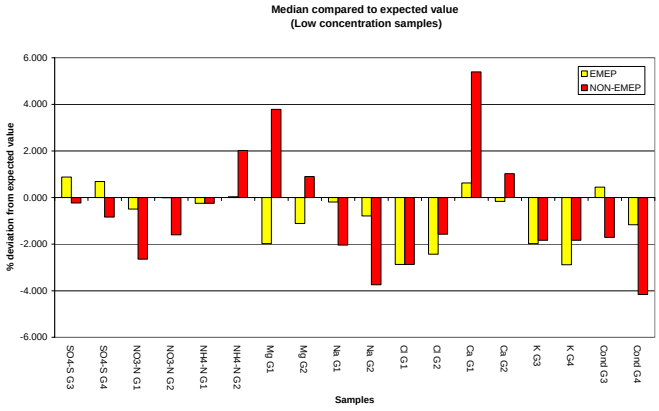
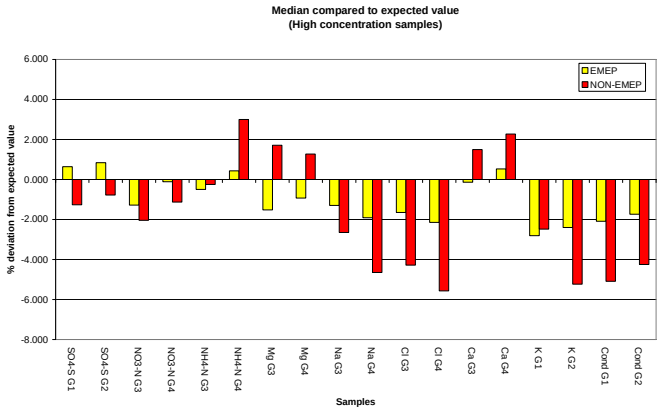
EMEP/CCC-Report 8/2005

EMEP Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe

The twenty-second intercomparison of analytical methods within EMEP

Anne-Gunn Hjellbrekke, Hilde Th. Uggerud, Jan Erik Hanssen and Jan Schaug





Norwegian Institute for Air Research
PO Box 100, NO-2027 Kjeller, Norway
Chemical Co-ordinating Centre of EMEP (CCC)

NILU : EMEP/CCC-Report 8/2005
REFERENCE : O-7729
DATE : SEPTEMBER 2005

EMEP Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

The twenty-second intercomparison of analytical methods within EMEP

Anne-Gunn Hjellbrekke, Hilde Th. Uggerud, Jan Erik Hanssen and Jan Schaug

Norwegian Institute for Air Research
P.O. Box 100, N-2027 Kjeller, Norway

Contents

Page

1. Introduction 5

2. Organisation of the intercomparison 5

3. Data handling 6
3.1 Data analysis 6
3.2 Bar plots 6
3.3 Youden plot 6
3.4 Estimating random and systematic errors from laboratory comparisons 8
3.4.1 Estimating random errors 8
3.4.2 Estimating systematic errors 9

4. Results 10
4.1 Sulphur dioxide in absorbing solution (A-samples) 10
4.2 Sulphur dioxide and nitric acid on impregnated filter (B-samples) 10
4.3 Nitrogen dioxide in absorbing solution (C-samples) 10
4.4 Ammonia on impregnated filters (J-samples) 11
4.5 Precipitation (G-samples) 11
4.5.1 Conductivity and ion balance 11

5. Summary 12

6. References 12

Appendix 1 Tables 15

Appendix 2 Figures 49

The twenty-second intercomparison of analytical methods within EMEP

1. Introduction

36 different laboratories in European countries are performing chemical analysis of air and precipitation samples within EMEP (Co-operative Programme for Monitoring and Evaluation of Long-range Transmission of Air Pollutants in Europe). Since the measurement programme is based on individual national networks, the participating laboratories apply different sampling and analytical methods. Most of the methods used are described in the manual for sampling and chemical analysis (EMEP, 1996).

In order to improve the data comparability and to get a picture of the different laboratories' performance, interlaboratory comparisons are organised by the Chemical Co-ordinating Centre (CCC) at the Norwegian Institute for Air Research (NILU). So far twenty-two intercomparisons have been arranged (Hanssen, 1988, 1990; Hanssen et al., 1983; Hanssen and Ladegård, 1984, 1985, 1987; Hanssen and Skjelmoen, 1992, 1994, 1995, 1996, 1997, 2001; Thrane, 1978, 1980a, 1980b, 1981; Uggerud et al., 2001, 2002, 2003, 2004).

Since 2000 the laboratory intercomparisons within EMEP have also been open for participation of laboratories from other networks.

This report gives the results of the twenty-second interlaboratory test.

2. Organisation of the intercomparison

The samples for the twenty-second intercomparison (see Table 2) were prepared and distributed to 68 laboratories in July 2004.

Most of the laboratories had returned their results to the CCC within one month after the deadline given as 15 October 2004. A total of 68 laboratories have returned their results. This includes 32 EMEP-laboratories.

The participating laboratories received the theoretical (expected) values by e-mail 26.11.2004. The laboratories were given the opportunity to compare their results with the expected ones, and give corrected values if obvious mistakes e.g. misprints had occurred. A few corrections were reported. In those cases the corrected values are used in this report. In accordance with the decision of the Steering Body of EMEP, the results are presented in such a way that the different laboratories are identified. Tables 3a and 3b give the names of the participating laboratories together with the numbers used when presenting the results in tables and figures.

Information received on the analytical methods used is given in Tables 4–8.

3. Data handling

The data reported from the participants are presented in Tables 9, 11, 13, 15, 17 and 19–29.

3.1 Data analysis

The reported values are presented in the tables in decreasing order together with the number of the laboratory. The expected (theoretical) value, the number of results, the arithmetic mean value, the median, the standard deviation and the relative standard deviation in percent are also given. After the first statistical run with all results included, the calculation was repeated with the outliers excluded. The outliers (unused) are defined as the results more than two standard deviations from the mean value in the first run.

The ratio between expected values (theoretical) to reported values, the ratio between measured to calculated conductivity and the ratio between equivalent concentrations of anions to equivalent concentrations cations, are presented in tables.

3.2 Bar plots

Bar-plots are used for the graphical presentation of the data. Figures 2–16 are showing the relative deviation from expected value for the different laboratories. There is one plot for each single sample.

Figure 17 gives median compared to expected value for the results reported by EMEP-laboratories and the other participating laboratories, respectively.

3.3 Youden plot

The Youden plot is a graphical method to analyse inter-laboratory data where the samples are ordered in pairs with similar concentrations. One plot is made for each pair of samples and gives results for all participating laboratories. The plots visualize both systematic and random errors.

The plot is draw as a scatter plot where each point represents a pair of concentrations for one laboratory. The expected values for the two samples are drawn as solid blue lines. The arithmetic average of the measured values excluding outliers are drawn as dotted lines. The solid lines divide the plot in four quadrants and a 45° reference line going through the intercept of the solid lines may be added.

If errors are due to random factors, the points will be evenly distributed around the mean value and situated in all four quadrants.

If systematic errors dominate, the results will be close to 45° reference line, and be situated in the upper right quadrant (overestimation) or lower left quadrant (underestimation).

Drawing a line from a given point perpendicular on the 45° reference line gives two line segments, one from the point to the intercept on the reference line (a),

and one continuing from the intercept to the point representing the expected values (b). The lengths of these line segments are measures of the random and systematic errors respectively.

Ellipses with radii corresponding to the data quality objectives (DQO, Table 1) are added in each plot. The data points are colour coded depending on the magnitude of errors as given in Table 1.

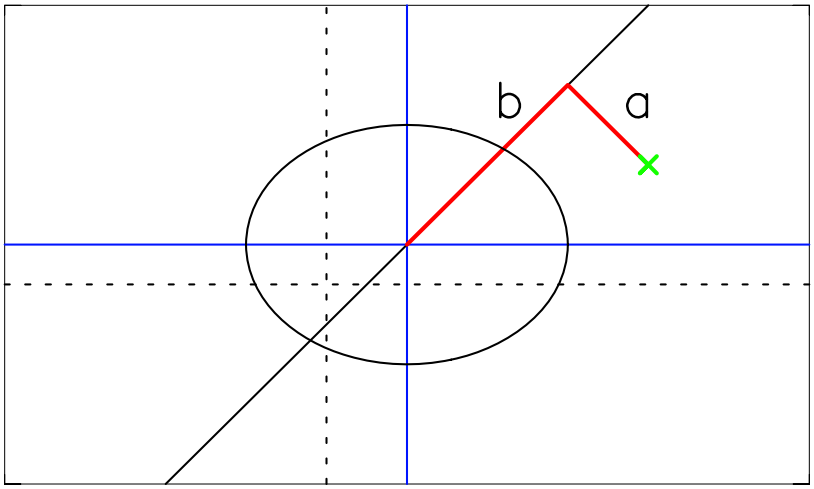


Figure 1: Youden plot showing concentrations for a pair of samples (green), expected values (blue lines), average of measured values (dotted lines) and random and systematic errors (red lines)

In Figures 18–33 the reported data are presented in Youden plots.

Table 1: Youden plot parameters.

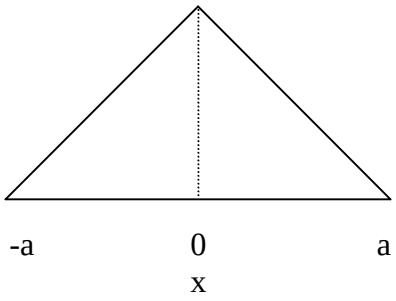
Radii	**Components**
10%	SO_2 in abs.sol, NO_2 in abs.sol.
20%	SO_2, HNO_3 and NH_3 in impregnated filter
Radii = DQO	**Components**
10% accuracy or better	SO_4^{2-}, NO_3^-
15% accuracy or better	NH_4^+, Cl^-, Ca^{2+}, K^+, Mg^{2+}, Na^+ , cond, H+ (from pH)
0.1 units	pH
Criteria	**Colour**
Within 0.5*DQO	Blue
Within DQO	Green
Within 2*DQO	Orange
> 2*DQO	Red

3.4 Estimating random and systematic errors from laboratory comparisons

Table 34 presents relative random and relative systematic errors obtained by the different laboratories in the analysis of each parameter in the precipitation samples. The calculation method and assumptions used are given in Chapter 3.4.1 and Chapter 3.4.2.

3.4.1 Estimating random errors

Systematic errors or bias in the laboratory analyses give a constant shift in the results from the expected ones at a particular concentration level. It is assumed that laboratories taking part in comparisons will obtain results near the expected ones when this bias is removed, and that the differences between expected and obtained results more often will be close to zero than not. A triangular distribution, based upon this assumption, can be used to quantify the random errors in the laboratory results (Eurachem/CITAC, 2000).



The triangle distribution is symmetric with a baseline 2a. The height in the triangle will be 1/a when the triangle area equals 1. The standard uncertainty is given by

$$u(x) = \frac{a}{\sqrt{6}} \quad (1)$$

and more than 95 % of the data will be within ± 2·u(x). The distance from -a to a (i.e. 2a) is called the range. When applied on the laboratory comparison results, the range equals the distance between the largest and smallest of the four differences between expected and found concentrations. As long as the bias can be assumed to be constant for the samples in the comparison of a specific component, it cannot have an effect on the distance corresponding to 2a. The bias may be dependent upon the concentrations, but can be considered approximate constant for the concentrations used here in the comparison of the main components in precipitation, since the differences between the concentrations are small.

L and T represent the laboratories' and the expected concentrations respectively, and D is the difference. The difference for the lowest concentration is

$$D_1 = L_1 - T_1 \quad (2)$$

and the differences are D_1, D_2, D_3, D_4 in increasing order.

The range is $D_4 - D_1$ and the standard uncertainty for the differences u(D) becomes

$$u(D) = \frac{(D_4 - D_1)}{(2 \cdot \sqrt{6})}. \quad (3)$$

The average expected concentration T for the four samples is given by

$$T = \frac{(T_1 + T_2 + T_3 + T_4)}{4} \quad (4)$$

The relative standard uncertainty, RSD, for 4 samples is given by $\frac{u(D)}{T}$, or

$$RSD = \frac{2 \cdot (D_4 - D_1 \cdot 100)}{\sqrt{6} \cdot (T_1 + T_2 + T_3 + T_4)}\%, \quad (5)$$

and 95 per cent of the laboratory results in this comparison are expected to be within $\pm 2 \cdot RSD$.

If the data quality objectives (DQO) likewise are looked upon as 95 percentiles, then 95 per cent of the laboratory analytical results should not be more than 10 or 15 per cent from the correct values (10 per cent for S and N containing components and 15 per cent for other components).

Correspondingly, the values $2 \cdot RSD$ should therefore be less than 10 or 15 per cent in order to comply with the DQO.

3.4.2 Estimating systematic errors

An estimation of bias in single measurements requires a long data series, and four samples as we normally have in laboratory comparison, are merely able to give an indication of the bias or a very coarse estimate.

Coarse estimates have been performed here in the cases where the four samples had similar concentrations and where all four laboratory results were either higher or lower than the expected concentrations. The median of the differences D_i, as defined above, was taken as a measure of the bias, B, in these cases.

$$B = \text{median}[D_i] \quad (6)$$

A relative bias, RB, was also calculated based upon the average expected concentration T, as defined in (4).

$$RB = \frac{4 \cdot \text{median}[D_i] \cdot 100}{(T_1 + T_2 + T_3 + T_4)}\% \quad (7)$$

4. Results

4.1 Sulphur dioxide in absorbing solution (A-samples)

Four samples and one blank solution were distributed to the laboratories that use the hydrogen peroxide absorption solution method. The results are given in Table 9, Figures 2 and 18. For those laboratories that reported a blank value this has been subtracted from the reported results. The ratios of measured value to expected value are presented in Table 10.

The sulphate concentration in the sample solutions correspond to a SO_2 concentration in air of 3.11–6.63 µg S m^{-3}, when 70 ml absorbing solution and 3.6 m^3 sampling volume is used.

Only 5 laboratories have reported values for SO_2 in absorbing solution.

4.2 Sulphur dioxide and nitric acid on impregnated filter (B-samples)

Five impregnated filter samples (including one blank) for determination of sulphur dioxide were analysed by 19 laboratories. The value reported for the blank filter was subtracted from the other values before the data were used.

The amount of sulphur on the distributed filters corresponds to air concentrations between 0.64-2.40 µg S m^{-3} when 25 m^3 is sampled.

In addition to sulphate, nitrate was added to the same impregnated filters for determination of HNO_3-N. The value reported for the blank filter was subtracted from the other values before using the data.

The amount of nitrogen on the distributed filters corresponds to air concentrations between 0.39 µg N m^{-3}–1.51 µg N m^{-3} when 25 m^3 sampling volume is used.

Sulphur dioxide results show prevalence of systematic versus random errors. The systematic error is most clearly for the low concentration samples.

Nitric acid on impregnated filters shows good agreement with expected values. Few outliers are reported and most results are within the 10% of expected value.

The results are presented in Tables 11 and 13 and Figures 3, 4, 19 and 20.

4.3 Nitrogen dioxide in absorbing solution (C-samples)

The four samples distributed were made to represent both absorption solutions and extracts from iodide-impregnated glass filters. The samples contain known amounts of sodium nitrite diluted in water. In order to assure sample stability and to give the laboratories the opportunity to use the matrix they use in their daily routine, the distributed samples were to be diluted 1:10. The results should be reported as the diluted concentrations.

The 10 times diluted samples correspond to air concentrations between 3.55-7.10 µg NO_2-N m^{-3}, when 70 ml absorbing solution and 1.4 m^3 are used. If

4 ml extraction solution and 0.7 m^3 sampling volume are used, the samples correspond to air concentrations between 0.23-0.81 µg NO_2-N m^{-3}.

Nitrogen dioxide in absorbing solution shows good agreement with expected values. Few outliers are reported and most results are within the 10% of expected value. The Youden plots show prevalence of systematic error versus random error.

The results are presented in Table 15 and Figures 5 and 21.

4.4 Ammonia on impregnated filters (J-samples)

For the second time impregnated filters for determination of ammonia were distributed. Six impregnated filters inclusive two unidentified blank filters were sent to 21 laboratories. 19 laboratories have reported their analytical results. The two blank values reported by each laboratory were averaged and subtracted from the other values reported before the data were used. The results are shown in Table 17 and Figures 6 and 22.

The amount of nitrogen on the filters correspond to air concentrations between 0.30-1.52 µg N m^{-3}, if 25 m^3 sampling volume is used.

Several reported values are more than 20% away from expected value. Youden plot shows that for the low concentration filters a considerable number of random errors are present. For the high concentration filters several results are biased low.

4.5 Precipitation (G-samples)

Four precipitation samples were distributed and 2629 single results from 68 laboratories were reported. 121 results were identified as outliers. This is ~4% of the data, which is about the same as obtained last year. It should be noted that 44% of the outliers are caused by only five laboratories. The results are presented in Tables 19–29 and Figures 7–16 and 23–33.

4.5.1 Conductivity and ion balance

In EMEP, conductivity measurements are mainly used for quality control reasons. When all the main ions in the precipitation have been measured, conductivity values are compared with values calculated from the reported results. Table 30 gives the ratios of the measured to the calculated values.

Low concentration ions do not contribute much to the sum of ionic conductivities. By looking at the ratio of measured to calculated conductivity, errors in determination of low concentration ions may not be revealed. To include low concentration ions in the quality control, ion balance control must be used. This ratio should be used as a tool in the quality control system for those laboratories that measure all main components. The ratios of equivalent concentrations of anions versus equivalent concentrations of cations are shown in Table 31.

The Youden plot of conductivity shows manly systematic error, which may be due to bad calibration of the instrument.

5. Summary

A total of 68 laboratories participated in the twenty-second intercomparison. 32 of these laboratories are within the EMEP network.

For all the samples analysed, the deviations from theoretical values are calculated. Figure 17 shows the median values compared to the expected values for all the parameters. For the EMEP laboratories the median deviations for both low- and high concentration samples are less than 3% and for other participants less than 6%. This is slightly better than obtained in earlier intercomparisons..

As in earlier intercomparisons, outliers are defined as values that deviate more than two standard deviations from the mean value. Outliers occur for all samples and almost all parameters. Out of a total of 3016 single results, 139 are defined as outliers. This is 5% of the reported data, which is comparable to earlier intercomparisons.

In Table 32 the ratio of the median values to the theoretical values for all the parameters is presented. As can be seen from this table, all parameters have median values that are in good agreement with the theoretical values.

6. References

Eurachem/CITAC (2000) Quantifying uncertainty in analytical measurements. 2nd ed. URL: http://www.measurementuncertainty.org/mu/QUAM2000-1.pdf.

EMEP (1996) Manual for sampling and chemical analysis. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 1/95) (Newest revision in 2001).

Hanssen, J.E. (1988) The tenth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 3/88).

Hanssen, J.E. (1990) The eleventh intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 1/90).

Hanssen, J.E. and Ladegård, N.E. (1984) The seventh intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 1/84).

Hanssen, J.E. and Ladegård, N.E. (1985) The eighth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 4/85).

Hanssen, J.E. and Ladegård, N.E. (1987) The ninth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 4/87).

Hanssen, J.E., Ladegård, N.E. and Thrane, K.E. (1983) The sixth intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 2/83).

Hanssen, J.E. and Skjelmoen, J.E. (1992) The twelfth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 7/92).

Hanssen, J.E. and Skjelmoen, J.E. (1994) The thirteenth intercomparison of analytical methods within EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 1/94).

Hanssen, J.E. and Skjelmoen, J.E. (1995) The fourteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 3/95).

Hanssen, J.E. and Skjelmoen, J.E. (1996) The fifteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 2/96).

Hanssen, J.E. and Skjelmoen, J.E. (1997) The sixteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 2/97).

Hanssen, J.E. and Skjelmoen, J.E. (2001) The seventeenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 10/2001).

Thrane, K.E. (1978) Report on the first intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 2/78).

Thrane, K.E. (1980a) Report on the second and third intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 1/80).

Thrane, K.E. (1980b) Report on the fourth intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 5/80).

Thrane, K.E. (1981) The fifth intercomparison of analytical methods within the EMEP. Lillestrøm, Norwegian Institute for Air Research (EMEP/CCC-Report 2/81).

Uggerud, H.T., Hanssen, J.E. and Skjelmoen, J.E. (2001) The eighteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 11/2001).

Uggerud, H.T., Hanssen, J.E., Schaug, J. and Skjelmoen, J.E. (2002) The nineteenth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 1/2002).

Uggerud, H.T., Hanssen, J.E., Schaug, J. and Skjelmoen, J.E. (2003) The twentieth intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 8/2003).

Uggerud, H.T., Hanssen, J.E., Schaug, J. and Hjellbrekke, A.-G. (2004) The twenty-first intercomparison of analytical methods within EMEP. Kjeller, Norwegian Institute for Air Research (EMEP/CCC-Report 6/2004).

Appendix 1

Tables

Table 2: Samples distributed for the twenty-second interlaboratory test.

A.	5 synthetic samples for determination of SO_2, consisting of 0.3% H_2O_2 absorbing solution and containing different concentrations of sulphuric acid. One of the samples was an unidentified blank.
B.	5 KOH-impregnated Whatman 40 filters, comprising 1 blank and 4 filters to which different amounts of sulphuric acid and nitrate salt have been added.
C.	4 synthetic samples for determination of NO_2 consisting of sodium nitrite diluted in water.
J.	6 Whatman 40 filters impregnated with 3% oxalic acid, comprising 2 blank and 4 filters to which different amounts of ammonium salt solution have been added.
G.	4 synthetic precipitation samples, containing SO_4^{2-}, NO_3^-, NH_4^+, H^+, Na^+, Mg^{2+} and Cl^-, and Ca^{2+} and K^+.

Table 3a: EMEP laboratories participating in the twenty-second laboratory intercomparison. The numbers in front of the names are used in tables and figures.

Austria	(1)	Umweltbundesamt Zweigstelle Sud, Klagenfurt
Canada	(26)	Meteorological Service of Canada, Toronto
Croatia	(35)	Meteorological and Hydrological Service of Croatia
Czech Republic	(3)	Czech Hydrometeorological Institute, Praha
Denmark	(4)	National Environmental Research Institute. Air Pollution Laboratory
Estonia	(38)	Estonian Environmental Research Centre, Tallinn
Finland	(5)	Finnish Meteorological Institute. Air Quality Department
France	(6)	Laboratories Wolff
Germany	(7)	IfE Leipzig GmbH, Umweltlabor
Germany	(8)	Umweltbundesamt, Messtelle Schauinsland
Hungary	(10)	Institute for Atmospheric Physics
Iceland	(11)	Idntæknistofnun Islands (Technological Inst. of Iceland)
Ireland	(12)	Met. Eirann, Dublin
Italy	(13)	C.N.R. Istituto Inquinamento Atmosferico
Italy	(30)	Join Research centre, Ispra
Latvia	(33)	Air Pollution Observation Laboratory
Lithuania	(32)	Atmospheric Pollution Research Laboratory, Institute of Physics, Vilnius
Netherlands	(14)	National Institute of Public Health and Environmental Protection (RIVM)
Norway	(15)	Norwegian Institute for Air Research (NILU)
Macedonia	(40)	Hydrometeorological Institute, Skopje
Poland	(16)	Institute of Meteorology and Water Management, Warsaw
Poland	(39)	Environmental Monitoring Laboratory, Institute of Environmental Protection
Portugal	(17)	Laboratorio Santo Andre
Romania	(18)	Research and Engineering Institute for Environment
Russian Federation	(22)	Institute of Global Climate and Ecology
Serbia and Montenegro	(24)	Rep. Hydrometeorological Institute of Serbia
Slovakia	(31)	Slovak Hydrometeorological Institute
Slovenia	(36)	Hydrometeorological Institute of Slovenia
Spain	(19)	Centro Nacional de Sanidad Ambiental
Sweden	(20)	Swedish Environmental Research Institute (IVL), Gothenburg
Switzerland	(21)	Swiss Federal Laboratories for Materials Testing (EMPA)
Turkey	(34)	Refik Saydam Institute, Ankara
United Kingdom	(23)	AEA Technology, National Environmental Technology Centre
United States of America	(27)	Illinois State Water Survey

Table 3b: Participating laboratories outside the EMEP network.

Germany	(102)	Ökologie-Zentrum Universität München
Germany	(104)	Hessige Landwirtschafliche
Finland	(107)	The Finnish Forest Institute
Germany	(108)	Institut f. Bondenkunde und Standortlehre, Dredsten
Germany	(110)	Thüringer Landesanstalt für Landwirtschaft (TTL), Jena
Germany	(112)	Niedersächsische Forstliche Versuchsanstalt (NVF)
Germany	(113)	Landesforstanstalt Eberswalde, abt. Waldökologie
Italy	(114)	C.N.R. Istituto Italiano di Idrobiologia
Germany	(115)	Bayerische Landesanstalt f. Wald- und Forstwirtshaft
Switzerland	(116)	Institute for Applied Plant Biology
Germany	(117)	Sächsische Landesanstalt für Forsten, Graupa
Germany	(118)	Forstliche Versuchs-und Forschungsansta
Germany	(120)	Landwirtschaftliche Untersuchungs- und Forschungsanstalt (LUFA)
Germany	(121)	Landesamt für Natur und Umwelt
Belgium	(124)	Laboratorium voor Bondemkunde, Gent
Germany	(125)	Bayerisches Landesamt für Umweltschutz, Augsburg
Italy	(126)	APPA Laboratorio Biologico Provinciale
China	(131)	Chongqing Institute of Environmental Science and Monitoring
Belarus	(133)	Institute for Problems of Natural Resources Use and Ecology
China	(138)	Guizhou Research Institute of Environmental Protection Science, Guiyang
Denmark	(139)	Danish Centre for Forest, Landscape and Planning, Hørsholm
Italy	(140)	C.N.R. Istituto di Ricerca sulle Acque
France	(142)	EPLD, Centre de Lagor
Finland	(145)	Tartu Environmental Research, Tartu
Luxembourg	(146)	Cellule de Recherche en Environment et Biotechnologies Public Research Center-Gabriel Lippmann
Austria	(147)	Institute of Pollution Research and Forest Chemistry
Netherlands	(148)	Alterra, Wageningen
Switzerland	(149)	WSL Zentrallabor, Birmensdorf
Belgium	(151)	Laboratoire de l'Unitè des Eaux et Forêst (EFOR), Louvain-la-Neuve
Norway	(152)	Norwegian Forest Research Institute, Ås
Slovenia	(153)	Slovenian Forestry Institute, Ljubljana
Portugal	(154)	Laboratorio de Analise Instrumental, Acores
Greece	(156)	Laboratory of Forest Land and Biogeochemistry, Ilisia
Japan	(158)	Acid Deposition and Oxidant Research Center (ADOCRC), Niigata

Table 4: Analytical methods used at the participating laboratories for the determination of sulphur dioxide in absorbing solution (A).

Method	Laboratory
1. Ion chromatography	6, 15, 19, 21, 23

Table 5: Analytical methods used at the participating laboratories for the determination of sulphur dioxide on impregnated filters (B) .

Method	Laboratory
1. Spectrophotometry	16
2. Ion chromatography	3, 4, 5, 8, 11, 12, 13, 15, 20, 22, 31,32, 33, 34, 36, 38, 116, 131, 138, 158
3. Capillary Ion Analysis	39

Table 6: Analytical methods used at the participating laboratories for determination of nitric acid on impregnated filters (B).

Method	Laboratory
1. Reduction to nitrite	16
2. Ion chromatography	3, 4, 5, 8, 11, 13, 15, 20, 22, 31,32, 33, 34, 36, 116,131, 138, 158
3. Capillary Ion Analysis	39

Table 7: Analytical method for determination of ammonia on impregnated filters (J).

Method	Laboratory
1. Spectrophotometry	3, 4, 8, 10, 16, 19,32, 33,34 39, 116,
2. FIA	11
3 Ion chromatography	5, 13,15, 20, 36, 131, 138, 158

Table 8: Analytical method used for NO_2 in absorbing solution (C).

Method	Laboratory
1. Spectrophotometry	3, 4, 8, 12, 15, 16, 19, 20, 22, 23, 31,32, 33, 34, 35, 38, 39, 131, 138
Ion chromatography	36

Table 9: Analytical results for sulphur dioxide in absorbing solution.

SO2-S in absorbing solution
Sample no.: 1
Theoretical value: 0.321
Unit: µg S / ml

Run 1:

Number of laboratories:	6
Arithmetic mean value:	0.307
Median:	0.329
Standard deviation	0.081
Rel. st. deviation (%)	26.415

Run 2:

Number of laboratories:	6
Arithmetic mean value:	0.307
Median:	0.329
Standard deviation	0.081
Rel. st. deviation (%)	26.415

Results in decreasing order:

17	0.390	21	0.324
15	0.333	6	0.311
23	0.333	19	0.151

SO2-S in absorbing solution
Sample no.: 3
Theoretical value: 0.361
Unit: µg S / ml

Run 1:

Number of laboratories:	6
Arithmetic mean value:	0.351
Median:	0.365
Standard deviation	0.051
Rel. st. deviation (%)	14.625

Run 2:

Number of laboratories:	6
Arithmetic mean value:	0.351
Median:	0.365
Standard deviation	0.051
Rel. st. deviation (%)	14.625

Results in decreasing order:

17	0.394	15	0.362
23	0.381	6	0.349
21	0.368	19	0.251

SO2-S in absorbing solution
Sample no.: 4
Theoretical value: 0.168
Unit: µg S / ml

Run 1:

Number of laboratories:	6
Arithmetic mean value:	0.222
Median:	0.174
Standard deviation	0.119
Rel. st. deviation (%)	53.545

Run 2:

Number of laboratories:	5
Arithmetic mean value:	0.174
Median:	0.172
Standard deviation	0.018
Rel. st. deviation (%)	10.487

Results in decreasing order:

6	0.462 (*)	15	0.172
17	0.201	21	0.170
23	0.176	19	0.150

SO2-S in absorbing solution
Sample no.: 5
Theoretical value: 0.140
Unit: µg S / ml

Run 1:

Number of laboratories:	6
Arithmetic mean value:	0.145
Median:	0.140
Standard deviation	0.015
Rel. st. deviation (%)	9.987

Run 2:

Number of laboratories:	6
Arithmetic mean value:	0.145
Median:	0.140
Standard deviation	0.015
Rel. st. deviation (%)	9.987

Results in decreasing order:

17	0.174	15	0.137
23	0.145	19	0.137
21	0.143	6	0.136

Table 10: The ratios of the theoretical values and the results found by the laboratories in the determination of sulphur dioxide in absorbing solutions.

	Measured value / Expected				
	Sample No				
Lab. No	A1	A2	A3	A5	Average
6	0.97	0.97	2.74	0.97	1.41
15	1.04	1.00	1.02	0.98	1.01
19	0.47	0.70	0.89	0.98	0.76
21	1.01	1.02	1.01	1.02	1.02
23	1.04	1.06	1.05	1.03	1.04

Table 11: Analytical results for sulphur dioxide in impregnated filter.

SO2-S on impregnated filter
Sample no.: 1
Theoretical value: 22.044
Unit: ugS/filter

Run 1:

Number of laboratories:	19
Arithmetic mean value:	22.507
Median:	21.610
Standard deviation	2.617
Rel. st. deviation (%)	11.627

Run 2:

Number of laboratories:	18
Arithmetic mean value:	22.043
Median:	21.605
Standard deviation	1.709
Rel. st. deviation (%)	7.754

Results in decreasing order:

138	30.857 (*)	16	21.600
32	26.960	131	21.560
38	24.800	3	21.490
33	22.919	34	21.067
5	22.727	22	20.800
8	22.717	4	20.700
15	22.460	158	20.470
36	22.400	20	20.300
31	22.397	116	19.800
39	21.610		

SO2-S on impregnated filter
Sample no.: 2
Theoretical value: 16.032
Unit: ugS/filter

Run 1:

Number of laboratories:	19
Arithmetic mean value:	16.762
Median:	16.400
Standard deviation	2.166
Rel. st. deviation (%)	12.921

Run 2:

Number of laboratories:	18
Arithmetic mean value:	16.373
Median:	16.285
Standard deviation	1.389
Rel. st. deviation (%)	8.483

Results in decreasing order:

138	23.756 (*)	20	16.170
131	19.280	39	15.910
16	19.000	32	15.860
8	17.747	34	15.389
5	17.355	4	15.300
33	17.343	116	15.100
15	16.760	38	14.900
3	16.650	158	14.870
31	16.484	22	14.200
36	16.400		

SO2-S on impregnated filter
Sample no.: 4
Theoretical value: 52.075
Unit: ugS/filter

Run 1:

Number of laboratories:	18
Arithmetic mean value:	53.522
Median:	52.463
Standard deviation	4.497
Rel. st. deviation (%)	8.403

Run 2:

Number of laboratories:	16
Arithmetic mean value:	52.119
Median:	52.059
Standard deviation	1.876
Rel. st. deviation (%)	3.600

Results in decreasing order:

36	66.700 (*)	31	52.087
138	62.791 (*)	131	52.030
33	54.930	8	51.789
39	53.810	22	51.500
5	53.793	20	51.470
16	53.620	158	51.370
32	53.610	4	51.200
116	53.300	38	49.000
34	52.839	15	47.560

SO2-S on impregnated filter
Sample no.: 5
Theoretical value: 60.087
Unit: ugS/filter

Run 1:

Number of laboratories:	18
Arithmetic mean value:	60.423
Median:	59.825
Standard deviation	4.070
Rel. st. deviation (%)	6.736

Run 2:

Number of laboratories:	17
Arithmetic mean value:	59.791
Median:	59.819
Standard deviation	3.153
Rel. st. deviation (%)	5.274

Results in decreasing order:

138	71.182 (*)	31	59.819
36	67.400	38	59.400
33	64.120	8	58.653
5	61.626	116	58.600
32	61.580	4	58.200
39	61.310	158	58.170
34	60.892	22	57.900
16	60.320	20	54.760
131	59.830	15	53.860

Table 12: The ratios of the theoretical values and the results found by the laboratories in the determination of sulphur dioxide on impregnated filters. The reported results are corrected for blank value (B1).

	Measured / Expected value				
	Sample No				
Lab. No	B1	B2	B4	B5	Average
3	0.97	1.04		1.01	1.01
4	0.94	0.95	0.98	0.97	0.96
5	1.03	1.08	1.03	1.03	1.04
8	1.03	1.11	0.99	0.98	1.03
15	1.02	1.05	0.91	0.90	0.97
16	0.98	1.19	1.03	1.00	1.05
20	0.92	1.01	0.99	0.91	0.96
22	0.94	0.89	0.99	0.96	0.95
31	1.02	1.03	1.00	1.00	1.01
32	1.22	0.99	1.03	1.02	1.07
33	1.04	1.08	1.05	1.07	1.06
34	0.96	0.96	1.01	1.01	0.99
36	1.02	1.02	1.28	1.12	1.11
38	1.13	0.93	0.94	0.99	1.00
39	0.98	0.99	1.03	1.02	1.01
116	0.90	0.94	1.02	0.98	0.96
131	0.98	1.20	1.00	1.00	1.04
138	1.40	1.48	1.21	1.18	1.32
158	0.93	0.93	0.99	0.97	0.95

Table 13: Analytical results for nitric acid on impregnated filter.

HNO3-N on impregnated filter
Sample no.: 1
Theoretical value: 9.816
Unit: ugN/filter

Run 1:

Number of laboratories:	17
Arithmetic mean value:	9.551
Median:	9.690
Standard deviation	0.917
Rel. st. deviation (%)	9.601

Run 2:

Number of laboratories:	16
Arithmetic mean value:	9.689
Median:	9.705
Standard deviation	0.744
Rel. st. deviation (%)	7.677

Results in decreasing order:

32	10.680	31	9.516	
5	10.605	158	9.510	
8	10.378	15	9.500	
131	10.344	20	9.340	
39	10.200	4	9.100	
138	10.070	22	8.800	
36	9.825	34	7.742	
16	9.720	33	7.348	(*)
3	9.690	116	<0.300	

HNO3-N on impregnated filter
Sample no.: 2
Theoretical value: 13.088
Unit: ugN/filter

Run 1:

Number of laboratories:	18
Arithmetic mean value:	12.914
Median:	13.008
Standard deviation	0.927
Rel. st. deviation (%)	7.178

Run 2:

Number of laboratories:	17
Arithmetic mean value:	13.053
Median:	13.125
Standard deviation	0.739
Rel. st. deviation (%)	5.659

Results in decreasing order:

32	14.270	20	12.890	
8	14.079	158	12.710	
5	13.775	39	12.700	
138	13.713	31	12.679	
131	13.484	16	12.570	
3	13.440	4	12.500	
15	13.200	33	12.365	
116	13.200	22	11.200	
36	13.125	34	10.558	(*)

HNO3-N on impregnated filter
Sample no.: 4
Theoretical value: 34.356
Unit: ugN/filter

Run 1:

Number of laboratories:	17
Arithmetic mean value:	33.920
Median:	34.206
Standard deviation	2.038
Rel. st. deviation (%)	6.010

Run 2:

Number of laboratories:	16
Arithmetic mean value:	34.215
Median:	34.308
Standard deviation	1.690
Rel. st. deviation (%)	4.938

Results in decreasing order:

36	37.825	33	33.933	
32	36.490	116	33.900	
39	35.300	4	33.600	
131	34.944	16	33.240	
138	34.803	31	33.093	
20	34.700	34	32.383	
5	34.412	15	30.200	
158	34.410	22	29.200	(*)
8	34.206			

HNO3-N on impregnated filter
Sample no.: 5
Theoretical value: 37.628
Unit: ugN/filter

Run 1:

Number of laboratories:	17
Arithmetic mean value:	36.382
Median:	36.510
Standard deviation	2.208
Rel. st. deviation (%)	6.070

Run 2:

Number of laboratories:	17
Arithmetic mean value:	36.382
Median:	36.510
Standard deviation	2.208
Rel. st. deviation (%)	6.070

Results in decreasing order:

33	40.227	4	36.000
32	39.850	31	35.983
138	38.577	16	35.980
39	37.600	34	35.701
36	37.425	116	34.900
5	37.280	20	34.700
8	36.931	15	32.200
131	36.634	22	32.000
158	36.510		

Table 14: The ratios of the theoretical values and the results found by the laboratories in the determination of nitric acid on impregnated filters. The reported results are corrected for blank value (B1).

	Measured / Expected value				
	Sample No				
Lab.No	B1	B2	B4	B5	Average
3	0.99	1.03		0.99	1.01
4	0.93	0.96	0.98	0.96	0.96
5	1.08	1.05	1.00	0.99	1.01
8	1.06	1.08	1.00	0.98	1.02
15	0.97	1.01	0.88	0.86	0.91
16	0.99	0.96	0.97	0.96	0.96
20	0.95	0.98	1.01	0.92	0.97
22	0.90	0.86	0.85	0.85	0.85
31	0.97	0.97	0.96	0.96	0.96
32	1.09	1.09	1.06	1.06	1.07
33	0.75	0.94	0.99	1.07	1.00
34	0.79	0.81	0.94	0.95	0.90
36	1.00	1.00	1.10	0.99	1.03
39	1.04	0.97	1.03	1.00	1.00
116		1.03	1.00	0.94	0.99
131	1.05	1.03	1.02	0.97	1.01
138	1.03	1.048	1.01	1.03	1.03
158	0.97	0.971	1.00	0.97	0.98

Table 15: Analytical results for nitrogen dioxide in absorbing solution.

NO2-N in absorbing solution
Sample no.: 1
Theoretical value: 0.112
Unit: ug N/ml

Run 1:

Number of laboratories:	21
Arithmetic mean value:	0.126
Median:	0.113
Standard deviation	0.060
Rel. st. deviation (%)	47.286

Run 2:

Number of laboratories:	20
Arithmetic mean value:	0.114
Median:	0.113
Standard deviation	0.014
Rel. st. deviation (%)	12.332

Results in decreasing order:

20	0.380 (*)	3	0.112
19	0.166	8	0.111
38	0.120	31	0.110
12	0.118	33	0.110
34	0.116	36	0.109
32	0.116	4	0.108
39	0.116	131	0.107
22	0.115	15	0.105
10	0.115	138	0.100
23	0.114	16	0.091
35	0.113		

NO2-N in absorbing solution
Sample no.: 2
Theoretical value: 0.071
Unit: ug N/ml

Run 1:

Number of laboratories:	21
Arithmetic mean value:	0.081
Median:	0.071
Standard deviation	0.036
Rel. st. deviation (%)	44.703

Run 2:

Number of laboratories:	20
Arithmetic mean value:	0.073
Median:	0.071
Standard deviation	0.009
Rel. st. deviation (%)	12.555

Results in decreasing order:

20	0.233 (*)	131	0.071
19	0.109	32	0.071
38	0.077	33	0.070
12	0.077	138	0.070
10	0.076	23	0.070
22	0.075	36	0.070
31	0.073	35	0.069
8	0.072	4	0.068
3	0.071	15	0.067
34	0.071	16	0.062
39	0.071		

NO2-N in absorbing solution
Sample no.: 3
Theoretical value: 0.125
Unit: ug N/ml

Run 1:

Number of laboratories:	21
Arithmetic mean value:	0.145
Median:	0.127
Standard deviation	0.074
Rel. st. deviation (%)	50.922

Run 2:

Number of laboratories:	20
Arithmetic mean value:	0.129
Median:	0.127
Standard deviation	0.015
Rel. st. deviation (%)	11.493

Results in decreasing order:

20	0.461 (*)	36	0.127
19	0.186	39	0.127
38	0.137	33	0.126
32	0.133	3	0.126
10	0.132	31	0.125
34	0.131	131	0.123
22	0.130	4	0.122
35	0.130	138	0.120
12	0.130	15	0.119
8	0.127	16	0.106
23	0.127		

NO2-N in absorbing solution
Sample no.: 4
Theoretical value: 0.142
Unit: ug N/ml

Run 1:

Number of laboratories:	21
Arithmetic mean value:	0.164
Median:	0.145
Standard deviation	0.082
Rel. st. deviation (%)	50.092

Run 2:

Number of laboratories:	20
Arithmetic mean value:	0.146
Median:	0.144
Standard deviation	0.017
Rel. st. deviation (%)	11.736

Results in decreasing order:

20	0.515 (*)	23	0.144
19	0.211	36	0.144
38	0.160	3	0.143
10	0.150	39	0.142
22	0.150	33	0.140
34	0.149	131	0.140
35	0.149	4	0.137
32	0.148	15	0.133
31	0.146	138	0.130
8	0.145	16	0.123
12	0.145		

Table 16: The ratios of the theoretical values and the results found by the laboratories in the determination of nitrogen dioxide in absorbing solutions.

	Measured / Expected				
	Sample No.				
Lab.No	C1	C2	C3	C4	Average
3	1.00	1.00	1.01	1.01	1.00
4	0.97	0.96	0.97	0.96	0.97
8	0.99	1.02	1.01	1.02	1.01
10	1.03	1.07	1.05	1.06	1.05
12	1.06	1.08	1.04	1.02	1.05
15	0.94	0.94	0.95	0.94	0.94
16	0.81	0.87	0.85	0.87	0.85
19	1.49	1.53	1.49	1.48	1.50
20	1.04	1.00	1.12	1.10	1.07
22	1.03	1.06	1.04	1.06	1.04
23	1.02	0.98	1.01	1.01	1.01
31	0.98	1.02	1.00	1.03	1.01
32	1.04	1.00	1.06	1.04	1.04
33	0.98	0.98	1.01	0.98	0.99
34	1.04	1.00	1.05	1.05	1.03
35	1.01	0.97	1.04	1.05	1.02
36	0.98	0.98	1.01	1.01	1.00
38	1.07	1.08	1.09	1.13	1.09
39	1.04	1.00	1.01	1.00	1.01
131	0.96	0.99	0.98	0.98	0.98
138	0.90	0.98	0.96	0.91	0.94

Table 17: Analytical results for ammonia on impregnated filter.

NH3-N on impregnated filter
Sample no.: 1
Theoretical value: 14.035
Unit: ug N/filter

Run 1:

Number of laboratories:	19
Arithmetic mean value:	13.983
Median:	13.675
Standard deviation	1.535
Rel. st. deviation (%)	10.977

Run 2:

Number of laboratories:	18
Arithmetic mean value:	13.753
Median:	13.648
Standard deviation	1.198
Rel. st. deviation (%)	8.708

Results in decreasing order:

33	18.115 (*)	32	13.620
13	15.610	5	13.450
131	15.595	20	13.297
8	15.531	158	13.235
116	14.615	39	13.140
138	14.356	34	13.005
16	14.335	19	12.680
15	14.260	3	12.310
4	13.905	10	10.943
36	13.675		

NH3-N on impregnated filter
Sample no.: 3
Theoretical value: 22.055
Unit: ug N/filter

Run 1:

Number of laboratories:	19
Arithmetic mean value:	21.579
Median:	21.705
Standard deviation	1.874
Rel. st. deviation (%)	8.685

Run 2:

Number of laboratories:	17
Arithmetic mean value:	21.590
Median:	21.705
Standard deviation	1.391
Rel. st. deviation (%)	6.444

Results in decreasing order:

13	25.500 (*)	15	21.560
8	25.022	3	21.090
131	23.475	39	20.940
116	22.585	158	20.935
138	22.444	16	20.595
32	21.960	20	20.277
36	21.905	19	19.460
5	21.890	34	19.320
33	21.865	10	17.472 (*)
4	21.705		

NH3-N on impregnated filter
Sample no.: 4
Theoretical value: 8.521
Unit: ug N/filter

Run 1:

Number of laboratories:	19
Arithmetic mean value:	8.290
Median:	8.250
Standard deviation	0.778
Rel. st. deviation (%)	9.381

Run 2:

Number of laboratories:	18
Arithmetic mean value:	8.178
Median:	8.225
Standard deviation	0.622
Rel. st. deviation (%)	7.609

Results in decreasing order:

13	10.310 (*)	5	8.200
131	9.325	158	8.155
116	9.175	39	8.080
138	8.677	16	7.855
36	8.655	34	7.815
4	8.605	19	7.440
8	8.495	20	7.394
32	8.370	3	7.270
33	8.365	10	7.080
15	8.250		

NH3-N on impregnated filter
Sample no.: 5
Theoretical value: 38.095
Unit: ug N/filter

Run 1:

Number of laboratories:	19
Arithmetic mean value:	36.787
Median:	37.235
Standard deviation	4.686
Rel. st. deviation (%)	12.737

Run 2:

Number of laboratories:	18
Arithmetic mean value:	37.502
Median:	37.350
Standard deviation	3.602
Rel. st. deviation (%)	9.605

Results in decreasing order:

13	45.980	5	36.390
32	42.020	3	36.310
8	41.681	158	36.235
4	39.005	19	35.060
131	38.705	20	34.857
15	38.660	34	34.653
138	38.595	39	34.540
116	38.475	10	29.168
33	37.465	16	23.925 (*)
36	37.235		

Table 18: The ratios of the theoretical values and the results found by the laboratories in the determination of ammonia on impregnated filters. The reported results are corrected for an average blank value (J1 and J6).

	Measured / Expected				
	Sample No.				
Lab. no.	J1	J3	J4	J5	Average
3	0.88	0.96	0.85	0.95	0.91
4	0.99	0.98	1.01	1.02	1.00
5	0.96	0.99	0.96	0.96	0.97
8	1.11	1.13	1.00	1.09	1.08
10	0.78	0.79	0.83	0.77	0.79
13	1.11	1.16	1.21	1.21	1.17
15	1.02	0.98	0.97	1.01	0.99
16	1.02	0.93	0.92	0.63	0.88
19	0.90	0.88	0.87	0.92	0.89
20	0.95	0.92	0.87	0.91	0.91
32	0.97	1.00	0.98	1.10	1.01
33	1.29	0.99	0.98	0.98	1.06
34	0.93	0.88	0.92	0.91	0.91
36	0.97	0.99	1.02	0.98	0.99
39	0.94	0.95	0.95	0.91	0.94
116	1.04	1.02	1.08	1.01	1.04
131	1.11	1.06	1.09	1.02	1.07
138	1.02	1.02	1.02	1.01	1.02
158	0.94	0.95	0.96	0.95	0.95

Table 19: Analytical results for sulphate in precipitations samples.

Sulphate in precipitation
Sample no.: 1
Theoretical value: 1.620
Unit: µg/l

Run 1:

Number of laboratories:	67
Arithmetic mean value:	1.607
Median:	1.613
Standard deviation	0.305
Rel. st. deviation (%)	18.974

Run 2:

Number of laboratories:	63
Arithmetic mean value:	1.614
Median:	1.619
Standard deviation	0.116
Rel. st. deviation (%)	7.163

Results in decreasing order:

22	3.464 (*)	131	1.605	
133	1.939	124	1.600	
148	1.871	142	1.600	
118	1.810	152	1.600	
30	1.794	102	1.600	
139	1.780	110	1.600	
39	1.749	158	1.600	
7	1.733	15	1.595	
154	1.720	23	1.593	
107	1.717	6	1.580	
35	1.715	26	1.578	
10	1.707	20	1.573	
13	1.694	146	1.570	
125	1.680	36	1.564	
140	1.680	16	1.563	
14	1.670	114	1.560	
33	1.667	38	1.550	
24	1.660	153	1.540	
21	1.655	147	1.540	
4	1.652	32	1.532	
5	1.652	113	1.530	
12	1.650	117	1.520	
149	1.648	112	1.510	
116	1.647	120	1.502	
138	1.643	121	1.472	
27	1.638	31	1.464	
8	1.635	19	1.451	
156	1.630	126	1.435	
3	1.627	18	1.324	
11	1.624	145	1.179	
115	1.620	151	0.990 (*)	
1	1.620	108	0.900 (*)	
34	1.619	104	0.620 (*)	
17	1.613			

Sulphate in precipitation
Sample no.: 2
Theoretical value: 1.764
Unit: µg/l

Run 1:

Number of laboratories:	67
Arithmetic mean value:	1.781
Median:	1.767
Standard deviation	0.359
Rel. st. deviation (%)	20.144

Run 2:

Number of laboratories:	64
Arithmetic mean value:	1.772
Median:	1.768
Standard deviation	0.109
Rel. st. deviation (%)	6.141

Results in decreasing order:

22	4.229 (*)	32	1.767	
133	2.061	1	1.760	
148	2.021	152	1.760	
118	2.010	131	1.759	
30	1.975	115	1.750	
154	1.910	153	1.750	
35	1.887	113	1.750	
116	1.886	126	1.748	
107	1.878	158	1.740	
10	1.866	108	1.740	
125	1.850	23	1.734	
140	1.850	110	1.730	
139	1.840	26	1.725	
7	1.835	11	1.722	
13	1.832	6	1.720	
14	1.830	114	1.720	
39	1.829	20	1.714	
24	1.820	16	1.713	
33	1.813	36	1.711	
21	1.801	146	1.710	
12	1.800	147	1.700	
124	1.800	117	1.690	
4	1.797	31	1.686	
149	1.794	156	1.670	
3	1.794	120	1.666	
138	1.793	121	1.666	
27	1.784	38	1.660	
142	1.780	112	1.640	
5	1.780	18	1.630	
102	1.780	19	1.584	
8	1.777	145	1.295	
15	1.775	151	1.060 (*)	
17	1.768	104	0.670 (*)	
34	1.767			

Sulphate in precipitation
Sample no.: 3
Theoretical value: 0.897
Unit: µg/l

Run 1:

Number of laboratories:	67
Arithmetic mean value:	0.897
Median:	0.900
Standard deviation	0.172
Rel. st. deviation (%)	19.164

Run 2:

Number of laboratories:	64
Arithmetic mean value:	0.899
Median:	0.900
Standard deviation	0.065
Rel. st. deviation (%)	7.204

Results in decreasing order:

22	1.927 (*)	110	0.900	
148	1.089	17	0.898	
133	1.009	1	0.895	
10	0.997	16	0.893	
118	0.990	36	0.891	
116	0.986	153	0.890	
102	0.980	20	0.890	
142	0.980	115	0.880	
30	0.979	114	0.880	
13	0.963	131	0.880	
19	0.957	26	0.878	
14	0.950	121	0.875	
33	0.948	108	0.875	
156	0.945	11	0.874	
35	0.940	6	0.870	
4	0.934	15	0.870	
7	0.930	113	0.870	
154	0.930	158	0.870	
140	0.920	126	0.868	
12	0.920	23	0.868	
138	0.919	24	0.860	
39	0.919	38	0.860	
21	0.915	152	0.860	
107	0.912	120	0.852	
8	0.909	147	0.850	
3	0.909	146	0.830	
27	0.906	32	0.814	
149	0.905	112	0.810	
5	0.904	31	0.757	
124	0.900	145	0.703	
125	0.900	151	0.670	
117	0.900	104	0.370 (*)	
139	0.900	18	0.306 (*)	
34	0.900			

Sulphate in precipitation
Sample no.: 4
Theoretical value: 0.984
Unit: µg/l

Run 1:

Number of laboratories:	67
Arithmetic mean value:	0.985
Median:	0.980
Standard deviation	0.188
Rel. st. deviation (%)	19.075

Run 2:

Number of laboratories:	64
Arithmetic mean value:	0.985
Median:	0.981
Standard deviation	0.082
Rel. st. deviation (%)	8.307

Results in decreasing order:

22	2.106 (*)	153	0.980	
10	1.273	154	0.980	
148	1.191	3	0.980	
116	1.120	20	0.978	
118	1.090	17	0.977	
133	1.072	121	0.971	
30	1.067	115	0.970	
13	1.060	139	0.970	
102	1.050	16	0.970	
142	1.050	34	0.969	
107	1.038	36	0.968	
35	1.031	23	0.963	
14	1.030	114	0.960	
39	1.029	6	0.960	
7	1.028	26	0.958	
140	1.020	131	0.957	
19	1.017	126	0.955	
4	1.016	158	0.950	
138	1.012	11	0.950	
156	1.010	117	0.950	
33	1.010	152	0.950	
12	1.010	146	0.950	
5	1.002	32	0.931	
149	1.001	147	0.930	
21	1.000	120	0.922	
124	1.000	38	0.910	
8	0.996	112	0.900	
125	0.995	31	0.855	
27	0.991	145	0.810	
110	0.990	108	0.785	
24	0.990	151	0.670	
15	0.985	18	0.429 (*)	
1	0.982	104	0.400 (*)	
113	0.980			

Table 20: Analytical results for nitrate in precipitations samples.

Nitrate in precipitation
Sample no.: 1
Theoretical value: 0.442
Unit: µg/l

Run 1:

Number of laboratories:	67
Arithmetic mean value:	0.438
Median:	0.439
Standard deviation	0.047
Rel. st. deviation (%)	10.720

Run 2:

Number of laboratories:	62
Arithmetic mean value:	0.435
Median:	0.439
Standard deviation	0.023
Rel. st. deviation (%)	5.351

Results in decreasing order:

40	0.618 (*)	11	0.438
102	0.590 (*)	26	0.438
142	0.590 (*)	3	0.434
19	0.510	22	0.432
39	0.477	1	0.430
108	0.476	6	0.430
23	0.463	24	0.430
140	0.460	36	0.430
139	0.460	38	0.430
154	0.460	110	0.430
30	0.454	113	0.430
125	0.453	115	0.430
149	0.451	158	0.430
32	0.451	33	0.429
114	0.450	34	0.427
15	0.450	35	0.423
5	0.450	116	0.423
31	0.448	4	0.421
8	0.446	104	0.420
131	0.446	117	0.420
121	0.446	107	0.411
148	0.445	14	0.410
17	0.445	112	0.410
10	0.445	153	0.410
7	0.444	13	0.410
146	0.443	147	0.400
20	0.442	152	0.400
27	0.441	156	0.400
118	0.440	124	0.400
16	0.440	126	0.380
120	0.440	133	0.358
12	0.440	151	0.330 (*)
138	0.440	145	0.290 (*)
		21	<0.439
		112	<0.370

Nitrate in precipitation
Sample no.: 2
Theoretical value: 0.376
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.372
Median:	0.373
Standard deviation	0.031
Rel. st. deviation (%)	8.302

Run 2:

Number of laboratories:	61
Arithmetic mean value:	0.375
Median:	0.374
Standard deviation	0.019
Rel. st. deviation (%)	5.059

Results in decreasing order:

40	0.487 (*)	116	0.373
142	0.430	146	0.373
102	0.430	16	0.372
19	0.428	12	0.370
108	0.402	118	0.370
124	0.400	1	0.370
154	0.400	6	0.370
31	0.395	104	0.370
30	0.393	21	0.369
140	0.390	138	0.368
15	0.390	3	0.368
120	0.390	36	0.367
39	0.389	33	0.362
23	0.388	34	0.360
13	0.385	139	0.360
17	0.384	115	0.360
5	0.384	126	0.360
125	0.383	24	0.360
121	0.383	158	0.360
149	0.382	4	0.357
32	0.382	35	0.354
113	0.380	147	0.350
114	0.380	14	0.350
131	0.379	110	0.350
8	0.379	153	0.350
7	0.378	38	0.350
26	0.378	117	0.350
20	0.377	107	0.346
148	0.377	152	0.340
10	0.376	151	0.310 (*)
22	0.376	145	0.298 (*)
27	0.374	133	0.282 (*)
11	0.374	156	0.277 (*)

Nitrate in precipitation
Sample no.: 3
Theoretical value: 0.663
Unit: µg/l

Run 1:

Number of laboratories:	67
Arithmetic mean value:	0.654
Median:	0.652
Standard deviation	0.057
Rel. st. deviation (%)	8.665

Run 2:

Number of laboratories:	63
Arithmetic mean value:	0.655
Median:	0.652
Standard deviation	0.027
Rel. st. deviation (%)	4.172

Results in decreasing order:

133	0.861 (*)	1	0.650
40	0.814 (*)	38	0.650
30	0.727	6	0.650
108	0.726	24	0.650
124	0.700	158	0.650
154	0.700	118	0.650
31	0.697	131	0.649
125	0.694	17	0.649
23	0.692	33	0.646
13	0.691	22	0.645
140	0.690	32	0.643
104	0.680	16	0.642
121	0.679	26	0.641
19	0.676	34	0.641
5	0.674	139	0.640
149	0.674	110	0.640
39	0.673	115	0.640
146	0.672	116	0.640
120	0.670	126	0.640
114	0.670	35	0.639
7	0.669	4	0.634
8	0.668	142	0.620
27	0.666	153	0.620
10	0.663	102	0.620
3	0.662	14	0.620
20	0.661	117	0.620
148	0.660	107	0.615
12	0.660	156	0.610
113	0.660	147	0.610
138	0.657	112	0.600
15	0.655	152	0.600
11	0.654	145	0.460 (*)
36	0.652	151	0.410 (*)
21	0.652		

Nitrate in precipitation
Sample no.: 4
Theoretical value: 0.590
Unit: µg/l

Run 1:

Number of laboratories:	67
Arithmetic mean value:	0.582
Median:	0.587
Standard deviation	0.040
Rel. st. deviation (%)	6.864

Run 2:

Number of laboratories:	64
Arithmetic mean value:	0.582
Median:	0.587
Standard deviation	0.025
Rel. st. deviation (%)	4.312

Results in decreasing order:

40	0.711 (*)	148	0.587
133	0.673 (*)	21	0.581
19	0.623	158	0.580
31	0.623	110	0.580
149	0.617	38	0.580
13	0.617	1	0.580
125	0.616	118	0.580
23	0.615	36	0.579
30	0.613	11	0.577
121	0.611	20	0.576
24	0.610	16	0.576
140	0.610	33	0.573
39	0.610	26	0.573
10	0.601	35	0.570
32	0.601	6	0.570
5	0.601	115	0.570
124	0.600	34	0.569
120	0.600	22	0.565
15	0.600	156	0.563
114	0.600	4	0.561
131	0.596	126	0.560
8	0.595	147	0.560
7	0.595	153	0.560
27	0.591	107	0.552
116	0.591	139	0.550
138	0.591	117	0.550
113	0.590	112	0.550
12	0.590	14	0.550
154	0.590	152	0.530
104	0.590	142	0.520
17	0.589	102	0.520
3	0.588	145	0.511
146	0.588	151	0.380 (*)
108	0.587		

Table 21: Analytical results for ammonium in precipitations sample.

Ammonium in precipitation
Sample no.: 1
Theoretical value: 0.241
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.248
Median:	0.240
Standard deviation	0.063
Rel. st. deviation (%)	25.533

Run 2:

Number of laboratories:	65
Arithmetic mean value:	0.241
Median:	0.240
Standard deviation	0.029
Rel. st. deviation (%)	11.927

Results in decreasing order:

40	0.700 (*)	115	0.240
154	0.350	139	0.240
124	0.300	24	0.240
147	0.290	26	0.239
22	0.283	4	0.238
3	0.278	19	0.238
17	0.277	149	0.238
107	0.277	121	0.237
39	0.275	138	0.237
120	0.270	14	0.235
112	0.270	5	0.235
13	0.262	16	0.234
116	0.258	7	0.233
36	0.253	8	0.232
156	0.250	145	0.230
140	0.250	146	0.230
158	0.250	110	0.230
31	0.249	117	0.230
35	0.249	118	0.230
23	0.249	6	0.230
32	0.247	15	0.230
34	0.246	20	0.229
108	0.244	10	0.227
18	0.244	148	0.222
27	0.241	1	0.220
102	0.240	104	0.220
152	0.240	113	0.210
114	0.240	126	0.207
142	0.240	131	0.206
33	0.240	151	0.200
38	0.240	133	0.194
12	0.240	30	0.188
21	0.240	153	0.130

Ammonium in precipitation
Sample no.: 2
Theoretical value: 0.176
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.191
Median:	0.178
Standard deviation	0.070
Rel. st. deviation (%)	36.438

Run 2:

Number of laboratories:	65
Arithmetic mean value:	0.183
Median:	0.178
Standard deviation	0.030
Rel. st. deviation (%)	16.260

Results in decreasing order:

40	0.696 (*)	39	0.178
18	0.299	149	0.178
154	0.280	21	0.177
156	0.260	27	0.177
107	0.236	4	0.176
120	0.220	33	0.176
22	0.211	19	0.175
115	0.210	5	0.175
112	0.210	121	0.174
147	0.210	26	0.173
31	0.205	8	0.172
124	0.200	14	0.171
17	0.199	117	0.170
30	0.199	6	0.170
3	0.198	15	0.170
158	0.190	138	0.170
36	0.190	118	0.170
102	0.190	13	0.170
142	0.190	12	0.170
152	0.190	24	0.170
116	0.188	7	0.169
35	0.187	146	0.168
23	0.186	20	0.166
32	0.186	10	0.163
108	0.185	148	0.161
145	0.180	104	0.160
38	0.180	110	0.160
114	0.180	1	0.160
34	0.180	113	0.160
126	0.180	131	0.155
139	0.180	133	0.155
140	0.180	151	0.150
16	0.179	153	0.080

Ammonium in precipitation
Sample no.: 3
Theoretical value: 0.401
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.411
Median:	0.400
Standard deviation	0.085
Rel. st. deviation (%)	20.612

Run 2:

Number of laboratories:	64
Arithmetic mean value:	0.399
Median:	0.400
Standard deviation	0.034
Rel. st. deviation (%)	8.631

Results in decreasing order:

40	0.982 (*)	104	0.400
107	0.650 (*)	39	0.399
30	0.501	121	0.399
147	0.500	5	0.399
17	0.456	33	0.399
22	0.456	26	0.399
120	0.450	4	0.397
154	0.430	118	0.395
158	0.430	108	0.395
3	0.428	14	0.394
31	0.428	19	0.391
116	0.421	7	0.390
23	0.420	115	0.390
16	0.417	117	0.390
32	0.415	24	0.390
35	0.415	8	0.389
36	0.413	10	0.387
102	0.410	146	0.382
114	0.410	148	0.382
139	0.410	138	0.381
140	0.410	13	0.381
142	0.410	15	0.380
145	0.410	6	0.380
152	0.410	34	0.376
12	0.410	156	0.373
20	0.407	1	0.370
149	0.404	126	0.365
21	0.401	131	0.357
27	0.401	113	0.350
112	0.400	18	0.339
110	0.400	151	0.320
124	0.400	133	0.318
38	0.400	153	0.290

Ammonium in precipitation
Sample no.: 4
Theoretical value: 0.369
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.385
Median:	0.371
Standard deviation	0.085
Rel. st. deviation (%)	22.105

Run 2:

Number of laboratories:	65
Arithmetic mean value:	0.375
Median:	0.371
Standard deviation	0.037
Rel. st. deviation (%)	9.828

Results in decreasing order:

40	0.999 (*)	21	0.371
30	0.503	24	0.370
147	0.460	110	0.370
31	0.453	27	0.369
154	0.450	4	0.368
22	0.423	108	0.367
17	0.421	26	0.367
156	0.420	5	0.367
102	0.410	149	0.365
142	0.410	118	0.363
3	0.404	121	0.362
23	0.402	14	0.360
152	0.400	104	0.360
158	0.400	117	0.360
124	0.400	19	0.358
107	0.393	15	0.358
120	0.390	131	0.358
35	0.388	8	0.358
116	0.388	13	0.356
36	0.387	10	0.355
16	0.386	146	0.355
20	0.381	7	0.353
139	0.380	138	0.352
113	0.380	1	0.350
38	0.380	6	0.350
12	0.380	34	0.350
112	0.380	148	0.344
145	0.380	126	0.330
140	0.380	18	0.327
32	0.380	115	0.320
114	0.380	151	0.300
39	0.376	133	0.295
33	0.372	153	0.270

Table 22: Analytical results for pH in precipitations samples.

pH in precipitation
Sample no.: 1
Theoretical value: 4.076
Unit: pH-unit

Run 1:

Number of laboratories:	67
Arithmetic mean value:	4.125
Median:	4.120
Standard deviation	0.114
Rel. st. deviation (%)	2.761

Run 2:

Number of laboratories:	64
Arithmetic mean value:	4.118
Median:	4.120
Standard deviation	0.068
Rel. st. deviation (%)	1.656

Results in decreasing order:

156	4.670	(*)	118	4.120
117	4.440	(*)	120	4.120
40	4.300		24	4.110
19	4.260		107	4.110
110	4.260		121	4.110
148	4.230		16	4.110
153	4.230		3	4.108
133	4.200		124	4.100
115	4.200		15	4.100
147	4.200		139	4.100
22	4.190		21	4.100
7	4.170		39	4.100
34	4.165		116	4.100
112	4.160		4	4.096
104	4.160		5	4.090
140	4.160		23	4.080
113	4.150		33	4.080
14	4.150		32	4.080
114	4.150		30	4.080
18	4.150		6	4.080
20	4.147		149	4.070
152	4.140		10	4.060
158	4.140		12	4.060
26	4.140		142	4.050
27	4.140		102	4.050
35	4.140		145	4.050
36	4.140		1	4.020
126	4.130		138	4.010
151	4.130		108	3.990
31	4.130		131	3.970
8	4.130		154	3.970
11	4.120		17	3.930
13	4.120		38	3.720 (*)
146	4.120			

pH in precipitation
Sample no.: 2
Theoretical value: 4.046
Unit: pH-unit

Run 1:

Number of laboratories:	67
Arithmetic mean value:	4.081
Median:	4.080
Standard deviation	0.092
Rel. st. deviation (%)	2.261

Run 2:

Number of laboratories:	63
Arithmetic mean value:	4.075
Median:	4.080
Standard deviation	0.049
Rel. st. deviation (%)	1.215

Results in decreasing order:

156	4.490	(*)	24	4.080
117	4.300	(*)	8	4.080
40	4.280	(*)	23	4.080
19	4.200		13	4.070
147	4.170		18	4.070
148	4.160		21	4.070
153	4.140		39	4.070
133	4.140		107	4.070
152	4.140		139	4.070
112	4.130		5	4.070
115	4.130		4	4.067
158	4.130		22	4.060
26	4.120		126	4.060
146	4.110		33	4.050
27	4.110		121	4.050
151	4.110		6	4.050
11	4.100		12	4.050
36	4.100		16	4.050
20	4.100		116	4.050
113	4.100		32	4.040
124	4.100		149	4.040
34	4.098		145	4.030
14	4.090		154	4.030
104	4.090		10	4.030
35	4.090		1	4.030
30	4.090		142	4.010
31	4.090		7	4.010
140	4.090		102	4.010
110	4.090		138	3.990
3	4.089		108	3.950
114	4.080		131	3.940
15	4.080		17	3.940
120	4.080		38	3.690 (*)
118	4.080			

pH in precipitation
Sample no.: 3
Theoretical value: 4.495
Unit: pH-unit

Run 1:

Number of laboratories:	67
Arithmetic mean value:	4.543
Median:	4.511
Standard deviation	0.187
Rel. st. deviation (%)	4.126

Run 2:

Number of laboratories:	64
Arithmetic mean value:	4.525
Median:	4.511
Standard deviation	0.087
Rel. st. deviation (%)	1.931

Results in decreasing order:

40	5.610	(*)	13	4.510
117	5.180	(*)	23	4.510
156	4.910		24	4.510
19	4.750		151	4.510
113	4.710		31	4.510
110	4.680		33	4.510
148	4.670		36	4.510
146	4.630		39	4.510
133	4.630		124	4.500
115	4.600		126	4.500
35	4.580		4	4.500
140	4.570		5	4.500
14	4.570		120	4.500
112	4.570		139	4.500
153	4.570		18	4.490
158	4.570		149	4.490
30	4.560		154	4.480
27	4.550		116	4.480
22	4.550		32	4.480
107	4.550		121	4.480
26	4.550		6	4.470
34	4.534		7	4.450
152	4.530		12	4.450
8	4.530		145	4.440
118	4.530		1	4.440
20	4.527		10	4.430
104	4.520		102	4.420
11	4.520		142	4.420
114	4.520		108	4.400
147	4.520		131	4.380
21	4.520		138	4.380
16	4.520		17	4.370
15	4.520		38	4.020 (*)
3	4.511			

pH in precipitation
Sample no.: 4
Theoretical value: 4.444
Unit: pH-unit

Run 1:

Number of laboratories:	67
Arithmetic mean value:	4.500
Median:	4.480
Standard deviation	0.197
Rel. st. deviation (%)	4.371

Run 2:

Number of laboratories:	64
Arithmetic mean value:	4.481
Median:	4.480
Standard deviation	0.072
Rel. st. deviation (%)	1.603

Results in decreasing order:

40	5.830	(*)	22	4.480
156	4.920	(*)	21	4.470
19	4.710		15	4.470
110	4.690		33	4.460
117	4.660		39	4.460
148	4.620		16	4.460
113	4.580		23	4.460
133	4.560		24	4.460
30	4.560		4	4.454
153	4.540		114	4.450
146	4.540		10	4.450
31	4.540		13	4.450
147	4.530		120	4.450
112	4.530		121	4.450
158	4.530		126	4.450
140	4.520		18	4.450
152	4.520		5	4.450
35	4.510		12	4.440
26	4.510		149	4.440
34	4.509		116	4.430
3	4.502		6	4.430
36	4.500		1	4.420
115	4.500		32	4.410
139	4.500		7	4.410
124	4.500		145	4.400
104	4.500		102	4.400
27	4.500		142	4.400
107	4.490		17	4.370
14	4.490		154	4.370
118	4.480		108	4.360
151	4.480		131	4.350
8	4.480		138	4.340
11	4.480		38	3.990 (*)
20	4.480			

Table 23: Analytical results for strong acid calculated from pH.

Strong acid calculated from pH
Sample no.: 1
Theoretical value: 84.000
Unit: µeq

Run 1:

Number of laboratories:	67
Arithmetic mean value:	77.386
Median:	75.858
Standard deviation	20.320
Rel. st. deviation (%)	26.258

Run 2:

Number of laboratories:	64
Arithmetic mean value:	77.135
Median:	75.858
Standard deviation	12.357
Rel. st. deviation (%)	16.019

Results in decreasing order:

38	190.546	(*)	13	75.858
17	117.490		118	75.858
154	107.152		8	74.195
131	107.152		151	74.131
108	102.329		126	74.131
138	97.724		31	74.131
1	95.499		26	72.444
142	89.125		152	72.444
145	89.125		158	72.444
102	89.125		27	72.444
10	87.096		36	72.444
12	87.096		35	72.444
149	85.114		20	71.285
32	83.176		14	70.795
33	83.176		18	70.795
6	83.176		113	70.795
23	83.176		114	70.795
30	83.176		104	69.183
5	81.283		140	69.183
4	80.168		112	69.183
15	79.433		34	68.391
139	79.433		7	67.608
39	79.433		22	64.565
116	79.433		133	63.096
124	79.433		115	63.096
21	79.433		147	63.096
3	77.983		153	58.884
107	77.625		148	58.884
16	77.625		110	54.954
121	77.625		19	54.954
24	77.625		40	50.119
146	75.858		117	36.308 (*)
120	75.858		156	21.380 (*)
11	75.858			

Strong acid calculated from pH
Sample no.: 2
Theoretical value: 90.000
Unit: µeq

Run 1:

Number of laboratories:	67
Arithmetic mean value:	84.772
Median:	83.176
Standard deviation	19.633
Rel. st. deviation (%)	23.159

Run 2:

Number of laboratories:	65
Arithmetic mean value:	83.741
Median:	83.176
Standard deviation	11.433
Rel. st. deviation (%)	13.653

Results in decreasing order:

38	204.174	(*)	15	83.176
17	114.815		120	83.176
131	114.815		8	82.272
108	112.202		3	81.470
138	102.329		110	81.283
142	97.724		14	81.283
7	97.724		140	81.283
102	97.724		31	81.283
1	93.325		104	81.283
154	93.325		35	81.283
10	93.325		30	81.283
145	93.325		34	79.799
149	91.201		11	79.433
32	91.201		113	79.433
6	89.125		20	79.433
12	89.125		124	79.433
33	89.125		36	79.433
121	89.125		151	77.625
116	89.125		27	77.625
16	89.125		146	77.625
126	87.096		26	75.858
22	87.096		158	74.131
4	85.704		115	74.131
18	85.114		112	74.131
5	85.114		152	72.444
139	85.114		153	72.444
21	85.114		133	72.444
13	85.114		148	69.183
39	85.114		147	67.608
107	85.114		19	63.096
24	83.176		40	52.481
114	83.176		117	50.119
118	83.176		156	32.359 (*)
23	83.176			

Strong acid calculated from pH
Sample no.: 3
Theoretical value: 32.000
Unit: µeq

Run 1:

Number of laboratories:	67
Arithmetic mean value:	30.596
Median:	30.832
Standard deviation	10.611
Rel. st. deviation (%)	34.682

Run 2:

Number of laboratories:	64
Arithmetic mean value:	30.396
Median:	30.867
Standard deviation	5.418
Rel. st. deviation (%)	17.823

Results in decreasing order:

38	95.499	(*)	15	30.200
17	42.658		104	30.200
138	41.687		16	30.200
131	41.687		21	30.200
108	39.811		11	30.200
102	38.019		147	30.200
142	38.019		114	30.200
10	37.154		20	29.717
1	36.308		152	29.512
145	36.308		118	29.512
7	35.481		8	29.478
12	35.481		34	29.242
6	33.884		107	28.184
154	33.113		26	28.184
116	33.113		27	28.184
121	33.113		22	28.184
32	33.113		30	27.542
149	32.359		153	26.915
18	32.359		158	26.915
4	31.623		112	26.915
5	31.623		140	26.915
139	31.623		14	26.915
124	31.623		35	26.303
126	31.623		115	25.119
120	31.623		133	23.442
39	30.903		146	23.442
151	30.903		148	21.380
13	30.903		110	20.893
23	30.903		113	19.498
24	30.903		19	17.783
31	30.903		156	12.303
33	30.903		117	6.607 (*)
36	30.903		40	2.455 (*)
3	30.832			

Strong acid calculated from pH
Sample no.: 4
Theoretical value: 36.000
Unit: µeq

Run 1:

Number of laboratories:	67
Arithmetic mean value:	33.692
Median:	33.113
Standard deviation	10.973
Rel. st. deviation (%)	32.570

Run 2:

Number of laboratories:	65
Arithmetic mean value:	33.131
Median:	33.113
Standard deviation	5.834
Rel. st. deviation (%)	17.608

Results in decreasing order:

38	102.329	(*)	151	33.113
138	45.709		20	33.113
131	44.668		118	33.113
108	43.652		8	32.933
154	42.658		14	32.359
17	42.658		107	32.359
145	39.811		115	31.623
102	39.811		27	31.623
142	39.811		104	31.623
7	38.905		36	31.623
32	38.905		124	31.623
1	38.019		139	31.623
116	37.154		3	31.477
6	37.154		34	30.974
149	36.308		26	30.903
12	36.308		35	30.903
13	35.481		152	30.200
18	35.481		140	30.200
10	35.481		158	29.512
5	35.481		112	29.512
120	35.481		147	29.512
114	35.481		31	28.840
126	35.481		146	28.840
121	35.481		153	28.840
4	35.156		30	27.542
23	34.674		133	27.542
24	34.674		113	26.303
33	34.674		148	23.988
39	34.674		117	21.878
16	34.674		110	20.417
15	33.884		19	19.498
21	33.884		156	12.023
11	33.113		40	1.479 (*)
22	33.113			

Table 24: Analytical results for chloride in precipitations samples.

Chloride in precipitation
Sample no.: 1
Theoretical value: 0.185
Unit: µg/l

Run 1:
Number of laboratories: 64
Arithmetic mean value: 0.195
Median: 0.180
Standard deviation 0.137
Rel. st. deviation (%) 70.438

Run 2:
Number of laboratories: 63
Arithmetic mean value: 0.179
Median: 0.180
Standard deviation 0.053
Rel. st. deviation (%) 29.905

Results in decreasing order:

156	1.190 (*)	6	0.180
17	0.334	140	0.180
154	0.320	146	0.180
133	0.286	7	0.179
10	0.270	16	0.178
115	0.230	34	0.178
120	0.230	32	0.175
113	0.230	3	0.173
139	0.220	4	0.173
39	0.212	138	0.170
24	0.210	38	0.170
110	0.210	13	0.170
145	0.206	1	0.170
40	0.205	158	0.170
124	0.200	31	0.164
12	0.200	20	0.164
117	0.200	5	0.163
153	0.200	131	0.163
152	0.200	107	0.161
23	0.198	126	0.160
30	0.197	151	0.160
33	0.193	11	0.158
149	0.188	104	0.150
21	0.185	108	0.140
8	0.184	14	0.130
36	0.183	147	0.130
35	0.183	116	0.130
26	0.183	22	0.102
27	0.182	18	0.075
118	0.180	102	0.040
15	0.180	142	0.040
114	0.180	148	0.010
		19	<0.300
		112	<0.370
		121	<0.100
		125	<0.200

Chloride in precipitation
Sample no.: 2
Theoretical value: 0.232
Unit: µg/l

Run 1:
Number of laboratories: 66
Arithmetic mean value: 0.229
Median: 0.227
Standard deviation 0.069
Rel. st. deviation (%) 30.108

Run 2:
Number of laboratories: 62
Arithmetic mean value: 0.227
Median: 0.227
Standard deviation 0.035
Rel. st. deviation (%) 15.355

Results in decreasing order:

156	0.576 (*)	138	0.226
17	0.390 (*)	34	0.225
133	0.328	146	0.224
10	0.301	11	0.223
120	0.300	35	0.223
154	0.300	23	0.223
113	0.280	158	0.220
39	0.274	38	0.220
108	0.260	114	0.220
139	0.260	6	0.220
115	0.260	16	0.218
40	0.259	4	0.216
117	0.250	3	0.215
110	0.250	32	0.215
140	0.250	22	0.215
30	0.243	126	0.210
24	0.240	1	0.210
153	0.240	20	0.209
21	0.239	5	0.206
131	0.237	31	0.202
107	0.235	145	0.201
26	0.235	124	0.200
15	0.235	152	0.200
121	0.232	148	0.200
8	0.231	118	0.190
13	0.231	116	0.185
36	0.231	104	0.180
12	0.230	151	0.180
149	0.230	147	0.170
125	0.228	14	0.170
27	0.228	18	0.100
7	0.227	142	0.020 (*)
33	0.227	102	0.020 (*)
		19	<0.300
		112	<0.370

Chloride in precipitation
Sample no.: 3
Theoretical value: 0.533
Unit: µg/l

Run 1:
Number of laboratories: 68
Arithmetic mean value: 0.540
Median: 0.510
Standard deviation 0.203
Rel. st. deviation (%) 37.535

Run 2:
Number of laboratories: 67
Arithmetic mean value: 0.517
Median: 0.510
Standard deviation 0.069
Rel. st. deviation (%) 13.414

Results in decreasing order:

156	2.090 (*)	158	0.510
17	0.847	142	0.510
133	0.714	6	0.510
10	0.641	153	0.510
40	0.610	102	0.510
39	0.592	34	0.509
108	0.580	36	0.505
139	0.580	131	0.502
22	0.570	20	0.502
154	0.570	1	0.500
24	0.560	124	0.500
115	0.550	38	0.500
26	0.546	117	0.500
15	0.545	145	0.499
12	0.540	30	0.498
8	0.536	138	0.497
125	0.535	32	0.497
149	0.532	13	0.493
27	0.531	16	0.490
140	0.530	120	0.490
110	0.530	4	0.487
7	0.530	19	0.484
113	0.530	116	0.484
23	0.529	118	0.480
35	0.529	31	0.476
21	0.529	112	0.470
5	0.527	18	0.451
33	0.524	121	0.450
146	0.521	14	0.440
126	0.520	147	0.430
114	0.520	148	0.430
11	0.517	152	0.400
3	0.517	104	0.380
107	0.511	151	0.310

Chloride in precipitation
Sample no.: 4
Theoretical value: 0.556
Unit: µg/l

Run 1:
Number of laboratories: 68
Arithmetic mean value: 0.558
Median: 0.532
Standard deviation 0.182
Rel. st. deviation (%) 32.690

Run 2:
Number of laboratories: 67
Arithmetic mean value: 0.539
Median: 0.532
Standard deviation 0.088
Rel. st. deviation (%) 16.327

Results in decreasing order:

156	1.860 (*)	20	0.532
17	0.870	146	0.531
133	0.864	153	0.530
10	0.845	6	0.530
24	0.630	158	0.530
22	0.629	138	0.529
39	0.627	36	0.526
140	0.590	107	0.521
115	0.580	116	0.521
18	0.577	1	0.520
40	0.575	38	0.520
15	0.570	4	0.517
139	0.570	13	0.515
26	0.567	32	0.515
21	0.565	16	0.512
125	0.565	118	0.510
35	0.564	112	0.510
12	0.560	145	0.506
113	0.560	19	0.502
8	0.557	31	0.501
7	0.556	152	0.500
27	0.553	124	0.500
149	0.550	108	0.490
110	0.550	121	0.485
114	0.550	30	0.479
33	0.550	14	0.460
34	0.544	117	0.450
5	0.542	102	0.440
126	0.540	142	0.440
154	0.540	147	0.430
3	0.539	120	0.430
131	0.538	104	0.420
23	0.534	148	0.390
11	0.533	151	0.320

Table 25: Analytical results for sodium in precipitations samples.

Sodium in precipitation
Sample no.: 1
Theoretical value: 0.271
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.266
Median:	0.269
Standard deviation	0.042
Rel. st. deviation (%)	15.660

Run 2:

Number of laboratories:	62
Arithmetic mean value:	0.260
Median:	0.269
Standard deviation	0.025
Rel. st. deviation (%)	9.671

Results in decreasing order:

148	0.470	(*)	138	0.269
156	0.390	(*)	7	0.268
149	0.354	(*)	107	0.265
4	0.314		31	0.263
40	0.304		38	0.261
147	0.300		8	0.261
32	0.298		16	0.260
133	0.295		124	0.260
14	0.285		104	0.260
146	0.284		39	0.254
1	0.280		21	0.250
112	0.280		153	0.250
126	0.280		115	0.250
151	0.280		11	0.247
15	0.280		10	0.246
140	0.280		152	0.245
6	0.280		30	0.242
121	0.280		116	0.242
158	0.280		117	0.240
34	0.276		24	0.240
26	0.276		102	0.240
5	0.275		142	0.240
145	0.274		110	0.240
19	0.274		22	0.238
33	0.272		120	0.234
13	0.271		154	0.230
36	0.271		113	0.220
114	0.270		131	0.217
3	0.270		35	0.214
20	0.270		23	0.204
12	0.270		108	0.197
118	0.270		17	0.195
27	0.269		139	0.181 (*)

Sodium in precipitation
Sample no.: 2
Theoretical value: 0.322
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.319
Median:	0.319
Standard deviation	0.041
Rel. st. deviation (%)	12.865

Run 2:

Number of laboratories:	62
Arithmetic mean value:	0.318
Median:	0.319
Standard deviation	0.028
Rel. st. deviation (%)	8.890

Results in decreasing order:

148	0.491	(*)	19	0.318
35	0.418	(*)	107	0.316
140	0.400		8	0.315
156	0.380		38	0.313
32	0.375		124	0.310
34	0.367		16	0.310
4	0.366		21	0.308
14	0.364		39	0.308
108	0.346		30	0.306
121	0.340		133	0.305
118	0.340		20	0.301
126	0.340		115	0.300
158	0.340		13	0.300
15	0.336		102	0.300
146	0.336		104	0.300
40	0.335		142	0.300
149	0.335		120	0.299
145	0.334		11	0.299
3	0.333		22	0.296
36	0.332		152	0.295
31	0.331		10	0.294
33	0.331		154	0.290
138	0.331		153	0.290
151	0.330		110	0.290
112	0.330		24	0.280
6	0.330		117	0.280
26	0.326		116	0.274
5	0.325		23	0.274
114	0.320		113	0.270
12	0.320		131	0.270
1	0.320		17	0.257
7	0.319		139	0.222 (*)
27	0.319		147	0.210 (*)

Sodium in precipitation
Sample no.: 3
Theoretical value: 0.668
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.655
Median:	0.655
Standard deviation	0.056
Rel. st. deviation (%)	8.599

Run 2:

Number of laboratories:	62
Arithmetic mean value:	0.654
Median:	0.655
Standard deviation	0.036
Rel. st. deviation (%)	5.548

Results in decreasing order:

148	0.879	(*)	107	0.655
30	0.801	(*)	108	0.654
4	0.722		33	0.654
32	0.720		8	0.652
14	0.715		27	0.651
156	0.710		118	0.650
147	0.710		152	0.649
35	0.709		3	0.645
15	0.701		39	0.642
133	0.700		117	0.640
158	0.700		151	0.640
149	0.692		23	0.634
126	0.690		11	0.632
34	0.684		104	0.630
140	0.680		153	0.630
121	0.680		24	0.630
145	0.676		115	0.630
146	0.675		138	0.629
36	0.675		20	0.627
26	0.674		102	0.620
5	0.673		142	0.620
112	0.670		13	0.618
110	0.670		10	0.618
1	0.670		40	0.616
31	0.668		131	0.614
19	0.667		120	0.606
21	0.664		124	0.590
6	0.660		116	0.589
16	0.660		22	0.585
114	0.660		17	0.577
12	0.660		113	0.560
7	0.658		154	0.520 (*)
38	0.656		139	0.466 (*)

Sodium in precipitation
Sample no.: 4
Theoretical value: 0.640
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.622
Median:	0.624
Standard deviation	0.063
Rel. st. deviation (%)	10.071

Run 2:

Number of laboratories:	64
Arithmetic mean value:	0.620
Median:	0.624
Standard deviation	0.048
Rel. st. deviation (%)	7.745

Results in decreasing order:

148	0.897	(*)	107	0.624
30	0.742		38	0.623
4	0.700		8	0.623
156	0.690		118	0.620
14	0.689		151	0.610
133	0.685		104	0.610
35	0.680		11	0.607
3	0.675		20	0.605
15	0.674		138	0.604
121	0.670		39	0.603
126	0.670		102	0.600
147	0.670		110	0.600
158	0.670		153	0.600
145	0.668		117	0.600
32	0.665		142	0.600
149	0.659		13	0.596
120	0.659		24	0.590
140	0.650		152	0.588
36	0.649		10	0.587
26	0.643		131	0.587
5	0.642		23	0.585
112	0.640		31	0.583
1	0.640		40	0.576
21	0.640		124	0.570
114	0.640		115	0.560
146	0.639		113	0.540
7	0.631		108	0.537
6	0.630		34	0.535
19	0.630		17	0.533
16	0.630		22	0.522
12	0.630		154	0.520
33	0.625		116	0.511
27	0.624		139	0.439 (*)

Table 26: Analytical results for magnesium in precipitations samples.

Magnesium in precipitation
Sample no.: 1
Theoretical value: 0.087
Unit: µg/l

Run 1:

Number of laboratories:	64
Arithmetic mean value:	0.088
Median:	0.086
Standard deviation	0.028
Rel. st. deviation (%)	31.406

Run 2:

Number of laboratories:	61
Arithmetic mean value:	0.084
Median:	0.086
Standard deviation	0.012
Rel. st. deviation (%)	14.036

Results in decreasing order:

154	0.230 (*)	146	0.086	
147	0.210 (*)	40	0.086	
113	0.120	5	0.085	
126	0.100	131	0.085	
153	0.100	3	0.085	
102	0.100	33	0.084	
145	0.100	121	0.084	
142	0.100	4	0.084	
138	0.097	14	0.083	
149	0.095	16	0.083	
107	0.093	151	0.083	
1	0.090	120	0.083	
104	0.090	23	0.081	
140	0.090	11	0.081	
15	0.090	31	0.081	
17	0.090	6	0.080	
124	0.090	7	0.080	
118	0.090	30	0.080	
117	0.090	115	0.080	
112	0.090	114	0.080	
139	0.089	156	0.080	
12	0.088	158	0.080	
26	0.088	20	0.078	
10	0.088	38	0.074	
13	0.088	22	0.073	
34	0.088	24	0.070	
152	0.087	148	0.061	
27	0.087	110	0.060	
36	0.087	39	0.054	
21	0.087	133	0.051	
19	0.087	35	0.048	
8	0.087	116	0.028	(*)
		108	<0.001	

Magnesium in precipitation
Sample no.: 2
Theoretical value: 0.099
Unit: µg/l

Run 1:

Number of laboratories:	65
Arithmetic mean value:	0.099
Median:	0.099
Standard deviation	0.032
Rel. st. deviation (%)	32.716

Run 2:

Number of laboratories:	62
Arithmetic mean value:	0.095
Median:	0.099
Standard deviation	0.012
Rel. st. deviation (%)	12.781

Results in decreasing order:

154	0.290 (*)	26	0.099	
147	0.220 (*)	131	0.098	
113	0.120	14	0.098	
30	0.115	8	0.098	
102	0.110	19	0.098	
126	0.110	10	0.098	
153	0.110	146	0.098	
142	0.110	120	0.096	
138	0.108	121	0.095	
145	0.108	33	0.095	
107	0.105	39	0.095	
17	0.102	151	0.095	
139	0.101	16	0.094	
140	0.100	36	0.094	
149	0.100	23	0.094	
21	0.100	11	0.094	
5	0.100	1	0.090	
156	0.100	6	0.090	
34	0.100	7	0.090	
104	0.100	24	0.090	
112	0.100	115	0.090	
114	0.100	158	0.090	
117	0.100	38	0.086	
13	0.100	22	0.085	
118	0.100	20	0.079	
15	0.100	40	0.077	
124	0.100	148	0.072	
27	0.099	110	0.070	
3	0.099	116	0.068	
4	0.099	133	0.058	
31	0.099	35	0.051	
12	0.099	108	0.019	(*)
152	0.099			

Magnesium in precipitation
Sample no.: 3
Theoretical value: 0.124
Unit: µg/l

Run 1:

Number of laboratories:	65
Arithmetic mean value:	0.127
Median:	0.123
Standard deviation	0.045
Rel. st. deviation (%)	35.665

Run 2:

Number of laboratories:	63
Arithmetic mean value:	0.119
Median:	0.123
Standard deviation	0.017
Rel. st. deviation (%)	14.574

Results in decreasing order:

147	0.400 (*)	8	0.123	
154	0.310 (*)	5	0.122	
140	0.150	31	0.122	
30	0.142	7	0.121	
107	0.142	118	0.121	
113	0.140	121	0.120	
153	0.140	15	0.120	
126	0.140	6	0.120	
138	0.138	3	0.120	
17	0.133	1	0.120	
104	0.130	39	0.120	
102	0.130	14	0.119	
112	0.130	33	0.118	
117	0.130	23	0.117	
142	0.130	120	0.117	
24	0.130	151	0.116	
156	0.130	16	0.115	
145	0.128	11	0.115	
12	0.128	115	0.112	
146	0.126	114	0.110	
149	0.126	22	0.110	
139	0.126	38	0.110	
131	0.125	124	0.110	
21	0.124	158	0.110	
19	0.124	20	0.107	
152	0.124	116	0.103	
4	0.124	40	0.097	
13	0.124	148	0.095	
34	0.124	110	0.090	
27	0.124	35	0.078	
10	0.123	133	0.072	
26	0.123	108	0.037	
36	0.123			

Magnesium in precipitation
Sample no.: 4
Theoretical value: 0.136
Unit: µg/l

Run 1:

Number of laboratories:	65
Arithmetic mean value:	0.140
Median:	0.136
Standard deviation	0.047
Rel. st. deviation (%)	33.559

Run 2:

Number of laboratories:	63
Arithmetic mean value:	0.132
Median:	0.136
Standard deviation	0.018
Rel. st. deviation (%)	13.766

Results in decreasing order:

147	0.410 (*)	27	0.136
154	0.350 (*)	5	0.135
30	0.199	10	0.135
153	0.160	19	0.135
113	0.150	14	0.134
107	0.150	131	0.134
138	0.149	15	0.134
17	0.147	152	0.134
31	0.144	120	0.133
145	0.143	7	0.132
104	0.140	39	0.131
102	0.140	158	0.130
112	0.140	121	0.130
117	0.140	124	0.130
126	0.140	6	0.130
140	0.140	1	0.130
142	0.140	151	0.129
23	0.140	33	0.129
24	0.140	11	0.128
12	0.140	16	0.126
156	0.140	115	0.123
26	0.138	38	0.123
3	0.138	148	0.123
4	0.138	20	0.121
139	0.138	114	0.120
149	0.138	22	0.120
146	0.137	116	0.116
36	0.137	40	0.107
21	0.137	110	0.100
118	0.137	35	0.082
8	0.136	133	0.078
34	0.136	108	0.063
13	0.136		

Table 27: Analytical results for calcium in precipitations samples.

Calcium in precipitation
Sample no.: 1
Theoretical value: 0.199
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.213
Median:	0.203
Standard deviation	0.111
Rel. st. deviation (%)	52.313

Run 2:

Number of laboratories:	65
Arithmetic mean value:	0.200
Median:	0.202
Standard deviation	0.050
Rel. st. deviation (%)	24.870

Results in decreasing order:

147	1.010 (*)	27	0.202
126	0.370	6	0.200
39	0.326	1	0.200
156	0.300	15	0.200
40	0.287	120	0.198
113	0.260	21	0.195
145	0.257	12	0.190
114	0.240	102	0.190
149	0.237	104	0.190
31	0.232	115	0.190
153	0.230	151	0.190
140	0.230	38	0.190
19	0.226	142	0.190
152	0.220	139	0.189
118	0.220	23	0.188
112	0.220	33	0.188
107	0.216	20	0.186
36	0.216	133	0.185
138	0.214	30	0.182
3	0.213	11	0.182
146	0.213	7	0.182
10	0.211	158	0.180
121	0.210	24	0.180
34	0.210	108	0.177
4	0.210	131	0.175
117	0.210	124	0.170
110	0.210	17	0.128
26	0.208	22	0.128
8	0.208	32	0.125
16	0.208	154	0.120
13	0.205	35	0.109
5	0.204	116	0.055
14	0.203	148	0.048

Calcium in precipitation
Sample no.: 2
Theoretical value: 0.238
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.246
Median:	0.240
Standard deviation	0.110
Rel. st. deviation (%)	44.837

Run 2:

Number of laboratories:	65
Arithmetic mean value:	0.234
Median:	0.240
Standard deviation	0.048
Rel. st. deviation (%)	20.684

Results in decreasing order:

147	1.040 (*)	16	0.240
39	0.377	4	0.240
156	0.340	27	0.239
108	0.317	8	0.238
126	0.310	146	0.236
145	0.295	13	0.235
153	0.290	10	0.233
40	0.279	38	0.232
31	0.275	1	0.230
30	0.261	140	0.230
34	0.260	124	0.230
112	0.260	24	0.230
114	0.260	139	0.224
107	0.253	23	0.222
3	0.251	33	0.221
118	0.250	115	0.220
152	0.250	151	0.220
121	0.250	12	0.220
113	0.250	104	0.220
138	0.250	158	0.220
117	0.250	131	0.217
36	0.246	11	0.216
26	0.245	7	0.215
19	0.245	110	0.210
14	0.243	20	0.191
21	0.242	32	0.180
5	0.242	35	0.177
149	0.242	17	0.175
15	0.240	133	0.161
120	0.240	22	0.155
102	0.240	154	0.130
6	0.240	148	0.077
142	0.240	116	0.069

Calcium in precipitation
Sample no.: 3
Theoretical value: 0.276
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.297
Median:	0.278
Standard deviation	0.209
Rel. st. deviation (%)	70.333

Run 2:

Number of laboratories:	65
Arithmetic mean value:	0.272
Median:	0.277
Standard deviation	0.056
Rel. st. deviation (%)	20.486

Results in decreasing order:

147	1.910 (*)	8	0.277
35	0.435	16	0.277
39	0.427	3	0.276
153	0.350	146	0.276
107	0.343	27	0.275
108	0.341	14	0.275
156	0.340	13	0.274
38	0.333	6	0.270
30	0.321	4	0.270
140	0.310	120	0.268
126	0.310	7	0.266
19	0.305	131	0.264
31	0.300	12	0.260
138	0.295	24	0.260
149	0.290	139	0.260
34	0.290	151	0.260
121	0.290	33	0.252
118	0.290	23	0.251
113	0.290	32	0.250
112	0.290	104	0.250
152	0.290	11	0.250
145	0.290	115	0.250
36	0.285	158	0.250
10	0.284	110	0.240
26	0.281	124	0.240
1	0.280	20	0.238
102	0.280	40	0.206
114	0.280	22	0.202
5	0.280	17	0.196
117	0.280	133	0.176
142	0.280	154	0.150
15	0.280	116	0.093
21	0.279	148	0.085

Calcium in precipitation
Sample no.: 4
Theoretical value: 0.284
Unit: µg/l

Run 1:

Number of laboratories:	66
Arithmetic mean value:	0.306
Median:	0.286
Standard deviation	0.195
Rel. st. deviation (%)	63.848

Run 2:

Number of laboratories:	65
Arithmetic mean value:	0.283
Median:	0.286
Standard deviation	0.054
Rel. st. deviation (%)	19.089

Results in decreasing order:

147	1.810 (*)	146	0.286
39	0.451	16	0.285
35	0.412	149	0.285
153	0.360	32	0.283
156	0.350	27	0.283
140	0.350	8	0.283
30	0.347	10	0.281
31	0.335	142	0.280
107	0.322	4	0.280
145	0.319	24	0.280
126	0.310	102	0.280
114	0.310	13	0.279
138	0.305	131	0.276
34	0.305	133	0.274
120	0.304	38	0.273
19	0.303	7	0.272
23	0.302	12	0.270
36	0.301	151	0.270
121	0.300	104	0.270
118	0.300	158	0.270
112	0.300	139	0.266
108	0.297	33	0.263
3	0.295	11	0.261
26	0.295	110	0.260
1	0.290	115	0.260
6	0.290	20	0.248
21	0.290	124	0.240
113	0.290	40	0.216
15	0.290	17	0.205
117	0.290	22	0.190
152	0.290	154	0.140
5	0.289	148	0.124
14	0.287	116	0.082

Table 28: Analytical results for potassium in precipitations samples.

Potassium in precipitation
Sample no.: 1
Theoretical value: 0.306
Unit: µg/l

Run 1:

Number of laboratories:	65
Arithmetic mean value:	0.297
Median:	0.297
Standard deviation	0.039
Rel. st. deviation (%)	13.119

Run 2:

Number of laboratories:	61
Arithmetic mean value:	0.293
Median:	0.296
Standard deviation	0.025
Rel. st. deviation (%)	8.600

Results in decreasing order:

149	0.458	(*)	39	0.296
153	0.400	(*)	13	0.296
148	0.377	(*)	21	0.295
14	0.360		40	0.295
112	0.350		146	0.293
156	0.350		23	0.292
11	0.345		113	0.290
10	0.324		115	0.290
117	0.320		33	0.290
19	0.317		16	0.290
5	0.314		151	0.290
26	0.313		158	0.290
126	0.310		32	0.289
118	0.310		3	0.289
15	0.310		36	0.286
138	0.307		31	0.284
1	0.304		116	0.283
8	0.302		104	0.280
34	0.301		124	0.280
121	0.300		145	0.278
4	0.300		140	0.270
6	0.300		38	0.262
114	0.300		30	0.258
12	0.300		131	0.256
147	0.300		133	0.255
110	0.300		35	0.252
107	0.300		154	0.250
142	0.300		120	0.249
102	0.300		108	0.247
27	0.300		139	0.243
152	0.298		22	0.239
20	0.297		17	0.174 (*)
7	0.297			

Potassium in precipitation
Sample no.: 2
Theoretical value: 0.265
Unit: µg/l

Run 1:

Number of laboratories:	64
Arithmetic mean value:	0.258
Median:	0.257
Standard deviation	0.040
Rel. st. deviation (%)	15.427

Run 2:

Number of laboratories:	61
Arithmetic mean value:	0.256
Median:	0.256
Standard deviation	0.027
Rel. st. deviation (%)	10.543

Results in decreasing order:

153	0.410	(*)	34	0.256
149	0.390	(*)	39	0.256
148	0.331		21	0.256
156	0.320		152	0.253
112	0.320		7	0.252
14	0.307		33	0.252
108	0.304		145	0.251
110	0.280		146	0.251
10	0.280		32	0.250
138	0.280		158	0.250
5	0.270		113	0.250
117	0.270		114	0.250
26	0.270		121	0.250
118	0.270		124	0.250
31	0.270		104	0.250
3	0.269		147	0.250
19	0.269		13	0.248
40	0.269		120	0.247
23	0.265		16	0.244
8	0.262		116	0.244
1	0.260		20	0.241
4	0.260		30	0.237
6	0.260		131	0.227
142	0.260		35	0.219
12	0.260		38	0.217
151	0.260		139	0.215
15	0.260		22	0.211
102	0.260		115	0.210
126	0.260		140	0.210
27	0.258		133	0.205
36	0.258		154	0.180
107	0.258		17	0.133 (*)
			11	<0.300

Potassium in precipitation
Sample no.: 3
Theoretical value: 0.183
Unit: µg/l

Run 1:

Number of laboratories:	64
Arithmetic mean value:	0.185
Median:	0.180
Standard deviation	0.041
Rel. st. deviation (%)	22.227

Run 2:

Number of laboratories:	59
Arithmetic mean value:	0.179
Median:	0.180
Standard deviation	0.022
Rel. st. deviation (%)	12.228

Results in decreasing order:

153	0.320	(*)	110	0.180
30	0.308	(*)	114	0.180
149	0.306	(*)	118	0.180
156	0.300	(*)	8	0.179
108	0.244		13	0.179
148	0.231		31	0.179
112	0.230		20	0.178
121	0.220		7	0.178
151	0.210		27	0.177
22	0.201		39	0.177
115	0.200		23	0.177
14	0.193		3	0.176
19	0.192		33	0.175
158	0.190		116	0.174
117	0.190		107	0.173
12	0.190		6	0.170
10	0.189		124	0.170
26	0.187		36	0.169
146	0.186		152	0.167
34	0.185		145	0.166
133	0.185		16	0.166
138	0.184		120	0.165
5	0.184		131	0.162
32	0.181		102	0.160
1	0.180		142	0.160
126	0.180		140	0.160
4	0.180		139	0.150
147	0.180		35	0.147
15	0.180		38	0.133
21	0.180		113	0.130
40	0.180		154	0.110
104	0.180		17	0.060 (*)
			11	<0.300

Potassium in precipitation
Sample no.: 4
Theoretical value: 0.143
Unit: µg/l

Run 1:

Number of laboratories:	64
Arithmetic mean value:	0.144
Median:	0.139
Standard deviation	0.040
Rel. st. deviation (%)	27.549

Run 2:

Number of laboratories:	59
Arithmetic mean value:	0.139
Median:	0.138
Standard deviation	0.024
Rel. st. deviation (%)	16.945

Results in decreasing order:

120	0.269	(*)	13	0.138
149	0.263	(*)	27	0.138
156	0.260	(*)	39	0.138
153	0.230	(*)	40	0.138
148	0.210		107	0.137
112	0.190		8	0.137
30	0.181		23	0.137
121	0.180		5	0.137
151	0.180		33	0.136
108	0.179		7	0.133
31	0.166		114	0.130
4	0.160		142	0.130
14	0.158		140	0.130
34	0.156		124	0.130
19	0.152		126	0.130
12	0.150		16	0.130
117	0.150		147	0.130
146	0.147		6	0.130
3	0.146		102	0.130
138	0.146		110	0.130
10	0.145		36	0.127
26	0.144		152	0.126
145	0.143		116	0.124
20	0.141		22	0.120
118	0.140		131	0.116
1	0.140		139	0.115
113	0.140		35	0.114
104	0.140		133	0.100
21	0.140		38	0.094
15	0.140		154	0.080
158	0.140		115	0.070
32	0.139		17	0.020 (*)
			11	<0.300

Table 29: Analytical results for conductivity in precipitations samples.

Conductivity in precipitation
Sample no.: 1
Theoretical value: 43.500
Unit: µS/cm

Run 1:

Number of laboratories:	63
Arithmetic mean value:	40.694
Median:	42.000
Standard deviation	6.135
Rel. st. deviation (%)	15.075

Run 2:

Number of laboratories:	60
Arithmetic mean value:	41.789
Median:	42.200
Standard deviation	2.911
Rel. st. deviation (%)	6.965

Results in decreasing order:

139	50.000	117	42.000	
149	49.880	23	41.900	
108	45.700	158	41.700	
12	45.600	114	41.700	
5	44.500	126	41.400	
21	44.060	32	41.400	
142	43.700	121	41.300	
102	43.700	133	41.300	
115	43.600	8	41.300	
20	43.530	145	41.200	
10	43.500	18	41.000	
31	43.400	124	41.000	
7	43.200	118	41.000	
15	43.200	154	40.900	
14	43.000	16	40.900	
151	42.900	120	40.800	
107	42.800	34	40.500	
3	42.800	17	40.500	
38	42.800	110	40.500	
1	42.800	6	39.800	
27	42.800	146	39.700	
112	42.700	152	38.600	
33	42.700	104	38.300	
22	42.600	147	37.000	
19	42.500	156	36.800	
36	42.400	113	34.800	
13	42.400	153	34.470	
140	42.300	116	31.910	
11	42.200	148	26.200	(*)
35	42.200	40	26.000	(*)
4	42.200	138	4.150	(*)
30	42.000			

Conductivity in precipitation
Sample no.: 2
Theoretical value: 45.900
Unit: µS/cm

Run 1:

Number of laboratories:	63
Arithmetic mean value:	43.095
Median:	44.800
Standard deviation	6.381
Rel. st. deviation (%)	14.806

Run 2:

Number of laboratories:	60
Arithmetic mean value:	44.237
Median:	44.950
Standard deviation	2.923
Rel. st. deviation (%)	6.607

Results in decreasing order:

139	53.000	18	44.800	
12	48.400	4	44.700	
108	47.800	23	44.600	
5	47.000	13	44.233	
140	46.700	34	44.200	
21	46.520	16	44.000	
20	46.400	151	44.000	
38	46.300	8	43.900	
115	46.000	36	43.900	
14	46.000	133	43.900	
10	45.850	32	43.700	
15	45.700	110	43.700	
31	45.700	30	43.500	
11	45.500	145	43.400	
114	45.400	158	43.300	
22	45.400	6	43.100	
27	45.300	118	43.000	
3	45.300	17	43.000	
102	45.300	156	42.600	
142	45.300	124	42.000	
121	45.200	147	42.000	
126	45.200	152	41.400	
104	45.200	153	41.290	
1	45.100	146	41.100	
112	45.100	113	38.700	
35	45.100	7	38.000	
19	45.100	116	37.410	
33	45.100	148	31.000	
107	45.100	40	29.000	(*)
117	45.000	149	27.406	(*)
120	44.900	138	4.400	(*)
154	44.800			

Conductivity in precipitation
Sample no.: 3
Theoretical value: 25.500
Unit: µS/cm

Run 1:

Number of laboratories:	63
Arithmetic mean value:	24.686
Median:	25.200
Standard deviation	3.490
Rel. st. deviation (%)	14.136

Run 2:

Number of laboratories:	60
Arithmetic mean value:	25.062
Median:	25.250
Standard deviation	1.370
Rel. st. deviation (%)	5.465

Results in decreasing order:

139	33.000	(*)	112	25.200
149	28.672		115	25.100
34	26.700		120	25.100
108	26.700		23	25.100
12	26.600		147	25.000
31	26.500		118	25.000
153	26.480		117	25.000
5	26.400		32	24.900
104	26.300		6	24.900
3	26.270		133	24.800
121	26.200		35	24.800
30	26.200		110	24.800
15	26.100		13	24.700
14	26.000		8	24.700
21	25.880		158	24.600
20	25.860		107	24.500
11	25.800		152	24.400
10	25.730		16	24.300
27	25.700		145	24.200
1	25.700		102	24.100
4	25.600		142	24.100
114	25.600		124	24.000
17	25.500		7	23.600
140	25.400		156	23.600
19	25.400		146	23.200
33	25.400		116	22.490
36	25.320		113	21.800
154	25.300		148	21.700
151	25.300		38	19.600
22	25.300		40	16.000	(*)
18	25.300		138	2.520	(*)
126	25.200				

Conductivity in precipitation
Sample no.: 4
Theoretical value: 26.800
Unit: µS/cm

Run 1:

Number of laboratories:	63
Arithmetic mean value:	24.905
Median:	26.030
Standard deviation	4.900
Rel. st. deviation (%)	19.676

Run 2:

Number of laboratories:	61
Arithmetic mean value:	25.660
Median:	26.100
Standard deviation	2.547
Rel. st. deviation (%)	9.928

Results in decreasing order:

139	34.000	117	26.000	
3	28.100	23	26.000	
108	27.800	115	26.000	
5	27.700	32	25.900	
12	27.700	36	25.880	
104	27.200	6	25.800	
15	27.200	107	25.800	
21	27.130	8	25.800	
140	27.000	147	25.600	
34	27.000	35	25.600	
20	26.960	110	25.600	
22	26.900	158	25.600	
121	26.900	16	25.500	
10	26.720	102	25.300	
27	26.700	142	25.300	
4	26.700	145	25.100	
31	26.600	7	25.100	
126	26.600	14	25.000	
11	26.500	152	25.000	
120	26.500	118	25.000	
114	26.500	124	25.000	
17	26.500	156	24.700	
1	26.400	116	23.200	
19	26.400	113	23.000	
18	26.400	148	21.600	
33	26.400	146	21.600	
153	26.370	38	19.900	
30	26.300	40	16.000	
112	26.200	151	15.800	
154	26.100	138	2.630	(*)
133	26.100	149	1.064	(*)
13	26.030			

Table 30: Ratio of the measured to the calculated conductivity in synthetic precipitation samples (G1-G4).

Lab.No.	Measured value / calculated value				Remarks
	G1	G2	G3	G4	
1	0.90	0.96	0.96	0.97	
3	1.03	1.05	1.05	1.11	
4	1.00	1.00	1.01	1.01	
5	1.04	1.06	1.04	1.04	
6	0.93	0.95	0.97	0.97	
7	1.13	0.78	0.88	0.90	
8	1.03	1.02	1.01	1.01	
10	0.96	0.96	0.93	0.94	
11	1.08	1.11	1.15	1.12	
12	1.02	1.06	0.99	1.03	
13	1.04	1.00	0.98	0.97	
14	1.11	1.07	1.10	0.99	
15	1.03	1.05	1.06	1.04	
16	1.00	0.97	0.99	0.98	
17	0.74	0.79	0.87	0.90	
18	1.25	1.13	1.62	1.51	Reports only SO_4^{2-}, NH_4^+, Cl^-, pH and cond.
19	1.28	1.25	1.22	1.25	
20	1.13	1.12	1.07	1.06	
21	1.05	1.05	1.04	1.04	
22	0.94	0.80	0.87	0.87	
23	0.97	1.03	1.01	0.99	
24					Conductivity is missing
26					Conductivity is missing
27	1.08	1.09	1.07	1.06	
30	0.96	0.98	1.01	1.03	
31	1.10	1.07	1.08	1.10	
32	0.98	0.95	1.00	0.96	
33	0.99	0.99	1.01	1.01	
34	1.07	1.04	1.10	1.10	
35	1.08	1.05	1.04	1.01	
36	1.08	1.05	1.01	1.03	
38	0.53	0.54	0.41	0.40	
39					Conductivity is missing
40	0.95	1.05	1.12	1.20	SO_4^{2-} is missing
102	0.96	0.93	0.87	0.91	
104	1.16	1.22	1.21	1.24	
107	1.03	1.00	0.96	1.00	
108	1.00	0.89	0.94	1.00	
110	1.23	1.03	1.17	1.23	
111					
112	1.11	1.12	1.10	1.09	
113	0.91	0.92	1.07	0.99	
114	1.08	1.05	1.04	1.00	
115	1.21	1.14	1.11	1.07	
116	0.78	0.82	0.89	0.87	
117	1.61	1.43	1.54	1.23	
118	0.99	0.96	1.01	0.96	
120	1.02	1.03	1.00	1.00	
121	1.02	1.00	1.02	1.01	
124	0.98	0.99	0.96	1.00	
125					
126	1.06	1.00	1.01	1.02	
133	1.12	1.09	1.06	1.06	
137					
138	0.86	0.87	0.88	0.87	

Table 30, cont.

Lab.No.	Measured value / calculated value				Remarks
	G1	G2	G3	G4	
139	1.18	1.20	1.33	1.39	
140	1.09	1.07	1.05	1.07	
141					
142	0.96	0.93	0.87	0.91	
143					
144					
145	0.97	0.97	0.97	0.93	
146	0.98	1.00	1.05	0.90	
147	0.96	1.04	0.81	0.85	
148	0.74	0.78	0.98	0.93	
149	1.12	0.59	1.10	0.04	
151	1.19	1.18	1.17	0.71	
152	0.99	1.05	1.03	1.04	
153	1.02	1.05	1.14	1.11	
154	0.77	0.92	0.96	0.88	
156	1.52	1.61	1.06	1.13	
158	1.06	1.08	1.05	1.05	

Table 31: Ratio of equivalent concentration of anions to the equivalent concentration of cation measured in synthetic precipitation samples.

Lab.No.	Measured value / calculated value					Remarks
	G1	G2	G3	G4	Average	
1	0.93	0.98	0.96	0.98	0.96	
3	1.02	1.05	1.01	0.99	1.02	
4	1.02	1.02	0.98	0.97	1.00	
5	1.04	1.04	1.01	1.02	1.03	
6	0.99	0.99	0.98	0.98	0.98	
7	1.22	1.00	1.01	1.03	1.06	
8	1.09	1.07	1.05	1.05	1.07	
10	1.04	1.05	1.06	1.27	1.11	
11	1.23	1.19	1.33	1.27	1.26	
12	1.00	1.03	0.98	1.01	1.01	
13	1.07	1.09	1.09	1.08	1.08	
14	1.09	1.05	1.01	0.99	1.04	
15	1.03	1.07	1.00	1.02	1.03	
16	1.03	0.99	1.02	0.99	1.01	
17	0.87	0.93	1.03	1.08	0.97	
18	0.96	0.98	0.56	0.73	0.81	
19	1.23	1.19	1.16	1.19	1.19	
20	1.10	1.11	1.05	1.04	1.07	
21	1.06	1.06	1.02	1.02	1.04	
22	2.20	2.20	1.65	1.75	1.95	
23	1.04	1.06	1.03	1.00	1.03	
24	1.17	1.16	1.06	1.10	1.12	
26	1.06	1.09	1.01	1.02	1.05	
27	1.10	1.11	1.05	1.05	1.08	
30	1.16	1.15	0.95	0.93	1.05	
31	0.99	1.00	0.92	0.94	0.96	
32	1.04	1.06	1.00	1.03	1.03	
33	1.03	1.03	1.05	1.03	1.04	
34	1.11	1.04	1.01	1.06	1.06	
35	1.24	1.14	1.01	1.02	1.10	
36	1.05	1.04	0.98	1.00	1.02	
38	0.55	0.53	0.63	0.62	0.58	
39	1.08	1.04	0.99	1.01	1.03	
40	0.35	0.29	0.62	0.55	0.45	
102	1.01	0.94	0.97	0.93	0.96	
104	0.01	0.01	0.03	0.03	0.02	
107	1.05	1.04	0.85	1.00	0.98	
108	0.66	0.87	1.00	0.89	0.86	
109	1.05	1.05	0.92	0.95	0.99	
110	1.30	1.09	1.14	1.22	1.19	
112	1.05	1.05	0.92	0.95	0.99	
113	1.06	1.10	1.19	1.11	1.11	
114	1.07	1.02	1.01	0.99	1.03	
115	1.21	1.13	1.08	1.13	1.14	
116	1.13	1.15	1.14	1.22	1.16	
117	1.46	1.35	1.25	1.08	1.28	
118	1.15	1.14	1.06	1.07	1.11	
120	1.03	1.02	0.98	0.90	0.98	
121	0.96	0.97	0.96	0.98	0.97	
124	0.99	1.10	1.08	1.08	1.06	
126	0.89	0.97	0.96	0.97	0.95	
131	0.89	0.89	0.95	0.95	0.92	
133	1.41	1.38	1.51	1.38	1.42	
138	0.91	0.92	0.93	0.94	0.92	
139	1.18	1.12	1.09	1.10	1.12	

Table 31, cont.

Lab.No.	Measured value / calculated value					Remarks
	G1	G2	G3	G4	Average	
140	1.14	1.10	1.03	1.05	1.08	
142	1.01	0.94	0.97	0.93	0.96	
145	0.69	0.72	0.73	0.80	0.73	
146	1.04	1.07	1.05	1.05	1.05	
147	0.75	0.81	0.47	0.50	0.63	
148	1.33	1.32	1.21	1.17	1.26	
149	0.94	0.98	0.97	0.99	0.97	
151	0.72	0.73	0.73	0.71	0.72	
152	1.07	1.11	0.93	0.98	1.02	
153	1.20	1.13	1.02	1.04	1.10	
154	0.86	0.97	1.02	0.88	0.93	
156	1.89	1.39	1.54	1.45	1.57	
158	1.08	1.11	1.01	1.01	1.05	

Table 32: The ratio of the median values to the theoretical values for all parameters and samples.

Parameter	Sample No.	Median / Expected
SO_4-S	G1	0.99
	G2	0.99
	G3	1.00
	G4	0.99
NO_3-N	G1	0.97
	G2	0.98
	G3	0.98
	G4	0.99
NH_4-N	G1	1.00
	G2	1.02
	G3	1.00
	G4	1.03
pH (calc.From H^+)	G1	0.95
	G2	0.96
	G3	0.79
	G4	0.81
H	G1	0.82
	G2	0.96
	G3	0.75
	G4	0.49
Mg	G1	1.04
	G2	1.01
	G3	1.02
	G4	1.01
Na	G1	0.98
	G2	0.96
	G3	0.97
	G4	0.95
Cl	G1	0.97
	G2	0.98
	G3	0.96
	G4	0.94
Ca	G1	1.05
	G2	1.01
	G3	1.01
	G4	1.02
K	G1	0.98
	G2	0.95
	G3	0.98
	G4	0.98
Cond	G1	0.95
	G2	0.96
	G3	0.98
	G4	0.96

Table 33: Analytical methods used for the determination of chemical constituents in precipitation samples.

Constituents	Methods	Laboratory
SO_4	1. Thorin	18
	2. Ion chromatography	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 26, 27, 31,32, 33, 34, 35, 36, 38, 104, 107,110, 111, 114, 115, 116, 118, 126, 130, 131, 133, 135, 136, 138, 140, 145, 146, 147, 151, 152, 154, 156, 158
	3. Capillary electrophoresis	39
	4. ICP-AES	109, 112, 113, 117
	5. FIA	121
NO_3	1 Griess after Cd-red.	112,117
	2 Ion chromatography	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 26, 27, 31,32, 33, 34, 35, 36, 38, 107,110, 113, 114, 115, 116, 118, 126,130, 131, 133, 135, 136, 138, 140, 145,146,147,151,152,154,156,158
	3 UV-method/Photometric	40, 104,
	4 Capillary electrophoresis	39
	5 FIA	109, 111, 121
NH_4	1 Indophenol	10, 19, 20, 32, 33, 34, 39, 40, 112, 114, 116, 117, 126, 140
	2 Berthelot reaction, salycilate	26, 118,
	3 Ion chromatography	1, 5, 6, 7, 8, 12, 13, 15, 21, 22, 23, 24, 31, 35, 36, 107,113, 115, 131,135,136,151,154,156,158
	4 Flow injection analysis (FIA)	14, 27, 109, 111, 121,145,146,147,152
	5 Chloramin T	16
	6 Nessler method	18,
	7 Kjeldahl	
	8 Photometry	3, 4, 104, 110,114, 133
H^+	Titration	6, 13,14, 31, 34, 104, 126,146, 154
Mg	1 Atomic absorption (AAS)	3, 4, 10, 16, 19, 22, 26, 27, 33, 34, 38, 39, 40, 116, 133, 154, 156
	2 Ion chromatography	1, 5, 6, 7, 8, 12, 13, 15, 20, 21, 23, 31, 35, 36, 107, 113, 114, 126, 130, 131, 135, 136, 138, 140, 145, 146, 147,158
	3 ICP-AES	11, 104, 109, 111, 112, 115, 117, 118, 121,151,152
	4 ICP-MS	14
Na	1 AES	32, 33, 38, 39, 116, 133
	2 AAS	3, 4, 10, 16, 19, 26, 27, 34, 40,154,156
	3 ICP-AES	11, 104, 109, 110,111, 112, 115, 117,118, 121
	5 Ion chromatography	1, 5, 6, 7, 8, 12, 13, 15, 20, 21, 22, 23, 31, 35, 36, 107, 113, 114, 126, 130, 131, 135, 136, 138, 140, 145, 146, 147, 151, 152, 158
	6 ICP-MS	14
Cl	1 Mercury thiocyanate-iron	18, 117, 40
	2 Ion chromatography	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 26, 27, 31,32, 33, 34, 35, 36, 38, 104, 107,110, 111, 113, 114, 115, 116, 118, 126, 130, 131, 133, 135, 136, 138, 140, 145, 146, 147, 151, 152, 154, 156, 158
	3 Capillary electrophoresis	39
	4 Potentiometric method	109, 112
	5 FIA	121
Ca	1 AAS	3, 4, 10, 16, 19, 22, 26, 27, 33, 34, 38, 39, 40, 116, 133, 154,156
	2 ICP-AES	11, 104, 109,110, 111, 112, 115,117, 118, 121, 151, 152
	3 Ion chromatography	1, 5, 6, 7, 8, 12, 15, 20,21, 23, 31, 35, 36, 107, 113, 114, 126, 130, 131, 135, 136, 138, 140, 145, 146, 147, 158
	6 AES	32,
	7 ICP-MS	14
K	1 AAS	3, 4, 10, 16, 19, 26, 27, 33, 34, 35, 40,154
	2 Ion chromatography	1, 5, 6, 7, 8, 12, 13, 15, 20, 21, 22, 23, 31, 35, 36, 107, 113, 114, 126,130, 131, 135, 136, 138, 140, 145, 146, 147, 151, 158
	3 AES	32, 39, 116, 133, 156
	4 ICP-AES	11, 104, 109, 110,111, 112, 115, 117, 118, 121,152
	5 ICP-MS	14

Table 34: Relative random and systematic errors obtained by the different laboratories in the analysis of each parameter in the precipitation samples.

Lab. no.	SO_4^{2-}		NO^{3-}		NH_4^+		Mg^{2+}		H^+ calc	
	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %
1	0	0	0	-2	2	-7	2	-2	11	0
3	1	1	1	-1	2	10	2	-1	4	-14
4	0	2	1	-5	0	-1	2	0	3	-10
5	1	1	0	2	1	-1	1	-1	4	-10
6	1	-3	1	-2	2	-5	2	-6	4	0
7	2	4	0	1	1	-3	2	-5	15	-7
8	0	1	0	1	1	-3	0	0	2	-16
10	6	8	1	0	0	-5	1	-1	7	0
11	1	-2	1	-1			1	-6	2	-16
12	0	2	0	0	2	1	2	2	7	-4
13	0	5	5	3	6	-3	1	0	3	-13
14	1	4	1	-7	0	-2	1	-3	3	-19
15	1	-1	2	2	0	-4	1	-1	4	-13
16	2	-2	2	-2	3	3	2	-6	6	0
17	0	0	**2**	**0**	4	15	3	6	22	21
18	14	-32			25	-6			5	-13
19	7	-5	4	8	1	-2	1	0	4	-40
20	1	-2	1	0	3	-1	4	-14	2	-17
21	1	2	1	-2	0	0	0	0	4	-11
22	45	113	2	-3	3	16	1	-13	10	-18
23	0	-2	1	4	3	5	4	-5	5	-12
24	3	2	3	-2	2	-1	8	-2	2	-12
26	1	-2	2	-2	0	-1	1	1	2	-19
27	0	1	0	0	0	0	0	0	1	-19
30	4	10	4	4	26	21	26	15	10	-16
31	2	-10	2	5	10	9	5	-1	4	-15
32	3	-5	2	1	1	3			5	-5
33	1	4	0	-3	1	0	2	-4	5	-8
34	1	0	1	-4	4	-3	1	0	3	-18
35	2	5	0	-4	1	4	6	-42	3	-19
36	2	-3	0	-2	1	4	2	0	2	-17
38	2	-5	1	-2	2	0	0	-12	37	128
39	3	4	2	3	5	1	11	-4	3	-11
40	27	-99	5	26	23	185	10	-22	5	-58
102	3	3	17	1	6	4	3	8	8	2
104	18	-60	3	-1	3	-4	2	3	4	-17
107	3	6	1	-7	31	16	4	9	4	-14
108	22	-8	5	6	2	0	5	-74	14	14
110	1	-1	1	-3	2	-2	3	-28	13	-33
112	1	-8	4	-7	5	7	2	3	2	-23
113	3	-2	1	0	9	-8	7	17	6	-24
114	1	-3	0	1	2	2	6	-9	4	-14
115	1	-1	1	-3	11	-2	2	-9	5	-24
116	3	8	2	-2	1	6	14	-23	4	-9
117	3	-4	2	-6	1	-3	2	3	16	-57
118	5	11	1	-2	1	-2	2	1	3	-14
120	2	-6	1	2	4	12	1	-3	1	-13
121	4	-5	1	2	1	-1	1	-4	5	-10
124	2	1	6	3	8	9	6	-2	5	-15
125	3	3	2	4						
126	5	-2	4	-5	6	-12	5	11	4	-13
131	1	-1	2	1	5	-9	1	-1	15	19
133	7	16	23	0	8	-20	8	-42	3	-26
138	0	2	1	-1	2	-4	2	10	8	11
139	5	3	5	-4	2	2	0	2	5	-10
140	2	4	1	4	1	3	9	3	4	-21
142	3	3	17	1	6	4	3	8	8	2
145	9	-24	10	-22	3	2	3	7	6	0
146	1	-4	1	0	1	-4	1	0	5	-21
147	1	-4	2	-7	9	24	57	178	8	-27
148	2	17	1	0	1	-6	6	-24	4	-32
149	1	2	2	2	1	0	3	2	6	-5
151	15	-36	15	-31	8	-18	2	-5	2	-16
152	1	-2	2	-10	4	4	1	0	4	-20
153	2	-1	1	-6	2	-35	5	13	8	-25
154	5	5	3	4	11	31	26	169	19	2
156	4	1	6	-9	15	10	5	2	22	-69
158	0	-2	0	-2	3	7	3	-7		-19

Table 34, cont.

Lab. no.	Na^+		Cl^-		Ca^{2+}		K^+		Cond.	
	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %	Random error %	Systematic error %
1	0	0	3	-7	2	2	1	-1	1	-1
3	5	1	1	-4	2	5	4	-1	2	0
4	1	10	4	-7	3	0	4	-2	2	-2
5	0	1	2	-5	0	2	3	1	0	3
6	2	0	2	-5	2	1	2	-4	4	-5
7	1	-1	1	-1	2	-6	1	-4	9	-5
8	1	-3	0	0	1	0	0	-2	2	-4
10	2	-8	24	26	3	1	3	5	0	0
11	1	-6	2	-5	1	-9	22	0	2	-1
12	1	-1	2	1	1	-6	2	0	2	5
13	4	-7	4	-7	2	-1	2	-3	1	-3
14	3	9	4	-21	1	1	8	13	3	-1
15	2	5	2	2	1	1	1	0	1	0
16	0	-2	4	-7	9	1	2	-7	2	-4
17	4	-17	18	63	3	-30	2	-57	3	-4
18			17	-26					3	-2
19	1	0			4	9	1	4	1	-2
20	3	-6	1	-6	5	-15	4	-3	0	1
21	2	-2	1	1	2	2	1	-3	0	1
22	8	-12	17	3	4	-31	15	-17	1	-1
23	3	-11	4	-2	7	-5	3	-3	1	0
24	2	-8	7	7	3	-5			0	0
26	0	1	2	2	1	3	1	2		
27	1	-2	0	-1	1	0	0	-3	1	-1
30	14	9	10	-3	13	14	31	2	4	-3
31	6	-1	4	-11	4	14	8	0	0	0
32	2	8	3	-7	12	-17	3	-4	2	-4
33	2	0	2	-1	2	-7	2	-5	1	-2
34	13	2	2	-3	2	7	4	-1	5	-2
35	13	9	2	-1	41	14	5	-18	1	-3
36	1	2	3	-4	1	5	2	-7	2	0
38	1	-2	3	-6	11	-3	1	-22	8	-9
39	2	-4	5	13	7	58	1	-3		
40	8	-4	6	6	26	-5	3	-2	9	-39
102	2	-7	20	-35	2	0	3	-4	2	-3
103					14	-103				
104	2	-5	13	-25	3	-6	4	-4	7	0
107	1	-2	4	-6	8	11	1	-3	0	-2
108	11	-9	12	-2	17	16	22	17	1	4
110	4	-7	3	2	8	-10	5	-2	3	-5
112	1	1			1	7	2	21	1	-2
113	5	-16	6	6	9	5	9	-7	6	-15
114	1	0	1	-2	6	10	2	-4	2	-1
115	5	-6	3	7	3	-8	16	-16	1	0
116	9	-13	2	-13	9	-71	2	-9	10	-17
117	1	-7	13	-2	1	3	2	3	1	-2
118	3	-2	5	-12	1	6	2	0	3	-6
120	7	-6	21	0	5	0	33	-8	3	-2
121	2	3			1	5	10	7	3	-1
122							30	-100		
124	6	-9	8	-9	6	-13	2	-6	3	-6
126	2	4	1	-5	24	21	3	-2	2	-1
131	0	-11	4	-5	3	-7	5	-14		
133	5	6	23	37	15	-18	11	-21	2	-4
138	4	-4	3	-6	1	7	3	1	2	-3
139	10	-32	4	8	1	-6	6	-19	1	20
140	6	2	4	2	12	13	8	-13	2	0
142	2	-7	20	-35	2	0	3	-4	2	-3
145	2	2	8	-9	7	19	5	-7	1	-5
146	1	2	2	-3	3	1	3	-2	3	-12
147	13	6	8	-22	136	469	2	-4	7	-7
148	8	43	16	-36	6	-64	4	30	16	-28
149	6	5	1	0	6	4	6	55	37	-22
151	3	-2	23	-36	1	-6	10	5	12	-3
152	3	-6	16	-12	2	5	2	-6	4	-9
153	2	-7	4	-2	7	25	11	52	12	-7
154	10	-17	16	14	11	-47	5	-30	3	-2
156	7	11	132	307	6	34	13	38	6	-8
158	2	5	2	-5	2	-7	4	-4	2	-4

Appendix 2

Figures

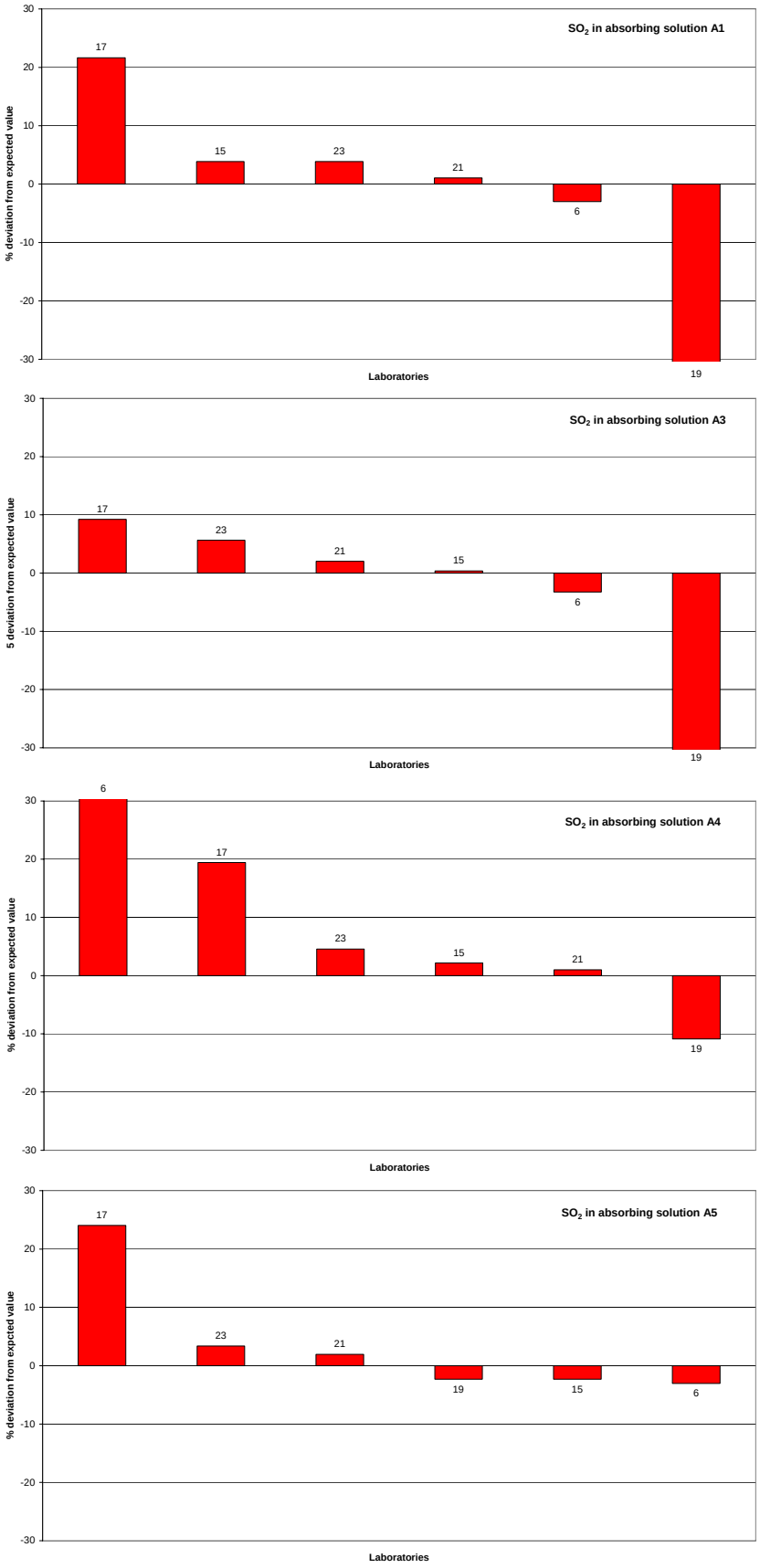


Figure 2: SO_2 in absorbing solution.

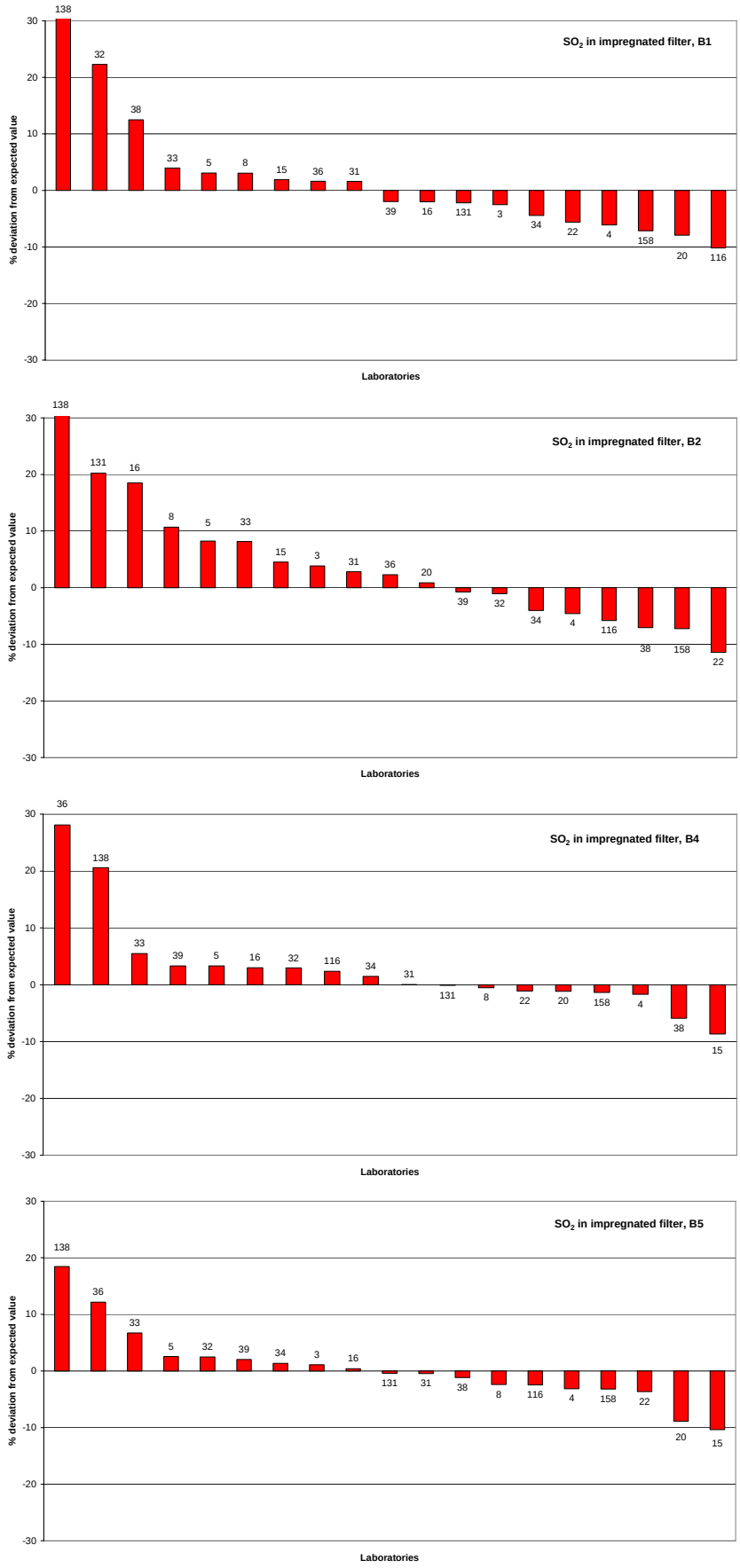


Figure 3: SO_2 in impregnated filter.

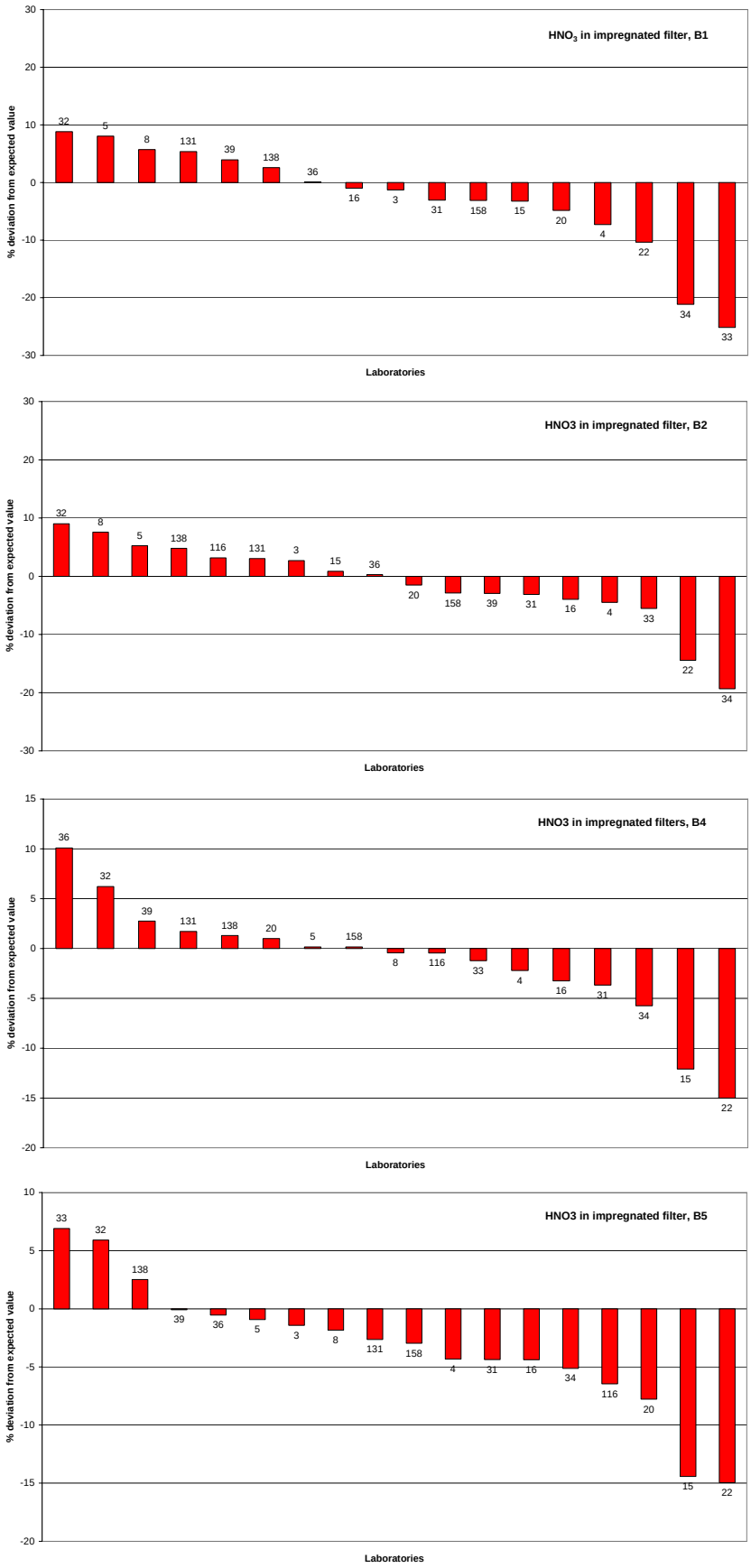


Figure 4: HNO_3 in impregnated filter.

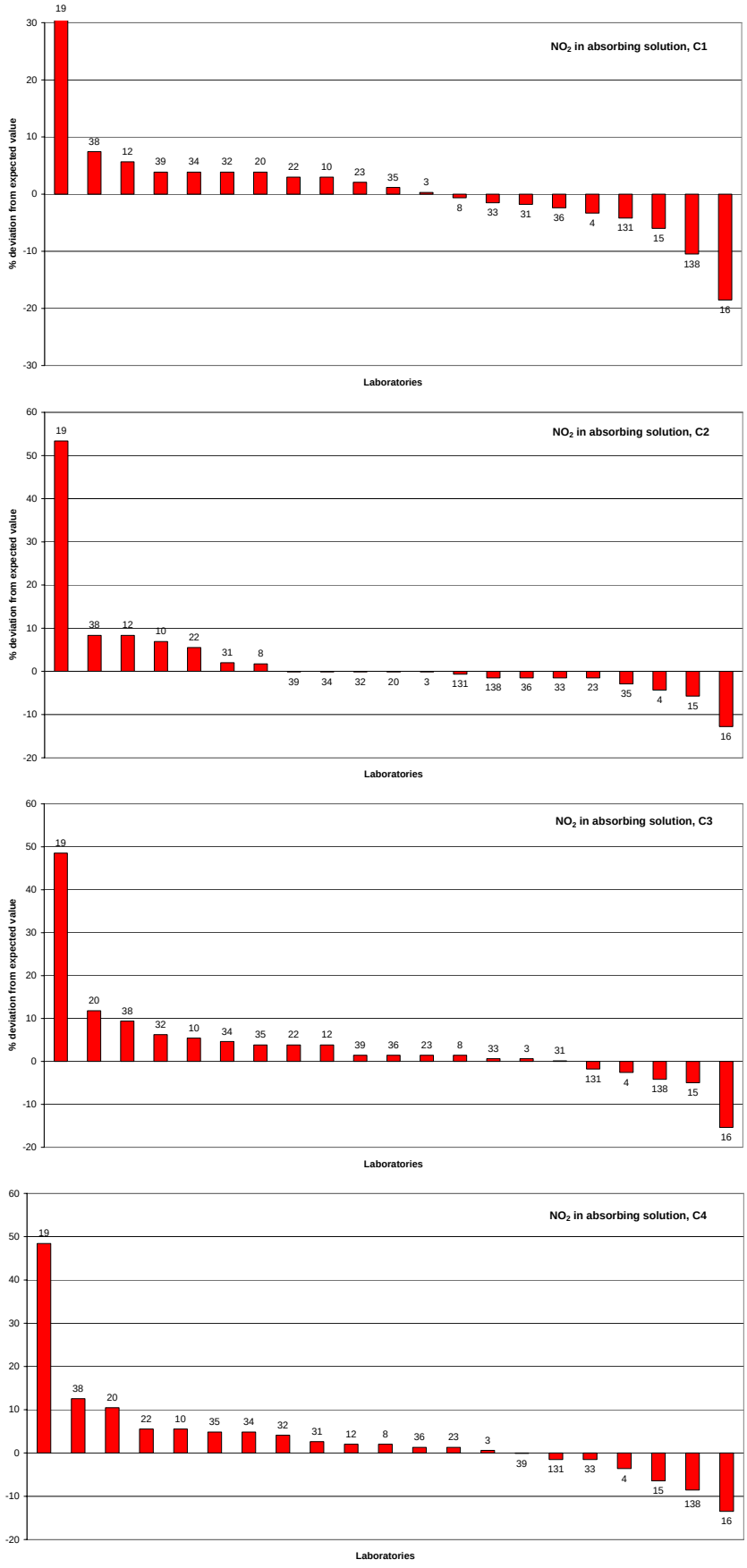


Figure 5: NO_2 in absorbing solution.

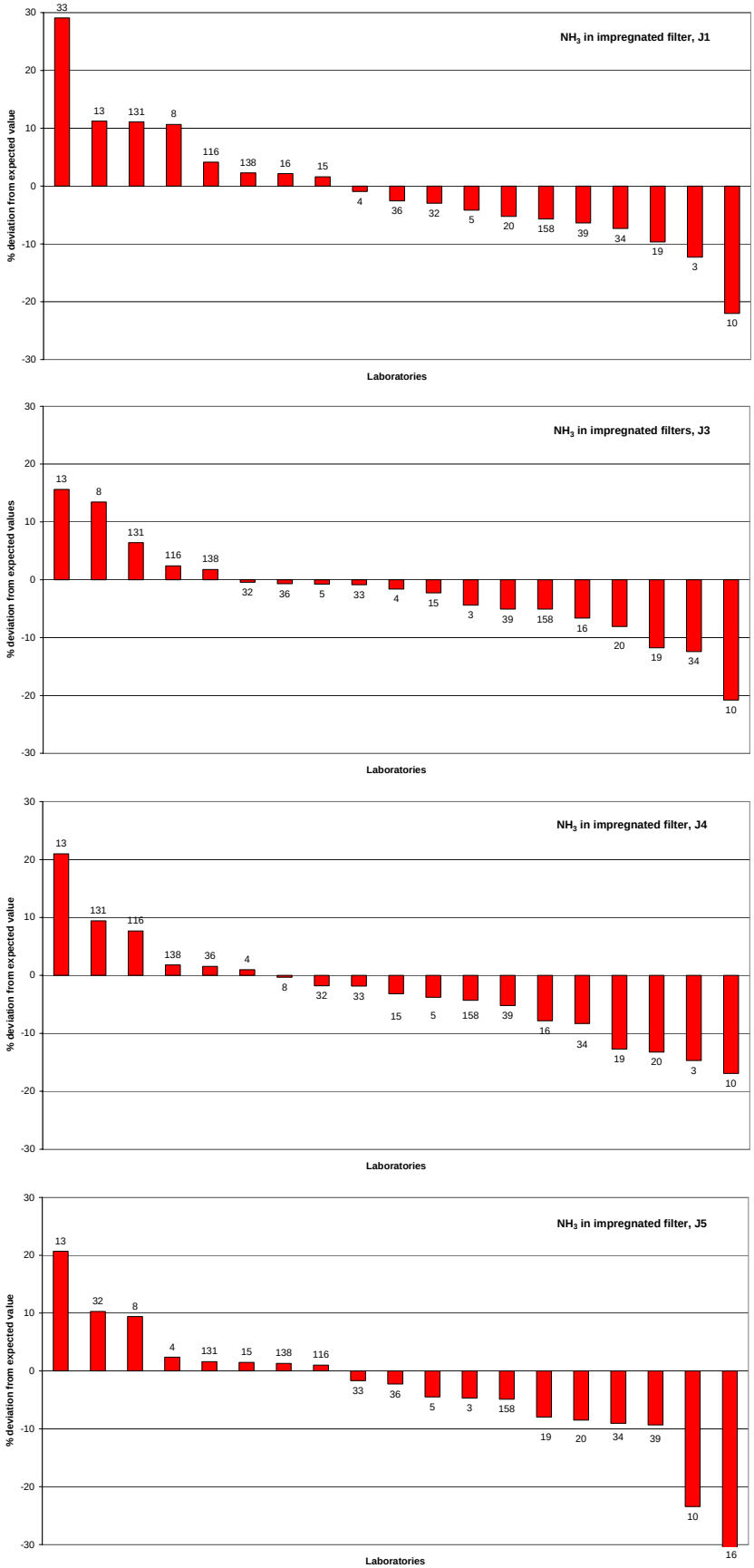


Figure 6: NH_3 in impregnated filter.

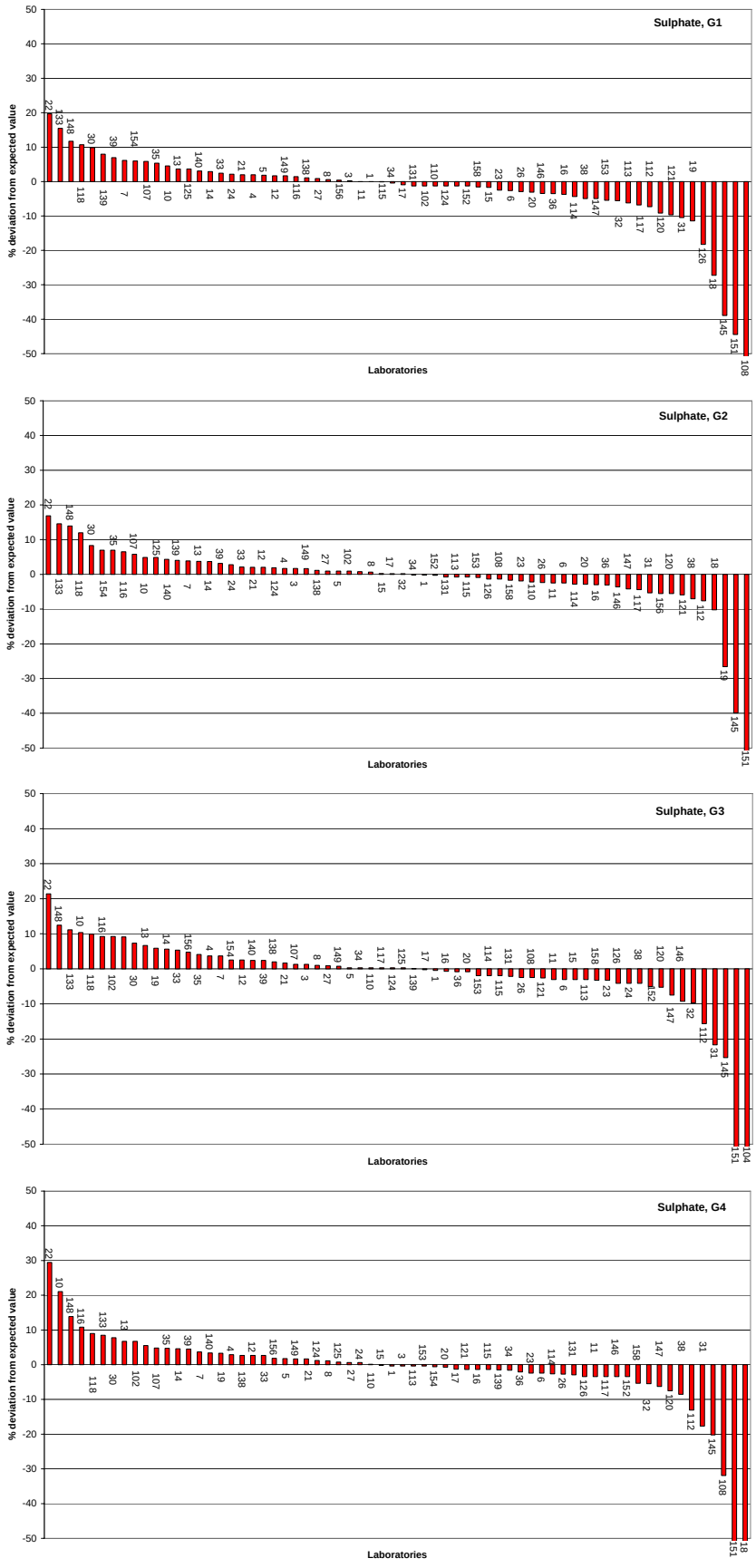


Figure 7: Percent deviation from theoretical value for sulphate.

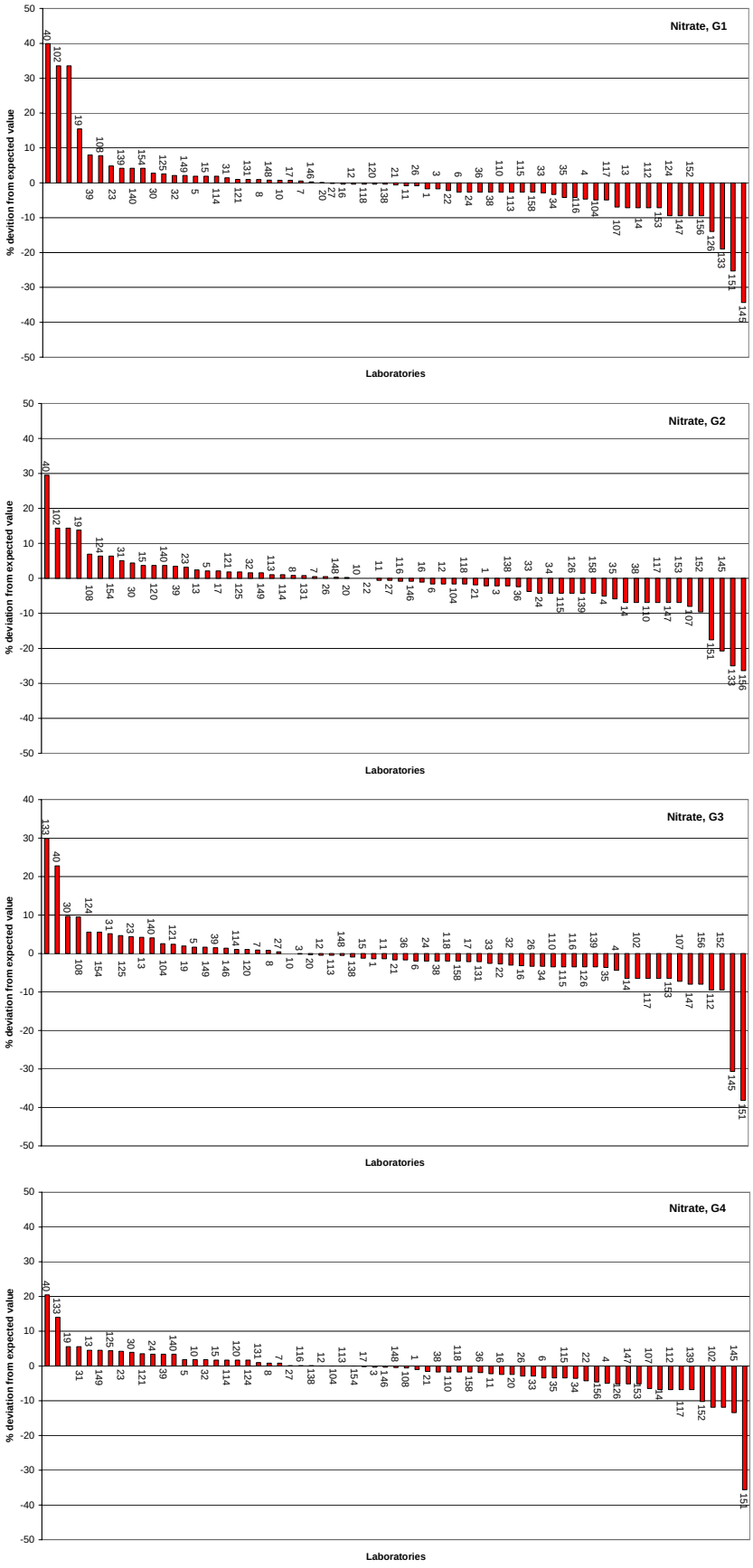


Figure 8: Percent deviation from theoretical value for nitrate.

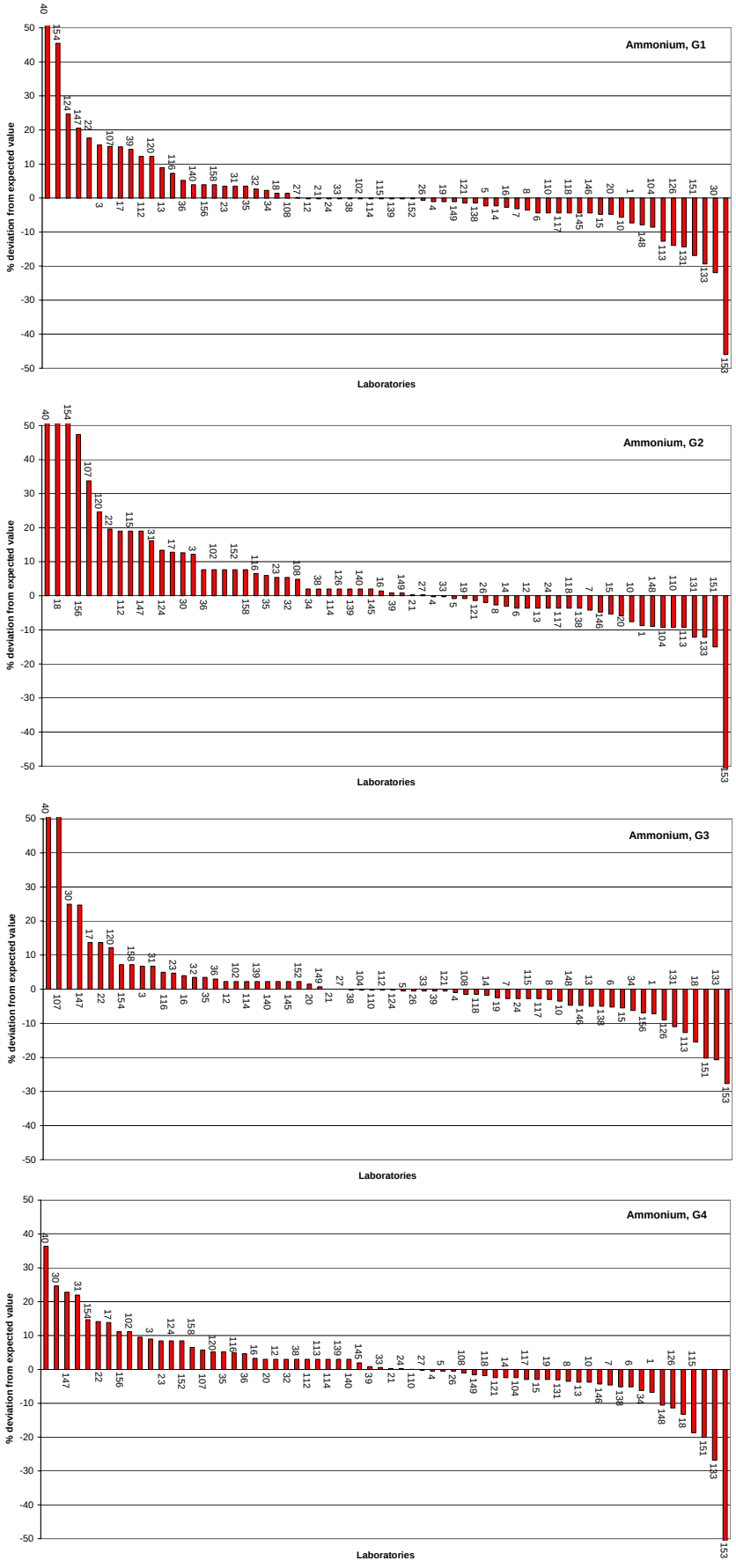


Figure 9: Percent deviation from theoretical value for ammonium.

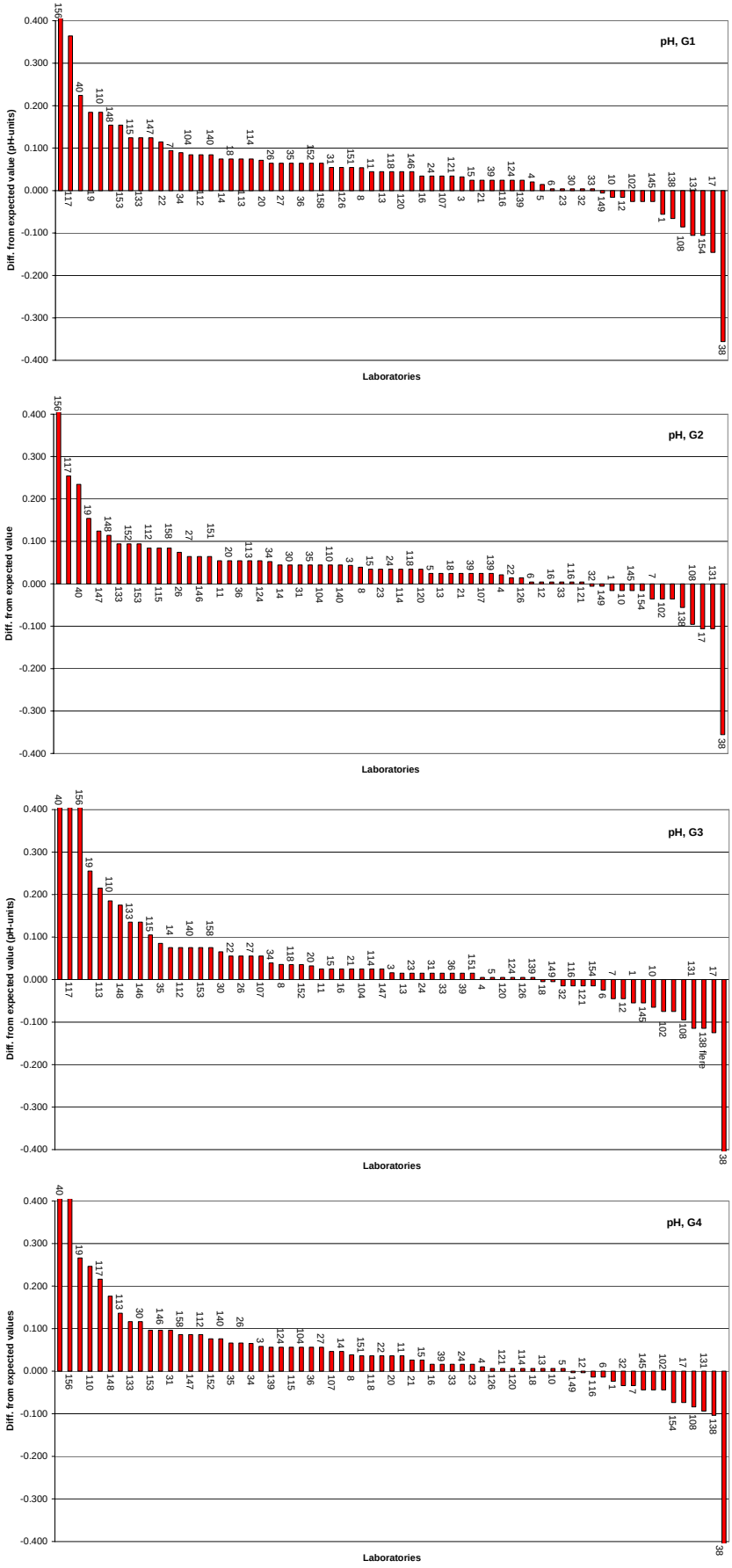


Figure 10: Percent deviation from theoretical value for pH.

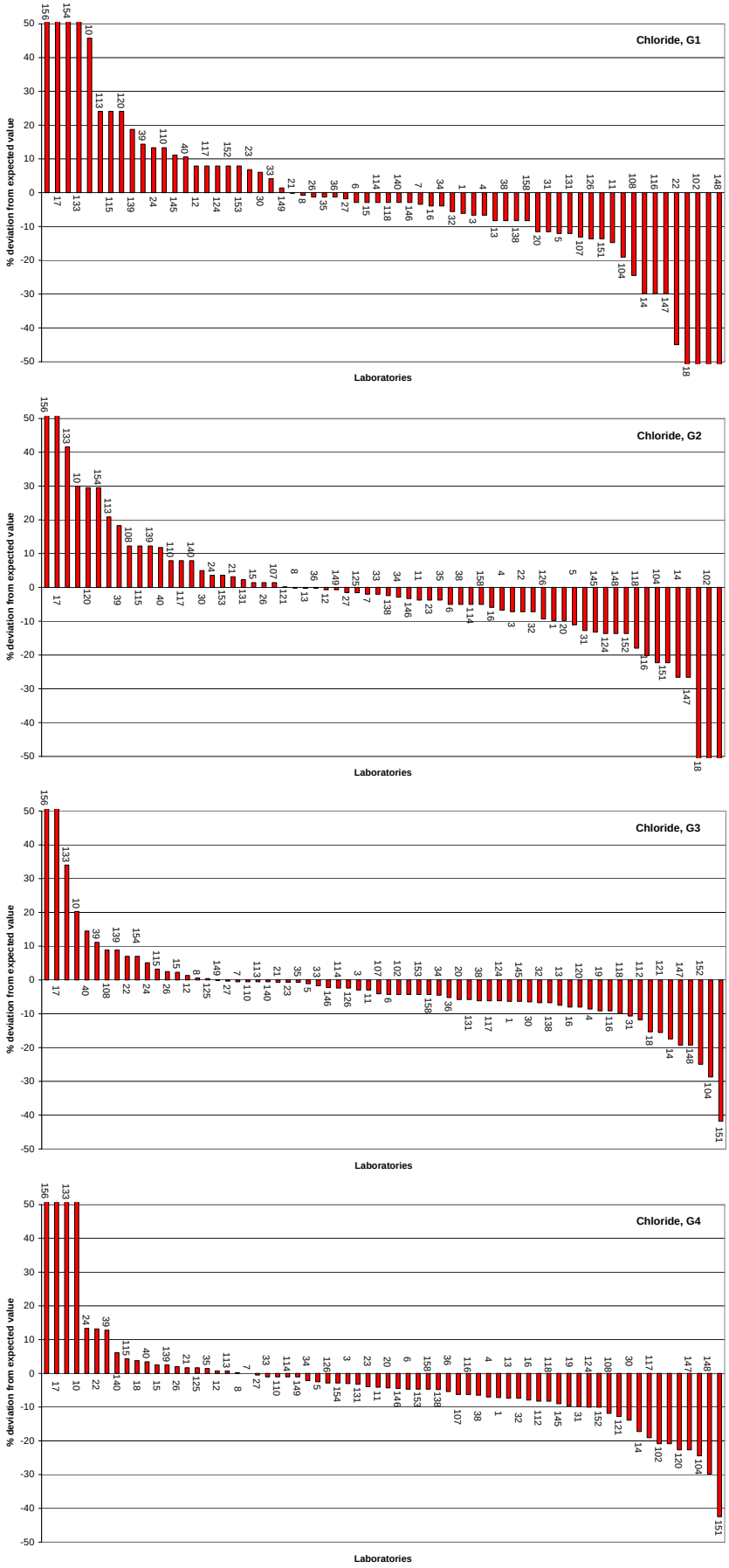


Figure 11: Percent deviation from theoretical value for chloride.

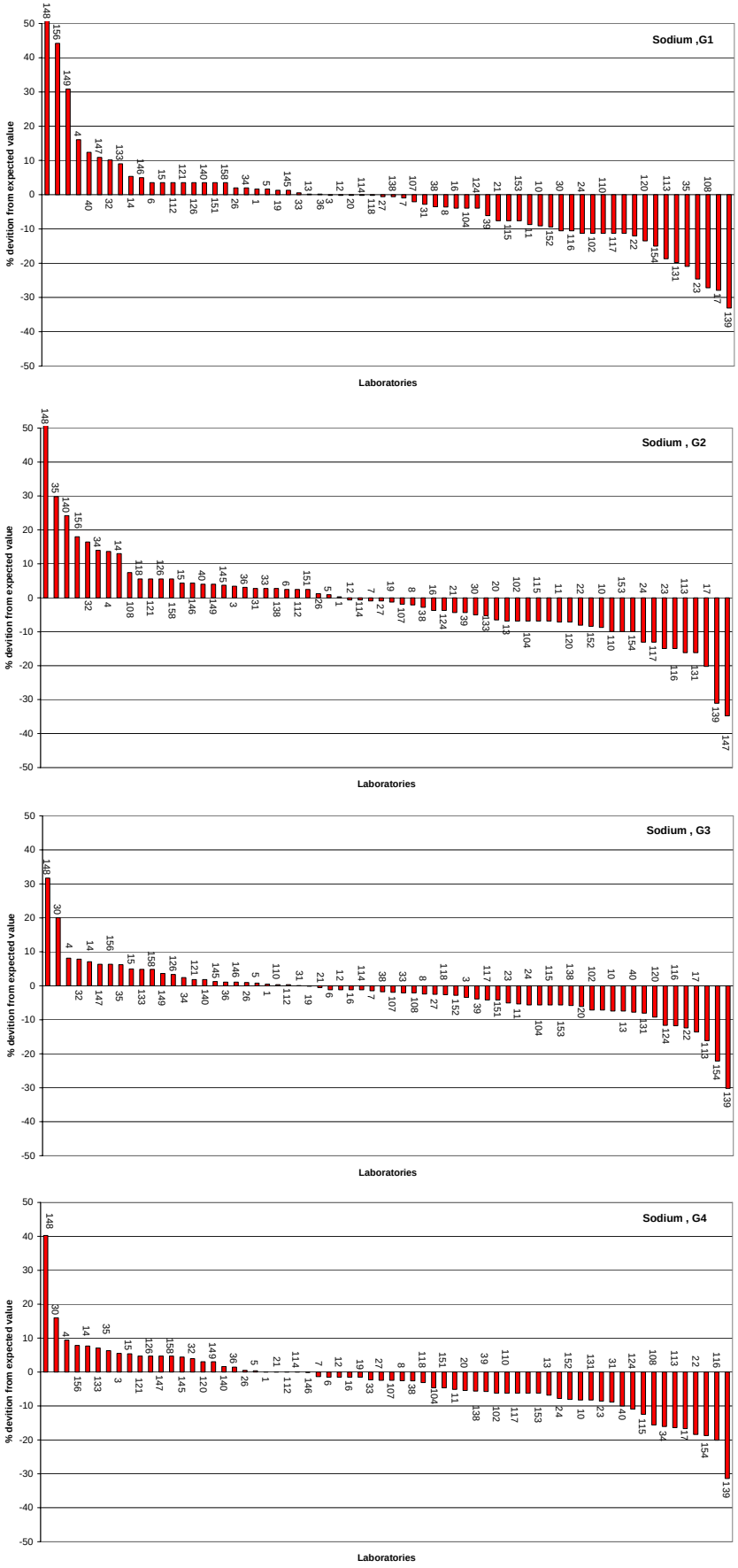


Figure 12: Percent deviation from theoretical value for sodium.

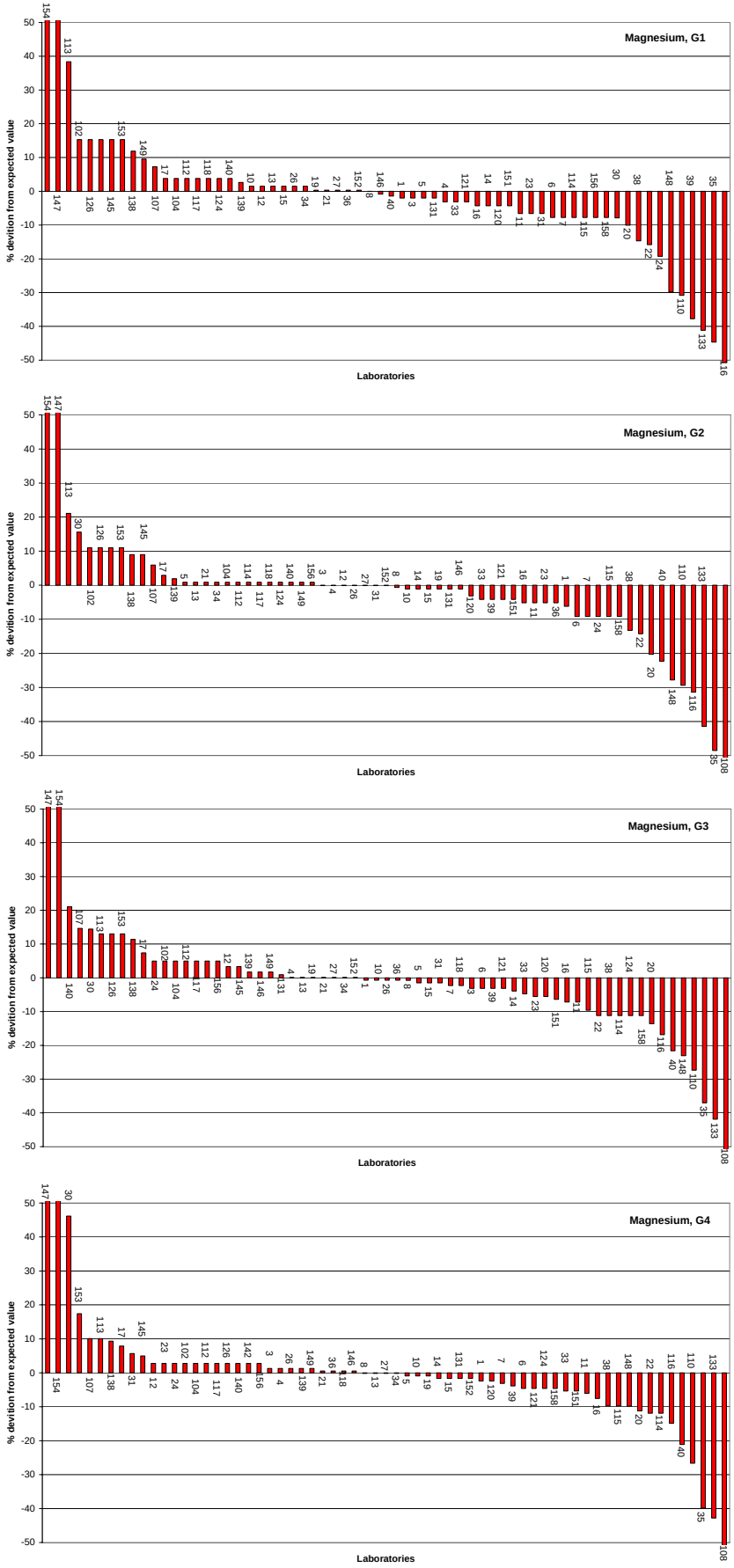


Figure 13: Percent deviation from theoretical value for magnesium.

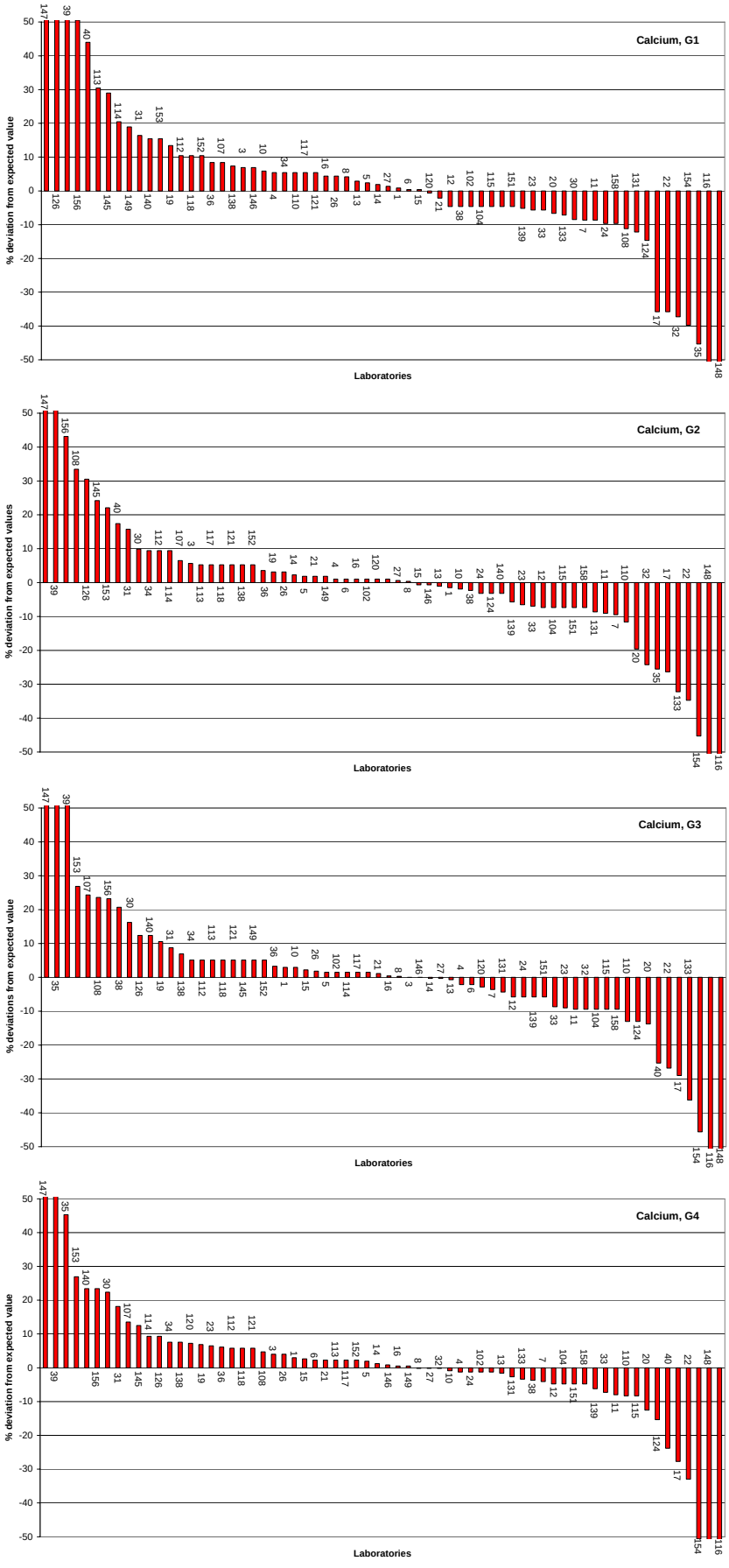


Figure 14: Percent deviation from theoretical value for calcium.

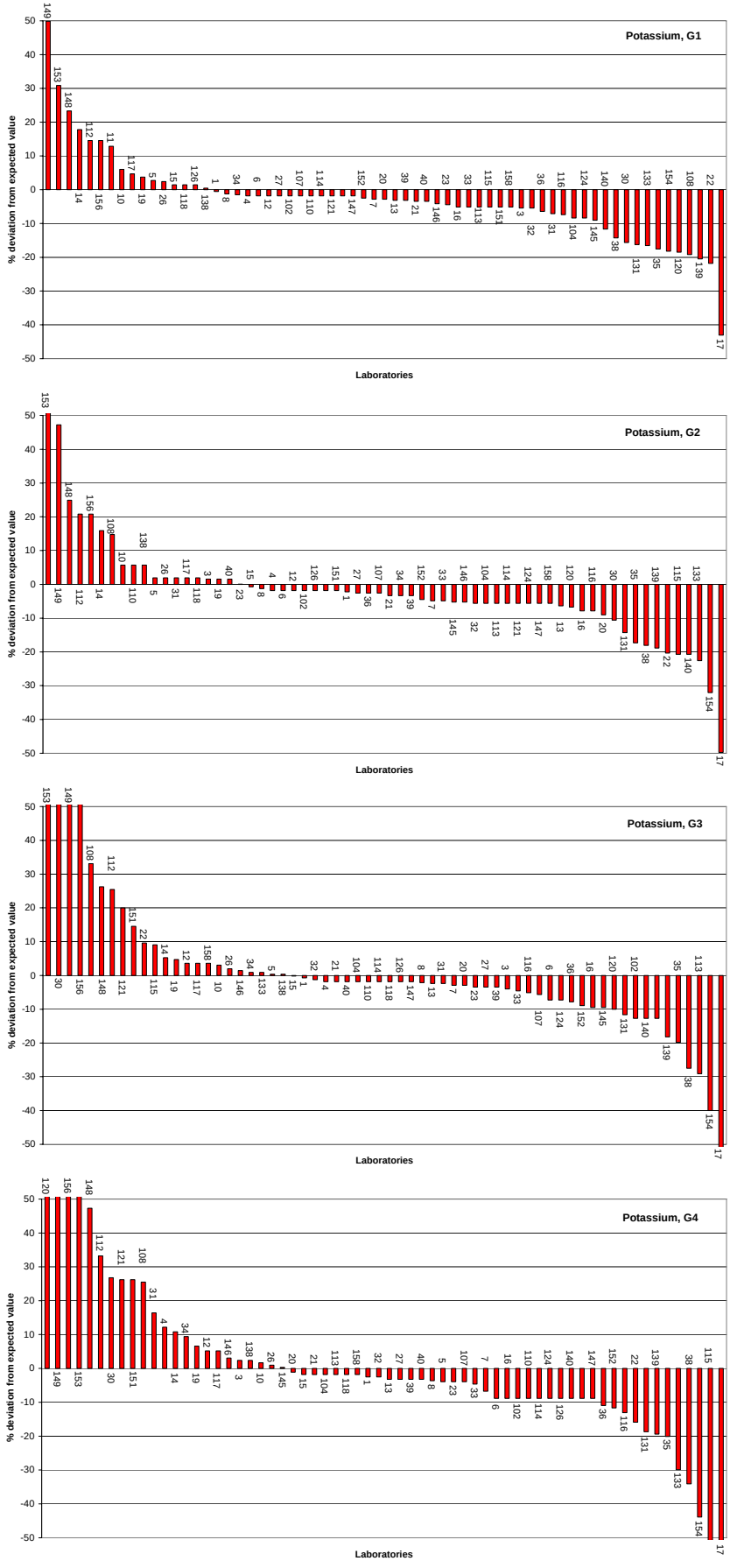


Figure 15: Percent deviation from theoretical value for potassium.

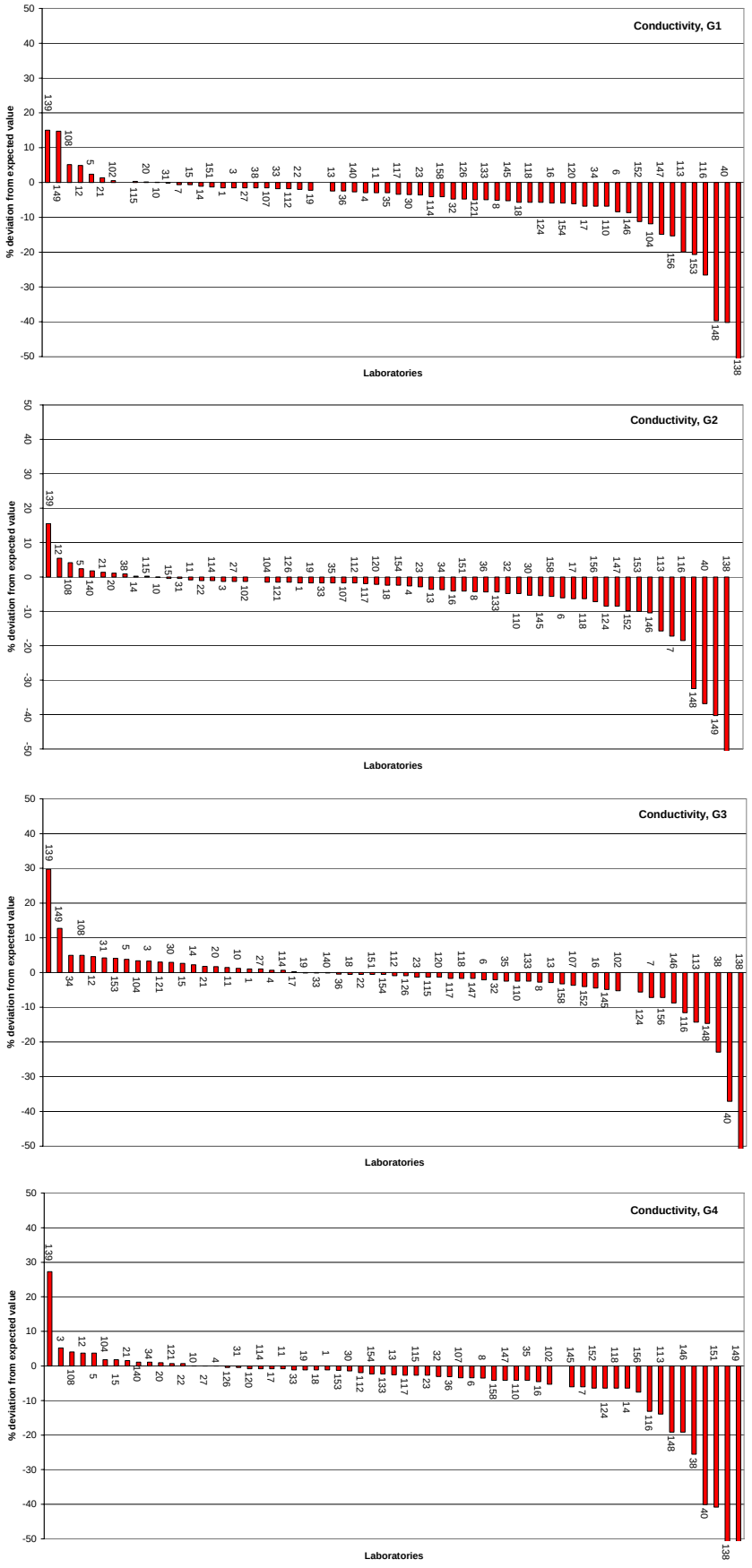


Figure 16: Percent deviation from theoretical value for conductivity.

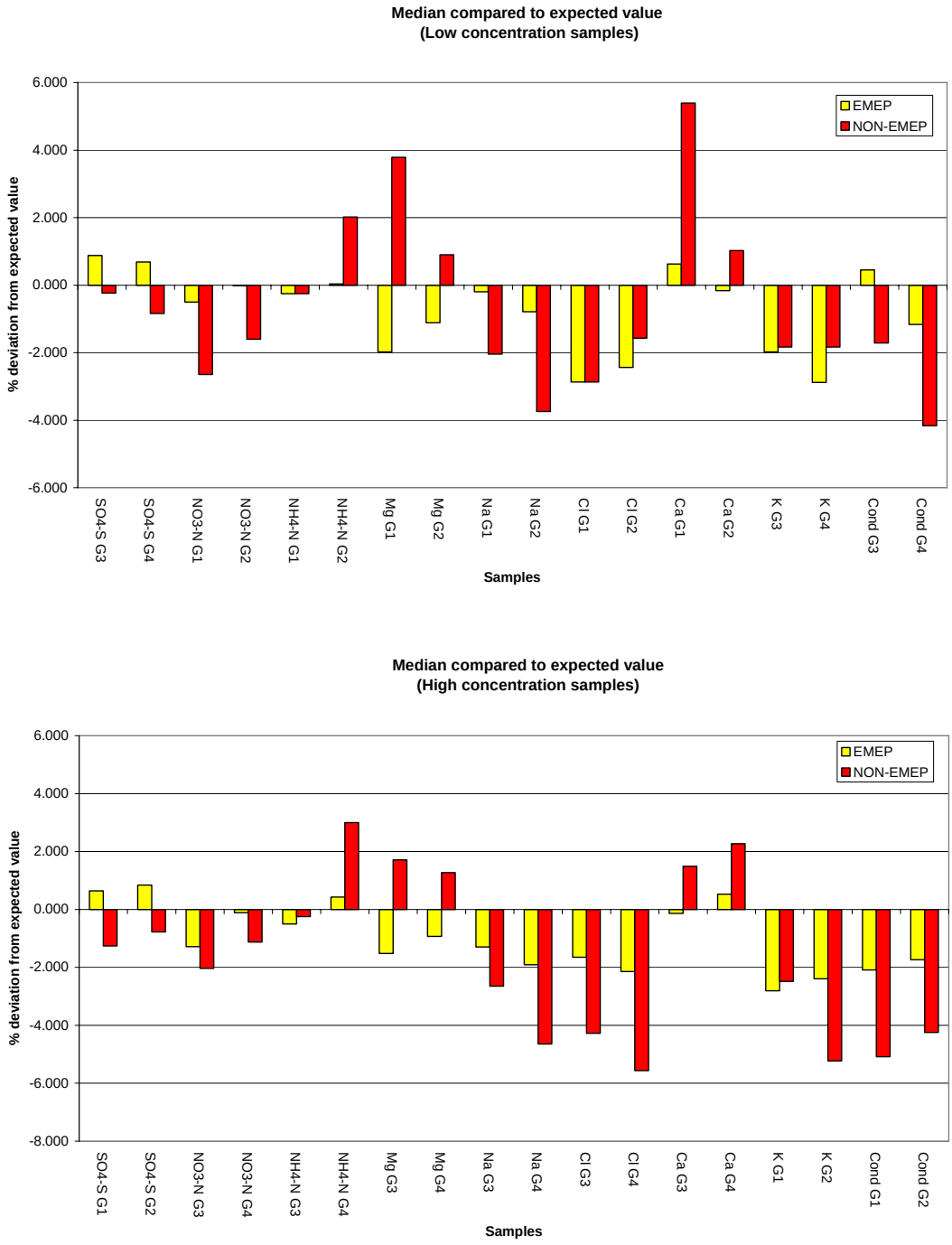


Figure 17: The median compared to theoretical value.

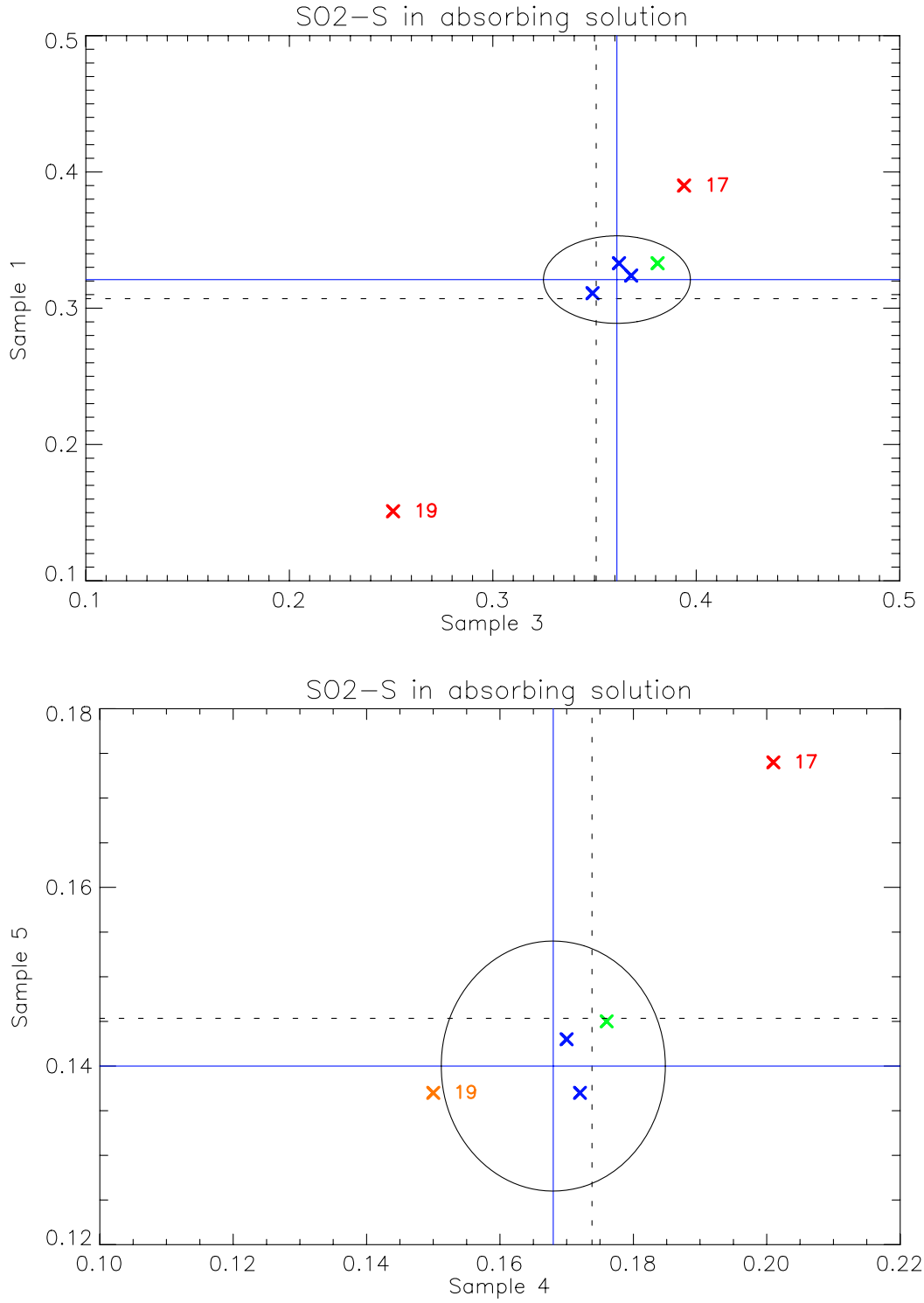


Figure 18: Youden plot of SO_2-S in absorbing solution.

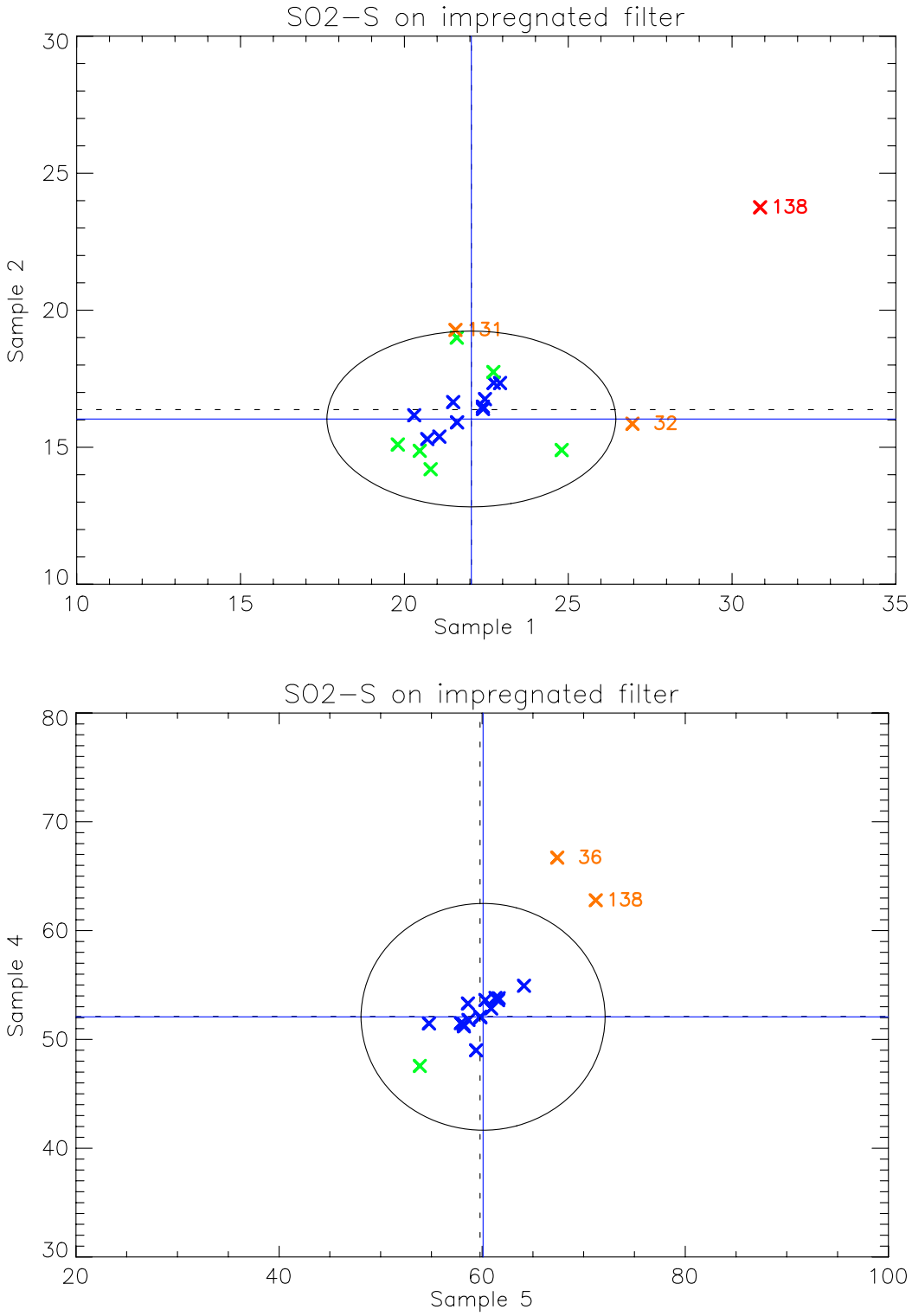


Figure 19: Youden plot of SO_2-S on impregnated filter.

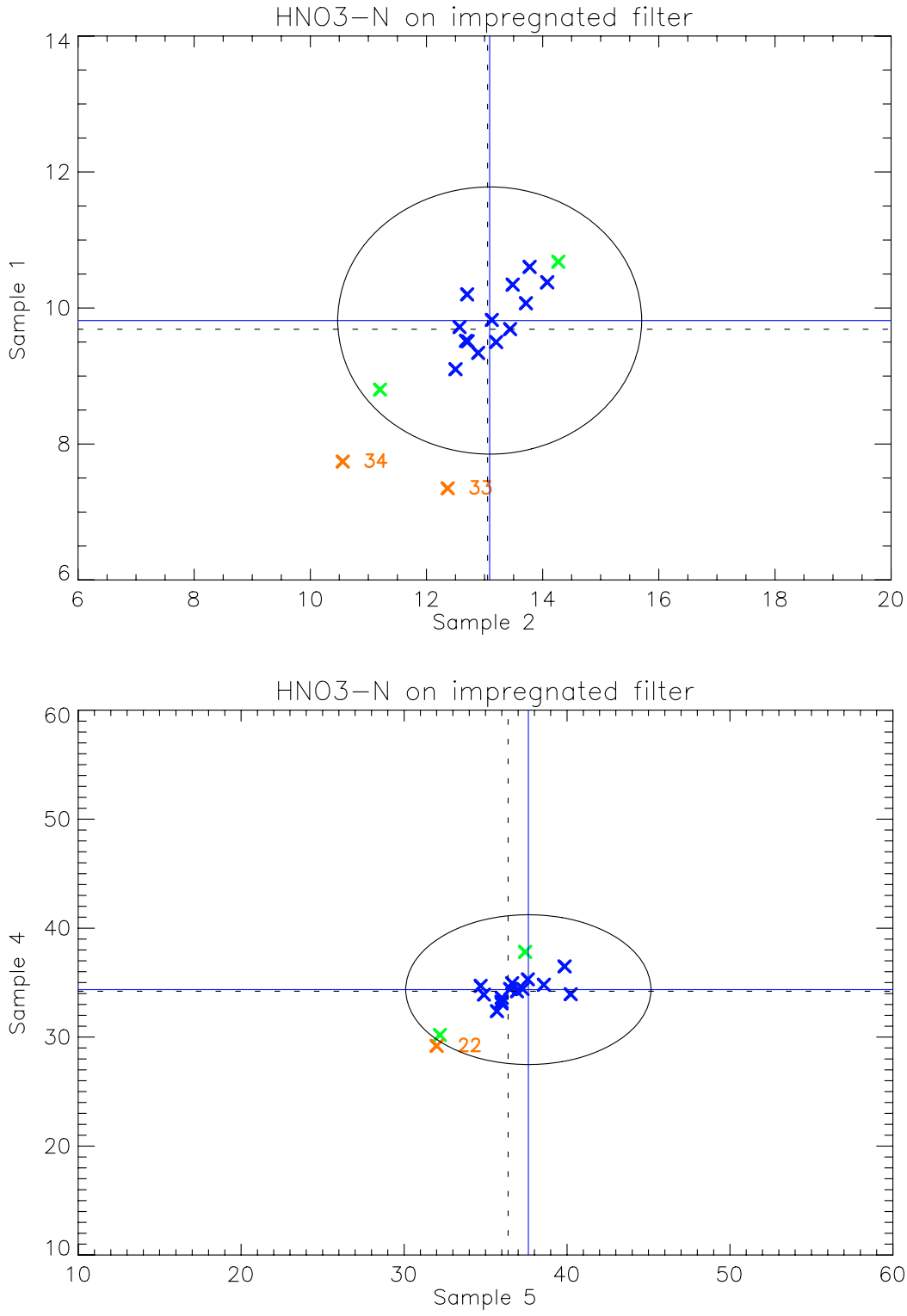


Figure 20: Youden plot of HNO_3-N on impregnated filter.

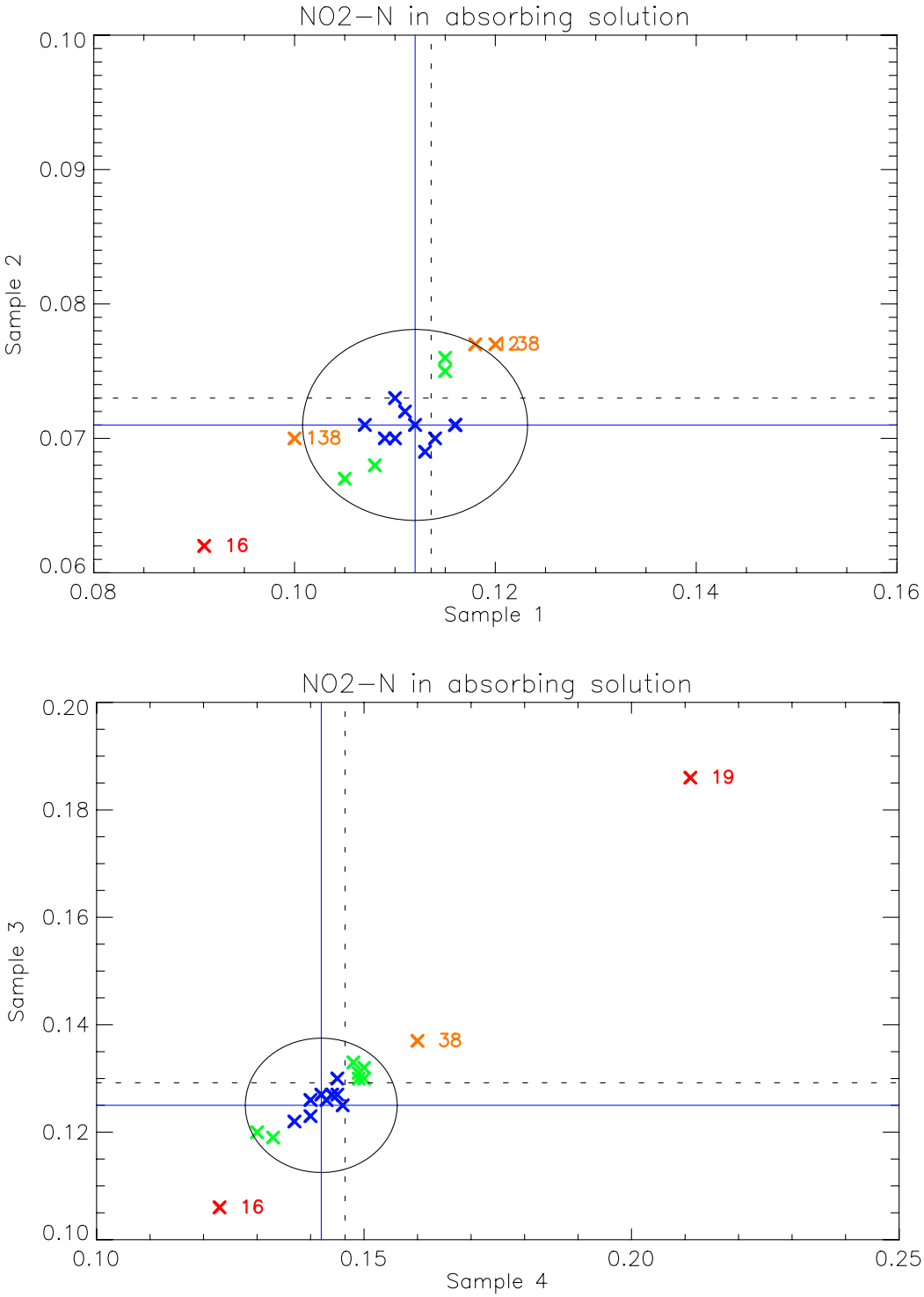


Figure 21: Youden plot of NO_2-N in absorbing solution.

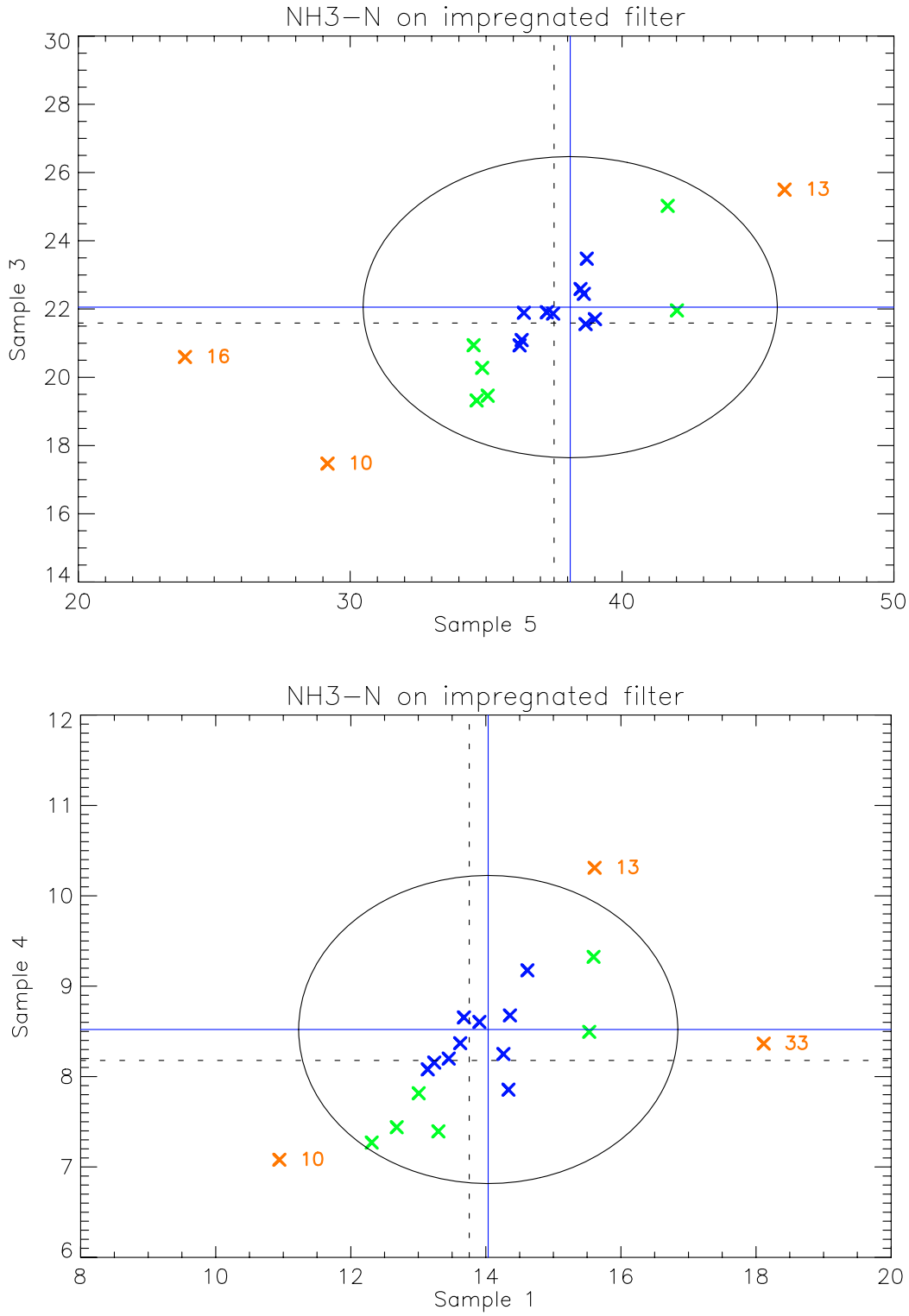


Figure 22: Youden plot of NH_3-N on impregnated filter.

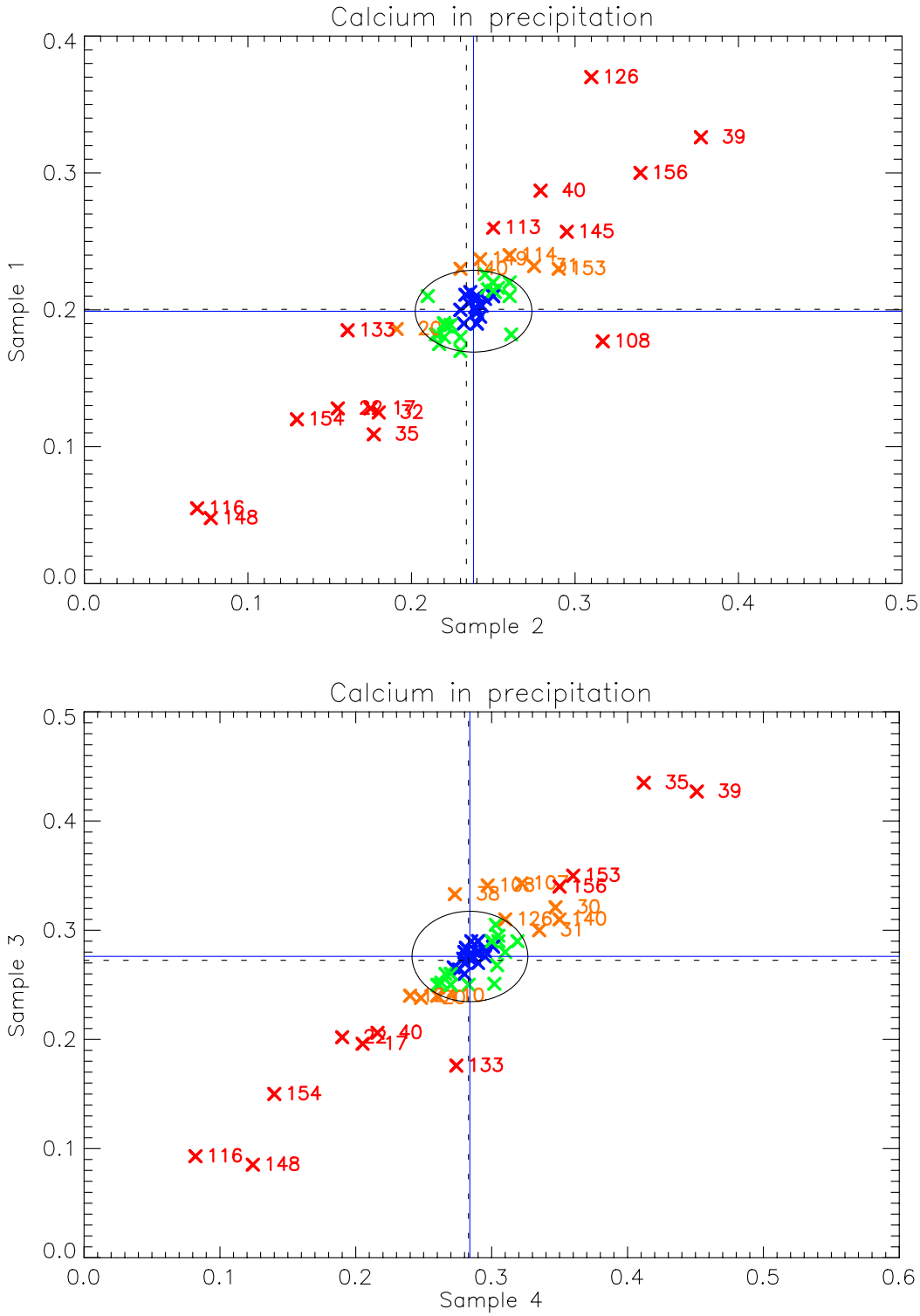


Figure 23: Youden plot of Ca in precipitation.

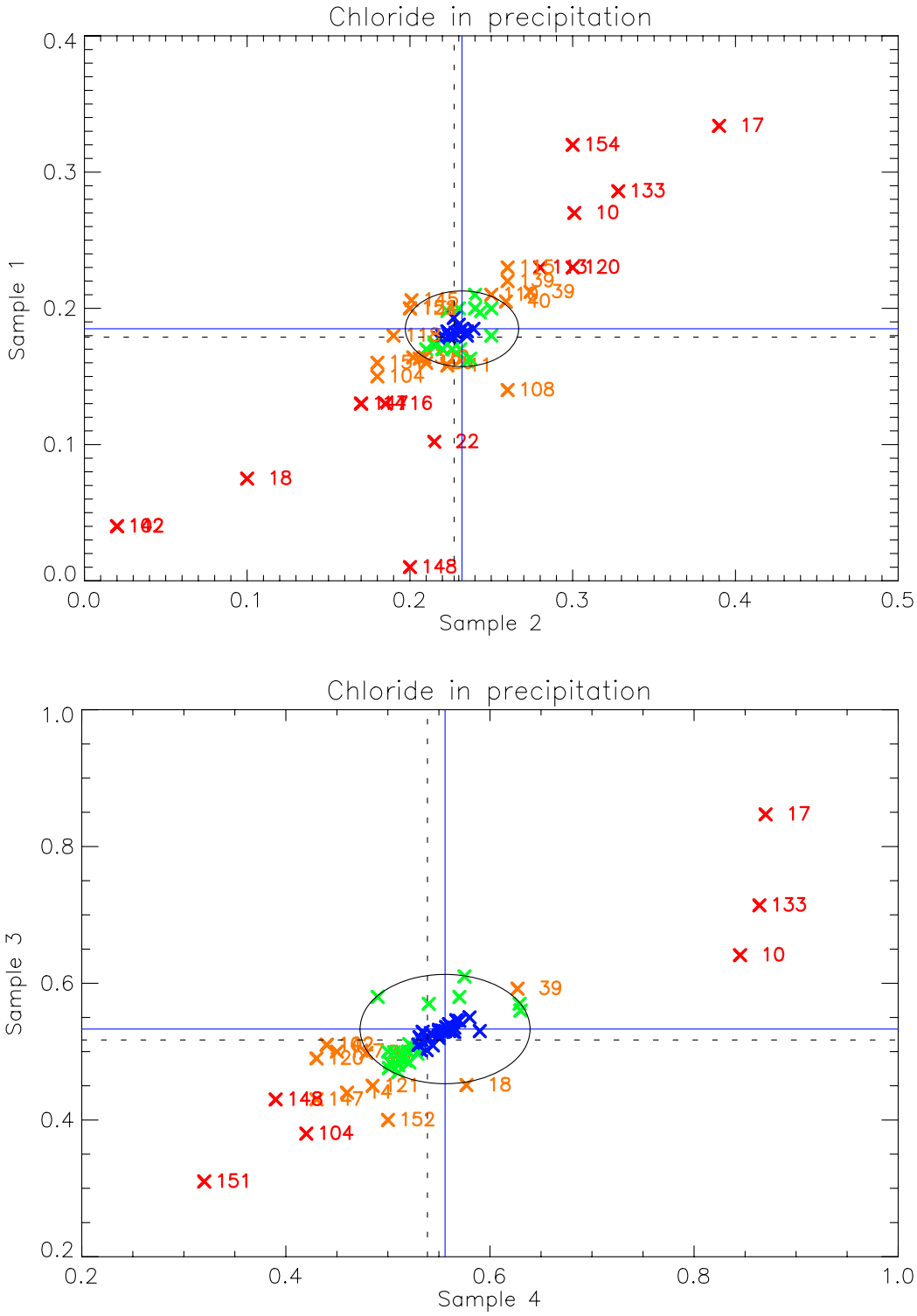


Figure 24: Youden plot of Cl in precipitation.

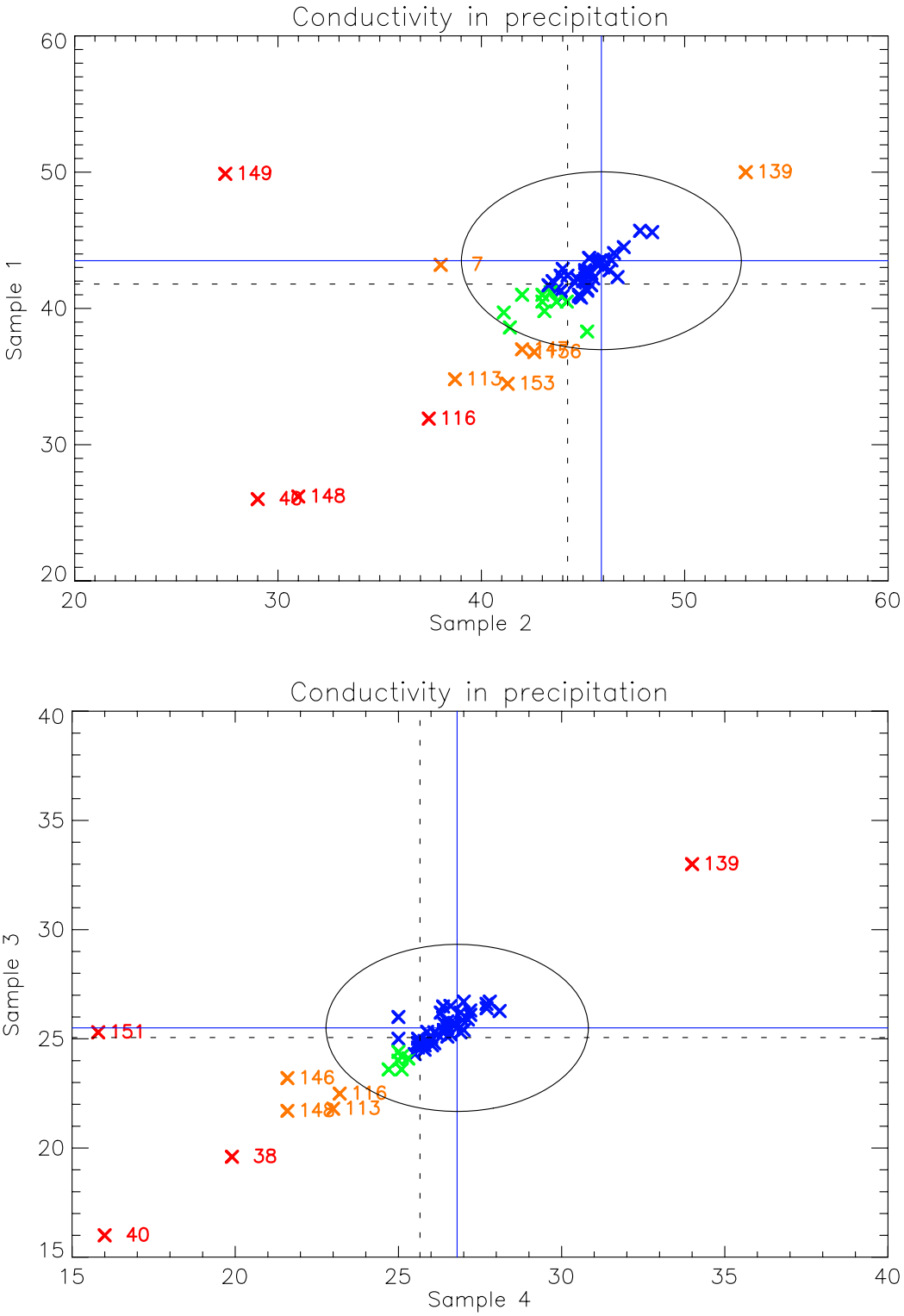


Figure 25: Youden plot of conductivity in precipitation.

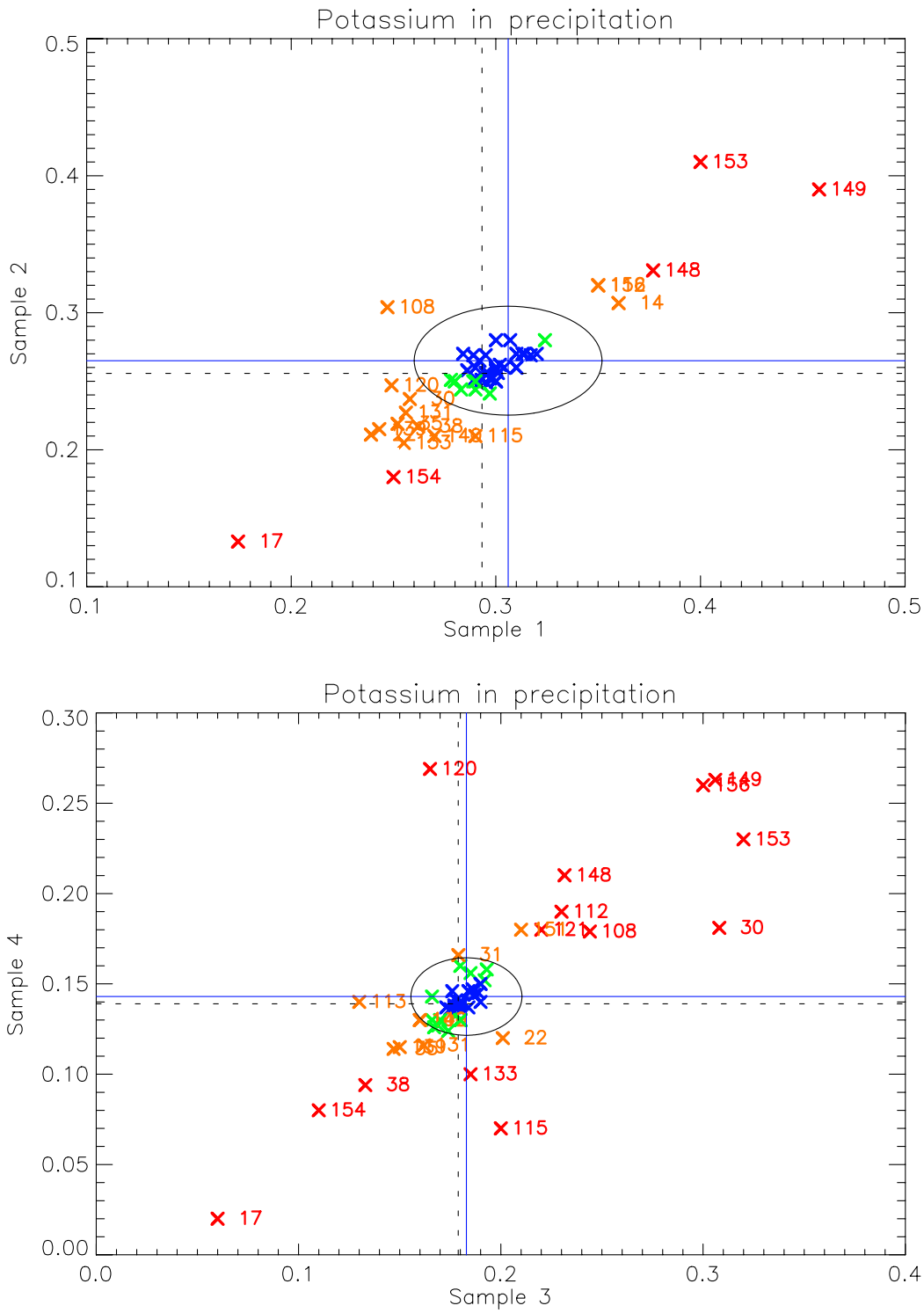


Figure 26: Youden plot of K in precipitation.

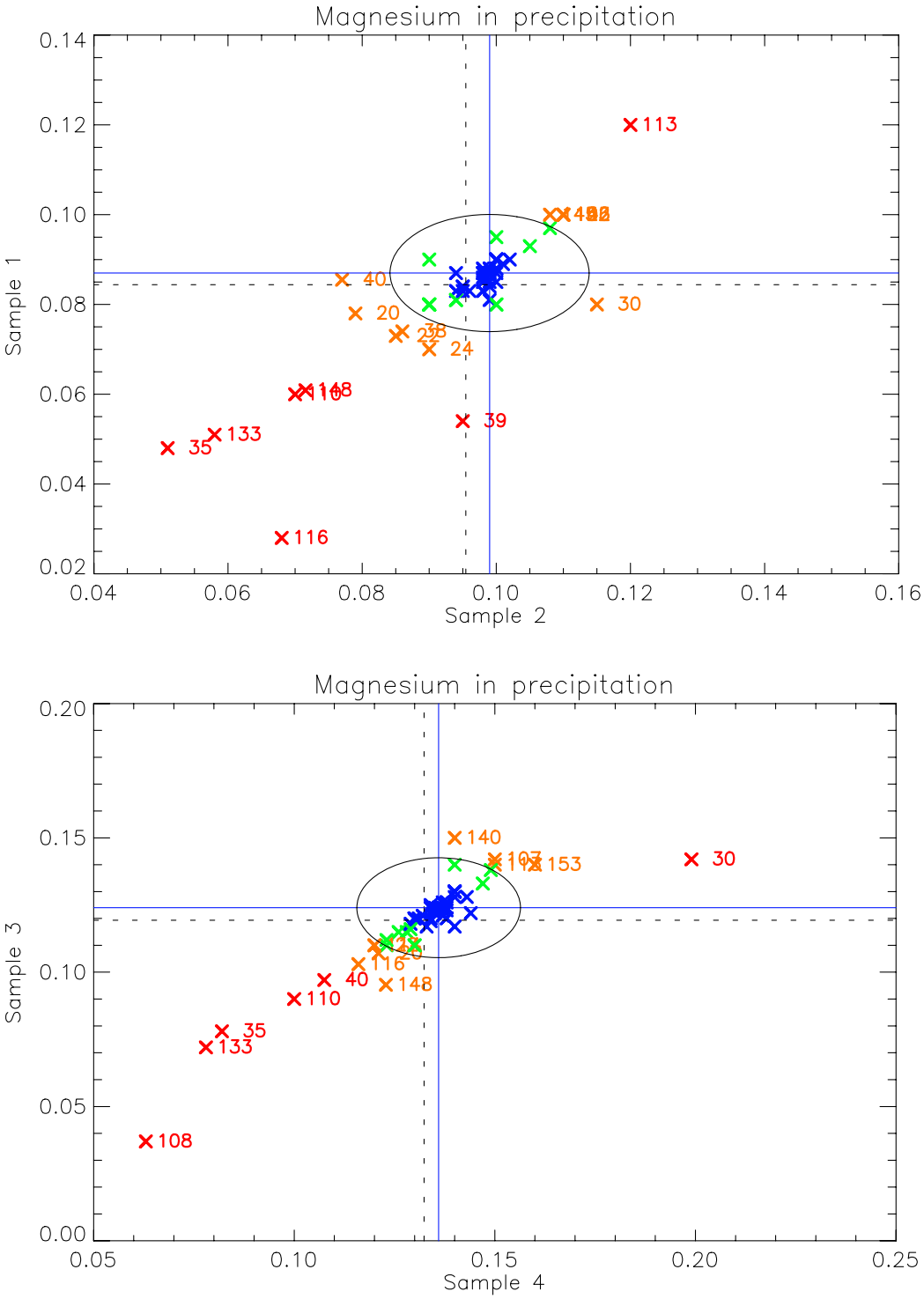


Figure 27: Youden plot of Mg in precipitation.

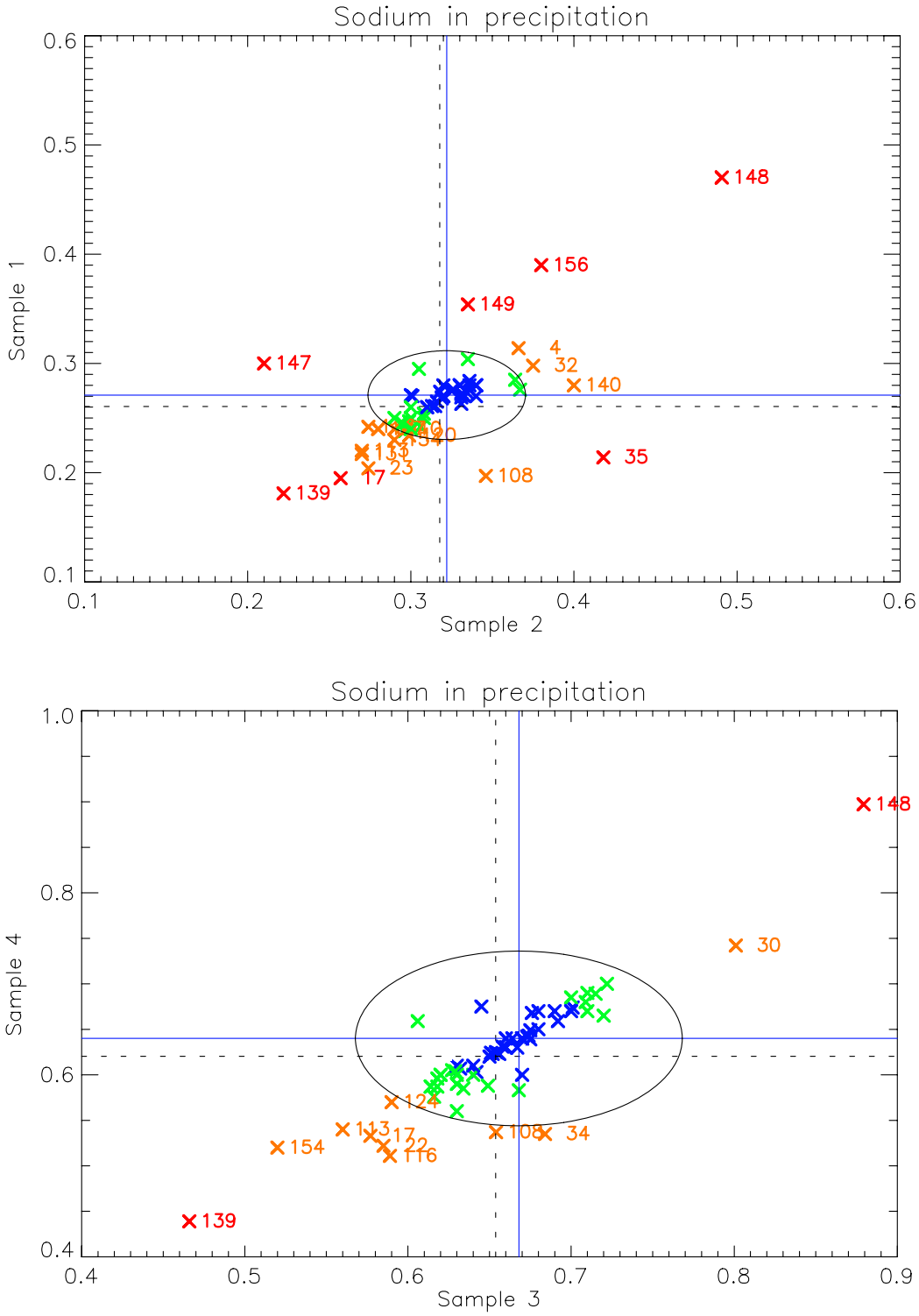


Figure 28: Youden plot of Na in precipitation.

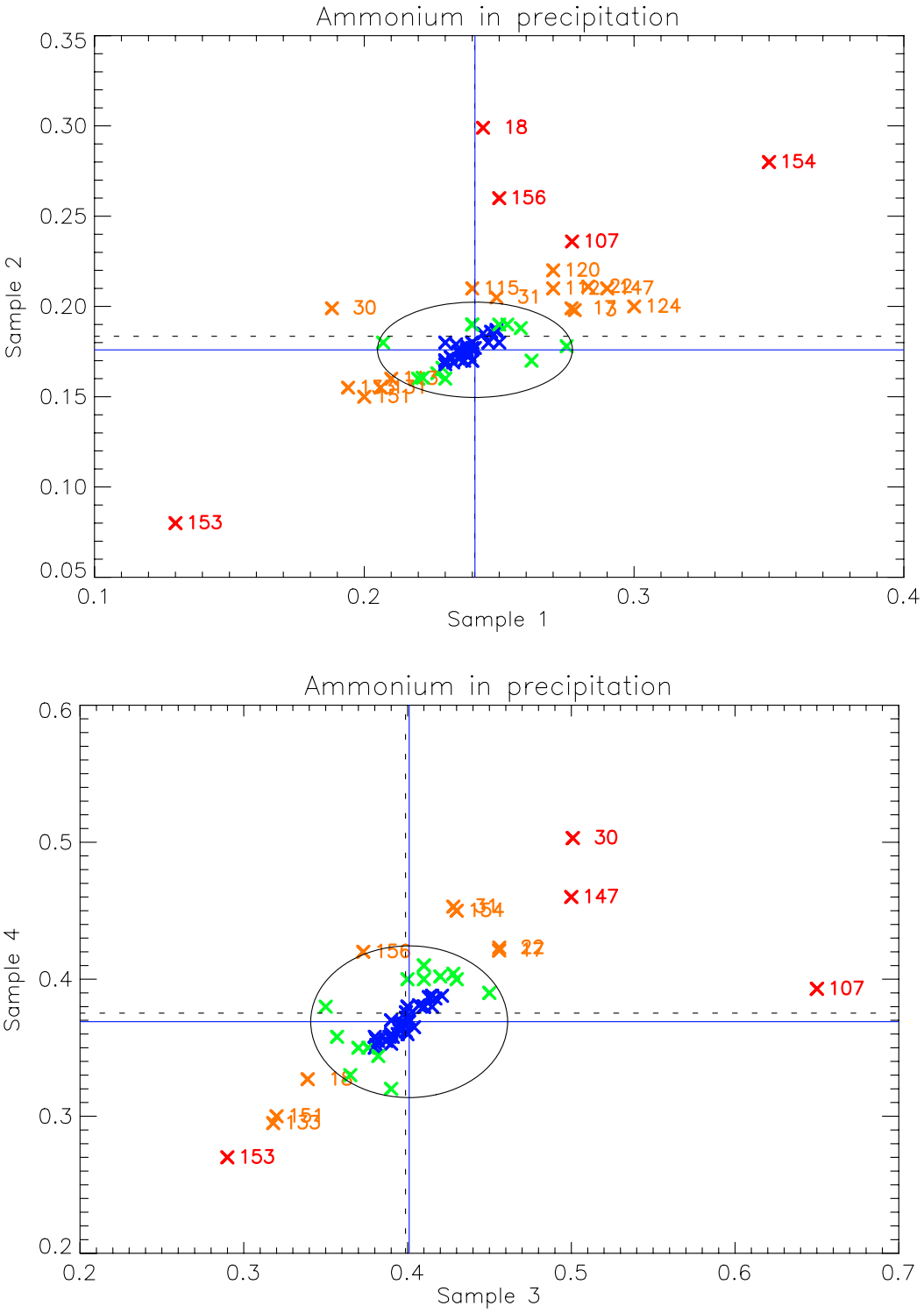


Figure 29: Youden plot of NH_4-N in precipitation.

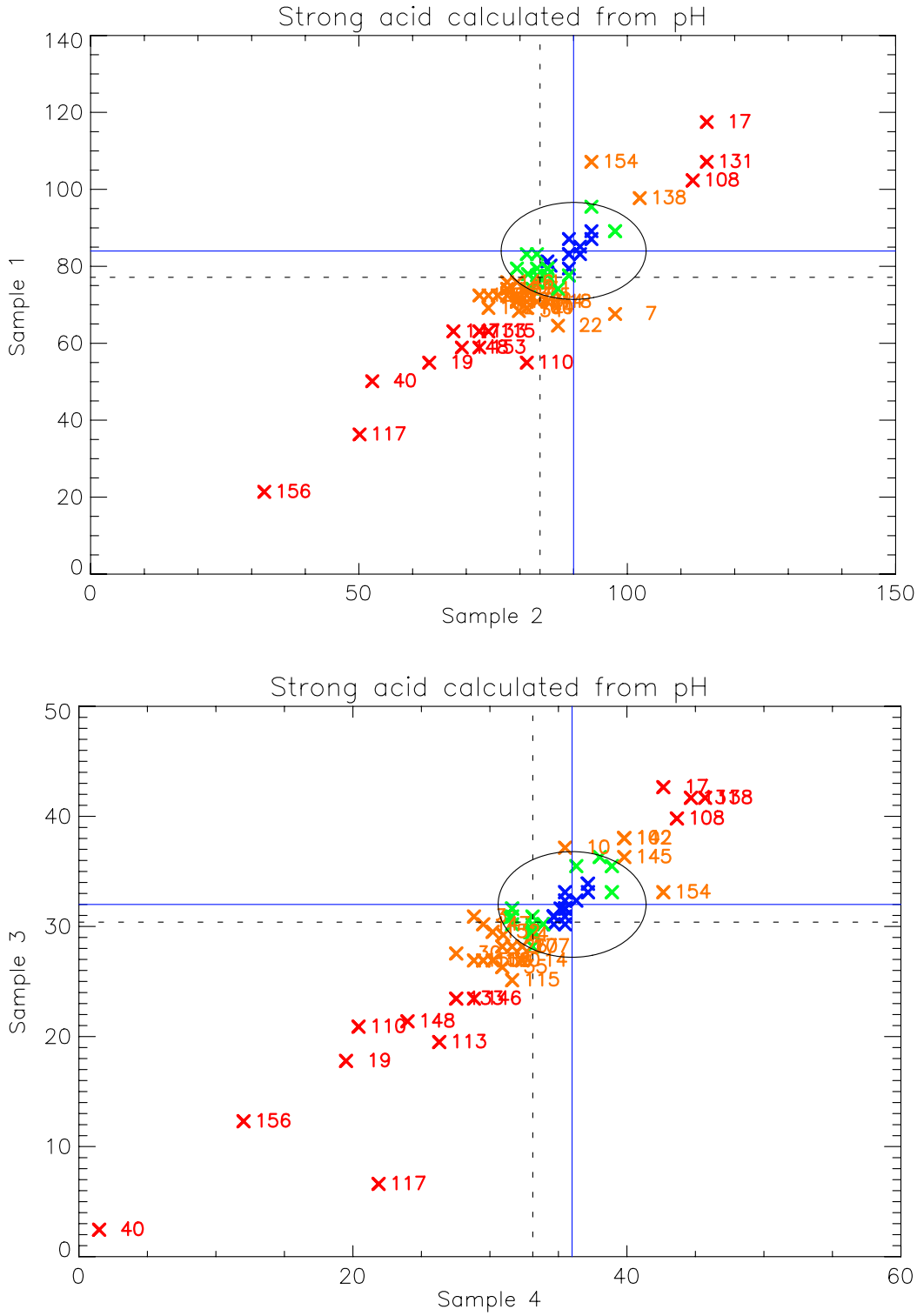


Figure 30: Youden plot of strong acid in precipitation.

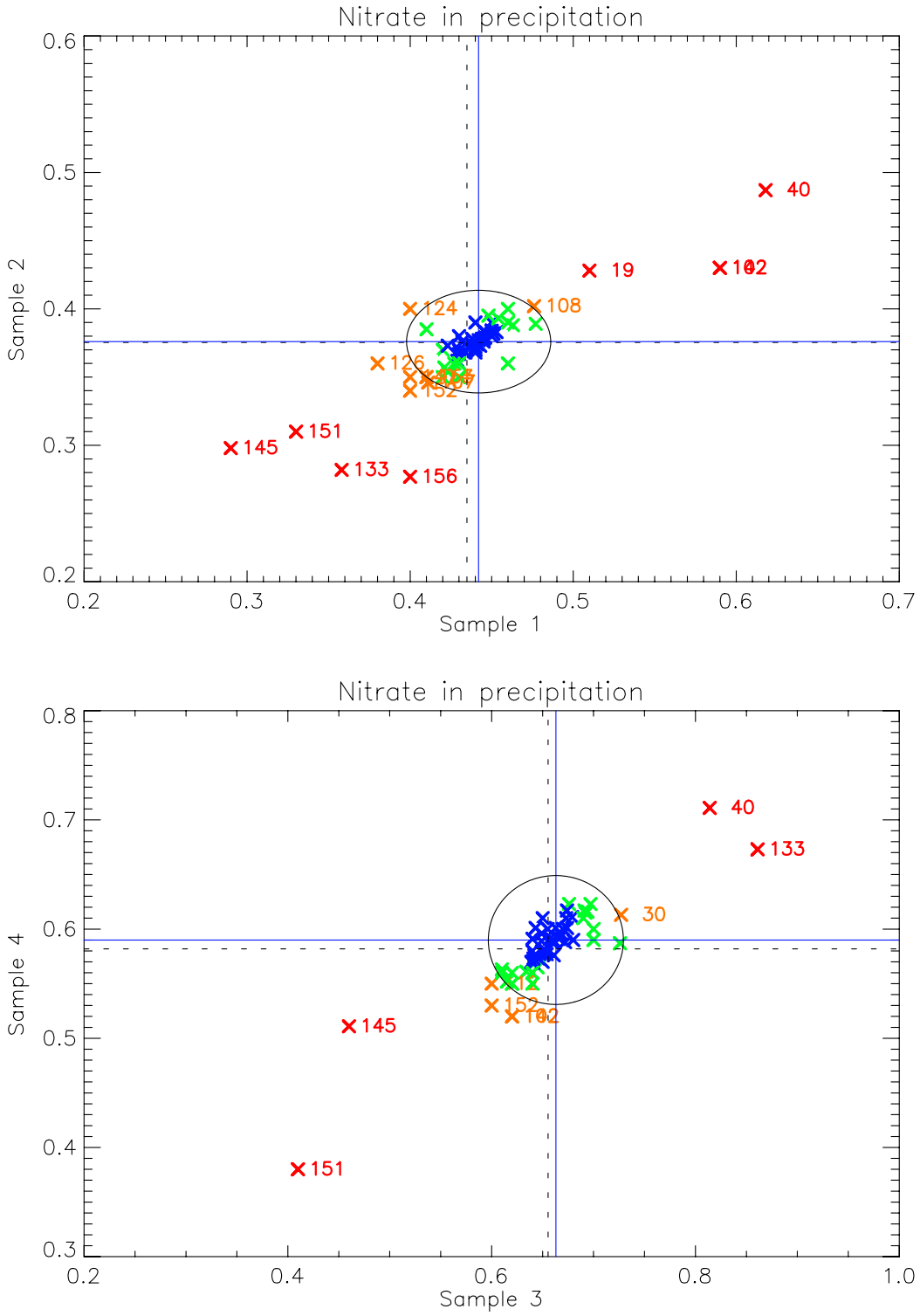


Figure 31: Youden plot of NO_3-N in precipitation.

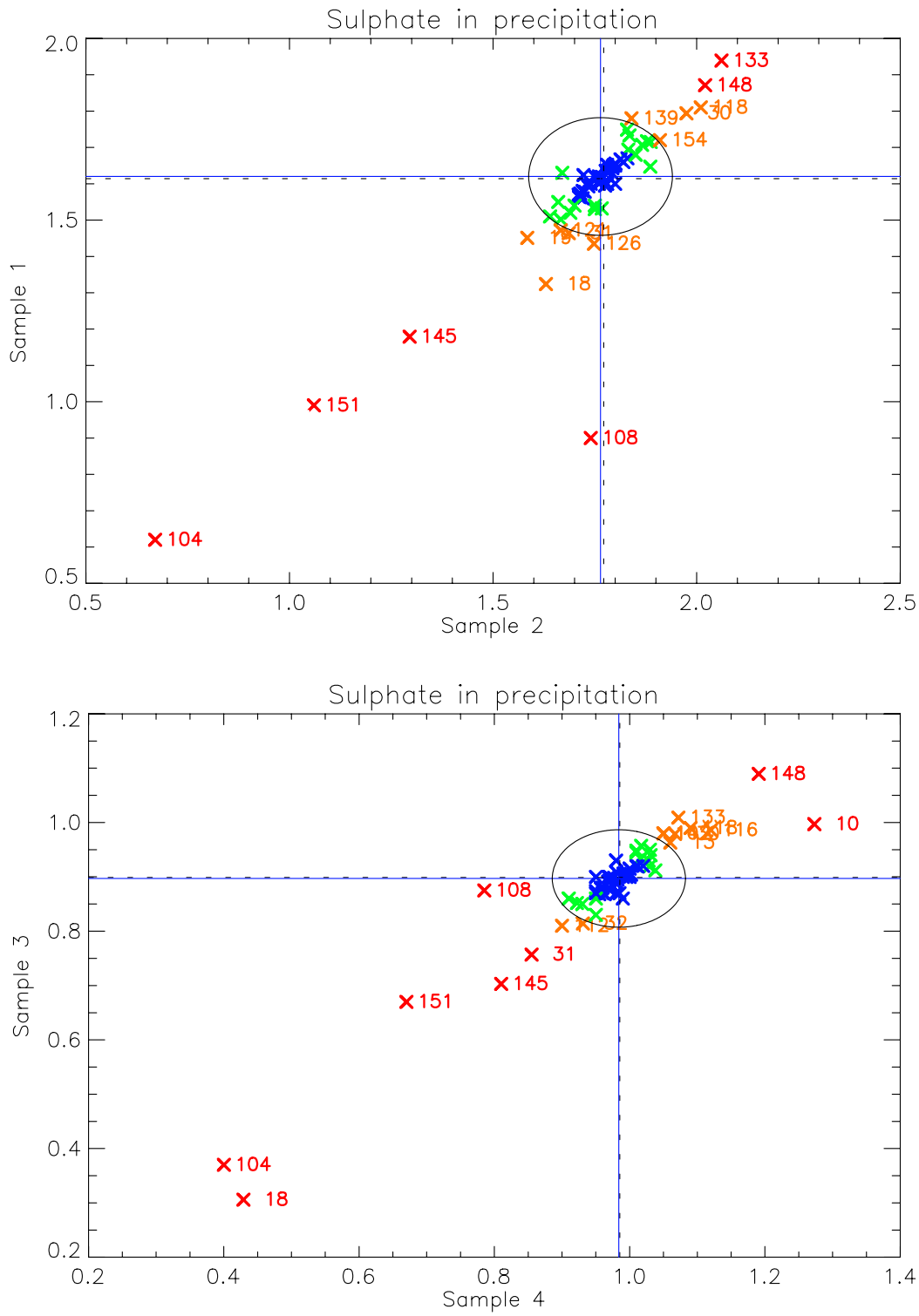


Figure 32: Youden plot of SO_4-S in precipitation.

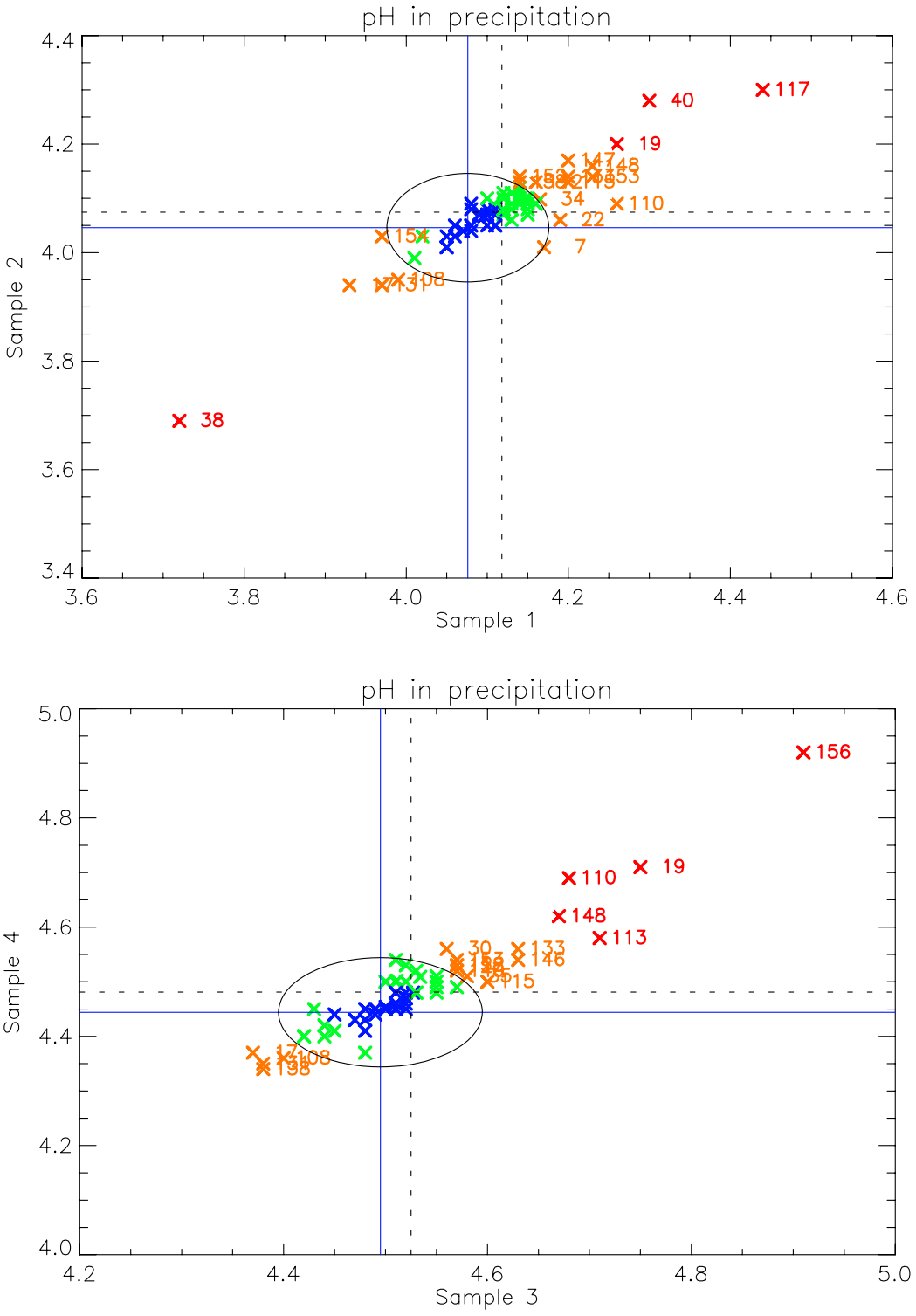


Figure 33: Youden plot of pH in precipitation.