

the influence of storage on deposition and soil water samples

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1. Arrangement of the storage test
2. Examples for changes of chemical sample composition at different temperatures for filtered and unfiltered samples
3. Typical results for the different tested parameters:
 - TC / TOC / IC
 - pH
 - NH₄ / NO₃ / N_{tot}
4. Overview of all results for all tested samples for the different parameters
5. Conclusions



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Storage of water samples can lead to changes of the chemical composition of the samples.

The mostly changing parameters are pH, DOC, IC, NH_4 , NO_3 and N_{tot}

The following parameters have an effect on the changes of the chemical composition:

- Time of storage
- Temperature
- Type of filtration before storage

The first unintended „storage“ happens in the field: weekly or 2-weekly sampling means „storage“ in the field for up to 2 weeks under uncertain conditions! Therefore the organized storage test gives also some informations about the possible changes of the chemical composition of the samples in the field.



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Test design:

13 different samples (5 stemflow-, 5 throughfall- and 3 soil water samples) from 5 different plots were taken in the field within one day after rainfall and brought to the laboratory.

Each sample was divided into 16 subsamples; 8 of them were filtrated with washed paper filters (Sartorius „Schwarzband“, 12-15- μm).

Respectively 2 filtered and 2 unfiltered subsamples were stored under different temperature conditions: 4 °C, 8 °C, 20 °C and 30 °C

Each of the 208 subsamples were measured after 0, 2, 5, 13, 27 and 86 days for the following parameters: pH, TC, IC, NH_4 , NO_3 and N_{tot} (1248 samples analysed)



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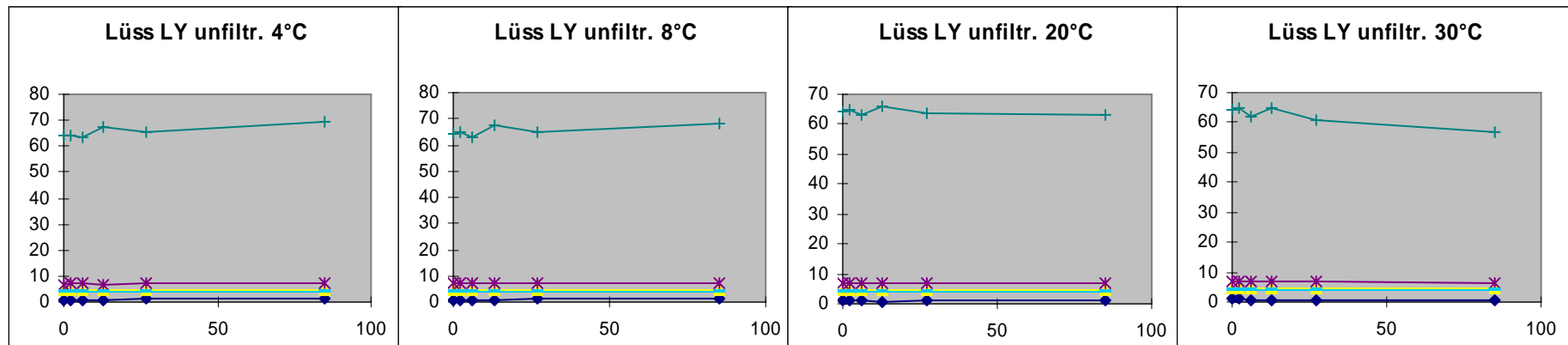
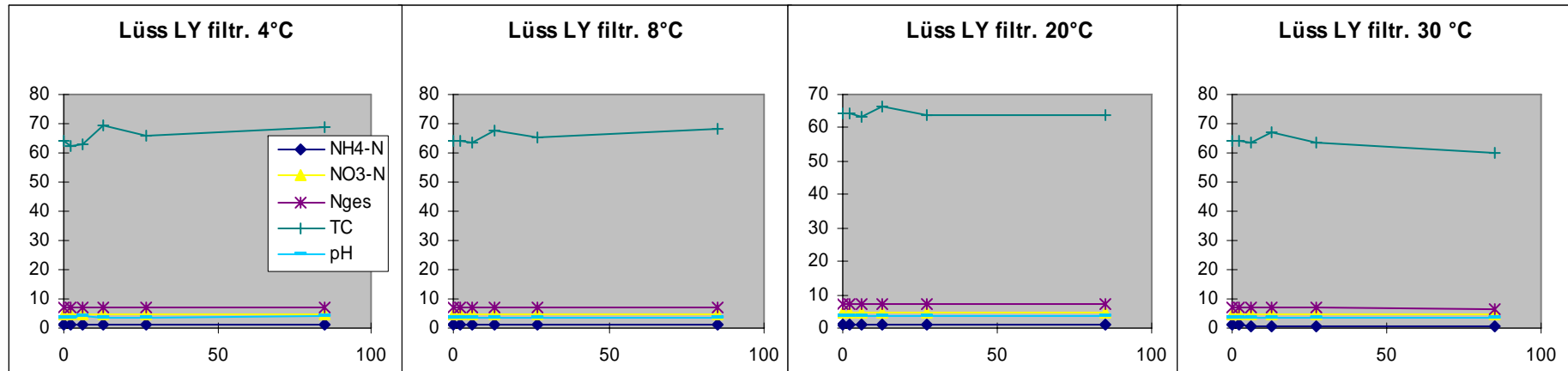
<u>plot</u>	<u>sample typ</u>		<u>tree species</u>	<u>pH</u>	<u>TC</u>
Lüss	Stemflow	ST	oak	3,8	350
Lüss	soil water	LY		4	70
Solling	throughfall	KR	spruce	4	20
Solling	Stemflow	ST	beech	4,3	10
Solling	soil water	LY		4,5	5
Göttinger Wald	Stemflow	ST	beech	4,9	5
Solling	throughfall	KR	beech	5	5
Harste	Stemflow	ST	beech	5	10
Harste	throughfall	KR	beech	5	5
Lüss	Stemflow	ST	beech	5,2	10
Göttinger Wald	throughfall	KR	beech	5,4	5
Lüss	throughfall	KR	oak/beech	6	10
Göttinger Wald	soil water	LY		8	70



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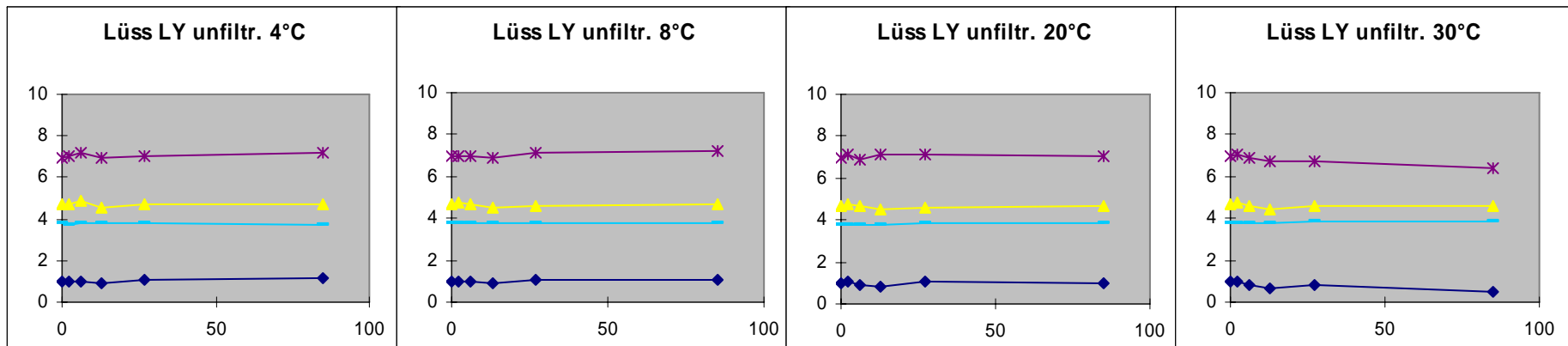
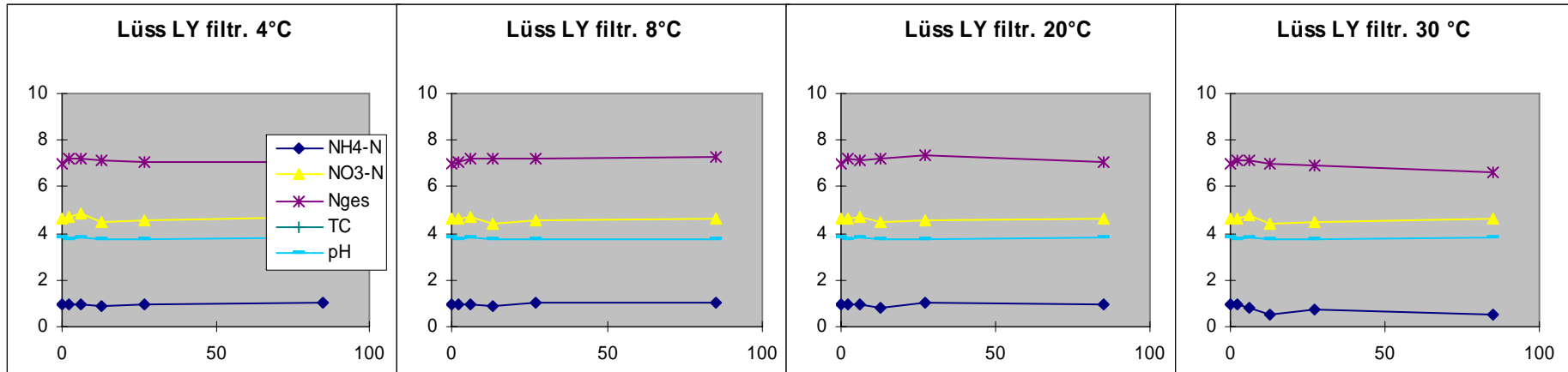


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pH 4 Soil water



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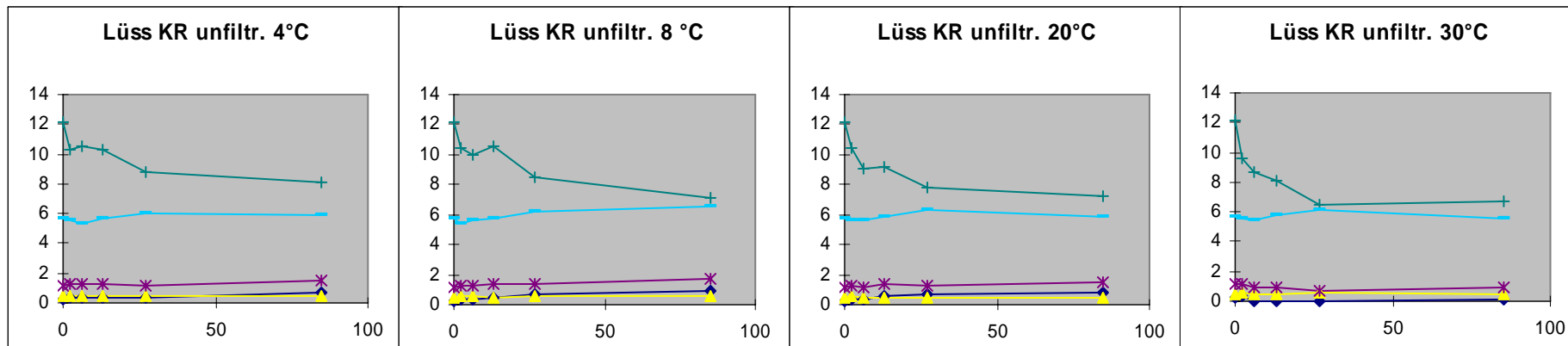
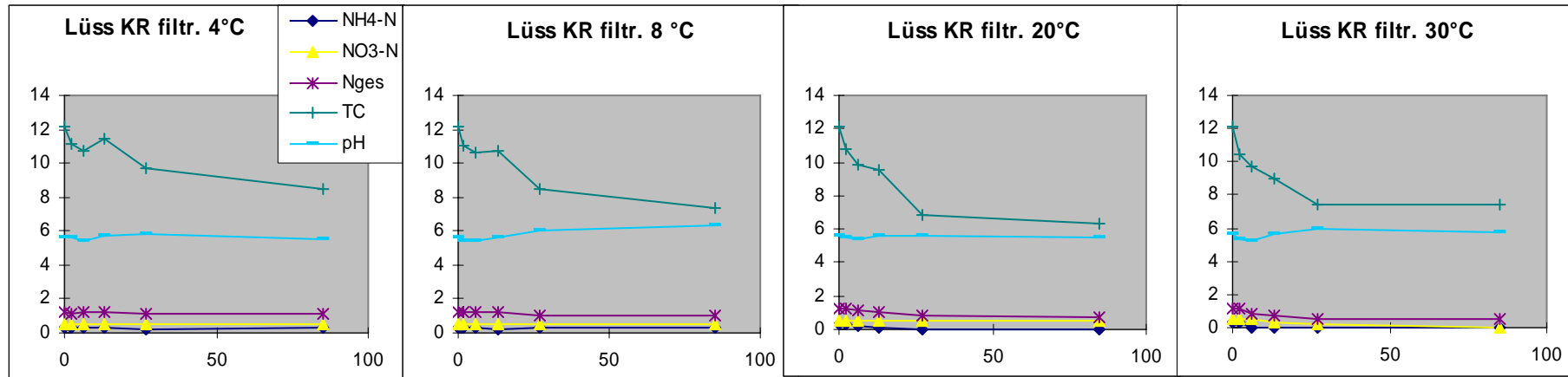
pH 4 Soil water



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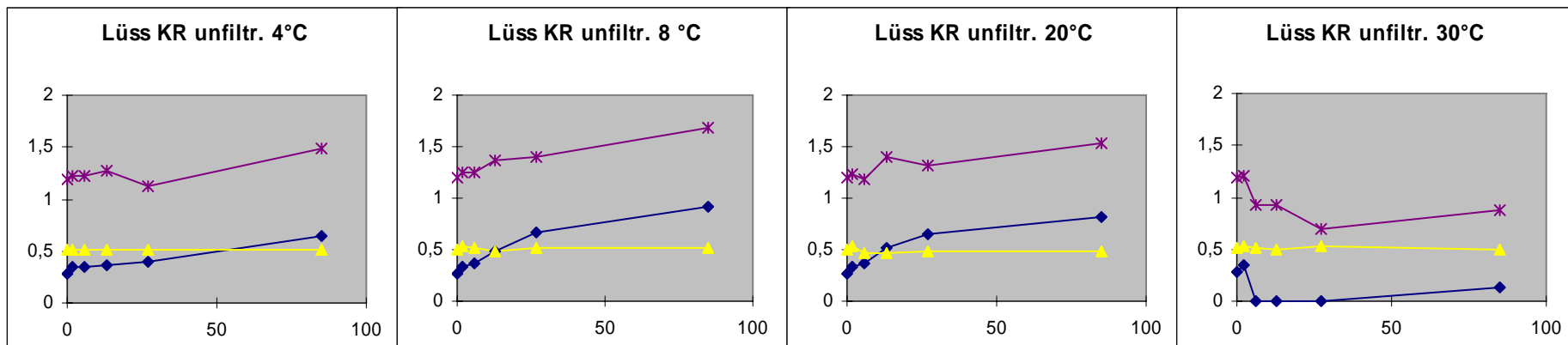
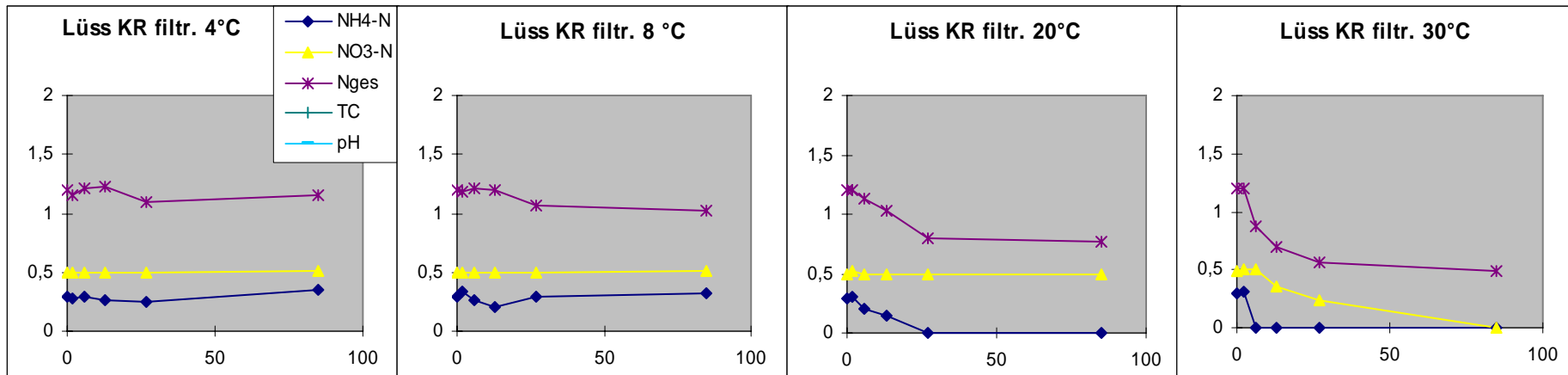
pH 6 Throughfall



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pH 6

Throughfall



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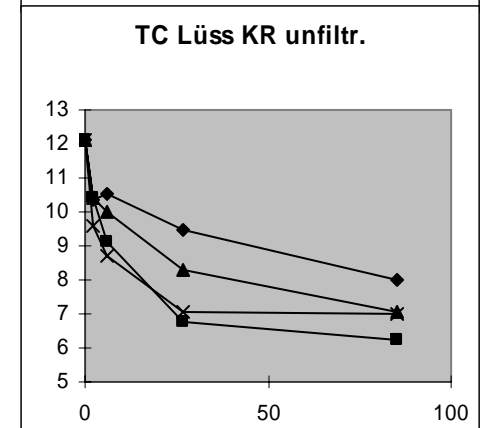
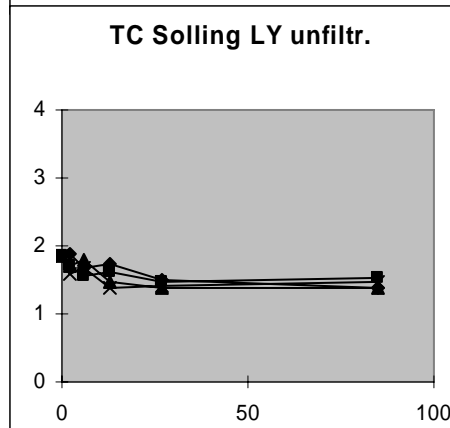
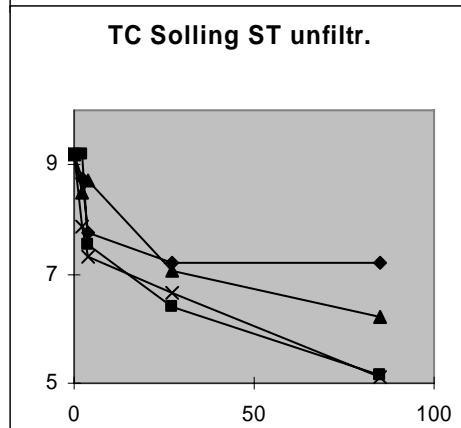
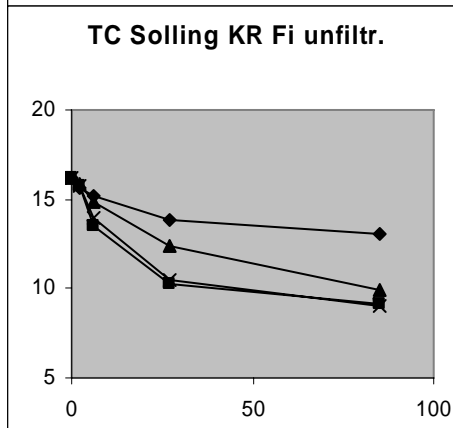
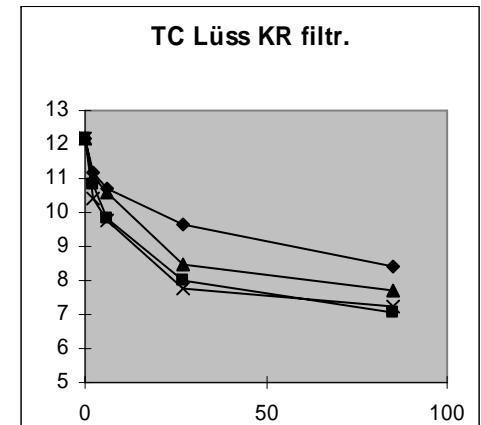
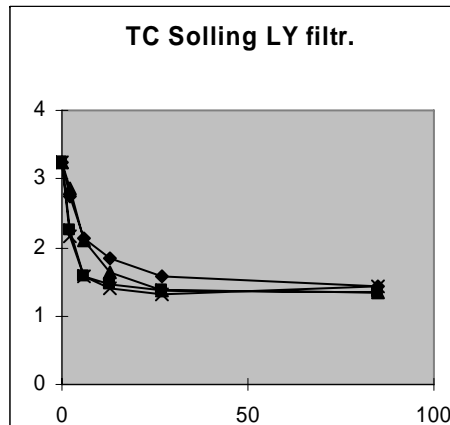
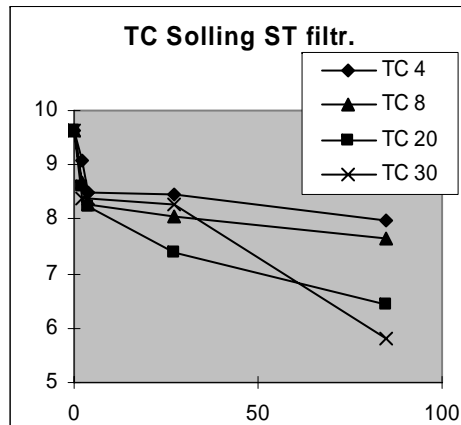
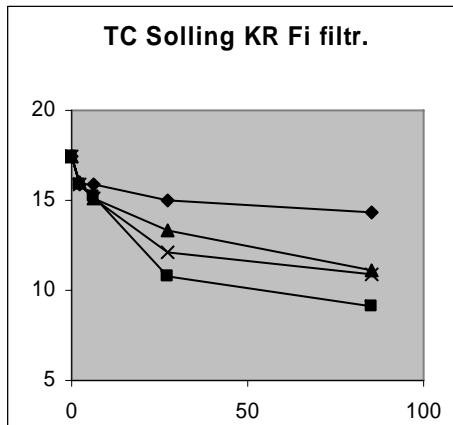
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pH 4,6 Throughfall

pH 4,3 Stemflow

pH 4,4 Soil water

pH 5,6 Throughfall



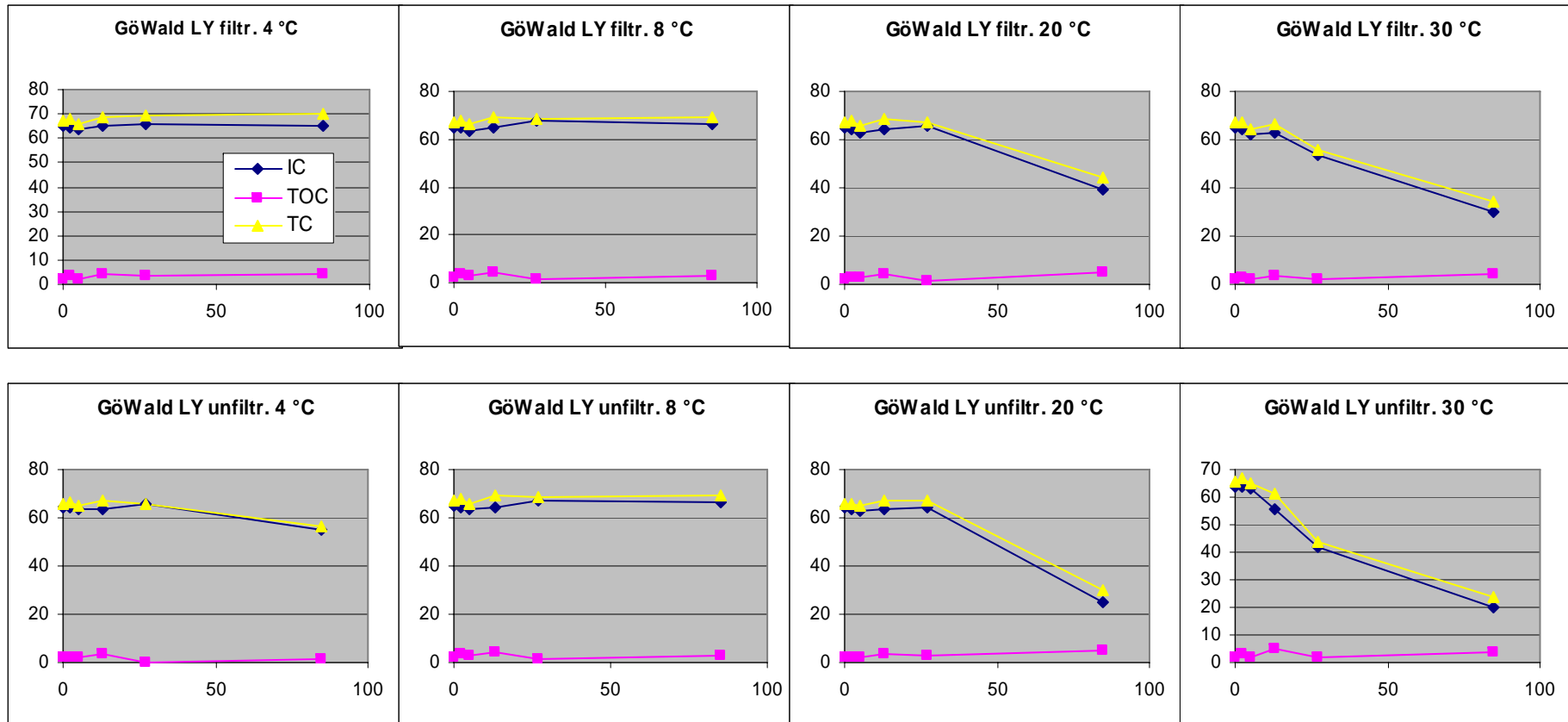
TOC



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pH 8

TC / IC



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pH 5,2

Stemflow

pH 5,0

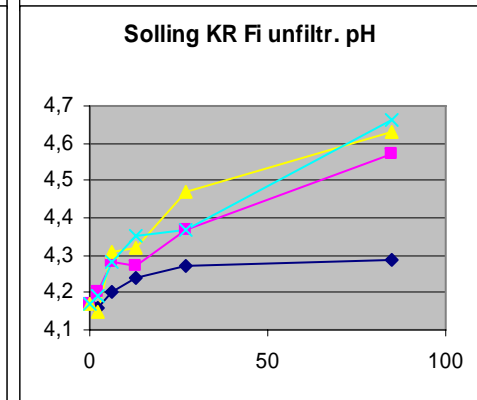
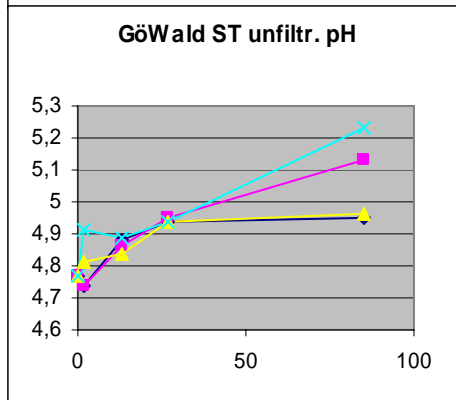
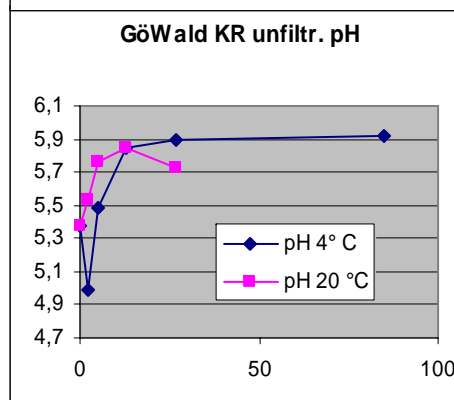
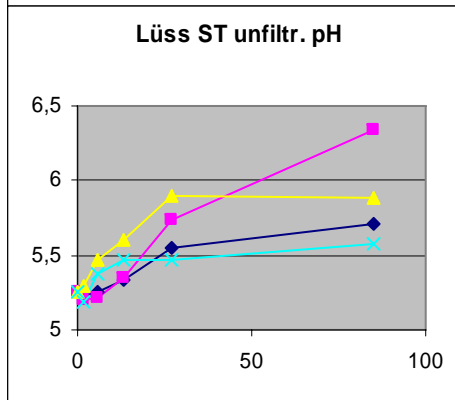
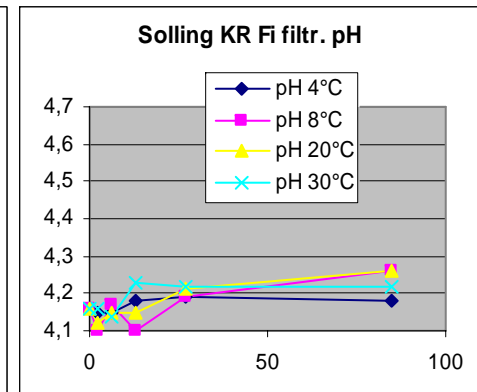
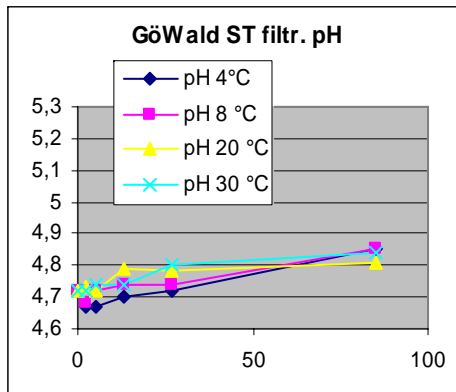
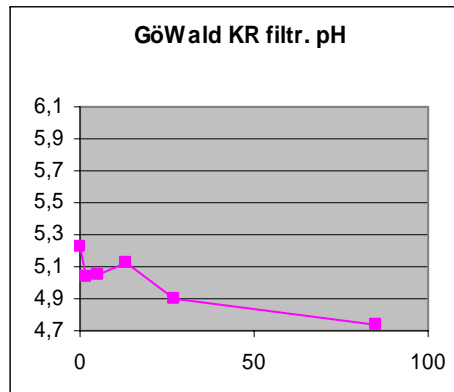
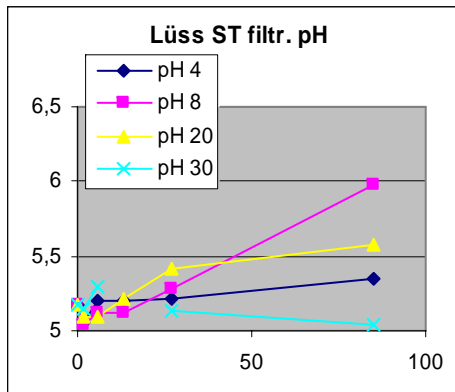
Throughfall

pH 4,7

Stemflow

pH 4,2

Throughfall



pH

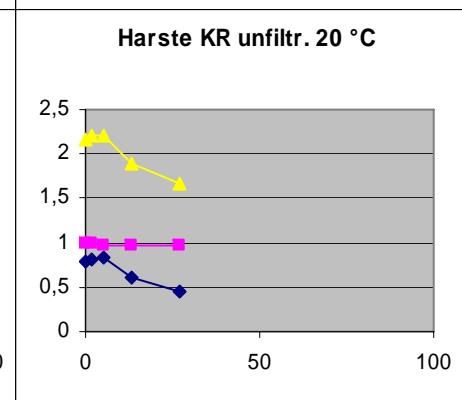
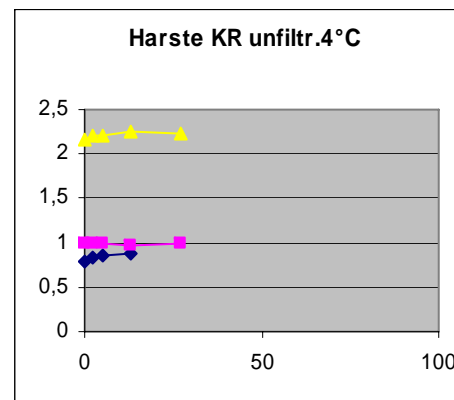
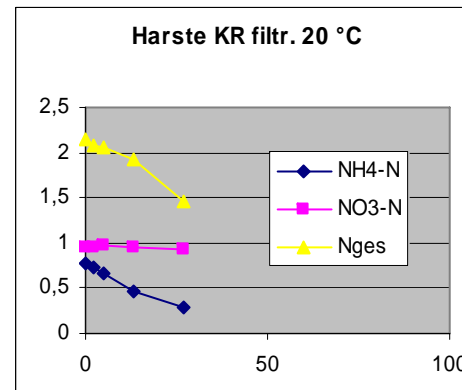


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pH 5,0 Throughfall



NH_4 / NO_3 / N_{tot}



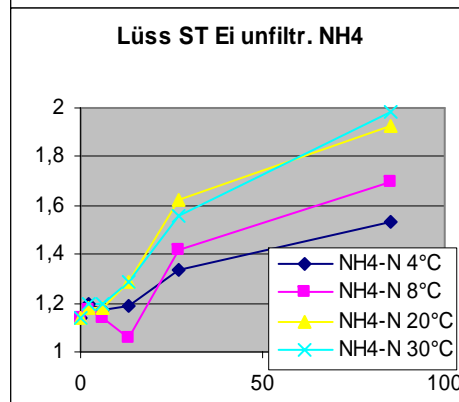
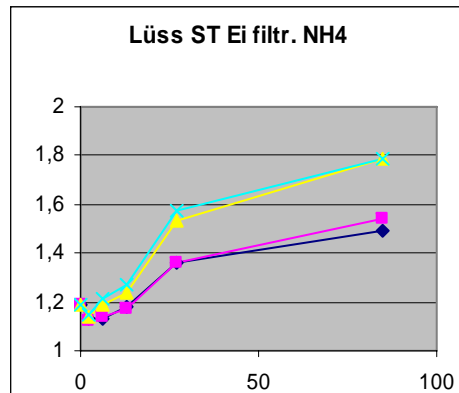
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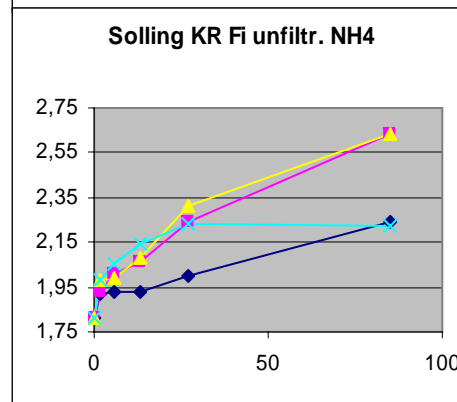
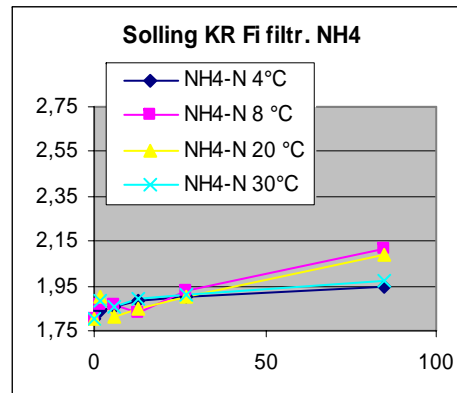
pH 3,8

Stemflow



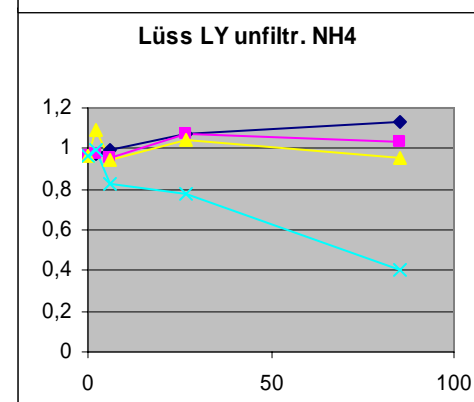
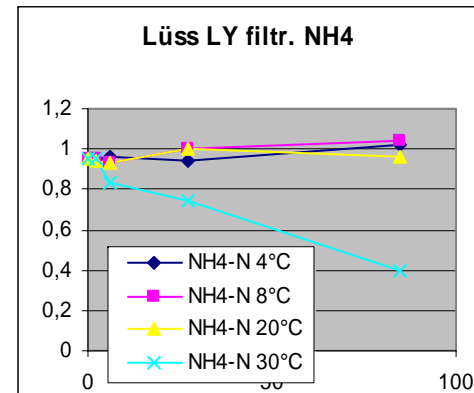
pH 4,0

Throughfall



pH 4,0

Soil water



NH₄



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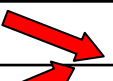
















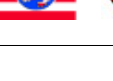
plot	sample typ		tree species	pH	TC			Temp.
						filtr.	unfiltr.	
Lüss	Stemflow	ST	oak	3,8	350	→	→	
Lüss	soil water	LY		4	70	→	→	
Solling	throughfall	KR	spruce	4	20	→	↗	(X)
Solling	Stemflow	ST	beech	4,3	10	→	→	
Solling	soil water	LY		4,5	5	↘ ↗	↘ ↗	
Göttinger Wald	Stemflow	ST	beech	4,9	5	↘	↘	(X)
Solling	throughfall	KR	beech	5	5	→	↘	
Harste	Stemflow	ST	beech	5	10	→	→	
Harste	throughfall	KR	beech	5	5	→	→	
Lüss	Stemflow	ST	beech	5,2	10	↘	↘	
Göttinger Wald	throughfall	KR	beech	5,4	5	→	↘	
Lüss	throughfall	KR	oak/beech	6	10	→	→	
Göttinger Wald	soil water	LY		8	70	↘	↘	



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plot	sample typ		tree species	pH	TC			Temp.
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Lüss	Stemflow	ST	oak	3,8	350			X
Lüss	soil water	LY		4	70			X
Solling	throughfall	KR	spruce	4	20			(X)
Solling	Stemflow	ST	beech	4,3	10			X
Solling	soil water	LY		4,5	5			(X)
Göttinger Wald	Stemflow	ST	beech	4,9	5			(X)
Solling	throughfall	KR	beech	5	5			X
Harste	Stemflow	ST	beech	5	10			X
Harste	throughfall	KR	beech	5	5			(X)
Lüss	Stemflow	ST	beech	5,2	10			X
Göttinger Wald	throughfall	KR	beech	5,4	5			X
Lüss	throughfall	KR	oak/beech	6	10			X
Göttinger Wald	soil water	LY		8	70	IC 	IC 	X



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Solling	Stemflow	ST	beech	4,3	10	0	0	
Solling	soil water	LY		4,5	5	0	0	
Göttinger Wald	Stemflow	ST	beech	4,9	5	0	0	
Solling	throughfall	KR	beech	5	5			
Harste	Stemflow	ST	beech	5	10			
Harste	throughfall	KR	beech	5	5			X
Lüss	Stemflow	ST	beech	5,2	10			X
Göttinger Wald	throughfall	KR	beech	5,4	5			
Lüss	throughfall	KR	oak/beech	6	10			(X)
Göttinger Wald	soil water	LY		8	70	0	0	



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<u>plot</u>	<u>sample typ</u>		<u>tree species</u>	pH	TC			Temp.
						filtr.	unfiltr.	
Lüss	Stemflow	ST	oak	3,8	350	→	→	
Lüss	soil water	LY		4	70	→	→	
Solling	throughfall	KR	spruce	4	20	→	→	
Solling	Stemflow	ST	beech	4,3	10	0	0	
Solling	soil water	LY		4,5	5	0	0	
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Solling	throughfall	KR	beech	5	5	→	→	
Harste	Stemflow	ST	beech	5	10	→	→	
Harste	throughfall	KR	beech	5	5	→	→	
Lüss	Stemflow	ST	beech	5,2	10	0	0	
Göttinger Wald	throughfall	KR	beech	5,4	5	→	→	
Lüss	throughfall	KR	oak/beech	6	10	→	→	
Göttinger Wald	soil water	LY		8	70	→	→	



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plot	sample typ		tree species	pH	TC	pH	TC	NH4	NO3
Lüss	Stemflow	ST	oak	3,8	350	→	+10%	→	→
Lüss	soil water	LY		4	70	→	+10%	→	→
Solling	throughfall	KR	spruce	4	20	→	-15%	→	→
Solling	Stemflow	ST	beech	4,3	10	→	-50%	0	0
Solling	soil water	LY		4,5	5	→	-20%	0	0
Göttinger Wald	Stemflow	ST	beech	4,9	5	→	-20%	→	0
Solling	throughfall	KR	beech	5	5	→	-10%	→	→
Harste	Stemflow	ST	beech	5	10	→	-10%	→	→
Harste	throughfall	KR	beech	5	5	→	→	→	→
Lüss	Stemflow	ST	beech	5,2	10	→	-25%	0	0
Göttinger Wald	throughfall	KR	beech	5,4	5	→	-10%	→	→
Lüss	throughfall	KR	oak/beech	6	10	→	-25%	→	→
Göttinger Wald	soil water	LY		8	70	→	→	→	→

4 °C / filtr. / 85 days



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Conclusions:

1. Most of the tested samples changed their chemical composition during storage
2. Changing parameters were pH, TC / TOC, NH_4 and N_{tot}
3. The changes in unfiltered samples normally were higher than in filtered samples, but in filtered samples there were also changes
4. In the majority of cases the changes were higher at higher temperatures
5. The pH increased; filtered samples with $\text{pH} < 4,9$ didn't change
6. TC / TOC decreased; typically the decrease was higher with increasing temperature
7. NH_4 can increase and decrease; typically the increase or decrease was higher or faster with increasing temperature
8. NO_3 didn't change in the tested samples



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Conclusions (continued):

9. In filtered samples stored at 4°C only the TC /TOC content decreased; the other parameters didn't change.

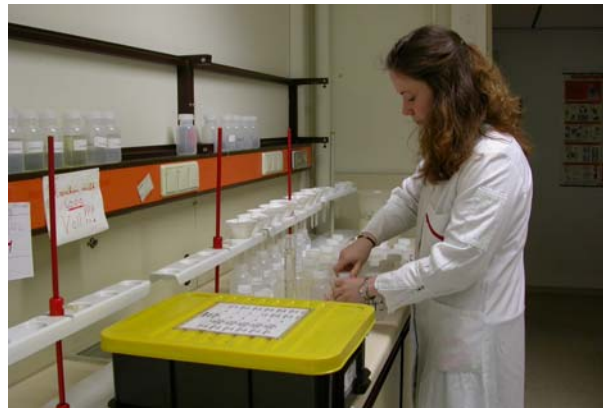
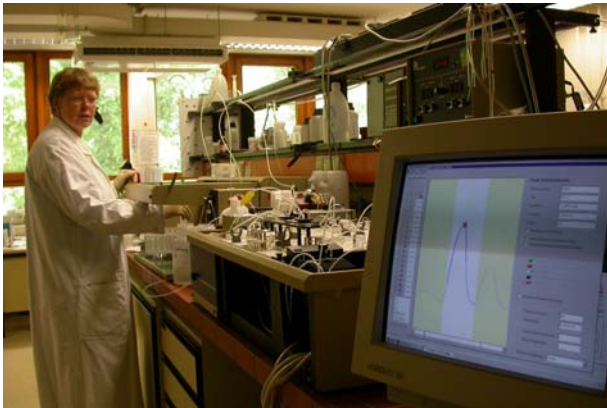
10. The results for the unfiltered samples stored up to 13 days at different temperatures show many different changes for pH, TOC / TC / IC, NH₄ and N_{tot}. That means, that there must be many changes for these parameters in the different samplers in the field before the samples were collected.



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Many Thanks to our technicians, who have done most of the work for this presentation !



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