

UAH Ceilometer Data Formats

clo????????.dat Files

```
00:00:08 05/21/2012
00 // // // // 000000000000
00100 10 1540 101 +46 100 01 0018 L0032HN15 006
 0 112 97 102 103 88 96 102 106 101 102 100 98 100 100 100 99
16 97 95 92 90 87 86 83 81 80 78 78 78 75 74 72 72
32 71 69 69 68 66 67 66 66 65 65 64 63 63 62 62 60
48 61 62 63 60 59 61 60 59 60 58 57 57 55 55 54 54
64 59 58 57 59 60 60 55 54 58 61 61 61 60 59 59 59
80 59 54 56 58 58 61 62 54 56 60 61 56 54 58 61 47
96 40 44 48 44 48 60 57 58 61 59 65 61 55 68 70 63
112 50 52 57 50 50 57 46 40 65 73 62 45 48 51 60 61
128 64 78 73 73 66 63 68 66 60 58 60 65 58 49 55 59
144 46 41 43 38 48 39 41 61 67 56 47 46 50 69 67 72
160 83 81 90 67 55 52 56 48 64 68 51 55 37 42 77 94
176 117 79 46 70 40 32 53 60 84 71 43 66 71 70 60 66
192 41 73 93 95 61 43 72 83 64 76 104 86 61 45 77 79
208 50 47 76 89 79 65 55 37 68 62 67 90 91 39 37 65
224 38 33 63 75 55 68 110 63 6 50 65 103 100 105 78 91
240 71 51 41 37 50 25 64 96 104 120 46 22 43 71 92 14
256 33 71 76 130 73 2 -8 86 33 62 61 58 62 35 27 31
272 37 49 44 36 69 30 43 59 48 3 19 30 68 31 25 44
288 25 5 4 89 54 48 30 14 21 22 23 5 24 62 63 40
304 21 44 66 29 43 32 11 17 19 -16 -14 -17 -19 19 62 70
320 15 -4 32 80 75 14 0 33 45 13 0 0 3 14 69 36
336 -1 20 17 31 56 21 6 4 -17 6 10 6 24 38 24 14
352 7 -5 0 5 8 13 37 22 33 36 19 42 47 -15 10 37
368 13 -4 -26 17 66 86 29 47 87 52 31 0 4 19 38 78
384 32 -12 29 29 7 30 52 34 48 20 1 63 25 -11 55 78
400 19 8 39 42 -5 -9 31 37 7 -40 -13 24 30 41 37 80
416 91 26 40 49 25 36 48 23 32 29 25 2 -11 -12 31 34
432 11 0 40 38 21 5 8 27 25 8 15 29 44 -16 17 44
448 38 53 67 7 -26 32 43 35 13 35 53 45 8 -4 14 -14
464 -54 -19 54 61 22 0 14 29 12 27 33 79 58 36 28 36
480 44 25 26 -4 -26 25 41 54 50 49 43 18 28 45 60 21
496 13 -12 5 -2 -9 27 32 5 5 9 12 50 72 38 8 39
512 35 11 -16 4 -9 0 33 66 66 0 14 54 10 9 2 8
528 9 22 31 28 52 55 59 29 -8 -24 19 49 49 25 -18 2
544 24 22 37 -4 -4 -31 -50 -23 4 41 77 45 -8 -10 15 33
560 22 2 21 -7 32 51 -9 0 8 4 -3 57 51 35 33 35
576 11 47 55 38 50 43 -21 1 16 27 14 17 12 -6 -1 4
592 -4 -17 5 14 37 37 5 32 14 5 8 15 37 -5 -25 18
608 -2 -24 3 -8 14 24 31 35 21 13 35 17 32 51 30 11
624 6 -25 -5 2 -10 -46 -24 38 25 30 23 30 10 -3 27 25
640 -24 -28 -7 0 12 -2 0 -4 19 27 26 44 19 1 -20 15
656 44 9 19 -5 -62 -46 23 51 45 38 36 14 -12 16 4 9
672 -13 -6 2 7 25 1 20 19 -21 -9 -26 28 54 51 75 73
688 51 34 40 30 -16 -30 0 36 19 21 45 30 -11 -19 21 46
704 43 32 -12 -35 -11 2 19 55 28 18 23 -14 -19 13 22 17
720 2 -14 30 23 19 30 21 24 54 62 39 24 27 3 -9 10
736 50 63 27 0 3 27 45 22 47 28 30 8 -7 0 6 -4
752 27 1 27 18 -27 -28 -1 4 26 51 35 6 -27 -22 11 50
768 49 27 -1 10 25 26 16 31 -12 -13 16 20 9 -19 6 59
784 41 38 6 26 40 41 12 -9 -12 -11 -10 -16 -44 4 16 32
800 22 13 2 -11 -8 35 49 14 19 60 44 45 46 43 -1 11
816 17 -8 3 22 3 -11 0 -5 17 -1 -30 -12 37 -10 -21 8
832 12 -18 -14 17 51 33 33 13 -12 -1 -30 -48 -12 1 3 2
848 -27 -14 15 12 24 35 41 18 -6 18 15 -19 -40 -29 -28 -3
864 11 3 20 32 17 8 10 40 57 19 43 15 3 -4 24 44
880 35 46 34 21 3 -1 33 40 6 20 11 6 -5 -17 18 28
896 31 17 17 3 10 -15 13 7 -18 12 28 6 -13 -11 24 20
912 -14 28 8 -22 9 38 47 88 33 6 42 16 0 -1 -16 6
928 8 -7 29 48 29 11 8 30 0 -12 -10 5 26 29 29 29
```

```

944 8 -14 51 46 12 -13 -31 -3 34 -12 -19 -22 -6 -13 -12 13
960 12 4 18 7 44 28 0 -15 19 71 24 -19 42 91 12 33
976 59 13 -11 -10 -61 -4 33 27 38 23 -7 3 -8 1 -9 -18
992 -31 -5 -3 -3 14 23 49 38 -12 5 -7 -29 3 31 32 9
1008 1 42 61 8 -2 -6 -5 31 31 31 30 40 20 -4 11 52
1024 75 46 17 9 17 30 53 47 40 24 0 -16 -25 20 14 23
1040 36 10 47 29 -3 21 -1 23 12 -23 -41 -55 -61 -74 -46 0
1056 -7 -19 16 -1 23 24 19 -21 -25 -23 -3 29 41 40 12 8
1072 -7 8 38 43 0 5 27 27 0 -2 -35 -58 -28 36 9 -32
1088 -11 36 23 46 25 16 49 70 52 31 -6 -10 -14 -11 -19 -5
1104 30 31 14 -9 -15 -5 4 23 3 13 7 9 2 26 19 12
1120 17 37 2 52 34 -29 -20 42 24 15 21 13 26 24 28 21
1136 12 42 -4 -33 -7 -8 30 23 -4 5 5 4 1 12 -13 -19
1152 28 22 -7 -3 -6 4 -34 -54 -3 5 -13 -40 -34 10 35 34
1168 -19 -8 13 22 -11 -25 -4 -13 4 31 16 -2 -5 11 2 -11
1184 10 -3 -18 12 -12 -33 -19 -29 -18 -13 3 30 37 9 9 19
1200 -22 -29 -9 33 22 8 -48 -20 43 21 -2 11 -14 -50 -46 -11
1216 -16 2 17 10 4 -14 1 -13 -11 2 24 25 -33 -15 10 7
1232 17 19 8 6 9 -12 -8 1 15 50 39 8 7 0 6 -7
1248 21 34 -6 -15 48 41 5 2 16 36 43 21 16 25 1 -12
1264 -21 -35 16 -34 -24 35 39 15 -5 0 30 24 -9 -13 -8 0
1280 -21 -35 -26 22 8 22 19 7 17 43 7 -21 -19 23 39 -24
1296 -8 4 9 47 30 -13 -18 0 -15 -43 -40 -14 -9 -34 -22 -10
1312 -1 15 19 15 19 22 1 -18 -10 29 52 -8 -57 -19 -1 -17
1328 -20 29 -20 -66 -29 -30 -10 -8 -21 -31 -17 32 27 -26 -1 -2
1344 12 36 39 4 -40 -55 23 51 33 12 18 31 3 4 50 7
1360 2 -3 -26 -16 -15 -29 36 27 35 47 19 -28 -43 -19 -26 -14
1376 -17 18 51 47 27 -9 -5 6 -6 -6 6 -7 10 10 -8 -17
1392 -25 -35 -27 -22 -4 6 -8 -4 33 30 10 40 6 -26 -24 -8
1408 25 52 8 -13 6 -18 -14 -2 18 18 15 13 6 43 5 -12
1424 -18 -15 20 72 6 -15 -4 -10 5 24 25 32 0 0 -8 -1
1440 -26 -5 -2 -5 -13 41 28 1 16 20 29 -11 0 11 10 11
1456 8 26 38 11 -19 10 43 8 -9 52 61 15 -2 0 -1 -17
1472 -51 -27 25 27 17 -7 11 -2 -7 -3 20 37 -3 0 42 12
1488 -23 -32 -8 25 11 5 6 6 19 -41 -37 -16 -29 3 6 21
1504 28 -6 -38 -38 0 24 24 5 2 16 17 -22 -49 5 62 48
1520 30 -5 -29 8 -7 -2 25 18 -6 24 18 -18 -37 -33 -4 22
1536 29 -5 0 18
$

```

The ceilometer is vertically pointing. A measurement is made every 15 seconds. Gate spacing is 10 m.

Line 1:

HH:MM:SS MM/DD/YYYY (UTC)

Line 2:

Example: 30 01230 12340 23450 FEDCBA987654□

where

3

= First digit of line:

Detection status as follows:

0

No significant backscatter

1

One cloud base detected

2

Two cloud bases detected

3 Three cloud bases detected

4 Full obscuration determined but no cloud
detected base

5 Some obscuration detected but determined
transparent to be

/ Raw data input to algorithm missing or
suspect

0 = Second digit of line:
Warning and Alarm information as follows:

0
Self-check OK

W At least one Warning active, no Alarms

A At least one Alarm active

01230 = If detection status is 1, 2, or 3: Lowest cloud base height
If detection status is 4:
Vertical Visibility as calculated

If detection status is 0 or 5:
/////

12340 = If detection status is 2 or 3:
Second lowest cloud base height

If detection status is 4:
Highest signal detected

If detection status is 0, 1, or 5: /////

23450 = If detection status is 3:
Highest cloud base height

If detection status is 0, 1, 2, 4, /////

5:

FEDC = Alarm (A), Warning (W), and internal status (S) information. Each
character is

BA98 a hexadecimal representation of four bits, i.e. values between 0
and 9 are

7654 presented with respective numbers and values 10,11, 12, 13, 14, and 15 are
presented with letters A, B, C, D, E, and F, respectively. As
each of the 12 characters represent the sum of four individual bits, the total number of
bits is

48 (b00-b47), with the following breakdown and interpretation:

F:

b47
(8000 0000 0000) Transmitter shut-off (A)

b46
(4000 0000 0000) Transmitter failure (A)

b45
(2000 0000 0000) Receiver failure (A)

b44 (1000 0000 0000)
Voltage failure (A)

E:

b43 (0800 0000 0000)
(spare) (A)

b42 (0400 0000 0000)
Memory error (A)

b41 (0200 0000 0000)
Light path obstruction (A)

b40 (0100 0000 0000)
Receiver saturation (A)

D:

b39 (0080 0000 0000)
(spare) (A)

b38 (0040 0000 0000)
(spare) (A)

b37 (0020 0000 0000)
(spare) (A)

b36 (0010 0000 0000)
(spare) (A)

C:

b35 (0008 0000 0000)
(spare) (A)

b34 (0004 0000 0000)
(spare) (A)

b33 (0002 0000 0000)
Coaxial cable failure (A)

b32 (0001 0000 0000)
Ceilometer engine board failure (A)

B:

b31 (0000 8000 0000)
Window contamination (W)

b30 (0000 4000 0000)
Battery voltage low (W)

b29 (0000 2000 0000)
Transmitter expires (W)

b28 (0000 1000 0000)
High humidity (W)

A:

b27 (0000 0800 0000) (spare) (W)

b26 (0000 0400 0000)
Blower failure (W)

b25 (0000 0200 0000)
(spare) (W)

b24 (0000 0100 0000)
Humidity sensor failure (W)

9:

b23 (0000 0080 0000)
Heater fault (W)

b22 (0000 0040 0000)
High background radiance (W)

b21 (0000 0020 0000)
Ceilometer engine board failure (W)

b20 (0000 0010 0000)
Battery failure (W)

8:

b19 (0000 0008 0000)
Laser monitor failure (W)

b18 (0000 0004 0000)
Receiver warning (W)

b17 (0000 0002 0000)
Tilt angle > 45 degrees warning (W)

b16 (0000 0001 0000)
(spare) (W)

7

: b15 (0000 0000 8000)
Blower is on (S)

b14 (0000 0000 4000)
Blower heater is on (S)

b13 (0000 0000 2000)
Internal heater is on (S)

b12 (0000 0000 1000)
Working from battery (S)

6

b11 (0000 0000 0800)
Standby mode is on (S)

b10 (0000 0000 0400)
Self test in progress (S)

b09 (0000 0000 0200)
Manual data acquisition settings are
effective (S)

b08 (0000 0000 0100)
(spare) (S)

5

b07 (0000 0000 0080)
Units are meters if on, else feet (S)

b06 (0000 0000 0040)
Manual blower control (S)

b05 (0000 0000 0020)
Polling mode is on (S)
b04 (0000 0000 0010)

(spare) (S)

4

b03 (0000 0000 0008)
(spare) (S)

b02 (0000 0000 0004)
(spare) (S)

b01 (0000 0000 0002)
(spare) (S)

b00 (0000 0000 0001)
(spare) (S)

For example, if no clouds are detected, if the window is contaminated, the battery voltage is too low, the internal heater is on and units are meters, a warning is given and the second line appears as follows:

```
0W  
///// ///// /////  
0000C0002080
```

3rd Line

Example: 00100 10 1540 098 +34 099 12 621 L0112HN15 139□

where

00100 = Parameter SCALE, 100 (%) is normal (0 ... 99999 possible)

10 = Backscatter profile resolution in meters.

1540 = Length of the profile in samples.

098 = Laser pulse energy, % of nominal factory setting
(0 ... 999)

+34 = Laser temperature degrees C (-50 ... +99)

099 = Window transmission estimate % (0 ... 100)

12 = Tilt angle, degrees from vertical (0 ... 90)

0621 = Background light, millivolts at internal ADC input
(0 ... 2500)

L0112HN15 = Measurement parameters (pulse Long/Short, pulse qty
0112x1024, gain High/Low, bandwidth Narrow/Wide,
sampling 15/30 MHz)

139 = SUM of detected and normalized backscatter,
0 ... 999. Multiplied by scaling factor times 104. At
scaling factor 1.0 the SUM range 0 ... 999

Line 4-94:

Example: 00000111112222233333..... $\square\square$ (5 x 1540 + 2 bytes)

The two-way attenuated backscatter profile with sensitivity normalized units $(100000 \cdot \text{srad} \cdot \text{km})^{-1}$ unless otherwise scaled with the SCALE parameter. Each sample is coded with a 20-bit HEX ASCII character set; msb nibble and bit first, 2's complement. The length of this line is equal to 5 times the length of the profile + 2. Note that the profile is not corrected with the tilt angle.

Using the SCALE parameter a total dynamic range of 29 bits can be achieved for this message.

\$ or blank line indicates end of record

Ceilometer Description

The ceilometer is a Viasala CL51 which is a pulsed laser that operates at 0.910 μm . The range is from 0 to 15 km, vertical resolution is 10 m and time resolution is 15 s.