Mappeoppgave 1

Oppgave 1

```
Global_temp <- fread("http://vortex.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt", sep = " ")
```

```
## Warning in fread("http://vortex.nsstc.uah.edu/data/msu/v6.0/tlt/
## uahncdc_lt_6.0.txt", : Stopped early on line 520. Expected 29 fields but found
## 0. Consider fill=TRUE and comment.char=. First discarded non-empty line: <<Trend
## 0.14 0.18 0.12 0.16 0.19 0.14 0.11 0.16 0.10 0.12 0.16 0.11 0.18 0.21 0.17 0.10
## 0.15 0.09 0.25 0.23 0.27 0.01 0.09 -0.02 0.18 0.18 0.18>>
```

```
View(Global_temp)

Global_temp <- Global_temp[-c(518:526),]
```

```
## Warning in `[.data.table`(Global_temp, -c(518:526), ): Item 2 of i is -519 but
## there are only 518 rows. Ignoring this and 7 more like it out of 9.
```

```
str(Global_temp)
```

```
## Classes 'data.table' and 'data.frame':   517 obs. of  29 variables:
##  $ Year : chr  "1978" "1979" "1979" "1979" ...
##  $ Mo   : chr  "12" "1" "2" "3" ...
##  $ Globe: chr  "-0.48" "-0.47" "-0.43" "-0.38" ...
##  $ Land : chr  "-0.51" "-0.64" "-0.56" "-0.51" ...
##  $ Ocean: chr  "-0.47" "-0.41" "-0.39" "-0.33" ...
##  $ NH   : chr  "-0.44" "-0.64" "-0.47" "-0.46" ...
##  $ Land : chr  "-0.46" "-0.86" "-0.57" "-0.51" ...
##  $ Ocean: chr  "-0.42" "-0.50" "-0.41" "-0.44" ...
##  $ SH   : chr  "-0.52" "-0.31" "-0.39" "-0.30" ...
##  $ Land : chr  "-0.62" "-0.13" "-0.53" "-0.53" ...
##  $ Ocean: chr  "-0.50" "-0.34" "-0.37" "-0.26" ...
##  $ Trpcs: chr  "-0.60" "-0.47" "-0.36" "-0.36" ...
##  $ Land : chr  "-0.62" "-0.54" "-0.25" "-0.43" ...
##  $ Ocean: chr  "-0.59" "-0.45" "-0.39" "-0.34" ...
##  $ NoExt: chr  "-0.37" "-0.73" "-0.54" "-0.53" ...
##  $ Land : chr  "-0.44" "-0.93" "-0.67" "-0.53" ...
##  $ Ocean: chr  "-0.30" "-0.55" "-0.42" "-0.52" ...
##  $ SoExt: chr  "-0.46" "-0.23" "-0.41" "-0.26" ...
##  $ Land : chr  "-0.55" "0.12" "-0.70" "-0.59" ...
##  $ Ocean: chr  "-0.45" "-0.29" "-0.36" "-0.21" ...
##  $ NoPol: chr  "-0.39" "-0.46" "-2.00" "-0.56" ...
##  $ Land : chr  "-0.68" "-0.95" "-2.30" "-0.47" ...
```

```
##  $ Ocean: chr  "-0.06" "0.10" "-1.66" "-0.65" ...
##  $ SoPol: chr  "-0.45" "-0.16" "-0.80" "-0.53" ...
##  $ Land : chr  "-0.38" "-0.15" "-1.25" "-1.25" ...
##  $ Ocean: chr  "-0.49" "-0.16" "-0.58" "-0.18" ...
##  $ USA48: chr  "-1.29" "-3.22" "-1.76" "-0.70" ...
##  $ USA49: chr  "-1.15" "-2.42" "-1.84" "-0.38" ...
##  $ AUST : chr  "-1.29" "0.92" "-0.30" "0.23" ...
##  - attr(*, ".internal.selfref")=<externalptr>
```

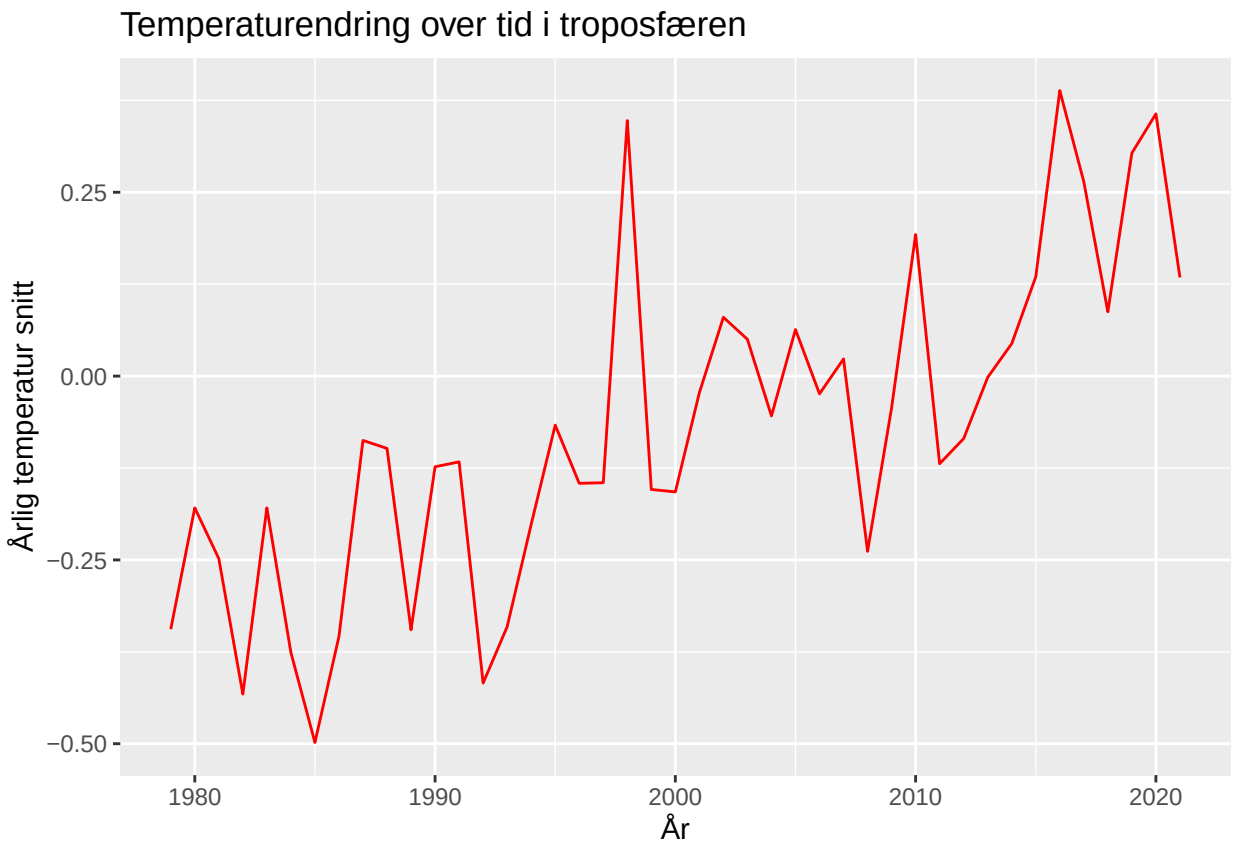
```
Global_temp <- as.data.frame(apply(Global_temp, 2, as.numeric))
str(Global_temp)
```

```
## 'data.frame':    517 obs. of  29 variables:
##  $ Year : num  1978 1979 1979 1979 1979 ...
##  $ Mo   : num  12 1 2 3 4 5 6 7 8 9 ...
##  $ Globe: num  -0.48 -0.47 -0.43 -0.38 -0.4 -0.4 -0.39 -0.31 -0.4 -0.32 ...
##  $ Land : num  -0.51 -0.64 -0.56 -0.51 -0.57 -0.56 -0.61 -0.57 -0.54 -0.44 ...
##  $ Ocean: num  -0.47 -0.41 -0.39 -0.33 -0.34 -0.33 -0.31 -0.21 -0.35 -0.28 ...
##  $ NH   : num  -0.44 -0.64 -0.47 -0.46 -0.47 -0.52 -0.5 -0.21 -0.34 -0.33 ...
##  $ Land : num  -0.46 -0.86 -0.57 -0.51 -0.62 -0.54 -0.61 -0.33 -0.37 -0.31 ...
##  $ Ocean: num  -0.42 -0.5 -0.41 -0.44 -0.37 -0.52 -0.44 -0.14 -0.32 -0.34 ...
##  $ SH   : num  -0.52 -0.31 -0.39 -0.3 -0.34 -0.27 -0.29 -0.41 -0.46 -0.32 ...
##  $ Land : num  -0.62 -0.13 -0.53 -0.53 -0.46 -0.62 -0.62 -1.11 -0.91 -0.73 ...
##  $ Ocean: num  -0.5 -0.34 -0.37 -0.26 -0.31 -0.19 -0.22 -0.26 -0.36 -0.23 ...
##  $ Trpcs: num  -0.6 -0.47 -0.36 -0.36 -0.35 -0.46 -0.37 -0.41 -0.37 -0.35 ...
##  $ Land : num  -0.62 -0.54 -0.25 -0.43 -0.37 -0.55 -0.49 -0.55 -0.35 -0.42 ...
##  $ Ocean: num  -0.59 -0.45 -0.39 -0.34 -0.34 -0.43 -0.33 -0.37 -0.38 -0.33 ...
##  $ NoExt: num  -0.37 -0.73 -0.54 -0.53 -0.54 -0.54 -0.55 -0.15 -0.36 -0.33 ...
##  $ Land : num  -0.44 -0.93 -0.67 -0.53 -0.72 -0.52 -0.63 -0.33 -0.43 -0.29 ...
##  $ Ocean: num  -0.3 -0.55 -0.42 -0.52 -0.38 -0.56 -0.48 0.01 -0.3 -0.36 ...
##  $ SoExt: num  -0.46 -0.23 -0.41 -0.26 -0.33 -0.18 -0.27 -0.37 -0.47 -0.29 ...
##  $ Land : num  -0.55 0.12 -0.7 -0.59 -0.43 -0.7 -0.74 -1.35 -1.17 -0.95 ...
##  $ Ocean: num  -0.45 -0.29 -0.36 -0.21 -0.31 -0.09 -0.19 -0.2 -0.34 -0.17 ...
##  $ NoPol: num  -0.39 -0.46 -2 -0.56 -0.84 -0.76 -0.76 -0.2 -0.26 -0.17 ...
##  $ Land : num  -0.68 -0.95 -2.3 -0.47 -0.81 -0.56 -1.14 -0.38 -0.35 -0.02 ...
##  $ Ocean: num  -0.06 0.1 -1.66 -0.65 -0.87 -1 -0.32 0.01 -0.15 -0.35 ...
##  $ SoPol: num  -0.45 -0.16 -0.8 -0.53 -0.26 0.05 -0.98 -0.95 -1 -0.11 ...
##  $ Land : num  -0.38 -0.15 -1.25 -1.25 0.26 -0.43 -1.62 -2.18 -1.67 -0.65 ...
##  $ Ocean: num  -0.49 -0.16 -0.58 -0.18 -0.51 0.27 -0.67 -0.37 -0.69 0.15 ...
##  $ USA48: num  -1.29 -3.22 -1.76 -0.7 -0.72 -0.82 -0.62 -0.15 -0.74 0.61 ...
##  $ USA49: num  -1.15 -2.42 -1.84 -0.38 -0.46 -0.75 -0.67 -0.09 -0.36 0.68 ...
##  $ AUST : num  -1.29 0.92 -0.3 0.23 -1.12 -1.1 -0.56 -1.16 -1.05 -0.76 ...
```

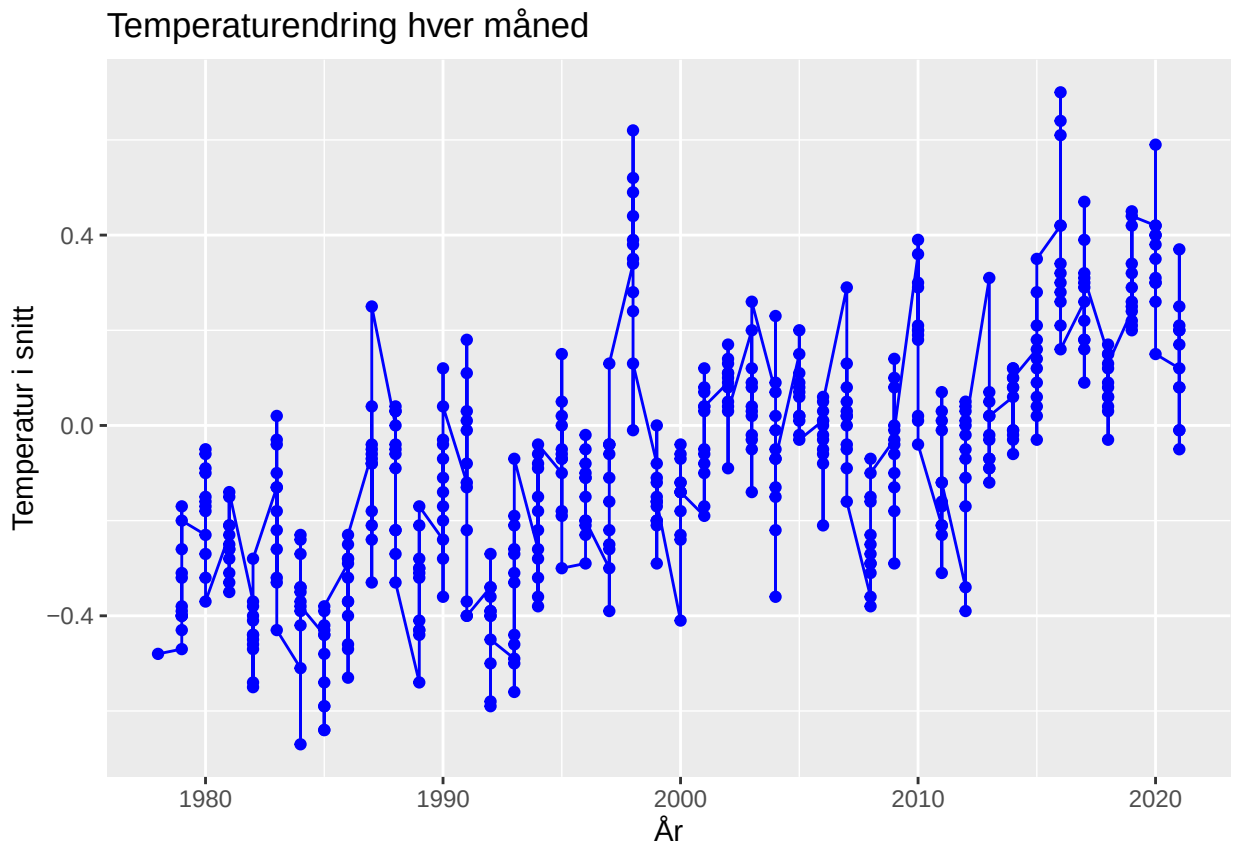
Først laster jeg inn data fra "Lower Troposphere" hvor jeg også fjerner de siste 8 radene med data, etter som dette ikke er verdifullt å ha med i tabellen. I tillegg endrer jeg dataen fra "character" verdier til numeriske verdier slik at utregningen blir enklere.

```
keeps <- c("Year", "Mo", "Globe")
Global_temp <- Global_temp[keeps]

Global_temp1 <- Global_temp %>%
  arrange(Year) %>%
  group_by(Year) %>%
```

```
  mutate(yearmean = rollmean(Globe, k = 12, fill = NA)) %>%
  ungroup()

Global_temp2 <- Global_temp1 %>% drop_na()
Global_temp2 <- Global_temp2 %>%
  rename(Filler = Globe,
         Globe=yearmean)

Global_temp2 %>%
  ggplot(aes(x = Year, y = Globe)) +
  geom_line(colour = "red") +
  labs(title = "Temperaturendring over tid i troposfæren",
       x = "År",
       y = "Årlig temperatur snitt")
```




```
Global_temp1 %>%
  ggplot(aes(x = Year, y = Globe)) +
  geom_line(color = "blue") + geom_point(color= "blue") +
  labs(title = "Temperaturendring hver måned",
       x = "År",
       y = "Temperatur i snitt")
```



Deretter lager jeg to plot. En som bruker funksjonen "rollmean" fra Zoo. For å lage årlige snitt, og en for hver måned i alle årene.

Oppgave 2

```
Lower_Trop <- fread("https://www.nsstc.uah.edu/data/msu/v6.0/tlt/uahncdc_lt_6.0.txt", sep = " ")
```

```
## Warning in fread("https://www.nsstc.uah.edu/data/msu/v6.0/tlt/
## uahncdc_lt_6.0.txt", : Stopped early on line 520. Expected 29 fields but found
## 0. Consider fill=TRUE and comment.char=. First discarded non-empty line: <<Trend
## 0.14 0.18 0.12 0.16 0.19 0.14 0.11 0.16 0.10 0.12 0.16 0.11 0.18 0.21 0.17 0.10
## 0.15 0.09 0.25 0.23 0.27 0.01 0.09 -0.02 0.18 0.18 0.18>>
```

```
Lower_Trop <- Lower_Trop[-c(518)]
Lower_Trop <- as.data.frame(apply(Lower_Trop, 2, as.numeric))

Mid_Trop <- fread("https://www.nsstc.uah.edu/data/msu/v6.0/tmt/uahncdc_mt_6.0.txt", sep = " ")
```

```
## Warning in fread("https://www.nsstc.uah.edu/data/msu/v6.0/tmt/
## uahncdc_mt_6.0.txt", : Stopped early on line 520. Expected 29 fields but found
## 0. Consider fill=TRUE and comment.char=. First discarded non-empty line: <<Trend
## 0.10 0.13 0.08 0.12 0.14 0.10 0.07 0.10 0.07 0.09 0.12 0.09 0.13 0.15 0.12 0.06
## 0.09 0.06 0.17 0.16 0.19 -0.02 0.01 -0.03 0.14 0.14 0.13>>
```

```
Mid_Trop <- Mid_Trop[-c(518)]
Mid_Trop <- as.data.frame(apply(Lower_Trop, 2, as.numeric))

Trop <- fread("https://www.nsstc.uah.edu/data/msu/v6.0/ttp/uahncdc_tp_6.0.txt", sep = " ")
```

```
## Warning in fread("https://www.nsstc.uah.edu/data/msu/v6.0/ttp/
## uahncdc_tp_6.0.txt", : Stopped early on line 520. Expected 29 fields but found
## 0. Consider fill=TRUE and comment.char=. First discarded non-empty line: <<Trend
## 0.02 0.02 0.02 0.03 0.04 0.03 0.01 -0.00 0.01 0.03 0.04 0.03 0.03 0.04 0.03
## -0.01 -0.03 -0.00 0.02 0.02 0.03 -0.08 -0.13 -0.05 0.05 0.05 0.04>>
```

```
Trop <- Trop[-c(518)]
Trop <- as.data.frame(apply(Trop, 2, as.numeric))

Lower_Strat <- fread("https://www.nsstc.uah.edu/data/msu/v6.0/tls/uahncdc_ls_6.0.txt" , sep = " ")
```

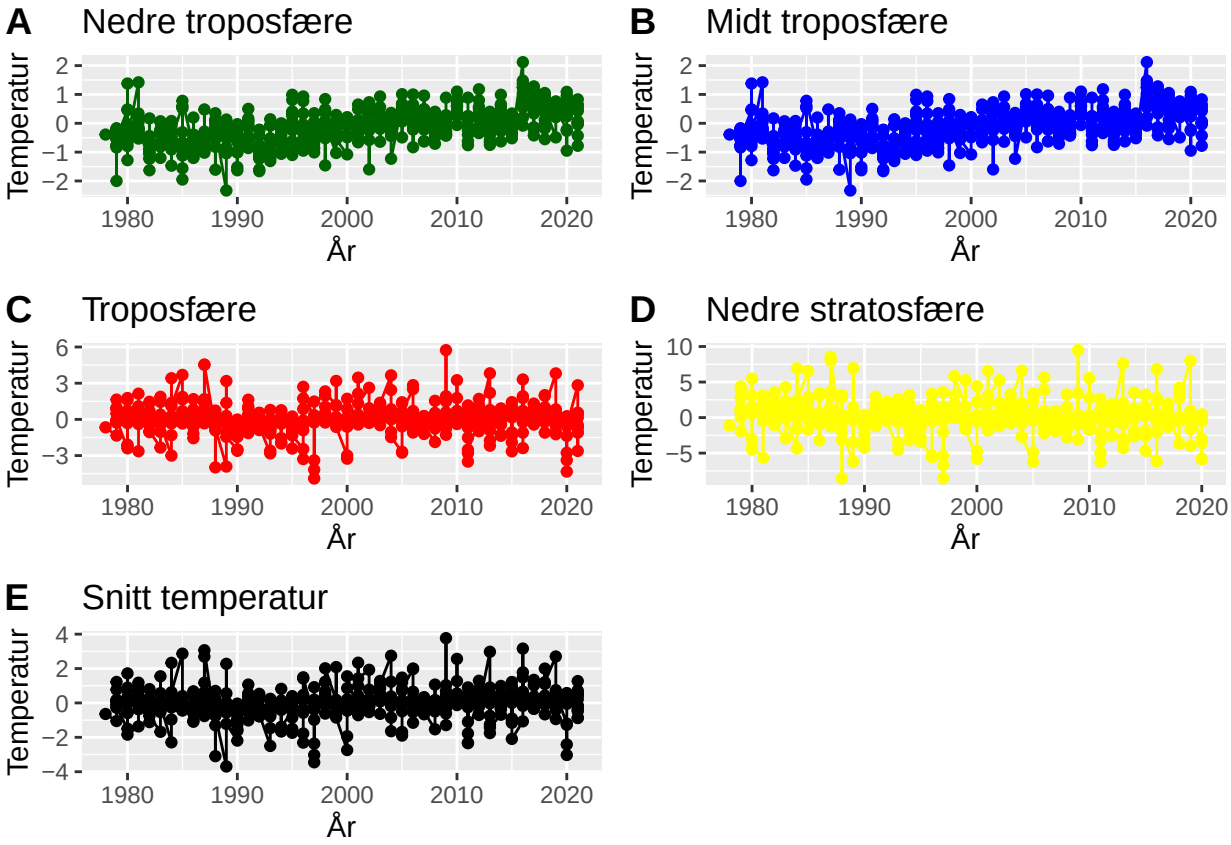
```
## Warning in fread("https://www.nsstc.uah.edu/data/msu/v6.0/tls/
## uahncdc_ls_6.0.txt", : Stopped early on line 505. Expected 29 fields but found
## 28. Consider fill=TRUE and comment.char=. First discarded non-empty line: <<2020
## 11 -0.23 -0.96 0.05 0.05 -0.40 0.34 -0.52 -2.24 -0.16 1.29 1.26 1.31 -0.53 -0.78
## -0.30 -1.55 -5.03 -0.94 -1.85 -2.08 -1.58 -8.78-13.45 -6.57 -0.32 -1.04 0.53>>
```

```
Lower_Strat <- as.data.frame(apply(Lower_Strat, 2, as.numeric))
```

Henter inn data fra alle tabellene og lagrer de som nye variabler. Deretter lager jeg et plot for hver ved bruk av NoPol verdiene, samt også en for gjennomsnittet, og plotter disse i lag ved bruk av Cowplot.

```
keep <- c("Year", "Mo", "NoPol")
Lower_Trop <- Lower_Trop[keep]
Mid_Trop <- Mid_Trop[keep]
Trop <- Trop[keep]
Lower_Strat <- Lower_Strat[keep]

p1 <- Lower_Trop %>%
  ggplot(aes(x = Year, y = NoPol)) +
  geom_line(col = "dark green") +
  geom_point(col = "dark green") +
  labs(title = "Nedre troposfære",
       x = "År",
       y = "Temperatur")

p2 <- Mid_Trop %>%
  ggplot(aes(x = Year, y = NoPol)) +
  geom_line(col = "blue") +
  geom_point(col = "blue") +
  labs(title = "Midt troposfære",
       x = "År",
       y = "Temperatur")

p3 <- Trop %>%
  ggplot(aes(x = Year, y = NoPol)) +
```

```
  geom_line(col = "red") +
  geom_point(col = "red") +
  labs(title = "Troposfære",
       x = "År",
       y = "Temperatur")

p4 <- Lower_Strat %>%
  ggplot(aes(x = Year, y = NoPol)) +
  geom_line(col = "yellow") +
  geom_point(col = "yellow") +
  labs(title = "Nedre stratosfære",
       x = "År",
       y = "Temperatur")

library(data.table)

Snitt <- rbindlist(list(Lower_Trop, Mid_Trop, Trop, Lower_Strat))[,lapply(.SD,mean), list(Year, Mo)]

p5 <- Snitt %>%
  ggplot(aes(x = Year, y = NoPol)) +
  geom_line(col = "black") +
  geom_point(col = "black") +
  labs(title = "Snitt temperatur",
       x = "År",
       y = "Temperatur")

plot_grid(p1, p2, p3, p4, p5, ncol = 2, labels = "AUTO")
```


A
Nedre troposfære
Temperatur
2
1
0
−1
−2
1980
1990
2000
2010
2020
År
B
Midt troposfære
Temperatur
2
1
0
−1
−2
1980
1990
2000
2010
2020
År
C
Troposfære
Temperatur
6
3
0
−3
1980
1990
2000
2010
2020
År
D
Nedre stratosfære
Temperatur
10
5
0
−5
1980
1990
2000
2010
2020
År
E
Snitt temperatur
Temperatur
4
2
0
−2
−4
1980
1990
2000
2010
2020
År