UNIVERSITÄT BAYREUTH
Abt. Mikrometeorologie

Documentation of the WALDATEM-2003 Experiment
April, 28th to August, 03rd 2003

Christoph Thomas
Johannes Ruppert
Johannes Lüers
Joel Schröter
Jens-Christopher Mayer
Teresa Bertolini

Arbeitsergebnisse
Nr. 24
Bayreuth, Mai 2004

Contents

1 Introduction

Abstract

Field campaign WALDATEM at the site tower Weidenbrunnen, Waldstein: The field campaign is carried out in the framework of the BITOEK-research program and aims on the intensive investigation of coherent structures and carbon fluxes within and above a tall spruce forest. The name WALDATEM was chosen from the analysing system used in the campaign: WALD = WAveLet Detection and ATEM = Atmospheric Turbulence Exchange Measurements. Coherent Structures are well-organized low-frequent eddies with their spatial and temporal scales being different from well-known turbulence. The eddy-covariance-technique used for the determination of the overall flux does not account for their contribution to the flux or gives erroneous results. Detection and analysis of the coherent structures is performed using the software WALDSCHRAT (WAveLet Detection Software for CoHerent Ramp paTterns) developed at the Department of Micrometeorology, BITÖK, University of Bayreuth. Its implemented algorithms are based on the wavelet transform and yield results about both individual events and statistical properties. The input data are obtained by a vertical profile of sonic anemometers covering all parts of the forest up to the lower part of the roughness sub layer. The sonics are installed at six different heights and operated at a sampling frequency not smaller than 10 Hz, while four heights are additionally equipped with fast CO_2 and/or H_2O analysers for assessing the carbon dioxide and water vapour budgets. The vertical profile is continued up to a height of several hundreds of meters above ground by using acoustic and radar remote sensing (SODAR-RASS). The results are expected to enhance the accuracy and reliability of ecosystem flux measurements and allow deeper insight into the dynamics of the generation of coherent structures. Detailed information about source and sink terms of the carbon budget are assessed through measurements of ^{13}C isotope fluxes. For this purpose, Relaxed Eddy Accumulation (REA) technique is here being applied. The air samples are taken at the top level of the sonic profile ~13 m above the canopy top at a height of 33 m above ground. The applied REA system takes "whole air" samples, which are temporally stored in reservoirs before being filled into glass flasks. The air samples are subsequently analysed in the isotope laboratory of the Max-Planck-Institute of Jena with high precision. Diurnal variations of the mean carbon dioxide concentration within the spruce forest are obtained through combined CO_2-/^{13}C-profile measurements. Despite its goal studying local processes within the canopy, it is used to assess the vertical advection terms in the CO_2 budget. Both applied systems are controlled by the software ATEM and ATEM_PROFILE developed at the Department of Micrometeorology, BITÖK, University of Bayreuth. Three small towers placed at a distance of 50 m from the main tower give additional information about the advective flow in the sub-canopy space, while the CO_2-analysing system HYDRA developed at the National Center for Atmospheric Research in Boulder/USA will be used for determination of the horizontal advective terms. Special interest is paid to cold drainage flow along the smooth slope during night conditions.

Zusammenfassung

Experiment WALDATEM am Messturm Weidenbrunnen/Waldstein: Im Rahmen der BITÖK-Forschungen dient dieses komplexe Experiment der intensiven Untersuchung von kohärenten Strukturen und Kohlenstoffflüssen in und über einem hohen Fichtenwald, dessen Name sich von den verwendeten Analysesystemen herleitet (WALD = WAveLet Detection, ATEM = Atmospheric Turbulence Exchange Measurement). Kohärente Strukturen sind niederfrequente gut organisierte Luftwirbel, die sich in ihren Zeit- und Raumskalen deutlich von der atmosphärischen Turbulenz unterscheiden und deren z. T. erheblicher Flussanteil durch die herkömmliche Eddy-Kovarianz-Methode nur unzureichend oder falsch erfasst wird. Zur Detektion und Analyse wird die selbstentwickelte Software WALDSCHRAT (WAveLet Detection Software for CoHerent Ramp paTterns) verwendet, die durch die implementierte Wavelet-Transformation sowohl individuelle kohärente Strukturen, als auch ihre statistischen Eigenschaften erkennt. Die Eingangsdaten werden durch ein Vertikalprofil von sechs Ultraschallanemometern erhoben, das den Stamm-, Kronenraum und Teile der darüber liegende rauen Unterschicht umfasst. Vier Messhöhen sind zusätzlich mit schnellen CO_2- und/oder H_2O-Analysatoren ausgestattet, um direkt den Kohlenstofffluss und die Verdunstung zu bilanzieren. Nach oben hin wird das Profil durch fernerkundliche Schallsondierungen mittels SODAR-RASS bis in eine Höhe von mehreren Hundert Metern über Grund fortgeführt. Durch die Ergebnisse der intensiven Messungen soll eine exaktere Bestimmung der ökosystemrelevanten Stoffflüsse ermöglicht und ein detaillierter Einblick in die Dynamik der Entstehung kohärenter Strukturen geschaffen werden. Informationen über die Quellen und Senken des Kohlendioxids und die Austauschprozesse mit der Atmosphäre soll die Messung von ^{13}C Isotopen liefern. Im Rahmen des WALDATEM Experiments werden die ^{13}C-Flüsse mittels der Relaxed Eddy Accumulation (REA) Methode gemessen. Dieses Messsystem läuft oberhalb des Fichtenbestandes parallel zu den CO_2-Flussmessungen des Standardmessprogramms auf 33 m Höhe. Es handelt sich dabei um ein "Whole air"-REA-System, in dem die Luftproben in einem Zwischenreservoir gesammelt und anschließend in Glasflaschen abgefüllt werden. Anschließend werden sie mit hoher Präzision im Isotopenlabor des Max Planck Institutes für Biogeochemie in Jena analysiert. Aufschluss über den zeitlichen Verlauf der Konzentrationen innerhalb des Fichtenbestandes gibt ein kombiniertes CO_2-/^{13}C-Profil. Neben der Beobachtung von lokalen Prozessen innerhalb des Bestandes dient es dazu, vertikale advektive Terme in der CO_2-Bilanz zu bestimmen. Zur automatischen Steuerung dieser Systeme verwenden wir die selbst entwickelte Software ATEM und ATEM_PROFILE. Die advektiven Luftbewegungen im Stammraum des Bestandes werden an drei weiteren Türmen in 50 m Abstand vom Hauptturm gemessen. In Kombination mit dem CO2-Konzentrationsmesssystem HYDRA, das am National Center for Atmospheric Research entwickelt wurde, sollen horizontale advektive Terme in der CO_2-Bilanz erfasst werden. Besonderes Interesse gilt dabei der Suche nach nächtlichen Kaltluftabflüssen entlang der leichten Hangneigung.

2 General Information

2.1 Location

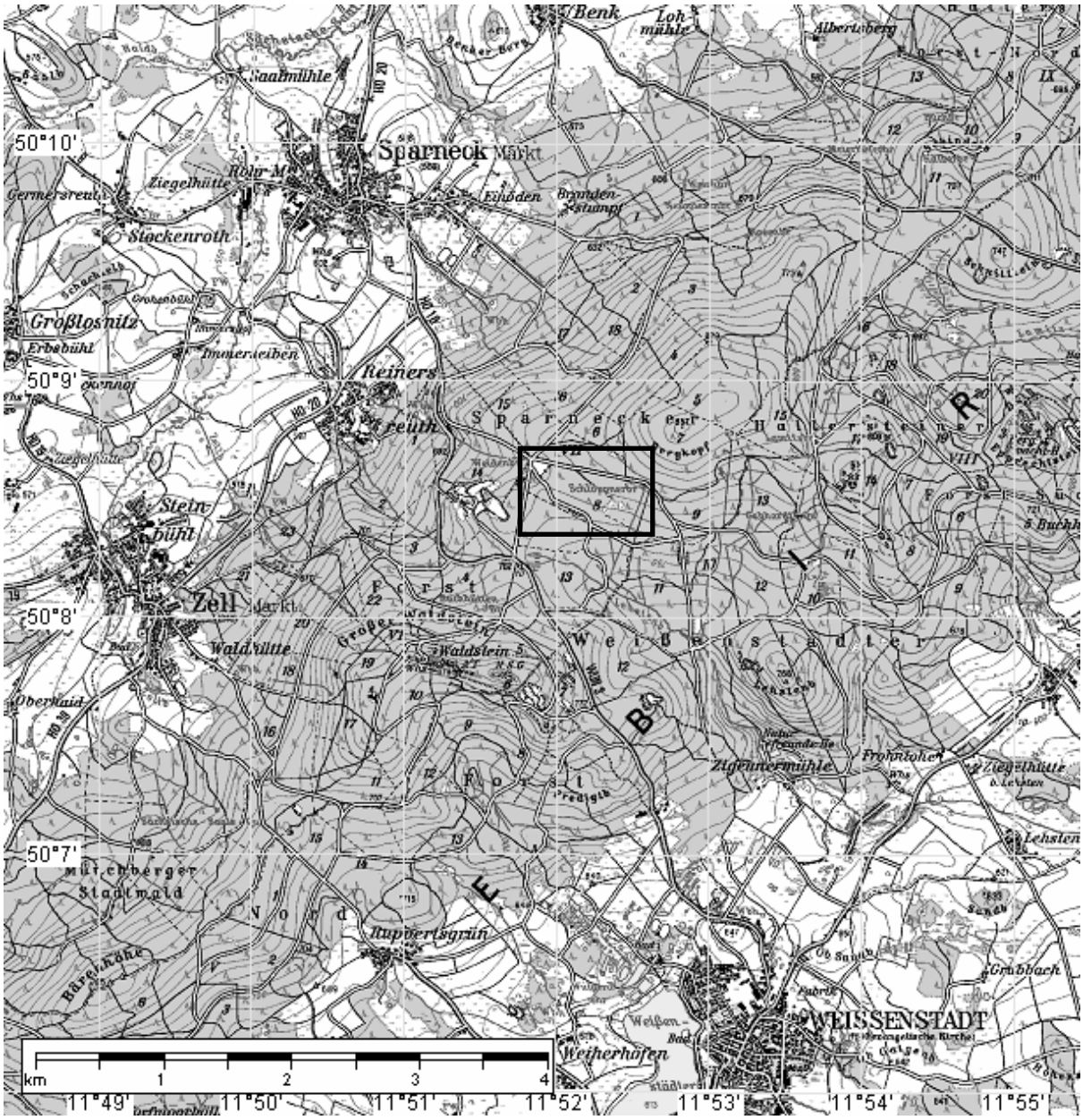
Location	Waldstein: Weidenbrunnen and Pflanzgarten. Meteorological Experimental Site of the Bayreuther Institute for Terrestrial Ecosystem Research (BITÖK)
Coordinates Weidenbrunnen:	50°08'31" N and 11°52'01" E
Altitude Weidenbrunnen:	775 m a. s. l.
Land use Weidenbrunnen:	Coniferous Forest, main specie Spruce (*Picea abies*)
Coordinates Pflanzgarten:	50°08'39" N and 11°52'00" E
Altitude Pflanzgarten:	765 m a. s. l.
Land use Pflanzgarten:	Clearing, Gras
Time zone	CET = MEZ Given times and filenames reflect starting time of intervals

2.2 Canopy heights

site	date	Canopy height	Displacement height
Weidenbrunnen	01.07.2003	~ 19 m	~ 12.5 m
Pflanzgarten	19.05.2003	~ 0.5 m	~ 0.3 m

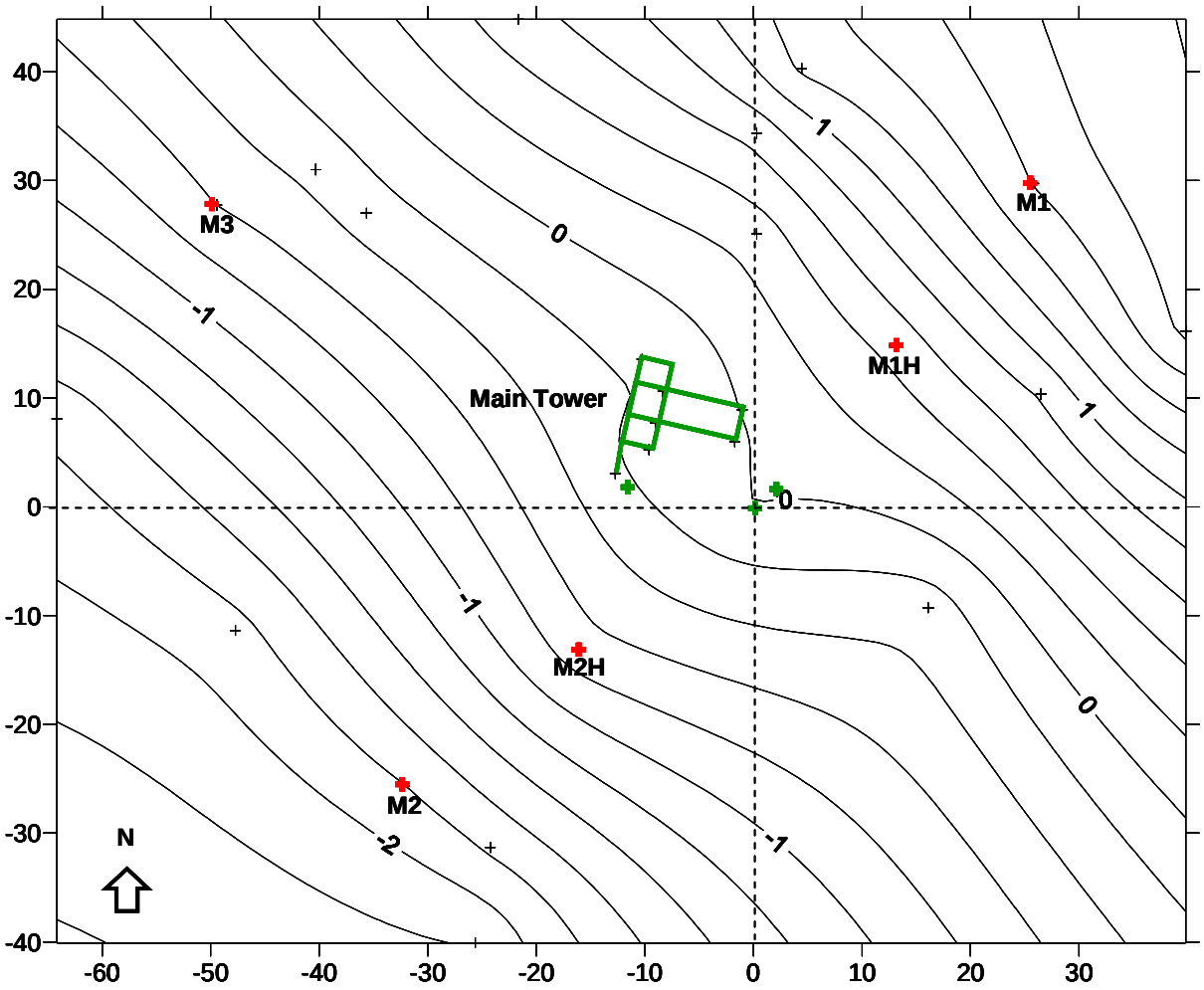
3 Overview of measuring sites

3.1 Maps and sketches

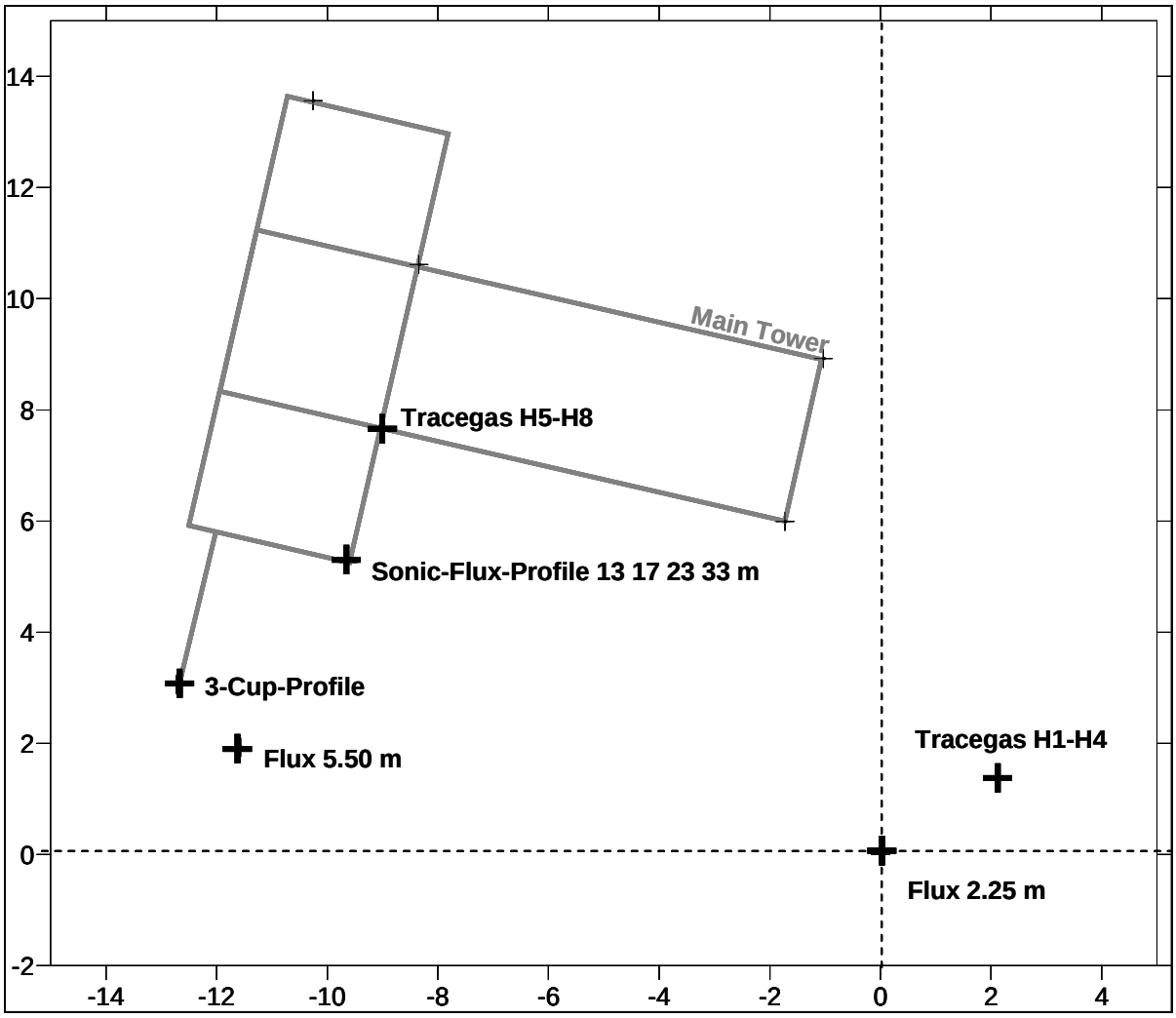


General overview of the Waldstein region, Fichtelgebirge mountains with Weidenbrunnen and Pflanzgarten meteorological experimental sites of the Bayreuth Institute for Terrestrial Ecosystem Research (BITÖK). Map is a courtesy of the Landesvermessungsamt Bayern, TK 50.

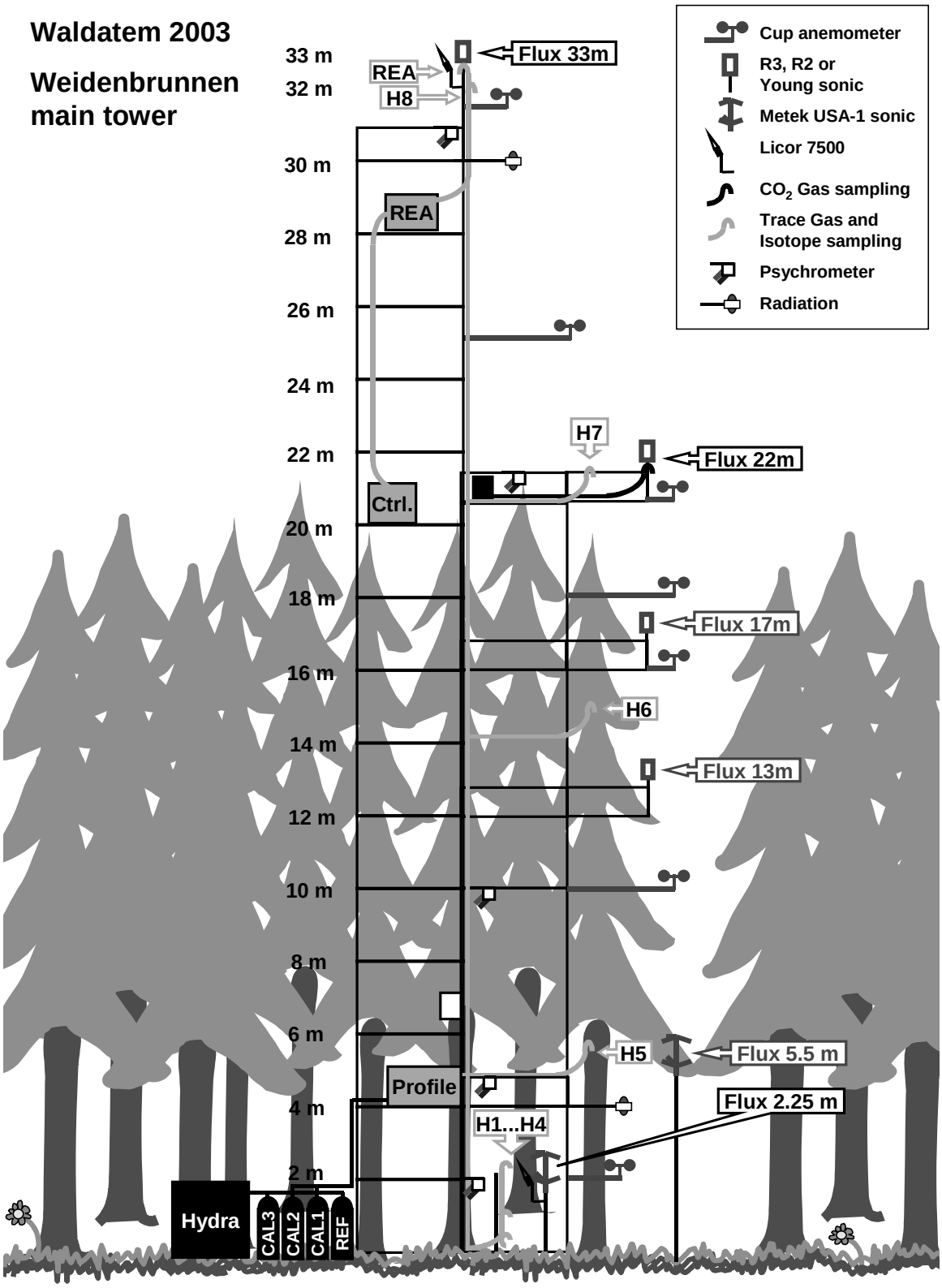
3.1.1 Weidenbrunnen site



Positions and elevation of the sub-canopy masts in relation to reference level (775 m a. s. l.). Units of x-axis and y-axis are meters [m]. M1 to M3 denote the positions of the sub-canopy masts in combination with the HYDRA air inlets. M1H and M2H stand for additional HYDRA air inlets.



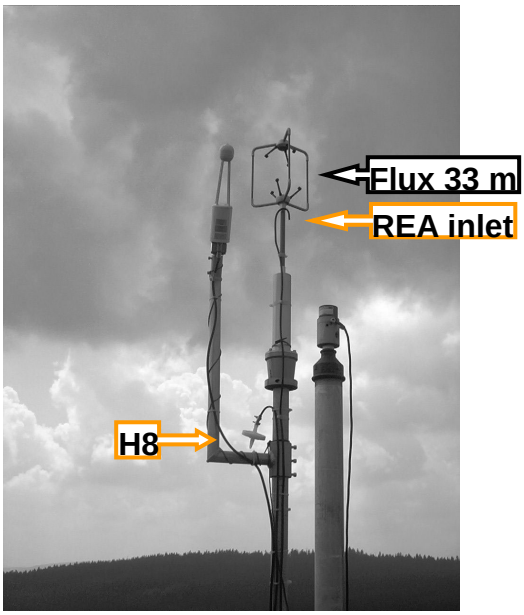
Detailed sketch of the Main Tower. Units of x-axis and y-axis are meters [m]. The upper border of the figure points to North.



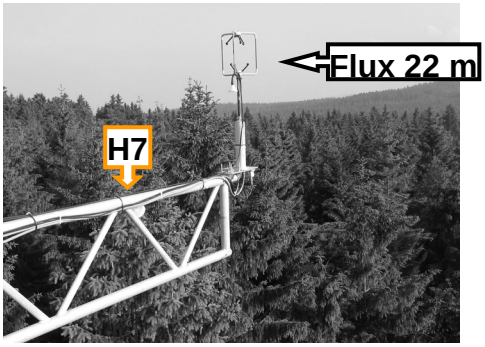
Setup of the Main Tower.

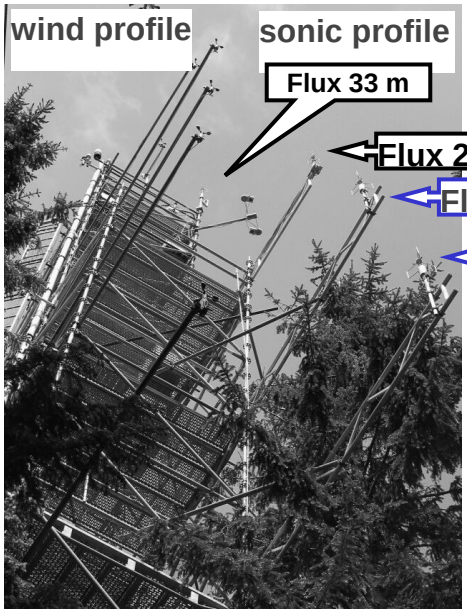

Weidenbrunnen, main tower

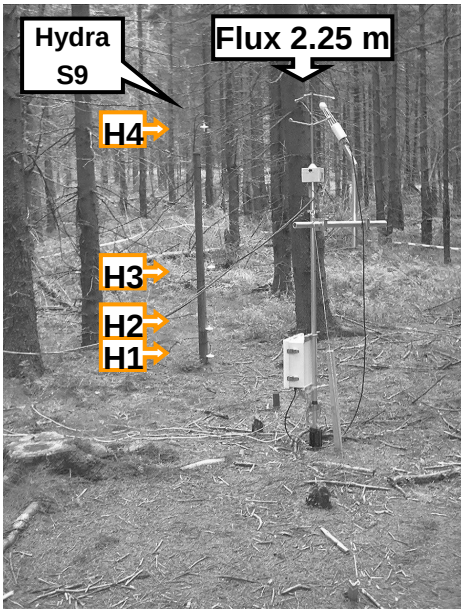

tower top


Flux 33 m
REA inlet
H8

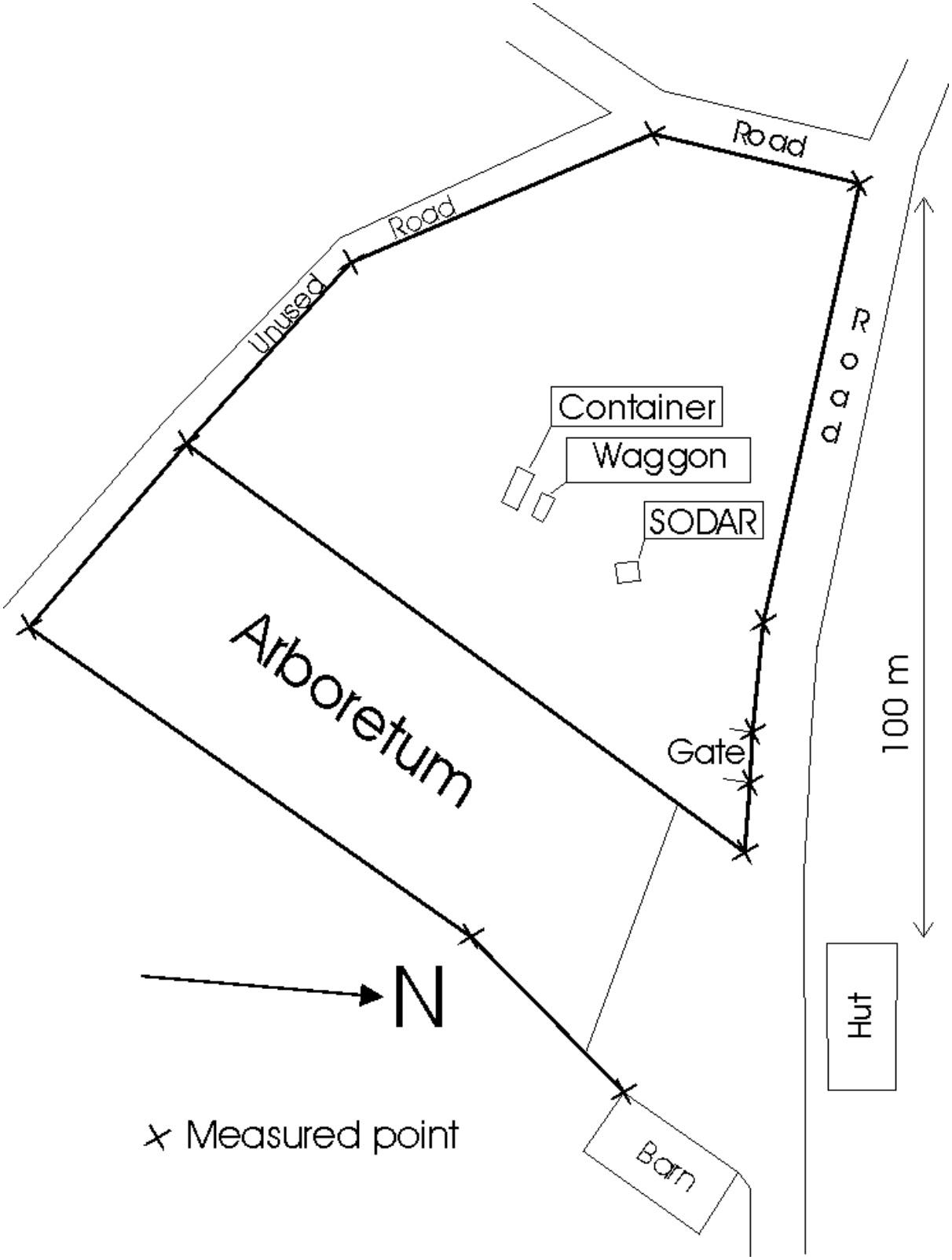

sonic profile
wind profile


Flux 22 m
H7

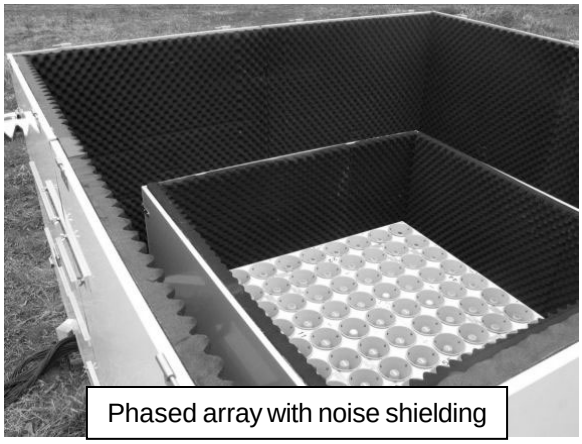

wind profile
sonic profile
Flux 33 m
Flux 22 m
Flux 17 m
Flux 13 m


Hydra
S9
Flux 2.25 m
H4
H3
H2
H1

3.1.2 Pflanzgarten site

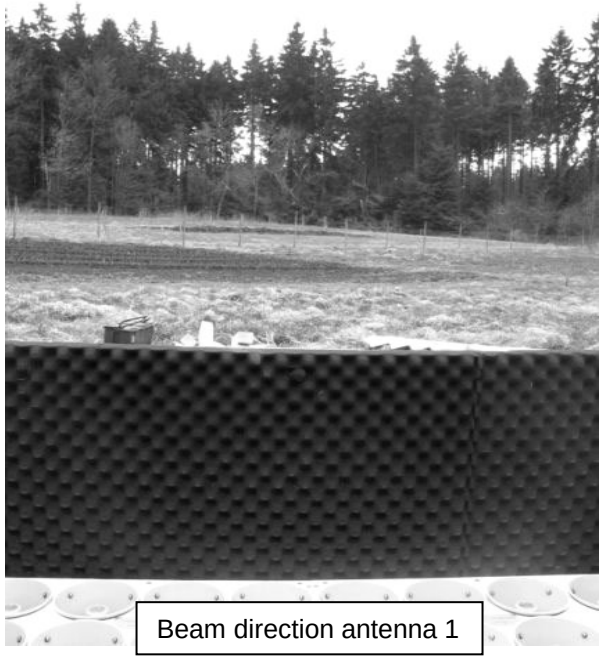


Detailed sketch of Pflanzgarten site.

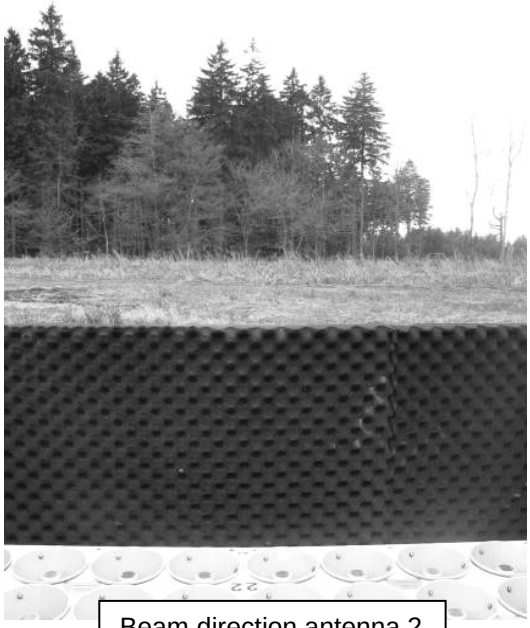


Phased array with noise shielding

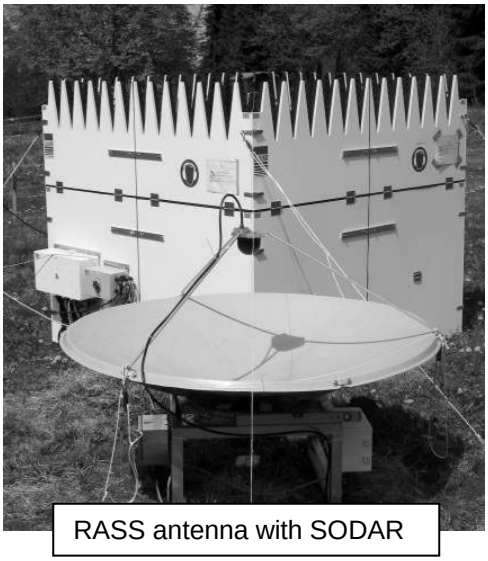
SODAR with RASS extension



Beam direction antenna 1



Beam direction antenna 2



RASS antenna with SODAR

Waggon for SODAR

4 Measuring complexes

4.1 Flux measurements and sonic profile

No.	Name	Position	Instrument	Period
1	Flux 33 m	Main tower	Gill R3 Sonic, Licor 7500	28.04.03 – 31.07.03
2	Flux 22 m	Main tower	Gill R2 Sonic, 2 Inclinometer Jewell Instr. LCF101-14.5° Licor 6262	21.05.03 – 31.07.03 04.06.03 – 20.07.03
3	Flux 17 m	Main tower	Young Sonic 81000	21.05.03 – 31.07.03
4	Flux 13 m	Main tower	Young Sonic 81000	24.05.03 – 31.07.03
5	Flux 5.50 m	Mast 5.50 m	Metek Sonic USA-1-FHN Krypton Hygrometer (for Krypton Hygrometer no valid data are available for the entire experiment)	24.06.03 – 17.07.03
6	Flux 2.25 m	Mast 2.25 m	Metek Sonic USA-1-A Licor 7500	16.06.03 - 01.08.03

4.2 Relaxed Eddy Accumulation (REA) measurements

No.	Name	Position	Instrument	Period
7	Flux 33 m (Same as complex no. 1)	Main tower	Gill R3, Licor 7500	Continuous measurement see no. 1 Additional 10 Hz record with ATEM software 24.6.03 – 28.7.03
8	REA-System 32 m	Main tower	Isotope REA system (University of Bayreuth, Department of Micrometeorology, Johannes Ruppert)	26.6.03, 28.6.03, 6.7.03, 7.7.03, 8.7.03, 23.7.03

4.3 Trace Gas Profile and sub-canopy CO_2-measurements

No.	Name	Position	Instrument	Period
9	Trace gas Profile-System	Main Tower & Sub-canopy center	CO2 and Isotope Profile system (University of Bayreuth, Department of Micrometeorology, Johannes Ruppert)	Continous sampling 13.6.03 – 2.8.03 Trace Gas Flask measurements 26.6.03, 28.6.03, 6.7.03, 7.7.03, 8.7.03, 23.7.03
10	Hydra-System	Sub-canopy	CO_2 Measurement-System (National Center for Atmospheric Research, NCAR, Antony C. Delany)	5.7.03 –2.8.03

4.4 Sub-canopy wind measurements

No.	Name	Position	Instrument	Period
11	Sub-canopy Mast 1	50 m NE of Main tower	2 x Anemometer Climatronics F460 1 x Anemometer Climatronics F460 1 x Vane Vector Inst. W200P	20.6.03 – 4.8.03 27.6.03 – 4.8.03 20.6.03 – 4.8.03
12	Sub-canopy Mast 2	50 m S of Main tower	2 x Anemometer Climatronics F460 1 x Vane Vector Inst. W200P	20.6.03 – 4.8.03 20.6.03 – 4.8.03
13	Sub-canopy Mast 3	50 m W of Main tower	2 x Anemometer Climatronics F460 1 x Vane Climatronics F 460	25.6.03 – 4.8.03 26.6.03 – 4.8.03

4.5 SODAR-RASS measurements

No.	Name	Position	Instrument	Period
14	SODAR-RASS	Clearing Pflanzgarten	Metek DSDPA.90/64 + 1290MHz RASS extension	Setup: 29.04.03 – 09.05.03 Measurements: 09.05.03 - 16.07.03

4.6 Standard meteorological measurements

4.6.1 Weidenbrunnen, Main Tower (Nov 2003)

No.	Name	Position	Instrument, measurement height	Period
15	Wind velocity profile	Main tower	Friedrichs cup anemometers 2 m, 10 m, 16 m, 18 m, 21 m, 25 m, 32 m	continuous
15	Temperature & Humidity profile	Main tower	HMP45a; psychrometer Assmann 2 m, 21 m, 31 m additional psychrometers 12.5 m, 5.50 m	2003 25.06.03 – 30.09.03
15	Wind direction	Main tower	Skye Wind vane; Thies 2D Ultra sonic 32 m	continuous
15	Present weather detector	Main tower	PWD11 21 m	continuous
15	Short & Long wave Radiation	Main tower	CM14, CG2 30 m	continuous
15	Soil temperature profile	Main tower	PT100 −5 cm, −10 cm, −20 cm, −50 cm	continuous

4.6.2 Pflanzgarten, LfU Container (Nov 2003)

No.	Name	Position	Instrument, measurement height	Period
16	Wind velocity	LfU Container	Thies anemometers 10 m	continuous
16	Wind direction	LfU Container	Thies Wind vane 10 m	continuous
16	Air temperature	LfU Container	HMP45a 2 m	continuous
16	Relative humidity	LfU Container	HMP45a 2 m	continuous
16	Precipitation	LfU Container	Thies OMC 212 1 m	continuous
16	Short wave Radiation, direct & diffuse	LfU Container	CM11, Shadow ring 4 m	continuous
16	Air chemistry: O_3, SO_2, NO_2, NO	LfU Container	MLU-Analyzers, Eco-Physic-Analyzers	continuous

4.6.3 Extended measuring program

No.	Name	Position	Instrument, measurement height	Period
17	Sub-canopy short & long wave radiation	Main tower	Kipp&Zonen CNR1 4.60 m	25.06.2003 - 23.09.2003
17	Sub-canopy air temperature & humidity	Main tower	Psychrometer 5.5 m and 12.5 m	25.06.2003 - 23.09.2003

5 Detailed description of instrumentation

All heights are given as height above ground level (a. g. l.). The displacement height is not subtracted (for details see section 2.2).

5.1 Flux measurements and sonic profile

Measuring Complex 1: Flux 33 m

Flux 33 m			
Height [m]	Instrument Type	No.	Calibration / Reference
33.05	Gill R3-50, 20 Hz sampling frequency	0253	Calibration: Gill at Southampton University 7x5 Wind tunnel, 24.03.2003
32.87	CO_2/H_2O-Analyzer LI-7500 'solar–fixed' , 20 Hz sampling frequency	75 H-0270	CO_2/H_2O-Calibration: LiCOR 25.02.2003, see Calibration Certificate; Zero/Span-Calibration: LiCOR 26.02.2003, see Calibration certificate. Separation (horizontal) from R3: 28 cm, 43.5° tilted from zenith against North. Separation (vertical) from R3: -18 cm Separation (direct) from R3: 33 cm, pointing to ~ 80° from sonic Settings: Valid until 25.6.03, 7:40 h **CD WALDATEM2003 REA atc**:\WALDATEM2003 REA atc\experiment setup\licor7500 36m\Configuration jr2003jun25_0740.l75 Valid from 25.6.03, 11:00 h **CD WALDATEM2003 REA atc**:\WALDATEM2003 REA atc\experiment setup\licor7500 36m\Configuration jr2003jun25_1100 300ms delay.l75

Measuring Complex 2: Flux 22 m

Flux 22 m			
Height [m]	Instrument Type	No.	Calibration / Reference
22.40	Gill R2, 20.82 Hz sampling frequency	N/A	N/A
22.40 (Inlet), directly fixed at the sonic R2	Li6262, 10 Hz sampling frequency recorded at 20.82 Hz sampling frequency by analogue inputs of Gill R2	IRG3-725	Calibration (from German distributor): WALZ 14.02.2002 Zero/Span: Christoph Thomas with CO2 (0 ppm and 373.5 ppm) and H2O (0 mmol/mol and dewpoint generator depending on ambient water vapour pressure) 04.06.2003, 09.06.03, 17.06.03, 26.06.03, 08.07.03, 17.07.03 Settings: **CD WALDATEM2003 R2+Li6262** CD1/CD2 c2003*.cfg files, lines 4-5
~22.0	2 Inclinometer LCF-101- 14.5° (along and across the sonic mounting bar), recorded at 20.82 Hz sampling frequency by analogue inputs of Gill R2	2030637, 2030633	Calibration (manufacturer): Jewell 24.01.2003 see calibration certificate for details

Measuring Complex 3: Flux 17 m

Flux 17 m			
Height [m]	Instrument Type	No.	Calibration / Reference
17.7	Young 81000, 10 Hz sampling frequency	-	N/A

Measuring Complex 4: Flux 13 m

Flux 13 m			
Height [m]	Instrument Type	No.	Calibration / Reference
13.6	Young 81000,10 Hz sampling frequency	-	N/A

Measuring Complex 5: Flux 5.50 m

Flux 5.50 m			
Height [m]	Instrument Type	No.	Calibration / Reference
5.54	Ultraschallanemometer Metek USA-1-FHN	99 05007	User Manual 02/99
5.54	Kryptonhygrometer KH20	1462	User Guide und Calibration certificate from 12.10.2001

Measuring Complex 6: Flux 2.25 m

Flux 2.25 m			
Height [m]	Instrument Type	No.	Calibration / Reference
2.26	Ultraschallanemometer USA-1-A	98-12004	Orientation: Dir-X = 2° (N) User Manual 10/98 Settings: Sampling Frequency = 10 Hz, **CD WALDATEM2003 SONIC PROFILE**:\experiment setup\Metek1, 2_25m\ metek1, 2_25m settings, jr2003aug06.txt
2.21	CO_2/H_2O-Analyzer LI-7500	75H 0220	Kalibrierung 21.3.2003 Distance hor: 32 cm in 99° gg. N Distance vert.: -5 cm Inclination: 30° Richtung 0° gg. N Settings: Since 27.6.03, 11:52 h until 1.8.03, 11:05 h **CD WALDATEM2003 SONIC PROFILE**:\experiment setup\Licor7500, 2_25m\ Configuration 2003aug06_1254.l75

Position and Orientation of the flux complexes Flux 33 m, Flux 22 m, Flux 17 m, Flux 13 m and Flux 5.50 m

Period	Orientation	Position of the gas analysers in relation to the sonics
21.05.2003 – 31.07.2003, (17.07.2003)	North arrow of sonics = 0 ° against North, vertical orientation checked!	see details in description of individual complexes

Positioning and Orientation of the Flux 2.25 m System (Weidenbrunnen) (Record from Experiment Book, 01.08.03)

Period	Orientation of Metek 2.25 m sonic	Position of LiCor 7500 relativ to Metek 2.25 m sonic sonic	Position of Profile inlets H1, H2, H3, H4 relative to Metek 2.25 m sonic
16.06.2003 to 01.08.2003	X-Axis = 2° against N Vertical alignment ok.	Horizontal distance: 32 cm pointing to 99° against N Vertical distance.: -5 cm Inclination: 30° pointing to 0° against N	Horizontal distance: 255 cm in direction 58°

5.2 Relaxed Eddy Accumulation measurements

Measuring Complex 7: Flux 33 m (instruments same as in Measuring complex 1)

Flux 33m			
Height [m]	Instrument Type	No.	Calibration / Reference
33.05	Gill R3-50	0253	See measuring complex no. 1 Additional 10 Hz record with ATEM software 24.6.03 – 28.7.03
32.87	CO_2/H_2O-Analyzer LI-7500	75H-0270	See measuring complex no. 1 Additional 10 Hz record with ATEM software 24.6.03 – 28.7.03

Measuring Complex 8: REA-System

REA System (Weidenbrunnen)			
Height [m]	Instrument Type	No.	Calibration / Reference
32.90 (inlet)	Isotope REA system (University of Bayreuth, Department of Micrometeorology, Johannes Ruppert)		Ballon Experiment May 2002, REA System Lab Experiment April 2003, Tube delay experiment WALDATEM 2003 25.6.03, 7:40 h - 25.6.03, 11:00 h

Positioning and Orientation of the REA-System and Trace-gas profile-system relative to R3 sonic (Flux 33 m, Weidenbrunnen)

Period	Position of LiCor 7500 relativ to R3 sonic	Position of REA inlet relative to R3 sonic	Position of Profile inlets relative to R3 sonic
06.06.2003 to 01.08.2003	Distance horizontal 28 cm vertical -18 cm Direct distance = 33 cm direction ~ 80° against N	Directly beneath the R3 sonic measuring pathes	H8 = below R3 Sonic H7...H5 = mounted to the SE corner of Weidenbrunnen tower H1…H4 = SE of tower close to Metek 1, 2.25 m in the sub-canopy space
For a photo of R3, Licor 7500, Profile H8 and REA inlet see section 3.			

5.3 Trace Gas Profile and sub-canopy CO_2-measurements

Measuring Complex 9: Trace gas Profile-System

Trace gas profile system (Weidenbrunnen)			
Height [m]	Instrument Type	tube flow [l/min]	Calibration / Reference
0.03 = H1	CO2 and Isotope Profile system (University of Bayreuth, Department of Micrometeorology, Johannes Ruppert)	~ 1.2	continuous CO_2 measurements LiCor 820 Gashound 24.6.03: zero (with N2) span with CAL_373.5 gas = 371.9 ppm to 373.0 ppm
0.30 = H2		1.2	
0.90 = H3		1.2	Isotope and trace gas flask sampling: 26.6.03, 28.6.03, 6.7.03, 7.7.03, 8.7.03, 23.7.03 Analysis of air samples at the Max Planck Institute BGC Jena Database: **CD GRASATEM2003 WALDATEM2003 flask measurements**:\database\38 data retrieval\flask measurements all _final jr2003dec11_ v38.mdb
2.25 = H4		1.6	
5.25 = H5		1.6	
15.0 = H6		1.2	
21.6 = H7		1.2	
32.6 = H8		1.2	

Measuring Complex 10: HYDRA-system

Trace gas profile system (Weidenbrunnen)			
Location & Height [m]	Instrument Type	No.	Calibration / Reference
Sub-canopy mast 1 = NE, 1 m = **S1**	CO_2 Measurement-System (National Center for Atmospheric Research, NCAR, Antony C. Delany)		continuous CO_2 measurements CO_2/H_2O-Analyzer LI-7000
Sub-canopy mast 1 = NE, 2.25 m = **S2**			See **CD WALDATEM2003 PROFILE HYDRA**: \WALDATEM2003 CO2 PROFILE HYDRA\experiment setup\HYDRA LICOR7000 calibration and setup files\...
Sub-canopy mast 2 =S, 1 m = **S3**			Continuous calibration by sampling standard gas tanks of compressed air:
Sub-canopy mast 2 =S, 2.25 m = **S4**			REF (Cell A flushing) 381.07 ± 0.17 ppm CO_2
Sub-canopy mast 3 =W, 1 m = **S5**			CAL1 391.77 ± 0.517 ppm CO_2
Sub-canopy mast 3 =W, 2.25 m = **S6**			CAL2 378.26 ± 0.57 ppm CO_2
Sub-canopy ½ NE, 2.25 m = **S7**			CAL3 399.20 ± 0.06 ppm CO_2
Sub-canopy ½ S, 2.25 m = **S8**			CAL373_5 (synthetic air) 371.88 ± 0.23 ppm CO_2
Sub-canopy center, 2.25 m = **S9** Same location as Trace gas Profile 2.25 m = **H4**			**CD GRASATEM2003 WALDATEM2003 flask measurements**: \Hydra\calibration\ CAL Gastanks definitions.xls

Sub-canopy Mast	Hydra inlet at Mast	Sampling Height (m)	Hydra Connection	Tube length to Hydra (m)
M1	A1	2.25	S1	47
M1	A2	1.00	S2	44
M1h		2.25	S7	28
M2	B1	2.25	S3	48
M2	B2	1.00	S4	49
M2h		2.25	S8	?
M3	C1	2.25	S5	52 (1)
M3	C2	1.00	S6	47 (2)
Inter Calibration with ProfileH4			S8	17

1) With 14 m rubber tubing

2) With 15 m rubber tubing

5.4 Sub-canopy wind measurements

Measuring Complex 11: Sub-canopy mast M1

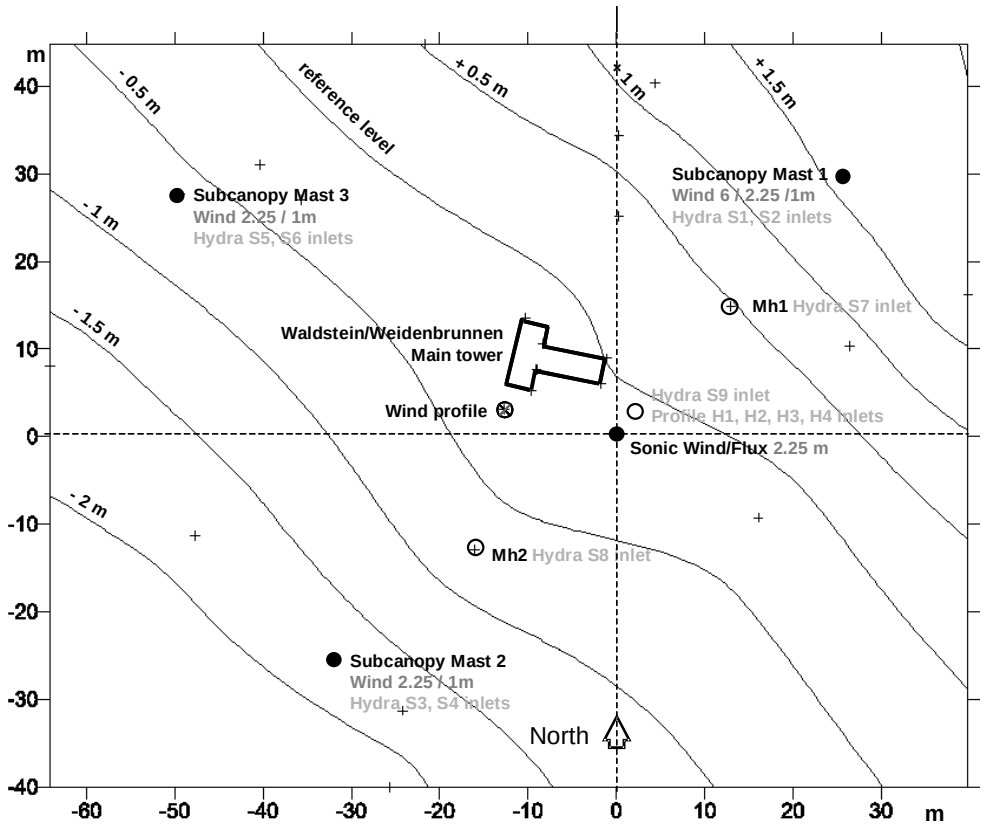
Height [m]	Instrument Type	SN	Period
6.00	3-cup Wind Speed Climatronics F460	4529	27.06.03 12:43 - 04.08.03 10:05
2.26	Climatronics F460	4522	20.06.03 22:16 - 04.08.03 10:05
1.61	Vane Vector Inst W200P	3524	20.06.03 22:16 - 04.08.03 10:05
1.01	3-cup Wind Speed Climatronics F460	4534	20.06.03 22:16 - 04.08.03 10:05

Measuring Complex 12: Sub-canopy mast M2

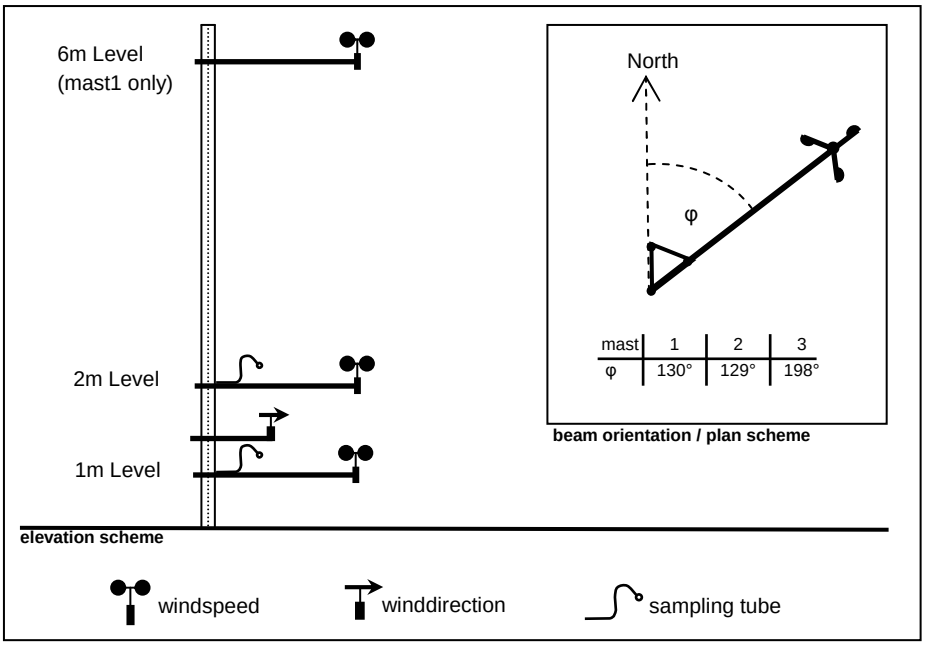
Height [m]	Instrument Type	SN	Period
2.20	3-cup Wind Speed Climatronics F460	4524	20.06.03 17:16 - 04.08.03 10:23
1.55	Vane Vector Inst W200P	3526	20.06.03 17:16 - 04.08.03 10:23
1.10	3-cup Wind Speed Climatronics F460	4713	20.06.03 17:16 - 04.08.03 10:23

Measuring Complex 13: Sub-canopy mast M3

Height [m]	Instrument Type	SN	Period
2.25	3-cup Wind Speed Climatronics F460	4505	25.06.03 15:00 - 04.08.03 10:40
1.83	Vane Climatronics F460	4218	26.06.03 13:10 - 04.08.03 10:40
1.05	3-cup Wind Speed Climatronics F460	4719	25.06.03 15:00 - 04.08.03 10:40



Positions of sub-canopy masts (measuring complex 11, 12 and 13) and HYDRA air inlets (measuring complex 10). Reference Level: 775 m a. s. l. (for details see **CD Waldatem_SubCanopyWIND**\SiteMapping\Aufmass_040510_northcorrected.xls).



Setup of the sub-canopy masts (**CD Waldatem_SubCanopyWIND:**Figures\Sub_canopy_mast2.wmf)

Data logger channels

Connector pin assignment DT-Logger (Sub-canopy mast M1)

Channel	Connection to DC Power Supply 12 V	Color of cable shielding
6 m F 460 Wind Speed SNR.4529		
31+ (Signal)		yellow
31 - (Ground)	(-)	green
	(+)	brown
2.26 m F 460 Wind Speed SNR.4522		
61 + (Signal)		yellow
61 - (Ground)	(-)	green
	(+)	brown
1.01 m F 460 Wind Speed SNR.4534		
62 + (Signal)		yellow
62 - (Ground)	(-)	green
	(+)	brown
1.61 m Wind vane W 200 P SNR.3524		
1 + (Signal)		green
1 - (Ground)		yellow
1 - (Ground)		blue

Connector pin assignment DT-Logger (Sub-canopy mast M2)

Channel	Connection to DC Power Supply 12 V	Color of cable shielding
2.20 m F 460 Wind Speed SNR.4524		
61 + (Signal)		yellow
61 - (Ground)	(-)	green
	(+)	brown
1.10 m F 460 Wind Speed SNR.4713		
62 + (Signal)		yellow
62 - (Ground)	(-)	green
	(+)	brown
1.55 m Wind vane W 200 P SNR.3526		
1 + (Signal)		green
1 - (Ground)		yellow
1 - (Ground)		blue

Connector pin assignment DT-Logger (Sub-canopy mast M3)

Channel	Connection to DC Power Supply 12 V	Color of cable shielding
2.25m F 460 Wind Speed SNR.4505		
61 + (Signal)		yellow
61 - (Ground)	(-)	green
	(+)	brown
1.05m F 460 Wind Speed SNR.4719		
62 + (Signal)		yellow
62 - (Ground)	(-)	green
	(+)	brown
1.83m F 460 Wind Direction SNR.4218		
1 + (Signal)		green
1 - (Ground)		yellow
---		brown

5.5 SODAR-RASS measurements

Measuring Complex 14: SODAR-RASS

Height [m]	Instrument Type	SN	Calibration / Reference	Period
-	Metek DSDPA.90/64 + 1290MHz RASS extension	-	-	Setup: 29.04.03 – 09.05.03 Measurements: 09.05.03 - 16.07.03

	Sounding frequency [kHz]	Height resolution [m]	Minimum height [m]	Maximum height [m]	Noise height [m]	Averaging time [s]	Used antennas
Set A	1.65	20	30	990	1100	300	1 2 3 r
Set B	1.65	10	30	450	800	300	1 2 3 r
Set C	2.0	10	30	150	170	1500	3 r

Measured parameters Set A + B		
H	Height	m
Fna	Spectra	dB
P a	Power	dB
R a	Reflectivity	dB
VRa	Radial component	m/s
VVc	Vector component	m/s
V	Wind speed	m/s
D	Wind direction	°
S a	Sigma of radial speed	m/s
SD	Standard deviation of wind direction	°
DC	Diffusion category	1
TMP	Temperature	°C
G a	Amplification	1
DAa	Availability	%
SNa	Signal/noise ratio	dB
ERa	Plausibility code	1

Measured parameters Set C		
H	Height	m
Fna	Spectra	dB
P a	Power	dB
R a	Reflectivity	dB
VRa	Radial component	m/s
S a	Sigma of radial speed	m/s
TMP	Temperature	°C
G a	Amplification	1
DAa	Availability	%
SNa	Signal/noise ratio	dB
ERa	Plausibility code	1

Recorded raw data Set A, B + C		
H	Height	m
P a	Power	dB
R a	Reflectivity	dB
VRa	Radial component	m/s
SNa	Signal/noise ratio	dB
ERa	Plausibility code	1

Used programs for continuous measurements:

Name of Program	Used settings	Description
mix	A	For mixing height
coh	B, C	For coherent structures

Explanation of the header lines in the *.sdr data files	
AVE	Averaging interval
MIN	Minimum height
MAX	Maximum height
NOI	Noise height
STP	Height resolution (step)
VOL	Volume of emitted sound for each antenna, 5 or 6 values
XMT	Emitted frequencies, first value for SODAR, second value for RASS
MIX	Center frequencies, 5 or 6 values
SMP	Internal detection frequency
AZI	Azimuth for each antenna, beginning with antenna 1
ZEN	Zenith angle for each antenna, beginning with antenna 1
TMP	PT100 temperature
DST	Distance between RASS antennas
XTL	Cross talk of RASS
SRV	Indicates, that the system is in service mode while data were acquired

5.6 Standard meteorological measurements

Measuring Complex 15: Main Tower (Nov 2003)

Main Tower Data Logger and Channels			Parameter (heights in Meter above Ground, depths in cm)	Sensor	phys. Unit	Data-ID
1	QLC1	2–	Air temperature 2 m	HMP45, PT 100	°C	14493
2	QLC1	2+	Relative humidity 2 m	HMP45, kapazitiv	%	14504
3	QLC1	1	Air temperature 2 m (dry)	Psychrometer, PT 100	°C	14492
4	QLC1	0	Air temperature 2 m (wet)	Psychrometer, PT 100	°C	14499
5	QLI4	4–	Air temperature 21 m	HMP45, PT 100	°C	14491
6	QLI4	4+	Relative humidity 21 m	HMP45m capacitive	%	14503
7	QLI4	3	Air temperature 21 m (dry)	Psychrometer, PT 100	°C	14490
8	QLI4	2	Air temperature 21 m (wet)	Psychrometer, PT 100	°C	14498
9	QLI3	0–	Air temperature 31 m	HMP45, PT 100	°C	14488
10	QLI3	0+	Relative humidity 31 m	HMP45, kapazitiv	%	14501
11	QLI3	1	Air temperature 31 m (dry)	Psychrometer, PT 100	°C	14487
12	QLI3	2	Air temperature 31 m (wet)	Psychrometer, PT 100	°C	14496
13	QLI2	9	Air temperature 30 m	Thies Haarhygrometer	°C	2688
14	QLI2	8	Relative humidity 30 m	Thies Haarhygrometer	%	2701
15	QLC1	6	Soil temperature –05 cm	PT 100	°C	14479
16	QLC1	7	Soil temperature –10 cm	PT 100	°C	14478
17	QLC1	8	Soil temperature –20 cm	PT 100	°C	14480
18	QLC1	9	Soil temperature –50 cm	PT 100	°C	14481
19	QLC1	3	Ground heat flux 1 –x cm			14483
20	QLC1	4	Ground heat flux 2 –x cm			14485
21	QLC1	5	Ground heat flux 3 –x cm			14486
22	QLI2	3	Global radiation 30 m	CM 14	Wm^{-2}	14517
23	QLI2	4	Reflected radiation 30 m	CM 14	Wm^{-2}	14518
24	QLI2	1	Incoming long wave radiation 30 m	CG 2	Wm^{-2}	14513
25	QLI2	2	Outgoing long wave radiation 30 m	CG 2	Wm^{-2}	14514
26		?	Body temperature 30 m (CG 2)	PT100 CG 2	°C	14522
27		?	Body temperature 30 m (CG 2)	PT100 CG 2	°C	14523
28	QLC1	F2	Horizontal wind speed 02 m	Friedrichs Anemometer	ms^{-1}	14507
29	QLC1	F1	Horizontal wind speed 10 m	Friedrichs Anemometer	ms^{-1}	2693
30	QLI4	F2	Horizontal wind speed 16 m	Friedrichs Anemometer	ms^{-1}	2694
31	QLI4	F1	Horizontal wind speed 18 m	Friedrichs Anemometer	ms^{-1}	2695
32	QLI3	F1	Horizontal wind speed 21 m	Friedrichs Anemometer	ms^{-1}	14506
33	QLI2	F2	Horizontal wind speed 25 m	Friedrichs Anemometer	ms^{-1}	2697
34	QLI2	F1	Horizontal wind speed 32 m	Friedrichs Anemometer	ms^{-1}	2698
35	QLI2	0	Wind direction 32 m	Skye W200P	Grad	2691
36		?	Horizontal wind speed 32 m	Thies Ultrasonic	ms^{-1}	14725
37		?	Wind direction 32 m	Thies Ultrasonic	Grad	14726

38	QLI2	?	Precipitation 32 m (funnel)	Ship rain gauge SRM	mm	14711
39	QLI2	?	Precipitation 32 m (side)	Ship rain gauge SRM	mm	14712
40		?	Visibility 21 m	PWD 11	m	14836
41		?	Weather-Code (WMO) 21 m	PWD 11	––	38651

6 Calibration

6.1 Licor-7500 (Flux 33 m)

Basic calibration (25.02.2003)

	CO_2 calibration values	H_2O calibration values
A	131.505	4598.57
B	3897.73	2843770
C	3.44208e+07	2.18604e+07
D	-9.59023e+09	-
E	1.20412e+12	-
XS	0.0067	-0.0036
Z	0.0005	0.0197

Zero/span calibration (26.02.2003)

	CO_2	H_2O
zero	0.8919	0.6900
span	0.9972	0.9965
at	39.337 mmol/m3	578.739 mmol/m3

See **CD WALDATEM2003 REA atc**:\WALDATEM2003 REA atc\experiment setup\licor7500 36m\...

Flux 33 m Licor 7500 settings and calibration valid					
			to	25.06.03	07:40

Configuration jr2003jun25_0740.l75

(Ack(Received FALSE)(Val 0.000000))(Calibrate(SpanCO2(Date "Mar 21 2003 at 10:46:38 AM")(Target 1950.000)(Tdensity 78.80576)(Val 0.9985018))(SpanH2O(Date "Mar 21 2003 at 10:16:44 AM")(Target 12.00000)(Tdensity 573.0988)(Val 1.023160))(ZeroCO2(Date "Mar 21 2003 at 9:54:23 AM")(Val 0.8914649))(ZeroH2O(Date "Mar 21 2003 at 9:54:14 AM")(Val 0.6906865)))(Coef(Current(Band(A 1.150000))(CO2(A 131.5050)(B 3897.730)(C 3.442080e+07)(D -9.590230e+09)(E 1.204120e+12)(XS 0.006700000)(Z 0.0005000000))(H2O(A 4598.570)(B 2843770.)(C 2.186040e+08)(XS -0.003600000)(Z 0.01970000))(SerialNo "75H-0270")))(Data(Aux 0.000000)(CO2D 14.19767)(CO2Raw 0.08929610)(Cooler 1.280488)(DiagVal 249)(H2OD 538.8012)(H2ORaw 0.07441664)(Ndx 12358)(Pres 93.22723)(Temp 18.94363))(Diagnostics(Chopper TRUE)(DetOK TRUE)(PLL TRUE)(Path 61.00000)(SYNC TRUE))(EmbeddedSW(Model "LI-7500 CO2/H2O Analyzer Application")(Version 2.0.1))(Error(Received FALSE))(Inputs(Aux(A 1.000000)(B 0.000000))(Pressure(Source Measured)(UserVal 98.00000))(Temperature(Source Measured)(UserVal 25.00000)))(Outputs(BW 20)(Dac1(Full 19.00000)(Source CO2MMOL)(Zero 13.00000))(Dac2(Full 800.0000)(Source H2OMMOL)(Zero 0.000000))(Delay 3)(RS232(Aux TRUE)(Baud 9600)(CO2D TRUE)(CO2Raw TRUE)(Cooler TRUE)(DiagRec TRUE)(DiagVal TRUE)(EOL 0A)(Freq 1.000000)(H2OD TRUE)(H2ORaw TRUE)(Labels TRUE)(Ndx TRUE)(Pres TRUE)(Temp TRUE))(SDM(Address 7)))|(Chart(LV None)(Lmax 100.0000)(Lmin 0.000000)(RV None)(Rmax 100.0000)(Rmin 0.000000)(Scroll(Coarse FALSE)(Smooth TRUE))(Units(Mins FALSE)(Secs TRUE))(Xmax 20))(Connect(Baud 19200)(Freq 10.00000)(Port 1))(Log(CI TRUE)(Del(Space FALSE)(Tab TRUE))(LogVals(CV TRUE)(Cabs TRUE)(Cden TRUE)(CdenMg TRUE)(Cmf TRUE)(Dew TRUE)(Habs TRUE)(Hden TRUE)(HdenMg TRUE)(Hmf TRUE)(PortB TRUE)(Pres TRUE)(RelTime TRUE)(Temp TRUE))(Name C:\Programme2\LI7500\LI7500v2_2_0\LogFile.txt)(Rem FALSE)(TS TRUE))

Flux 33 m Licor 7500 settings and calibration valid					
from	25.06.03	11:00			

Configuration jr2003jun25_1100 300ms delay.l75

(Ack(Received FALSE)(Val 0.000000))(Calibrate(SpanCO2(Date "Mar 21 2003 at 10:46:38 AM")(Target 1950.000)(Tdensity 78.80576)(Val 0.9985018))(SpanH2O(Date "Mar 21 2003 at 10:16:44 AM")(Target 12.00000)(Tdensity 573.0988)(Val 1.023160))(ZeroCO2(Date "Mar 21 2003 at 9:54:23 AM")(Val 0.8914649))(ZeroH2O(Date "Mar 21 2003 at 9:54:14 AM")(Val 0.6906865)))(Coef(Current(Band(A 1.150000))(CO2(A 131.5050)(B 3897.730)(C 3.442080e+07)(D -9.590230e+09)(E 1.204120e+12)(XS 0.006700000)(Z 0.0005000000))(H2O(A 4598.570)(B 2843770.)(C 2.186040e+08)(XS -0.003600000)(Z 0.01970000))(SerialNo "75H-0270")))(Data(Aux 0.000000)(CO2D 13.99731)(CO2Raw 0.08826804)(Cooler 1.401000)(DiagVal 249)(H2OD 435.2505)(H2ORaw 0.06352901)(Ndx 7153)(Pres 93.16811)(Temp 18.11707))(Diagnostics(Chopper TRUE)(DetOK TRUE)(PLL TRUE)(Path 62.00000)(SYNC TRUE))(EmbeddedSW(Model "LI-7500 CO2/H2O Analyzer Application")(Version 2.0.1))(Error(Received FALSE))(Inputs(Aux(A 1.000000)(B 0.000000))(Pressure(Source Measured)(UserVal 98.00000))(Temperature(Source Measured)(UserVal 25.00000)))(Outputs(BW 20)(Dac1(Full 19.00000)(Source CO2MMOL)(Zero 13.00000))(Dac2(Full 800.0000)(Source H2OMMOL)(Zero 0.000000))(Delay 11)(RS232(Aux TRUE)(Baud 38400)(CO2D TRUE)(CO2Raw FALSE)(Cooler TRUE)(DiagRec FALSE)(DiagVal TRUE)(EOL 0D0A)(Freq 20.00000)(H2OD TRUE)(H2ORaw FALSE)(Labels FALSE)(Ndx TRUE)(Pres TRUE)(Temp TRUE))(SDM(Address 7)))|(Chart(LV None)(Lmax 100.0000)(Lmin 0.000000)(RV None)(Rmax 100.0000)(Rmin 0.000000)(Scroll(Coarse FALSE)(Smooth TRUE))(Units(Mins FALSE)(Secs TRUE))(Xmax 20))(Connect(Baud 38400)(Freq 20.00000)(Port 1))(Log(CI TRUE)(Del(Space FALSE)(Tab TRUE))(LogVals(CV TRUE)(Cabs TRUE)(Cden TRUE)(CdenMg TRUE)(Cmf TRUE)(Dew TRUE)(Habs TRUE)(Hden TRUE)(HdenMg TRUE)(Hmf TRUE)(PortB TRUE)(Pres TRUE)(RelTime TRUE)(Temp TRUE))(Name C:\Programme2\LI7500\LI7500v2_2_0\LogFile.txt)(Rem FALSE)(TS TRUE))

6.2 Licor-7500 (Flux 2.25 m)

Basic calibration (21.3.2003)

	CO_2 calibration values	H_2O calibration values
A	$1.44182 \cdot 10^{2}$	$4.76436 \cdot 10^{3}$
B	$1.83092 \cdot 10^{4}$	$2.91218 \cdot 10^{6}$
C	$3.81293 \cdot 10^{7}$	$2.16092 \cdot 10^{8}$
D	$-1.08268 \cdot 10^{10}$	-
E	$1.59325 \cdot 10^{12}$	-
XS	0.0086	-0.0048
Z	0.0012	-0.0020

Zero/span calibration (21.03.2003)

	CO_2	H_2O
zero	0.985	1.056
span	1.002	0.995
at	1950 µmol/mol 39.187 mmol/m³	12 °C 583.133 mmol/m³

Settings since 27.6.03, 11:52 h until 1.8.03, 11:05 h:

CD WALDATEM2003 SONIC PROFILE:\experiment setup\Licor7500, 2_25m\ Configuration 2003aug06_1254.l75

6.3 Trace-gas profile system

Continuous CO_2 measurements LiCor 820 Gashound
calibration on 24.6.03:
zero (with N2)
span with CAL_373.5 gas = 371.9 ppm (gas tank calibration)
to 373.0 ppm (LiCor 820 reading)

6.4 Licor-7000 (HYDRA)

See **CD WALDATEM2003 PROFILE HYDRA**:\WALDATEM2003 CO2 PROFILE HYDRA\experiment setup\HYDRA LICOR7000 calibration and setup files\...

Hydra Licor 7000 settings and calibration valid

from	08.07.03	01:14	to	08.07.03	18:01

WA settings 2003jul08 0114.l70

(Reference (CO2 Estimated)(H2O Estimated)(H2O-units mm/m))(DAC (DAC1 (Source "")(Zero 0)(Full 1.25)(Polarity Unipolar))(DAC2 (Source "")(Zero 0)(Full 2.5))(DAC3 (Source "")(Zero 0)(Full 3.334)(Polarity Unipolar)(Vmax 5))(DAC4 (Source "")(Zero 0)(Full 5)(Polarity Unipolar)(Vmax 5)))(Display (Sources ("Aux1" "Aux2" "CO2 AGC" "CO2A abs" "CO2A um/m" "CO2B abs" "CO2B um/m" "CO2D um/m" "Diag" "Flow V" "H2O AGC" "H2OA abs" "H2OA dpC" "H2OA mm/m" "H2OB abs" "H2OB dpC" "H2OB mm/m" "H2OD mm/m" "Integral" "P kPa" "Peak" "RH %" "T C"))(BackLt 3)(Contrast 88)(Display1 (Type Text)(Text (Source1 "CO2B um/m")(Source2 "CO2D um/m")(Source3 "T C")(Source4 "H2OA mm/m")(Source5 "H2OB mm/m")(Source6 "H2OD mm/m")(Source7 "P kPa")(Source8 "CO2A um/m"))(Graphs (Graph1 (Source "CO2B um/m")(Time 120)(Y-Scale Scrolled)(Min 0)(Max 1000)(Delta 1000))(Graph2 (Source "H2OB dpC")(Time 120)(Y-Scale Scrolled)(Min 0)(Max 25)(Delta 25))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))))(Display2 (Type Text)(Text (Source1 "Integral")(Source2 "Peak")(Source3 "Flow V")(Source4 "Aux1")(Source5 "H2OA dpC")(Source6 "H2OB dpC")(Source7 "")(Source8 "Aux2"))(Graphs (Graph1 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph2 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))))(Display3 (Type Text)(Text (Source1 "CO2A abs")(Source2 "CO2B abs")(Source3 "CO2 AGC")(Source4 "Diag")(Source5 "H2OA abs")(Source6 "H2OB abs")(Source7 "H2O AGC")(Source8 "RH %"))(Graphs (Graph1 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph2 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0)))))(Aux (Aux1 (a0 0)(a1 0)(a2 0))(Aux2 (a0 0)(a1 0)(a2 0)))(RS232 (Rate 2Hz)(Sources ("Aux1" "Aux2" "CO2 AGC" "CO2A abs" "CO2A um/m" "CO2B abs" "CO2B um/m" "CO2D um/m" "Diag" "Flow V" "H2O AGC" "H2OA abs" "H2OA dpC" "H2OA mm/m" "H2OB abs" "H2OB dpC" "H2OB mm/m" "H2OD mm/m" "Integral" "P kPa" "Peak" "RH %" "T C"))(Timestamp Short))(Diagnostics 0)(Integral (Start Manual)(Stop Manual)(Threshold 0)(Time 0)(Source "Aux2")(State Off))(Pump (Installed True)(FlowRate Off)(Slow 150)(Medium 175)(Fast 255))(Filter (Time 0.5))(WinParams (InstrMask 0)(AutoFilter True)(RS232 (Rate 2Hz)(Sources ("P kPa" "T C" "CO2A um/m" "CO2B um/m" "CO2D um/m" "H2OA mm/m" "H2OB mm/m" "H2OD mm/m" "Diag" "Flow V"))(Timestamp None))(RS232Enable True))

WA settings 2003jul08 0105.c70

(Cal (H2O (a1 31.7784)(a2 25080.7)(a3 225291)(gamma 1)(Z 0.884424)(Zt -2.02e-05)(Zm 2.41e-05)(S 1)(W0' 1.28488e+06)(W0'_d 1.33047e+06)(AGC 0.6))(CO2 (a1 936.503)(a2 84284.4)(a3 1.92929e+08)(a4 -4.41509e+10)(a5 5.28901e+12)(gamma 1)(Z 0.839494)(Zt 0.000123)(Zm 8.37068e-06)(S 1)(W0' 1.24652e+06)(W0'_d 1.29988e+06)(AGC 0.55)(VpCrr 1.57))("P kPa" (a0 58.64)(a1 30.5))("T C" (A 0.000828003)(B 0.000208687)(C 8.0874e-08))("RH %" (a0 0)(a1 1)))

Hydra Licor 7000 settings and calibration valid

from	08.07.03	18:46	to	10.07.03	11:00

WA config jr2003jul08_1846.l70

(Reference (CO2 Estimated)(H2O Estimated)(H2O-units mm/m))(DAC (DAC1 (Source "")(Zero 0)(Full 1.25)(Polarity Unipolar))(DAC2 (Source "")(Zero 0)(Full 2.5))(DAC3 (Source "")(Zero 0)(Full 3.334)(Polarity Unipolar)(Vmax 5))(DAC4 (Source "")(Zero 0)(Full 5)(Polarity Unipolar)(Vmax 5)))(Display (Sources ("Aux1" "Aux2" "CO2 AGC" "CO2A abs" "CO2A um/m" "CO2B abs" "CO2B um/m" "CO2D um/m" "Diag" "Flow V" "H2O AGC" "H2OA abs" "H2OA dpC" "H2OA mm/m" "H2OB abs" "H2OB dpC" "H2OB mm/m" "H2OD mm/m" "Integral" "P kPa" "Peak" "RH %" "T C"))(BackLt 3)(Contrast 88)(Display1 (Type Text)(Text (Source1 "CO2A um/m")(Source2 "CO2B um/m")(Source3 "CO2D um/m")(Source4 "T C")(Source5 "H2OA mm/m")(Source6 "H2OB mm/m")(Source7 "H2OD mm/m")(Source8 "P kPa"))(Graphs (Graph1 (Source "CO2B um/m")(Time 120)(Y-Scale Scrolled)(Min 0)(Max 1000)(Delta 1000))(Graph2 (Source "H2OB dpC")(Time 120)(Y-Scale Scrolled)(Min 0)(Max 25)(Delta 25))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))))(Display2 (Type Text)(Text (Source1 "Integral")(Source2 "Peak")(Source3 "Flow V")(Source4 "Aux1")(Source5 "H2OA dpC")(Source6 "H2OB dpC")(Source7 "")(Source8 "Aux2"))(Graphs (Graph1 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph2 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))))(Display3 (Type Text)(Text (Source1 "CO2A abs")(Source2 "CO2B abs")(Source3 "CO2 AGC")(Source4 "Diag")(Source5 "H2OA abs")(Source6 "H2OB abs")(Source7 "H2O AGC")(Source8 "RH %"))(Graphs (Graph1 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph2 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0)))))(Aux (Aux1 (a0 0)(a1 0)(a2 0))(Aux2 (a0 0)(a1 0)(a2 0)))(RS232 (Rate 2Hz)(Sources ("Aux1" "Aux2" "CO2 AGC" "CO2A abs" "CO2A um/m" "CO2B abs" "CO2B um/m" "CO2D um/m" "Diag" "Flow V" "H2O AGC" "H2OA abs" "H2OA dpC" "H2OA mm/m" "H2OB abs" "H2OB dpC" "H2OB mm/m" "H2OD mm/m" "Integral" "P kPa" "Peak" "RH %" "T C"))(Timestamp Short))(Diagnostics 0)(Integral (Start Manual)(Stop Manual)(Threshold 0)(Time 0)(Source "Aux2")(State Off))(Pump (Installed True)(FlowRate Off)(Slow 150)(Medium 175)(Fast 255))(Filter (Time 0.5))(WinParams (InstrMask 0)(AutoFilter True)(RS232 (Rate 2Hz)(Sources ("P kPa" "T C" "CO2A um/m" "CO2B um/m" "CO2D um/m" "H2OA mm/m" "H2OB mm/m" "H2OD mm/m" "Diag" "Flow V"))(Timestamp None))(RS232Enable True))

WA calib jr2003jul08_1846.c70

(Cal (H2O (a1 31.7784)(a2 25080.7)(a3 225291)(gamma 1)(Z 0.894425)(Zt -2.02e-05)(Zm 2.41e-05)(S 1)(W0' 1.29571e+06)(W0'_d 1.33047e+06)(AGC 0.6))(CO2 (a1 936.503)(a2 84284.4)(a3 1.92929e+08)(a4 -4.41509e+10)(a5 5.28901e+12)(gamma 1)(Z 0.842548)(Zt 0.000123)(Zm 6.26376e-06)(S 1)(W0' 1.26245e+06)(W0'_d 1.29988e+06)(AGC 0.55)(VpCrr 1.57))("P kPa" (a0 58.64)(a1 30.5))("T C" (A 0.000828003)(B 0.000208687)(C 8.0874e-08))("RH %" (a0 0)(a1 1)))

Hydra Licor 7000 settings and calibration valid					
from	10.07.03	11:59	to	02.08.03	17:04

WA settings jr2003jul10_1158.l70

(Reference (CO2 Estimated)(H2O Estimated)(H2O-units mm/m))(DAC (DAC1 (Source "")(Zero 0)(Full 1.25)(Polarity Unipolar))(DAC2 (Source "")(Zero 0)(Full 2.5))(DAC3 (Source "")(Zero 0)(Full 3.334)(Polarity Unipolar)(Vmax 5))(DAC4 (Source "")(Zero 0)(Full 5)(Polarity Unipolar)(Vmax 5)))(Display (Sources ("Aux1" "Aux2" "CO2 AGC" "CO2A abs" "CO2A um/m" "CO2B abs" "CO2B um/m" "CO2D um/m" "Diag" "Flow V" "H2O AGC" "H2OA abs" "H2OA dpC" "H2OA mm/m" "H2OB abs" "H2OB dpC" "H2OB mm/m" "H2OD mm/m" "Integral" "P kPa" "Peak" "RH %" "T C"))(BackLt 3)(Contrast 88)(Display1 (Type Text)(Text (Source1 "CO2A um/m")(Source2 "CO2B um/m")(Source3 "CO2D um/m")(Source4 "T C")(Source5 "H2OA mm/m")(Source6 "H2OB mm/m")(Source7 "H2OD mm/m")(Source8 "P kPa"))(Graphs (Graph1 (Source "CO2B um/m")(Time 120)(Y-Scale Fixed)(Min 360)(Max 390)(Delta 1000))(Graph2 (Source "H2OB dpC")(Time 120)(Y-Scale Scrolled)(Min 0)(Max 25)(Delta 25))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))))(Display2 (Type Text)(Text (Source1 "Integral")(Source2 "Peak")(Source3 "Flow V")(Source4 "Aux1")(Source5 "H2OA dpC")(Source6 "H2OB dpC")(Source7 "")(Source8 "Aux2"))(Graphs (Graph1 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph2 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))))(Display3 (Type Text)(Text (Source1 "CO2A abs")(Source2 "CO2B abs")(Source3 "CO2 AGC")(Source4 "Diag")(Source5 "H2OA abs")(Source6 "H2OB abs")(Source7 "H2O AGC")(Source8 "RH %"))(Graphs (Graph1 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph2 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0))(Graph3 (Source "")(Time 0)(Y-Scale Fixed)(Min 0)(Max 0)(Delta 0)))))(Aux (Aux1 (a0 0)(a1 0)(a2 0))(Aux2 (a0 0)(a1 0)(a2 0)))(RS232 (Rate 2Hz)(Sources ("Aux1" "Aux2" "CO2 AGC" "CO2A abs" "CO2A um/m" "CO2B abs" "CO2B um/m" "CO2D um/m" "Diag" "Flow V" "H2O AGC" "H2OA abs" "H2OA dpC" "H2OA mm/m" "H2OB abs" "H2OB dpC" "H2OB mm/m" "H2OD mm/m" "Integral" "P kPa" "Peak" "RH %" "T C"))(Timestamp Short))(Diagnostics 0)(Integral (Start Manual)(Stop Manual)(Threshold 0)(Time 0)(Source "Aux2")(State Off))(Pump (Installed True)(FlowRate Off)(Slow 150)(Medium 175)(Fast 255))(Filter (Time 0.5))(WinParams (InstrMask 0)(AutoFilter True)(RS232 (Rate 2Hz)(Sources ("P kPa" "T C" "CO2A um/m" "CO2B um/m" "CO2D um/m" "H2OA mm/m" "H2OB mm/m" "H2OD mm/m" "Diag" "Flow V"))(Timestamp None))(RS232Enable True))

WA hydra cal jr2003jul10_1159.c70

(Cal (H2O (a1 31.7784)(a2 25080.7)(a3 225291)(gamma 1)(Z 0.892291)(Zt -2.02e-05)(Zm 2.41e-05)(S 1)(W0' 1.29631e+06)(W0'_d 1.33047e+06)(AGC 0.6))(CO2 (a1 936.503)(a2 84284.4)(a3 1.92929e+08)(a4 -4.41509e+10)(a5 5.28901e+12)(gamma 1)(Z 0.841303)(Zt 0.000123)(Zm 6.51611e-06)(S 0.999892)(W0' 1.26287e+06)(W0'_d 1.29988e+06)(AGC 0.55)(VpCrr 1.57))("P kPa" (a0 58.64)(a1 30.5))("T C" (A 0.000828003)(B 0.000208687)(C 8.0874e-08))("RH %" (a0 0)(a1 1)))

6.5 Gas tank measurements

The vertical trace-gas profile system regularly sampled CAL1 and CAL2 gas tanks (Valve 9 and 10) in the measurement cell of the Licor 820 Gashound. In the Hydra system the REF gas tank was used to continuously flush the reference cell A of the Licor 7000 system. CAL1, CAL2, CAL3 were regularly sampled in order to calibrate cell B. CAL_373_5 was used to span the Licor 820 and Licor 6262 systems. However samples taken from the gas tank showed that the actual CO_2 mixing ratio was 371.88 +/- 0.23 and different from 373.5 ppm like specified on the tank. Samples of gas tanks were taken during the WALDATEM-2003 experiment during 22nd and 23rd of July 2003 (Ruppert, Bertolini) and analysed with high precision at the Gas and Isotope Laboratory of the Max-Planck Institute in Jena.

REF		REF MEAN	REF STDEV
co2	[ppm]	381.07	0.17
ch4	[ppb]	1,880.49	0.82
n2o	[ppb]	320.48	0.08
d13c	[‰ PDB]	- 8.96	0.01
d18o	[‰ PDB]	- 5.20	0.02

CAL1		CAL1 MEAN	CAL1 STDEV
co2	[ppm]	391.77	0.57
ch4	[ppb]	1,868.79	14.11
n2o	[ppb]	321.21	0.43
d13c	[‰ PDB]	- 9.19	0.02
d18o	[‰ PDB]	- 2.99	1.76

CAL2		CAL2 MEAN	CAL2 STDEV
co2	[ppm]	378.26	0.57
ch4	[ppb]	1,889.60	6.17
n2o	[ppb]	320.87	0.47
d13c	[‰ PDB]	- 9.33	0.01
d18o	[‰ PDB]	- 5.63	0.01

CAL3		CAL3 MEAN	CAL3 STDEV
co2	[ppm]	399.20	0.06
ch4	[ppb]	1,919.45	0.33
n2o	[ppb]	323.69	0.01
d13c	[‰ PDB]	- 6.74	0.07
d18o	[‰ PDB]	- 3.99	0.09

CAL373_5		CAL373_5 MEAN	CAL373_5 STDEV
co2	[ppm]	371.88	0.23
ch4	[ppb]	- 0.93	-
n2o	[ppb]	12.58	0.05
d13c	[‰ PDB]	- 32.41	0.01
d18o	[‰ PDB]	- 31.27	0.38

6.6 Wind direction sensor Climatronics F460

SN	measuring	resulting	Relation
4218 + blade	resistance R [kohm]	direction D [degree]	D= (R-2.43)*360/10

2) Manual-F469 WIND DIRECTION SENSOR P/N M100076 Rev C

6.7 Wind vanes Vector Inst. W200P

SN	measuring	result	Relation
3524	resistance R [ohm]	direction D [degree]	D = (R-5)/(1060)*357
3526			D = (R-4)/(1059)*357

6.8 Wind speed sensors Climatronics F460

SN	measuring	result	Relation for Rotor Lexan
4529 4522 4534 4524 4713 4505 4719	Frequency f [Hz]	Wind speed u [m/s]	**If f = 0 :** u = 0 **If 0 < f < 6.7509/s :** u = (0.5*exp(0.10412*f)) *1609.3/3600 (1) **if f ≥ 6.7509/s :** u = (0.5 + f / 9.511) 1609.3/3600 (2)

Note: 1) Exponential function evaluated according to VDI-Richtlinien VDI 3786, Blatt 2, "Meteorologische Messungen für Fragen der Luftreinhaltung – Wind", Düsseldorf 2000
2) Linear Section s. Manual-F469 WIND SPEED SENSOR, P/N M100075 Rev D

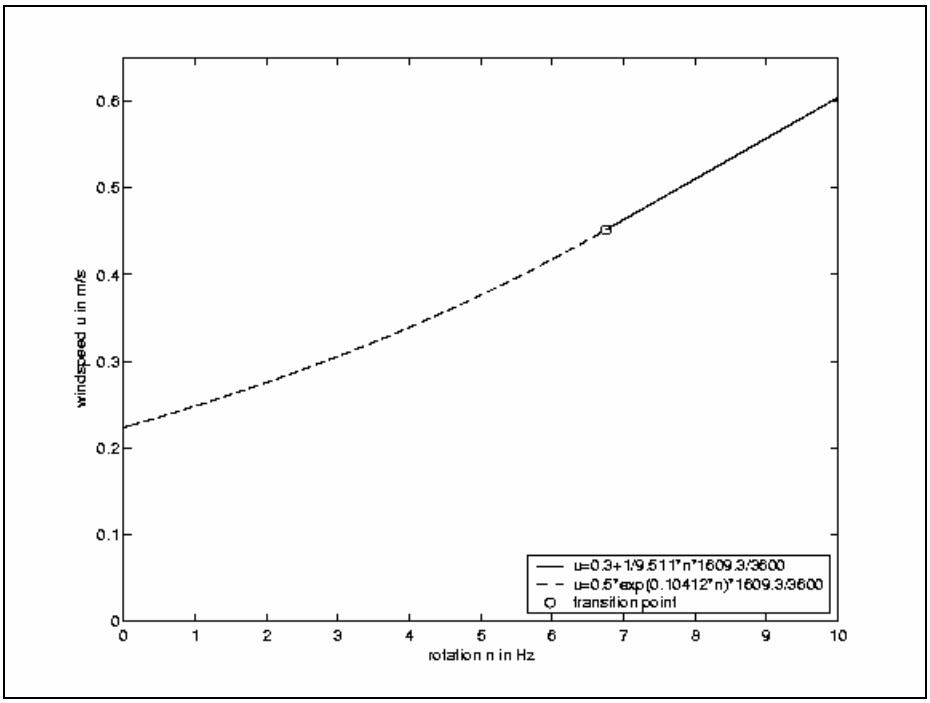


Figure: Characteristic curve of the CLIMATRONICS F 460 according to VDI 3786 2 / Part 2, 1.2.1.1. Exponential section dashed. Linear section solid. See **CD Waldatem_SubCanopyWIND:**\Figures\ CharacteristicCurveCLIMATRONICS_F460

7 Data acquisition and recording

7.1 Sonic Profile

Measuring complex (Weidenbrunnen)	start date	start time MEZ	end date	end time MEZ	Software
Flux 33 m	28.04.03	00:00	31.07.03	23:30	Eddymeas (by O. Kolle)
Flux 22 m	21.05.03	09:30	31.07.03	23:30	Eddymeas (by O. Kolle)
Settings used for data acquisition by Eddymeas see CDs **WALDATEM2003 R3+Li7500**:\eddydata_33m\w2003*.cfg files **WALDATEM2003 R2+Li6262+Inclinometer**:\eddydata_23m\c2003*.cfg files					
Flux 17 m	21.05.03	13:30	17.07.03	13:00	YoungAcqui (by T. Wrzesinsky)
Flux 13 m	24.05.03	13:00	17.07.03	13:00	YoungAcqui (by T. Wrzesinsky)
Setting used for data acquisition by YoungAcqui: OUTPUT FORMAT: CUSTOM 5ABE1234 [UVW SOS Ts ERR-CODE VIN1 VIN2 VIN3 VIN4] WIND SPEED UNITS: m/s OUTPUT RATE: 10 Hz SAMPLES FOR AVERAGE: 0 MODE: MEAN WAKE CORRECTION: YES SCALING MULTIPLIER: 10000 ERROR HANDLING: INCLUDE INVALID DATA					
Flux 5.50 m	24.06.03	12:00	17.07.03	10:00	atem121.llb
Flux 2.25 m	see **7.3**				atem121.llb

7.2 Extended measurement program Main Tower (Vaisala logger)

Measuring complex	start date	start time	end date	time	name
Complex 17	25.06.2003	19:21	23.09.2003	08:30	waldst02.qsp

7.3 REA and Trace-gas profiles (LabView)

Measuring complex (Weidenbrunnen)	start date	start time MEZ	end date	end time MEZ	name
REA + Flux 33 m	25.06.03	10:57	02.07.03	14:28	atem134.llb
REA + Flux 33 m	02.07.03	14:28	28.07.03	10:00	atem136.llb
See **CD WALDATEM2003 REA atc**:\WALDATEM2003 REA atc\ATEM running versions archive\…					
Flux 2.25 m	16.06.2002	17:13	01.08.03	11:05	atem121.llb
See **CD WALDATEM2003 Metek1+2:\metek***					
Trace gas profile	11.06.03	15:03	05.07.03	14:04	copy of atem_profil_11.llb
Trace gas profile + Hydra	05.07.03	Test only, 18:03-18:04, 18:11-18:18			atem_profil_hydra_20.llb
Trace gas profile + Hydra	05.07.03	18:33	06.07.03	18:30	atem_profil_hydra_21.llb
Trace gas profile + Hydra	06.07.03	18:46	10.07.03	23:04	atem_profil_hydra_25.llb
Trace gas profile + Hydra	12.07.03	13:25	02.08.03	17:23	atem_profil_hydra_26.llb
See **CD WALDATEM 2003 PROFILE HYDRA**:\WALDATEM2003 CO2 PROFILE HYDRA\ATEM_PROFILE_HYDRA archive of running versions					

7.3.1 Codes used in ATEM software

All codes are binary digits. Digit symbols are to be read as follows:

1 = true

0 = false

x = true OR false

All binary codes were converted to decimal numbers!

ATEM – error and event codes

error code (ATEM99.llb)
xxxxxxxxx1 = incorrect data from sonic
xxxxxxxx1x = error during sonic data conversion
xxxxxxx1xx = error during OP data conversion
xxxxxx1xxx = warning from OP diagnostic flag
xxxxx1xxxx = interval delay
xxxx1xxxxx = op_agc > 70%
xxx1xxxxxx = analog in reading error
xx1xxxxxxx = digital out error
x1xxxxxxxx = <not used>
1xxxxxxxxx = user flag

event code (ATEM99.llb)
xxxxxxxxx1 = valve 1 set on
xxxxxxxx1x = valve 2 set on
xxxxxxx1xx = flush bags and flasks
xxxxxx1xxx = Eddy Sampling
xxxxx1xxxx = transfere bag 1 <not used>
xxxx1xxxxx = transfere bags 1+2 to flask 1+2
xxx1xxxxxx = ES system locked
xx1xxxxxxx = bag 1 samples up/down
x1xxxxxxxx = manual set
1xxxxxxxxx = event 10 <not used>

ATEM_PROFILE and ATEM_PROFILE_HYDRA – error and event codes

ATEM_PROFILE: valid before July 5th, ATEM_PROFILE_HYDRA valid after July 5th

error code (atem_profile_hydra_31.llb)
xxxxxxxxx1 =<not used>
xxxxxxxx1x = error during LI7000 data conversion
xxxxxxx1xx = error during LI820 data conversion
xxxxxx1xxx = <not used>
xxxxx1xxxx = interval delay
xxxx1xxxxx = <not used>
xxx1xxxxxx = <not used>
xx1xxxxxxx = digital out error
x1xxxxxxxx = <not used>
1xxxxxxxxx = user flag

event code (atem_profile_hydra_31.llb)
xxxxxxxxx1 = cleaning PROFILE cell with sample
xxxxxxxx1x = cleaning HYDRA cell with sample
xxxxxxx1xx = HYDRA measurement
xxxxxx1xxx = PROFILE measurement
xxxxx1xxxx = PROFILE calibration
xxxx1xxxxx = HYDRA calibration
xxx1xxxxxx = PROFILE and HYDRA locked
xx1xxxxxxx = <not used>
x1xxxxxxxx = <not used>
1xxxxxxxxx = <not used>

ATEM_PROFILE and ATEM PROFILE_HYDRA – valve switching codes

profile valve code (hydra_v) (atem_profile_hydra_26.llb)			
Digits HYDRA	Digits PROFILE	Channel	
xxxxxxxxxxxxxx0000000001 = H1			
xxxxxxxxxxxxxx0000000010 = H2			
xxxxxxxxxxxxxx0000000100 = H3			
xxxxxxxxxxxxxx0000001000 = H4			
xxxxxxxxxxxxxx0000010000 = H5			
xxxxxxxxxxxxxx0000100000 = H6			
xxxxxxxxxxxxxx0001000000 = H7			
xxxxxxxxxxxxxx0010000000 = H8			
xxxxxxxxxxxxxx0100000000 = CAL1 (H9)			
xxxxxxxxxxxxxx1000000000 = CAL2 (H10)			
x1000000000001xxxxxxxxxx = S1			
x1000000000010xxxxxxxxxx = S2			
x1000000000100xxxxxxxxxx = S3			
x1000000001000xxxxxxxxxx = S4			
x1000000010000xxxxxxxxxx = S5			
x1000000100000xxxxxxxxxx = S6			
x1000001000000xxxxxxxxxx = S7			
x1000010000000xxxxxxxxxx = S8			
x1000100000000xxxxxxxxxx = S9			
x1000100000000xxxxxxxxxx = S9			
x0001xxxxxxxxxxxxxxxxxx = CAL1			
x0010xxxxxxxxxxxxxxxxxx = CAL2			
x0100xxxxxxxxxxxxxxxxxx = CAL3			
x1xxxxxxxxxxxxxxxxxxxxx = Sx (S1…S9)			
1xxxxxxxxxxxxxxxxxxxxxx = <S14, not used>			
profile_code (profile_v) (atem_profile_hydra_26.llb)			
Digits PROFILE	Channel		
00x00000001 = H1			
00x00000010 = H2			
00x00000100 = H3			
00x00001000 = H4			
00x00010000 = H5			
00x00100000 = H6			
00x01000000 = H7			
00x10000000 = H8			
00x00000000 = <not used>			
01x00000000 = CAL1 (H9)			
10x00000000 = CAL2 (H10)			

Note: Erroneous port A and port B were resolved into 9 binary channels instead of 8 binary channels (= 1 byte) leading to a shift of CAL1, CAL2 positions in the profile valve code!

7.4 Sub-canopy masts (DT-Logger)

complex	start: day	start: time	stop: day	stop: time	Name
SC Mast 1	20/06	22:09:16	27/06	12:40:10	M1_10s
SC Mast 1	27/06	12:43:10	04/08	10:05:09	M1_10sg
SC Mast 2	20/06	17:16:39	27/06	10:38:49	M1_10s
SC Mast 2	27/06	10:42:00	04/08	10:23:20	M2_10s
SC Mast 3	25/06	15:10:00	04/08	10:40:30	M3_10s
See **CD Waldatem_SubCanopyWIND:** \ConfigurationDTLogger					

Calibration was performed by the FORTRAN-Program ‘DL_DATEN18c’.

See **CD Waldatem_SubCanopyWIND:** \PreparedRawDataSubCanopyWIND_ ProgrammDL_Daten18c_CalibratedData.

Calibration results were calculated from the signal readings using relations given in Section 6.6 to 6.8.

Input Files:

- Raw-data-DAT-files recorded by the Delta-T-Logger. Configuration see table above.
- Name of raw-data file consist of seven characters. The second character indicates the number of the mast. See 8.5

Output Files:

- Calibrated data are saved as text files (see 8.5)

Error flags in the raw-data files were interpreted as follows:

Error flag of Logger - Reading [3]	Reading of anemometer replaced by:	Reading of wind direction sensor replaced by:
over-run error, noisy, outside limits	-9999.0 [1]	-9999.0 [1]
over range	-9999.0 [1]	0.0 [2]

1) ’-9999.0’ is just the sign for ‘no data’. So in all cases data obviously showing reading errors are not accounted.
2) Only in case of the wind direction sensors over ranged resistance data very probably represents correct readings in the dead band of potentiometer. As the dead band is aligned exactly to the north direction of the Vane all over ranged readings are given the values of zero degree, if nothing else indicates malfunction of the sensor or logger.
3) For further information of Delta-T-Logger output file, see: DELTA-T Logger User Manual 2.01, Delta-T Devices Ltd. 128 Low Road, Burwell, Cambridge CB5 0EJ, UK

7.5 SODAR-RASS

start: day	start: time	stop: day	stop: time	used program*	Annotations
29/04		09/05			first test
09/05	14:40	04/06	15:50		frequency finding
04/06	17:25	04/06	18:55	mix	
05/06	07:45	05/06	10:35	coh	
05/06	12:00	06/06	09:10	mix	
06/06	09:41	06/06	15:20	mix	
06/06	16:15	12/06	20:36	mix	
13/06	13:02	23/06	14:38	mix	
25/06	18:45	26/06	05:15	coh	
26/06	05:30	27/06	21:00	coh	
27/06	21:05	28/06	12:21	mix	
28/06	13:55	05/07	15:00	coh	
05/07	15:10	08/07	11:55	mix	
08/07	12:00	10/07	11:33	coh	Stop due to computer failure
15/07	10:02	16/07	13:52	mix	

*For details of sounding program see Section 5.1, Measuring Complex 14.

Data acquisition was performed using the built-in SODAR Datendienst in combination with the Microsoft Windows Hyper terminal.

8 Data archiving

8.1 Sonic profile data

8.1.1 Flux 33 m and Flux 22 m by Eddymeas

Flux33 m, see **CDs WALDATEM2003 R3+Li7500**: \eddydata_33m\W*
Flux23 m, see **CDs WALDATEM2003 R2+Li6262+Inclinometer**: \eddydata_23m\C*
Raw data are stored in 30-min files compressed in daily zip- archives
Filename of the 30-min files: PYYYYDOYhhmm (P: File prefix: W for Flux33 m, C for Flux 23 m; YYYY: year; DOY: day of the year, hhmm: hour (2-digits) and minutes (2-digits) starting time of interval)
File format: binary (16-bit), with 1 preceeding headerline (8-bit), for details see manual of eddysoft (eddysoft.pdf)
File extension: SLT
Filename of the zip- archives: PYYYY_DOY (explanation see above)
File extension: ZIP
Filename of error-logs: PYYYYDOYHHMM.LOG (starting time of acquisition period)

No.	Filenames of zip-archives	Starting time	End time
CD I	W2003_118 -- W2003_143	28.04.2003 00:00	23.05.2003 23:30
CD II	W2003_144 – W2003_198	24.05.2003 00:00	17.07.2003 13:00
CD III	W2003_198 – W2003_212	17.07.2003 00:00	31.07.2003 23:30
CD I	C2003_141 – C2003_189	21.05.2003 09:00	08.07.2003 23:30
CD II	C2003_190 – C2003_212	09.07.2003 00:00	31.07.2003 23:30

8.1.2 Flux 17 m and Flux 13 m by YoungAcqui

Flux 17 m, see **CD WALDATEM2003 Young 17m** (all data zipped): \Young_17m_data
Flux 13 m, see **CD WALDATEM2003 Young 13m** (all data zipped): \Young_13m_data
Raw data are stored in 30-min files compressed in periodic zip-archives
Filename of the 30-min files: YoungYYYYMMDDhhmmss (YYYY: year; MM: month; DD: day; hhmmss: hour (2-digits),minutes (2-digits) and seconds (2-digits) starting time of interval)
File format: ASCII, with 1 preceeding headerline ("Zeit","u [m/s]","v [m/s]","w [m/s]","Schall-Temperatur [K]","A/D1","A/D2","A/D3","A/D4","Fehler-Code")
File extension: CSV
Filename of the zip- archives: Young_ZZm_data 2003MMMx (ZZ: approx. height above ground, MMM:month as string, x: number of archive in current month)
File extension: ZIP

No.	Filenames of zip-archives	Starting time	End time
CD I	Young_17m_data 2003may	21.05.2003 13:30	31.05.2003 23:30
	Young_17m_data 2003jun1	01.06.2003 00:00	08.06.2003 23:30
	Young_17m_data 2003jun2	09.06.2003 00:00	16.06.2003 23:30
	Young_17m_data 2003jun3	17.06.2003 00:00	24.06.2003 23:30
	Young_17m_data 2003jun4	25.06.2003 00:00	30.06.2003 23:30
	Young_17m_data 2003jul1	01.07.2003 00:00	07.07.2003 23:30
	Young_17m_data 2003jul1	08.07.2003 00:00	14.07.2003 23:30
	Young_17m_data 2003jul3	15.07.2003 00:00	17.07.2003 13:30
	Young_17m_data 2003jul4	17.07.2003 00:00	01.08.2003 10:00
CD I	Young_13m_data 2003may	24.05.2003 13:00	31.05.2003 23:30
	Young_13m_data 2003jun1	01.06.2003 00:00	08.06.2003 23:30
	Young_13m_data 2003jun2	09.06.2003 00:00	16.06.2003 23:30
	Young_13m_data 2003jun3	17.06.2003 00:00	24.06.2003 23:30
	Young_13m_data 2003jun4	25.06.2003 00:00	30.06.2003 23:30
	Young_13m_data 2003jul1	01.07.2003 00:00	07.07.2003 23:30
	Young_13m_data 2003jul2	08.07.2003 00:00	14.07.2003 23:30
	Young_13m_data 2003jul3	15.07.2003 00:00	17.07.2003 13:30
	Young_13m_data 2003jul4	17.07.2003 00:00	01.08.2003 10:00

8.1.3 Flux 5.5 m by LabView

Flux 5.5 m, see **CD WALDATEM2003 Metek1+2** (zipped): \Metek2
Raw data are stored in 30-min files compressed in 3-day zip-archives
Filename of the 30-min files: jrctYYYYMMMDD_hhhmm_METEK2_CCCC (YYYY: year; MMM: month as string; DD: day; hh: hour (2-digits); mm: minutes (2-digits) starting time of interval; CCCC: counter (4 digits))
File format: ASCII, with 1 preceeding headerline (DOY,TIME,x,y,z,ta,a4,a5,a6,a7,op_agc,error)
File extension: ATD
Filename of the zip- archives: data MMMYYYY_xx_yy (MMM:month as string; YYYY: year; xx: starting day of archive; yy: end day of archive)
File extension: ZIP

Filenames of zip-archives	Starting time	Counter	End time	Counter
data jun2003_25_26	24.06.2003 12:00	0005	26.06.2003 23:30	0126
data jun2003_27_29	27.06.2003 00:00	0127	29.06.2003 23:30	0271
data jun2003_30	30.06.2003 00:00	0272	30.06.2003 23:30	0318
data jul2003_01_03	01.07.2003 00:00	0319	03.07.2003 23:30	0457
data jul2003_04_06	04.07.2003 00:00	0458	04.07.2003 23:30	0599
data jul2003_07_09	07.07.2003 00:00	0600	09.07.2003 23:30	0745
data jul2003_10_12	10.07.2003 00:00	0746	12.07.2003 23:30	0889
data jul2003_13_15	13.07.2003 00:00	0890	15.07.2003 23:30	1032
data jul2003_16_17	16.07.2003 00:00	1033	17.07.2003 10:00	1101

8.2 REA-system and Flux 33 m by ATEM software

Continuous data acquisition: See **CD WALDATEM2003 REA atc**: \WALDATEM2003 REA atc\data atc zip files\… Filename = author initials+date_time_experiment_system_file number Extension .atc = Time records were checked and corrected to yield even spacing.	
File numbers	Storage of raw data as ZIP file
Settings: HREA (H=1.0) Raw data (first filename): jr2003Jun24_08h34_WALDATEM03_0008.atc	
0008 - 0041	jr2003Jun24_23h30_WALDATEM03_0041.zip
0042 0074	jr2003Jun25_15h00_WALDATEM03_0074.zip
Settings: HREA (H=1.0) Raw data (first filename): jr2003Jun26_07h23_WALDATEM03_REA_0008.atc	
0008 0046	jr2003Jun26_23h30_WALDATEM03_REA_0046.zip
0047 - 0094	jr2003Jun27_23h30_WALDATEM03_REA_0094.zip
0095 - 0140	jr2003Jun28_23h30_WALDATEM03_REA_0140.zip
0141 – 0188	jr2003Jun29_23h30_WALDATEM03_REA_0188.zip
0189 - 0236	jr2003Jun30_23h30_WALDATEM03_REA_0236.zip
0237 - 0284	jr2003Jul01_23h30_WALDATEM03_REA_0284.zip
0285 - 0342	jr2003Jul02_23h30_WALDATEM03_REA_0342.zip
0343 - 0390	jr2003Jul03_23h30_WALDATEM03_REA_0390.zip
0391 - 0438	jr2003Jul04_23h30_WALDATEM03_REA_0438.zip
0439 - 0486	jr2003Jul05_23h30_WALDATEM03_REA_0486.zip
0487 - 0534	jr2003Jul06_23h30_WALDATEM03_REA_0534.zip
0535 – 0581	jr2003Jul07_23h30_WALDATEM03_REA_0581.zip
0581 - 0629	jr2003Jul08_23h30_WALDATEM03_REA_0629.zip
0630 - 0677	jr2003Jul09_23h30_WALDATEM03_REA_0677.zip
0678 - 0725	jr2003Jul10_23h30_WALDATEM03_REA_0725.zip
0726 - 0773	jr2003Jul11_23h30_WALDATEM03_REA_0773.zip
0774 - 0821	jr2003Jul12_23h30_WALDATEM03_REA_0821.zip
0822 - 0869	jr2003Jul13_23h30_WALDATEM03_REA_0869.zip
0870 - 0917	jr2003Jul14_23h30_WALDATEM03_REA_0917.zip
0918 - 0965	jr2003Jul15_23h30_WALDATEM03_REA_0965.zip
0966 - 1013	jr2003Jul16_23h30_WALDATEM03_REA_1013.zip
1014 – 1061	jr2003Jul17_23h30_WALDATEM03_REA_1061.zip
1062 - 1109	jr2003Jul18_23h30_WALDATEM03_REA_1109.zip
1110 - 1157	jr2003Jul19_23h30_WALDATEM03_REA_1157.zip
1158 - 1205	jr2003Jul20_23h30_WALDATEM03_REA_1205.zip
1206 - 1253	jr2003Jul21_23h30_WALDATEM03_REA_1253.zip
1254 - 1277	jr2003Jul22_11h30_WALDATEM03_REA_1277.zip
settings: REA (D = 1.0) Raw data (first filename): jr2003Jun26_04h31_WALDATEM03_REA_0008.atc	
1500 – 1542	jr2003Jul23_23h30_WALDATEM03_REA_1542.zip
1543 – 1590	jr2003Jul24_23h30_WALDATEM03_REA_1590.zip
1591 - 1638	jr2003Jul25_23h30_WALDATEM03_REA_1638.zip
1639 - 1686	jr2003Jul26_23h30_WALDATEM03_REA_1686.zip
1687 - 1734	jr2003Jul27_23h30_WALDATEM03_REA_1734.zip

1735 - 1754	jr2003Jul28_09h30_WALDATEM03_REA_1754.zip
Settings during acquisition (.ati ATEM initialization files) See **CD WALDATEM2003 REA atc**: \WALDATEM2003 REA atc\data atc zip files\ WALDATEM03_REA_ati files.zip Protocol of time record correction (ATEM_data_row_correction_log.atl files) See **CD WALDATEM2003 REA atc**: \WALDATEM2003 REA atc\data atc zip files\… 2003Aug11_16h10_ATEM_data_row_correction_log.atl 2003Aug11_16h52_ATEM_data_row_correction_log.atl 2003Aug11_16h58_ATEM_data_row_correction_log.atl 2003Aug11_17h24_ATEM_data_row_correction_log.atl 2003Aug11_17h46_ATEM_data_row_correction_log.atl Settings for time record correction See **CD WALDATEM2003 REA atc**: \WALDATEM2003 REA atc\data atc zip files\jr2003aug11 REA data correction\… jr2003aug07_WA03_REA data correction.ati jr2003aug07_WA03_REA data correction2.ati	
Data acquisition during Eddy Sampling with REA System See **CD WALDATEM2003 REA atc**:\WALDATEM2003 REA atc\ data ES atc files.zip Filename = author initials+date_time_experiment_system_file number Extension rea ES.atc = REA Eddy Sampling, Time records were checked and corrected to yield even spacing.	
Settings: HREA (H=1.0) Raw data (first filename): jr2003Jul06_13h37_WALDATEM03_REA_ES.atc	
Settings: REA (D = 1.0) Raw data (first filename): jr2003Jul06_05h01_WALDATEM03_REA_ES.atc	
For a complete list of Eddy Sampling times see **CD GRASATEM2003 WALDATEM2003 flask measurements:** \REA and PROFILE sampling times\GA WA REA and PROFILE start and end times jr2003dec09_v32 final.xls	

8.3 Trace-gas profile and HYDRA-systems

See **CD WALDATEM2003 PROFILE HYDRA**: \WALDATEM2003 CO2 PROFILE HYDRA\data atc zip files Filename = author initials+date_time_experiment_system_file number Extension rea ES.atc = REA Eddy Sampling, Time records were checked and corrected to yield even spacing.		
File numbers	Raw data (first and last filename):	Storage of raw data in ZIP file
PROFILE		
0016, …	jr2003jun13_15h03_WEALDATEM2003_profile_0016.atc	jr2003Jun13_23h30_WEALDATEM2003_profile_0033.zip
…, 0906	jr2003jul05_14h00_WEALDATEM2003_profile_0906.atc	jr2003Jul04_23h30_WEALDATEM2003_profile_0877.zip
PROFILE and HYDRA		
0922, ...	jr2003jul05_18h33_WALDATEM2003_profile_hydra_0922.atc	jr2003Jul05_23h30_WALDATEM2003_profile_hydra_0932.zip
…, 2073	jr2003aug02_17h00_WALDATEM2003_profile_hydra_2073.atc	jr2003Aug02_17h00_WALDATEM2003_profile_hydra_2073.zip
Settings during aquisition (.ati ATEM initialization files) **CD WALDATEM 2003 Hydra Profile**: \WALDATEM2003 CO2 PROFILE HYDRA\data atc zip files\WEALDATEM2003_profile_hydra_ati files.zip Protocol of time record correction (ATEM_data_row_correction_log.atl files) **CD WALDATEM 2003 Hydra Profile**: \WALDATEM2003 CO2 PROFILE HYDRA\data atc zip files\2003Aug07_16h12_ATEM_data_row_correction_log.atl Settings for time record correction **CD WALDATEM 2003 Hydra Profile**: \WALDATEM2003 CO2 PROFILE HYDRA\data atc zip files\jr2003aug07 profile hydra data correction\ jr2003aug07_WA03_profile_hydra data correction.ati		

8.4 Air samples of REA- and Trace-gas profile systems

REA start time CET		REA end time CET		PROFILE start time CET		PROFILE end time CET	
doy	hh:mm:ss.00	doy	hh:mm:ss.00	doy	hh:mm:ss.00	doy	hh:mm:ss.00
177	08:00:24.70	177	08:30:00.20	177	03:17:00.00	177	03:35:00.00
177	09:13:22.60	177	09:48:24.30	177	09:31:00.00	177	09:43:00.00
177	10:28:13.30	177	11:03:14.20	177	11:51:00.00	177	12:05:00.00
177	11:43:34.80	177	12:15:24.30	177	14:28:00.00	177	14:39:00.00
177	13:01:23.80	177	13:36:25.20	179	03:03:00.00	179	03:19:00.00
177	14:20:01.80	177	14:55:03.30	179	09:19:00.00	179	09:31:00.00
177	15:31:49.10	177	16:06:50.30	179	11:20:00.00	179	11:32:00.00
177	16:33:24.40	177	17:03:25.80	179	12:43:00.00	179	13:00:00.00
179	07:50:01.60	179	08:20:03.30	187	13:52:00.00	187	14:04:00.00
179	08:58:42.10	179	09:28:43.30	187	23:58:00.00	188	00:18:00.00
179	10:05:17.50	179	10:40:19.30	188	08:33:00.00	188	08:45:00.00
179	11:17:11.20	179	11:52:12.30	188	11:23:00.00	188	11:44:00.00
179	12:30:02.70	179	13:05:04.30	188	13:51:00.00	188	14:05:00.00
179	13:35:40.90	179	14:10:42.20	189	01:42:00.00	189	01:58:00.00
179	14:43:02.50	179	15:18:04.30	189	09:10:00.00	189	09:24:00.00
187	13:37:07.80	187	14:12:09.30	189	11:16:00.00	189	11:28:00.00
187	14:42:25.50	187	15:17:27.30	189	14:28:00.00	189	14:40:00.00
187	15:46:52.00	187	16:21:53.30	204	03:11:00.00	204	03:23:00.00
188	07:15:05.70	188	07:45:07.30	204	06:18:00.00	204	06:36:00.00
188	08:18:16.20	188	08:53:17.30	204	09:09:00:00	204	09:21:00.00
188	09:33:18.80	188	10:08:20.10	204	10:33:00.00	204	10:45:00.00
188	11:21:55.40	188	11:51:57.00	204	12:50:00.00	204	13:02:00.00
188	12:30:46.10	188	13:00:47.10	204	14:45:00.00	204	14:57:00.00
188	13:41:59.20	188	14:12:01.10	204	15:57:00.00	204	16.09:00.00
188	14:41:34.70	188	15:11:36.10	204	18:31:00.00	204	18:51:00.00
189	09:04:55.30	189	09:34:57.10				
189	10:05:47.70	189	10:35:49.10				
189	11:19:00.90	189	11:44:22.10				
189	12:19:25.90	189	12:49:27.10				
189	13:19:18.60	189	13:49:20.10				
189	14:19:25.00	189	14:49:26.10				
189	15:23:27.40	189	15:53:29.10				
189	16:27:38.70	189	16:57:40.10				
204	06:04:51.20	204	06:27:00.10				
204	07:10:06.60	204	07:28:53.10				
204	08:01:56.70	204	08:28:28.00				

204	09:17:16.90	204	09:48:44.10				
204	10:26:09.40	204	10:52:23.10				
204	12:34:10.80	204	13:01:02.10				
204	13:42:25.50	204	14:05:28.10				
204	15:35:41.40	204	16:00:44.10				
204	17:18:52.90	204	17:40:20.10				
204	18:24:42.70	204	18:51:54.10				

Analysis of the air samples was performed in the Max-Planck Institute for Biogeochemistry in Jena, Germany.
See database:
CD GRASATEM2003 WALDATEM2003 flask measurements: \database\38 data retrieval\flask measurements all _final jr2003dec11_ v38.mdb

8.5 Sub-canopy masts

All data were collected from the logger as binary data (BIN) and then were transformed to the corresponding DAT format by using the DELTA-T-Logger software. The filename syntax is '**Mx_ddmh.EXT**, where '**x**' is the number of the mast and '**ddmh**' is the start time of the file in the order day **dd**, month **m**, hour MEZ **h**. The extension (EXT) indicates the data format BIN or DAT. List of files, see table 'List of files'.
Calibrated data in output files FORTRAN program 'DL_Daten15', see 7.5. The filename syntax is 'M**x_doy**[1]**_doy**[2].txt, where '**x**' is the number of the mast, '**doy**[1]' is the day of the year of the first data and **doy**[2] is the day of the year of the last data written in the file.
See **CD Waldatem_SubCanopyWIND:** \PreparedRawDataSubCanopyWIND_ProgrammDL_Daten18c_CalibratedData.

Raw-Data-file. BIN or DAT	Calibrated Data-file. TXT	Logger-configuration
M1_20622	M1_171_174.txt	M1_10s
M1_23610	M1_174_176.txt	,,
M1_25609	M1_176_176.txt	,,
M1_25615	M1_176_177.txt	,,
M1_26614	M1_177_178.txt	,,
M1_27612	M1_178_178.txt	M1_10sg (1)
M1_27615	M1_178_179.txt	,,
M1_28616	M1_179_182.txt	,,
M1_03715	M1_184_186.txt	,,
M1_05718	M1_186_188.txt	,,
M1_08716	M1_189_191.txt	,,
M1_10711	M1_191_192.txt	,,
M1_11710	M1_192_193.txt	,,
M1_12716	M1_193_196.txt	,,
M1_15709	M1_196_198.txt	,,
M1_17717	M1_198_199.txt	,,
M1_18714	M1_199_202.txt	,,

M1_21708	M1_202_203.txt	,,
M1_22710	M1_203_204.txt	,,
M1_23717	M1_204_206.txt	,,
M1_25711	M1_206_209.txt	,,
M1_28709	M1_209_211.txt	,,
M1_30710	M1_211_213.txt	,,
M1_01809	M1_213_216.txt	,,
M2_20617	M2_171_174.txt	M1_10s (2)
M2_23611	M2_174_176.txt	,,
M2_25615	M2_176_178.txt	,,
M2_27610	M2_178_179.txt	M2_10s (3)
M2_28616	M2_179_184.txt	,,
M2_03711	M2_184_186.txt	,,
M2_05718	M2_186_189.txt	,,
M2_08713	M2_189_191.txt	,,
M2_10712	M2_191_193.txt	,,
M2_12713	M2_193_196.txt	,,
M2_15709	M2_196_199.txt	,,
M2_18715	M2_199_202.txt	,,
M2_21708	M2_202_203.txt	,,
M2_22710	M2_203_206.txt	,,
M2_25712	M2_206_209.txt	,,
M2_28710	M2_209_211.txt	,,
M2_30710	M2_211_213.txt	,,
M2_01809	M2_213_216.txt	,,
M3_25616	M3_176_177.txt	M3_10s (4)
M3_26614	M3_177_179.txt	,,
M3_28616	M3_179_181.txt	,,
M3_30604	M3_181_184.txt	,,
M3_03710	M3_184_186.txt	,,
M3_05718	M3_186_189.txt	,,
M3_08715	M3_189_191.txt	,,
M3_10712	M3_191_193.txt	,,
M3_12712	M3_193_196.txt	,,
M3_15710	M3_196_199.txt	,,
M3_18715	M3_199_202.txt	,,
M3_21708	M3_202_203.txt	,,
M3_22710	M3_203_206.txt	,,
M3_25712	M3_206_209.txt	,,
M3_28710	M3_209_211.txt	,,
M3_30710	M3_211_213.txt	,,
M3_01809	M3_213_216.txt	,,
Files with all calibrated Data for Mast nr.		
1	M_1.txt	See files above.
2	M_2.txt	,,
3	M_3.txt	,,

Footnotes see next page

1) Start wind speed measurement at Height 6.25 m
2) Name of configuration not consistent, instead of 'M2_10s'. But measurements correct!
3) Name of configuration now corrected to 'M2_10s'.
4) No wind vane installed until DOY 177, 14:19:00.00

8.6 SODAR-RASS

Raw data
See **CD WALDATEM2003 SODAR-RASS**: \Sodar-RASS\Rohdaten\

200304.ZIP	Contains 2 dayfiles of raw data	Filenames: 0429.sdr – 0430.sdr
200305.ZIP	Contains 31 dayfiles of raw data	Filenames: 0501.sdr – 0531.sdr
200306.ZIP	Contains 30 dayfiles of raw data	Filenames: 0601.sdr – 0630.sdr
200307.ZIP	Contains 12 dayfiles of raw data	Filenames: 0701.sdr – 0710.sdr 0715.sdr – 0716.sdr

All *.sdr- files are day-files of format MMDD.sdr(MM: month, DD:day); timestamps contained in day-files are end time of interval!

Averaged (5 min) data
See **CD WALDATEM2003 SODAR-RASS**: \ Sodar-RASS\Daten\

200304.ZIP	Contains 2 dayfiles of data	Filenames: 0429.sdr – 0430.sdr
200305.ZIP	Contains 31 dayfiles of data	Filenames: 0501.sdr – 0531.sdr
200306.ZIP	Contains 30 dayfiles of data	Filenames: 0601.sdr – 0630.sdr
200307.ZIP	Contains 12 dayfiles of data	Filenames: 0701.sdr – 0710.sdr 0715.sdr – 0716.sdr

All *.sdr- files are day-files of format MMDD.sdr(MM: month, DD:day); timestamps contained in day-files are end time of interval!

8.7 Standard measurements Main tower and LfU container

CD WALDATEM2003 Meteodata Main Tower & LfU Container: \Main_Tower\WT* and :\LfU_Container\WP*
Raw data are available through BITÖK database using GOAT client.
Quality checked and corrected data are available on CD (see above) for the entire period.
Main tower data: WT_x_YYYYMMDD-YYYYMMDD (x: parameter description; YYYY: year; MM: month; DD: day; starting and end date respectively)
LfU Container data: WP_x_YYYYMMDD-YYYYMMDD (x: parameter description; YYYY: year; MM: month; DD: day; starting and end date respectively)
File format : XLS and CSV with 1 preceeding headerline

9 Appendix

Newspaper report

Bisher erschienene Arbeiten der Reihe ‚Universität Bayreuth, Abt. Mikrometeorologie, Arbeitsergebnisse'

Nr	Name	Titel	Datum
01	Foken	Der Bayreuther Turbulenzknecht	01/99
02	Foken	Methode zur Bestimmung der trockenen Deposition von Bor	02/99
03	Liu	Error analysis of the modified Bowen ratio method	02/99
04	Foken et al.	Nachtfrostgefährdung des ÖBG	03/99
05	Hierteis	Dokumentation des Expertimentes Dlouha Louka	03/99
06	Mangold	Dokumentation des Experiments am Standort Weidenbrunnen, Juli/August 1998	07/99
07	Heinz, Handorf, Foken	Strukturanalyse der atmosphärischen Turbulenz mittels Wavelet-Verfahren zur Bestimmung von Austauschprozessen über dem antarktischen Schelfeis	07/99
08	Foken	Comparison of the sonic Anemometer Young Model 81000 during VOITEX-99	10/99
09	Foken et al.	Lufthygienisch-Bioklimatische Kennzeichnung des oberen Egertales, Zwischenbericht 1999	11/99
10	Sodemann	Stationsdatenbank zum BStMLU-Projekt Lufthygienisch-Bioklimatische Kennzeichnung des oberen Egertales	03/00
11	Neuner	Dokumentation zur Erstellung der meteorologischen Eingabedateien für das Modell BEKLIMA	10/00
12	Foken et al.	Dokumentation des Experimentes VOITEX-99	12/00
13	Bruckmeier et al.	Documentation of the experiment EBEX-2000, July 20 to August 24, 2000	01/01
14	Foken et al.	Lufthygienisch-Bioklimatische Kennzeichnung des oberen Egertales	02/01

15	Göckede	Die Verwendung des footprint-Modells nach SCHMID (1997) zur stabilitätsabhängigen Bestimmung der Rauhigkeitslänge	03/01
16	Neuner	Berechnung der Evapotranspiration im ÖBG (Universität Bayreuth) mit dem SVAT-Modell BEKLIMA	05/01
17	Sodemann	Dokumentation der Software zur Bearbeitung der FINTUREX-Daten	08/02
18	Göckede et al.	Dokumentation des Experiments STINHO-1	08/02
19	Göckede et al.	Dokumentation des Experiments STINHO-2	12/02
20	Göckede et al.	Characterisation of a complex measuring site for flux measurements	12/02
21	Liebethal	Strahlungsmessgerätevergleich während des Experimentes STINHO_1	01/03
22	Mauder et al.	Dokumentation des Experiments EVA_GRIPS	03/03
23	Mauder et al.	Dokumentation des Experimentes Litfass-2003 Dokumentation des Experimentes GRASTATEM-2003	12/03
24	Thomas et al.	Documentation of WALDATEM-2003 Experiment	05/04