Tarfala Research Station automatic weather station, 2001

Peter Jansson
November 5, 2014

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1 Instrumentation
The TRS met station consisted of the following instruments during 2001

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Serial number</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100</td>
<td>in Stevenson screen</td>
<td></td>
</tr>
<tr>
<td>Pt100</td>
<td>in Young screen</td>
<td></td>
</tr>
<tr>
<td>T/Rh</td>
<td>at 2 m (Young screen)</td>
<td></td>
</tr>
<tr>
<td>Young Wind Monitor</td>
<td>at 3 m</td>
<td></td>
</tr>
<tr>
<td>LiCor Li-200SB pyranometer</td>
<td>at 2 m</td>
<td></td>
</tr>
<tr>
<td>Tipping bucket precipitation gauge</td>
<td>at 2 m</td>
<td></td>
</tr>
<tr>
<td>SR50</td>
<td>at 1.5 m</td>
<td></td>
</tr>
<tr>
<td>Ventilated T/Rh</td>
<td>at 2 m</td>
<td></td>
</tr>
<tr>
<td>CR10 data logger</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 Notes on the station data
- The SR 50, although not working properly (likely due to membrane failure), was attached to the station until 2001-05-05 18:00:00 when the precipitation gauge replaces SR50 data. The SR50 was not added in fall.
- Power failure occurred after 2001-01-31 00:00:00. Logger self started when power was restored at an unknown time. A floating segment of data from 2001-02-02 12:00:00 to 2001-02-26 15:00:00 exists based on the assumption that time was restored before 2001-02-26 16:00:00 from when time is correct. The power failure thus caused a loss of data spanning 2001-01-31 00:00:00 to 2001-02-02 12:00:00. This does not, however mean that the times specified in the floating data segment is correct. It could be as much as 1 hr off. The data still represents conditions during this period but has not been added to the main data file. Daily and ‘synoptic’ data from the period exist but are recorded at erroneous times. Judging by the raw data ‘synoptic data would be 1 hour off and daily data recorded at 12:00 instead of 24:00. No record of time adjustment constants have been recorded.
• A programming change was made 2001-05-05 18:00:00 when hourly maximum wind speed and and the time of the max was added as two additional columns in hourly data. These columns have been padded with NaN in the file until the onset of the program change.

• the ventilated T/Rh sensor misbehaves more frequently than other sensors.

3 Data coverage

• General data gap:
  2001-01-31 00:00:00 to approx. 2001-02-02 12:00:00 due to power failure
  2001-09-03 21:00:00 to 2001-09-04 17:00:00 (unknown reason)

• data time uncertainty:
  approx. 2001-02-02 12:00:00 to 2001-02-26 15:00:00 (data not included in parameter files)

• Precipitation data missing from
  2001-09-03 21:00:00 to 2001-09-04 17:00:00

• Radiation data missing from
  2001-03-09 11:00:00
  2001-03-30 11:00:00 to 2001-03-30 14:00:00
  2001-09-03 21:00:00 to 2001-09-04 17:00:00

• Relative humidity (only ventilated unless stated otherwise) data missing from
  2001-03-09 10:00:00 to 2001-03-09 11:00:00
  2001-03-09 15:00:00 to 2001-03-09 16:00:00
  2001-03-10 13:00:00 to 2001-03-10 21:00:00
  2001-03-11 11:00:00 to 2001-03-11 15:00:00
  2001-03-30 11:00:00 to 2001-03-30 14:00:00
  2001-03-31 09:00:00 to 2001-03-31 15:00:00
  2001-04-02 16:00:00 to 2001-04-02 18:00:00
  2001-04-06 13:00:00 to 2001-04-06 17:00:00
  2001-04-07 12:00:00 to 2001-04-07 16:00:00
  2001-09-03 21:00:00 to 2001-09-04 17:00:00 (both sensors)
  2001-10-22 02:00:00 (unventilated sensor)

• Temperature data missing from
  2001-03-09 11:00:00 (2 Pt100 sensors)
  2001-03-10 13:00:00 (ventilated sensor)
  2001-03-11 12:00:00 to 2001-03-11 19:00:00 (ventilated sensor)
  2001-03-30 11:00:00 to 2001-03-30 14:00:00 (2 Pt100 sensors)
  2001-03-30 11:00:00 to 2001-03-31 00:00:00 (ventilated sensor)
  2001-03-31 09:00:00 to 2001-04-02 22:00:00 (ventilated sensor)
  2001-03-31 12:00:00 to 2001-03-31 13:00:00 (2 Pt100 sensors)
  2001-04-03 00:00:00 to 2001-04-03 04:00:00 (ventilated sensor)
  2001-04-03 06:00:00 to 2001-04-05 02:00:00 (ventilated sensor)
  2001-04-05 05:00:00 (ventilated sensor)
  2001-04-05 16:00:00 (ventilated sensor)
  2001-04-06 11:00:00 to 2001-04-06 16:00:00 (ventilated sensor)
  2001-04-06 20:00:00 to 2001-04-06 21:00:00 (ventilated sensor)
  2001-04-07 06:00:00 (ventilated sensor)
  2001-04-07 10:00:00 to 2001-04-07 11:00:00 (ventilated sensor)
  2001-04-07 14:00:00 to 2001-04-07 16:00:00 (ventilated sensor)
  2001-04-08 11:00:00 (ventilated sensor)
  2001-05-15 21:00:00 (ventilated sensor)
2001-05-16 08:00:00 to 2001-05-20 05:00:00 (ventilated sensor)
2001-05-20 07:00:00 to 2001-05-22 02:00:00 (ventilated sensor)
2001-05-25 13:00:00 to 2001-05-25 16:00:00 (ventilated sensor)
2001-05-26 12:00:00 to 2001-05-26 17:00:00 (ventilated sensor)
2001-05-27 13:00:00 to 2001-05-27 17:00:00 (ventilated sensor)
2001-09-03 21:00:00 to 2001-09-04 17:00:00 (all sensors)

• Wind data missing from
  2001-09-03 21:00:00 to 2001-09-04 17:00:00

• Daily data missing from
  2000-05-24 00:00:00 to 2000-05-25 00:00:00 (2 Pt100, ventilated T, battery voltage)
  2000-08-01 00:00:00 (2 Pt100, ventilated T, battery voltage)

• ‘Synoptic’ data missing from:
  2001-03-10 00:00:00
  2001-03-31 00:00:00 to 2001-04-01 00:00:00
  2001-09-04 00:00:00

4 Notes on data storage

Example of hourly data:
101,2001,185,1300,5.985,5.807,6.307,65.38,5.539,330.7,0.054,420.5,0,7.1,73.8,12.91,1225,

<table>
<thead>
<tr>
<th>Column</th>
<th>Example data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>101</td>
<td>ID</td>
</tr>
<tr>
<td>02</td>
<td>2001</td>
<td>Year</td>
</tr>
<tr>
<td>03</td>
<td>185</td>
<td>Day of Year</td>
</tr>
<tr>
<td>04</td>
<td>1300</td>
<td>hour-minute (hhmm)</td>
</tr>
<tr>
<td>05</td>
<td>5.985</td>
<td>2 Pt100 T in Stevenson screen</td>
</tr>
<tr>
<td>06</td>
<td>5.807</td>
<td>3 T in Young screen</td>
</tr>
<tr>
<td>07</td>
<td>6.307</td>
<td>4 Pt100 in new Young screen</td>
</tr>
<tr>
<td>08</td>
<td>65.38</td>
<td>5 Rh in Young screen</td>
</tr>
<tr>
<td>09</td>
<td>5.539</td>
<td>6 Mean horizontal wind speed</td>
</tr>
<tr>
<td>10</td>
<td>330.7</td>
<td>7 resultant mean wind direction</td>
</tr>
<tr>
<td>11</td>
<td>0.054</td>
<td>8 Standard deviation of wind direction</td>
</tr>
<tr>
<td>12</td>
<td>420.5</td>
<td>9 Global radiation</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
<td>10 Precipitation/SR50</td>
</tr>
<tr>
<td>14</td>
<td>7.1</td>
<td>11 ventilated T</td>
</tr>
<tr>
<td>15</td>
<td>73.8</td>
<td>12 ventilated Rh</td>
</tr>
<tr>
<td>16</td>
<td>12.91</td>
<td>13 hourly max wind speed</td>
</tr>
<tr>
<td>17</td>
<td>1225</td>
<td>14 time for max wind speed</td>
</tr>
</tbody>
</table>

Example of daily data summaries:
124,2001,185,2400,5.524,5.424,5.972,65.47,7.84,1355,3.455,318,17.51,420,4.992,322.6,
152.9,0.16,13.91,6.735,74.2
<table>
<thead>
<tr>
<th>Column</th>
<th>Example data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01:</td>
<td>124</td>
<td>ID</td>
</tr>
<tr>
<td>02:</td>
<td>2001</td>
<td>Year</td>
</tr>
<tr>
<td>03:</td>
<td>185</td>
<td>Day of Year</td>
</tr>
<tr>
<td>04:</td>
<td>2400</td>
<td>hour-minute (hhmm)</td>
</tr>
<tr>
<td>05:</td>
<td>5.524</td>
<td>2 Daily average T in Stevenson screen</td>
</tr>
<tr>
<td>06:</td>
<td>5.424</td>
<td>3 Daily T from T/Rh in Young screen</td>
</tr>
<tr>
<td>07:</td>
<td>5.972</td>
<td>4 Daily T from T/Rh in Young screen</td>
</tr>
<tr>
<td>08:</td>
<td>65.47</td>
<td>5 daily average humidity in Young screen</td>
</tr>
<tr>
<td>08:</td>
<td>7.84</td>
<td>6 Daily maximum temperature in Young screen</td>
</tr>
<tr>
<td>10:</td>
<td>1355</td>
<td>7 hhmm for maximum daily temperature</td>
</tr>
<tr>
<td>11:</td>
<td>3.455</td>
<td>8 Daily minimum temperature in Young screen</td>
</tr>
<tr>
<td>12:</td>
<td>318</td>
<td>9 hhmm for minimum daily temperature</td>
</tr>
<tr>
<td>13:</td>
<td>15.51</td>
<td>10 Maximum wind speed</td>
</tr>
<tr>
<td>14:</td>
<td>420</td>
<td>11 hhmm for maximum wind speed</td>
</tr>
<tr>
<td>15:</td>
<td>4.992</td>
<td>12 Average wind speed</td>
</tr>
<tr>
<td>16:</td>
<td>322.6</td>
<td>13 Average wind direction</td>
</tr>
<tr>
<td>17:</td>
<td>152.9</td>
<td>14 Incoming radiation</td>
</tr>
<tr>
<td>18:</td>
<td>0.16</td>
<td>15 Totalized precipitation</td>
</tr>
<tr>
<td>19:</td>
<td>13.91</td>
<td>16 Battery voltage</td>
</tr>
<tr>
<td>20:</td>
<td>6.735</td>
<td>17 Average ventilated temperature</td>
</tr>
<tr>
<td>21:</td>
<td>74.2</td>
<td>18 Average ventilated relative humidity</td>
</tr>
</tbody>
</table>

Example of 'Synoptic' output:
103,2001,185,1300,6.471

<table>
<thead>
<tr>
<th>Column</th>
<th>Example data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01:</td>
<td>103</td>
<td>ID</td>
</tr>
<tr>
<td>02:</td>
<td>2001</td>
<td>Year</td>
</tr>
<tr>
<td>03:</td>
<td>185</td>
<td>Day of Year</td>
</tr>
<tr>
<td>04:</td>
<td>1300</td>
<td>hour-minute (hhmm)</td>
</tr>
<tr>
<td>05:</td>
<td>6.471</td>
<td>Pt100 in Young screen</td>
</tr>
</tbody>
</table>

5 Data files and content

TRSmet2001.csv Raw data file

TRSmet2001HourlyTimeAdjustedSegment.csv Floating segment raw data file

TRS_met_2001_Precipitation.csv
Date-time, Precipitation
2001-01-01 01:00:00,0.00

TRS_met_2001_Radiation.csv
Date-time, Global radiation
2001-01-01 01:00:00,0.33 2001-01-01 01:00:00,19.4,34.4

TRS_met_2001_Relative_humidity.csv
Date-time, hourly average Rh, ventilated Rh
2001-01-01 01:00:00,19.4,34.4

TRS_met_2001_Temperature.csv
Date-time, hourly average T (Stevenson), hourly average T (Young), hourly average T/Rh (Young), ventilated (T/Rh)
2001-01-01 01:00:00,-12.48,-11.69,-11.54,-11.20
The data collected during 2001 is summarized in Figure 1 and Table 1.

Figure 1: Summary of meteorological data from Tarfala Research Station automatic weather station 2001.
Table 1: Monthly averages of meteorological parameters from the Tarfala Research Station automatic weather station 2001.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average air temperature (Stevenson)</strong> (°C)</td>
<td>−8.6</td>
<td>−26.2</td>
<td>−14.6</td>
<td>−7.1</td>
<td>−1.8</td>
<td>4.8</td>
<td>6.2</td>
<td>6.2</td>
<td>3.0</td>
<td>−2.2</td>
<td>−7.6</td>
<td>−10.7</td>
</tr>
<tr>
<td>n</td>
<td>720</td>
<td>32</td>
<td>760</td>
<td>741</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>767</td>
<td>722</td>
<td>767</td>
<td>743</td>
<td>767</td>
</tr>
<tr>
<td><strong>Average air temperature (Young)</strong> (°C)</td>
<td>−8.4</td>
<td>−14.3</td>
<td>−6.9</td>
<td>−1.8</td>
<td>4.9</td>
<td>6.2</td>
<td>6.2</td>
<td>3.0</td>
<td>−2.2</td>
<td>−7.6</td>
<td>−10.5</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>720</td>
<td>760</td>
<td>741</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>767</td>
<td>722</td>
<td>767</td>
<td>743</td>
<td>767</td>
</tr>
<tr>
<td><strong>Positive degree sum</strong> (°C)</td>
<td>20</td>
<td>−95</td>
<td>457</td>
<td>3699</td>
<td>4587</td>
<td>4738</td>
<td>−</td>
<td>542</td>
<td>3</td>
<td>101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>39</td>
<td>0</td>
<td>96</td>
<td>199</td>
<td>666</td>
<td>738</td>
<td>761</td>
<td>−</td>
<td>276</td>
<td>10</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td><strong>Average relative humidity</strong> (%)</td>
<td>70.5</td>
<td>−</td>
<td>56.7</td>
<td>57.9</td>
<td>62.5</td>
<td>69.4</td>
<td>72.8</td>
<td>78.3</td>
<td>78.9</td>
<td>79.6</td>
<td>66.6</td>
<td>60.8</td>
</tr>
<tr>
<td>n</td>
<td>720</td>
<td>767</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>707</td>
<td>722</td>
<td>766</td>
<td>743</td>
<td>767</td>
</tr>
<tr>
<td><strong>Average incoming global radiation</strong> (W m⁻²)</td>
<td>2.5</td>
<td>−</td>
<td>54.8</td>
<td>110.5</td>
<td>158.8</td>
<td>136.8</td>
<td>99.5</td>
<td>63.5</td>
<td>35.4</td>
<td>18.1</td>
<td>4.6</td>
<td>0.7</td>
</tr>
<tr>
<td>n</td>
<td>720</td>
<td>762</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>707</td>
<td>722</td>
<td>766</td>
<td>743</td>
<td>767</td>
</tr>
<tr>
<td><strong>Global incoming energy sum</strong> (W m⁻²)</td>
<td>1823</td>
<td>−</td>
<td>82068</td>
<td>118009</td>
<td>101647</td>
<td>73957</td>
<td>48678</td>
<td>−</td>
<td>13897</td>
<td>3450</td>
<td>535</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>662</td>
<td>−</td>
<td>729</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>767</td>
<td>722</td>
<td>759</td>
<td>739</td>
<td>530</td>
</tr>
<tr>
<td><strong>Totalized precipitation</strong> (mm)</td>
<td>0.00</td>
<td>−</td>
<td>1047.07</td>
<td>1039.70</td>
<td>193.21</td>
<td>197.76</td>
<td>159.52</td>
<td>108.80</td>
<td>94.08</td>
<td>85.60</td>
<td>0.16</td>
<td>7.04</td>
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<td>n</td>
<td>720</td>
<td>767</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>767</td>
<td>722</td>
<td>767</td>
<td>743</td>
<td>767</td>
</tr>
<tr>
<td><strong>Average wind speed</strong> (m s⁻¹)</td>
<td>4.2</td>
<td>−</td>
<td>2.3</td>
<td>2.9</td>
<td>4.1</td>
<td>2.3</td>
<td>3.3</td>
<td>2.9</td>
<td>3.1</td>
<td>2.8</td>
<td>4.3</td>
<td>4.7</td>
</tr>
<tr>
<td>n</td>
<td>720</td>
<td>767</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>743</td>
<td>767</td>
<td>722</td>
<td>767</td>
<td>743</td>
<td>767</td>
</tr>
</tbody>
</table>
Logger program

5.1 Likely program until 5 May (copy of fall 2000)

; TARFALA MET STATION
; downloaded 6. August 1998, 15:21 wintertime
; NEW: VENTILATED TEMPERATURE SENSOR
; Regine Hock
;===================================================

*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

;========== TEMPERATURE 1 - PT100 in weather hut ===============
  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 [ Rs_Ro_T1 ]
     7: 100  Mult
     8: 0.0000  Offset

;========== TEMPERATURE 2 - PT100 in radiation shield ===============
  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

;== calculate Temp 1 and Temp 2 from Rs/Ro ===============
  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
;======= Temperature Rotronic =========================
7: Volt (Diff) (P2)
  1: 1  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

;======= RELATIVE HUMIDITY Rotronic ===============
8: Volts (SE) (P1)
  1: 1  Reps
  2: 35  2500 mV 50 Hz Rejection Range
  3: 7  SE Channel
  4: 4  Loc [ rH_Rot___ ]
  5: 0.1  Mult
  6: 0.0  Offset

;======= VENTILATED TEMPERATURE SENSOR (Vaisala PT100) ================
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 [ Rs_Ro_ven ]
  7: 100  Mult
  8: 0.0000  Offset

10: Temperature RTD (P16)
  1: 1  Reps
  2: 23  R/RO Loc [ Rs_Ro_ven ]
  3: 11  Loc [ TempVent ]
  4: 1  Mult
  5: 0.0000  Offset

;======= RELATIVE HUMIDITY (VENTILATED SENSOR) ===============
11: Volts (SE) (P1)
  1: 1  Reps
  2: 35  2500 mV 50 Hz Rejection Range
  3: 8  SE Channel
  4: 12  Loc [ HumVent ]
  5: 0.1  Mult
  6: 0.0  Offset

;============= WIND SPEED ================
12: Pulse (P3)
  1: 1  Reps
  2: 1  Pulse Input Channel
  3: 21  Low Level AC, Output Hz
  4: 5  Loc [ Vhast_m_s ]
  5: 0.098  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 (units 0.01 sec)
   6: 2500 mV Excitation
   7: 6  Loc [ Vrikt____ ]
   8: 0.142 Mult
   9: -135 Offset

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

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

16: End (P95)

17: Volts (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

18: 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: 0.0 Offset

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

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

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 [ T1_bur__C ]

24: Wind Vector (P69)
1: 1 Reps
2: 1 Samples per Sub-Interval
3: 0 S, 1, & (1) Polar
4: 5 Wind Speed/East Loc [ Vhast_m_s ]
5: 6 Wind Direction/North Loc [ Vrikt____ ]

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

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

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

28: Serial Out (P96)
1: 71 SM192/SM716/CSM1

; ======== STORAGE DAILY MEANS AT MIDNIGHT ==============

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

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

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

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

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

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

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

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

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

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

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

40: Average (P71)
   1: 2    Reps
   2: 11   Loc [ TempVent ]

41: Serial Out (P96)
   1: 71   SM192/SM716/CSM1

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

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

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

; SAMPLE TEMP FOR COMPARISON WITH 3-HOURLY DATA OF OTHER STATIONS ======

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

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

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

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

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

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

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

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

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

; 3-HOURLY TEMP VALUES TO FILE ========================================0

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

73: 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 ------ ------ ---
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5.2 Program valid from 5 May (SR50 removed)

{TARFALA MET STATION
based on program tarm0898 from 6. August 1998
NEW: output hourly max wind
Regine Hock, 5 May 2001
}

*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

;========== TEMPERATURE 1 - PT100 in weather hut ==============

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 [ Rs_Ro_T1 ]
   7: 100 Mult
   8: 0.0000 Offset

;========== TEMPERATURE 2 - PT100 in radiation shield ==============

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

;=== calculate Temp 1 and Temp 2 from Rs/Ro ==============

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

;====== Temperature Rotronic ==============
7: Volt (Diff) (P2)
   1: 1 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

;====== RELATIVE HUMIDITY Rotronic ===================

8: Volts (SE) (P1)
   1: 1 Reps
   2: 35  2500 mV 50 Hz Rejection Range
   3: 7 SE Channel
   4: 4 Loc [ rH_Rot__ ]
   5: 0.1 Mult
   6: 0.0 Offset

;====== VENTILATED TEMPERATURE SENSOR (Vaisala PT100) ========

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 [ Rs_Ro_ven ]
   7: 100 Mult
   8: 0.0000 Offset

10: Temperature RTD (P16)
    1: 1 Reps
    2: 23 R/R0 Loc [ Rs_Ro_ven ]
    3: 11 Loc [ TempVent ]
    4: 1 Mult
    5: 0.0000 Offset

;====== RELATIVE HUMIDITY (VENTILATED SENSOR) =============

11: Volts (SE) (P1)
    1: 1 Reps
    2: 35  2500 mV 50 Hz Rejection Range
    3: 8 SE Channel
    4: 12 Loc [ HumVent ]
    5: 0.1 Mult
    6: 0.0 Offset

;================= WIND SPEED ====================

12: Pulse (P3)
    1: 1 Reps
    2: 1 Pulse Input Channel
    3: 21 Low Level AC, Output Hz
    4: 5 Loc [ Vhast_m_s ]
    5: 0.098 Mult
    6: 0 Offset

;================= WIND DIRECTION ===================

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 (units 0.01 sec)
6: 2500 mV Excitation
7: 6 Loc [ Vrikt____ ]
8: 0.142 Mult
9: -135 Offset

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

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

16: End (P95)

;========== GLOBAL RADIATION ==============
17: Volts (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

;========== PRECIPITATION ================
18: 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: 0.0 Offset

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

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

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 [ T1_bur__C ]

24: Wind Vector (P69)
   1: 1 Reps
   2: 1 Samples per Sub-Interval
   3: 0 S, 1, & (1) Polar
   4: 5 Wind Speed/East Loc [ Vhast_m_s ]
   5: 6 Wind Direction/North Loc [ Vrikt____ ]

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

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

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

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

29: Serial Out (P96)
   1: 71 SM192/SM716/CSM1

; ======== STORAGE DAILY MEANS AT MIDNIGHT ==============

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 [ T1_bur__C ]

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

35: Minimize (P74)
   1: 1 Reps
   2: 10 Value with Hr-Min
   3: 2 Loc [ T2_skyd_C ]
36: Maximize (P73)
   1: 1 Reps
   2: 10 Value with Hr-Min
   3: 5 Loc [ Vhast_m_s ]

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

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

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

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

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

42: Serial Out (P96)
   1: 71 SM192/SM716/CSM1

43: If time is (P92)
   1: 60 Minutes (Seconds --) into a
   2: 1440 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)

; SAMPLE TEMP FOR COMPARISON WITH 3-HOURLY DATA OF OTHER STATIONS ======

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

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

48: Set Active Storage Area (P80)
   1: 1 Final Storage Area 1
   2: 103 Array ID
49: Real Time (P77)
   1: 1220 Year,Day,Hour/Minute (midnight = 2400)

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

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

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

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

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

; 3-HOURLY TEMP VALUES TO FILE

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

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

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

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

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

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

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

62: Sample (P70)
   1: 1 Reps
   2: 2 Loc [ T2_skyd_C ]
If time is (P92)
1: 960 Minutes (Seconds --) into a
2: 1440 Interval (same units as above)
3: 10 Set Output Flag High

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

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

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

If time is (P92)
1: 1140 Minutes (Seconds --) into a
2: 1440 Interval (same units as above)
3: 10 Set Output Flag High

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

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

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

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

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

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

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