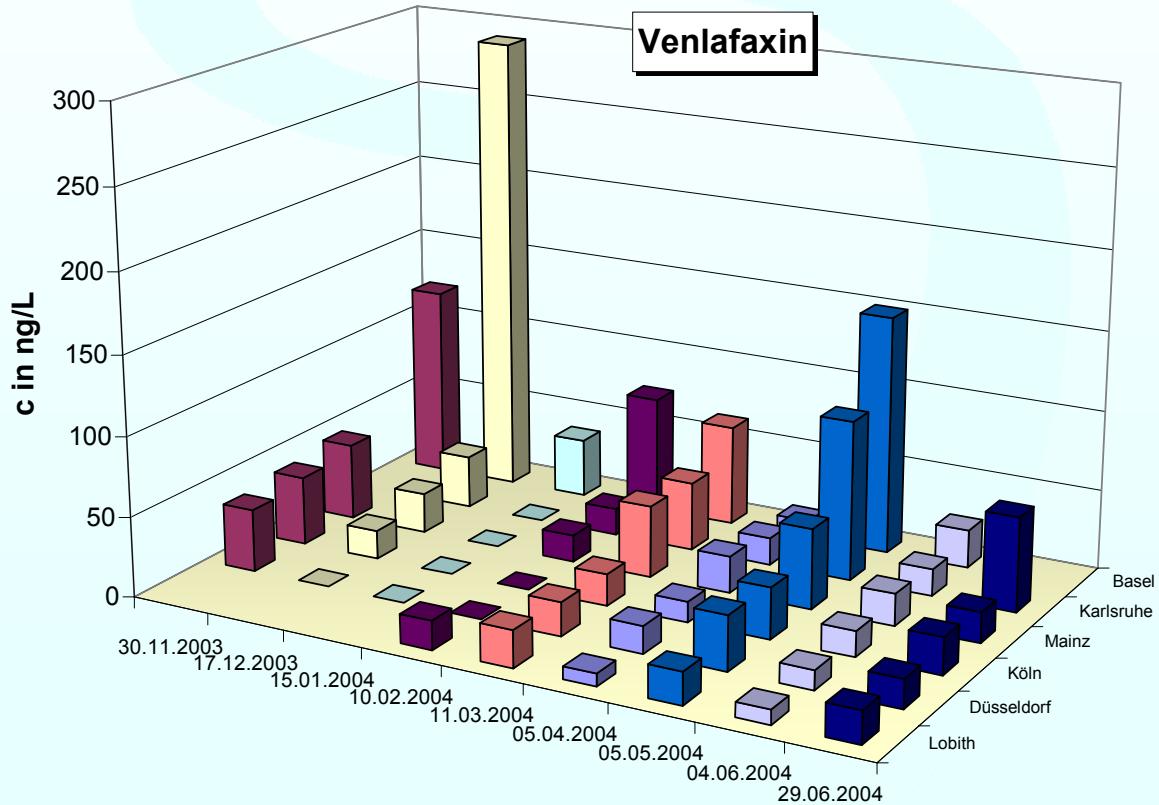
- *change over time at given location*
- *change over time in space*

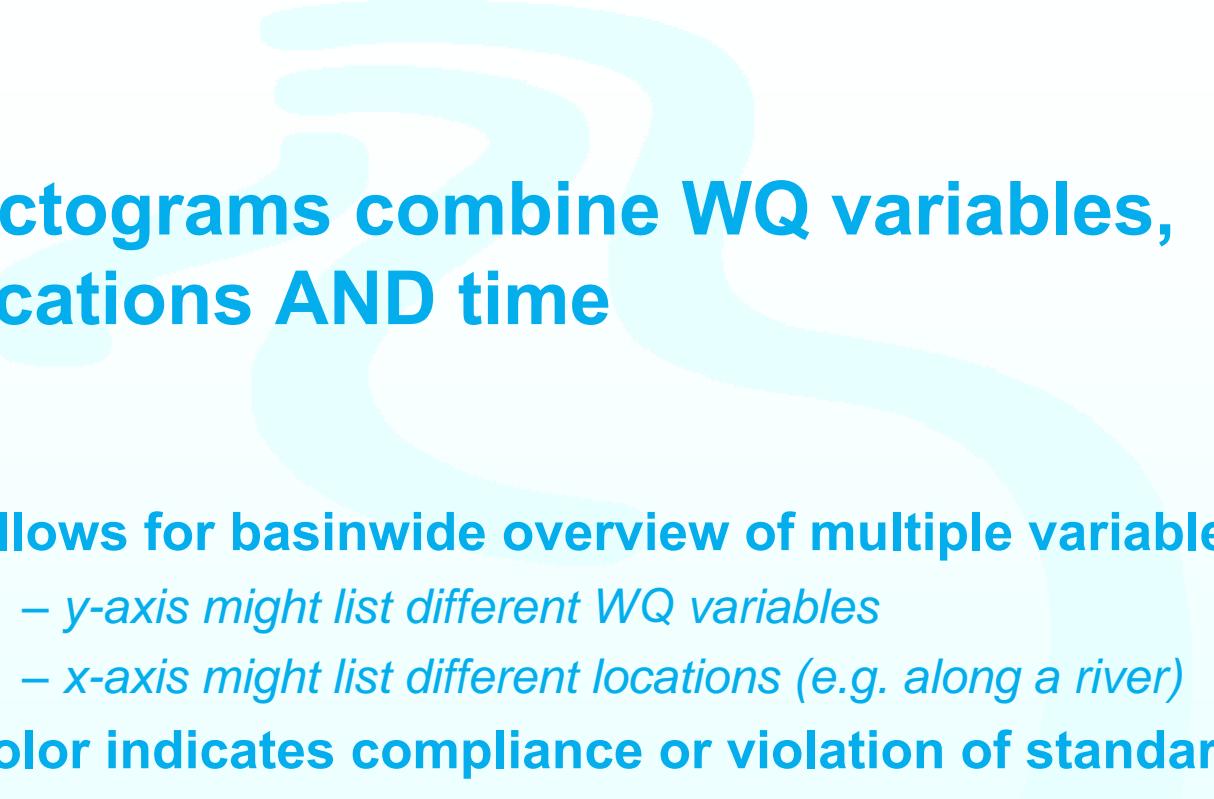
2 dimensions: conc versus time MTBE at NL / G border



3 dimensions: conc versus time in space

A pharmaceutical in the Rhine

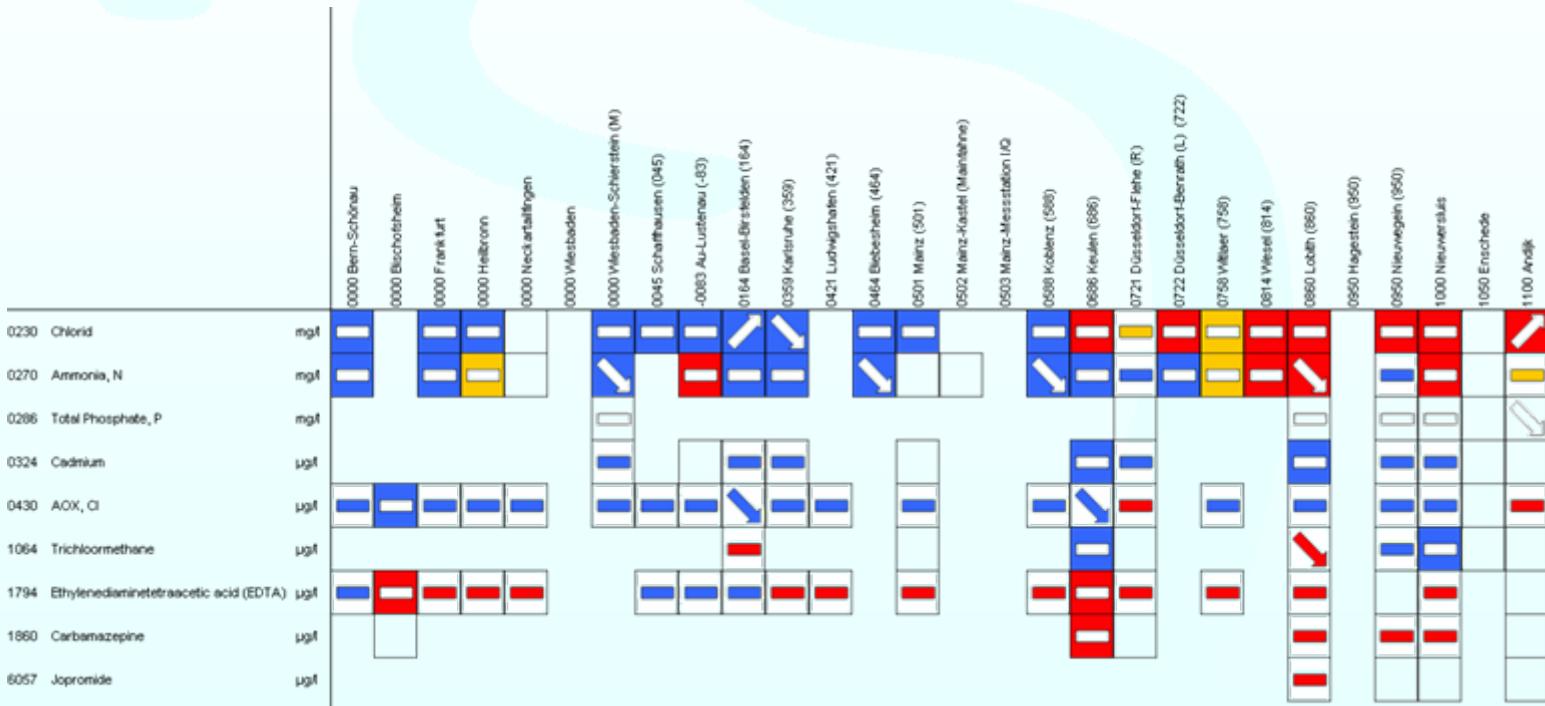




Pictograms combine WQ variables, locations AND time

- allows for basinwide overview of multiple variables
 - y-axis might list different WQ variables
 - x-axis might list different locations (e.g. along a river)
- color indicates compliance or violation of standards
 - easy overview “at a glance” of status
- arrow indicates trends
 - easy overview “at a glance” of development over time
- area coverage indicates accuracy of statements
 - the less data, the less area coverage

Trend & compliance of different WQ variables along the Rhine

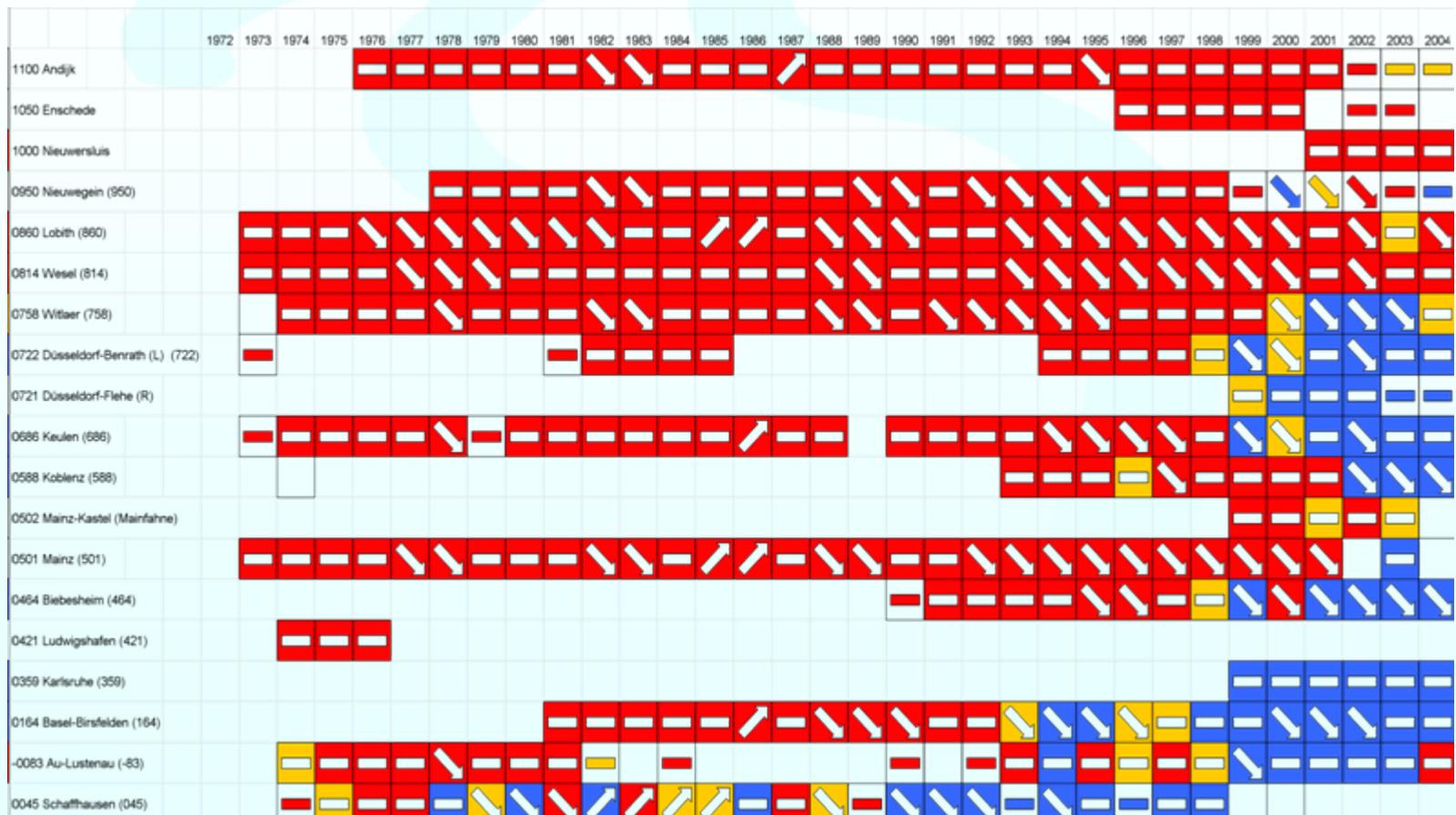


Also applicable at technical level

- plotting a single WQ variable at different locations
OR
 - plotting different (related) WQ variables at same location over time
gives info on reliability of data
- odd values easily detected

What it looks like

Ammonia in the Rhine 1972 – 2004



Summary

Standard violations and trends can be presented

- *for a single variable at different locations over time*
- *for several variables at a fixed location over time*

WQ development over 5 year period can be presented

- *for several variables at different locations simultaneously*

Summary (continued)

Used primarily for non-expert decision makers

Also: triggers WQ analist about curious events

- *software built into database management system*