Introduction to weathercan

Québec-Océan Students 2025

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Analysis and Data Tools for Science

Compiled: 2025-10-

Preamble

Online workshops can be challenging

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Consider keeping your video on (if possible)

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Interrupt me!

- Generally keep yourself muted but un-mute anytime to ask questions

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Ask Questions!

- Group trouble-shooting is really valuable
- If you have a problem, others may also (or may have it in the future)

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Ask Questions!

- Group trouble-shooting is really valuable
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Screen-sharing

- I may ask you to share your screen with the group (feel free to decline)
- For privacy, close your email etc. Or just share your RStudio window

Introductions

Me and my creatures

My garden

What about you?

- Name
- Background (Role, Area of study, etc.)
- Familiarity with R or Programming
- Creatures (furry, feathery, scaley, green or otherwise)?

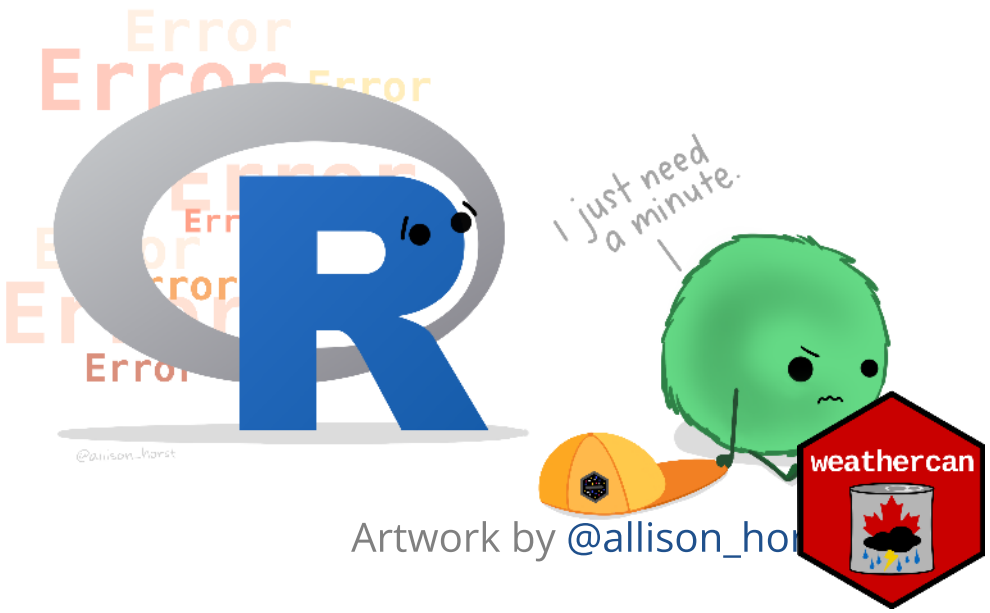
About this Workshop

Format

- I will provide you tools and workflow to get started with weathercan in R
- We'll have hands-on activities, lectures, and demonstrations

R is hard: But have no fear!

- Don't expect to remember everything!
- Copy/Paste is your friend (never apologize for using it!)
- Consider this workshop a resource to return to



Artwork by @allison_hor

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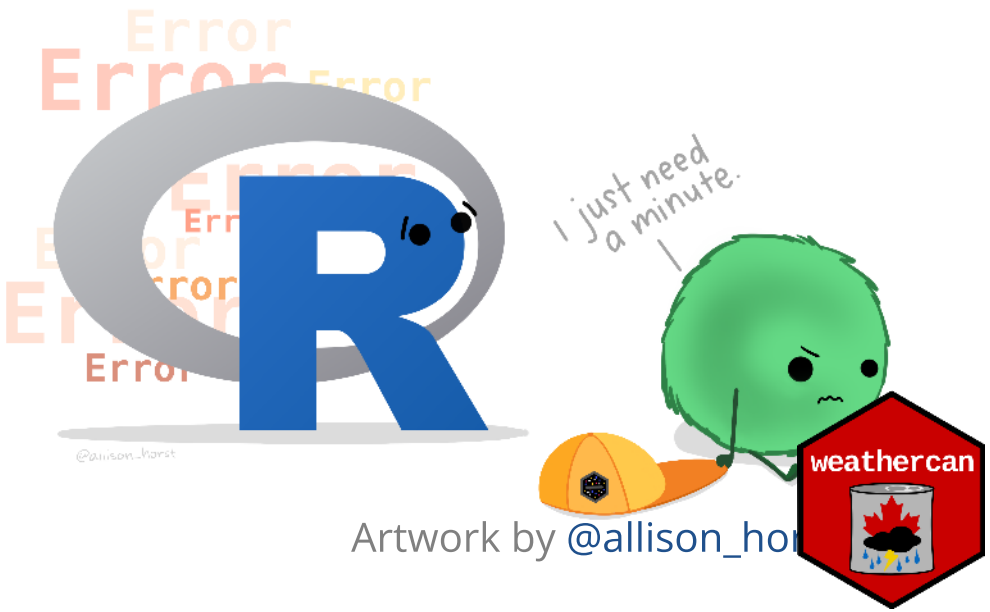


Artwork by @allison_hor

Getting Started

R is a Programming language

A programming **language** is a way to give instructions in order to get a computer to do something

- You need to know the language (i.e., the code)
- Computers don't know what you mean, only what you type (unfortunately)
- Spelling, punctuation, and capitalization all matter!

For example

R, what is 56 times 5.8?

```
56 * 5.8
```

```
[1] 324.8
```

Use code to tell R what to do

Use code to tell R what to do

R, what is the average of numbers 1, 2, 3, 4?

```
mean(c(1, 2, 3, 4))
```

```
[1] 2.5
```

Use code to tell R what to do

R, what is the average of numbers 1, 2, 3, 4?

```
mean(c(1, 2, 3, 4))
```

```
[1] 2.5
```

R, save this value for later

```
steffis_mean <- mean(c(1, 2, 3, 4))
```

Use code to tell R what to do

R, what is the average of numbers 1, 2, 3, 4?

```
mean(c(1, 2, 3, 4))
```

```
[1] 2.5
```

R, save this value for later

```
steffis_mean <- mean(c(1, 2, 3, 4))
```

R, multiply this value by 6

```
steffis_mean * 6
```

```
[1] 15
```

Some Terminology

Code, Output, Scripts

Code

- The actual commands

Output

- The result of running code or a script

Script

- A text file full of code that you want to run
- You should always keep your code in a script

For example:

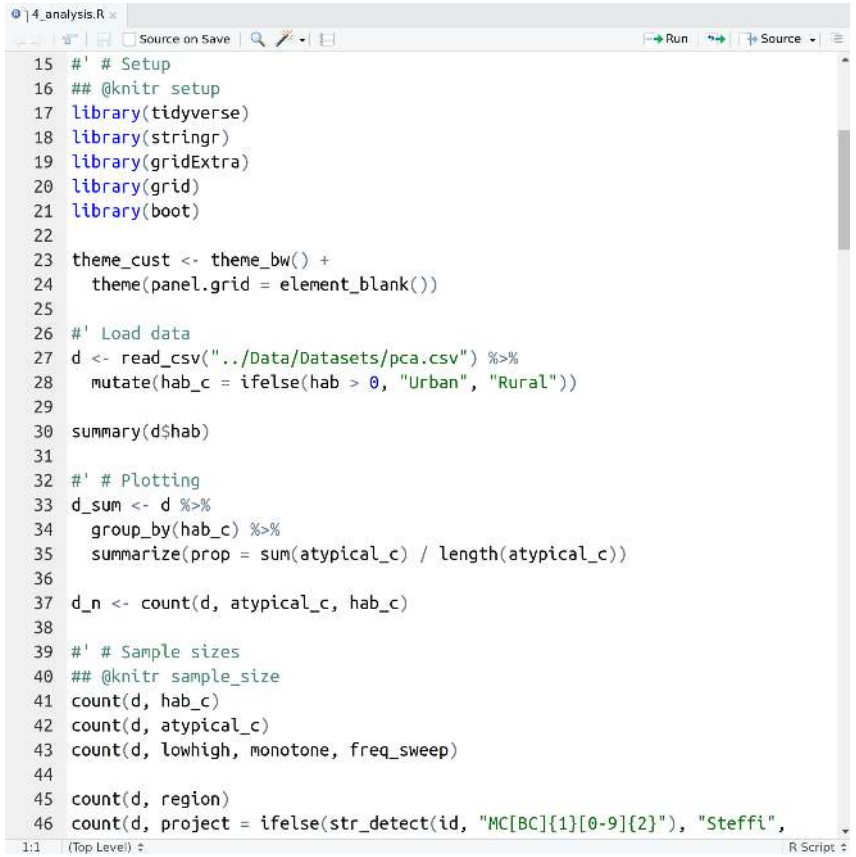
```
mean(c(1, 2, 3, 4))
```

Code

```
[1] 2.5
```

Output

Script



weathercan vs. WeatherCAN

weathercan

WeatherCAN

- **weathercan** is not **WeatherCAN**
- weathercan is an R package created by Steffi to access ECCC historical weather data
- WeatherCAN is an App created by ECCC for accessing current weather on your photo

We're using weathercan today

RStudio vs. R

RStudio

R

- **RStudio** is not **R**
- RStudio is a User Interface or IDE (integrated development environment)
  - (i.e., Makes coding simpler)

We're using both RStudio and R today

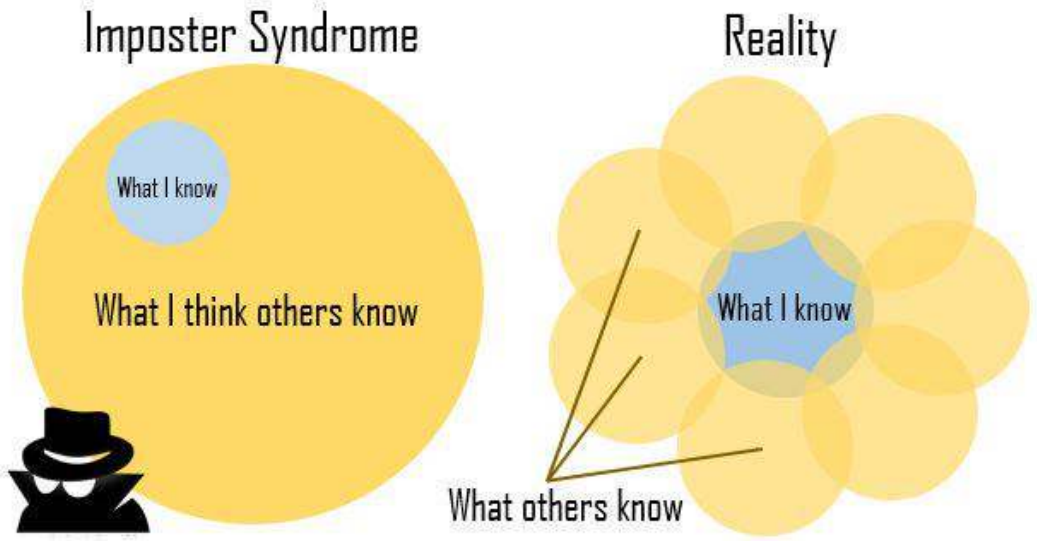
Open RStudio

ImpostR Syndrome

Impost  Syndrome

ImpostR Syndrome

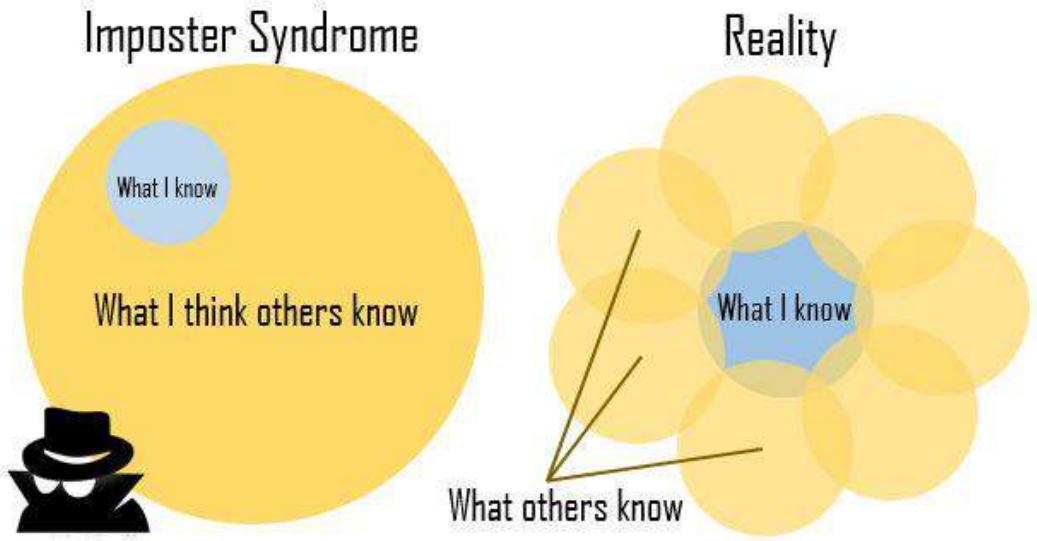
Impost R Syndrome



David Whittaker

ImpostR Syndrome

Impost R Syndrome

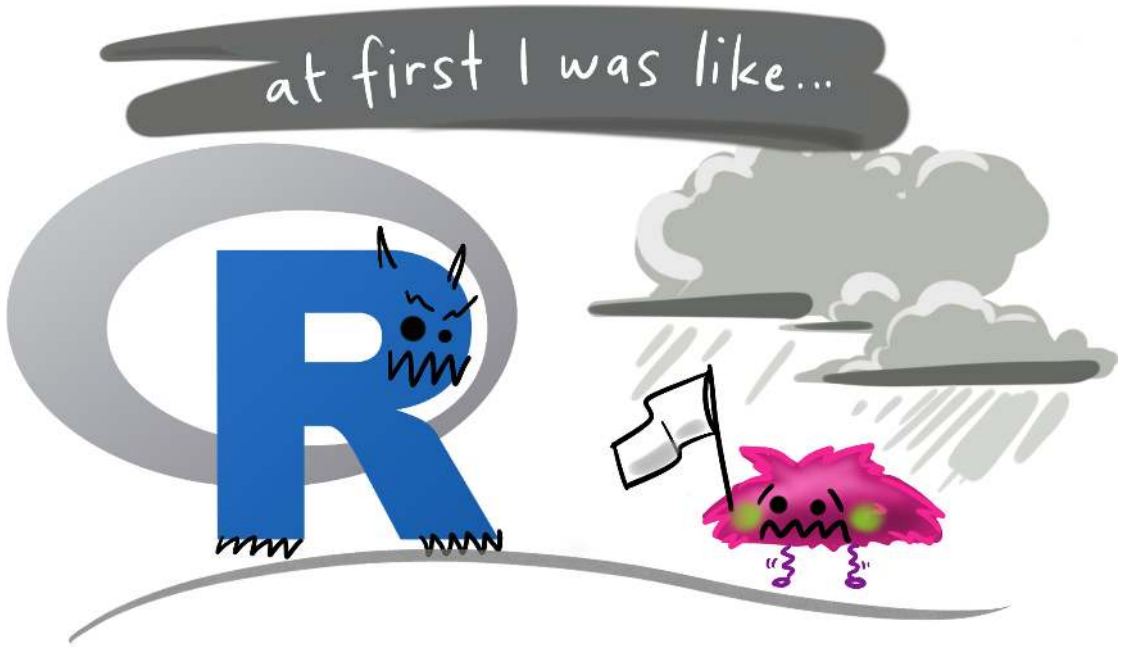


David Whittaker

Moral of the story?

Make friends, code in groups, learn together and don't beat yourself up

The Goal

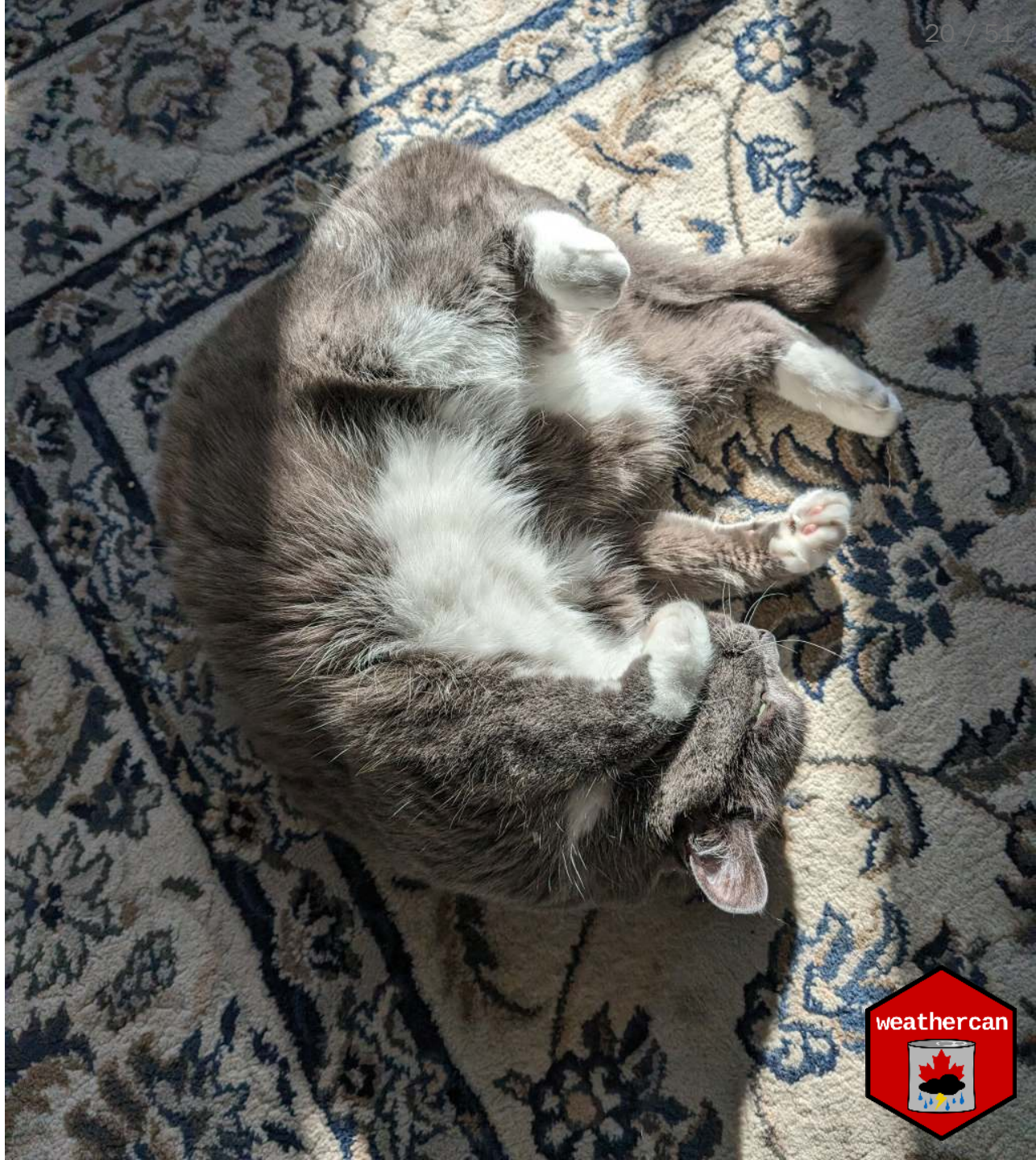


Artwork by @allison_hor

The Goal

Artwork by @allison_hor

weathercan



weathercan

What is weathercan?

- Peer-reviewed R package 🎉
- Bundle of functions for downloading ECCC historical weather data and normals

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Using weathercan in a nutshell

```
1 library(weathercan)                                          ①
2 stations()                                                   ②
3 stations_search("Brandon")                                   ③
4 w <- weather_dl("49909", start = "2025-09-01")               ④
5 n <- normals_dl("5010480")                                   ⑤
```

① Access weathercan functions with the `library()` function

② Use the `stations()` function to get a list of stations

③ OR use the `stations_search()` function to search for a station

④ Use `weather_dl()` to download recent data by *station_id*

⑤ Use `normals_dl()` to download climate normals by *climate_id*

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⑤ Use `normals_dl()` to download climate normals by *climate_id*

That's it! Workshop over 😁

Using weathercan

Understanding the functions - Documentation

- Online: https://docs.ropensci.org/weathercan
- In RStudio: `?weather_dl`

Citing weathercan

- Cite R and all R packages
- Cite *data* as ECCC historical weather data or Climate normals
- Cite weathercan as *access to data*

```
1 citation("weathercan")
```

```
To cite 'weathercan' in publications, please use:

  LaZerte, Stefanie E and Sam Albers (2018). weathercan: Download and format weather data from Environment
  and Climate Change Canada. The Journal of Open Source Software 3(22):571. doi:10.21105/joss.00571.

A BibTeX entry for LaTeX users is

  @Article{,
    title = {{weathercan}: {D}ownload and format weather data from Environment and Climate Change Canada},
    author = {Stefanie E LaZerte and Sam Albers},
```

Using weathercan

Understanding the data - Glossaries of terms

- Three glossaries with datasets in weathercan:
  - Flags, `flags`
  - Weather Terms and Units, `glossary`
  - Climate Normal Terms and Units, `glossary_normals`
- All from ECCC, sometimes best to go to the source!

```
1 flags
```

```
# A tibble: 16 × 2
   code    meaning
   <chr>   <chr>
 1 A       Accumulated
 2 B       More than one occurrence and estimated
 3 C       Precipitation occurred, amount uncertain
 4 D       Data subject to further quality control procedure
 5 E       Estimated
 6 F       Accumulated and estimated
 7 L       Precipitation may or may not have occurred
 8 M       Missing
 9 N       Temperature missing but known to be > 0
10 S       More than one occurrence
11 T       Trace
```

Stations

Where?

stations()

Included Data frame

```
1 library(weathercan)
2 stations()
```

```
# A tibble: 26,451 × 17
   prov  station_name        station_id climate_id WMO_id TC_id   lat   lon  elev tz        interval start   end normals
   <chr> <chr>                    <dbl> <chr>       <dbl> <chr> <dbl> <dbl> <dbl> <chr>     <chr>    <dbl> <dbl> <lgl>
 1 AB    DAYSLAND                  1795 301AR54        NA <NA>   52.9 -112.  689. Etc/GMT+7 day       1908  1922 FALSE
 2 AB    DAYSLAND                  1795 301AR54        NA <NA>   52.9 -112.  689. Etc/GMT+7 hour        NA    NA FALSE
 3 AB    DAYSLAND                  1795 301AR54        NA <NA>   52.9 -112.  689. Etc/GMT+7 month     1908  1922 FALSE
 4 AB    EDMONTON CORONATION       1796 301BK03        NA <NA>   53.6 -114.  671. Etc/GMT+7 day       1978  1979 FALSE
 5 AB    EDMONTON CORONATION       1796 301BK03        NA <NA>   53.6 -114.  671. Etc/GMT+7 hour        NA    NA FALSE
 6 AB    EDMONTON CORONATION       1796 301BK03        NA <NA>   53.6 -114.  671. Etc/GMT+7 month     1978  1979 FALSE
 7 AB    FLEET                     1797 301B6L0        NA <NA>   52.2 -112.  838. Etc/GMT+7 day       1987  1990 FALSE
 8 AB    FLEET                     1797 301B6L0        NA <NA>   52.2 -112.  838. Etc/GMT+7 hour        NA    NA FALSE
 9 AB    FLEET                     1797 301B6L0        NA <NA>   52.2 -112.  838. Etc/GMT+7 month     1987  1990 FALSE
10 AB    GOLDEN VALLEY             1798 301B8LR        NA <NA>   53.2 -110.  640  Etc/GMT+7 day       1987  1998 FALSE
# ℹ 26,441 more rows
# ℹ 3 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>
```

stations_dl()

Make sure it's up-to-date

```
1 stations_dl()
```

```
According to Environment Canada, Modified Date: 2025-10-08 23:30 UTC
```

```
Environment Canada Disclaimers:
"Station Inventory Disclaimer: Please note that this inventory list is a snapshot of stations on our website as of the
modified date, and may be subject to change without notice."
"Station ID Disclaimer: Station IDs are an internal index numbering system and may be subject to change without notice."
```

```
Stations data saved...
Use `stations()` to access most recent version and `stations_meta()` to see when this was last updated
```

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```

```
Stations data saved...
Use `stations()` to access most recent version and `stations_meta()` to see when this was last updated
```

```
1 stations_meta()
```

```
$ECCC_modified
[1] "2025-10-08 23:30:00 UTC"

$weathercan_modified
[1] "2025-10-27"
```

stations_search()

By name

```
1 stations_search(name = "Brandon")
```

```
# A tibble: 17 × 17
   prov  station_name          station_id climate_id WMO_id TC_id   lat    lon  elev tz     interval start   end normals
   <chr> <chr>                      <dbl> <chr>       <dbl> <chr> <dbl>  <dbl> <dbl> <chr>  <chr>    <dbl> <dbl> <lgl>
 1 MB    BRANDON #1 WINTER BAY       3474 5010498        NA <NA>   49.8 -100.0  396  Etc/G… day       1987  2002 FALSE
 2 MB    BRANDON #1 WINTER BAY       3474 5010498        NA <NA>   49.8 -100.0  396  Etc/G… month     1987  2002 FALSE
 3 MB    BRANDON A                   3471 5010480     71140 YBR    49.9 -100.0  409. Etc/G… day       1941  2012 TRUE
 4 MB    BRANDON A                   3471 5010480     71140 YBR    49.9 -100.0  409. Etc/G… hour      1958  2012 TRUE
 5 MB    BRANDON A                   3471 5010480     71140 YBR    49.9 -100.0  409. Etc/G… month     1941  2012 TRUE
 6 MB    BRANDON CDA                 3472 5010485        NA <NA>   49.9 -100.0  363. Etc/G… day       1890  2010 TRUE
 7 MB    BRANDON CDA                 3472 5010485        NA <NA>   49.9 -100.0  363. Etc/G… month     1890  2007 TRUE
 8 MB    BRANDON MUNI A             50821 5010481     71140 YBR    49.9 -100.0  409. Etc/G… day       2012  2025 TRUE
 9 MB    BRANDON MUNI A             50821 5010481     71140 YBR    49.9 -100.0  409. Etc/G… hour      2012  2025 TRUE
10 MB    BRANDON MUNI A             55738 5010482     71140 YBR    49.9 -100.0  409. Etc/G… day       2025  2025 FALSE
11 MB    BRANDON MUNI A             55738 5010482     71140 YBR    49.9 -100.0  409. Etc/G… hour      2025  2025 FALSE
12 MB    BRANDON RCS                49909 5010490     71136 PBO    49.9 -100.0  409. Etc/G… day       2012  2025 FALSE
13 MB    BRANDON RCS                49909 5010490     71136 PBO    49.9 -100.0  409. Etc/G… hour      2012  2025 FALSE
14 MB    BRANDON SOUTH               3473 5010494        NA <NA>   49.8 -100.0  396. Etc/G… day       1972  1975 FALSE
15 MB    BRANDON SOUTH               3473 5010494        NA <NA>   49.8 -100.0  396. Etc/G… month     1972  1975 FALSE
16 QC    ST GABRIEL DE BRANDON       5273 7017270        NA <NA>   46.3  -73.4  198. Etc/G… day       1919  1985 FALSE
17 QC    ST GABRIEL DE BRANDON       5273 7017270        NA <NA>   46.3  -73.4  198. Etc/G… month     1919  1985 FALSE
# ℹ 3 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>
```

stations_search()

By date and interval

```
stations_search(
  name = "Brandon",
  interval = "day",
  starts_latest = 2020,
  ends_earliest = 2025
)
```

```
# A tibble: 2 × 17
  prov  station_name   station_id climate_id WMO_id TC_id   lat    lon  elev tz        interval start   end normals
  <chr> <chr>               <dbl> <chr>       <dbl> <chr> <dbl>  <dbl> <dbl> <chr>     <chr>    <dbl> <dbl> <lgl>
1 MB    BRANDON MUNI A      50821 5010481     71140 YBR    49.9 -100.0  409. Etc/GMT+6 day       2012  2025 TRUE
2 MB    BRANDON RCS         49909 5010490     71136 PBO    49.9 -100.0  409. Etc/GMT+6 day       2012  2025 FALSE
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  prov  station_name   station_id climate_id WMO_id TC_id   lat    lon  elev tz        interval start   end normals
  <chr> <chr>               <dbl> <chr>       <dbl> <chr> <dbl>  <dbl> <dbl> <chr>     <chr>    <dbl> <dbl> <lgl>
1 MB    BRANDON MUNI A      50821 5010481     71140 YBR    49.9 -100.0  409. Etc/GMT+6 day       2012  2025 TRUE
2 MB    BRANDON RCS         49909 5010490     71136 PBO    49.9 -100.0  409. Etc/GMT+6 day       2012  2025 FALSE
# i 3 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>
```

Hmmm, that's a bit tough to read

Looking at tables

1. Use `glimpse()` from the dplyr package

```r
stations_search(
  name = "Brandon",
  interval = "day",
  starts_latest = 2020,
  ends_earliest = 2025
) |> dplyr::glimpse()
```

```
Rows: 2
Columns: 17
$ prov              <chr> "MB", "MB"
$ station_name      <chr> "BRANDON MUNI A", "BRANDON RCS"
$ station_id        <dbl> 50821, 49909
$ climate_id        <chr> "5010481", "5010490"
$ WMO_id            <dbl> 71140, 71136
$ TC_id             <chr> "YBR", "PBO"
$ lat               <dbl> 49.91, 49.90
$ lon               <dbl> -99.95, -99.95
$ elev              <dbl> 409.3, 409.4
$ tz                <chr> "Etc/GMT+6", "Etc/GMT+6"
$ interval          <chr> "day", "day"
$ start             <dbl> 2012, 2012
$ end               <dbl> 2025, 2025
$ normals           <lgl> TRUE, FALSE
$ normals_1991_2020 <lgl> TRUE, FALSE
$ normals_1981_2010 <lgl> FALSE, FALSE
$ normals_1971_2000 <lgl> FALSE, FALSE
```

Looking at tables

2. Save as an object and use RStudio's viewer

```
s <- stations_search(
  name = "Brandon",
  interval = "day",
  starts_latest = 2020,
  ends_earliest = 2025
)
```

After running this code, click on 's' in the Environment Pane

stations_search()

By distance

```
1 stations_search(coords = c(49.85, -99.91))
```

```
# A tibble: 15 × 18
   prov  station_name          station_id climate_id WMO_id TC_id   lat    lon  elev tz     interval start   end normals
   <chr> <chr>                      <dbl> <chr>       <dbl> <chr> <dbl>  <dbl> <dbl> <chr>  <chr>    <dbl> <dbl> <lgl>
 1 MB    BRANDON SOUTH               3473 5010494        NA <NA>   49.8 -100.0  396. Etc/G… day       1972  1975 FALSE
 2 MB    BRANDON SOUTH               3473 5010494        NA <NA>   49.8 -100.0  396. Etc/G… month     1972  1975 FALSE
 3 MB    BRANDON CDA                 3472 5010485        NA <NA>   49.9 -100.0  363. Etc/G… day       1890  2010 TRUE
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10 MB    BRANDON A                   3471 5010480     71140 YBR    49.9 -100.0  409. Etc/G… hour      1958  2012 TRUE
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15 MB    BRANDON MUNI A             55738 5010482     71140 YBR    49.9 -100.0  409. Etc/G… hour      2025  2025 FALSE
# ℹ 4 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>, distance <dbl>
```

stations_search()

Using dplyr package for advanced searching

```
 1 library(dplyr)
 2 library(stringr)
 3
 4 stations() |>
 5   filter(
 6     str_detect(station_name, "BRANDON"),
 7     interval == "day",
 8     start <= 2020,
 9     end >= 2025
10   )
```

```
# A tibble: 2 × 17
  prov  station_name   station_id climate_id WMO_id TC_id   lat    lon  elev tz        interval start   end normals
  <chr> <chr>               <dbl> <chr>       <dbl> <chr> <dbl>  <dbl> <dbl> <chr>     <chr>    <dbl> <dbl> <lgl>
1 MB    BRANDON RCS         49909 5010490     71136 PBO    49.9 -100.0  409. Etc/GMT+6 day       2012  2025 FALSE
2 MB    BRANDON MUNI A      50821 5010481     71140 YBR    49.9 -100.0  409. Etc/GMT+6 day       2012  2025 TRUE
# i 3 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>
```

We're not actually using `stations_search()` at all here

Your turn!

Locate a station of interest, take note of it's Station ID

(Feel free to locate several stations)

Weather

Historical hourly, daily, or monthly weather

weather_dl()

Find a station

```
stations_search("brandon", interval = "day")
```

```
# A tibble: 8 × 17
  prov  station_name          station_id climate_id WMO_id TC_id   lat    lon  elev tz      interval start   end normals
  <chr> <chr>                      <dbl> <chr>       <dbl> <chr> <dbl>  <dbl> <dbl> <chr>   <chr>    <dbl> <dbl> <lgl>
1 MB    BRANDON #1 WINTER BAY       3474 5010498        NA <NA>   49.8 -100.0  396  Etc/GM… day       1987  2002 FALSE
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6 MB    BRANDON RCS                49909 5010490     71136 PBO    49.9 -100.0  409. Etc/GM… day       2012  2025 FALSE
7 MB    BRANDON SOUTH               3473 5010494        NA <NA>   49.8 -100.0  396. Etc/GM… day       1972  1975 FALSE
8 QC    ST GABRIEL DE BRANDON       5273 7017270        NA <NA>   46.3  -73.4  198. Etc/GM… day       1919  1985 FALSE
# ℹ 3 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>
```

Now download the data

```
w <- weather_dl(station_id = 49909, interval = "day", start = "2025-01-01", end = "2025-08-31")
```

weathercan uses ‘caching’ and will only download this data once per session

What do we have?

```
1 w
```

```
# A tibble: 243 × 37
   station_name station_id station_operator prov    lat    lon  elev climate_id WMO_id TC_id date       year  month
   <chr>             <dbl> <lgl>            <chr> <dbl>  <dbl> <dbl> <chr>      <chr>  <chr> <date>     <chr> <chr>
 1 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-01 2025  01
 2 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-02 2025  01
 3 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-03 2025  01
 4 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-04 2025  01
 5 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-05 2025  01
 6 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-06 2025  01
 7 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-07 2025  01
 8 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-08 2025  01
 9 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-09 2025  01
10 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-10 2025  01
# ℹ 233 more rows
# ℹ 24 more variables: day <chr>, qual <chr>, cool_deg_days <dbl>, cool_deg_days_flag <chr>, dir_max_gust <dbl>,
#   dir_max_gust_flag <chr>, heat_deg_days <dbl>, heat_deg_days_flag <chr>, max_temp <dbl>, max_temp_flag <chr>,
#   mean_temp <dbl>, mean_temp_flag <chr>, min_temp <dbl>, min_temp_flag <chr>, snow_grnd <dbl>, snow_grnd_flag <chr>,
#   spd_max_gust <dbl>, spd_max_gust_flag <chr>, total_precip <dbl>, total_precip_flag <chr>, total_rain <dbl>,
#   total_rain_flag <chr>, total_snow <dbl>, total_snow_flag <chr>
```

What do we have?

```
1 w
```

```
# A tibble: 243 × 37
   station_name station_id station_operator prov    lat    lon  elev climate_id WMO_id TC_id date       year  month
   <chr>             <dbl> <lgl>            <chr> <dbl>  <dbl> <dbl> <chr>      <chr>  <chr> <date>     <chr> <chr>
 1 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-01 2025  01
 2 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-02 2025  01
 3 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-03 2025  01
 4 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-04 2025  01
 5 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-05 2025  01
 6 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-06 2025  01
 7 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-07 2025  01
 8 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-08 2025  01
 9 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-09 2025  01
10 BRANDON RCS       49909 NA               MB     49.9 -100.0  409. 5010490    71136  PBO   2025-01-10 2025  01
# ℹ 233 more rows
# ℹ 24 more variables: day <chr>, qual <chr>, cool_deg_days <dbl>, cool_deg_days_flag <chr>, dir_max_gust <dbl>,
#   dir_max_gust_flag <chr>, heat_deg_days <dbl>, heat_deg_days_flag <chr>, max_temp <dbl>, max_temp_flag <chr>,
#   mean_temp <dbl>, mean_temp_flag <chr>, min_temp <dbl>, min_temp_flag <chr>, snow_grnd <dbl>, snow_grnd_flag <chr>,
#   spd_max_gust <dbl>, spd_max_gust_flag <chr>, total_precip <dbl>, total_precip_flag <chr>, total_rain <dbl>,
#   total_rain_flag <chr>, total_snow <dbl>, total_snow_flag <chr>
```

A lot of stuff, apparently...

What do we have?

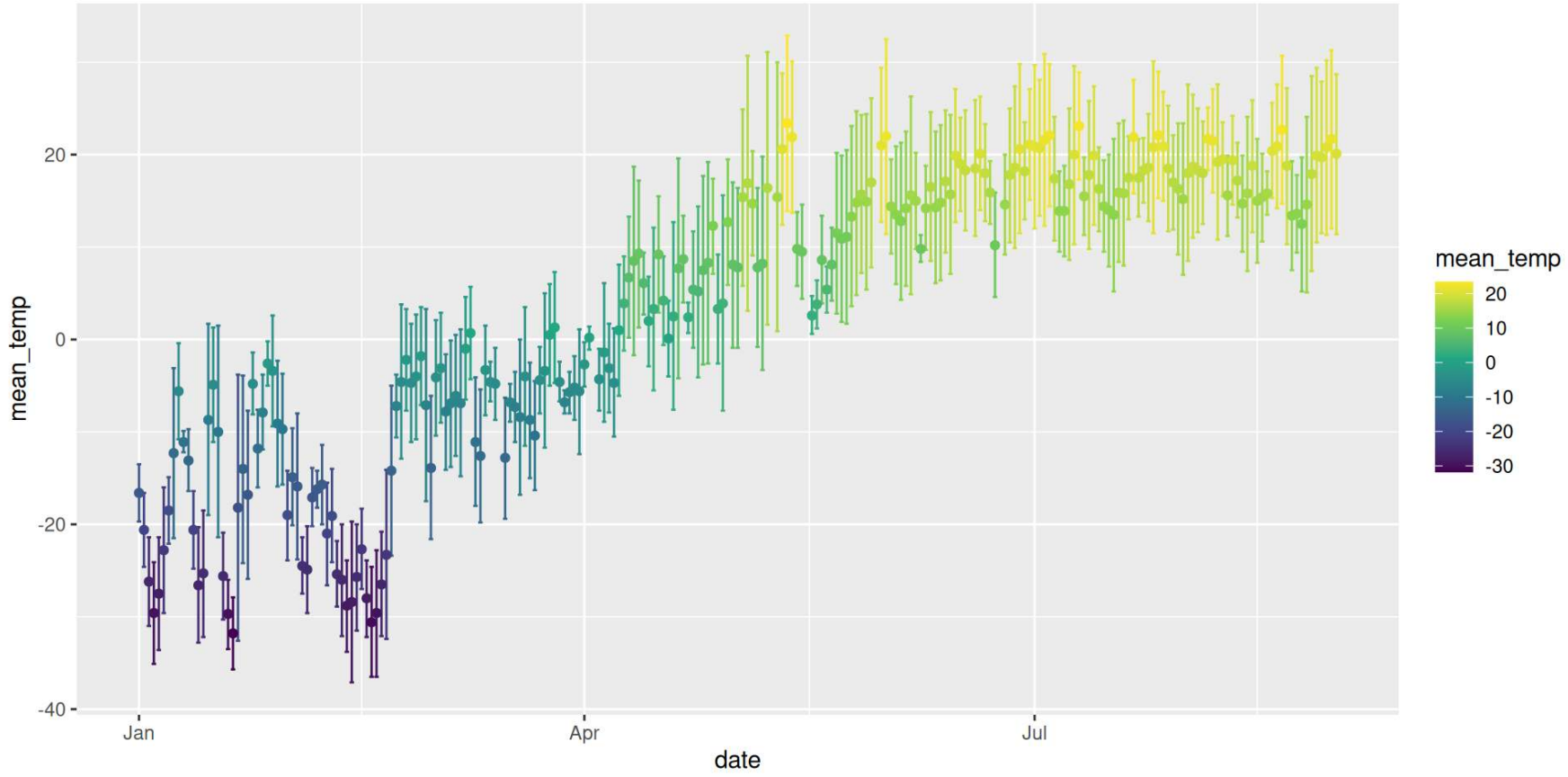
```r
skimr::skim(w)
```

```
SS Data Summary SSSSSSSSSSSSSSSSSSSSSSS
                           Values
Name                       w
Number of rows             243
Number of columns          37
_______________________
Column type frequency:
  character                20
  Date                     1
  logical                  1
  numeric                  15
________________________
Group variables            None

SS Variable type: character SSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSSS
   skim_variable      n_missing complete_rate min max empty n_unique whitespace
 1 station_name               0        1       11  11     0        1          0
 2 prov                       0        1        2   2     0        1          0
 3 climate_id                 0        1        7   7     0        1          0
 4 WMO_id                     0        1        5   5     0        1          0
 5 TC_id                      0        1        3   3     0        1          0
 6 year                       0        1        4   4     0        1          0
 7 month                      0        1        2   2     0        8          0
 8 day                        0        1        2   2     0       31          0
 9 qual                     243        0       NA  NA     0        0          0
10 cool_deg_days_flag       236        0.0288   1   1     0        1          0
11 dir_max_gust_flag        236        0.0288   1   1     0        1          0
12 heat_deg_days_flag       236        0.0288   1   1     0        1          0
13 max_temp_flag            236        0.0288   1   1     0        1          0
14 mean_temp_flag           236        0.0288   1   1     0        1          0
15 min_temp_flag            236        0.0288   1   1     0        1          0
16 snow_grnd_flag           243        0       NA  NA     0        0          0
```

What do we have?

```
1 library(ggplot2)
2 ggplot(data = w, aes(x = date, colour = mean_temp)) +
3   scale_color_viridis_c() +
4   geom_errorbar(aes(ymin = min_temp, ymax = max_temp)) +
5   geom_point(aes(y = mean_temp))
```



weather_dl()

Multiple stations at once

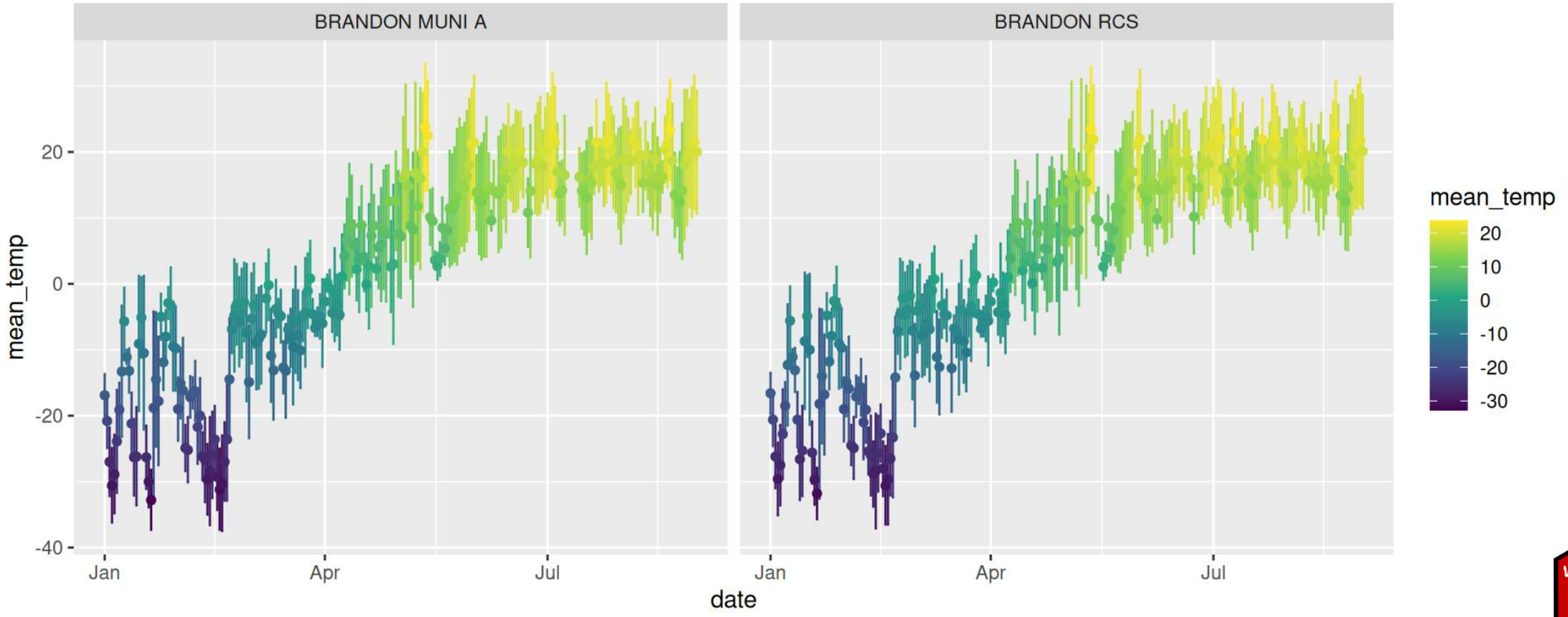
```
1 s <- stations_search("Brandon", interval = "day")
2 w <- weather_dl(station_id = s$station_id, interval = "day", start = "2025-01-01", end = "2025-08-31")
```

```
There are no data for some stations (3474, 3471, 3472, 3473, 5273), in this time range (2025-01-01 to 2025-08-31), for this
interval (day)
Available Station Data:
# A tibble: 11 × 17
   prov  station_name          station_id climate_id WMO_id TC_id   lat    lon  elev tz     interval start   end normals
   <chr> <chr>                      <dbl> <chr>       <dbl> <chr> <dbl>  <dbl> <dbl> <chr>  <chr>    <dbl> <dbl> <lgl>
 1 MB    BRANDON A                   3471 5010480     71140 YBR    49.9 -100.0  409. Etc/G… day       1941  2012 TRUE
 2 MB    BRANDON A                   3471 5010480     71140 YBR    49.9 -100.0  409. Etc/G… hour      1958  2012 TRUE
 3 MB    BRANDON A                   3471 5010480     71140 YBR    49.9 -100.0  409. Etc/G… month     1941  2012 TRUE
 4 MB    BRANDON CDA                 3472 5010485        NA <NA>   49.9 -100.0  363. Etc/G… day       1890  2010 TRUE
 5 MB    BRANDON CDA                 3472 5010485        NA <NA>   49.9 -100.0  363. Etc/G… month     1890  2007 TRUE
 6 MB    BRANDON SOUTH               3473 5010494        NA <NA>   49.8 -100.0  396. Etc/G… day       1972  1975 FALSE
 7 MB    BRANDON SOUTH               3473 5010494        NA <NA>   49.8 -100.0  396. Etc/G… month     1972  1975 FALSE
 8 MB    BRANDON #1 WINTER BAY       3474 5010498        NA <NA>   49.8 -100.0  396  Etc/G… day       1987  2002 FALSE
 9 MB    BRANDON #1 WINTER BAY       3474 5010498        NA <NA>   49.8 -100.0  396  Etc/G… month     1987  2002 FALSE
10 QC    ST GABRIEL DE BRANDON       5273 7017270        NA <NA>   46.3  -73.4  198. Etc/G… day       1919  1985 FALSE
11 QC    ST GABRIEL DE BRANDON       5273 7017270        NA <NA>   46.3  -73.4  198. Etc/G… month     1919  1985 FALSE
# ℹ 3 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>
```

Some stations don't have data in this time range (makes sense if you look at their start/end ranges)

What do we have?

```
ggplot(data = w, aes(x = date, colour = mean_temp)) +
  scale_color_viridis_c() +
  geom_errorbar(aes(ymin = min_temp, ymax = max_temp)) +
  geom_point(aes(y = mean_temp))  +
  facet_wrap(~ station_name)
```



Your turn!

Download some data for your station(s).

Take a look at them!

Normals

Climate normals and averages calculated by ECCC for 30-year periods

normals_dl()

Find station

```
1 stations_search("brandon", normals_years = "current")
```

```
The most current normals available for download by weathercan are '1981-2010'
```

```
# A tibble: 5 × 17
  prov  station_name station_id climate_id WMO_id TC_id   lat    lon  elev tz        interval start   end normals
  <chr> <chr>             <dbl> <chr>       <dbl> <chr> <dbl>  <dbl> <dbl> <chr>     <chr>    <dbl> <dbl> <lgl>
1 MB    BRANDON A          3471 5010480     71140 YBR    49.9 -100.0  409. Etc/GMT+6 day       1941  2012 TRUE
2 MB    BRANDON A          3471 5010480     71140 YBR    49.9 -100.0  409. Etc/GMT+6 hour      1958  2012 TRUE
3 MB    BRANDON A          3471 5010480     71140 YBR    49.9 -100.0  409. Etc/GMT+6 month     1941  2012 TRUE
4 MB    BRANDON CDA        3472 5010485        NA <NA>   49.9 -100.0  363. Etc/GMT+6 day       1890  2010 TRUE
5 MB    BRANDON CDA        3472 5010485        NA <NA>   49.9 -100.0  363. Etc/GMT+6 month     1890  2007 TRUE
# ℹ 3 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>
```

Now download the data

```
1 n <- normals_dl(climate_id = "5010480")  # Note: climate_id!!
```

'current' may not be what you think it is...
Run `?stations_search` or `?normals_dl` and look at the details of `normals_years`...

What do we have?

```
1 n
```

```
# A tibble: 1 × 7
  prov  station_name climate_id normals_years meets_wmo normals             frost
  <chr> <chr>        <chr>      <chr>         <lgl>     <list>              <list>
1 MB    BRANDON A    5010480    1981-2010     TRUE      <tibble [13 × 197]> <tibble [7 × 8]>
```

Oh weird! 'tibble's in the columns?

What do we have?

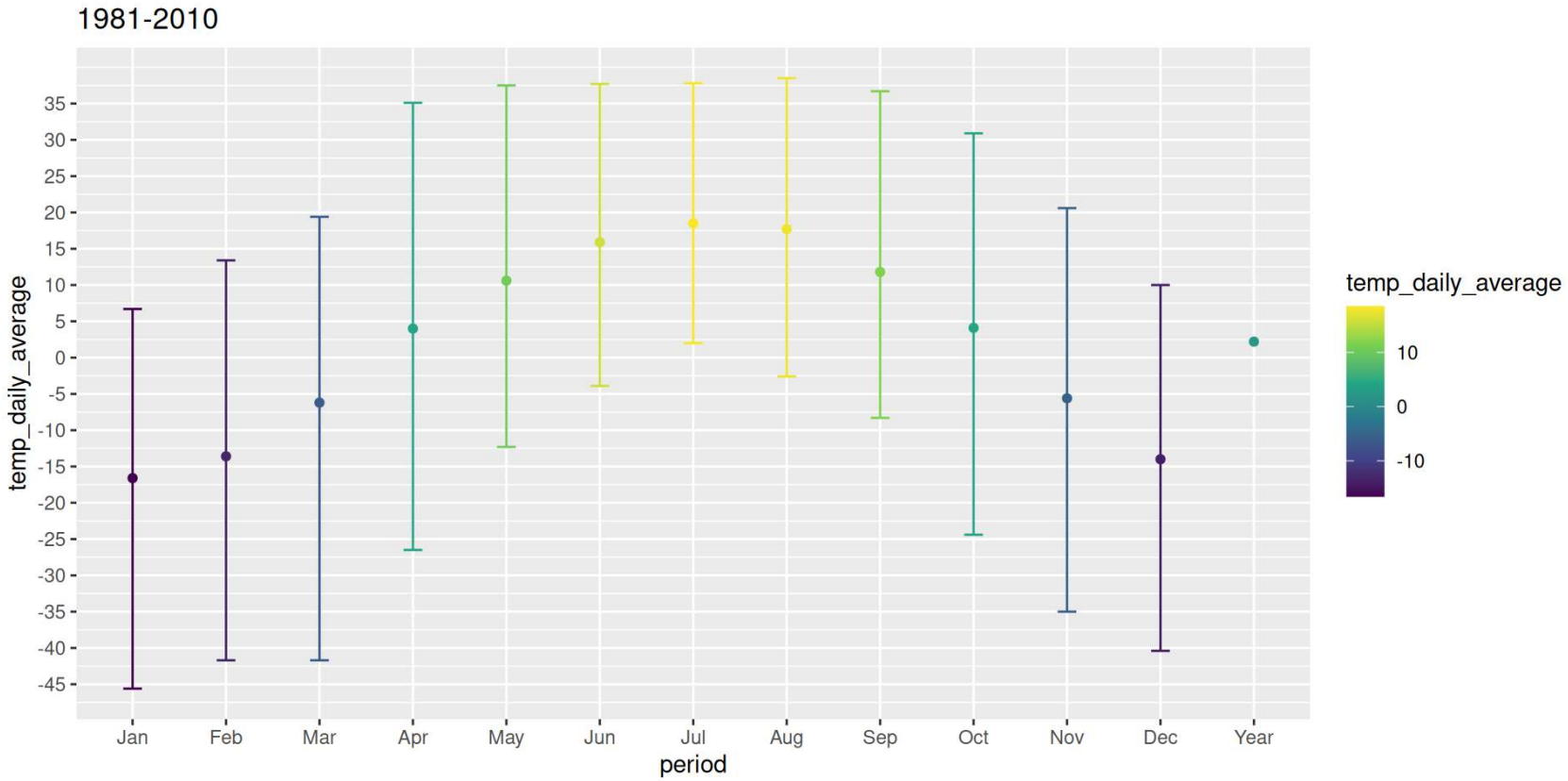
Because weather normals data are so different from frost normals data, they are separate data frames.

```
normals <- tidyr::unnest(n, "normals")
frost <- tidyr::unnest(n, "frost")
normals
```

```
# A tibble: 13 × 203
   prov  station_name climate_id normals_years meets_wmo period temp_daily_average temp_daily_average_code temp_sd
   <chr> <chr>        <chr>      <chr>         <lgl>     <fct>               <dbl> <chr>                       <dbl>
 1 MB    BRANDON A    5010480    1981-2010     TRUE      Jan                 -16.6 A                             4.2
 2 MB    BRANDON A    5010480    1981-2010     TRUE      Feb                 -13.6 A                             4
 3 MB    BRANDON A    5010480    1981-2010     TRUE      Mar                  -6.2 A                             3.2
 4 MB    BRANDON A    5010480    1981-2010     TRUE      Apr                   4   A                             2.4
 5 MB    BRANDON A    5010480    1981-2010     TRUE      May                  10.6 A                             1.8
 6 MB    BRANDON A    5010480    1981-2010     TRUE      Jun                  15.9 A                             1.8
 7 MB    BRANDON A    5010480    1981-2010     TRUE      Jul                  18.5 A                             1.4
 8 MB    BRANDON A    5010480    1981-2010     TRUE      Aug                  17.7 A                             1.8
 9 MB    BRANDON A    5010480    1981-2010     TRUE      Sep                  11.8 A                             1.6
10 MB    BRANDON A    5010480    1981-2010     TRUE      Oct                   4.1 A                             1.8
11 MB    BRANDON A    5010480    1981-2010     TRUE      Nov                  -5.6 A                             3.6
12 MB    BRANDON A    5010480    1981-2010     TRUE      Dec                 -14   A                             4.2
13 MB    BRANDON A    5010480    1981-2010     TRUE      Year                  2.2 A                             1.1
# ℹ 194 more variables: temp_sd_code <chr>, temp_daily_max <dbl>, temp_daily_max_code <chr>, temp_daily_min <dbl>,
#   temp_daily_min_code <chr>, temp_extreme_max <dbl>, temp_extreme_max_code <chr>, temp_extreme_max_date <date>,
#   temp_extreme_max_date_code <chr>, temp_extreme_min <dbl>, temp_extreme_min_code <chr>,
#   temp_extreme_min_date <date>, temp_extreme_min_date_code <chr>, rain <dbl>, rain_code <chr>, snow <dbl>,
#   snow_code <chr>, precip <dbl>, precip_code <chr>, snow_mean_depth <dbl>, snow_mean_depth_code <chr>,
```

What do we have?

```
ggplot(data = normals, aes(x = period, colour = temp_daily_average)) +
  geom_errorbar(aes(ymin = temp_extreme_min, ymax = temp_extreme_max), width = 0.2) +
  geom_point(aes(y = temp_daily_average)) +
  scale_colour_viridis_c() +
  scale_y_continuous(breaks = seq(-50, 35, 5)) +
  labs(title = normals$normals_years[1])
```



In Conclusion...

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- Check weathercan Documentation
- Cite all R packages
- ECCC is your source of truth
  - Climate Normals Technical documentation (EN | FR)
  - ECCC Glossary (EN | FR)

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Thank you!

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Troubleshooting

No Data!

```
1 w <- weather_dl(station_id = 5256, interval = "day", start = "1950-07-01", end = "1951-08-31")
```

```
There are no data for station 5256, in this time range (1950-07-01 to 1951-08-31), for this interval (day),
Available Station Data:
# A tibble: 2 × 17
  prov  station_name        station_id climate_id WMO_id TC_id   lat   lon  elev tz        interval start   end normals
  <chr> <chr>                    <dbl> <chr>       <dbl> <chr> <dbl> <dbl> <dbl> <chr>     <chr>    <dbl> <dbl> <lgl>
1 QC    ST ALEXIS DES MONTS       5256 7016816        NA <NA>   46.5 -73.2   183 Etc/GMT+5 day       1963  2025 TRUE
2 QC    ST ALEXIS DES MONTS       5256 7016816        NA <NA>   46.5 -73.2   183 Etc/GMT+5 month     1963  2018 TRUE
# i 3 more variables: normals_1991_2020 <lgl>, normals_1981_2010 <lgl>, normals_1971_2000 <lgl>
```

- Check the date range
- Check the interval
- Check for ‘replacement’ stations
  - Stations near by that start up after your station

```
# A tibble: 6 × 18
  prov  station_name            station_id climate_id WMO_id TC_id   lat   lon  elev tz     interval start   end normals
  <chr> <chr>                        <dbl> <chr>       <dbl> <chr> <dbl> <dbl> <dbl> <chr>  <chr>    <dbl> <dbl> <lgl>
1 QC    ST ALEXIS DES MONTS           5256 7016816        NA <NA>   46.5 -73.2  183  Etc/G… day       1963  2025 TRUE
2 QC    ST ALEXIS DES MONTS           5256 7016816        NA <NA>   46.5 -73.2  183  Etc/G… month     1963  2018 TRUE
3 QC    ST PAULIN                     5282 7017640        NA <NA>   46.4 -73.0  167  Etc/G… day       1950  1991 TRUE
4 QC    ST PAULIN                     5282 7017640        NA <NA>   46.4 -73.0  167  Etc/G… month     1951  1991 TRUE
5 QC    ST CHARLES MANDEVILLE 2       5263 7016981        NA <NA>   46.4 -73.4  174. Etc/G… day       1968  1970 FALSE
6 QC    ST CHARLES MANDEVILLE 2       5263 7016981        NA <NA>   46.4 -73.4  174. Etc/G… month     1968  1970 FALSE
```

Map

```
library(mapview)
library(sf)

# Our point of interest
# lat, lon = 49.85, -99.91

# Get local stations
s <- stations_search(
  coords = c(49.85, -99.91), interval = "day",
  starts_latest = 2020,
  ends_earliest = 2020) |>  # lat, lon
  st_as_sf(coords = c("lon", "lat"), crs = 4326)

p <- st_sfc(st_point(c(-99.91, 49.85)), crs = 4326)

# Interactive map of the stations with reference to
mapview(s, zcol = "distance") + mapview(p, col.regi
```