

SOK-1005-assignment-1

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First step: Clear the sheet and load necessary packages.

```
#removing all previous data to start on a clean sheet.
```

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

```
#loading necessary packages
```

```
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  1.0.9
v tidyr   1.2.0      v stringr 1.4.0
v readr   2.1.2      v forcats 0.5.1
-- Conflicts ----- tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()     masks stats::lag()
```

```
library(dplyr)
```

```
library(zoo)
```

Attaching package: 'zoo'

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

```
as.Date, as.Date.numeric
```

```
library(lubridate)
```

Attaching package: 'lubridate'

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

```
date, intersect, setdiff, union
```

Second step: Downloading the necessary data to answer the assignment.

```
#downloading Lower-Troposphere data
```

```
df_lower <- read_table2("https://www.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt")
```

Warning: `read_table2()` was deprecated in readr 2.0.0.
i Please use `read_table()` instead.

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 | file |
|-----|-----|------------|------------|--|
| 532 | -- | 29 columns | 1 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt' |
| 533 | -- | 29 columns | 28 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt' |
| 534 | -- | 29 columns | 1 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt' |
| 535 | -- | 29 columns | 7 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt' |
| 536 | -- | 29 columns | 7 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt' |
| ... | ... | ... | ... | ... |

See problems(...) for more details.

```
#downloading Mid-Troposphere data
```

```
df_mid <- read_table2("https://www.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 'https://www.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.tx
533 -- 29 columns 28 columns 'https://www.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.tx
534 -- 29 columns 1 columns 'https://www.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.tx
535 -- 29 columns 7 columns 'https://www.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.tx
536 -- 29 columns 7 columns 'https://www.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.tx
... ..
See problems(...) for more details.
```

```
#downloading Tropopause data
```

```
df_trop <- read_table2("https://www.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 | file |
|-----|---------------|------------|---|------|
| 532 | -- 29 columns | 1 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.tx' | |
| 533 | -- 29 columns | 28 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.tx' | |
| 534 | -- 29 columns | 1 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.tx' | |
| 535 | -- 29 columns | 7 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.tx' | |
| 536 | -- 29 columns | 7 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.tx' | |
| ... | ... | ... | ... | ... |

See problems(...) for more details.

```
#downloading Lower-Stratosphere data
```

```
df_lower_strat <- read_table2("https://www.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.tx")
```

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 | file |
|-----|---------------|------------|---|------|
| 504 | -- 29 columns | 28 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.tx' | |
| 519 | -- 29 columns | 28 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.tx' | |
| 532 | -- 29 columns | 1 columns | 'https://www.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.tx' | |

```

533 -- 29 columns 28 columns 'https://www.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.txt'
534 -- 29 columns 1 columns  'https://www.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.txt'
... ..
See problems(...) for more details.

```

Third step: Filtering, adjusting and calculating data

```

#filtering and adjusting the data to be able to answer the assignment

df_lower <- df_lower %>%
  select(c(Year,Mo,Globe)) %>% #selecting the needed vaiables
  filter(!row_number() %in% c(531:542)) %>% #removing the last rows with text
  filter(Year >= 1980) %>% #filtering by year
  mutate(Globe=as.numeric(Globe)) %>% #changing Globe variable from chr to num
  rename(globe_lower = Globe) %>% #renaming Globe variable for later convenience
  mutate(roll_avg_lower = zoo::rollmean(globe_lower, 12, fill=NA, align='right')) #calculating

#filtering and adjusting the data to be able to answer the assignment

df_mid <- df_mid %>%
  select(c(Year,Mo,Globe)) %>%
  filter(!row_number() %in% c(531:542)) %>%
  filter(Year >= 1980) %>%
  mutate(Globe=as.numeric(Globe)) %>%
  rename(globe_mid = Globe) %>%
  mutate(roll_avg_mid = zoo::rollmean(globe_mid, 12, fill=NA, align='right'))

df_trop <- df_trop %>%
  select(c(Year,Mo,Globe)) %>%
  filter(!row_number() %in% c(531:542)) %>%
  filter(Year >= 1980) %>%
  mutate(Globe=as.numeric(Globe)) %>%
  rename(globe_trop = Globe) %>%
  mutate(roll_avg_trop = zoo::rollmean(globe_trop, 12, fill=NA, align='right'))

df_lower_strat <- df_lower_strat %>%
  select(c(Year,Mo,Globe)) %>%
  filter(!row_number() %in% c(531:542)) %>%
  filter(Year >= 1980) %>%
  mutate(Globe=as.numeric(Globe)) %>%

```

```

rename(globe_lower_strat = Globe) %>%
mutate(roll_avg_lower_strat = zoo::rollmean(globe_lower_strat, 12, fill=NA, align='right')

#joining the dataframes together by Year and Mo and naming the new dataframe df_atmosphere

df_atmosphere <- df_lower %>%
  mutate(Date = ymd(paste(Year, Mo, 1, sep="-"))) %>%
  left_join(df_mid, by=c("Year", "Mo")) %>%
  left_join(df_trop, by=c("Year", "Mo")) %>%
  left_join(df_lower_strat, by=c("Year", "Mo"))

#making a new variable called average which is an average of the roll averages of the diff

df_atmosphere <- df_atmosphere %>%
  mutate(average=rowMeans(.[, c("roll_avg_lower","roll_avg_mid","roll_avg_trop","roll_avg_lower_strat")])
  relocate(Date, .after = Mo)

```

Fourth step: Plotting the data

```

#plotting the atmosphere-data and adding labs to the figure. Also adding a black horizontal line

df_atmosphere %>%
  ggplot() +
  geom_line(mapping = aes(x=Date, y=average,color="Average of the atmosphere's areas"), size=1) +
  geom_line(mapping = aes(x=Date, y=roll_avg_mid, color="Mid-Tropopause")) +
  geom_line(mapping = aes(x=Date, y=roll_avg_trop, color="Tropopause")) +
  geom_line(mapping = aes(x=Date, y=roll_avg_lower_strat, color="Lower Stratosphere")) +
  geom_line(mapping = aes(x=Date, y=roll_avg_lower, color="Lower Tropopause")) +
  geom_hline(yintercept = 0, color = "black", size = 0.35) +
  labs(title="Plot of average and rolling average temperature in the atmosphere from 1980 to 2015")

```

Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
 i Please use `linewidth` instead.

Warning: Removed 11 rows containing missing values (`geom_line()`).
 Removed 11 rows containing missing values (`geom_line()`).
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Plot of average and rolling average temperature in the atmosp

