Lab 3

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Libraries

```
library(tidyverse)
```

```
── Attaching core tidyverse packages ──────────────────── tidyverse 2.0.0 ──
✔ dplyr      1.1.2      ✔ readr      2.1.4
✔ forcats    1.0.0      ✔ stringr    1.5.0
✔ ggplot2    3.4.3      ✔ tibble     3.2.1
✔ lubridate  1.9.2      ✔ tidyr      1.3.0
✔ purrr      1.0.2
── Conflicts ──────────────────────────────────── tidyverse_conflicts() ──
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to
become errors
```

```
library(data.table)
```

```
Attaching package: 'data.table'

The following objects are masked from 'package:lubridate':

    hour, isoweek, mday, minute, month, quarter, second, wday, week,
    yday, year

The following objects are masked from 'package:dplyr':

    between, first, last

The following object is masked from 'package:purrr':

    transpose
```

Step 1: **Read in the data**

```
download.file(
  "https://raw.githubusercontent.com/USCbiostats/data-science-data/master/02_met/met_all.
  destfile = file.path("~", "Downloads", "met_all.gz"),
  method   = "libcurl",
  timeout  = 60
)
```

```
met <- data.table::fread(file.path("~", "Downloads", "met_all.gz"))
```

Step 2: **Check the dimensions**

```
dim(met)
```

```
[1] 2377343       30
```

There are **2,377,343 rows** and **30 columns** in the met dataset.

```
tail(met)
```

```
   USAFID  WBAN year month day hour min    lat      lon elev wind.dir
1: 726813 94195 2019     8  31   18  56 43.650 -116.633  741       NA
2: 726813 94195 2019     8  31   19  56 43.650 -116.633  741       70
3: 726813 94195 2019     8  31   20  56 43.650 -116.633  741       NA
4: 726813 94195 2019     8  31   21  56 43.650 -116.633  741       10
5: 726813 94195 2019     8  31   22  56 43.642 -116.636  741       10
6: 726813 94195 2019     8  31   23  56 43.642 -116.636  741       40
   wind.dir.qc wind.type.code wind.sp wind.sp.qc ceiling.ht ceiling.ht.qc
1:           9              C     0.0          5      22000             5
2:           5              N     2.1          5      22000             5
3:           9              C     0.0          5      22000             5
4:           5              N     2.6          5      22000             5
5:           1              N     2.1          1      22000             1
6:           1              N     2.1          1      22000             1
   ceiling.ht.method sky.cond vis.dist vis.dist.qc vis.var vis.var.qc temp
1:                 9        N    16093           5       N          5 30.0
2:                 9        N    16093           5       N          5 32.2
3:                 9        N    16093           5       N          5 33.3
4:                 9        N    14484           5       N          5 35.0
5:                 9        N    16093           1       9          9 34.4
6:                 9        N    16093           1       9          9 34.4
   temp.qc dew.point dew.point.qc atm.press atm.press.qc       rh
1:       5      11.7            5    1013.6            5 32.32509
2:       5      12.2            5    1012.8            5 29.40686
3:       5      12.2            5    1011.6            5 27.60422
4:       5       9.4            5    1010.8            5 20.76325
5:       1       9.4            1    1010.1            1 21.48631
6:       1       9.4            1    1009.6            1 21.48631
```

Step 3: **Take a look at the variables**

```
str(met)
```

```
Classes 'data.table' and 'data.frame':  2377343 obs. of  30 variables:
 $ USAFID           : int  690150 690150 690150 690150 690150 690150 690150 690150 690150
690150 ...
 $ WBAN             : int  93121 93121 93121 93121 93121 93121 93121 93121 93121 93121
```

```
...
 $ year            : int  2019 2019 2019 2019 2019 2019 2019 2019 2019 2019 ...
 $ month           : int  8 8 8 8 8 8 8 8 8 ...
 $ day             : int  1 1 1 1 1 1 1 1 1 1 ...
 $ hour            : int  0 1 2 3 4 5 6 7 8 9 ...
 $ min             : int  56 56 56 56 56 56 56 56 56 56 ...
 $ lat             : num  34.3 34.3 34.3 34.3 34.3 34.3 34.3 34.3 34.3 34.3 ...
 $ lon             : num  -116 -116 -116 -116 -116 ...
 $ elev            : int  696 696 696 696 696 696 696 696 696 696 ...
 $ wind.dir        : int  220 230 230 210 120 NA 320 10 320 350 ...
 $ wind.dir.qc     : chr  "5" "5" "5" "5" ...
 $ wind.type.code  : chr  "N" "N" "N" "N" ...
 $ wind.sp         : num  5.7 8.2 6.7 5.1 2.1 0 1.5 2.1 2.6 1.5 ...
 $ wind.sp.qc      : chr  "5" "5" "5" "5" ...
 $ ceiling.ht      : int  22000 22000 22000 22000 22000 22000 22000 22000 22000 22000
...
 $ ceiling.ht.qc   : int  5 5 5 5 5 5 5 5 5 5 ...
 $ ceiling.ht.method: chr  "9" "9" "9" "9" ...
 $ sky.cond        : chr  "N" "N" "N" "N" ...
 $ vis.dist        : int  16093 16093 16093 16093 16093 16093 16093 16093 16093 16093
...
 $ vis.dist.qc     : chr  "5" "5" "5" "5" ...
 $ vis.var         : chr  "N" "N" "N" "N" ...
 $ vis.var.qc      : chr  "5" "5" "5" "5" ...
 $ temp            : num  37.2 35.6 34.4 33.3 32.8 31.1 29.4 28.9 27.2 26.7 ...
 $ temp.qc         : chr  "5" "5" "5" "5" ...
 $ dew.point       : num  10.6 10.6 7.2 5 5 5.6 6.1 6.7 7.8 7.8 ...
 $ dew.point.qc    : chr  "5" "5" "5" "5" ...
 $ atm.press       : num  1010 1010 1011 1012 1013 ...
 $ atm.press.qc    : int  5 5 5 5 5 5 5 5 5 5 ...
 $ rh              : num  19.9 21.8 18.5 16.9 17.4 ...
 - attr(*, ".internal.selfref")=<externalptr>
```

Step 4: **Take a closer look at the key variables.**

```
table(met$year)
```

```
   2019
2377343
```

```
table(met$day)
```

```
     1     2     3     4     5     6     7     8     9    10    11    12    13
 75975 75923 76915 76594 76332 76734 77677 77766 75366 75450 76187 75052 76906
    14    15    16    17    18    19    20    21    22    23    24    25    26
 77852 76217 78015 78219 79191 76709 75527 75786 78312 77413 76965 76806 79114
    27    28    29    30    31
 79789 77059 71712 74931 74849
```

```
table(met$hour)
```

```
      0      1      2      3      4      5      6      7      8      9     10
  99434  93482  93770  96703 110504 112128 106235 101985 100310 102915 101880
     11     12     13     14     15     16     17     18     19     20     21
 100470 103605  97004  96507  97635  94942  94184 100179  94604  94928  96070
     22     23
  94046  93823
```

```
summary(met$temp)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
 -40.00   19.60   23.50   23.59   27.80   56.00   60089
```

```
summary(met$wind.sp)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
   0.00    0.00    2.10    2.46    3.60   36.00   79693
```

```
summary(met$elev)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  -13.0   101.0   252.0   415.8   400.0  9999.0
```

```
met[met$elev==9999.0] <- NA
summary(met$elev)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
    -13     101     252     413     400    4113     710
```

At what elevation is the highest weather station? **It is at 4113 meters.**

```
met <- met[temp>-40]
met2 <- met[order(temp)]
head(met2)
```

```
   USAFID WBAN year month day hour min    lat    lon elev wind.dir wind.dir.qc
1: 722817 3068 2019     8   1    0  56 38.767 -104.3 1838      190            5
2: 722817 3068 2019     8   1    1  56 38.767 -104.3 1838      180            5
3: 722817 3068 2019     8   3   11  56 38.767 -104.3 1838       NA            9
4: 722817 3068 2019     8   3   12  56 38.767 -104.3 1838       NA            9
5: 722817 3068 2019     8   6   21  56 38.767 -104.3 1838      280            5
6: 722817 3068 2019     8   6   22  56 38.767 -104.3 1838      240            5
   wind.type.code wind.sp wind.sp.qc ceiling.ht ceiling.ht.qc ceiling.ht.method
1:              N     7.2          5         NA             9                 9
```

```
2:                    N     7.7         5        NA             9              9
3:                    C     0.0         5        NA             9              9
4:                    C     0.0         5        NA             9              9
5:                    N     2.6         5        NA             9              9
6:                    N     7.7         5        NA             9              9
```

	sky.cond	vis.dist	vis.dist.qc	vis.var	vis.var.qc	temp	temp.qc	dew.point
1:	N	NA	9	N	5	-17.2	5	NA
2:	N	NA	9	N	5	-17.2	5	NA
3:	N	NA	9	N	5	-17.2	5	NA
4:	N	NA	9	N	5	-17.2	5	NA
5:	N	NA	9	N	5	-17.2	5	NA
6:	N	NA	9	N	5	-17.2	5	NA

	dew.point.qc	atm.press	atm.press.qc	rh
1:	9	NA	9	NA
2:	9	NA	9	NA
3:	9	NA	9	NA
4:	9	NA	9	NA
5:	9	NA	9	NA
6:	9	NA	9	NA

Step 5: **Check the data against an external data source.**

```
met <- met[temp>-15]
met2 <- met[order(temp)]
head(met2)
```

	USAFID	WBAN	year	month	day	hour	min	lat	lon	elev	wind.dir
1:	726764	94163	2019	8	27	11	50	44.683	-111.116	2025	NA
2:	726764	94163	2019	8	27	12	10	44.683	-111.116	2025	NA
3:	726764	94163	2019	8	27	12	30	44.683	-111.116	2025	NA
4:	726764	94163	2019	8	27	12	50	44.683	-111.116	2025	NA
5:	720411	137	2019	8	18	12	35	36.422	-105.290	2554	NA
6:	726764	94163	2019	8	26	12	30	44.683	-111.116	2025	NA

	wind.dir.qc	wind.type.code	wind.sp	wind.sp.qc	ceiling.ht	ceiling.ht.qc
1:	9	C	0	5	22000	5
2:	9	C	0	5	22000	5
3:	9	C	0	5	22000	5
4:	9	C	0	5	22000	5
5:	9	C	0	5	22000	5
6:	9	C	0	5	22000	5

	ceiling.ht.method	sky.cond	vis.dist	vis.dist.qc	vis.var	vis.var.qc	temp
1:	9	N	16093	5	N	5	-3.0
2:	9	N	16093	5	N	5	-3.0
3:	9	N	16093	5	N	5	-3.0
4:	9	N	16093	5	N	5	-3.0
5:	9	N	16093	5	N	5	-2.4
6:	9	N	16093	5	N	5	-2.0

	temp.qc	dew.point	dew.point.qc	atm.press	atm.press.qc	rh
1:	C	-5.0	C	NA	9	86.26537
2:	5	-4.0	5	NA	9	92.91083
3:	5	-4.0	5	NA	9	92.91083

```
4:          C       -4.0            C       NA              9 92.91083
5:          5       -3.7            5       NA              9 90.91475
6:          5       -3.0            5       NA              9 92.96690
```

Here we removed temperatures colder than -15C. The new dataset has minimum temp -3C which is reasonable.

Step 6: **Calculate summary statistics**

```
elev <- met[elev==max(elev), ]
summary(elev)
```

```
     USAFID              WBAN            year           month           day
 Min.   :720385    Min.   :419    Min.   :2019    Min.   :8    Min.   : 1.0
 1st Qu.:720385    1st Qu.:419    1st Qu.:2019    1st Qu.:8    1st Qu.: 8.0
 Median :720385    Median :419    Median :2019    Median :8    Median :16.0
 Mean   :720385    Mean   :419    Mean   :2019    Mean   :8    Mean   :16.1
 3rd Qu.:720385    3rd Qu.:419    3rd Qu.:2019    3rd Qu.:8    3rd Qu.:24.0
 Max.   :720385    Max.   :419    Max.   :2019    Max.   :8    Max.   :31.0

      hour             min              lat             lon             elev
 Min.   : 0.00    Min.   : 6.00    Min.   :39.8    Min.   :-105.8    Min.   :4113
 1st Qu.: 6.00    1st Qu.:13.00    1st Qu.:39.8    1st Qu.:-105.8    1st Qu.:4113
 Median :12.00    Median :36.00    Median :39.8    Median :-105.8    Median :4113
 Mean   :11.66    Mean   :34.38    Mean   :39.8    Mean   :-105.8    Mean   :4113
 3rd Qu.:18.00    3rd Qu.:53.00    3rd Qu.:39.8    3rd Qu.:-105.8    3rd Qu.:4113
 Max.   :23.00    Max.   :59.00    Max.   :39.8    Max.   :-105.8    Max.   :4113

    wind.dir       wind.dir.qc        wind.type.code        wind.sp
 Min.   : 10.0    Length:2117       Length:2117          Min.   : 0.000
 1st Qu.:250.0    Class :character  Class :character     1st Qu.: 4.100
 Median :300.0    Mode  :character  Mode  :character     Median : 6.700
 Mean   :261.5                                           Mean   : 7.245
 3rd Qu.:310.0                                           3rd Qu.: 9.800
 Max.   :360.0                                           Max.   :21.100
 NA's   :237                                             NA's   :168
  wind.sp.qc         ceiling.ht       ceiling.ht.qc     ceiling.ht.method
 Length:2117       Min.   :   30    Min.   :5.000      Length:2117
 Class :character  1st Qu.: 2591    1st Qu.:5.000      Class :character
 Mode  :character  Median :22000    Median :5.000      Mode  :character
                   Mean   :15145    Mean   :5.008
                   3rd Qu.:22000    3rd Qu.:5.000
                   Max.   :22000    Max.   :9.000
                   NA's   :4
    sky.cond          vis.dist         vis.dist.qc          vis.var
 Length:2117       Min.   :    0    Length:2117         Length:2117
 Class :character  1st Qu.:16093    Class :character    Class :character
 Mode  :character  Median :16093    Mode  :character    Mode  :character
                   Mean   :15913
                   3rd Qu.:16093
                   Max.   :16093
```

```
                      NA's   :683
   vis.var.qc            temp            temp.qc            dew.point
 Length:2117        Min.   : 1.00    Length:2117        Min.   :-6.0000
 Class :character   1st Qu.: 6.00    Class :character   1st Qu.: 0.0000
 Mode  :character   Median : 8.00    Mode  :character   Median : 0.0000
                    Mean   : 8.13                       Mean   : 0.8729
                    3rd Qu.:10.00                        3rd Qu.: 2.0000
                    Max.   :15.00                       Max.   : 7.0000

  dew.point.qc         atm.press        atm.press.qc        rh
 Length:2117        Min.   : NA      Min.   :9        Min.   :53.63
 Class :character   1st Qu.: NA      1st Qu.:9        1st Qu.:58.10
 Mode  :character   Median : NA      Median :9        Median :61.39
                    Mean   :NaN      Mean   :9        Mean   :60.62
                    3rd Qu.: NA      3rd Qu.:9        3rd Qu.:61.85
                    Max.   : NA      Max.   :9        Max.   :70.01
                    NA's   :2117
```

```
cor(elev$temp, elev$wind.sp, use="complete")
```

[1] -0.09373843

```
cor(elev$temp, elev$hour, use="complete")
```

[1] 0.4397261

```
cor(elev$wind.sp, elev$day, use="complete")
```

[1] 0.3643079

```
cor(elev$wind.sp, elev$hour, use="complete")
```

[1] 0.08807315

```
cor(elev$temp, elev$day, use="complete")
```
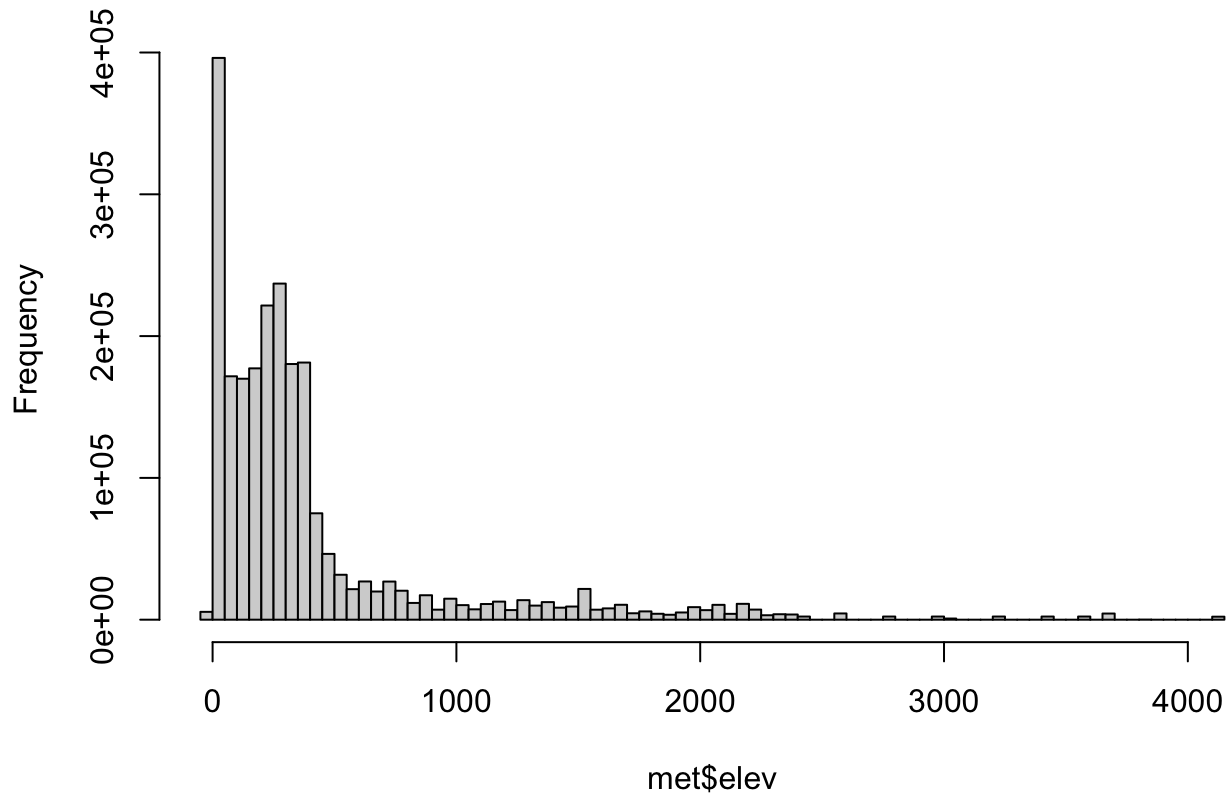
[1] -0.003857766

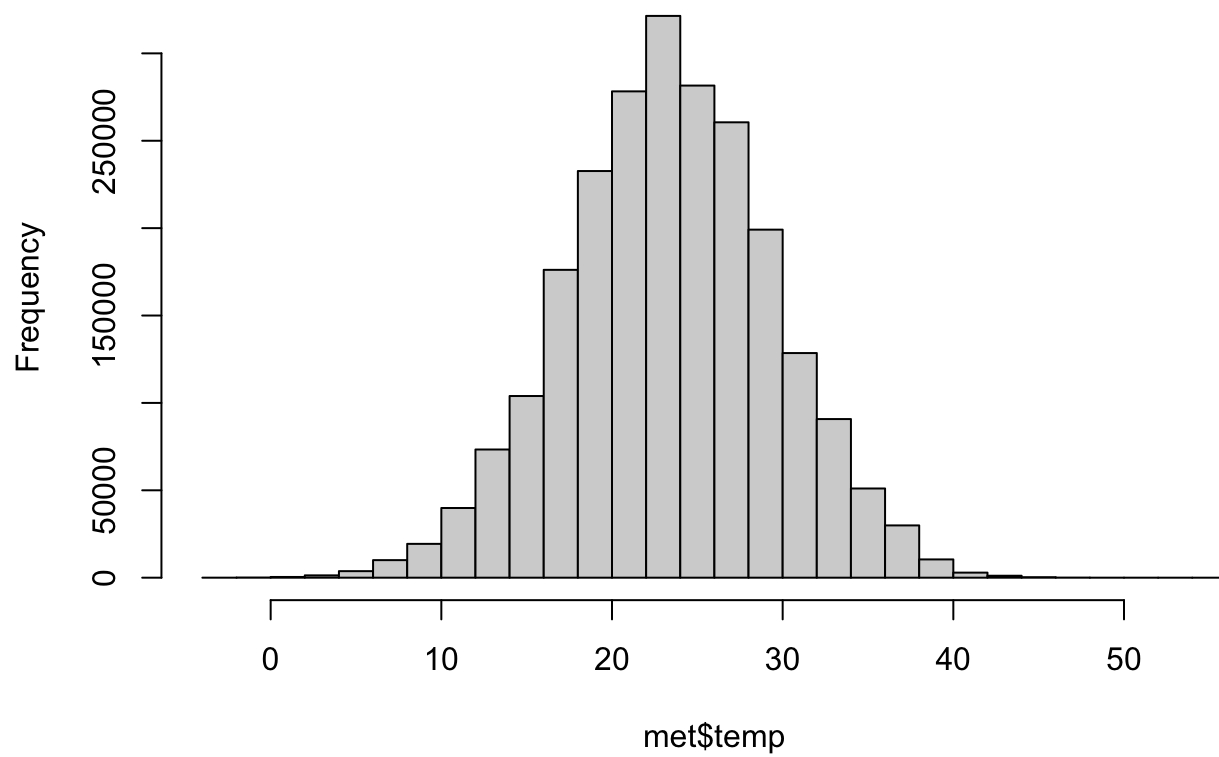## Step 7: **Exploratory graphs**

```
hist(met$elev, breaks=100)
```
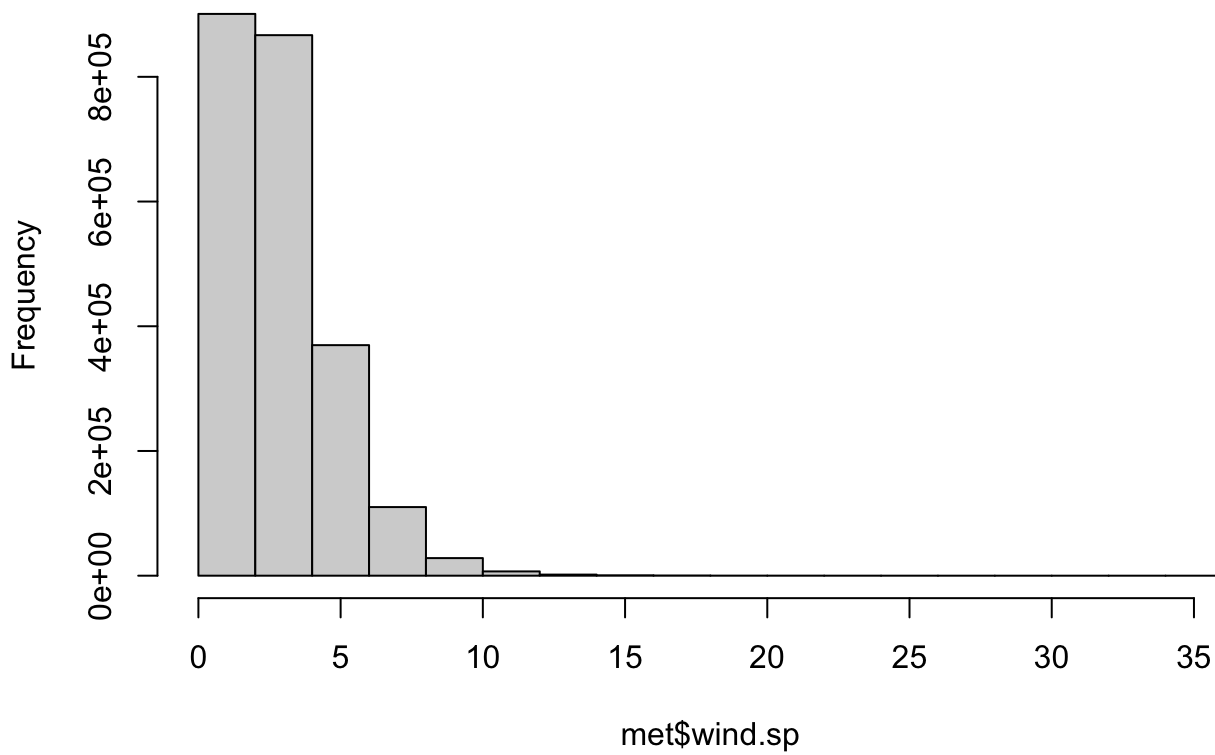
Histogram of met$elev


```
hist(met$temp)
```

Histogram of met$temp
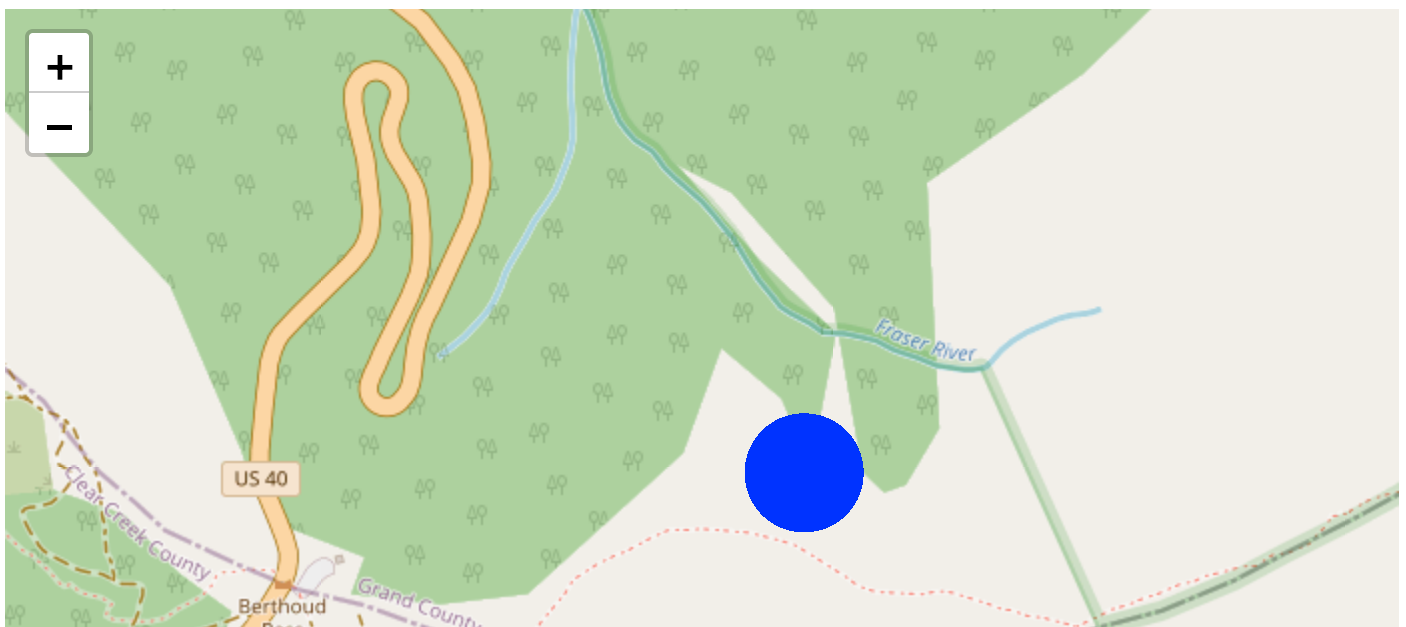


```
hist(met$wind.sp)
```

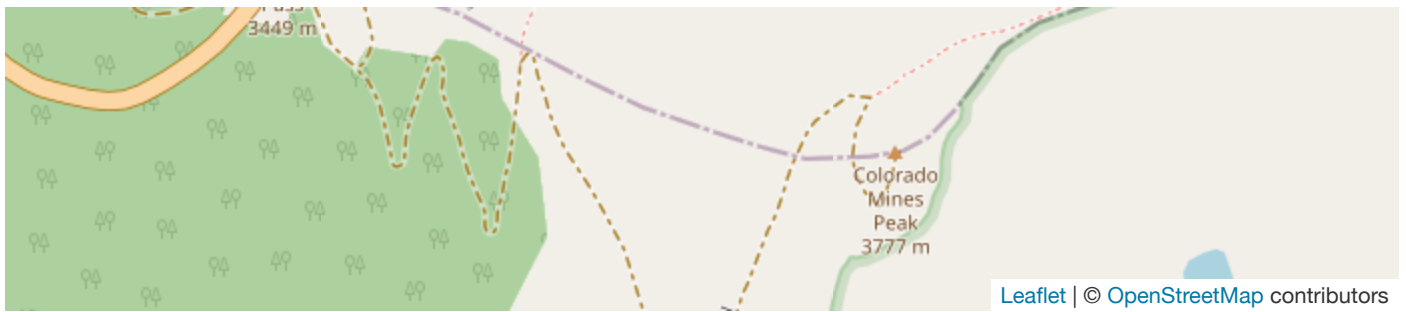# Histogram of met$wind.sp

The highest weather station is located close to Denver, CO.

```
library(leaflet)
```

```
leaflet(elev) |>
  addProviderTiles('OpenStreetMap') |>
  addCircles(lat=~lat,lng=~lon, opacity=1, fillOpacity=1, radius=100)
```

```
library(lubridate)
elev$date <- with(elev, ymd_h(paste(year, month, day, hour, sep= ' ')))
summary(elev$date)
```

```
                    Min.                      1st Qu.
"2019-08-01 00:00:00.0000" "2019-08-08 11:00:00.0000"
                  Median                         Mean
"2019-08-16 22:00:00.0000" "2019-08-16 14:09:56.8823"
                 3rd Qu.                         Max.
"2019-08-24 11:00:00.0000" "2019-08-31 22:00:00.0000"
```

```
elev <- elev[order(date)]
head(elev)
```

```
   USAFID WBAN year month day hour min  lat       lon elev wind.dir wind.dir.qc
1: 720385  419 2019     8   1    0  36 39.8 -105.766 4113      170           5
2: 720385  419 2019     8   1    0  54 39.8 -105.766 4113      100           5
3: 720385  419 2019     8   1    1  12 39.8 -105.766 4113       90           5
4: 720385  419 2019     8   1    1  35 39.8 -105.766 4113      110           5
5: 720385  419 2019     8   1    1  53 39.8 -105.766 4113      120           5
6: 720385  419 2019     8   1    2  12 39.8 -105.766 4113      120           5
   wind.type.code wind.sp wind.sp.qc ceiling.ht ceiling.ht.qc ceiling.ht.method
1:              N     8.8          5       1372             5                 M
2:              N     2.6          5       1372             5                 M
3:              N     3.1          5       1981             5                 M
4:              N     4.1          5       2134             5                 M
5:              N     4.6          5       2134             5                 M
6:              N     6.2          5      22000             5                 9
   sky.cond vis.dist vis.dist.qc vis.var vis.var.qc temp temp.qc dew.point
1:        N       NA           9       N          5    9       5         1
2:        N       NA           9       N          5    9       5         1
3:        N       NA           9       N          5    9       5         2
4:        N       NA           9       N          5    9       5         2
5:        N       NA           9       N          5    9       5         2
6:        N       NA           9       N          5    9       5         2
   dew.point.qc atm.press atm.press.qc       rh                date
1:            5        NA            9 57.61039 2019-08-01 00:00:00
2:            5        NA            9 57.61039 2019-08-01 00:00:00
3:            5        NA            9 61.85243 2019-08-01 01:00:00
4:            5        NA            9 61.85243 2019-08-01 01:00:00
```
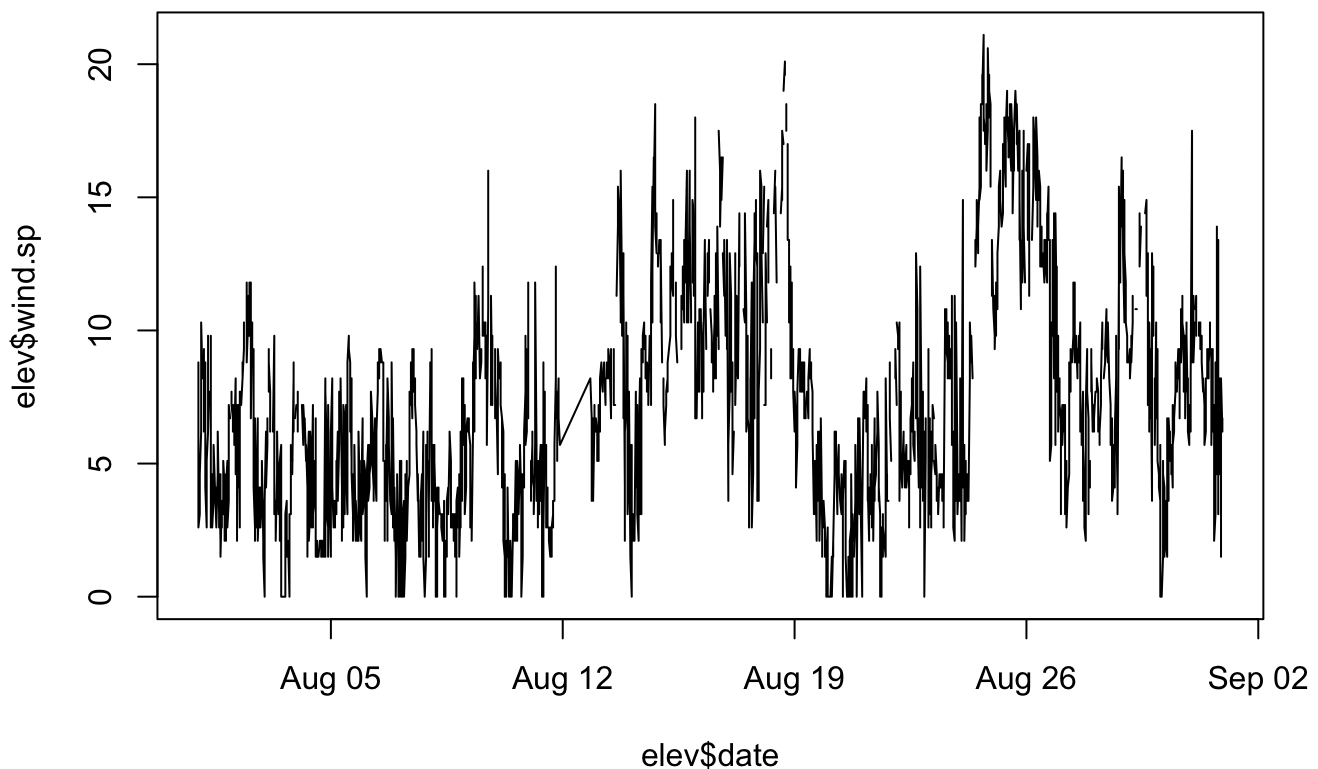
```
5:          5          NA              9 61.85243 2019−08−01 01:00:00
6:          5          NA              9 61.85243 2019−08−01 02:00:00
```

```
plot(elev$date, elev$temp, type='l')
```
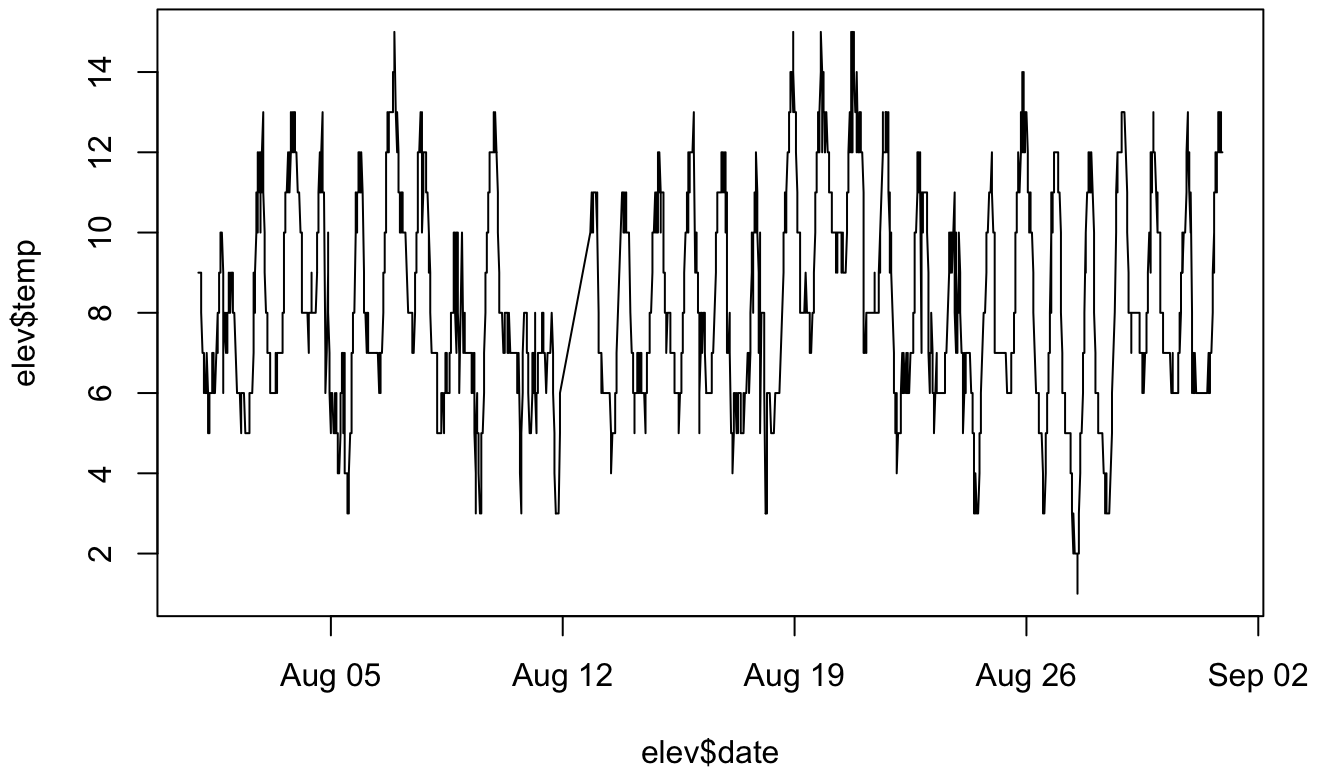


```
plot(elev$date, elev$wind.sp, type='l')
```

Summarizing trends: Between August - September, wind elevation ranged between 0 - 20 MPH. There was an oscillatory behavior exhibited in the plots. The wind elevation in itself seemed to be trending upwards from August to September.

```
met_stations <- (unique(met[,c("lat","lon")]))
dim(met_stations)
```

```
[1] 2823    2
```

```
leaflet(met_stations) |>
  addProviderTiles('CartoDB.Positron') |>
  addCircles(lat = ~lat, lng = ~lon, opacity = 1, fillOpacity = 1, radius = 400)
```

Leaflet | © OpenStreetMap contributors © CARTO
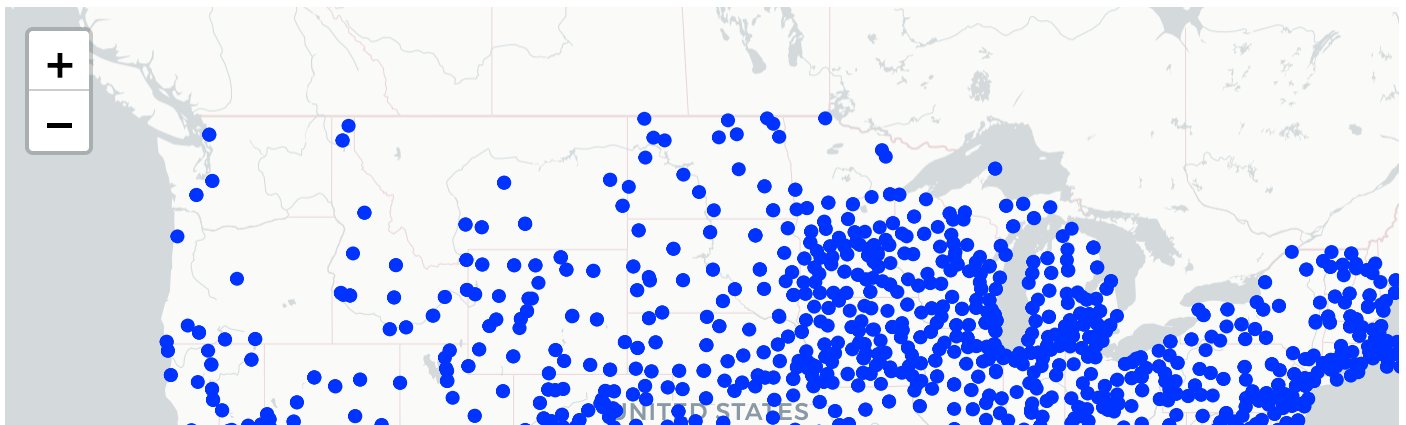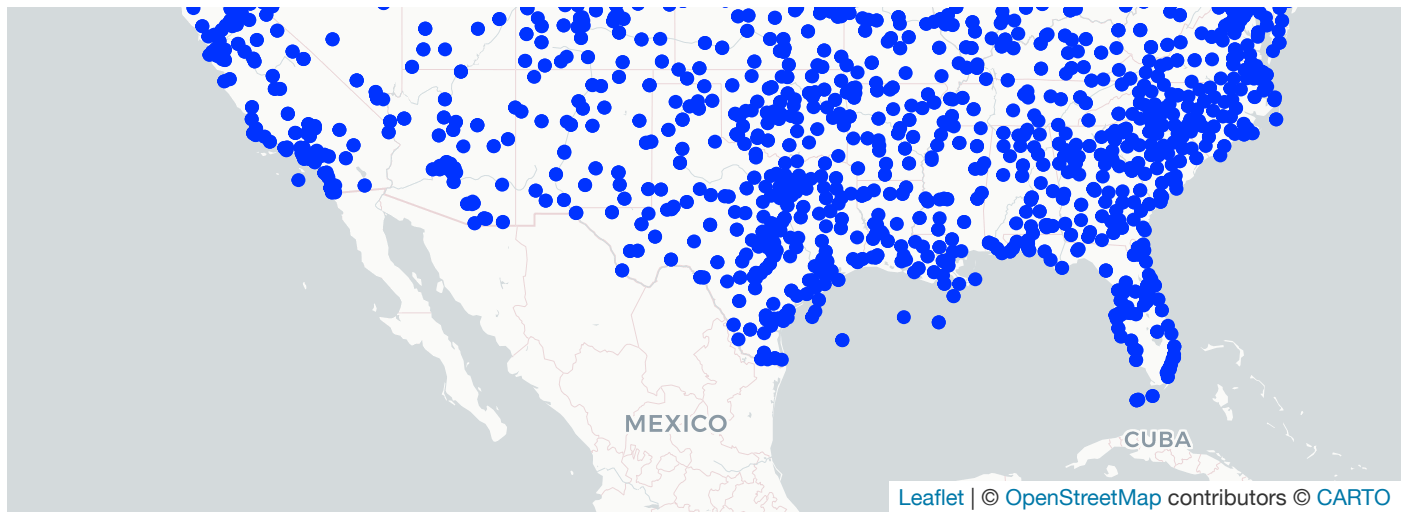
Step 8: Ask questions

```
table(met$dew.point)
```

-37.2	-36.9	-36.8	-36.7	-36.3	-36	-35	-34.8	-34.5	-34.2	-34	-33.6	-33.4
1	1	1	1	1	1	1	1	1	1	1	1	1

-33	-32.9	-32	-31.8	-31.6	-31.5	-31.2	-31.1	-31	-30.7	-30.3	-30.1	-30
8	2	4	1	1	1	2	2	4	1	1	1	4

-27	-25	-22	-21	-20	-19.5	-19	-18	-17.8	-17.6	-17	-16.7	-16.2
1	2	1	3	6	1	3	14	2	1	13	1	1

-16.1	-16	-15.6	-15.5	-15.4	-15.3	-15.1	-15	-14.9	-14.6	-14.5	-14.4	-14.3
1	11	6	1	1	1	2	67	1	1	7	10	1

-14.2	-14.1	-14	-13.9	-13.8	-13.7	-13.6	-13.5	-13.4	-13.3	-13.1	-13	-12.9
1	3	43	11	2	2	2	2	2	11	1	135	2

-12.8	-12.6	-12.5	-12.3	-12.2	-12.1	-12	-11.9	-11.8	-11.7	-11.6	-11.5	-11.4
36	2	2	2	75	2	203	3	3	57	3	7	2

-11.3	-11.2	-11.1	-11	-10.9	-10.7	-10.6	-10.5	-10.4	-10.3	-10.2	-10.1	-10
1	6	125	296	3	3	168	3	1	2	6	5	619

-9.9	-9.8	-9.7	-9.6	-9.5	-9.4	-9.3	-9.2	-9.1	-9	-8.9	-8.8	-8.7
3	3	3	6	7	317	4	9	8	397	426	16	7

-8.6	-8.5	-8.4	-8.3	-8.2	-8.1	-8	-7.9	-7.8	-7.7	-7.6	-7.5	-7.4
9	12	14	437	18	23	869	26	564	20	23	29	19

-7.3	-7.2	-7.1	-7	-6.9	-6.8	-6.7	-6.6	-6.5	-6.4	-6.3	-6.2	-6.1
33	586	19	1331	30	40	818	34	44	34	42	50	910

-6	-5.9	-5.8	-5.7	-5.6	-5.5	-5.4	-5.3	-5.2	-5.1	-5	-4.9	-4.8
1637	36	44	46	1023	40	44	53	54	44	3365	47	53

-4.7	-4.6	-4.5	-4.4	-4.3	-4.2	-4.1	-4	-3.9	-3.8	-3.7	-3.6	-3.5
59	81	82	1297	67	78	82	1847	1378	86	96	88	97

-3.4	-3.3	-3.2	-3.1	-3	-2.9	-2.8	-2.7	-2.6	-2.5	-2.4	-2.3	-2.2
66	1484	68	111	3328	92	1620	99	124	140	123	110	1889

-2.1	-2	-1.9	-1.8	-1.7	-1.6	-1.5	-1.4	-1.3	-1.2	-1.1	-1	-0.9
127	3972	119	139	1962	166	197	155	163	161	2181	4255	125

-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0	0.1	0.2	0.3	0.4
131	190	2265	194	181	183	223	266	9304	281	231	200	180

0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7
240	2831	195	190	196	4698	2918	213	194	215	231	248	3138

```
    1.8    1.9      2    2.1    2.2    2.3    2.4    2.5    2.6    2.7    2.8    2.9      3
    199    202   5223    226   3252    201    182    283    246    205   3203    204   5568
    3.1    3.2    3.3    3.4    3.5    3.6    3.7    3.8    3.9      4    4.1    4.2    4.3
    223    235   3343    217    252    249    249    214   3446   4851    269    257    213
    4.4    4.5    4.6    4.7    4.8    4.9      5    5.1    5.2    5.3    5.4    5.5    5.6
   3589    289    276    254    279    248  10850    337    333    334    313    427   4093
    5.7    5.8    5.9      6    6.1    6.2    6.3    6.4    6.5    6.6    6.7    6.8    6.9
    389    356    342   8365   4414    405    426    411    548    582   4838    492    512
      7    7.1    7.2    7.3    7.4    7.5    7.6    7.7    7.8    7.9      8    8.1    8.2
  10743    605   5392    613    565    897    762    753   6201    673  14104    993   1003
    8.3    8.4    8.5    8.6    8.7    8.8    8.9      9    9.1    9.2    9.3    9.4    9.5
   7187    911   1325   1184   1122   1143   8455  15893   1525   1419   1375  10142   1996
    9.6    9.7    9.8    9.9     10   10.1   10.2   10.3   10.4   10.5   10.6   10.7   10.8
   1795   1692   1563   1521  30984   2103   1980   2006   1715   2778  14623   2310   2050
   10.9     11   11.1   11.2   11.3   11.4   11.5   11.6   11.7   11.8   11.9     12   12.1
   1988  27827  16757   2545   2414   2034   3387   2847  18113   2603   2271  34726   3032
   12.2   12.3   12.4   12.5   12.6   12.7   12.8   12.9     13   13.1   13.2   13.3   13.4
  20166   2781   2393   3962   3293   3067  21704   2485  39349   3388   3244  22775   2572
   13.5   13.6   13.7   13.8   13.9     14   14.1   14.2   14.3   14.4   14.5   14.6   14.7
   4330   3567   3288   3098  22726  38237   3719   3571   3158  22873   4705   3751   3631
   14.8   14.9     15   15.1   15.2   15.3   15.4   15.5   15.6   15.7   15.8   15.9     16
   3159   2800  59528   3924   3686   3381   2949   5224  26668   3919   3636   3150  45233
   16.1   16.2   16.3   16.4   16.5   16.6   16.7   16.8   16.9     17   17.1   17.2   17.3
  28068   4326   3904   3399   5993   4736  29691   4126   3528  53318   5072  31278   4161
   17.4   17.5   17.6   17.7   17.8   17.9     18   18.1   18.2   18.3   18.4   18.5   18.6
   3571   6787   5401   5145  31795   3850  57719   5707   5351  32878   3947   7409   5621
   18.7   18.8   18.9     19   19.1   19.2   19.3   19.4   19.5   19.6   19.7   19.8   19.9
   5540   5034  32936  52186   6130   5925   5132  34389   7856   6405   5982   5183   4395
     20   20.1   20.2   20.3   20.4   20.5   20.6   20.7   20.8   20.9     21   21.1   21.2
  93805   6491   6255   5591   4594   8469  38585   6269   5856   4713  71065  39598   6949
   21.3   21.4   21.5   21.6   21.7   21.8   21.9     22   22.1   22.2   22.3   22.4   22.5
   5835   4559   8656   6627  37309   5671   4685  75259   6597  36063   5658   4350   8181
   22.6   22.7   22.8   22.9     23   23.1   23.2   23.3   23.4   23.5   23.6   23.7   23.8
   6318   5736  34736   4193  67252   5796   5475  33030   3942   6975   5107   4886   4348
   23.9     24   24.1   24.2   24.3   24.4   24.5   24.6   24.7   24.8   24.9     25   25.1
  28800  44687   4598   4102   3474  23579   4837   3366   3105   2720   2043  46271   2477
   25.2   25.3   25.4   25.5   25.6   25.7   25.8   25.9     26   26.1   26.2   26.3   26.4
   2131   1931   1528   2283   9938   1474   1197    944  13545   5130    981    877    595
   26.5   26.6   26.7   26.8   26.9     27   27.1   27.2   27.3   27.4   27.5   27.6   27.7
    954    570   2155    351    246   3442    230    836    131    112    147     98     77
   27.8   27.9     28   28.1   28.2   28.3   28.4   28.5   28.6   28.7   28.8   28.9     29
    306     33    795     43     33     84     13     16      9      3      1     15    135
   29.1   29.4   29.6     30     31     32     36
      1      2      1     22      1      2      1
```
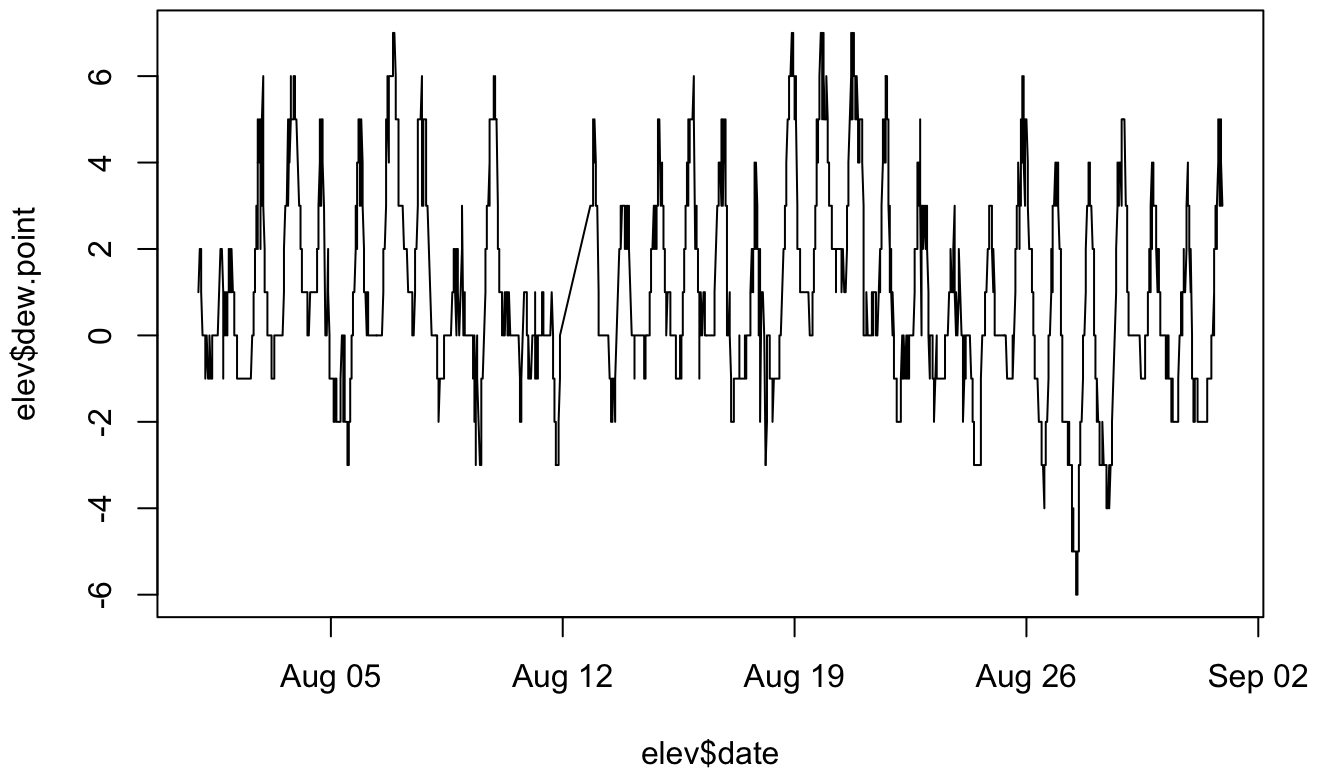
```
summary(met$dew.point)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
 -37.20   13.80   18.10   17.02   21.70   36.00    6105
```

```
hist(met$dew.point, breaks = 100)
```

Histogram of met$dew.point
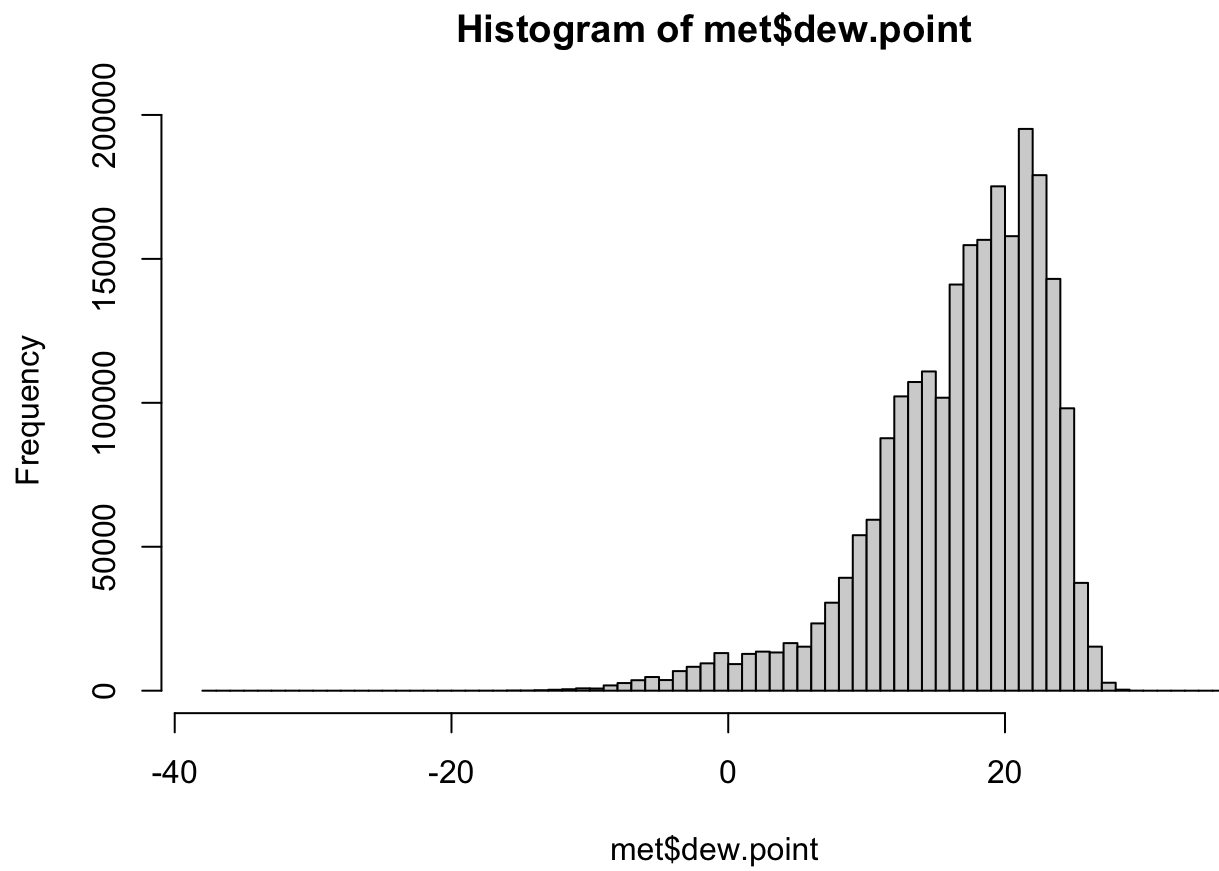

```
plot(elev$date, elev$dew.point, type = 'l')
```

How does dew point vary with date from August through September? It varies through an oscillatory behavior with a maximum of 6-7 and minimum of -6. It appears to vary in an oscillatory behavior over a time span of 1 day.