032_SOK1005_V23

```
rm(list=ls())
library(tidyverse)
```

```
-- Attaching packages --------------------------------------- tidyverse 1.3.2 --
v ggplot2 3.4.0     v purrr   1.0.1
v tibble  3.1.8     v dplyr   1.1.0
v tidyr   1.3.0     v stringr 1.5.0
v readr   2.1.3     v forcats 1.0.0
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
```

```
library(ggplot2)
library(readr)
library(zoo)
```

```
Attaching package: 'zoo'

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

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

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

```
Attaching package: 'data.table'
```

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

    between, first, last

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

    transpose
```

```
library(reshape2)
```

```
Attaching package: 'reshape2'

The following objects are masked from 'package:data.table':

    dcast, melt

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

    smiths
```

```
# import the txt files
lower_Trop <- 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.
```

```
mid_Trop <- 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.t
533  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.t
534  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.t
535  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.t
536  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.t
... ... ......... ......... ....................................................................
See problems(...) for more details.
```

```
trop <- 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.t
533  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.t
534  -- 29 columns 1 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.t
535  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.t
536  -- 29 columns 7 columns  'http://vortex.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.t
... ... ......... ......... ..........................................................
See problems(...) for more details.
```

```
low_Strat <- 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.
```

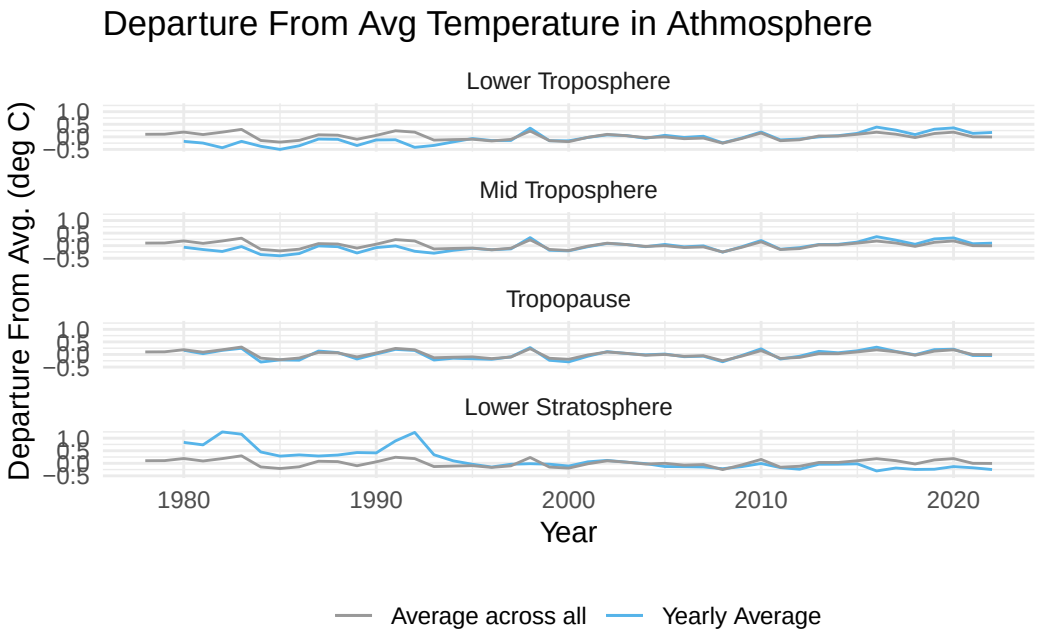
```
Warning: 13 parsing failures.
row col   expected     actual                                                                 
504  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.t
519  -- 29 columns 28 columns 'http://vortex.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.t
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.
```

```r
# extract the mean for each year
lower_Trop <-
  lower_Trop %>%
  filter(Year %in% c(1978:2022)) %>%
  group_by(Year) %>%
  summarize("Lower Troposphere" = mean(as.numeric(Globe))) %>%
  ungroup()

mid_Trop <-
  mid_Trop %>%
  filter(Year %in% c(1978:2022)) %>%
  group_by(Year) %>%
  summarize("Mid Troposphere" = mean(as.numeric(Globe))) %>%
  ungroup()

trop <-
  trop %>%
  filter(Year %in% c(1978:2022)) %>%
  group_by(Year) %>%
  summarize("Tropopause" = mean(as.numeric(Globe))) %>%
  ungroup()

low_Strat <-
  low_Strat %>%
  filter(Year %in% c(1978:2022)) %>%
  group_by(Year) %>%
  summarize("Lower Stratosphere" = mean(as.numeric(Globe))) %>%
  ungroup()
```

```r
# aggregate into one list
rolling_mean <-
```

```
  list(lower_Trop,
       mid_Trop,
       trop,
       low_Strat) %>%

  reduce(full_join,
         by = "Year")

# add column for average across averages pr year
rolling_mean$Average <-
  rowMeans(rolling_mean[, c(2:5)])
```

```
#plot average global temperature of the different parts of the atmosphere

# make it readable for ggplot to get all variables & filter from 1980
rolling_mean_m <- rolling_mean %>%
  select(!"Average") %>%
  filter(Year>=1980) %>%
  melt(id.var="Year")

# plot the different atmpspheric layers in individual plots with the average in all
plot <-
  ggplot()+
  geom_line(data=rolling_mean_m, aes(x=as.numeric(Year), y=value, group=1, color="Yearly A
  geom_line(data=rolling_mean, aes(x=as.numeric(Year), y=Average, group=2, color="Average
  facet_wrap(~variable, ncol=1)+
  ggtitle("Departure From Avg Temperature in Athmosphere")+
  ylab("Departure From Avg. (deg C)")+
  xlab("Year")+
  scale_color_manual(values=c("#999999", "#56B4E9"), name="")+
  theme_minimal()+
  theme(legend.position="bottom")

plot
```


Departure From Avg Temperature in Athmosphere
Lower Troposphere
Mid Troposphere
Tropopause
Lower Stratosphere
Departure From Avg. (deg C)
1.0
0.5
0.0
−0.5
1980
1990
2000
2010
2020
Year
Average across all
Yearly Average