ETC5510: Introduction to Data Analysis

Week 5, part A

Missing Data

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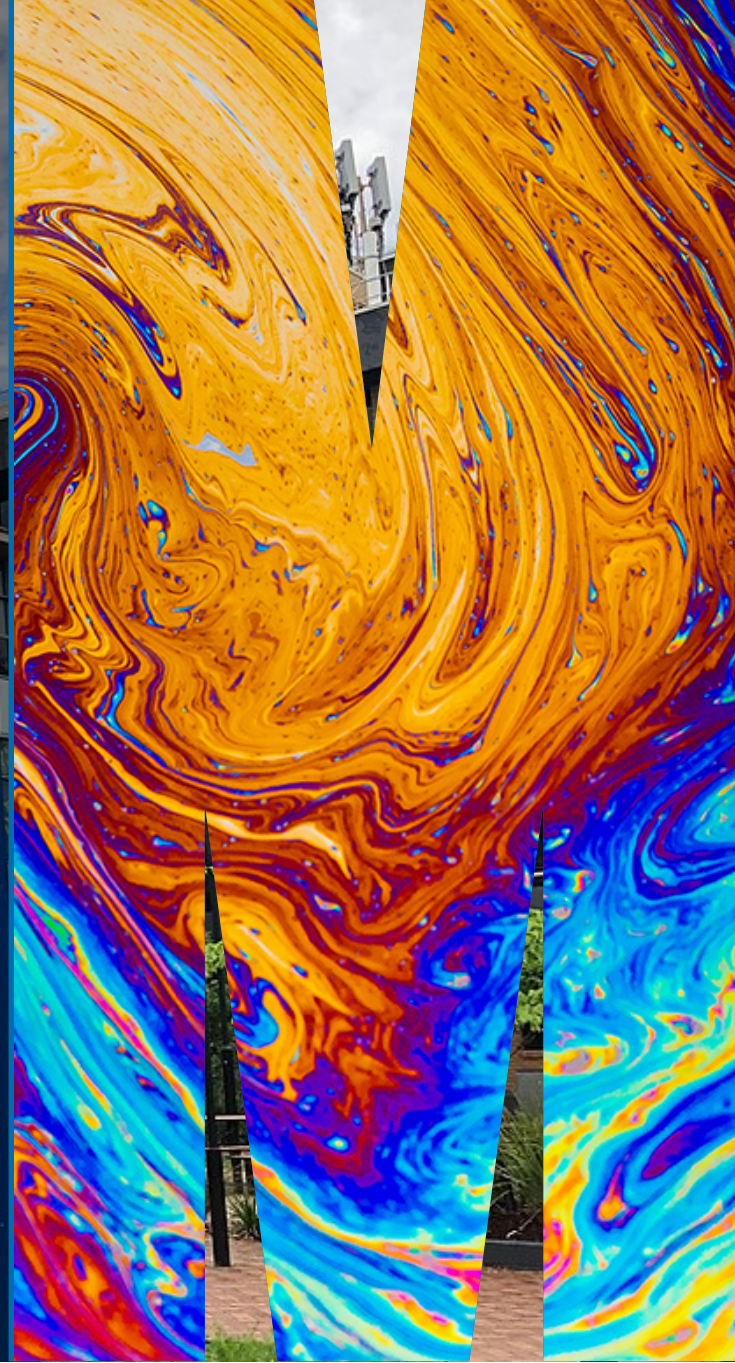


Recap

- Joins
- advanced data vis

Example

San Francisco weather data

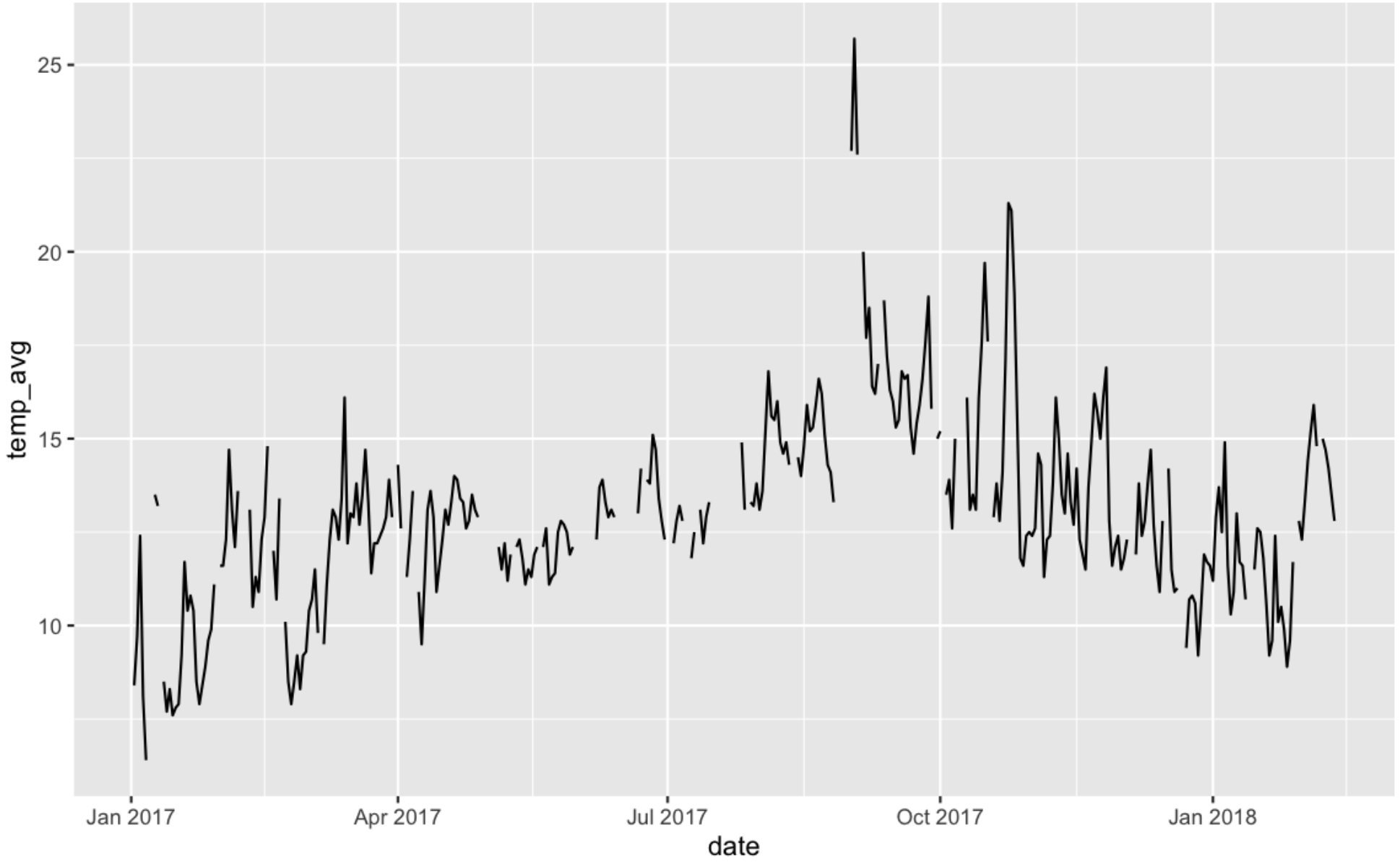
|| Date | Wind | Temp ||

Using the R package: GSODR

(Global Surface Summary of the Day)

Written by Adam Sparks

github.com/ropensci/GSODR

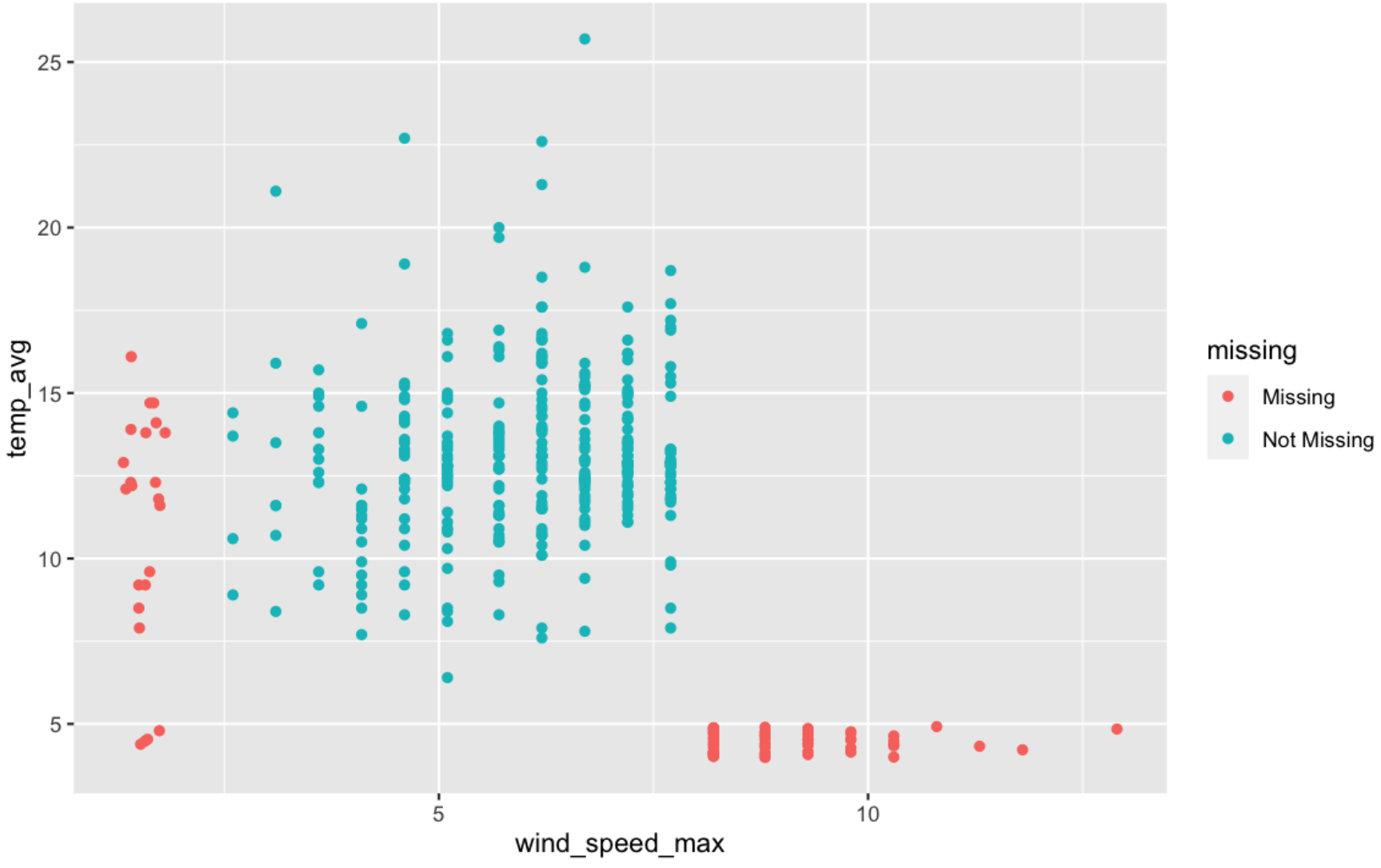

25
20
15
10
temp_avg
Jan 2017
Apr 2017
Jul 2017
Oct 2017
Jan 2018
date

Your Turn: These gaps are missing values! What are some reasons this might be a problem?

Some thoughts

- What is missing?
- Why are they missing?
- How can we summarise and explore this?

One way to show missing data



Wait, What?

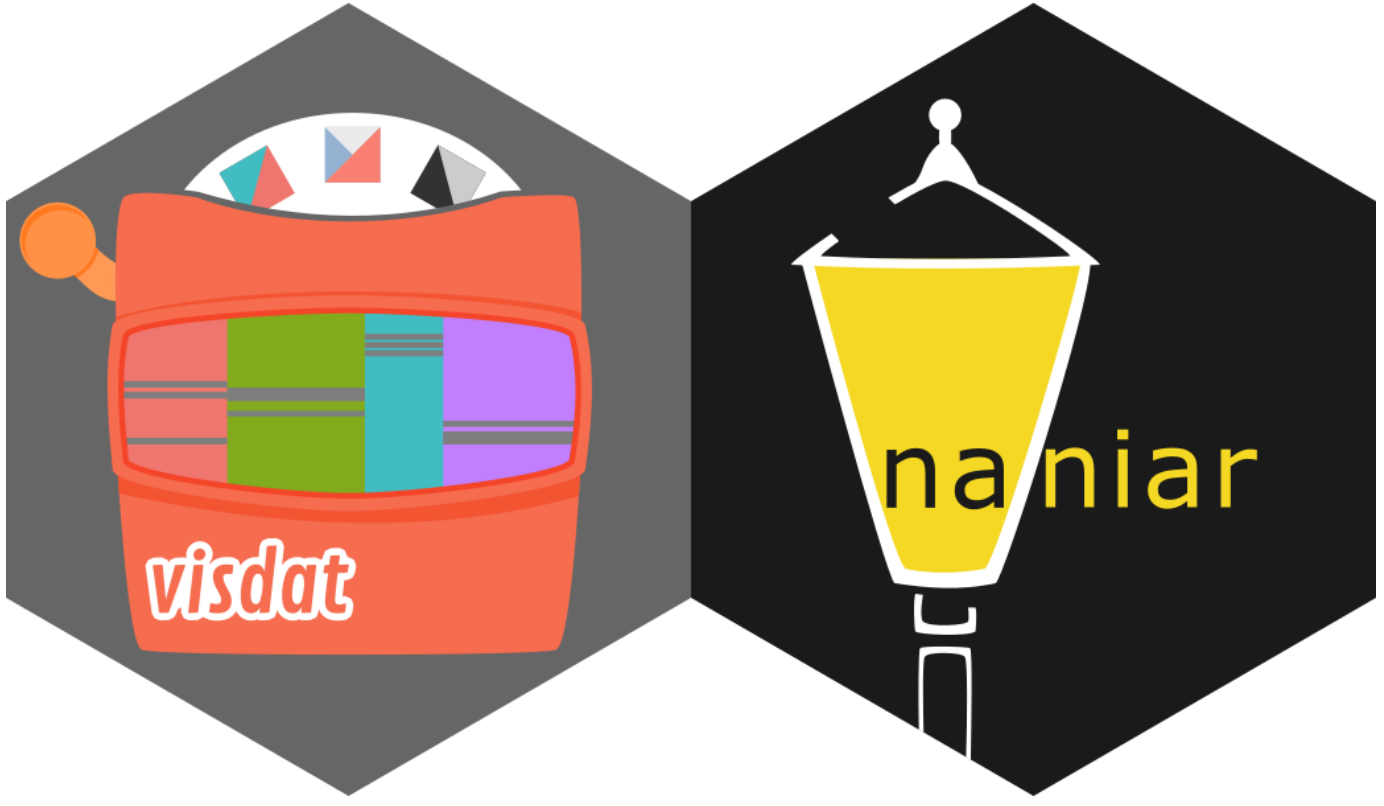
What people think dealing with missing data looks like

What dealing with missing data actually looks like

What I want dealing with missing data to be like


@草根足球记录员

Learn more



visdat.njtierney.com

naniar.njtierney.com

Overview

1. What even are missing values
2. How to start looking at missing data
3. How to start exploring missing data
4. How to impute (fill in) Missing values

What are missing values?

> *Missing values are values that should have been recorded but were not.*

NA = **N**ot **A**vailable.

How do I check if I have missing values?

```
x <- c(1, NA, 3, NA, NA, 5)

library(naniar)
any_na(x)
```

```
[1] TRUE
```

```
are_na(x)
```

```
[1] FALSE  TRUE FALSE  TRUE  TRUE FALSE
```

```
n_miss(x)
```

```
[1] 3
```

```
prop_miss(x)
```

```
[1] 0.5
```

Working with missing data

NA + [anything] = NA

```
heights
```

```
Sophie    Dan   Fred
   165    177     NA
```

```
sum(heights)
```

```
[1] NA
```

Working with missing data

`na.rm = TRUE` will removes missings

```
sum(heights, na.rm = TRUE)
```

```
[1] 342
```

Use this power `responsibly`!

Dangers of removing missing values

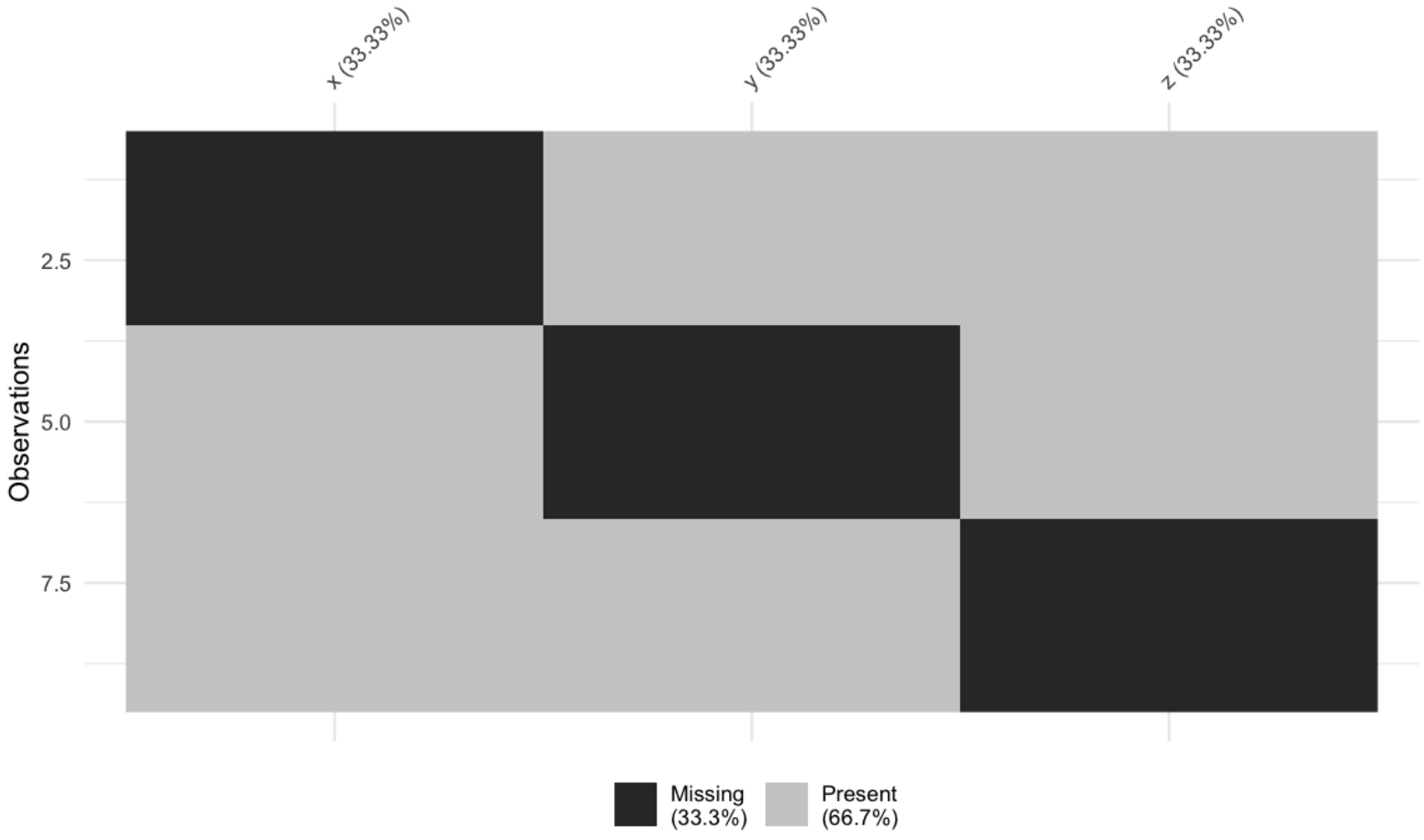
You can remove most of or all of your data:

x	y	z
NA	1	1
NA	2	2
NA	3	3
4	NA	4
5	NA	5
6	NA	6
7	7	NA
8	8	NA
9	9	NA

Dangers of removing missing values

You can remove most of or all of your data:

```
vis_miss(dat_df)
```



Dangers of removing missing values

You can remove most of or all of your data:

```
na.omit(dat_df)
## [1] x y z
## <0 rows> (or 0-length row.names)
```

wat?

`na.omit` / `na.rm` = listwise delection

x	y	z
~~NA~~	~~1~~	~~1~~
~~NA~~	~~2~~	~~2~~
~~NA~~	~~3~~	~~3~~
~~4~~	~~NA~~	~~4~~
~~5~~	~~NA~~	~~5~~
~~6~~	~~NA~~	~~6~~
~~7~~	~~7~~	~~NA~~
~~8~~	~~8~~	~~NA~~
~~9~~	~~9~~	~~NA~~

`na.omit` / `na.rm` = listwise delection

x	y	z
~~NA~~	~~1~~	~~1~~
~~NA~~	~~2~~	~~2~~
~~NA~~	~~3~~	~~3~~
4	NA	4
5	NA	5
6	NA	6
7	7	NA
8	8	NA
9	9	NA

`na.omit` / `na.rm` = listwise delection

x	y	z
~~NA~~	~~1~~	~~1~~
~~NA~~	~~2~~	~~2~~
~~NA~~	~~3~~	~~3~~
~~4~~	~~NA~~	~~4~~
~~5~~	~~NA~~	~~5~~
~~6~~	~~NA~~	~~6~~
7	7	NA
8	8	NA
9	9	NA

`na.omit` / `na.rm` = listwise delection

x	y	z
~~NA~~	~~1~~	~~1~~
~~NA~~	~~2~~	~~2~~
~~NA~~	~~3~~	~~3~~
~~4~~	~~NA~~	~~4~~
~~5~~	~~NA~~	~~5~~
~~6~~	~~NA~~	~~6~~
~~7~~	~~7~~	~~NA~~
~~8~~	~~8~~	~~NA~~
~~9~~	~~9~~	~~NA~~

Takehome:

- na.rm or na.omit can remove entire rows containing missings
- This is bad because you can lose data - sometimes all your data! This might not be what you anticipate!
- It can also mean that you are removing / censoring observations.

Dangers of removing missing values

You can introduce bias - what happens when you remove the NAs?

temp	location
27	inside
26	inside
NA	outside
29	inside
NA	outside
20	outside
21	outside
24	inside

Your turn:

- Open rstudio.
- go to `exercise-5a-intro-missing.Rmd`
- type the following:

```
# install.packages("usethis")
library(usethis)
use_course("https://mida.numbat.space/exercises/5a/mida-exercise-5a.zip")
```

Introduction to missingness summaries

Basic summaries of missingness:

- `n_miss`
- `n_complete`

Dataframe summaries of missingness:

- `miss_var_summary`
- `miss_case_summary`

These functions work with `group_by`

Missing data summaries: Variables

```
miss_var_summary(dat_sf_clean)
## # A tibble: 6 x 3
##   variable       n_miss pct_miss
##   <chr>           <int>    <dbl>
## 1 temp_min           70    17.3
## 2 temp_max           70    17.3
## 3 temp_avg           70    17.3
## 4 wind_speed_max     23     5.68
## 5 date                0     0
## 6 month               0     0
```

Missing data summaries: Cases

```
miss_case_summary(dat_sf_clean)
## # A tibble: 405 x 3
##     case n_miss pct_miss
##    <int>  <int>    <dbl>
##  1    89      4     66.7
##  2   182      4     66.7
##  3   188      4     66.7
##  4   271      4     66.7
##  5     6      3     50
##  6     7      3     50
##  7    10      3     50
##  8    29      3     50
##  9    37      3     50
## 10    39      3     50
## # … with 395 more rows
```

Missing data tabulations: variables

```
miss_var_table(dat_sf_clean)
## # A tibble: 3 x 3
##   n_miss_in_var n_vars pct_vars
##           <int>  <int>    <dbl>
## 1             0      2     33.3
## 2            23      1     16.7
## 3            70      3     50
```

Missing data tabulations: cases

```
miss_case_table(dat_sf_clean)
## # A tibble: 4 x 3
##   n_miss_in_case n_cases pct_cases
##            <int>   <int>     <dbl>
## 1              0     316    78.0
## 2              1      19     4.69
## 3              3      66    16.3
## 4              4       4     0.988
```

Using summaries with `group_by`

```
dat_sf_clean %>%
  group_by(month) %>%
  miss_var_summary()
## # A tibble: 60 x 4
## # Groups:   month [12]
##    month variable       n_miss pct_miss
##    <dbl> <chr>           <int>    <dbl>
##  1     1 temp_min            7    11.5
##  2     1 temp_max            7    11.5
##  3     1 temp_avg            7    11.5
##  4     1 wind_speed_max      4     6.56
##  5     1 date                0     0
##  6     2 temp_min            5    12.8
##  7     2 temp_max            5    12.8
##  8     2 temp_avg            5    12.8
##  9     2 wind_speed_max      4    10.3
## 10     2 date                0     0
## # … with 50 more rows
```

Your Turn

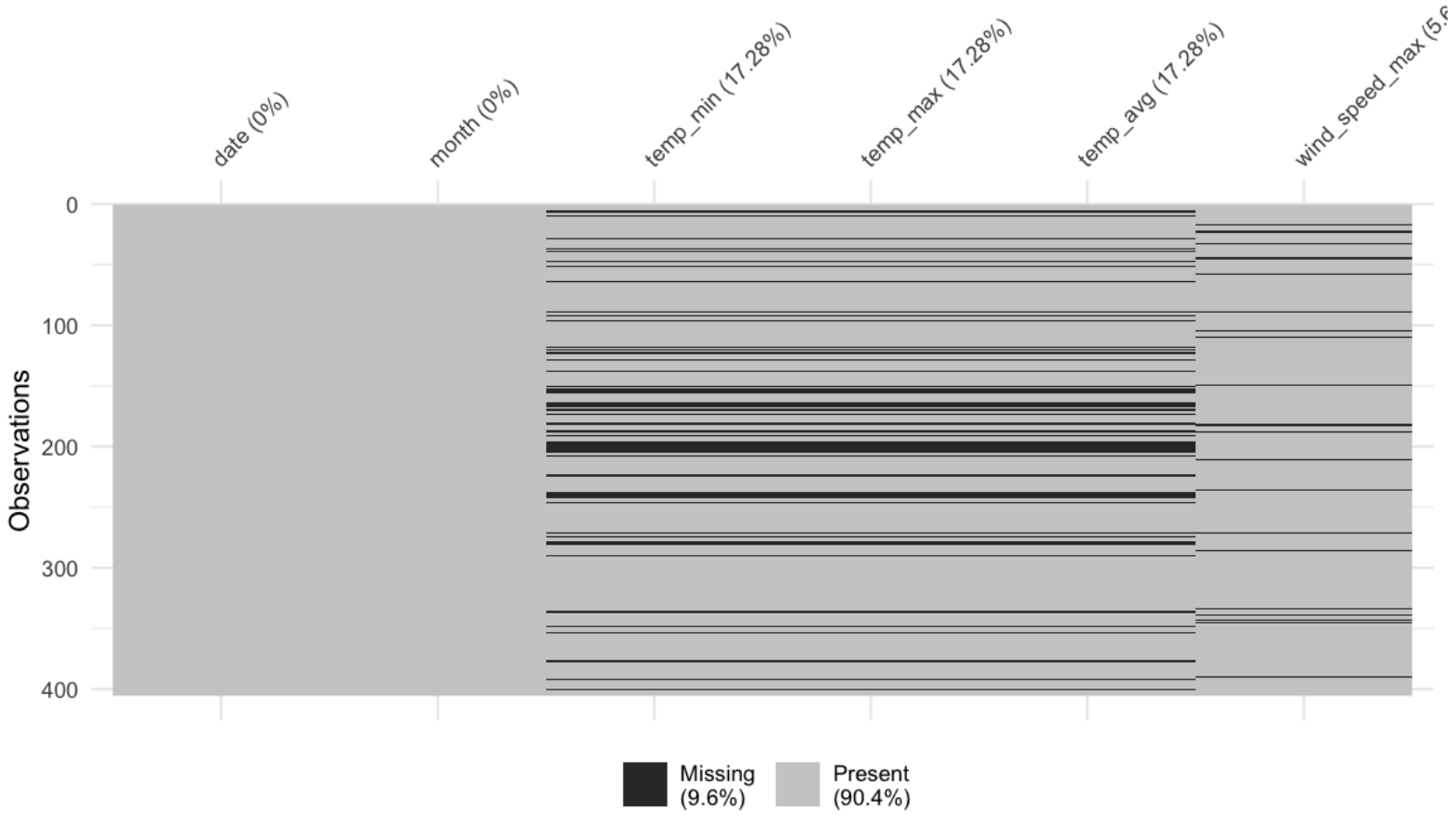
Open exercise-5a-summarise-missings.Rmd

Introduction to missing data visualisations in naniar

- Visualisation can quickly capture an idea or thought.
- `naniar` provides a friendly family of missing data visualization functions.
- Each visualization corresponds to a data summary.
- Visualisations help you operate closer to the speed of thought.

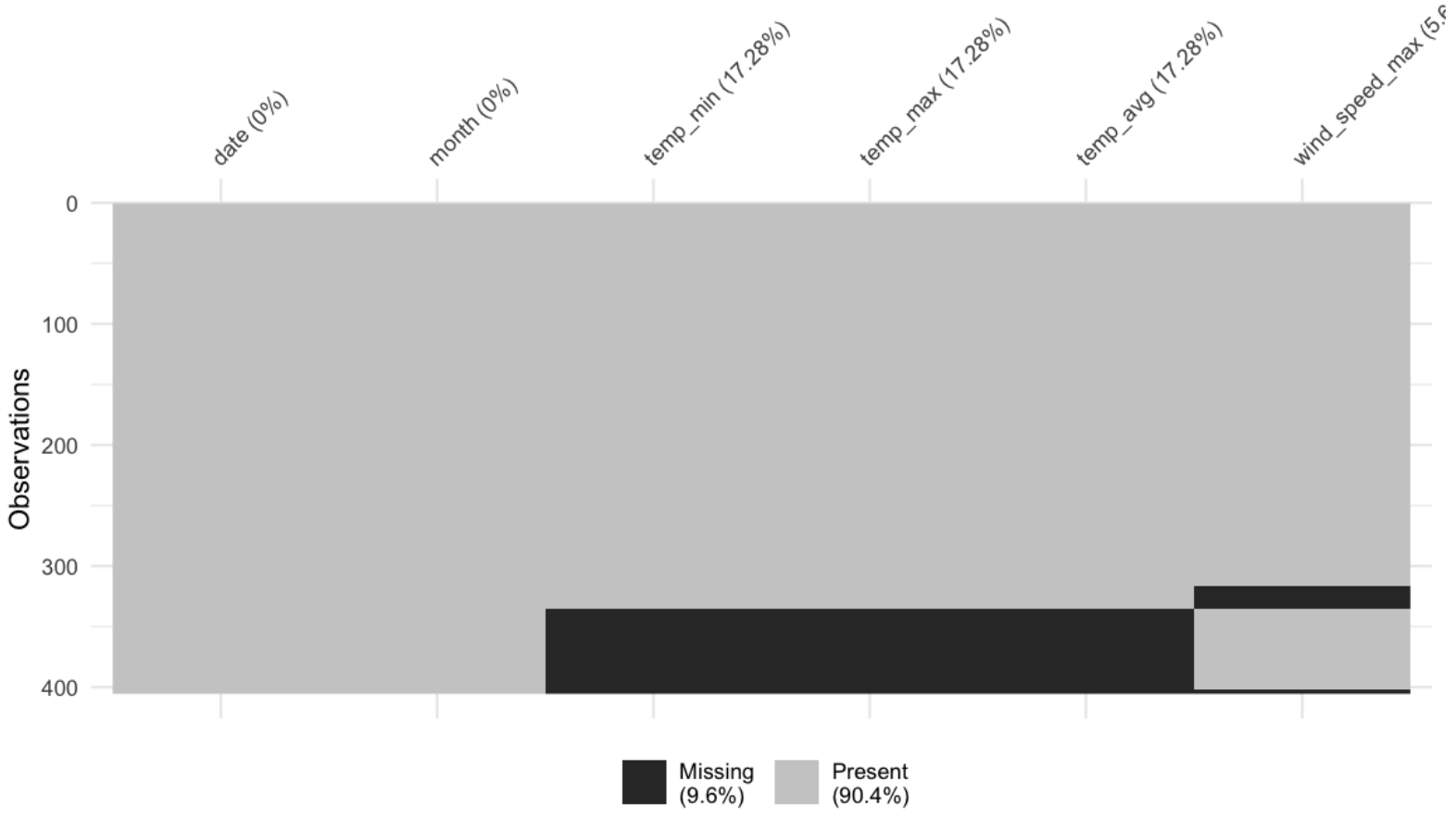
Get a bird's eye view of the missing data

```
vis_miss(dat_sf_clean)
```



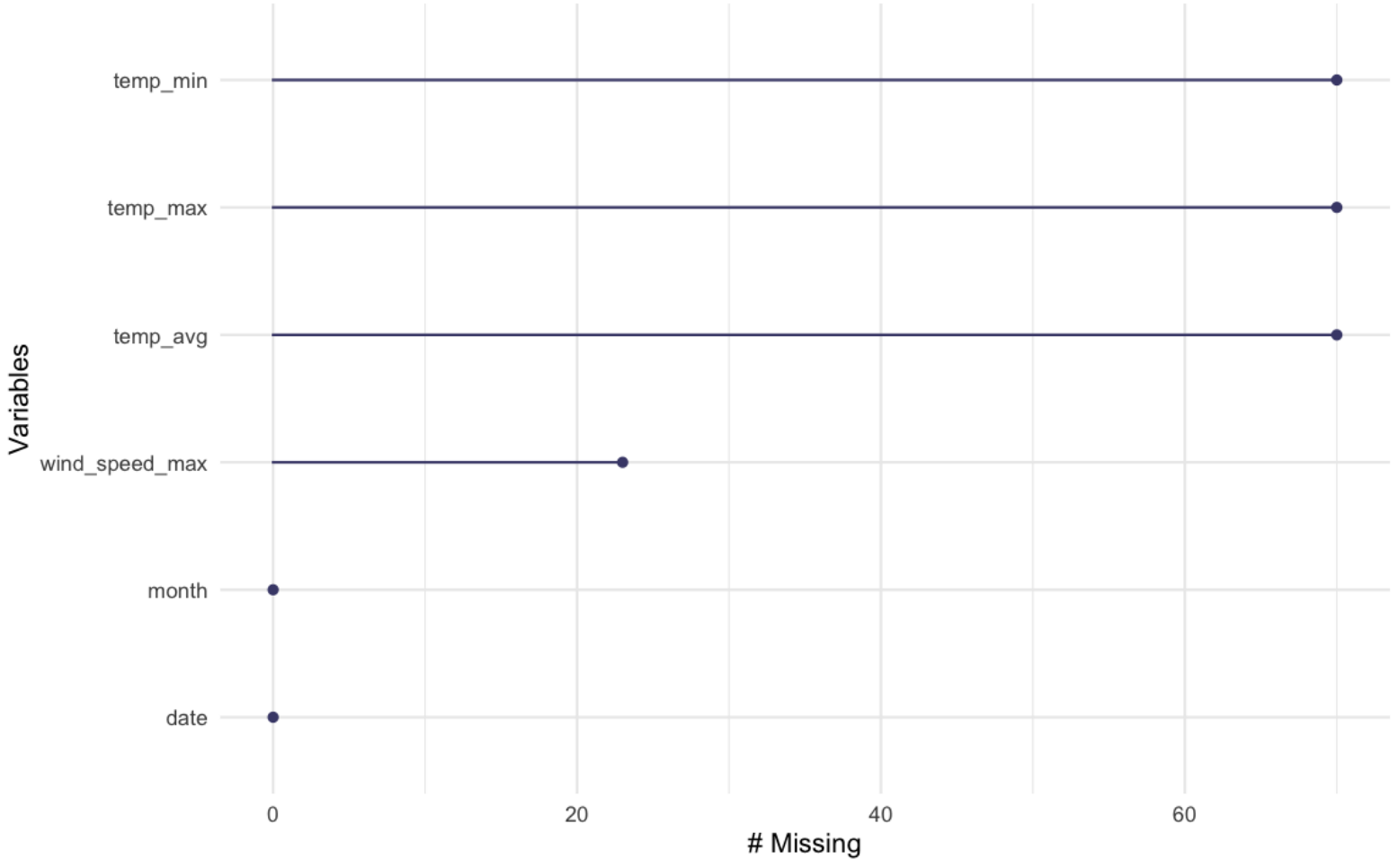
Get a bird's eye view of the missing data

```
vis_miss(dat_sf_clean, cluster = TRUE)
```



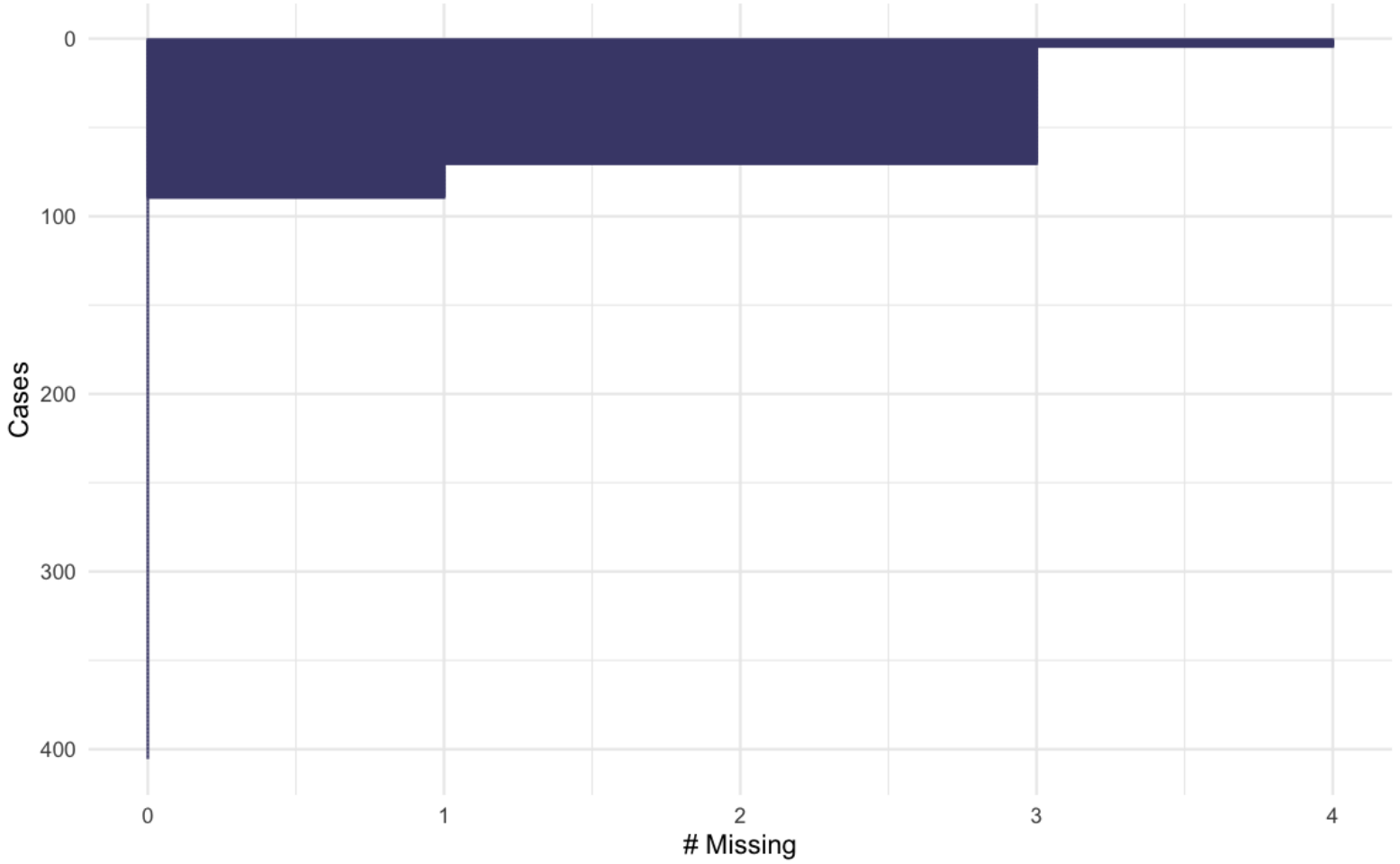
Look at missings in cases

```
gg_miss_var(dat_sf_clean)
```



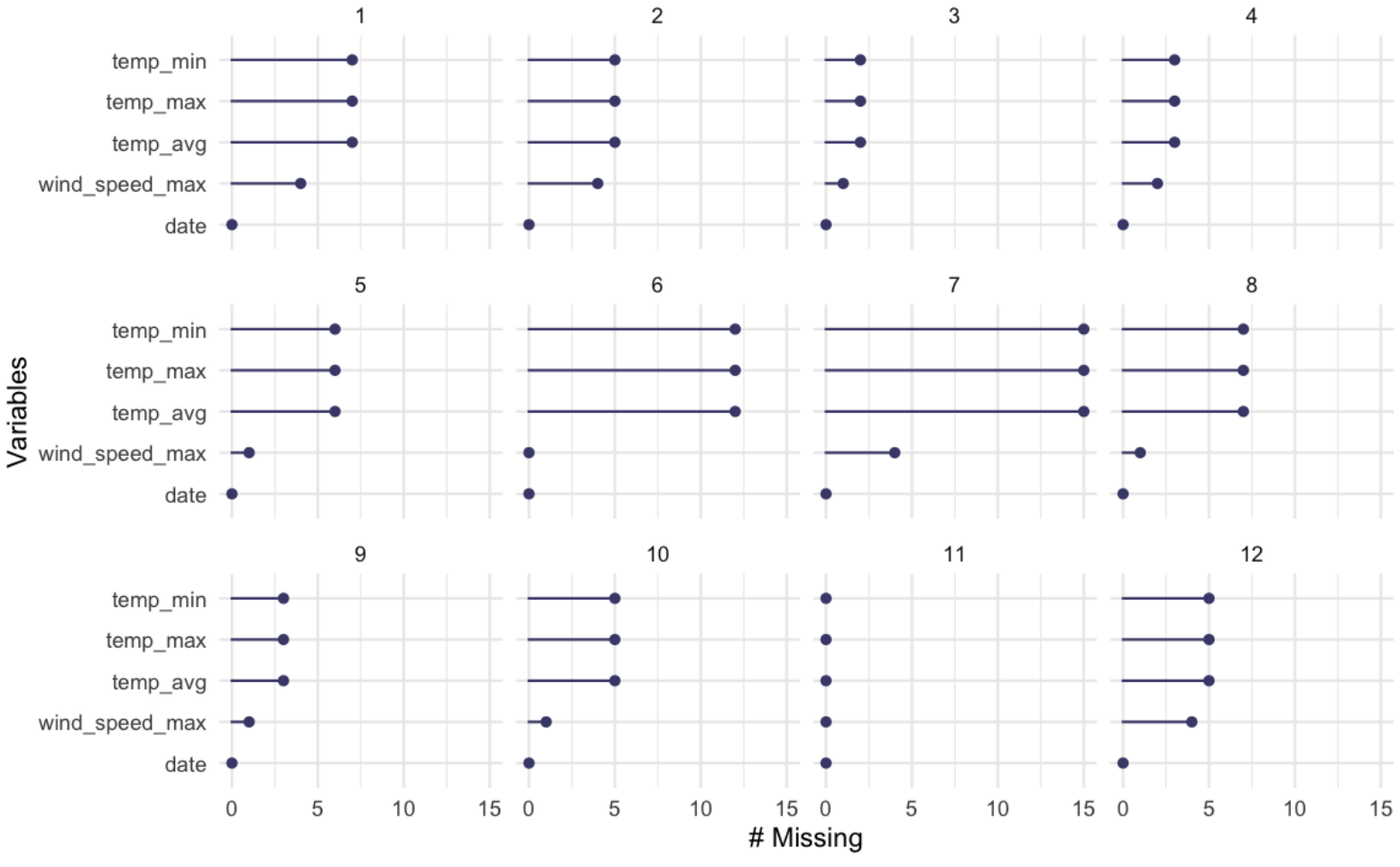
Look at missings in cases

```
gg_miss_case(dat_sf_clean)
```



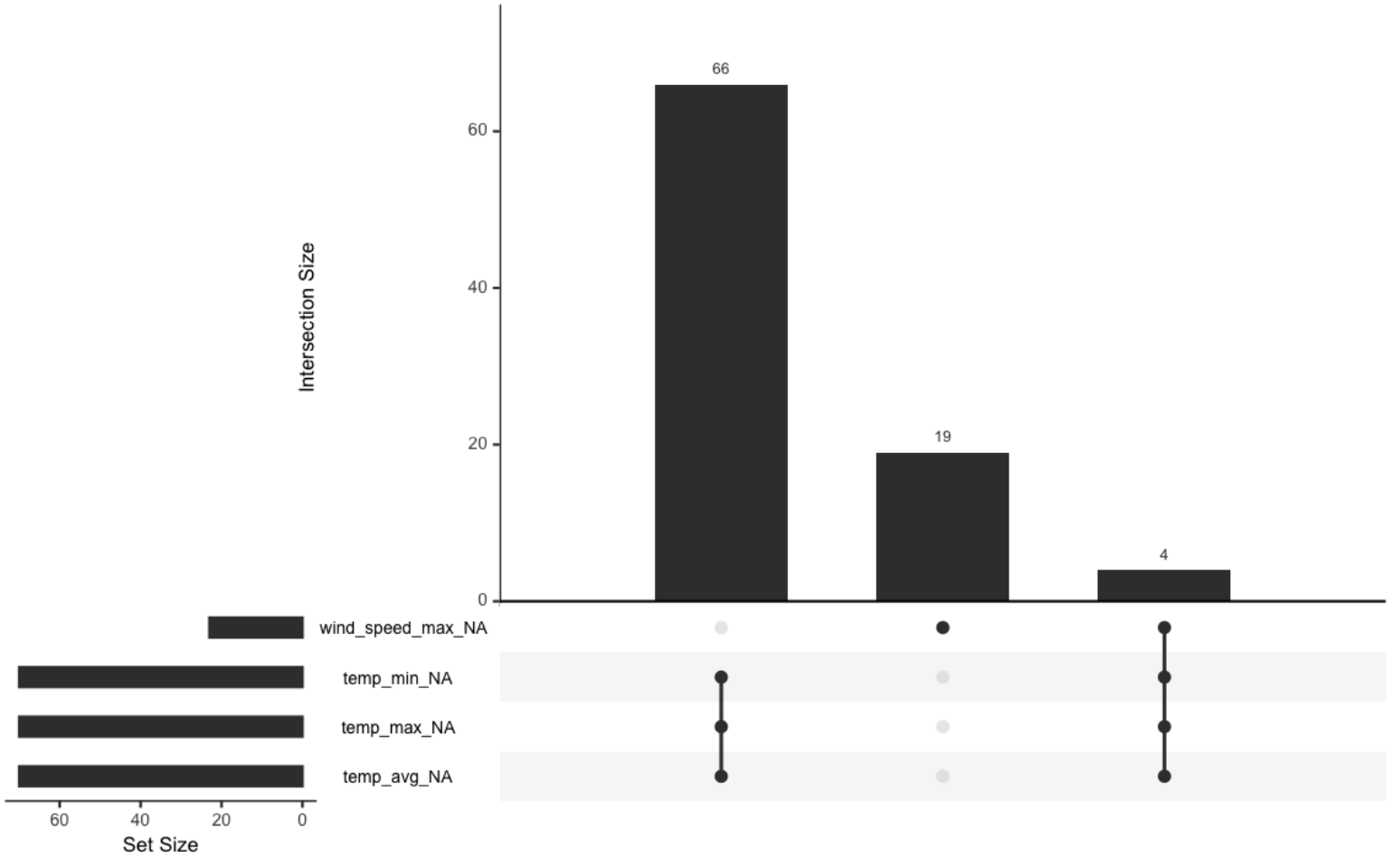
Look at missings in variables

```
gg_miss_var(dat_sf_clean, facet = month)
```



Visualizing missingness patterns

```
gg_miss_upset(dat_sf_clean)
```



Your Turn:

- lab quiz open (requires answering questions from Lab exercise)
- go to rstudio and finish final exercise

Resources

- R-miss-Tastic
- naniar
- visdat