# macroclimate

ibdj

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## Macroclimate

Background on macroclimate of Kangerluarsunnguaq

```
library(tidyverse)
library(janitor)
library(lubridate)
library(glue)
library(hms)
```

## Temperature data

```
data_temp <- read_delim("~/Library/CloudStorage/OneDrive-Aarhusuniversitet/MappingPlants/01 
  janitor::clean_names() |>
  drop_na() |>
  filter(at_c != -9999) |>
   mutate(year = year(date),
          month = month(date),
          doy = yday(date))
```

The imported data has entries between 2007 and 2022.

The temperature between -30.2°C and 23.2°C.

### Mean annual temperature

The mean temperature across all entries is -0.1003°C.

```
data_temp_annual_mean <- data_temp |>
  group_by(year) |>
  filter(year != 2007) |> #excluding 2007 because it is only the months of oct, nov, dec
  summarize(mean = mean(at_c))
```

```
ggplot(data_temp_annual_mean, aes(x = year, y = mean))+
  geom_smooth(method = lm, color = "blue")+
  geom_point()+
  geom_line(size = 0.25, color = "black", linetype="dotted")+
  scale_x_continuous(breaks=seq(2008, 2022, by = 1))+
  geom_hline(yintercept=year_mean, linetype="dashed", color = "blue", size=0.5)+
  labs(x = "Year", y = "Mean temperature (°C)", title = "Annual mean temperature")
```

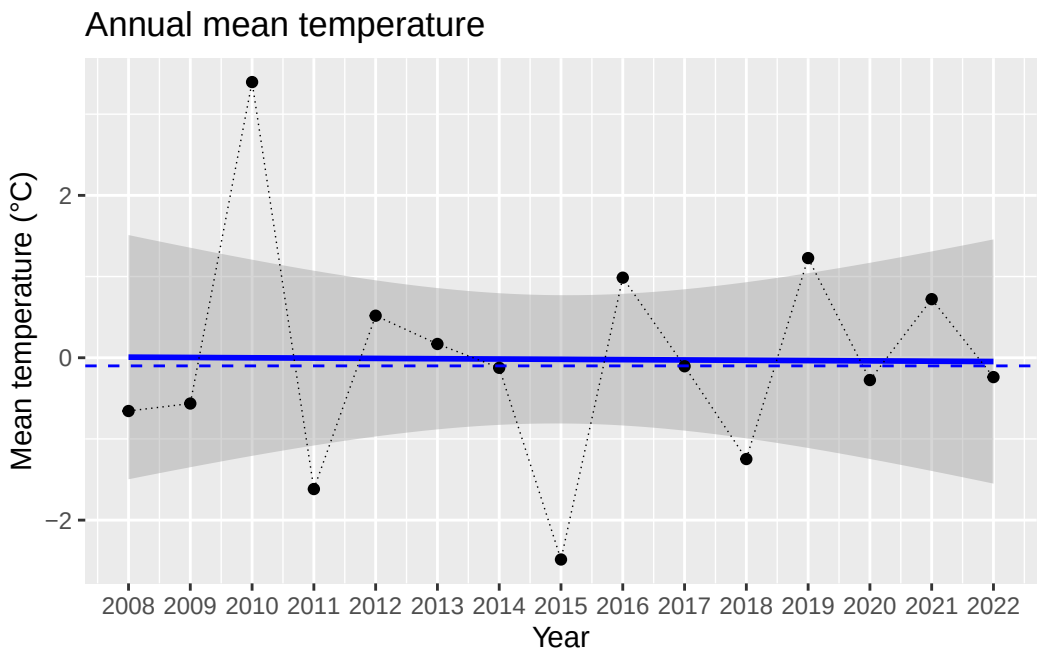


Figure 1: Mean air temperature pr year (°C) from 2008 to 2022. Data from 2007 is excluded because data is only from October, November and December. Blue dashed line indicate over all mean of -0.1003°C

```r
data_temp_monthly_mean <- data_temp |>
  group_by(month) |>
  summarize(mean = mean(at_c))
```

```r
ggplot(data_temp_monthly_mean, aes(x = month, y = mean))+
  geom_smooth(color = "blue")+
  geom_point()+
  geom_line(size = 0.25, linetype="dotted")+
  scale_x_continuous(breaks=seq(1, 12, by = 1))+
  geom_hline(yintercept=year_mean, linetype="dashed", color = "blue", size=0.5)+
  labs(x = "Month", y = "Mean temperature (°C)", title = "Mean temperature pr month")
```

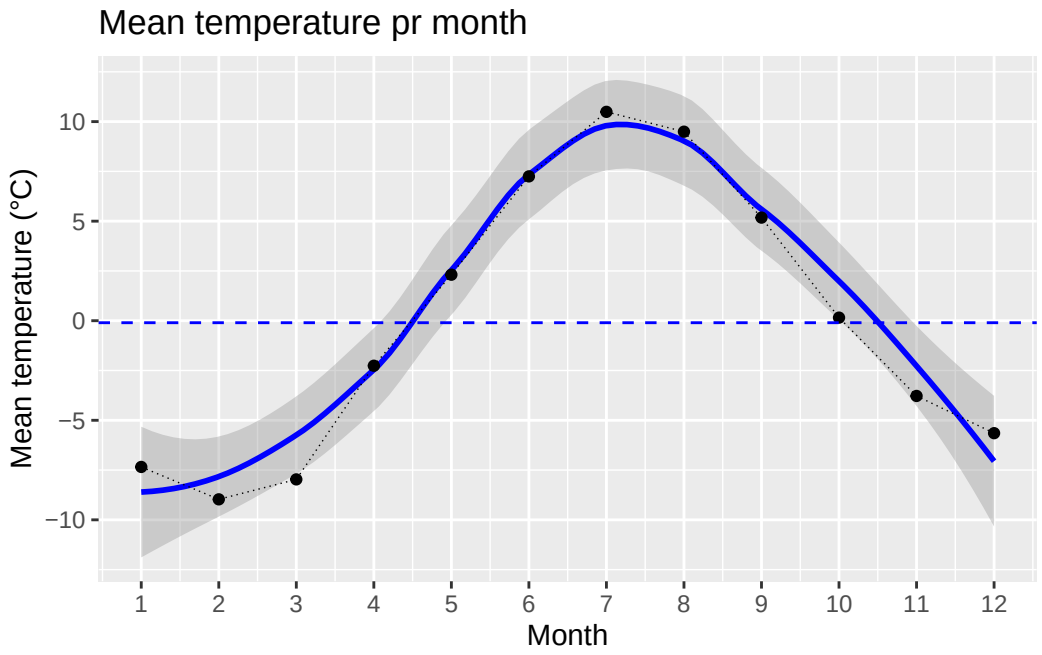


Figure 2: Mean air temperature pr month, based on data from 2007 to 2022. 2007 is included.

### Precipitation data

```r
data_precip <- read_delim("~/Library/CloudStorage/OneDrive-Aarhusuniversitet/MappingPlants/0
  janitor::clean_names() |>
  drop_na() |>
  filter(pre_mm != -9999) |>
   mutate(year = year(date),
```

```
         month = month(date),
         doy = yday(date))
```

### Yearly precipitation

```
data_precip_sum <- data_precip |>
  group_by(year) |>
  filter(year != 2007) |>
  summarise(pre_mm_sum = sum(pre_mm))
```

The mean annual precipitation is 887.36 mm.

```
ggplot(data_precip_sum, aes(y = pre_mm_sum, x = year))+
  geom_bar(stat = "identity", fill = "#6e6bc4")+
  scale_x_continuous(breaks=seq(min(data_precip_sum$year), max(data_precip_sum$year), by = 1)
geom_hline(yintercept = precip_year_mean, linetype="dashed", color = "blue", linewidth =0.5)+
  geom_smooth(method = lm, color = "blue", size = 0.5)
```

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

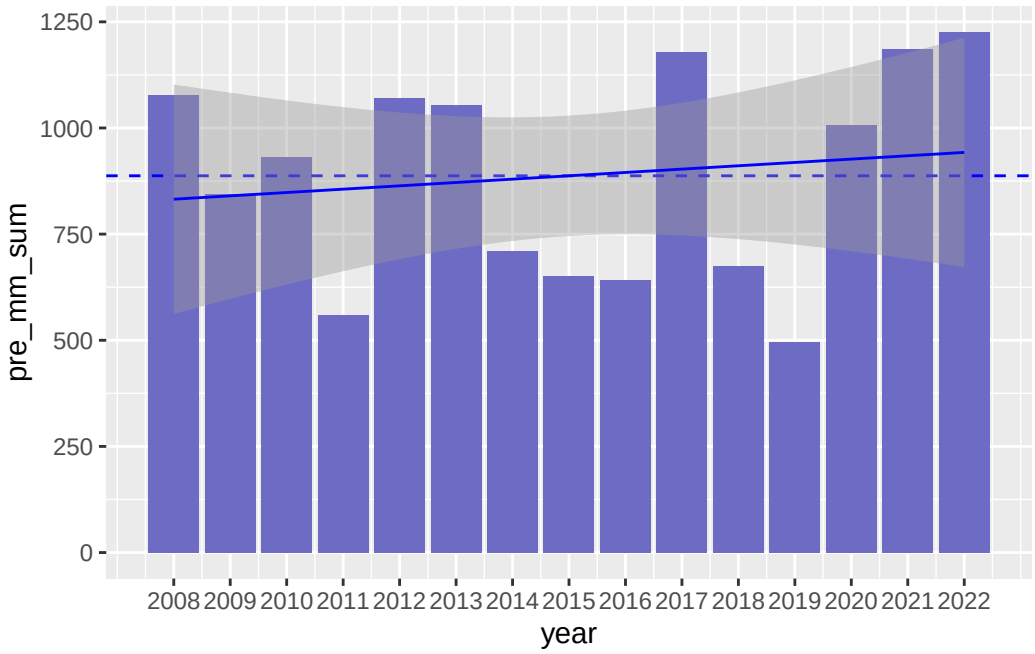


Figure 3: Mean yearly precipitation (mm) from 2008 to 2022. Data from 2007 is excluded because it was only from May - December. Blue dashed line indicate over all mean of 887.36 mm

### Monthly precipitation

```
data_precip_month_sum <- data_precip |>
  group_by(month, year) |>
  summarise(pre_mm_sum = sum(pre_mm))
```

```
`summarise()` has grouped output by 'month'. You can override using the
`.groups` argument.
```

```
data_precip_month_mean <- data_precip_month_sum |>
  group_by(month) |>
  summarise(pre_mm_mean = round(mean(pre_mm_sum),2))

precip_month_mean <- round(mean(data_precip_month_mean$pre_mm_mean),2)
```

```
ggplot(data_precip_month_mean, aes(y = pre_mm_mean, x = month))+
  geom_smooth(color = "blue")+
  geom_bar(stat = "identity", fill = "#6e6bc4")+
  scale_x_continuous(breaks=seq(min(data_precip_month_mean$month), max(data_precip_month_mean
geom_hline(yintercept = precip_month_mean, linetype="dashed", color = "blue", linewidth =0.25
```

```
`geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```

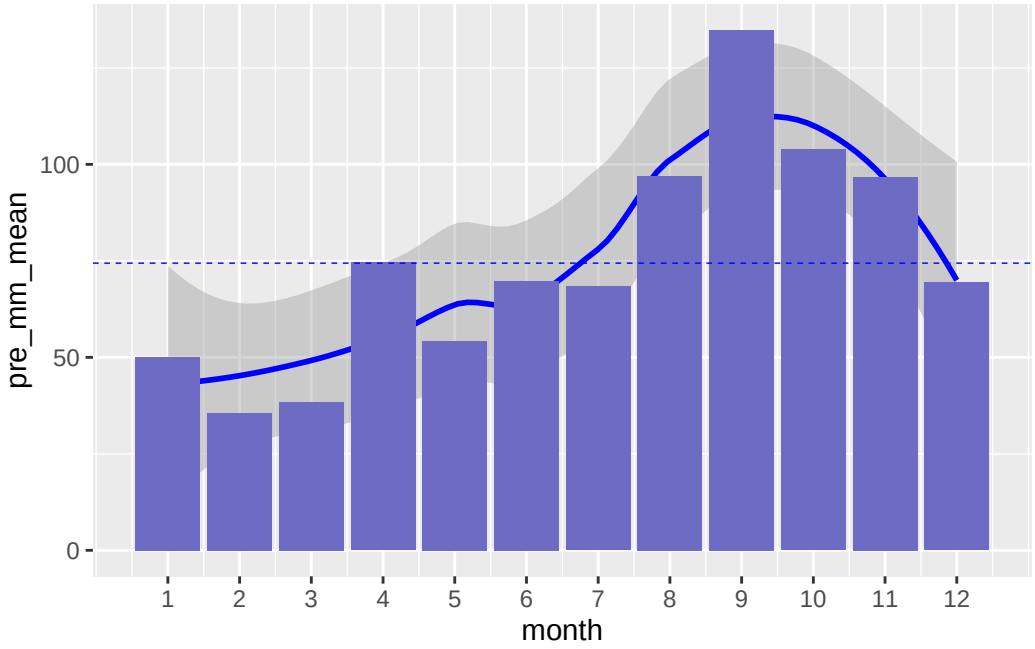


Figure 4: Mean yearly precipitation (mm) from 2007 to 2022. Data from 2007 is excluded because it was only from May - December.

On average across the monitoring period the months with most precipitation are September (134.80 mm), October (103.84 mm) and August (96.93 mm).

### Precipitation split in rain and snow

```
# making the temperature data hourly

data_temp_hour <- data_temp |>
  mutate(hour = substr(time, 1, 2)) |>
```

```
  group_by(date, hour) |>
  summarise(at_c = mean(at_c, na.rm = TRUE)) |>
  mutate(time = hms::hms(hours = as.numeric(hour)))
```

```
`summarise()` has grouped output by 'date'. You can override using the
`.groups` argument.
```

```
# joint the temperature precipitation data to destinguish snow and rain.

# data_pre_tem_joined <- data_precip |>
#   left_join(data_temp_hour, by = c("date" = "date", "time" = "time")) |>
#   drop_na() |>
#   mutate(precip_type = ifelse(at_c < 0,"snow","rain"))


  data_pre_tem_joined <- data_precip |>
  left_join(data_temp_hour, by = c("date" = "date", "time" = "time")) |>
  drop_na() |>
  mutate(precip_type = case_when(at_c < -1 ~ "snow",
                                 at_c <= 1 ~ "sleet",
                                 TRUE ~ "rain"))
```

```
# joint the temperature precipitation data to destinguish snow and rain.

data_pre_tem_joined_monthly <- data_pre_tem_joined |>
  group_by(year,month,precip_type) |>
  summarise(sum = sum(pre_mm)) |>
  filter(year != 2007)
```

```
`summarise()` has grouped output by 'year', 'month'. You can override using the
`.groups` argument.
```

```
# joint the temperature precipitation data to destinguish snow and rain.

data_pre_tem_monthly <- data_pre_tem_joined_monthly |>
  group_by(month,precip_type) |>
  summarise(mean = round(mean(sum),2))
```

```
`summarise()` has grouped output by 'month'. You can override using the
`.groups` argument.
```

```r
# joint the temperature precipitation data to destinguish snow and rain.

data_pre_tem_year <- data_pre_tem_joined_monthly |>
  group_by(year,precip_type) |>
  summarise(mean = round(sum(sum),2))
```

```
`summarise()` has grouped output by 'year'. You can override using the
`.groups` argument.
```

```r
ggplot(data_pre_tem_monthly, aes(x = month, y = mean, fill = precip_type)) +
  geom_bar(stat = "identity")+
  scale_x_continuous(breaks=seq(min(data_pre_tem_monthly$month), max(data_pre_tem_monthly$mon
  labs(x = "Month", y = "Mean precipitation (mm)", title = "Mean precipitation type pr month"
  scale_fill_manual(values = c("blue","purple" ,"#b3b3b3"))+
  guides(fill = guide_legend(title = ""))
```

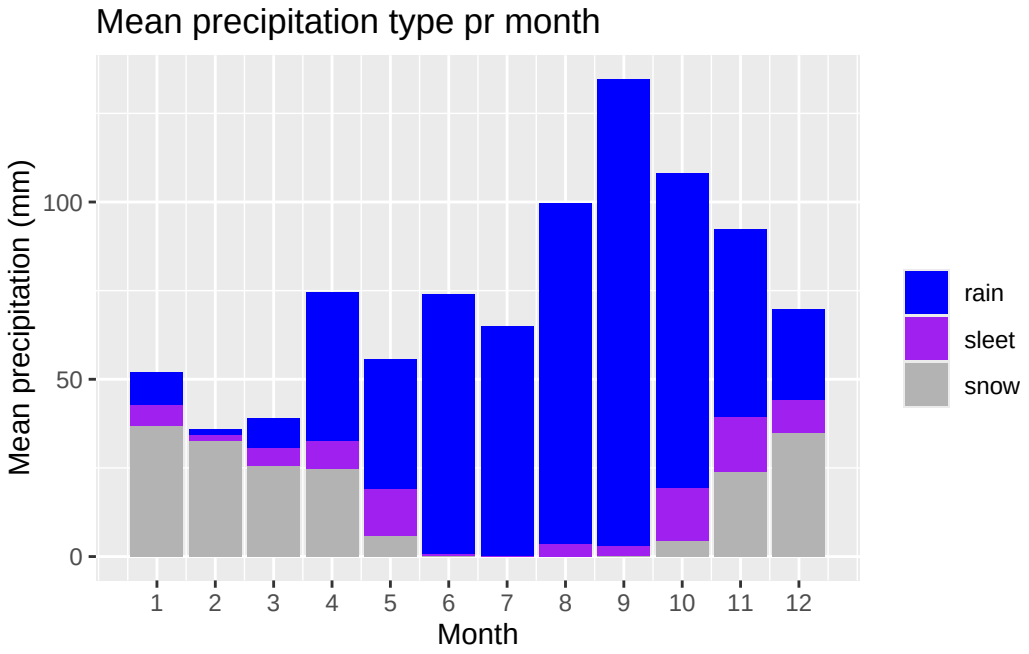


Figure 5: CAPTION

```r
ggplot(data_pre_tem_year, aes(x = year, y = mean, fill = precip_type)) +
  geom_bar(stat = "identity")+
  scale_x_continuous(breaks=seq(min(data_pre_tem_year$year), max(data_pre_tem_year$year), by
  labs(x = "Month", y = "Mean precipitation (mm)", title = "Mean precipitation type pr year"
```

```
  scale_fill_manual(values = c("blue","purple" ,"#b3b3b3"))+
  geom_smooth(method = "lm")+
  guides(fill = guide_legend(title = ""))
```

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

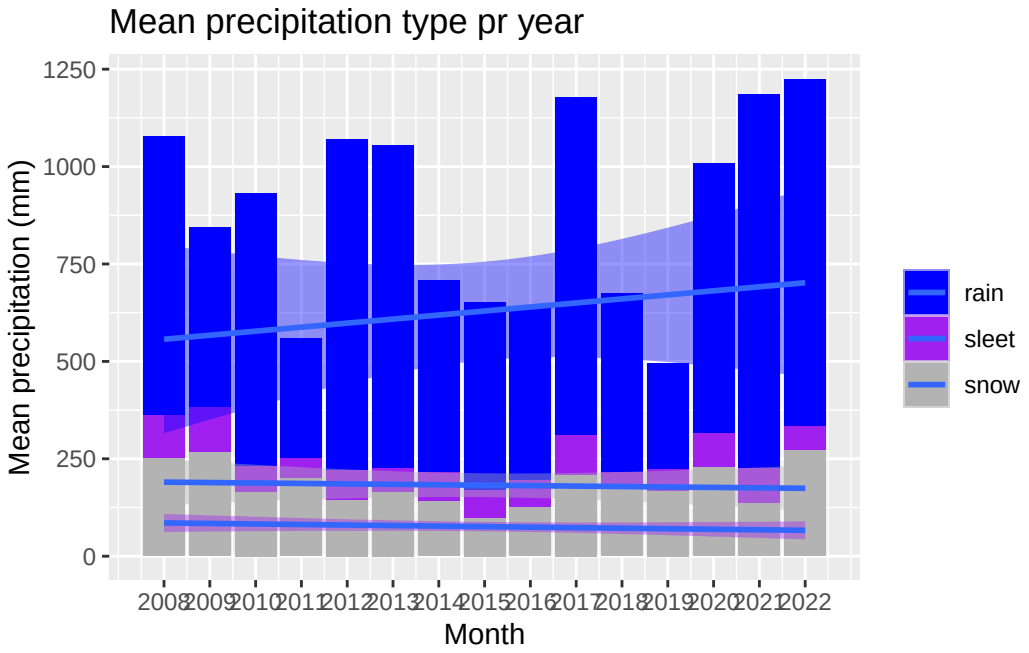


Figure 6: CAPTION