macroclimate

ibdj

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1 Macroclimate

Background macroclimate of Kangerluarsunnguaq (Kobbefjord, Nuuk 64.13334, -51.34368). Data produced by Asiaq - Greenland Survey for Greenland Ecosystem Monitoring (Asiaq 2023, 2020a, 2020b).

2 Temperature data

The imported data has entries between 2007 and 2022.

Temperatures between -30.2°C (2008-02-11) and 23.2°C (2016-06-10) have been recorded.

2.1 Mean annual temperature

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

The warmest months are July (10.49°C), August (9.49°C) and June (7.25°C).

The coldest months are February (-8.97°C), March (-7.97°C), and January (-7.34°C).
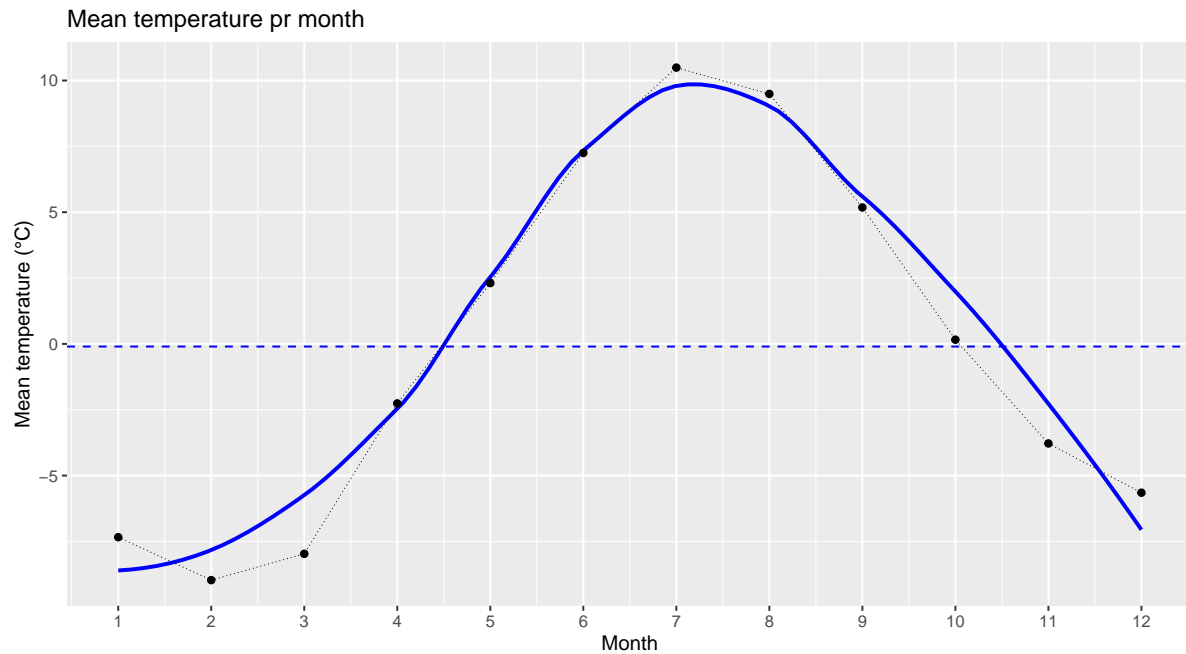
Figure 1: Mean air temperature (°C) pr month, based on data from 2007 to 2022. The dashed line represent yearly mean of -0.1°C.

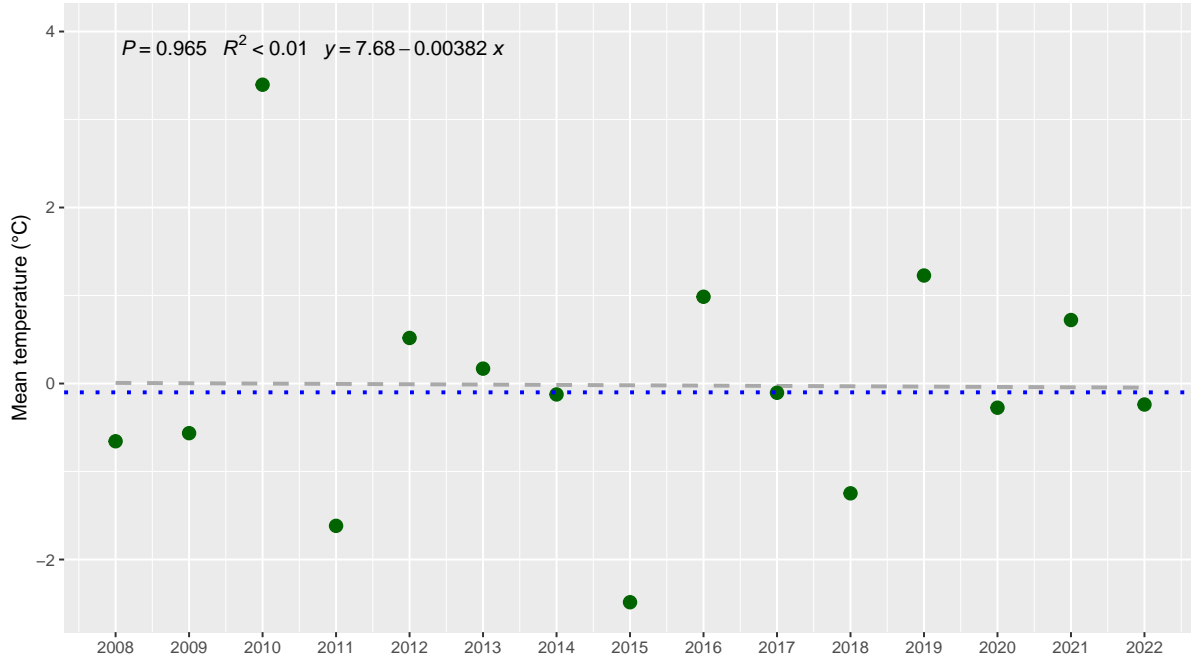$P = 0.965 \quad R^2 < 0.01 \quad y = 7.68 - 0.00382\,x$

Figure 2: 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 dotted line indicate over all mean of -0.1003°C. Dashed gray line is the trend line.

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Mean temperature of warmest months
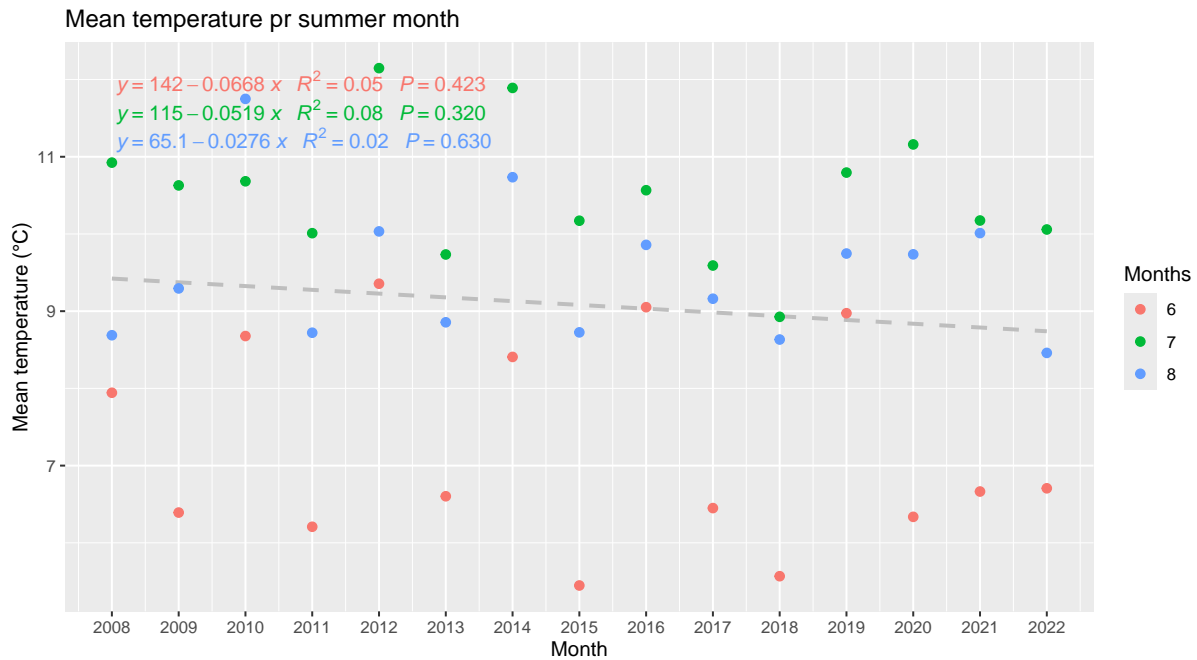
Mean temperature pr summer month

Figure 3: Mean air temperature (°C) pr for July, August, and June based on data from 2007 to 2022. P-value for the regression i 0.416. The mean of the warmests months across all years are 9.081°C.

```
Call:
lm(formula = mean ~ year, data = data_temp_monthly_mean_summer)

Residuals:
    Min      1Q  Median      3Q     Max
-3.6340 -0.7226  0.1279  1.2551  2.9202

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 107.34623  119.65318   0.897    0.375
year         -0.04877    0.05938  -0.821    0.416

Residual standard error: 1.721 on 43 degrees of freedom
Multiple R-squared:  0.01544,   Adjusted R-squared:  -0.007454
F-statistic: 0.6745 on 1 and 43 DF,  p-value: 0.416
```
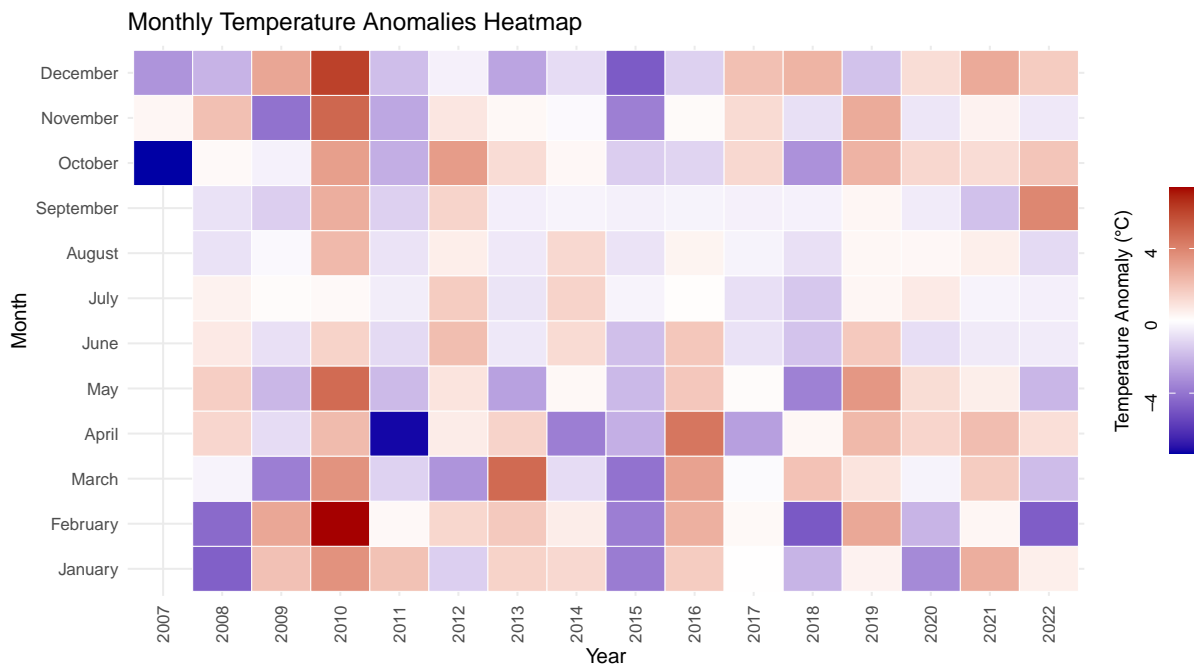
2.2 Temperature anomalies

Figure 4: Monthly Temperature Anomalies Heatmap. The stronger the color the bigger the difference from mean temperature of the respective month across all monitored years (°C).

2.3 Absolute values of anomolies

$P = 0.010$ $R^2 = 0.04$ $y = 130 - 0.0635\,x$

Figure 5: Absolut values of anomolies (difference from mean) of respective month.

3 Precipitation data

3.1 Yearly precipitation

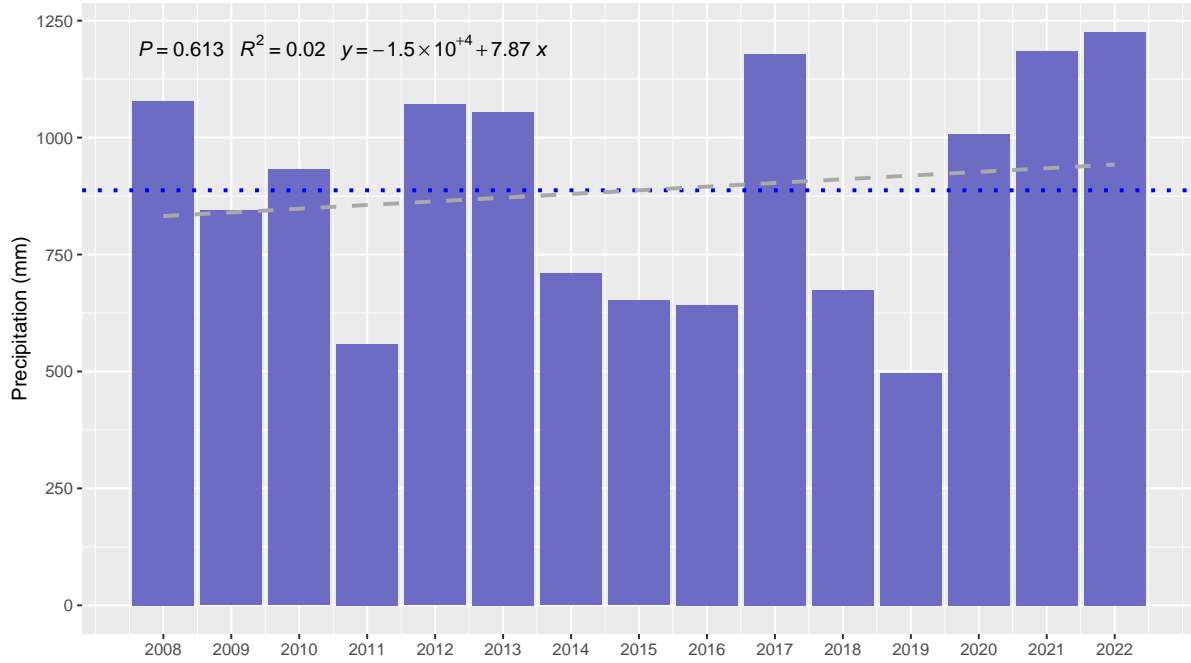The mean annual precipitation is 887.36 mm. 873.6875

Figure 6: 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.
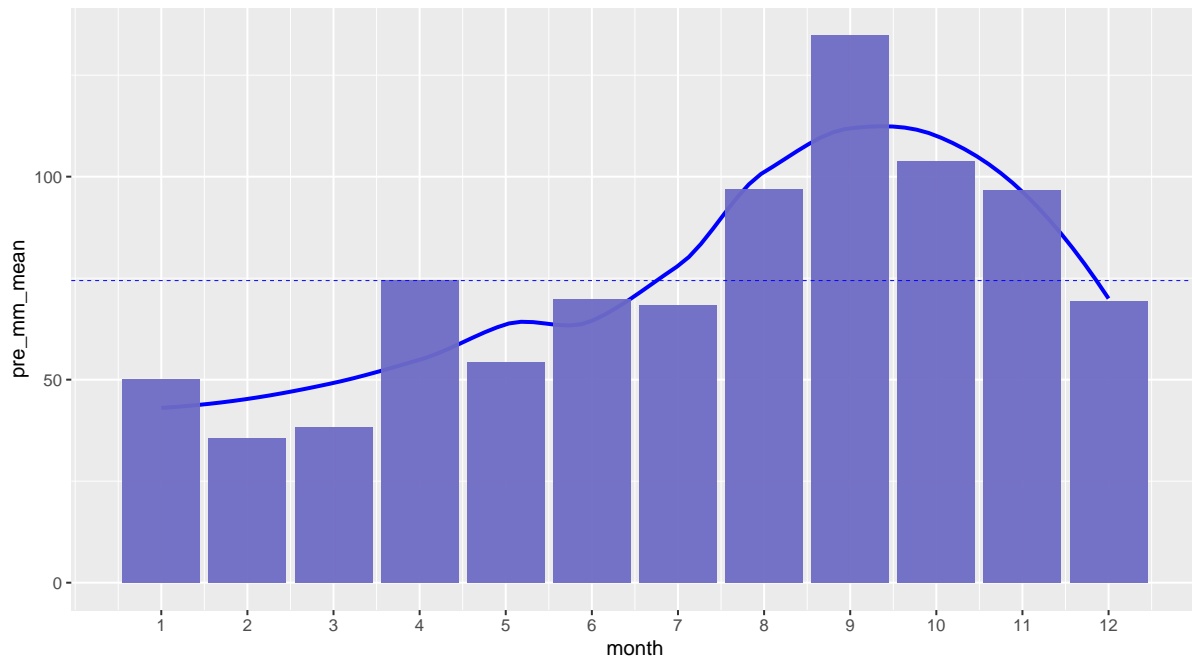
3.2 Monthly precipitation

Figure 7: Mean monthly precipitation (mm) including data from 2007 to 2022. Blue dashed line represent monthly mean of 74.4 mm. ADD SF BARS!

The months with the most precipitation are September (134.8 mm), October (103.84 mm), August (96.93 mm), which account for 335.57 mm or 37.82 % of the yearly precipitation.

The months with the least precipitation are January (50.03 mm), March (38.42 mm), February (35.57 mm).

3.3 Precipitation type
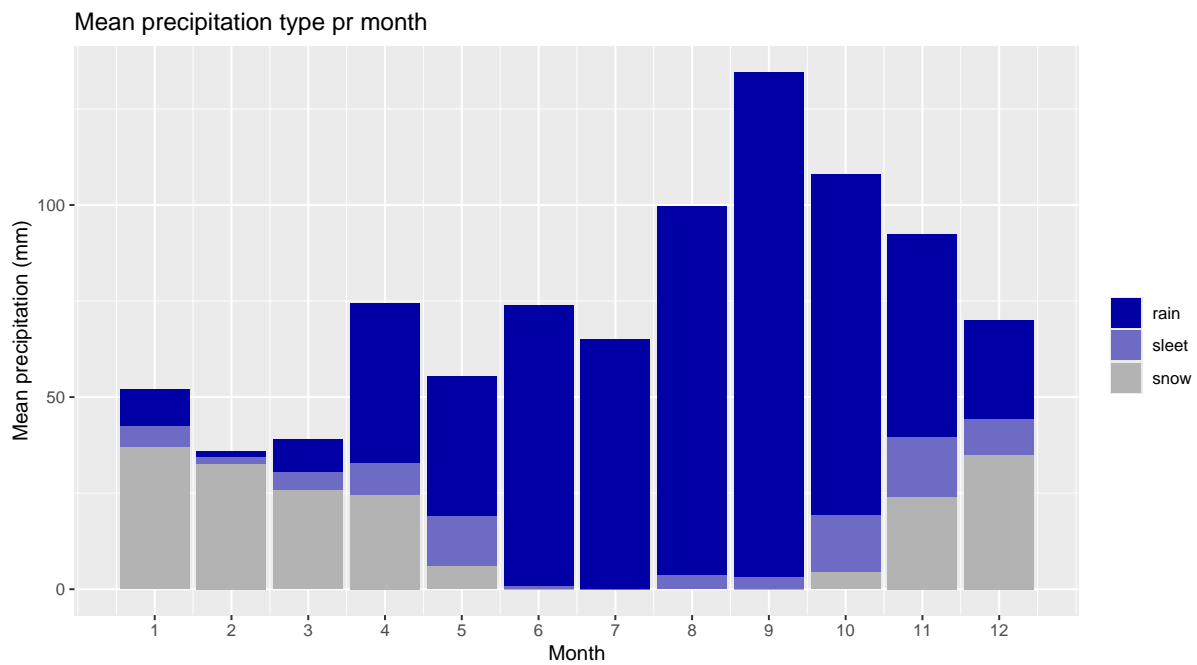
Mean precipitation type pr month

Figure 8: Mean monthly distribution of types of precipitation (mm). Based on data from 2007 to 2022. Sleet is defined as precipitation that fell when temperatures were between -1°C and 1°C.

Out of 887.36 (900.8) mm mean annual precipitation, rain accounts for 631.55 mm (70.1 %), snow accounts for 188.71 mm ((20.9 %)), and sleet for the remaining 80.54 mm (8.9 %).
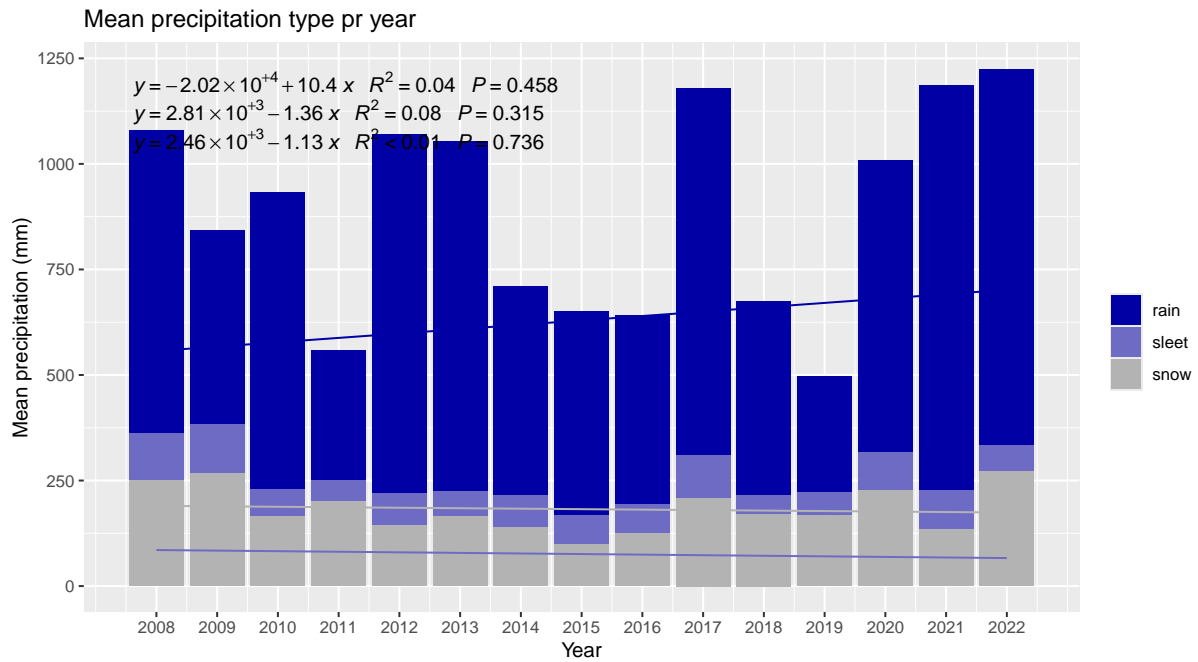
Figure 9: Mean percipitation pr. month over the monitoring period (2008 - 2022). Sleet is defined as precipitation that fell when temperatures were between -1°C and 1°C.
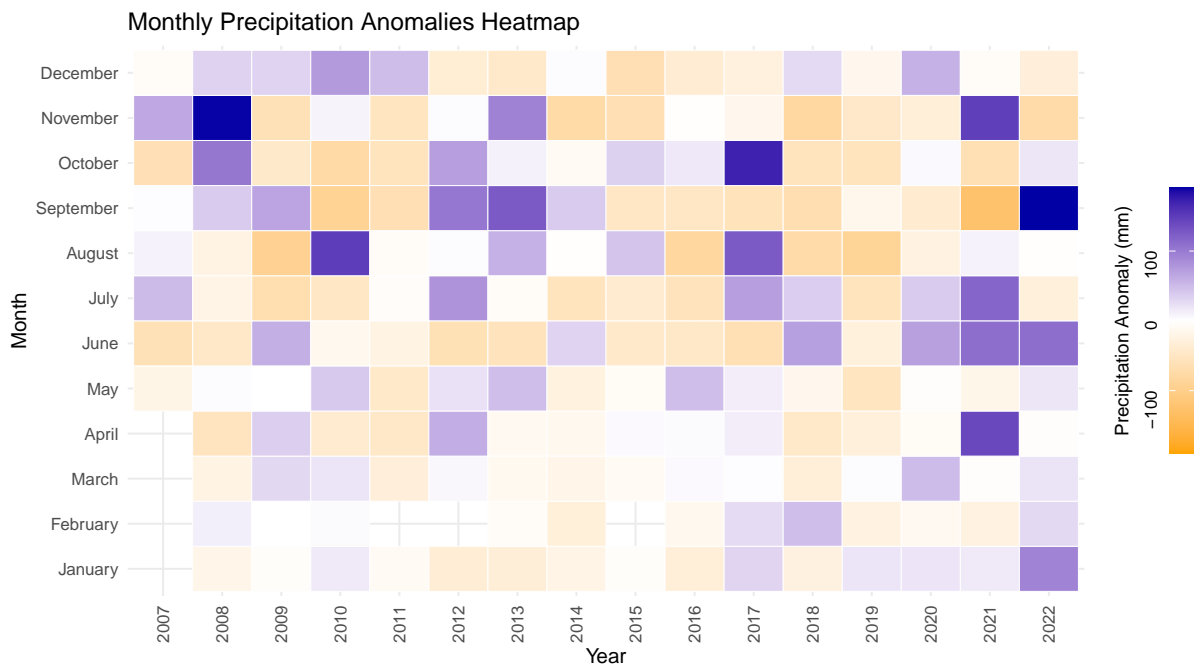
3.4 Precipitation anomalies

Figure 10: Monthly precipitation anomaly (°C). Stronger colors indicate large derivation from the month mean.
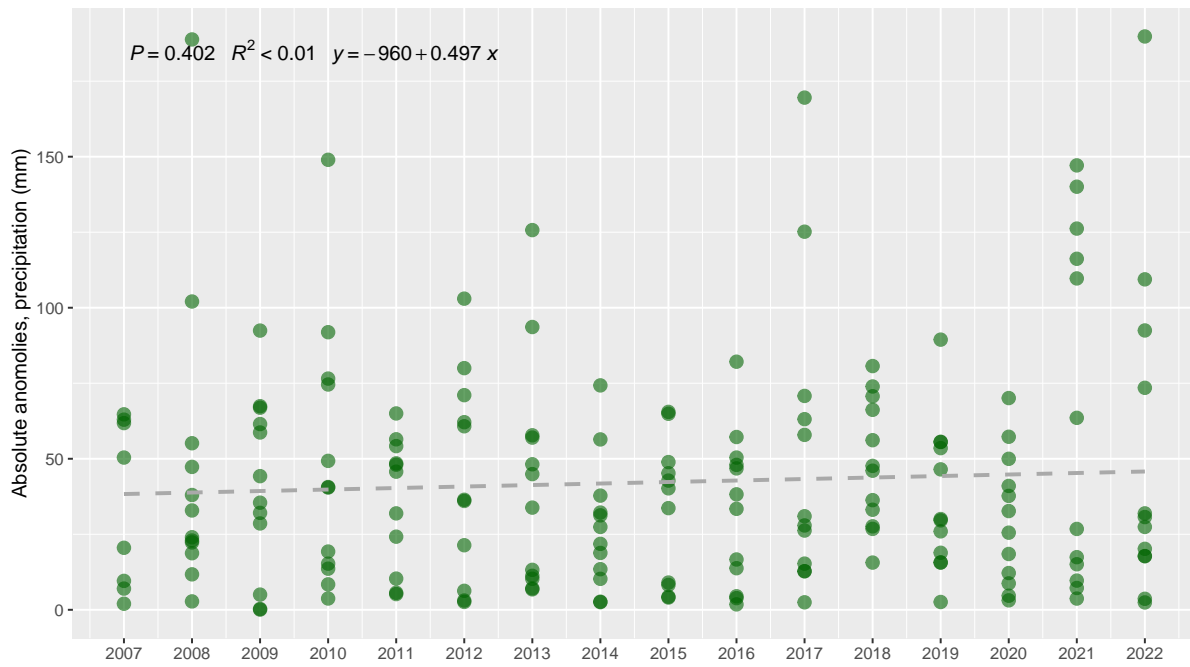
3.5 Absolute values of anomolies

Figure 11: Absolut values of anomolies (difference from mean) of respective month.
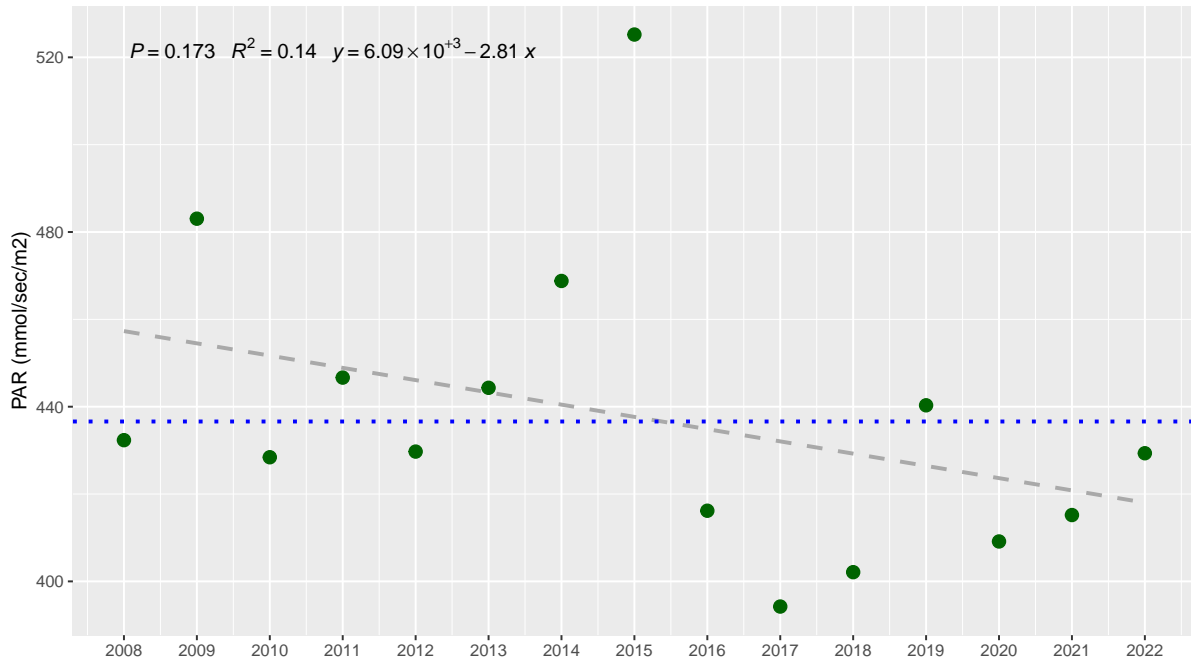
4 PAR data

Figure 12: Monthly mean PAR from 2008 to 2022. Calculations based on PAR values only when the sun is up (solar elevation > 0).
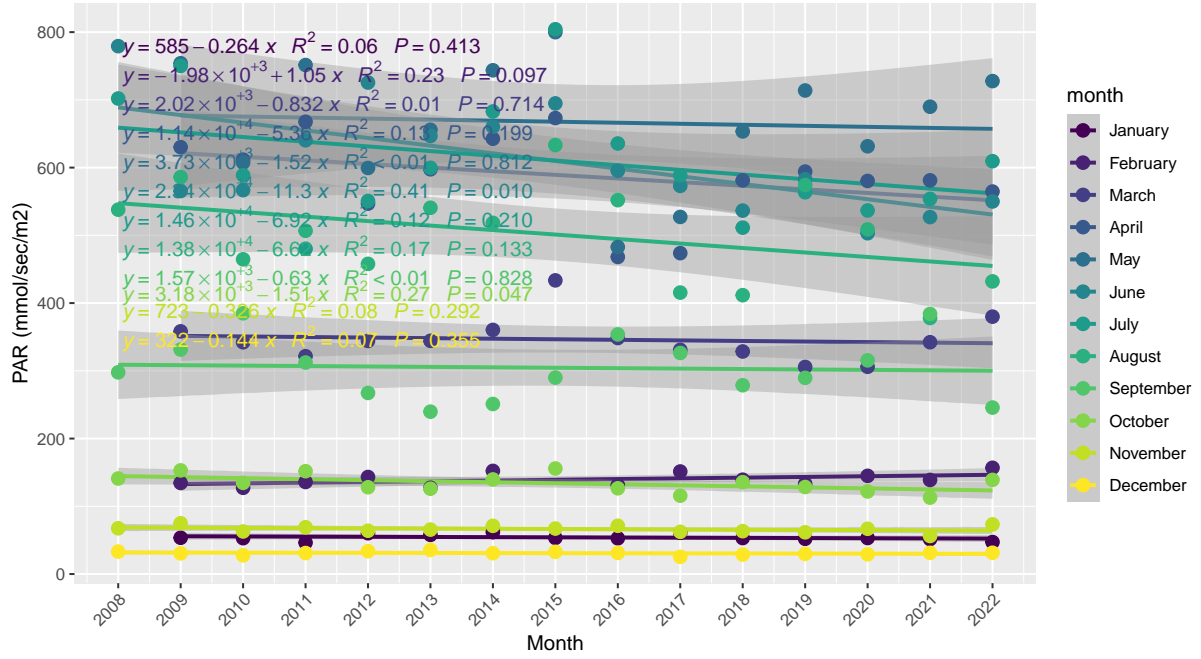
Figure 13: Monthly mean PAR from 2008 to 2022. Calculations based on PAR values only when the sun is up (solar elevation > 0).
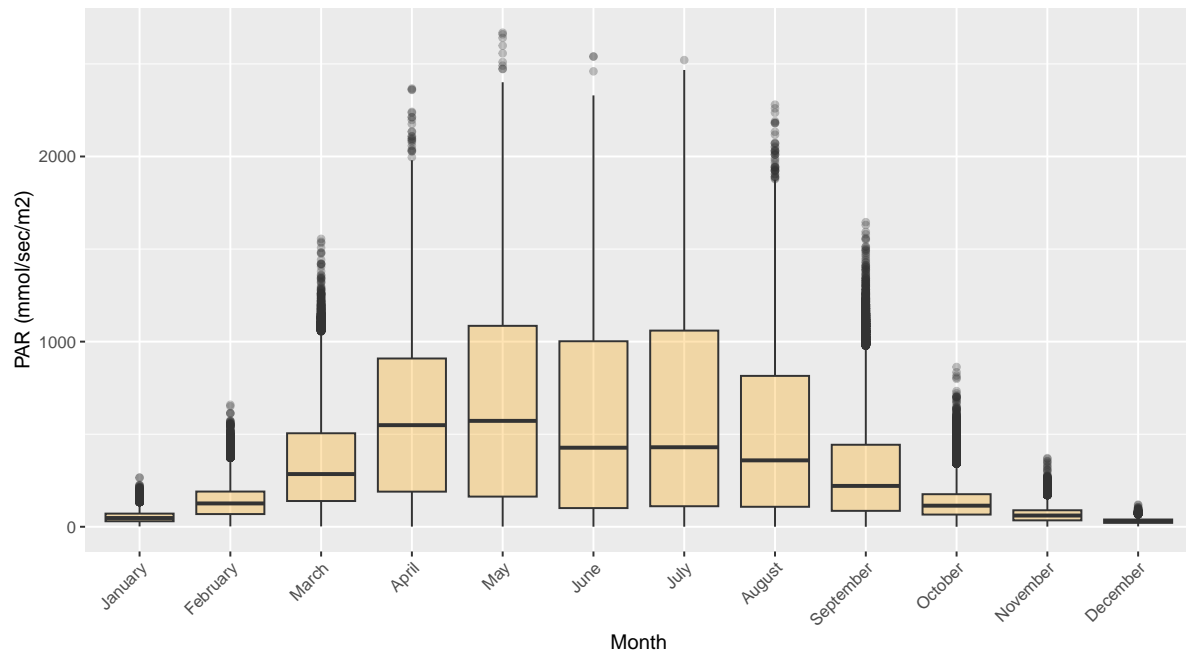
4.1 Monthly means

Figure 14: Monthly mean PAR from 2008 to 2022. Calculations based on PAR values only when the sun is up (solar elevation > 0).

4.2 Highest monthly means

The months with the highest mean levels of PAR (when the sun is up, solar elevation > 0) are May (663.1), July (610.3), June (597).
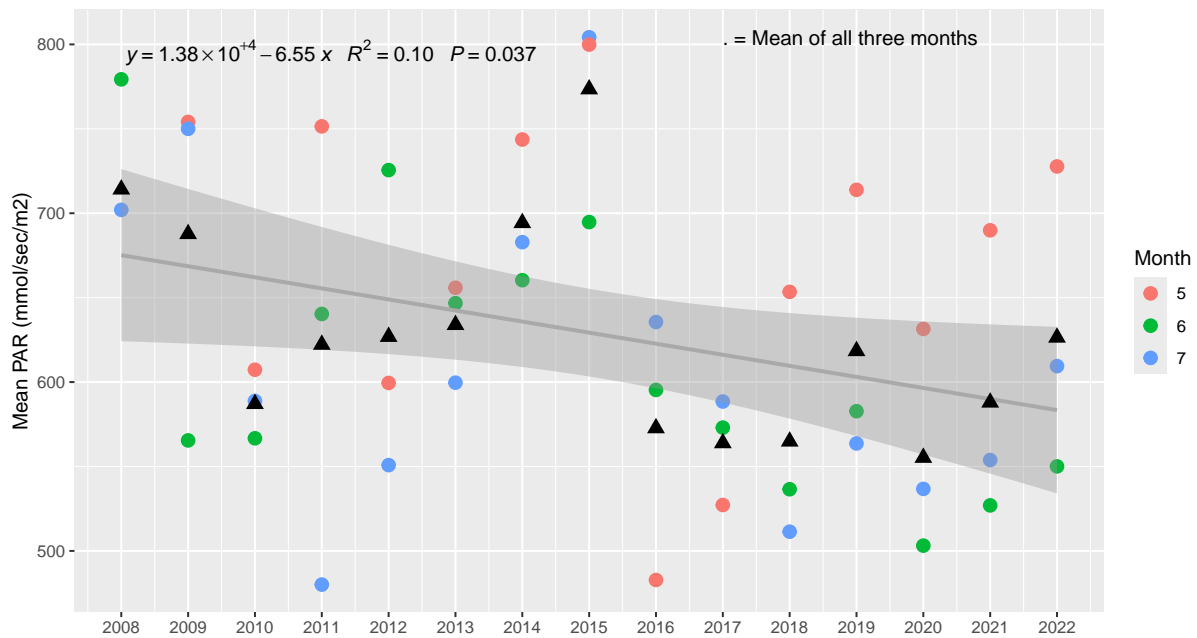
Figure 15: Mean of months with highest PAR.

Data indicate that high-radiation months have gotten less radiant during the monitoring period (see Figure 15).

```
Call:
lm(formula = par_mean ~ year, data = par_highest_mean)

Residuals:
    Min      1Q  Median      3Q     Max
-175.44  -60.59  -17.74   68.27  174.95

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 13835.416   6118.291   2.261   0.0290 *
year           -6.554      3.036  -2.159   0.0366 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 85.33 on 42 degrees of freedom
Multiple R-squared:  0.09987,    Adjusted R-squared:  0.07843
F-statistic:  4.66 on 1 and 42 DF,  p-value: 0.03664
```

4.3 Mean pr month

4.4 Observations above 2000

```
Call:
lm(formula = above_2000 ~ year, data = above_2000)

Residuals:
   Min     1Q Median     3Q    Max
-8.299 -6.156 -3.513  4.737 27.486

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 152.8806   646.6144   0.236    0.814
year         -0.0714     0.3210  -0.222    0.825

Residual standard error: 8.88 on 41 degrees of freedom
Multiple R-squared:  0.001205,  Adjusted R-squared:  -0.02316
F-statistic: 0.04946 on 1 and 41 DF,  p-value: 0.8251
```
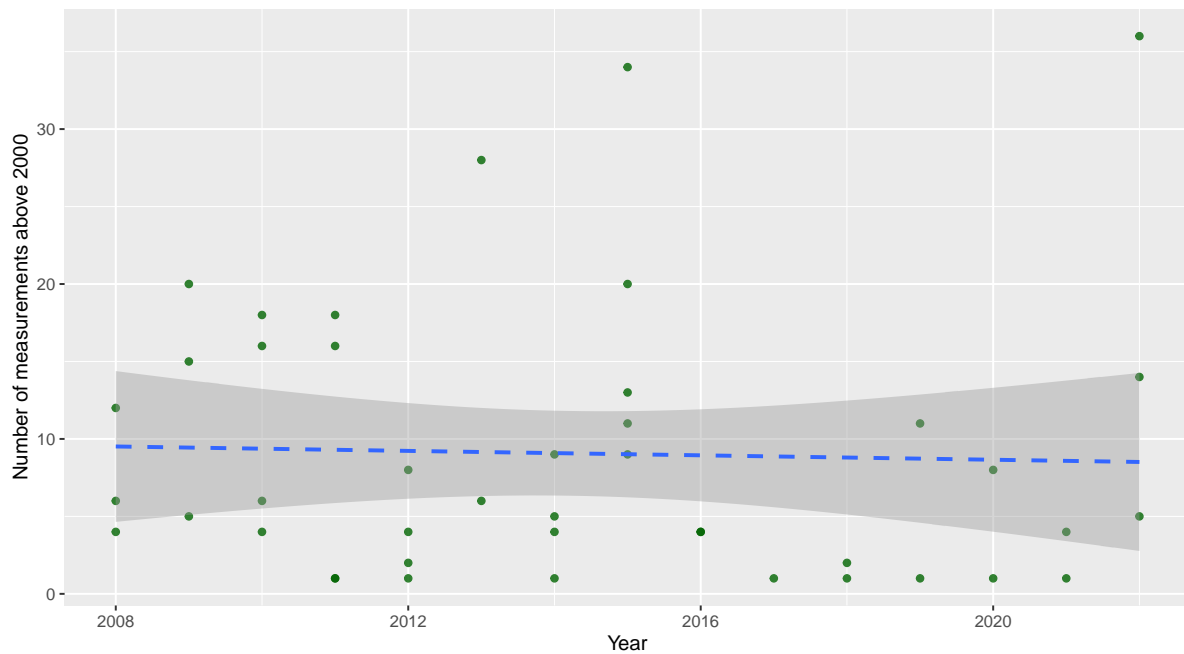

Figure 16: Number of measurements of PAR above 2000.

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4.5 PAR anomalies

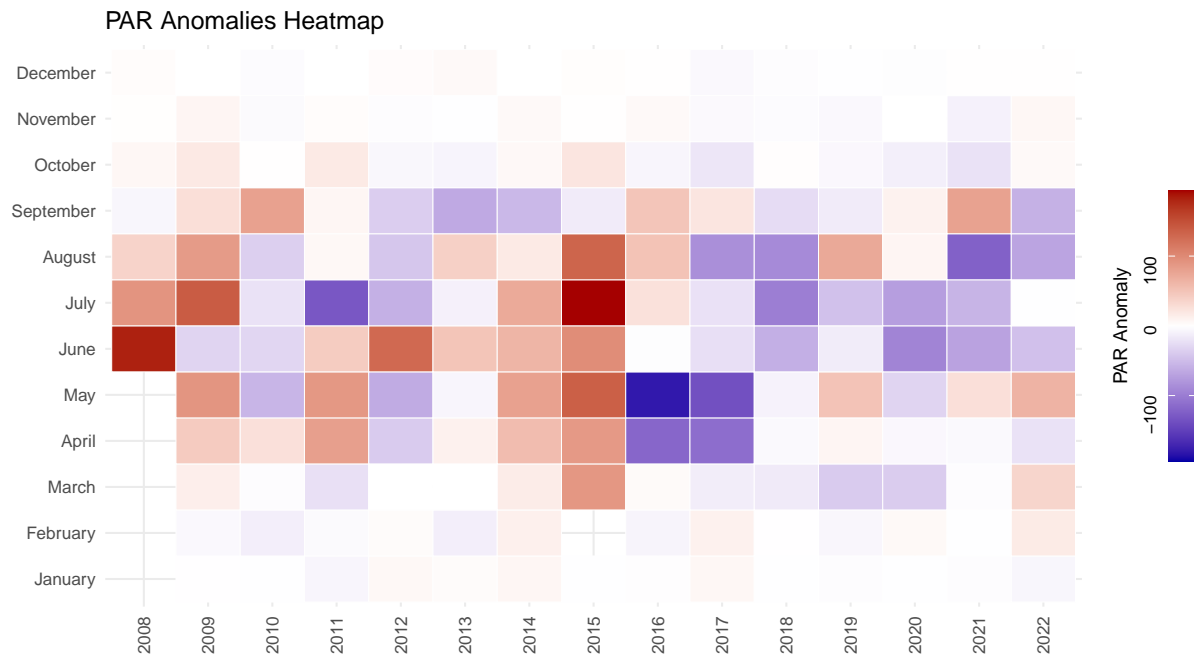Figure 17: Anomolies (difference from mean) of respective month. Stronger color indication bigger difference from monthly mean across entire period.
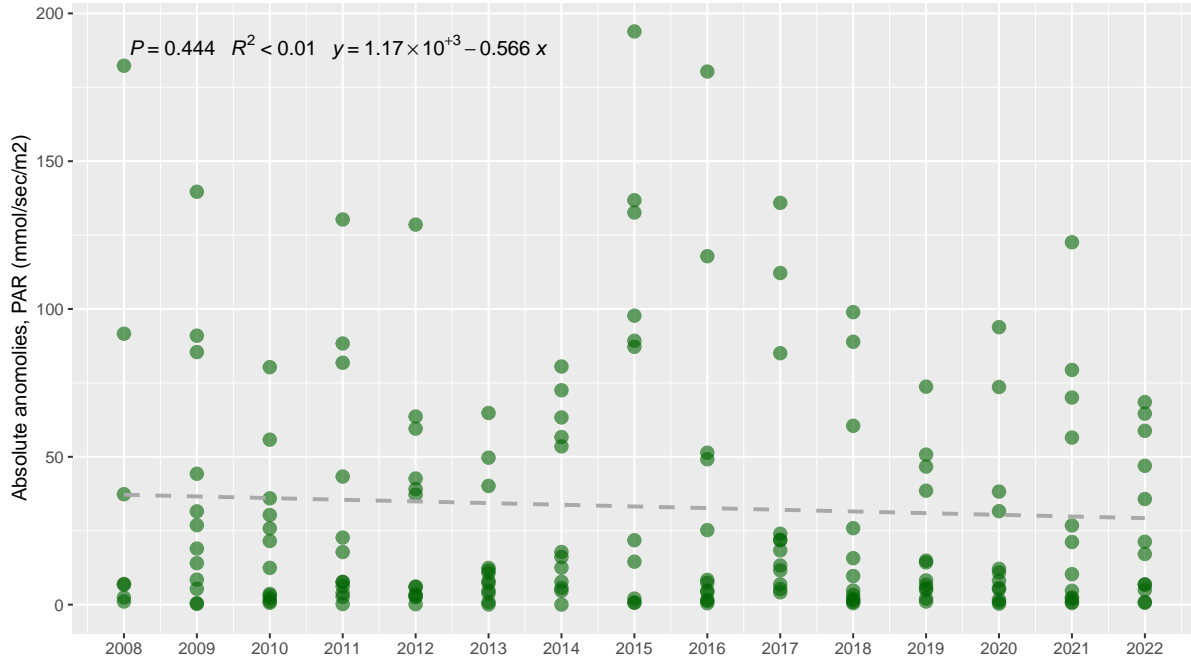
4.6 Absolute values of anomolies

Figure 18: Absolut values of anomolies (difference from mean) of respective month.

5 Degree days

The number of degree days (days with a mean temperature $> 0°C$) has not changed significantly during th emonitoring period.
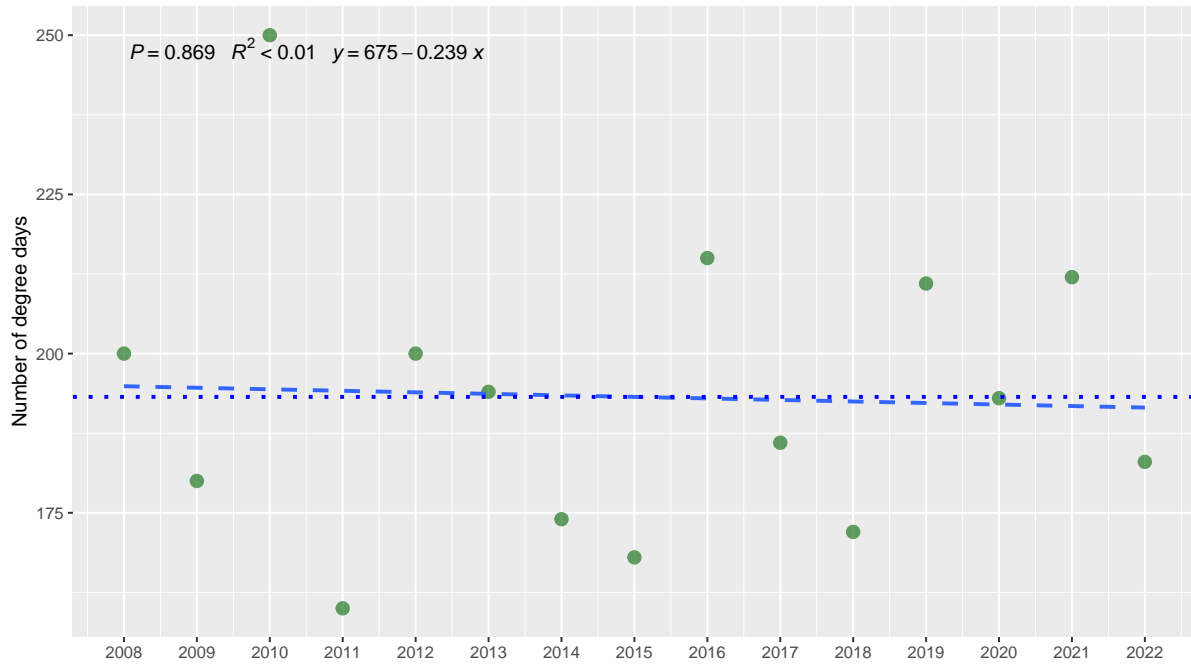
Figure 19: Degree days, days with mean temperature above 0°C

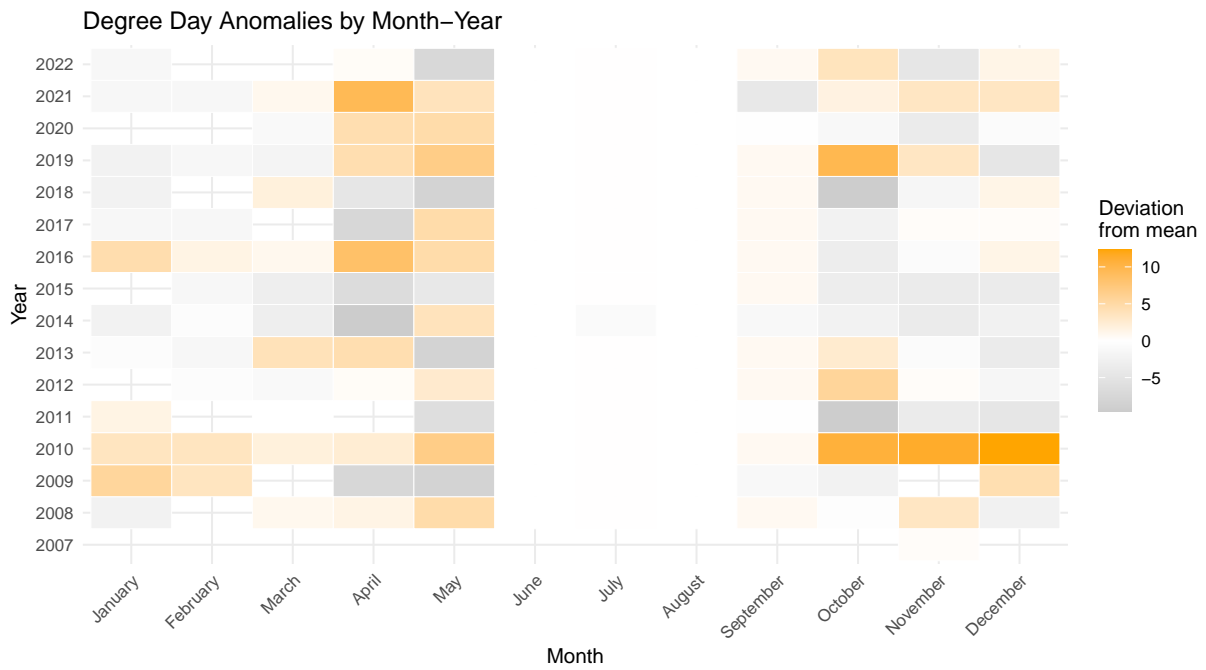##Degree days anomilies (in number of days)

Figure 20: Degree days, days with mean temperature above 0°C

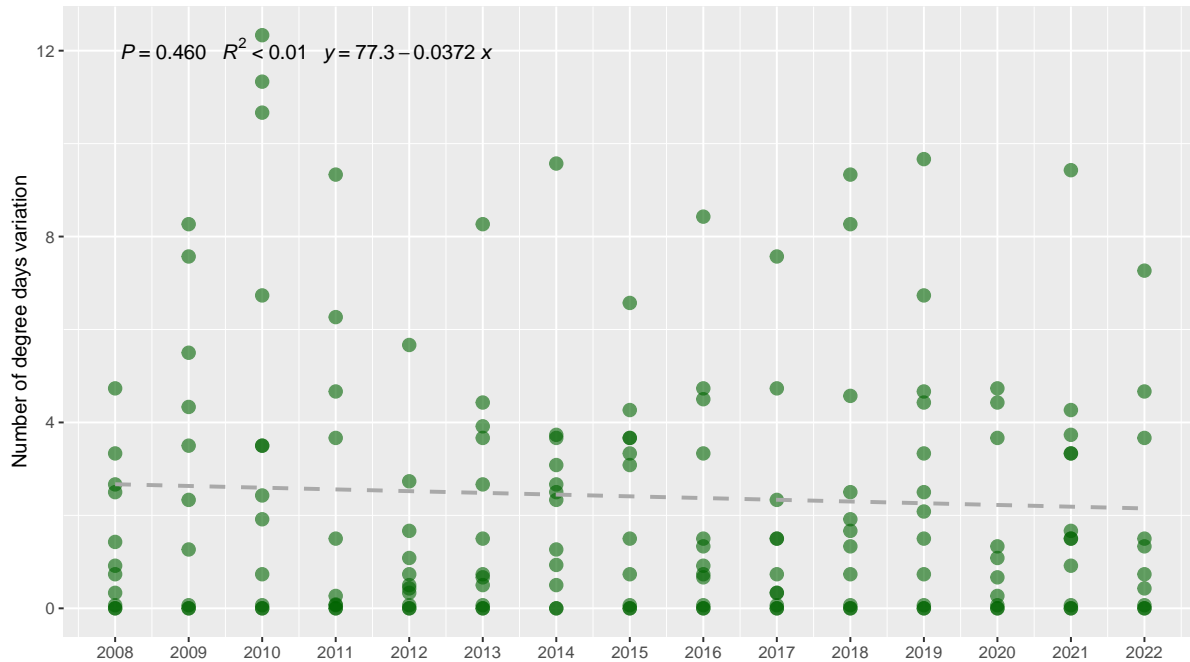##Absolute numers of variation in degree days

Figure 21: Absolute numers of deviation from mean number of degree days

6 Historic climate context

Lookings to see if CHELSA data shoc the same pattern of minimal change as the local data. Using this guide to optain data: https://gitlabext.wsl.ch/karger/rchelsa

References

Asiaq. 2020a. "ClimateBasis Nuuk - Precipitation - Precipitation Accumulated (Mm)." https://doi.org/10.17897/SXJ8-WA79.

———. 2020b. "ClimateBasis Nuuk - Radiation - Photosyntetic Active Radiation @ 200 Cm - 5min Average (Mmol/M2/Sec)." https://doi.org/10.17897/8Z2W-D993.

———. 2023. "Air Temperature @ 200 Cm - 30 Min Average (°c)." https://doi.org/10.17897/PGN3-7597.