SOK-1005-Assignment1

30 | Casper Andresen

```r
rm(list=ls())

library(tidyverse)
```

```
-- Attaching packages --------------------------------------- tidyverse 1.3.2 --
v ggplot2 3.4.0      v purrr   0.3.4
v tibble  3.1.8      v dplyr   1.0.10
v tidyr   1.2.1      v stringr 1.4.1
v readr   2.1.2      v forcats 0.5.2

Warning: package 'ggplot2' was built under R version 4.2.2

-- Conflicts --------------------------------------- tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
```

```r
library(lubridate)
```

```
Attaching package: 'lubridate'

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

    date, intersect, setdiff, union
```

Importing the data

```r
df_lt <- read_table("http://vortex.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt")
```

```
Warning: Duplicated column names deduplicated: 'Land' => 'Land_1' [7], 'Ocean'
=> 'Ocean_1' [8], 'Land' => 'Land_2' [10], 'Ocean' => 'Ocean_2' [11], 'Land' =>
'Land_3' [13], 'Ocean' => 'Ocean_3' [14], 'Land' => 'Land_4' [16], 'Ocean' =>
'Ocean_4' [17], 'Land' => 'Land_5' [19], 'Ocean' => 'Ocean_5' [20], 'Land' =>
'Land_6' [22], 'Ocean' => 'Ocean_6' [23], 'Land' => 'Land_7' [25], 'Ocean' =>
'Ocean_7' [26]


-- Column specification ------------------------------------------------------
cols(
  .default = col_character()
)
i Use `spec()` for the full column specifications.


Warning: 11 parsing failures.
row col    expected       actual
532  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.t
533  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.t
534  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.t
535  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.t
536  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.t
... ... .......... .......... ..............................................................
See problems(...) for more details.
```

```r
  df_mt <- read_table("http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.txt")
```

```
Warning: Duplicated column names deduplicated: 'Land' => 'Land_1' [7], 'Ocean'
=> 'Ocean_1' [8], 'Land' => 'Land_2' [10], 'Ocean' => 'Ocean_2' [11], 'Land' =>
'Land_3' [13], 'Ocean' => 'Ocean_3' [14], 'Land' => 'Land_4' [16], 'Ocean' =>
'Ocean_4' [17], 'Land' => 'Land_5' [19], 'Ocean' => 'Ocean_5' [20], 'Land' =>
'Land_6' [22], 'Ocean' => 'Ocean_6' [23], 'Land' => 'Land_7' [25], 'Ocean' =>
'Ocean_7' [26]


-- Column specification ------------------------------------------------------
cols(
  .default = col_character()
)
i Use `spec()` for the full column specifications.
```

```
Warning: 11 parsing failures.
row col   expected     actual                                                              
532  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.
533  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.
534  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.
535  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.
536  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.
... ... .......... .......... .................................................................
See problems(...) for more details.
```

```r
df_t <- read_table("http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.txt")
```

```
Warning: Duplicated column names deduplicated: 'Land' => 'Land_1' [7], 'Ocean'
=> 'Ocean_1' [8], 'Land' => 'Land_2' [10], 'Ocean' => 'Ocean_2' [11], 'Land' =>
'Land_3' [13], 'Ocean' => 'Ocean_3' [14], 'Land' => 'Land_4' [16], 'Ocean' =>
'Ocean_4' [17], 'Land' => 'Land_5' [19], 'Ocean' => 'Ocean_5' [20], 'Land' =>
'Land_6' [22], 'Ocean' => 'Ocean_6' [23], 'Land' => 'Land_7' [25], 'Ocean' =>
'Ocean_7' [26]
```

```
-- Column specification ---------------------------------------------------------
cols(
  .default = col_character()
)
i Use `spec()` for the full column specifications.
```

```
Warning: 11 parsing failures.
row col   expected     actual                                                              
532  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.
533  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.
534  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.
535  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.
536  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.
... ... .......... .......... .................................................................
See problems(...) for more details.
```

```r
df_ls <- read_table("http://vortex.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.txt")
```

```
Warning: Duplicated column names deduplicated: 'Land' => 'Land_1' [7], 'Ocean'
=> 'Ocean_1' [8], 'Land' => 'Land_2' [10], 'Ocean' => 'Ocean_2' [11], 'Land' =>
'Land_3' [13], 'Ocean' => 'Ocean_3' [14], 'Land' => 'Land_4' [16], 'Ocean' =>
'Ocean_4' [17], 'Land' => 'Land_5' [19], 'Ocean' => 'Ocean_5' [20], 'Land' =>
'Land_6' [22], 'Ocean' => 'Ocean_6' [23], 'Land' => 'Land_7' [25], 'Ocean' =>
'Ocean_7' [26]


-- Column specification --------------------------------------------------------
cols(
  .default = col_character()
)
i Use `spec()` for the full column specifications.

Warning: 13 parsing failures.
row col   expected      actual                                                                  :
504  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.t
519  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.t
532  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.t
533  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.t
534  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.t
... ... .......... .......... ....................................................................
See problems(...) for more details.
```

Removing unwanted bottom text

```
df_lt <- df_lt[1:which(df_lt$Year %in% "Year")-1, ]
df_mt <- df_mt[1:which(df_mt$Year %in% "Year")-1, ]
df_t <- df_t[1:which(df_t$Year %in% "Year")-1, ]
df_ls <- df_ls[1:which(df_ls$Year %in% "Year")-1, ]
```

Combinding the globe column in each dataframe into a new dataframe and changing them to
numeric

```
df_global <- cbind(df_lt$Globe, df_mt$Globe, df_t$Globe, df_ls$Globe)
df_global <- as.data.frame(df_global)

df_global <- df_global %>%
  rename(lt = V1) %>%
  rename(mt = V2) %>%
  rename(t = V3) %>%
  rename(ls = V4)
```

```r
df_global <- df_global %>%
  mutate_at(vars(lt, mt, t, ls), ~as.numeric(.))
```

Creating a Data variable using the year and month variable from the df_lt dataframe, then move it to the front

```r
df_global <- df_global %>%
  select(lt, mt, t, ls) %>%
  mutate(Date = ymd(paste(df_lt$Year, df_lt$Mo, 1, sep="-"))) %>%
  relocate(Date)
```

Calculating the rolling mean, filter out the dates I want

```r
df_global <- df_global %>%
  mutate(average_lt = zoo::rollmean(lt, 13, na.pad = TRUE, align = "right")) %>%
  mutate(average_mt = zoo::rollmean(mt, 13, na.pad = TRUE, align = "right")) %>%
  mutate(average_t = zoo::rollmean(t, 13, na.pad = TRUE, align = "right")) %>%
  mutate(average_ls = zoo::rollmean(ls, 13, na.pad = TRUE, align = "right")) %>%
  filter(between(Date, as.Date("1980-1-1"), as.Date("2022-12-1")))
```

Putting it in a tall format so I can plot them all together

```r
df_tall <- df_global %>%
  select(Date, average_lt, average_mt, average_t, average_ls) %>%
  pivot_longer(-Date, names_to = "Location", values_to = "Temp")
```

Drawing the figure

```r
df_tall %>%
  ggplot(aes(x=Date, y=Temp, color=Location)) +
  geom_line() +
  labs(title = "Average temperature over time", subtitle = "Rolling average in the lower l
  ylab("Global Temperature") + xlab("Year") +
  scale_color_discrete(labels=c("Lower Troposphere", "Mid-Troposphere", "Tropopause", "Low
  geom_smooth(method = lm, se = FALSE)
```

`geom_smooth()` using formula = 'y ~ x'

5

Average temperature over time

Rolling average in the lower layers of the atmosphere. 1980 – 2022