

Analysis of CNN 1/2 – data measured at the reference site Lindenberg

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Requirements for climate and NWP applications of ground-based sounding data sets

- **generated from independent measurements**
- **continuously available** [Tab 1](#) [Fig 1](#)
- **quality controlled**
- **practicable archiv**
- **accuracy estimation, evidence of steadiness**

CLIWA-NET status:
Validation site
Lindenberg

RAOB, MWP, Cei, IR_rad
2003:MWR, GPS,
Cloud radar, FTIR
Y
CNN1/2
ORACLE
CNN1/2

Validation using quality controlled data sets (1 RAOB \Leftrightarrow 1 MWP)

1. Estimation of retrieval accuracy (Regression, Neural Network) [Fig 2a](#) [Fig 2b](#)
 - Confirmation of results of an intercomparison from 1998/99 [Fig 3](#)
 - NN overestimates water vapour
 - Permanent completion of basis datasets for the regression method is necessary
2. Classification of cloud coverage (Ceil, IR, Synop); $N=0$, $0 < N < 1$, $N=1$ [Fig 4](#)
 - a new retrieval algorithm for CLW profiles is needed [Fig 5a](#) [Fig 5b](#)
(inclusion of ceilometer results, ... and other data)
3. Diurnal variation
 - Temperature: obvious
 - Water vapour: weak, additional tests required [Fig 6](#)
 - Liquid water: not recognized



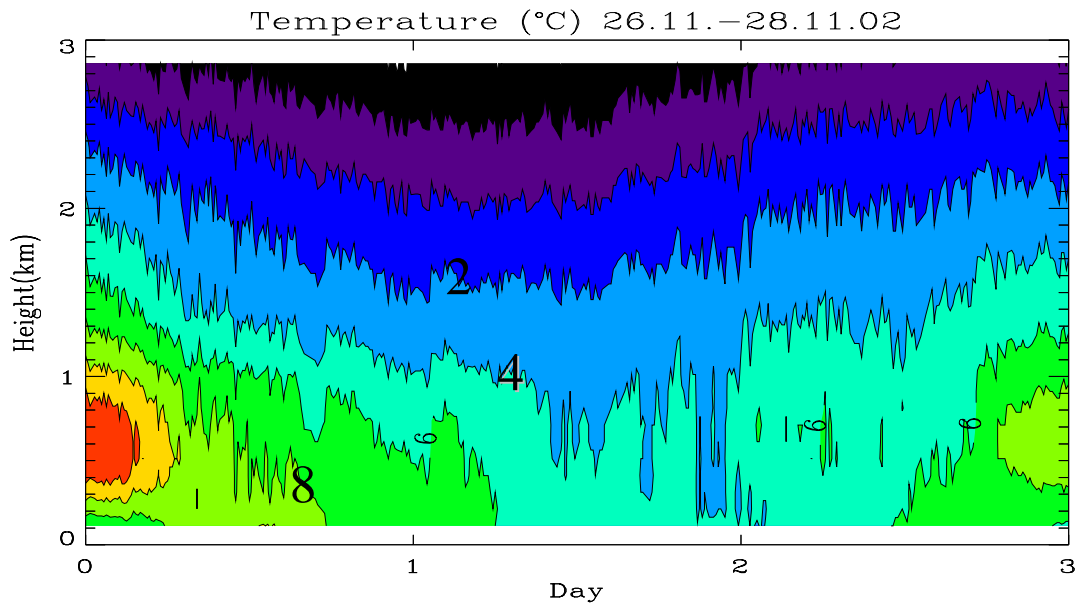
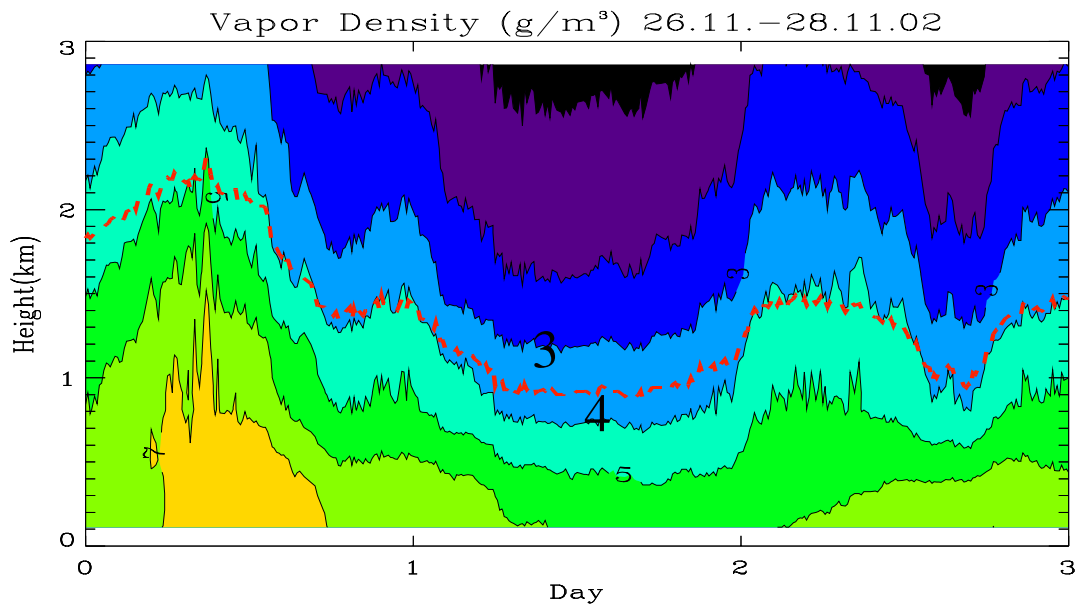


Fig 1. Temperature and vapour density profiles estimated from microwave profiler measurements at Lindenberg



<-- red line: Integrated water vapour (cm)



Datum	MWR(Anz)	C_MWP(Anz)	C_MWP(MW)	05 U	11 U	17 U	23 U		Datum	MWR(Anz)	C_MWP(Anz)	C_MWP(MW)	05 U	11 U	17 U	23 U
	144	144								144	144					
	108	108								108	108					
	6	6								6	6					
01.08.00 00:00	115	143	2,289	4,50	10,50	17,10	22,50		01.09.00 00:00	119	130	1,984	4,50	10,50	17,00	
02.08.00 00:00	106	105	2,653	4,50	-99,00	16,50	22,50		02.09.00 00:00	65	70	2,285	-99,00	-99,00	17,00	-99,00
03.08.00 00:00	123	136	2,101	4,50	-99,00	16,50	23,00		03.09.00 00:00	61	34	2,178	5,00			
04.08.00 00:00	118	130	2,28	4,50	10,50	-99,00	22,50		04.09.00 00:00	86	77	1,818			16,50	22,50
05.08.00 00:00	132	131	2,051	5,00	-99,00	16,50	22,50		05.09.00 00:00	112	100	1,582	5,00			22,50
06.08.00 00:00	138	143	2,1	4,50	10,50	17,10	22,50		06.09.00 00:00	110	124	1,779	5,10	10,50	17,00	-99,00
07.08.00 00:00	110	125	2,053	4,50	10,50	17,00	22,50		07.09.00 00:00	122	101	2,003		10,50	17,00	23,00
08.08.00 00:00	108	89	2,164	4,50	11,10	-99,00			08.09.00 00:00	124	119	2,967	4,50	10,50	17,00	22,50
09.08.00 00:00	126	113	1,819		10,50	17,10	22,50		09.09.00 00:00	123	134	2,972	4,50	10,50	17,00	22,50
10.08.00 00:00	102	72	2,374	5,00	-99,00	-99,00	-99,00		10.09.00 00:00	134	144	2,941	4,50	10,50	16,50	22,50
11.08.00 00:00	120	136	2,382	5,00	10,50	16,50	22,50		11.09.00 00:00	121	135	2,446	5,00	-99,00	16,50	22,50
12.08.00 00:00	140	139	2,152	5,00	11,00	16,50	22,50		12.09.00 00:00	5	109	2,503	5,10	11,00	16,50	
13.08.00 00:00	135	143	2,002	5,00	-99,00	16,50	22,50		13.09.00 00:00	114	98	2,423	5,00	-99,00	17,10	22,50
14.08.00 00:00	138	144	2,045	5,10	10,50	17,00	22,50		14.09.00 00:00	136	131	2,326	5,00	-99,00	16,50	22,50
15.08.00 00:00	101	98	3,025	-99,00	11,00				15.09.00 00:00	117	144	2,434	4,50	10,50	16,50	22,50
16.08.00 00:00	122	127	2,884	4,50	10,50	16,50	22,50		16.09.00 00:00	109	103	2,306	5,00		16,50	23,00
17.08.00 00:00	110	107	2,901	4,50	10,50	17,00	23,00		17.09.00 00:00	134	75	2,047	5,00	10,50		23,00
18.08.00 00:00	140	142	2,911	5,00	11,00	16,50	22,50		18.09.00 00:00	139	144	0,962	4,50	10,50	16,50	22,50
19.08.00 00:00	103	129	3,367	4,50	10,50	16,50	22,50		19.09.00 00:00	144	144	0,972	4,50	10,50	-99,00	
20.08.00 00:00	63	88	3,228	4,40	10,50	17,00			20.09.00 00:00	142	144	1,142		11,00	16,50	22,50
21.08.00 00:00	100	53	2,742			16,50	22,40		21.09.00 00:00	144	144	1,091	5,00	11,10	17,10	22,50
22.08.00 00:00	114	98	1,853		10,50	17,00	22,50		22.09.00 00:00	139	142	1,356	5,00	10,50	16,50	22,50
23.08.00 00:00	118	117	1,633		10,50	17,00	23,00		23.09.00 00:00	138	144	1,134	5,00	11,00	16,50	22,50
24.08.00 00:00	132	135	1,513	4,50	10,50	-99,00	-99,00		24.09.00 00:00	144	143	0,907	5,00	10,50	16,50	23,00
25.08.00 00:00	127	122	1,599	4,50	10,50	16,50	22,50		25.09.00 00:00	109	121	1,384	4,50		-99,00	23,00
26.08.00 00:00	141	143	1,542	5,00	10,50	16,50			26.09.00 00:00	144	143	2,253	4,50	11,00	-99,00	22,50
27.08.00 00:00	137	142	1,486				22,50		27.09.00 00:00	135	131	2,574	4,50	10,50	16,50	22,50
28.08.00 00:00	85	121	2,41	4,50	10,50	17,00			28.09.00 00:00	134	134	2,726	5,00	11,10	16,50	22,50
29.08.00 00:00	125	125	1,972				22,50		29.09.00 00:00	138	144	2,08	5,00	10,50	17,00	22,50
30.08.00 00:00	120	124	1,921	-99,00	-99,00	17,00	23,00		30.09.00 00:00	144	143	1,754	4,50	10,50	17,00	23,00
31.08.00 00:00	103	113	2,159	-99,00	10,50	17,00	23,00									

Tab 1. Availability of data during CNN1 after various quality checks.

MWR: 2-channel radiometer (Potsdam)

C_MWP: Microwave profiler (Lindenberg)

orange: > 75 %

yellow: > 5 %; < 75 %

blue box: comparison of profiler results and radiosonde observations is possible



CNN1, August/September 2000

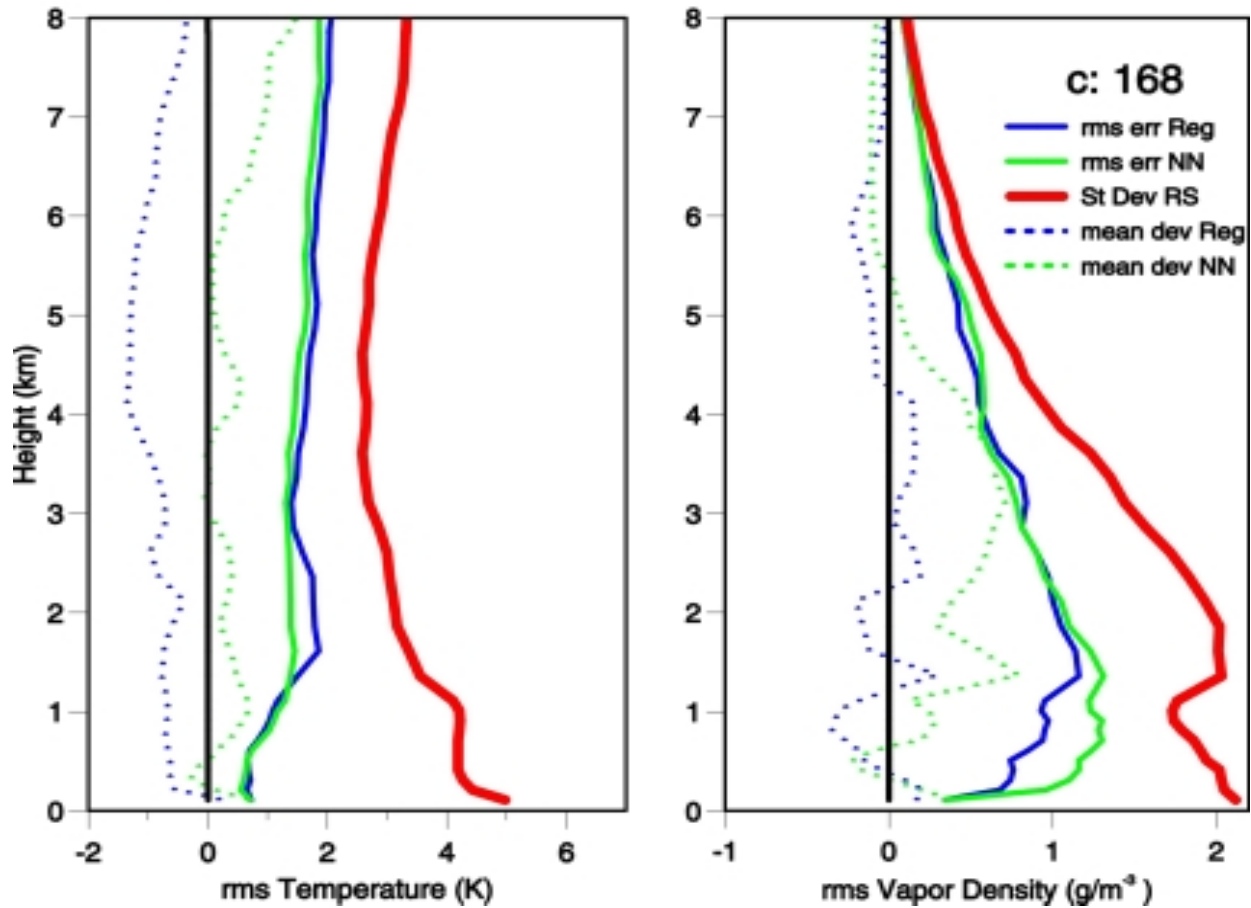


Fig 2a. Accuracy calculated from 168 intercomparisons (RAOB, MP retrieval) during CNN1

Reg: regression method - developed on the basis of data measured in 1998/99
as retrieval minus radiosonde (dashed line)

NN: Neural Network
mean deviation - defined



CNN2, April/May 2001

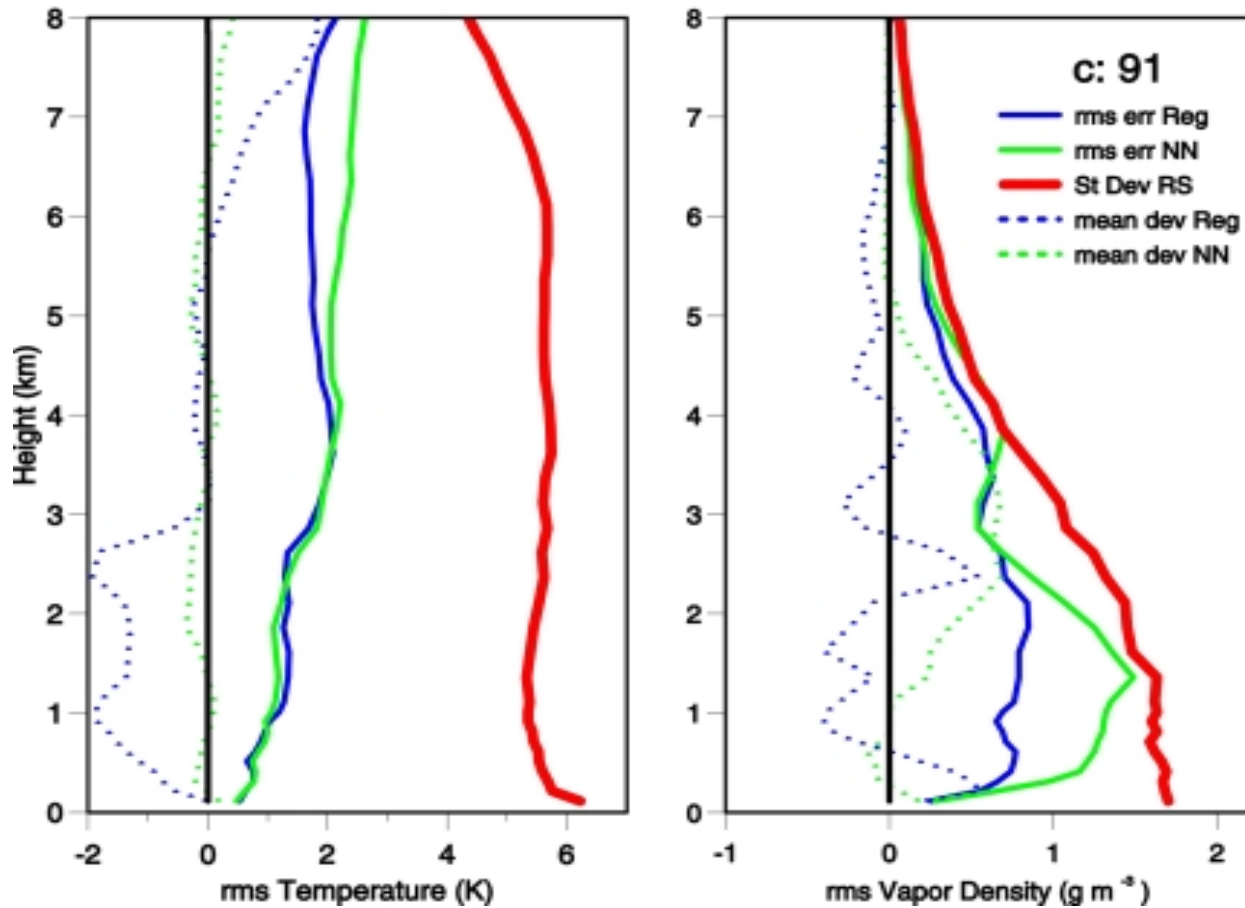


Fig 2b. Accuracy calculated from 91 comparisons (RAOB, MP retrieval) during CNN2

Reg: regression method - developed on the basis of data measured in 1998/9 NN: Neural Network
as retrieval minus radiosonde (dashed line) mean deviation - defined



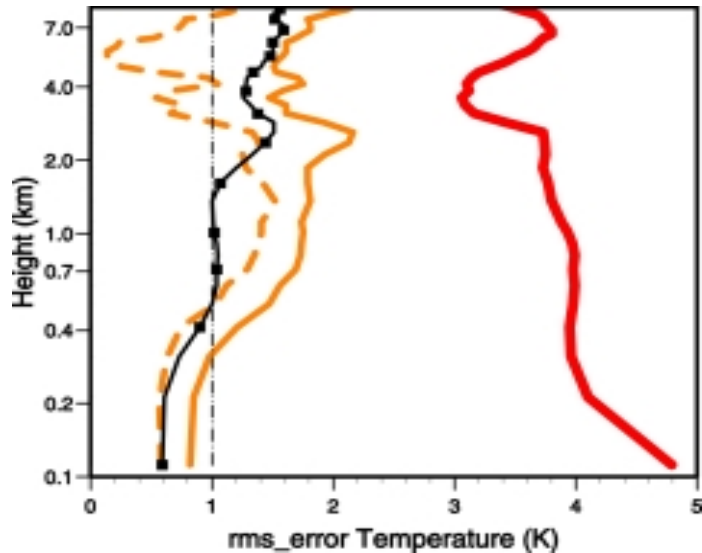
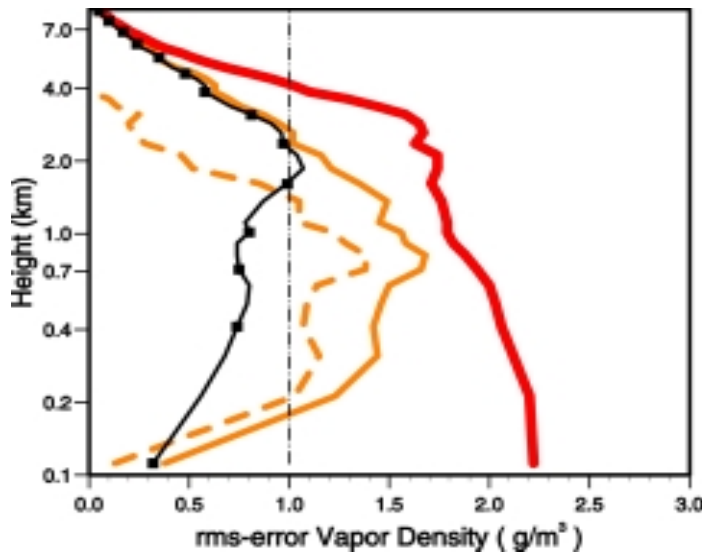


Fig 3. Retrieval error statistics for (top) temperature and (bottom) vapour density based on intercomparisons with radiosonde data in summer 1999.

Red solid line - standard deviation of the radiosondes used in the intercomparisons; solid line - neural network; solid line with squares - statistical regression; dashed line - bias defined as retrieval by neural network minus radiosonde.



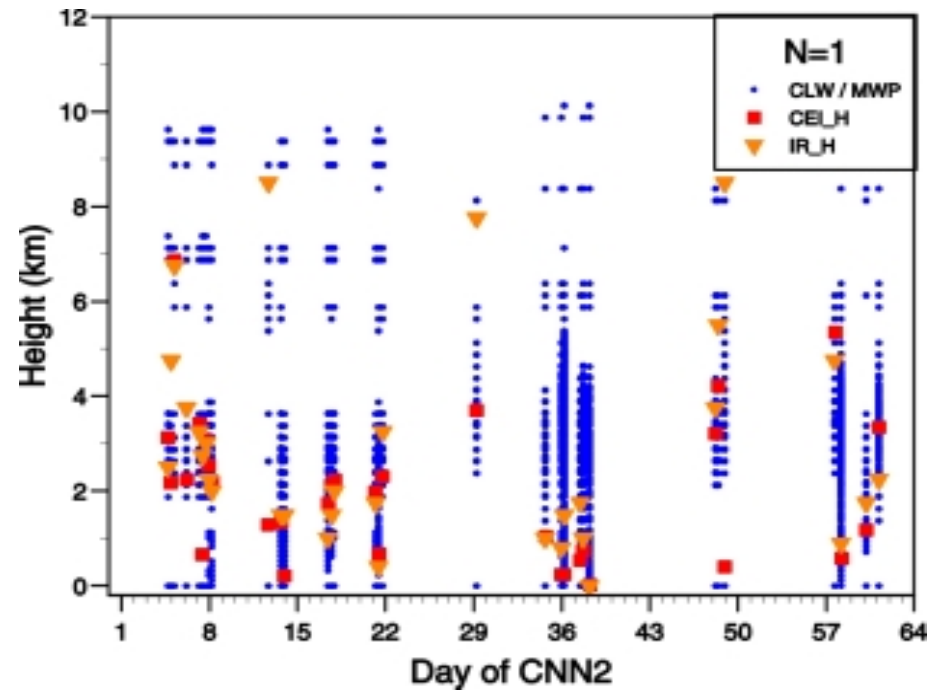
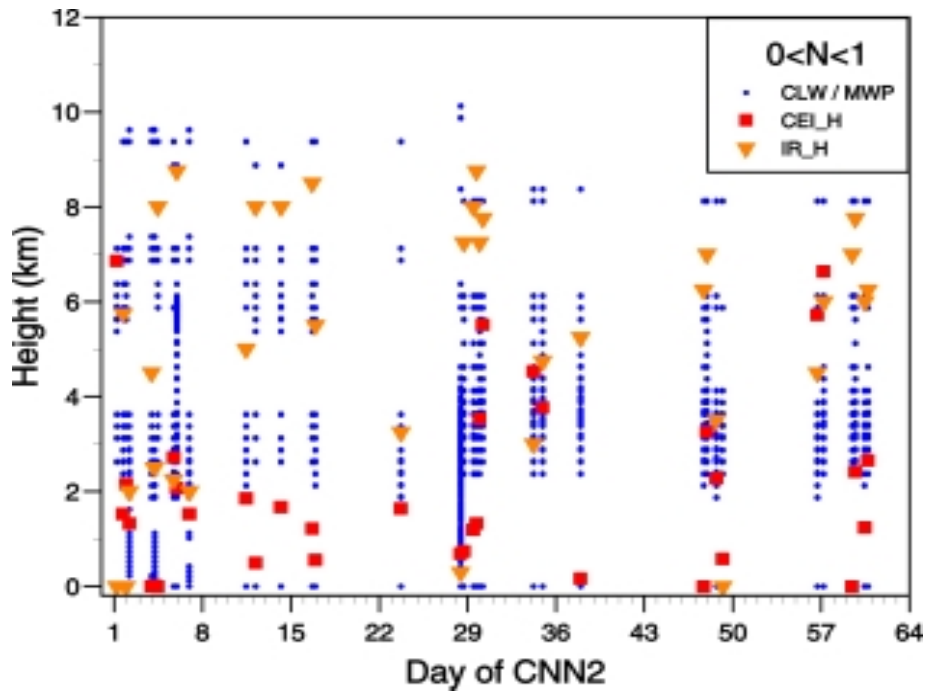


Fig 4. Comparison of cloud bottom height measured by ceilometer (red box) and IR radiometer (yellow triangle) vs microwave profiler calculation of liquid water. Blue dots denote values greater zero.

Plotted are all cases which were included in the intercomparison (MP vs RAOB) after a cloud classification.



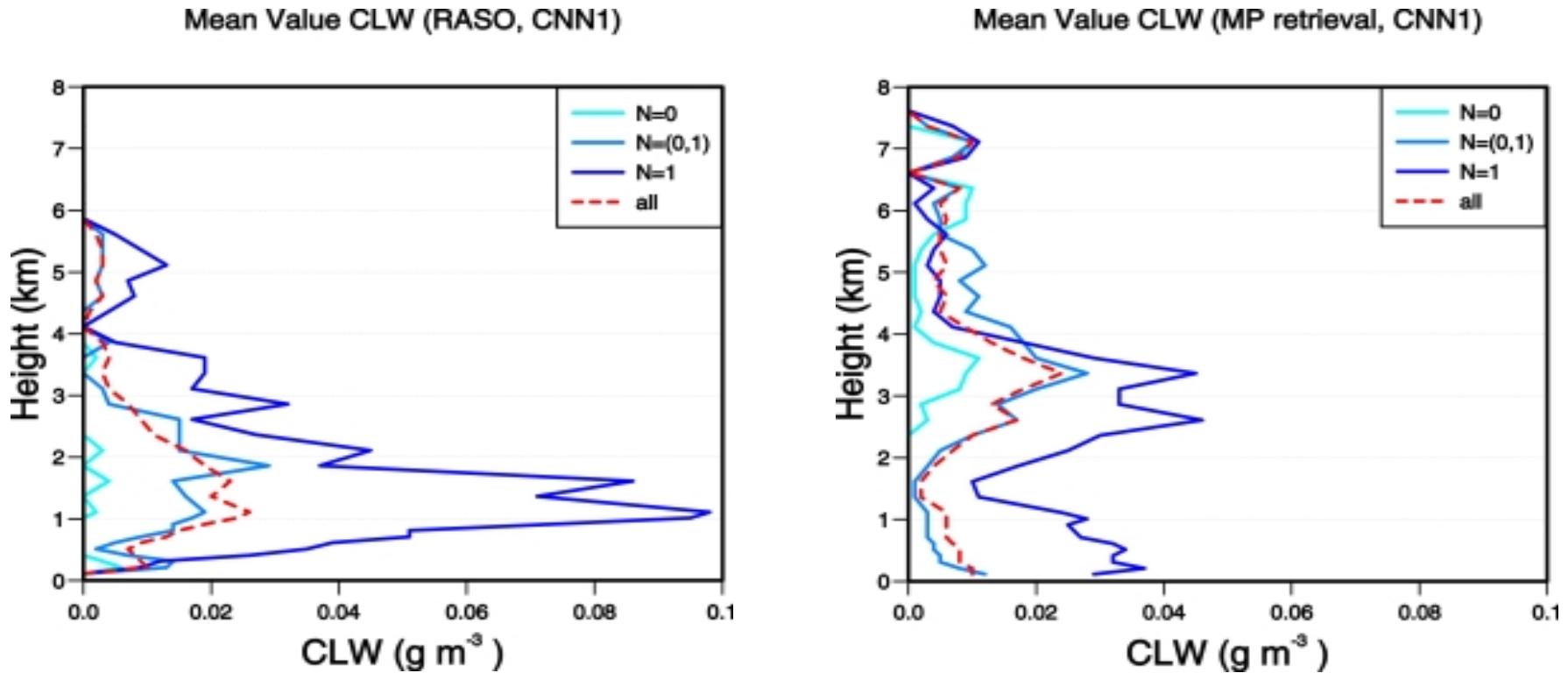
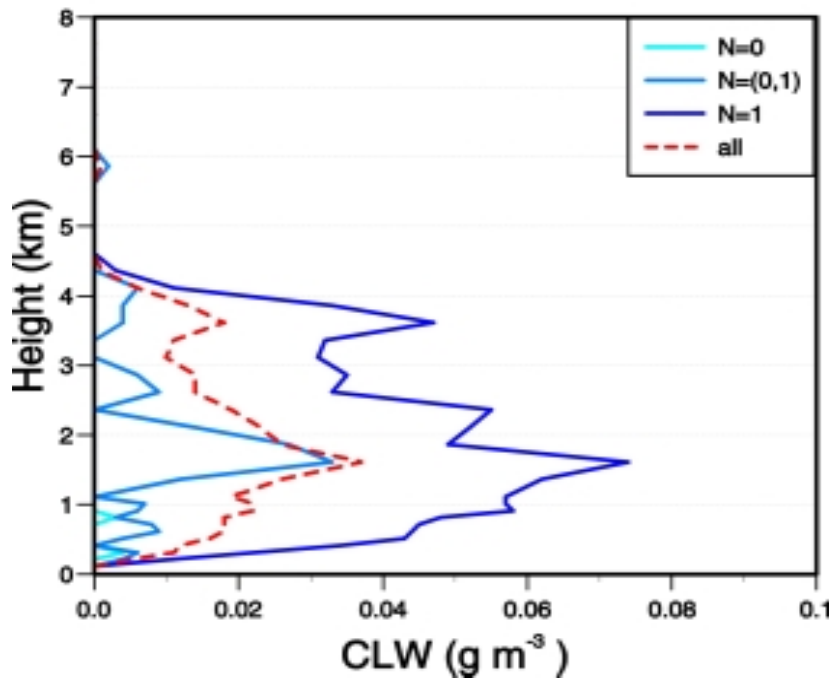


Fig 5a. Mean profile of cloud liquid water divided into classes of different estimated cloud fraction. Shown are the calculated mean profiles applying a cloud model for the appropriate radiosondes (left) and corresponding mean values of microwave profiler results (right) during CNN1.



Mean Value of CLW (RASO, CNN2)



Mean Value of CLW (MP retrieval, CNN2)

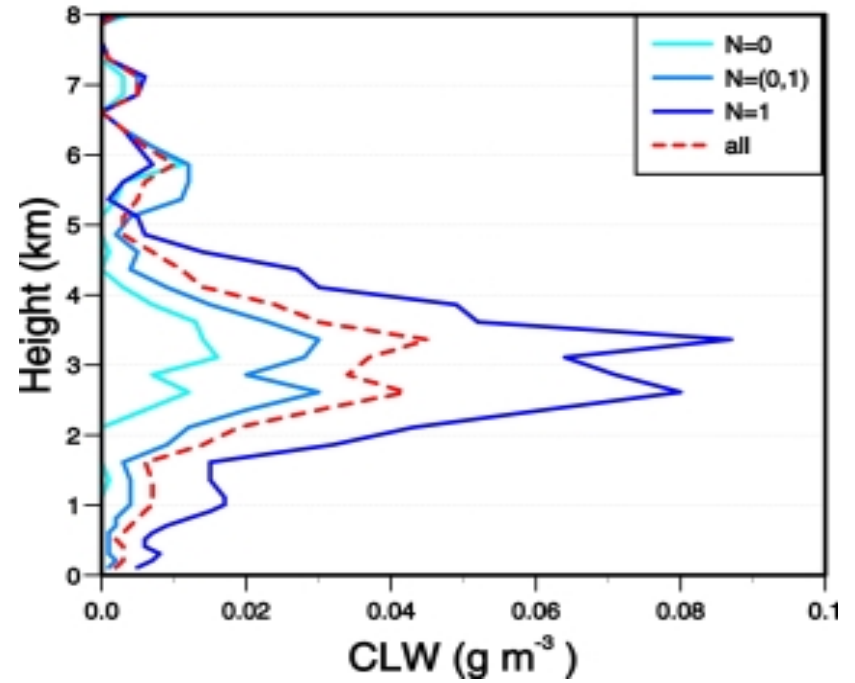


Fig 5b. Same as Fig 5a for CNN2



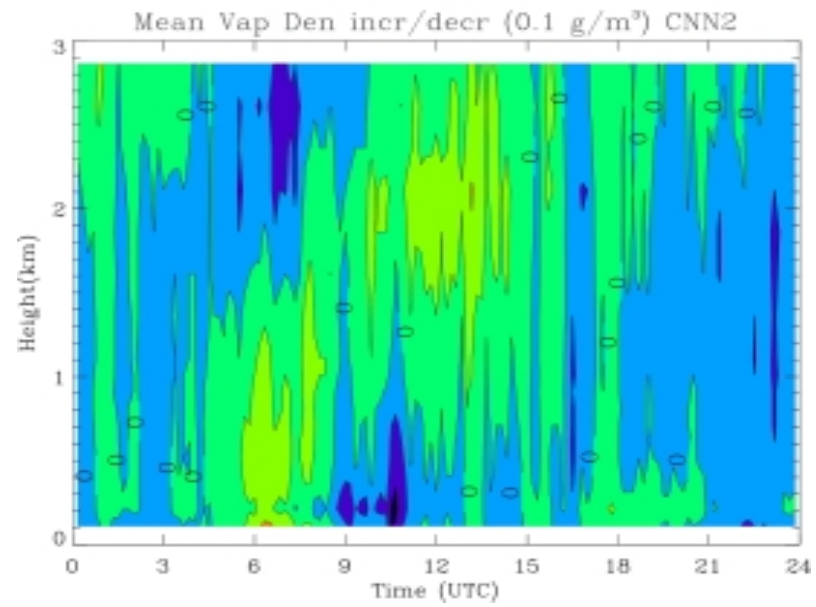
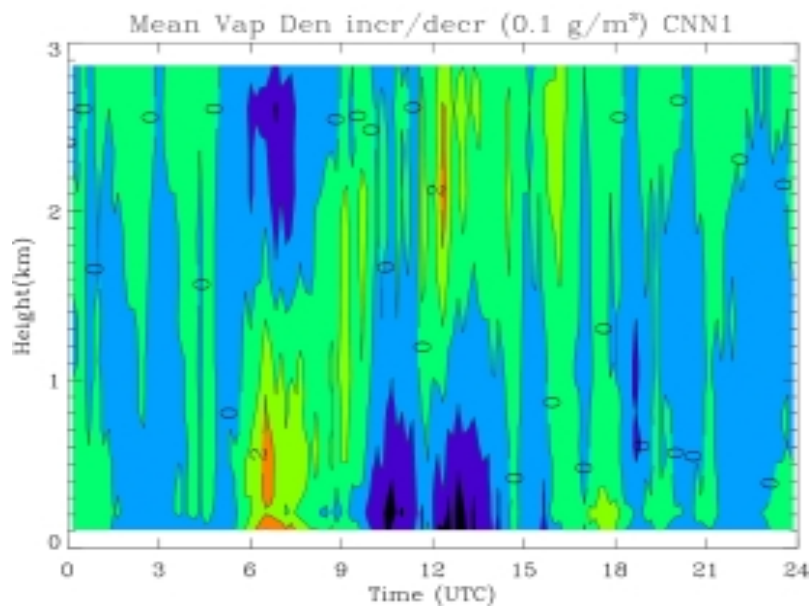
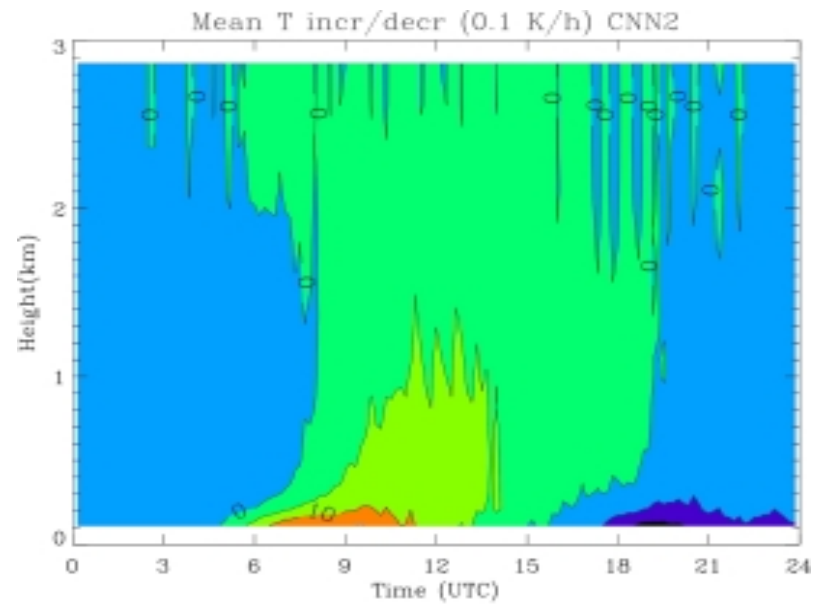
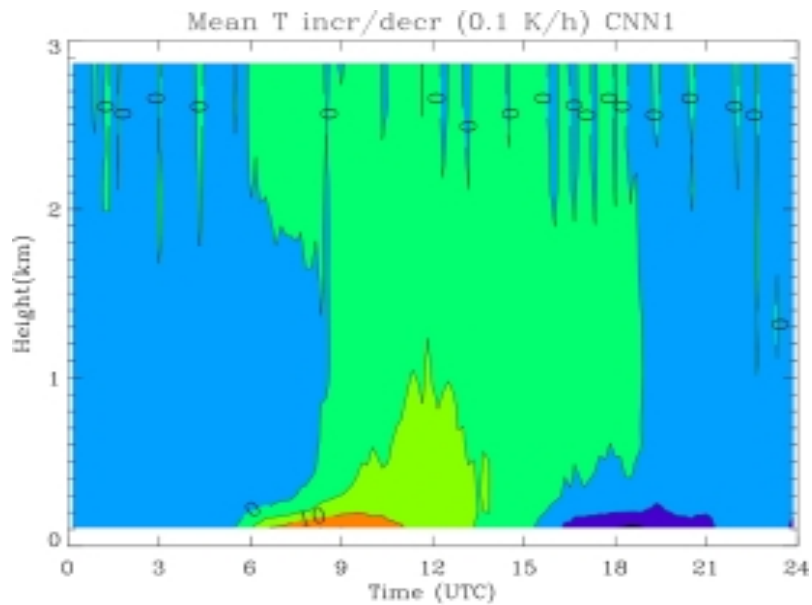


Fig 6. Mean hourly variation of temperature and water vapour during CNN1 (August/September 2000) and CNN2 (April/May 2001). Included are all pairs of profiles retrieved from microwave profiler measurements passing the quality checks. Green/red stands for increase and blue/black for decrease of observed values.

