



# Tarfala Research Station automatic weather station, 2004

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## 1 Instrumentation

The TRS met station consisted of the following instruments during 2004

Sensor	Serial number	Remark
Pt100		in Stevenson screen
Pt100		in Young screen
T/Rh		at 2 m (Young screen)
Young Wind Monitor		at 3 m
LiCor Li-200SB pyranometer		at 2 m
Tipping bucket precipitation gauge		at 2 m
Ventilated T/Rh		at 2 m
CR10 data logger		

## 2 Notes on the station data

- Pt100 sensors in Stevenson and Young shields misbehave from March and on throughout the year. January and February temperatures appear trustworthy.
- Ventilated humidity probe misbehaves throughout the year

## 3 Data coverage

- Relative humidity (ventilated) data missing from  
2004-11-06 09:00:00 to 2004-11-06 15:00:00  
2004-11-07 07:00:00 to 2004-11-07 12:00:00
- Temperature (ventilated unless stated otherwise) data missing from  
2004-02-20 12:00:00 to 2004-02-20 14:00:00  
2004-02-20 16:00:00 to 2004-02-20 18:00:00  
2004-03-06 13:00:00  
2004-03-10 11:00:00 to 2004-03-10 15:00:00  
2004-11-06 05:00:00 to 2004-11-06 11:00:00

## 4 Notes on data storage

Example of hourly data:

101,2004,185,1300,-18.21,-18.01,9.86,67.7,2.047,329.1,.044,171.9,0,10.43,.071,3.45,1216

Column	Example data	Description
01:	101	ID
02:	2004	Year
03:	185	Day of Year
04:	1300	hour-minute (hhmm)
05:	-18.21	2 Pt100 T in Stevenson screen)
06:	-18.01	3 T in Young screen
07:	9.86	4 Pt100 in new Young screen
08:	67.7	5 Rh in Young screen
09:	2.047	6 Mean horizontal wind speed
10:	329.1	7 resultant mean wind direction
11:	.044	8 Standard deviation of wind direction
12:	171.9	9 Global radiation
13:	0	10 Precipitation/SR50
14:	10.43	11 ventilated T
15:	.071	12 ventilated Rh
16:	3.45	13 hourly max wind speed
17:	1216	14 time for max wind speed

Example of daily data summaries:  
124,2004,185,2400,-7.31,-6.981,8.38,75.3,45.3,1937,-74.3,2153,6.811,40,2.068,330.2,  
110.4,0,13.9,8.97,.073

Column	Example data	Description
01:	124	ID
02:	2004	Year
03:	185	Day of Year
04:	2400	hour-minute (hhmm)
05:	-7.31	2 Daily average T in Stevenson screen)
06:	-6.981	3 Daily T from T/Rh in Young screen
07:	8.38	4 Daily T from T/Rh in Young screen
08:	75.3	5 daily average humidity in Young screen
08:	45.3	6 Daily maximum temperature in Young screen
10:	1937	7 hhmm for maximum daily temperature
11:	-74.3	8 Daily minimum temperature in Young screen
12:	2153	9 hhmm for minimum daily temperature
13:	6.811	10 Maximum wind speed
14:	40	11 hhmm for maximum wind speed
15:	2.068	12 Average wind speed
16:	330.2	13 Average wind direction
17:	110.4	14 Incoming radiation
18:	0	15 Totalized precipitation
19:	13.9	16 Battery voltage
20:	8.97	17 Average ventilated temperature
21:	.073	18 Average ventilated relative humidity

Example of 'Synoptic' output:  
103,2004,185,1300,-7.27

Column	Example data	Description
01:	103	ID
02:	2003	Year
03:	185	Day of Year
04:	1300	hour-minute (hhmm)
05:	12.85	Pt100 in Young screen

## 5 Data files and content

TRSmnet2004.csv Raw data file

TRS\_met\_2004\_Precipitation.csv

Date-time, Precipitation

2004-01-01 01:00:00,0.00

TRS\_met\_2004\_Radiation.csv

Date-time, Global radiation

2004-01-01 01:00:00,0.57

TRS\_met\_2004\_Relative\_humidity.csv

Date-time, hourly average Rh, ventilated Rh

2004-01-01 01:00:00,6.3,0.0

TRS\_met\_2004\_Temperature.csv

Date-time, hourly average T (Stevenson), hourly average T (Young), hourly average T/Rh (Young), ventilated (T/Rh)

2004-01-01 01:00:00,-11.80,-11.11,-10.89,-10.38

TRS\_met\_2004\_Wind.csv

Date-time, Mean horizontal wind speed, resultant mean wind direction, hourly max wind speed, time of max wind  
spd

2004-01-01 01:00:00,1.4,359.4,0.1290,3.40,53

TRS\_met\_2004\_Daily\_data.csv

Data columns follows description above

2004-01-02 00:00:00,-9.45,-8.74,-8.37,18.4,-4.46,2354,-13.82,12,7.1,  
237,2.0,350.2,0.7,0.0,13.93

TRS\_met\_2004\_Synop\_data.csv

Date-time, sample temperature

2004-01-01 01:00:00,-8.35

The data collected during 2004 is summarized the figure 1 and Table 1.

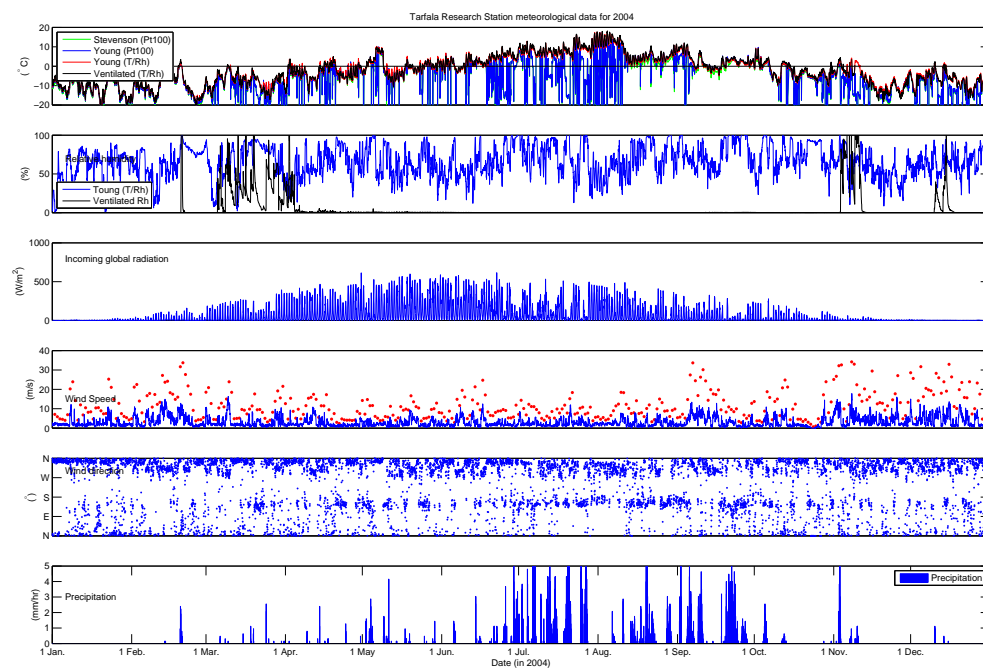


Figure. 1. Summary of meteorological data from Tarfala Research Station automatic weather station 2004.

Table. 1. Monthly averages of meteorological parameters from the Tarfala Research Station automatic weather station 2004.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Average air temperature (Stevenson)												
(°C)	−11.3	−10.9	—	—	—	—	—	—	—	—	—	—
<i>n</i>	743	695	—	—	—	—	—	—	—	—	—	—
Average air temperature (Young)												
(°C)	—	—	—	—	—	—	—	—	—	—	—	—
<i>n</i>	—	—	—	—	—	—	—	—	—	—	—	—
Average air temperature												
(°C)	−10.5	−10.0	−7.8	−3.4	−0.3	2.6	8.4	7.4	2.4	−2.6	−6.5	−6.7
<i>n</i>	743	695	767	743	743	743	743	767	743	767	743	767
Positive degree sum												
(°C)	15	22	5	227	1048	2153	6242	5707	2096	459	198	34
<i>n</i>	11	26	11	148	334	593	743	764	535	212	105	32
Average relative humidity												
(%)	56.4	63.8	66.5	60.9	64.4	63.6	73.6	67.1	76.5	74.1	57.8	64.3
<i>n</i>	743	695	767	743	743	743	743	767	743	767	743	767
Average incoming global radiation												
(W m <sup>−2</sup> )	1.6	12.2	48.3	115.0	162.4	156.0	100.5	88.7	42.5	23.1	4.4	2.0
<i>n</i>	743	695	767	743	743	743	743	767	743	767	743	767
Global incoming energy sum												
(W m <sup>−2</sup> )	1233	8505	37068	85452	120676	115926	74690	68060	31583	17694	3281	1514
<i>n</i>	535	502	636	740	743	743	743	714	678	757	740	744
Totalized precipitation												
(mm)	0.00	12.96	11.04	10.08	37.92	91.52	408.48	176.16	337.76	27.68	57.44	7.68
<i>n</i>	743	695	767	743	743	743	743	767	743	767	743	767
Average wind speed												
(m s <sup>−1</sup> )	2.4	4.5	3.1	2.4	2.4	2.7	2.6	2.6	3.6	2.4	4.6	4.7
<i>n</i>	743	695	767	743	743	743	743	767	743	767	743	767

## Logger program

### 5.1 Program valid for the year (copy from 2001 and 2002)

```

;{CR10}
*Table 1 Program
  01: 10.0000   Execution Interval (seconds)

;-----
; B A T T E R Y   voltage
;-----
; Measure battery voltage and skip to end of program
; if voltage is < 1.71.5 V
1:  Batt Voltage (P10)
  1: 10      Loc [ Battery   ]

2:  If (X<=>F) (P89)
  1: 10      X Loc [ Battery   ]
  2: 4       <
  3: 9.7     F
  4: 0       Go to end of Program Table

;-----
; T E M P E R A T U R E   measurements
;-----
;
3:  3W Half Bridge (P7)
  1: 1       Reps
  2: 33      25 mV 50 Hz Rejection Range
  3: 1       SE Channel
  4: 2       Excite all reps w/Exchan 2
  5: 2100    mV Excitation
  6: 21      Loc [ _____ ]
  7: 100.1   Mult
  8: 0       Offset

4:  3W Half Bridge (P7)
  1: 1       Reps
  2: 33      25 mV 50 Hz Rejection Range
  3: 3       SE Channel
  4: 2       Excite all reps w/Exchan 2
  5: 2100    mV Excitation
  6: 22      Loc [ _____ ]
  7: 100.2   Mult
  8: 0       Offset

5:  Temperature RTD (P16)
  1: 2       Reps
  2: 21      R/R0 Loc [ _____ ]
  3: 1       Loc [ _____ ]
  4: 1       Mult
  5: 0       Offset

6:  Do (P86)
  1: 41      Set Port 1 High

7:  Volt (Diff) (P2)
  1: 1       Reps
  2: 35      2500 mV 50 Hz Rejection Range
```



```

3: 3      DIFF Channel
4: 3      Loc [ _____ ]
5: .1     Mult
6: 0      Offset

8: Volt (SE) (P1)
1: 1      Reps
2: 35     2500 mV 50 Hz Rejection Range
3: 7      SE Channel
4: 4      Loc [ _____ ]
5: .1     Mult
6: 0      Offset

9: 3W Half Bridge (P7)
1: 1      Reps
2: 33     25 mV 50 Hz Rejection Range
3: 11     SE Channel
4: 3      Excite all reps w/Exchan 3
5: 2100   mV Excitation
6: 23     Loc [ _____ ]
7: 100    Mult
8: 0      Offset

10: Temperature RTD (P16)
1: 1      Reps
2: 23     R/R0 Loc [ _____ ]
3: 11     Loc [ _____ ]
4: 1      Mult
5: 0      Offset

11: Volt (SE) (P1)
1: 1      Reps
2: 35     2500 mV 50 Hz Rejection Range
3: 8      SE Channel
4: 12     Loc [ _____ ]
5: .1     Mult
6: 0      Offset

;-----
; P R E C I P I T A T I O N measurement
;-----
; Measure calcibrated tipping bucket. 0.16 mm/pulse
12: Pulse (P3)
1: 1      Reps
2: 1      Pulse Input Channel
3: 21     Low Level AC, Output Hz
4: 5      Loc [ _____ ]
5: .098   Mult
6: 0      Offset

13: Excite-Delay (SE) (P4)
1: 1      Reps
2: 5      2500 mV Slow Range
3: 9      SE Channel
4: 1      Excite all reps w/Exchan 1
5: 2      Delay (0.01 sec units)
6: 2500   mV Excitation
7: 6      Loc [ _____ ]

```

```

8: .142      Mult
9: -135      Offset

14: If (X<=>F) (P89)
  1: 6        X Loc [ _____ ]
  2: 4        <
  3: 0        F
  4: 30       Then Do

15: Z=X+F (P34)
  1: 6        X Loc [ _____ ]
  2: 360      F
  3: 6        Z Loc [ _____ ]

16: End (P95)

17: Volt (SE) (P1)
  1: 1        Reps
  2: 33       25 mV 50 Hz Rejection Range
  3: 10       SE Channel
  4: 7        Loc [ _____ ]
  5: 116.55   Mult
  6: 0        Offset

18: Pulse (P3)
  1: 1        Reps
  2: 2        Pulse Input Channel
  3: 2        Switch Closure, All Counts
  4: 8        Loc [ _____ ]
  5: .16      Mult
  6: 0        Offset

19: Internal Temperature (P17)
  1: 9        Loc [ _____ ]

;-----
; O U T P U T 1 hr means
;-----

20: If time is (P92)
  1: 0        Minutes (Seconds --) into a
  2: 60       Interval (same units as above)
  3: 10       Set Output Flag High

; Create special ID
21: Set Active Storage Area (P80)
  1: 1        Final Storage Area 1
  2: 101      Array ID

22: Real Time (P77)
  1: 1220     Year,Day,Hour/Minute (midnight = 2400)

23: Average (P71)
  1: 4        Reps
  2: 1        Loc [ _____ ]

24: Wind Vector (P69)

```

```

1: 1      Reps
2: 1      Samples per Sub-Interval
3: 0      S, theta(1), sigma(theta(1)) with polar sensor
4: 5      Wind Speed/East Loc [ _____ ]
5: 6      Wind Direction/North Loc [ _____ ]

25: Average (P71)
1: 1      Reps
2: 7      Loc [ _____ ]

26: Totalize (P72)
1: 1      Reps
2: 8      Loc [ _____ ]

27: Average (P71)
1: 2      Reps
2: 11     Loc [ _____ ]

28: Maximum (P73)
1: 1      Reps
2: 10     Value with Hr-Min
3: 5      Loc [ _____ ]

29: Serial Out (P96)
1: 71     Storage Module

;-----
; O U T P U T  24 hr means
;-----

30: If time is (P92)
1: 0      Minutes (Seconds --) into a
2: 1440   Interval (same units as above)
3: 10     Set Output Flag High

31: Set Active Storage Area (P80)
1: 1      Final Storage Area 1
2: 124    Array ID

32: Real Time (P77)
1: 1220   Year,Day,Hour/Minute (midnight = 2400)

33: Average (P71)
1: 4      Reps
2: 1      Loc [ _____ ]

34: Maximum (P73)
1: 1      Reps
2: 10     Value with Hr-Min
3: 2      Loc [ _____ ]

35: Minimum (P74)
1: 1      Reps
2: 10     Value with Hr-Min
3: 2      Loc [ _____ ]

36: Maximum (P73)
1: 1      Reps
2: 10     Value with Hr-Min

```

```

3: 5      Loc [ _____ ]

37: Wind Vector (P69)
1: 1      Reps
2: 1      Samples per Sub-Interval
3: 1      S, theta(1) with polar sensor
4: 5      Wind Speed/East Loc [ _____ ]
5: 6      Wind Direction/North Loc [ _____ ]

38: Average (P71)
1: 1      Reps
2: 7      Loc [ _____ ]

39: Totalize (P72)
1: 1      Reps
2: 8      Loc [ _____ ]

40: Sample (P70)
1: 1      Reps
2: 10     Loc [ Battery   ]

41: Average (P71)
1: 2      Reps
2: 11     Loc [ _____ ]

42: Serial Out (P96)
1: 71     Storage Module

;-----
;O U T P U T 3 hour (synoptic standard) data
;-----
; Data at 0100
43: If time is (P92)
1: 60     Minutes (Seconds --) into a
2: 180    Interval (same units as above)
3: 10     Set Output Flag High

44: Set Active Storage Area (P80)
1: 1      Final Storage Area 1
2: 103    Array ID

45: Real Time (P77)
1: 1220   Year,Day,Hour/Minute (midnight = 2400)

46: Sample (P70)
1: 1      Reps
2: 2      Loc [ _____ ]

*Table 2 Program
01: 0.0000 Execution Interval (seconds)

*Table 3 Subroutines

End Program

1      [ _____ ] RW-- 2      1      Start ----- ---
2      [ _____ ] RW-- 5      1      ----- End
3      [ _____ ] RW-- 2      1      ----- ---

```

4	[ _____ ]	RW--	2	1	-----	-----	---
5	[ _____ ]	RW--	4	1	-----	-----	---
6	[ _____ ]	RW--	4	2	-----	-----	---
7	[ _____ ]	RW--	2	1	-----	-----	---
8	[ _____ ]	RW--	2	1	-----	-----	---
9	[ _____ ]	-W--	0	1	-----	-----	---
10	[ Battery ]	RW--	2	1	-----	-----	---
11	[ _____ ]	RW--	2	1	-----	-----	---
12	[ _____ ]	RW--	2	1	-----	-----	---
13	[ _____ ]	----	0	0	-----	-----	---
14	[ _____ ]	----	0	0	-----	-----	---
15	[ _____ ]	----	0	0	-----	-----	---
16	[ _____ ]	----	0	0	-----	-----	---
17	[ _____ ]	----	0	0	-----	-----	---
18	[ _____ ]	----	0	0	-----	-----	---
19	[ _____ ]	----	0	0	-----	-----	---
20	[ _____ ]	----	0	0	-----	-----	---
21	[ _____ ]	RW--	1	1	-----	-----	---
22	[ _____ ]	RW--	1	1	-----	-----	---
23	[ _____ ]	RW--	1	1	-----	-----	---