



## Tarfala Research Station automatic weather station, 1995

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# 1 Instrumentation

The TRS met station consisted of the following instruments during 1995

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

## 2 Notes on the station data

- Some original logger files are missing and existing data files are based on processed data.
- Data logger program also saves temperature data every three hours at 01:00, 04:00, 07:00, 10:00, 13:00, 16:00, 19:00, and 22:00.

## 3 Data coverage

- No data breaks in Relative humidity, precipitation and Temperature data
- wind data missing from  
1995-10-25 13:00:00  
1995-10-28 02:00:00 to 1995-10-28 06:00:00  
1995-11-14 12:00:00 to 1995-11-14 15:00:00
- Radiation data is missing from  
1995-06-06 00:00:00 to 1995-06-08 11:00:00  
1995-10-25 13:00:00  
1995-10-28 02:00:00 to 1995-10-28 06:00:00  
1995-11-14 12:00:00 to 1995-11-14 15:00:00

## 4 Notes on data storage

Example data line for hourly data:

101,1995,7,4,185,1300,3.916,3.925,3.748,99.2,1.353,92.2,70.8,0

Column	Example data	Description
01:	101	ID
02:	1995	Year
03:	7	Month
04:	4	Day of month
05:	()	Day of Year
06:	1300	hour-minute (hhmm)
07:	3.916	2 Pt100 T in Stevenson screen)
08:	3.925	3 T in Young screen
09:	3.748	4 Pt100 in new Young screen
10:	99.2	5 Rh in Young screen
11:	1.353	6 Mean horizontal wind speed
12:	92.2	7 resultant mean wind direction
13:	70.8	8 Global radiation
14:	0	9 Precipitation

Example of daily data summaries:

124,1995,1,1,1,2400,-12.96,-12.65,-12.34,61.96,-9.52,2040,-18.89,2351,16.09,1549,  
2.725,132.1,-17.25, 0,-13.58,13.93

Column	Example data	Description
01:	124	ID
02:	1995	Year
03:	1	Month
04:	1	Day of Month
05:	1	Day of Year
06:	2400	hour-minute (hhmm)
07:	-12.96	2 Daily average T in Stevenson screen)
08:	-12.65	3 Daily T from T/Rh in Young screen
09:	-12.34	4 Daily T from T/Rh in Young screen
10:	61.96	5 daily average humidity in Young screen
11:	-9.52	6 Daily maximum temperature in Young screen
12:	2040	7 hhmm for maximum daily temperature
13:	-18.89	8 Daily minimum temperature in Young screen
14:	2351	9 hhmm for minimum daily temperature
15:	16.09	10 Maximum wind speed
16:	1549	11 hhmm for maximum wind speed
17:	2.725	12 Average wind speed
18:	132.1	13 Average wind direction
19:	-17.25	14 Incoming radiation
20:	0	15 Precipitation
21:	-13.58	16 Logger temperature
22:	13.93	17 Sample battery voltage

## 5 Data files and content

TRSmnet1995.csv Raw data file

TRS\_met\_1995\_Precipitation.csv

Date-time, hourly totalized P

1995-01-01 01:00:00,0.0

TRS\_met\_1995\_Radiation.csv

Date-time, Global radiation, Net radiation

1995-01-01 01:00:00,-17.35

TRS\_met\_1995\_Relative\_humidity.csv

Date-time, hourly average Rh

1995-01-01 01:00:00,65.4

TRS\_met\_1995\_Temperature.csv

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

1995-01-01 01:00:00,-14.44,-13.94,-13.63

TRS\_met\_1995\_Wind.csv

Date-time, Mean horizontal wind speed, Resultant mean wind speed, resultant mean wind direction, Standard deviation of wind direction

1995-01-01 01:00:00,1.2,138.9

TRS\_met\_1995\_Daily\_data.csv

Data columns follows description above

1995-01-01 00:00:00,-13.0,-12.7,-12.3,62.0,-9.5,2040,-18.9,2351,16.1,1549,2.7,132.1,-17.3,0.00,-13.6

The data collected during 1995 is summarized the figure 1 and Table 1.

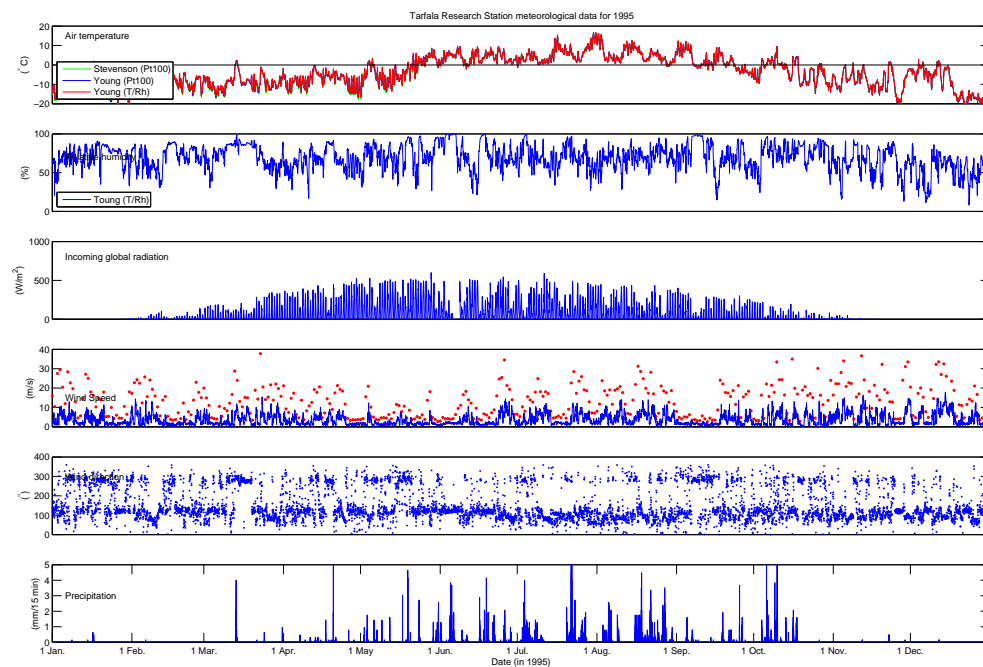


Figure. 1. Summary of meteorological data from Tarfala Research Station automatic weather station 1995.

Table. 1. Monthly averages of meteorological parameters from the Tarfala Research Station automatic weather station 1995.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Average air temperature (Stevenson)												
(°C)	−10.0	−10.6	−9.5	−8.3	−3.2	3.6	5.5	5.6	1.7	−3.6	−8.5	−9.8
<i>n</i>	743	671	767	743	743	743	743	767	743	767	743	767
Average air temperature (Young)												
(°C)	−9.7	−10.3	−9.2	−8.0	−2.9	3.9	5.6	5.7	1.8	−3.5	−8.4	−9.7
<i>n</i>	743	671	767	743	743	743	743	767	743	767	743	767
Average air temperature												
(°C)	−9.5	−10.1	−9.0	−7.8	−2.7	3.8	5.6	5.6	1.7	−3.5	−8.3	−9.6
<i>n</i>	743	671	767	743	743	743	743	767	743	767	743	767
Positive degree sum												
(°C)	32.9	0.0	35.0	0.0	743.3	2934.8	4177.8	4341.2	1992.6	514.9	26.3	25.0
<i>n</i>	31	0	27	0	260	702	738	748	449	224	36	29
Average relative humidity												
(%)	71	69	73	65	73	75	69	69	72	75	63	52
<i>n</i>	743	671	767	743	743	743	743	767	743	767	743	767
Average incoming global radiation												
(W m <sup>−2</sup> )	−16.4	−7.6	29.6	92.1	139.0	116.7	105.0	72.5	40.9	4.9	−14.5	−17.2
<i>n</i>	743	671	767	743	743	683	743	767	743	761	739	767
Global incoming energy sum												
(W m <sup>−2</sup> )	33	3518	30179	73485	106187	—	80803	60469	37174	—	528	0
<i>n</i>	8	133	307	420	514	—	512	450	322	—	48	0
Totalized precipitation												
(mm)	3.04	0.16	21.28	17.12	48.00	93.76	147.68	166.08	29.28	85.28	2.88	0.32
<i>n</i>	743	671	767	743	743	743	743	767	743	767	743	767
Average wind speed												
(m s <sup>−1</sup> )	3.3	3.3	3.9	3.0	2.0	3.2	4.1	4.8	2.6	3.5	5.2	5.2
<i>n</i>	743	671	767	743	743	743	743	767	743	761	739	767

## Logger program

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

1:  Batt Voltage (P10)
  1: 10        Loc [ Batteri_V ]

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

3:  3W Half Bridge (P7)
  1: 1         Reps
  2: 33        25 mV 50 Hz Rejection Range
  3: 1         SE Channel
  4: 1         Excite all reps w/Exchan 1
  5: 2100      mV Excitation
  6: 21        Loc [ Rs_Ro_T1 ]
  7: 100       Mult
  8: 0.0000    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 [ Rs_Ro_T2 ]
  7: 100.00    Mult
  8: 0.0000    Offset

5:  Temperature RTD (P16)
  1: 2         Reps
  2: 21        R/R0 Loc [ Rs_Ro_T1 ]
  3: 1         Loc [ T1_bur__C ]
  4: 1         Mult
  5: 0.0000    Offset

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

7:  Excitation with Delay (P22)
  1: 1         Ex Channel
  2: 200       Delay W/Ex (0.01 sec units)
  3: 25        Delay After Ex (0.01 sec units)
  4: 1         mV Excitation

8:  Volt (Diff) (P2)
  1: 2         Reps
  2: 35        2500 mV 50 Hz Rejection Range
  3: 3         DIFF Channel
  4: 3         Loc [ T3_Rot__C ]
  5: 0.1       Mult
  6: 0.0000    Offset
```

```

9: Do (P86)
  1: 51      Set Port 1 Low

10: Pulse (P3)
  1: 1      Reps
  2: 1      Pulse Input Channel
  3: 21     Low Level AC, Output Hz
  4: 5      Loc [ Vhast_m_s ]
  5: 0.0098 Mult
  6: 0      Offset

11: Excite-Delay (SE) (P4)
  1: 1      Reps
  2: 5      2500 mV Slow Range
  3: 9      SE Channel
  4: 3      Excite all reps w/Exchan 3
  5: 2      Delay (0.01 sec units)
  6: 2500   mV Excitation
  7: 6      Loc [ Vrikt____ ]
  8: 0.142  Mult
  9: 0.0000 Offset

12: Volt (SE) (P1)
  1: 1      Reps
  2: 33     25 mV 50 Hz Rejection Range
  3: 10     SE Channel
  4: 7      Loc [ Sol__W_m_ ]
  5: 116.55 Mult
  6: 0.0000 Offset

13: Pulse (P3)
  1: 1      Reps
  2: 2      Pulse Input Channel
  3: 2      Switch Closure, All Counts
  4: 8      Loc [ Nederb_mm ]
  5: 0.16   Mult
  6: 0.0000 Offset

14: Internal Temperature (P17)
  1: 9      Loc [ Logtemp_C ]

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

16: Set Active Storage Area (P80)
  1: 1      Final Storage Area 1
  2: 101    Array ID

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

18: Average (P71)
  1: 4      Reps
  2: 1      Loc [ T1_bur__C ]

```



```

19: Wind Vector (P69)
   1: 1      Reps
   2: 1      Samples per Sub-Interval
   3: 1      S, é1 Polar
   4: 5      Wind Speed/East Loc [ Vhast_m_s ]
   5: 6      Wind Direction/North Loc [ Vrikt____ ]

20: Average (P71)
   1: 1      Reps
   2: 7      Loc [ Sol__W_m_ ]

21: Totalize (P72)
   1: 1      Reps
   2: 8      Loc [ Nederb_mm ]

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

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

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

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

26: Average (P71)
   1: 4      Reps
   2: 1      Loc [ T1_bur__C ]

27: Maximum (P73)
   1: 1      Reps
   2: 10     Value with Hr-Min
   3: 2      Loc [ T2_skyd_C ]

28: Minimum (P74)
   1: 1      Reps
   2: 10     Value with Hr-Min
   3: 2      Loc [ T2_skyd_C ]

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

30: Wind Vector (P69)
   1: 1      Reps
   2: 1      Samples per Sub-Interval
   3: 1      S, é1 Polar
   4: 5      Wind Speed/East Loc [ Vhast_m_s ]
   5: 6      Wind Direction/North Loc [ Vrikt____ ]

31: Average (P71)
   1: 1      Reps

```

```

2: 7      Loc [ Sol__W_m_ ]

32: Totalize (P72)
1: 1      Reps
2: 8      Loc [ Nederb_mm ]

33: Average (P71)
1: 1      Reps
2: 9      Loc [ Logtemp_C ]

34: Sample (P70)
1: 1      Reps
2: 10     Loc [ Batteri_V ]

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

36: If time is (P92)
1: 60     Minutes (Seconds --) into a
2: 1440   Interval (same units as above)
3: 10     Set Output Flag High

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

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

39: Sample (P70)
1: 1      Reps
2: 2      Loc [ T2_skyd_C ]

40: If time is (P92)
1: 240    Minutes (Seconds --) into a
2: 1440   Interval (same units as above)
3: 10     Set Output Flag High

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

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

43: Sample (P70)
1: 1      Reps
2: 2      Loc [ T2_skyd_C ]

44: If time is (P92)
1: 420    Minutes (Seconds --) into a
2: 1440   Interval (same units as above)
3: 10     Set Output Flag High

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

```

```

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

47: Sample (P70)
   1: 1         Reps
   2: 2         Loc [ T2_skyd_C ]

48: If time is (P92)
   1: 600       Minutes (Seconds --) into a
   2: 1440      Interval (same units as above)
   3: 10        Set Output Flag High

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

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

51: Sample (P70)
   1: 1         Reps
   2: 2         Loc [ T2_skyd_C ]

52: If time is (P92)
   1: 780       Minutes (Seconds --) into a
   2: 1440      Interval (same units as above)
   3: 10        Set Output Flag High

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

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

55: Sample (P70)
   1: 1         Reps
   2: 2         Loc [ T2_skyd_C ]

56: If time is (P92)
   1: 960       Minutes (Seconds --) into a
   2: 1440      Interval (same units as above)
   3: 10        Set Output Flag High

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

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

59: Sample (P70)
   1: 1         Reps
   2: 2         Loc [ T2_skyd_C ]

60: If time is (P92)
   1: 1140      Minutes (Seconds --) into a
   2: 1440      Interval (same units as above)

```

```

3: 10      Set Output Flag High

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

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

63: Sample (P70)
  1: 1      Reps
  2: 2      Loc [ T2_skyd_C ]

64: If time is (P92)
  1: 1320   Minutes (Seconds --) into a
  2: 1440   Interval (same units as above)
  3: 10     Set Output Flag High

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

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

67: Sample (P70)
  1: 1      Reps
  2: 2      Loc [ T2_skyd_C ]

```

```

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

```

```

*Table 3 Subroutines

```

```

End Program

```

1	[ T1_bur__C ]	RW--	2	1	Start	-----	---
2	[ T2_skyd_C ]	RW--	12	1	-----	-----	End
3	[ T3_Rot__C ]	RW--	2	1	Start	-----	---
4	[ rH_Rot___ ]	RW--	2	1	-----	-----	End
5	[ Vhast_m_s ]	RW--	3	1	-----	-----	---
6	[ Vrikt_____ ]	RW--	2	1	-----	-----	---
7	[ Sol__W_m_ ]	RW--	2	1	-----	-----	---
8	[ Nederb_mm ]	RW--	2	1	-----	-----	---
9	[ Logtemp_C ]	RW--	1	1	-----	-----	---
10	[ Batteri_V ]	RW--	2	1	-----	-----	---
11	[ _____ ]	----	0	0	-----	-----	---
12	[ _____ ]	----	0	0	-----	-----	---
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	[ Rs_Ro_T1 ]	RW--	1	1	-----	-----	---

22	[ Rs_Ro_T2 ]	RW--	1	1	-----	-----	---
23	[ ----- ]	----	0	0	-----	-----	---
24	[ ----- ]	----	0	0	-----	-----	---
25	[ ----- ]	----	0	0	-----	-----	---
26	[ ----- ]	----	0	0	-----	-----	---
27	[ ----- ]	----	0	0	-----	-----	---
28	[ ----- ]	----	0	0	-----	-----	---