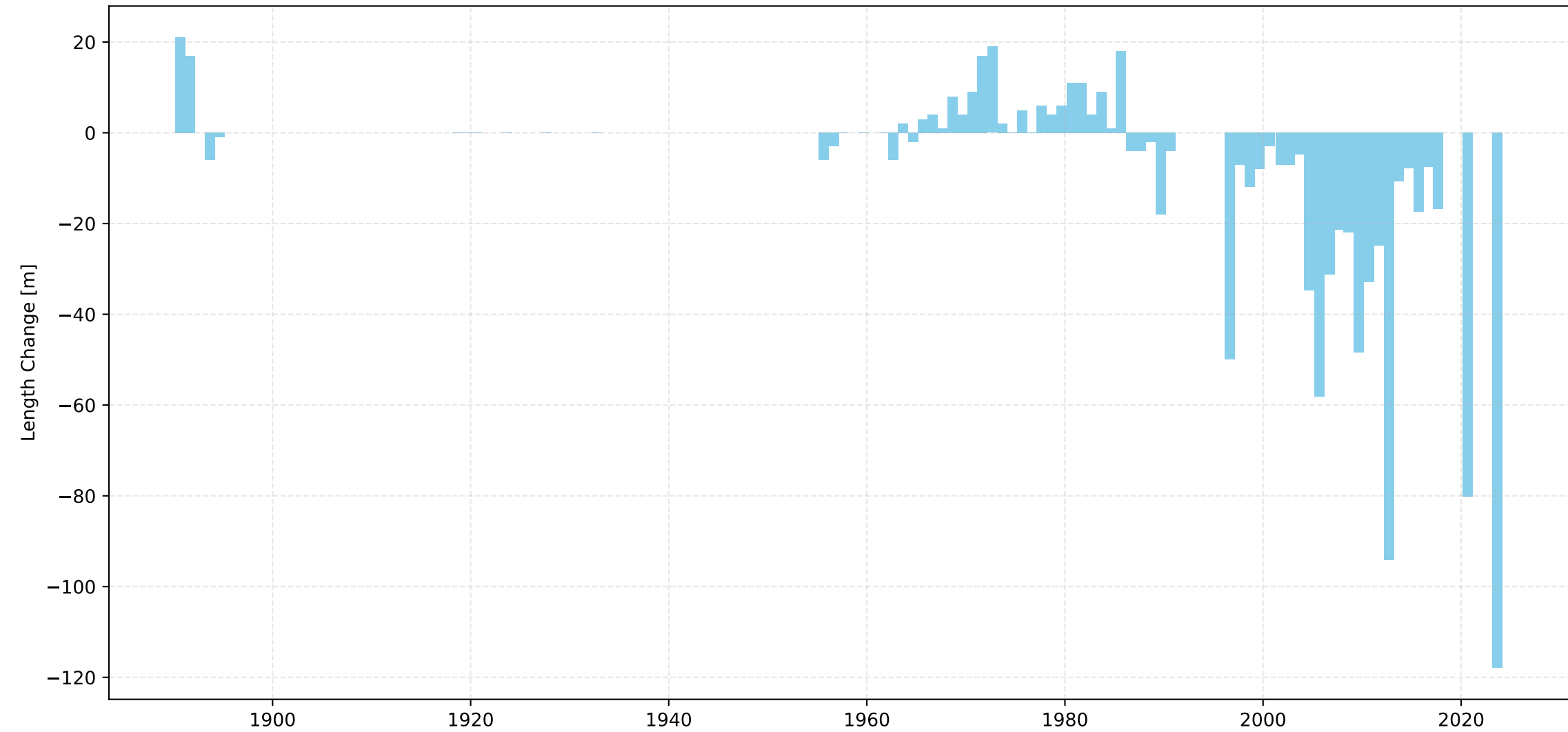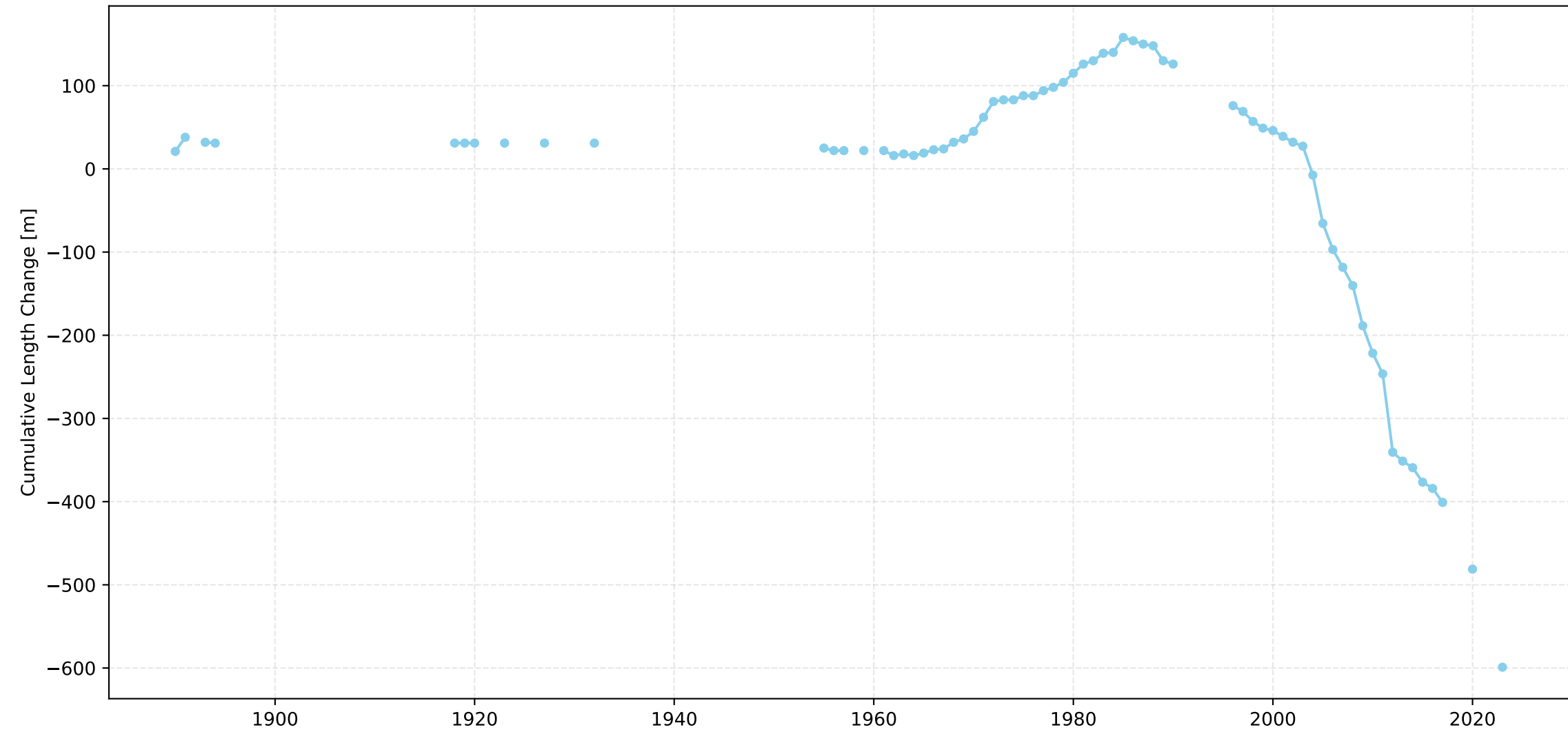Glacier du Giétro Length Change Over Time

Glacier du Giétro Cumulative Length Change Over Time

Glacier du Giétro Annual Mass Balance Over Time
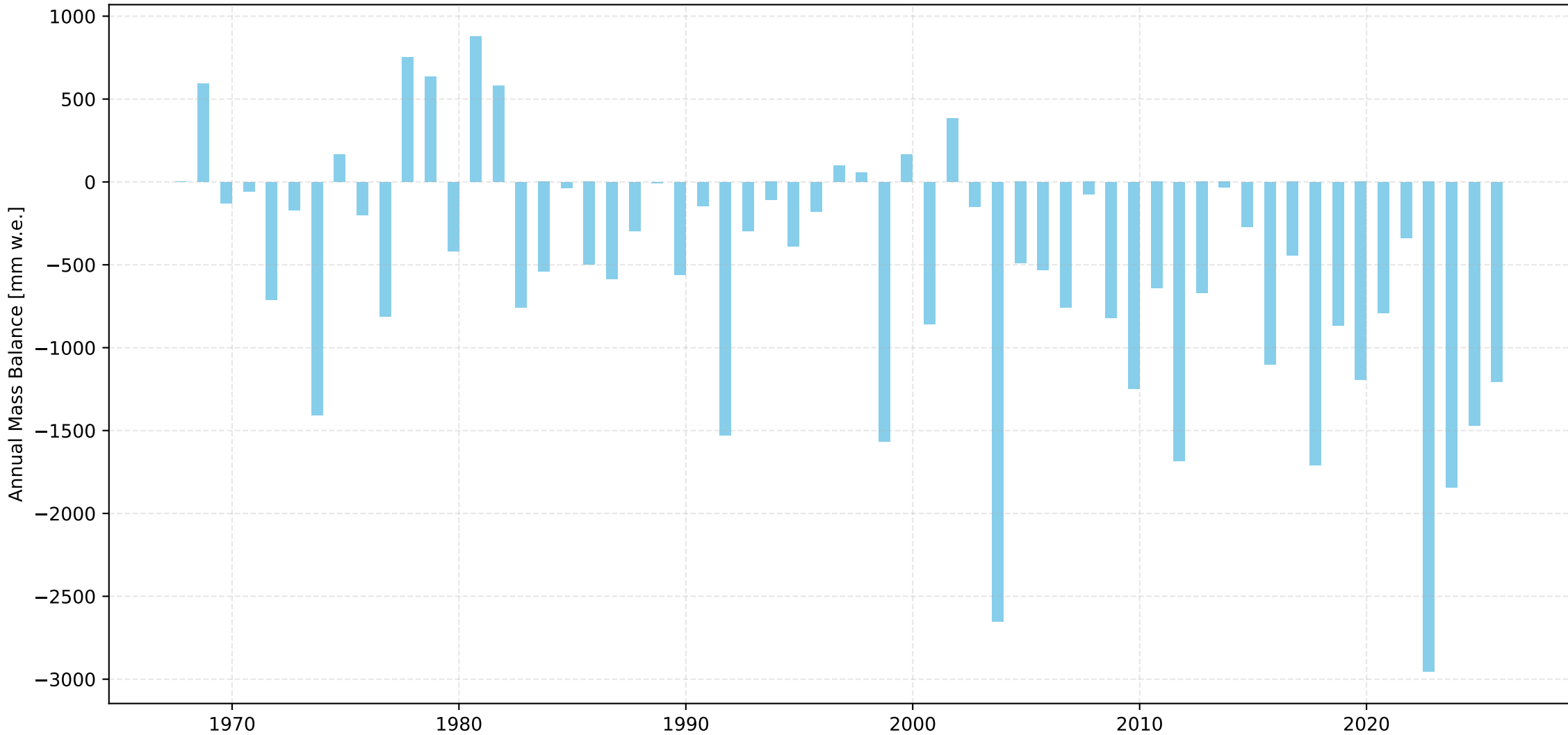
Glacier du Giétro Cumulative Annual Mass Balance Over Time
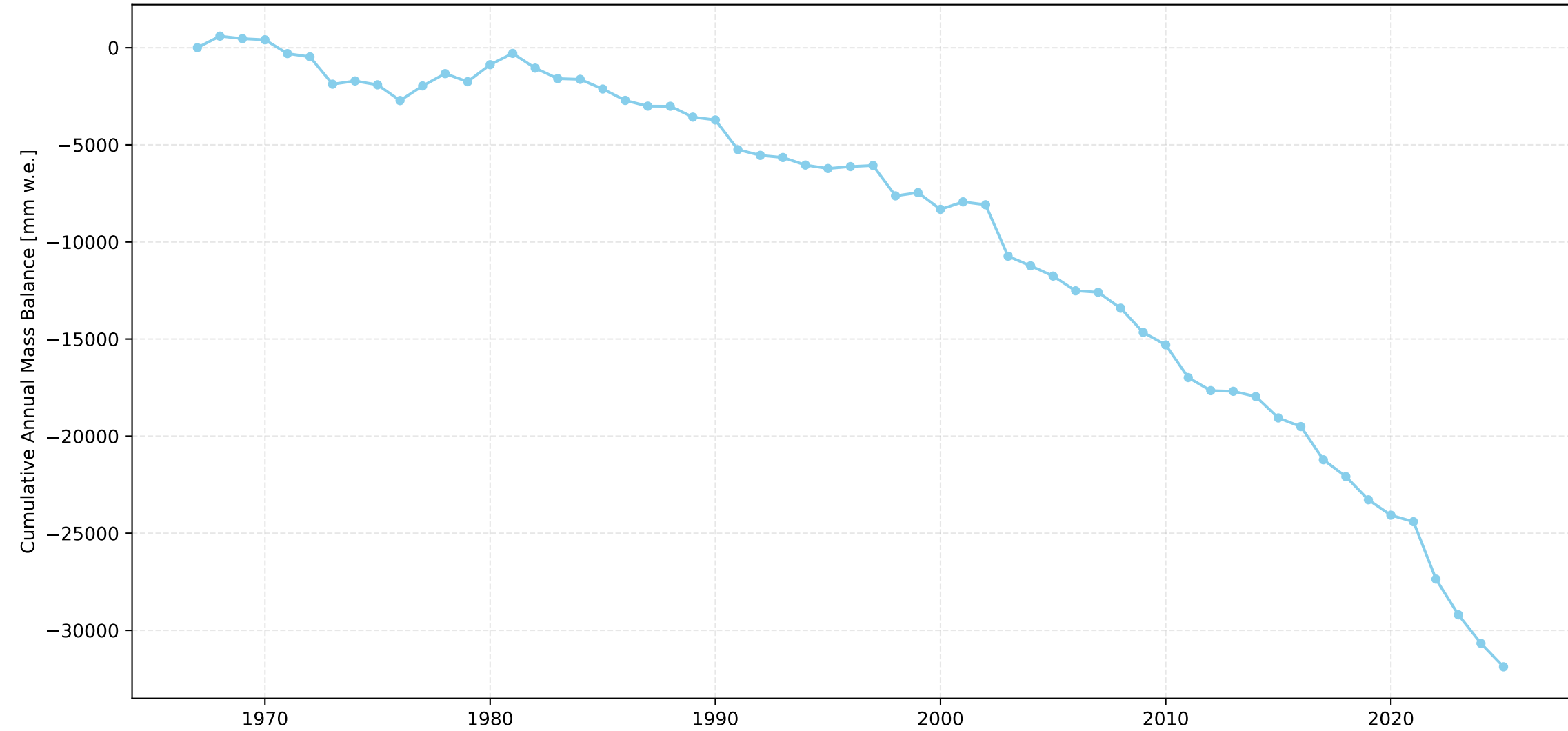
Annual Mass Balance for each Elevation Bin over Time - Glacier du Giétro
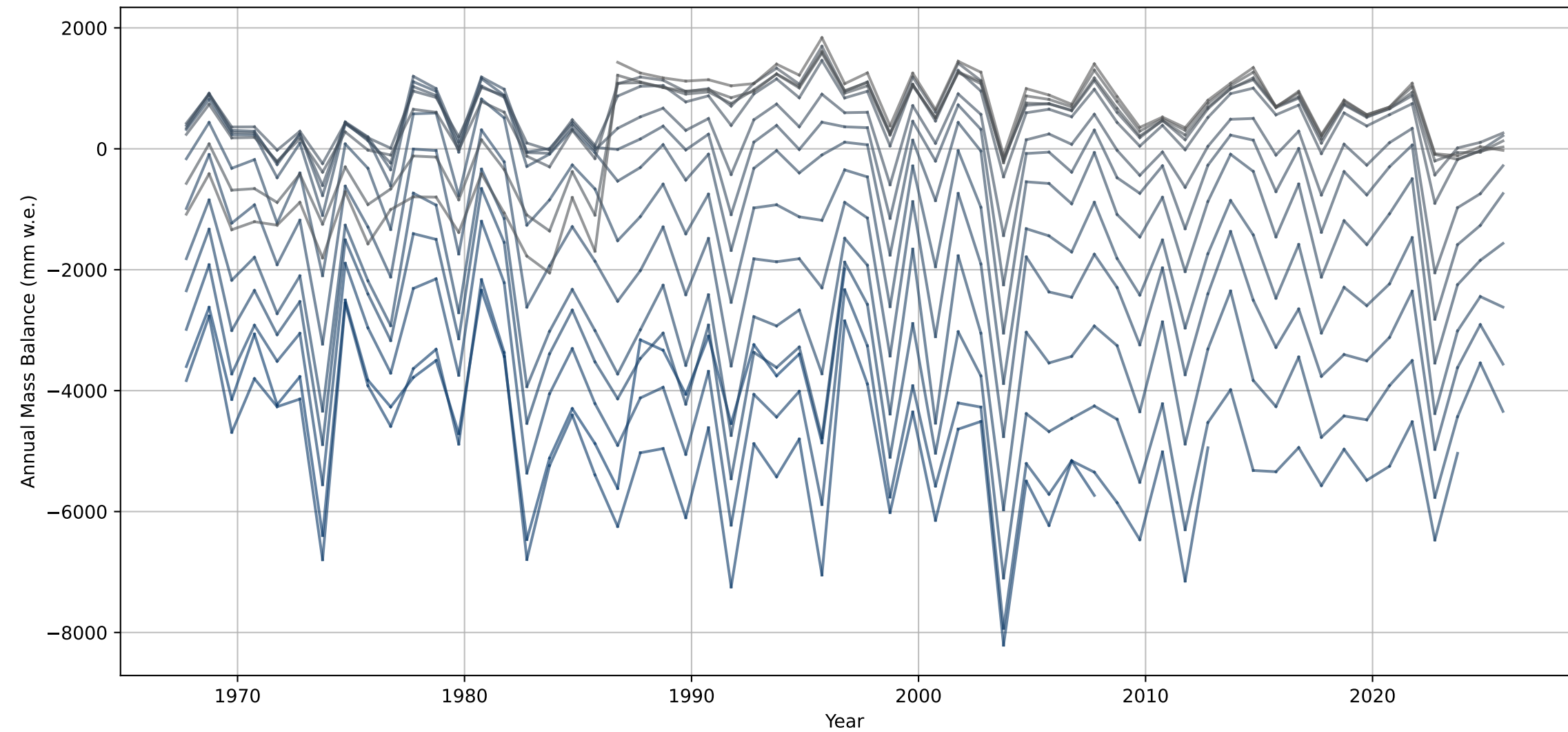
Sion Summer Mean Temperature

Sion Winter Total Precipitation

Legend:
- Winter Total Precipitation (mm)
- 1961-1990 Norm (365.0 mm)
- 1991-2020 Norm (324.0 mm)
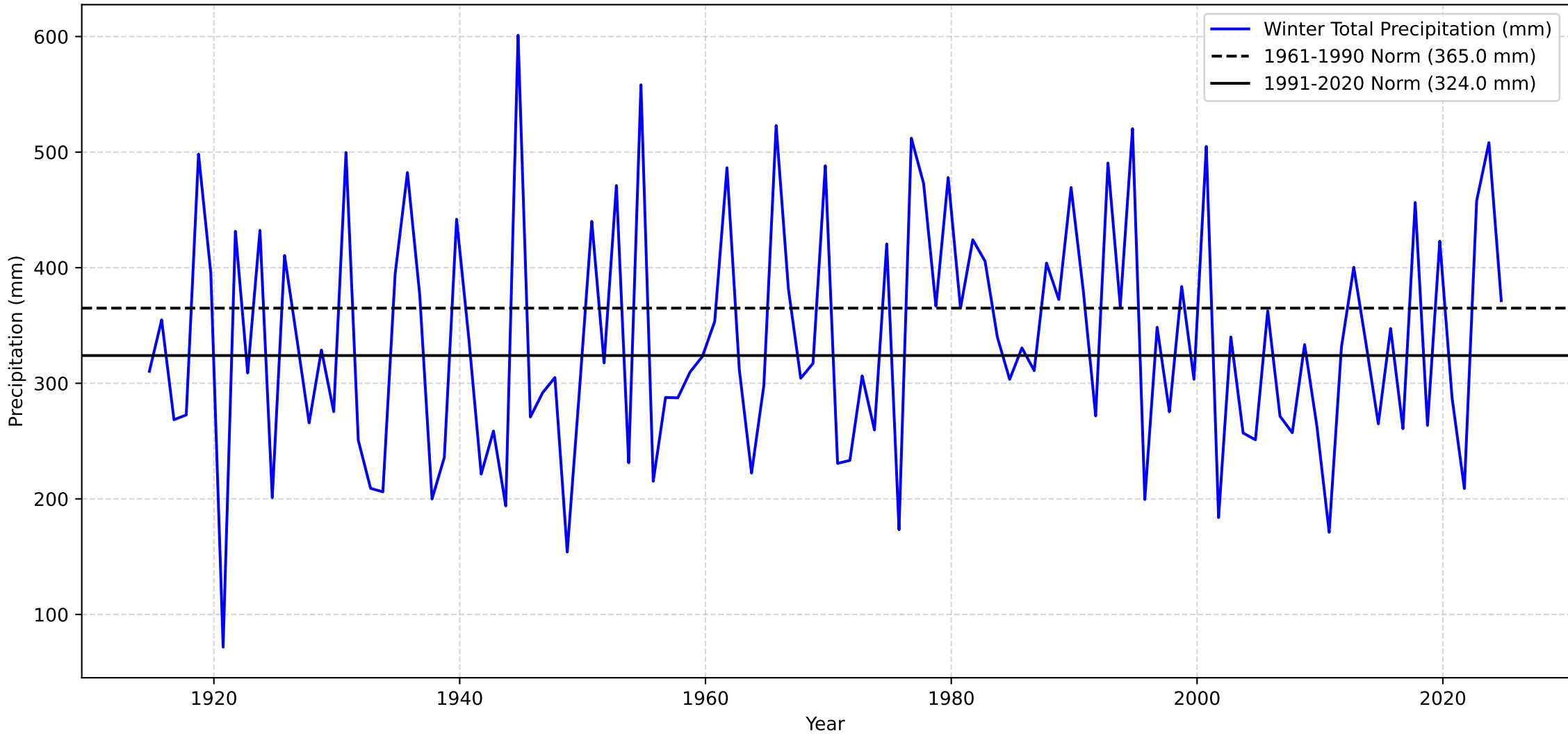
Glacier du Giétro Summer Mass Balance with relation to Temperature

```
================================================================================
MONTHLY DEVIATIONS ANALYSIS USING 1961-1990 CLIMATE NORMS
================================================================================


================================================================================
MONTHLY DEVIATIONS for Glacier du Giétro (1961-1990 norms)
================================================================================

Number of observations: 59

Regression Summary:
                          OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:            0.703
Model:                                      OLS    Adj. R-squared:       0.625
Method:                           Least Squares    F-statistic:          9.065
Date:                          Mon, 08 Dec 2025    Prob (F-statistic): 1.40e-08
Time:                                  00:57:57    Log-Likelihood:     -438.92
No. Observations:                            59    AIC:                  903.8
Df Residuals:                                46    BIC:                  930.9
Df Model:                                    12
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         1.617e+04   1948.539      8.300      0.000    1.23e+04    2.01e+04
may_td         -38.2728     50.064     -0.764      0.448    -139.046      62.500
june_td        -89.3936     45.822     -1.951      0.057    -181.629       2.842
july_td       -145.8930     49.850     -2.927      0.005    -246.235     -45.551
august_td     -120.0130     61.355     -1.956      0.057    -243.515       3.489
september_td   -75.7921     47.156     -1.607      0.115    -170.713      19.129
october_pd       2.3180      2.186      1.060      0.295      -2.083       6.719
november_pd     -1.5704      1.698     -0.925      0.360      -4.988       1.847
december_pd      1.3308      1.522      0.874      0.386      -1.733       4.395
january_pd       3.3608      1.667      2.017      0.050       0.006       6.715
february_pd      2.8796      1.417      2.032      0.048       0.027       5.732
march_pd         1.7271      1.961      0.881      0.383      -2.219       5.674
april_pd         3.1540      2.942      1.072      0.289      -2.768       9.076
==============================================================================
Omnibus:                        1.577   Durbin-Watson:                   2.085
Prob(Omnibus):                  0.454   Jarque-Bera (JB):                1.584
Skew:                          -0.345   Prob(JB):                        0.453
Kurtosis:                       2.589   Cond. No.                     2.52e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 2.52e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```
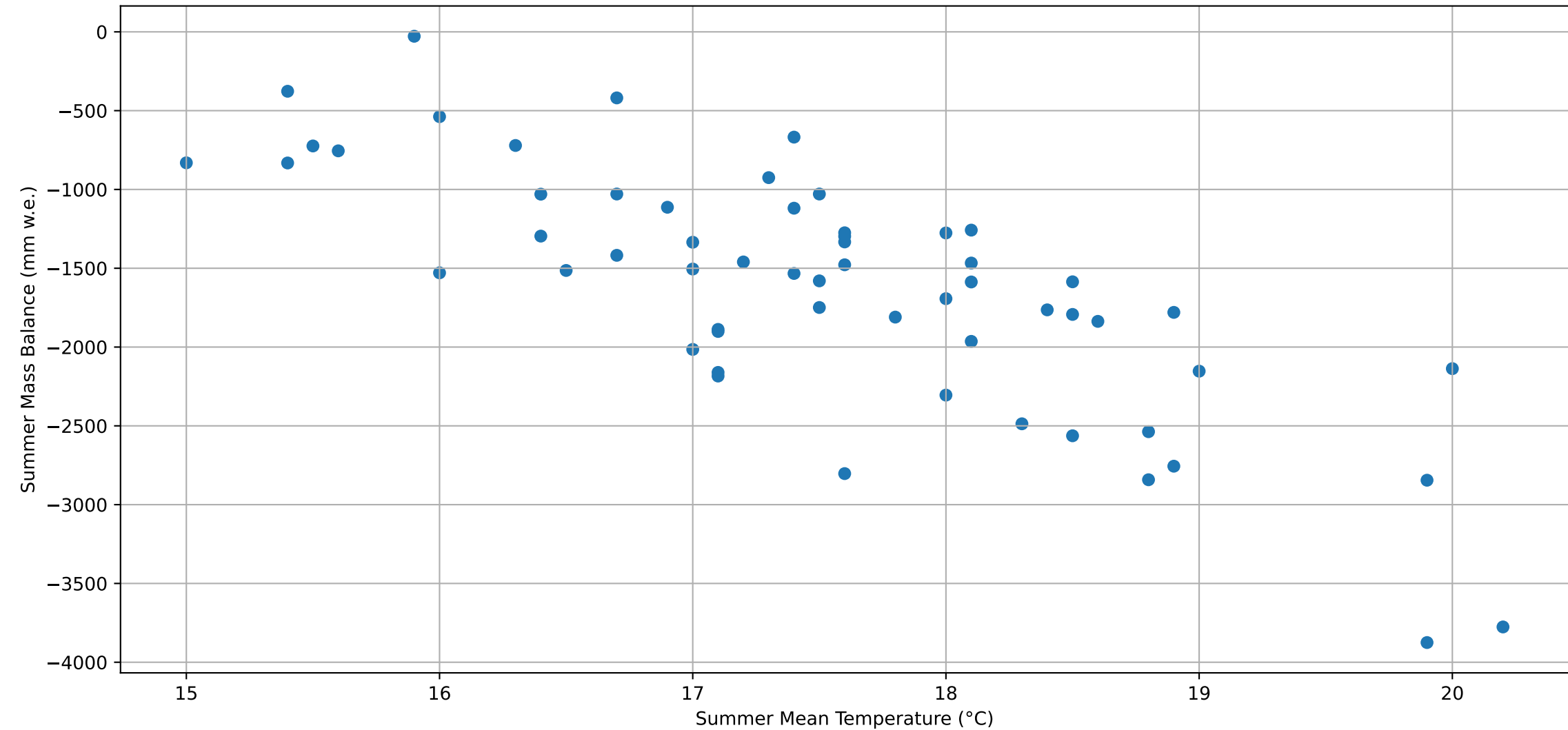
Coefficient Interpretation:
Intercept (normal mass balance): 16173.56 (p=0.0000)
may_td: -38.27 (p=0.4485)
june_td: -89.39 (p=0.0572)
july_td: -145.89 (p=0.0053)
august_td: -120.01 (p=0.0565)
september_td: -75.79 (p=0.1148)
october_pd: 2.32 (p=0.2946)
november_pd: -1.57 (p=0.3598)

```
================================================================================
OPTIMAL SEASONAL DEVIATIONS ANALYSIS USING 1961-1990 CLIMATE NORMS
================================================================================


================================================================================
OPTIMAL SEASONAL DEVIATIONS for Glacier du Giétro (1961-1990 norms)
================================================================================


Number of observations: 59

Regression Summary:
                          OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)  R-squared:              0.617
Model:                                       OLS  Adj. R-squared:         0.604
Method:                            Least Squares  F-statistic:            45.20
Date:                           Mon, 08 Dec 2025  Prob (F-statistic):  2.06e-12
Time:                                   00:57:57  Log-Likelihood:       -446.37
No. Observations:                             59  AIC:                    898.7
Df Residuals:                                 56  BIC:                    905.0
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          1.524e+04  1760.086      8.656      0.000    1.17e+04    1.88e+04
opt_season_td  -450.4983    50.330     -8.951      0.000    -551.322    -349.675
opt_season_pd     1.4877     0.787      1.889      0.064      -0.090       3.065
==============================================================================
Omnibus:                        1.705   Durbin-Watson:                   2.018
Prob(Omnibus):                  0.426   Jarque-Bera (JB):                1.531
Skew:                          -0.387   Prob(JB):                        0.465
Kurtosis:                       2.844   Cond. No.                     2.29e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 2.29e+03. This might indicate that there are
strong multicollinearity or other numerical problems.

Coefficient Interpretation:
Intercept (normal mass balance): 15235.01 (p=0.0000)
opt_season_td: -450.50 (p=0.0000)
opt_season_pd: 1.49 (p=0.0640)

Variance Inflation Factors (VIF):
        Variable        VIF
0          const  795.023059
1  opt_season_td    1.021034
2  opt_season_pd    1.021034

R-squared: 0.6175
Adjusted R-squared: 0.6038
```

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================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS ANALYSIS USING 1961-1990 CLIMATE NORMS
================================================================================


================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS for Glacier du Giétro (1961-1990 norms)
================================================================================


Number of observations: 59

Regression Summary:
                        OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)  R-squared:          0.636
Model:                                      OLS   Adj. R-squared:     0.623
Method:                           Least Squares   F-statistic:        48.96
Date:                          Mon, 08 Dec 2025   Prob (F-statistic): 5.08e-13
Time:                                  00:57:57   Log-Likelihood:     -444.89
No. Observations:                            59   AIC:                895.8
Df Residuals:                                56   BIC:                902.0
Df Model:                                     2
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         1.586e+04   1788.122      8.871      0.000    1.23e+04    1.94e+04
summer_td     -481.6753     52.641     -9.150      0.000    -587.128    -376.223
winter_pd        1.7815      0.666      2.676      0.010       0.448       3.115
==============================================================================
Omnibus:                        2.465   Durbin-Watson:                  2.093
Prob(Omnibus):                  0.292   Jarque-Bera (JB):               2.370
Skew:                          -0.431   Prob(JB):                       0.306
Kurtosis:                       2.529   Cond. No.                    2.78e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 2.78e+03. This might indicate that there are
strong multicollinearity or other numerical problems.

Coefficient Interpretation:
Intercept (normal mass balance): 15862.72 (p=0.0000)
summer_td: -481.68 (p=0.0000)
winter_pd: 1.78 (p=0.0098)

Variance Inflation Factors (VIF):
    Variable        VIF
0      const  862.630407
1  summer_td    1.013727
2  winter_pd    1.013727

R-squared: 0.6362
Adjusted R-squared: 0.6232
```

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================================================================================
MONTHLY DEVIATIONS ANALYSIS USING 1991-2020 CLIMATE NORMS
================================================================================


================================================================================
MONTHLY DEVIATIONS for Glacier du Giétro (1991-2020 norms)
================================================================================

Number of observations: 59

Regression Summary:
                          OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:              0.703
Model:                                      OLS    Adj. R-squared:         0.625
Method:                           Least Squares    F-statistic:            9.065
Date:                          Mon, 08 Dec 2025    Prob (F-statistic):   1.40e-08
Time:                                  00:57:57    Log-Likelihood:        -438.92
No. Observations:                            59    AIC:                     903.8
Df Residuals:                                46    BIC:                     930.9
Df Model:                                    12
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         -848.2916     69.883    -12.139      0.000    -988.959    -707.625
may_td         -38.2728     50.064     -0.764      0.448    -139.046      62.500
june_td        -89.3936     45.822     -1.951      0.057    -181.629       2.842
july_td       -145.8930     49.850     -2.927      0.005    -246.235     -45.551
august_td     -120.0130     61.355     -1.956      0.057    -243.515       3.489
september_td   -75.7921     47.156     -1.607      0.115    -170.713      19.129
october_pd       2.3180      2.186      1.060      0.295      -2.083       6.719
november_pd     -1.5704      1.698     -0.925      0.360      -4.988       1.847
december_pd      1.3308      1.522      0.874      0.386      -1.733       4.395
january_pd       3.3608      1.667      2.017      0.050       0.006       6.715
february_pd      2.8796      1.417      2.032      0.048       0.027       5.732
march_pd         1.7271      1.961      0.881      0.383      -2.219       5.674
april_pd         3.1540      2.942      1.072      0.289      -2.768       9.076
==============================================================================
Omnibus:                        1.577   Durbin-Watson:                   2.085
Prob(Omnibus):                  0.454   Jarque-Bera (JB):                1.584
Skew:                          -0.345   Prob(JB):                        0.453
Kurtosis:                       2.589   Cond. No.                         59.6
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Coefficient Interpretation:
Intercept (normal mass balance): -848.29 (p=0.0000)
may_td: -38.27 (p=0.4485)
june_td: -89.39 (p=0.0572)
july_td: -145.89 (p=0.0053)
august_td: -120.01 (p=0.0565)
september_td: -75.79 (p=0.1148)
october_pd: 2.32 (p=0.2946)
november_pd: -1.57 (p=0.3598)
december_pd: 1.33 (p=0.3865)
january_pd: 3.36 (p=0.0496)
```

```
================================================================================
OPTIMAL SEASONAL DEVIATIONS ANALYSIS USING 1991-2020 CLIMATE NORMS
================================================================================


================================================================================
OPTIMAL SEASONAL DEVIATIONS for Glacier du Giétro (1991-2020 norms)
================================================================================


Number of observations: 59

Regression Summary:
                          OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:             0.613
Model:                                      OLS    Adj. R-squared:        0.599
Method:                           Least Squares    F-statistic:           44.30
Date:                          Mon, 08 Dec 2025    Prob (F-statistic):  2.91e-12
Time:                                  00:57:57    Log-Likelihood:       -446.73
No. Observations:                            59    AIC:                   899.5
Df Residuals:                                56    BIC:                   905.7
Df Model:                                     2
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         -852.7609     71.051    -12.002      0.000    -995.092    -710.429
opt_season_td -448.0476     50.588     -8.857      0.000    -549.388    -346.707
opt_season_pd    1.4408      0.793      1.816      0.075      -0.148       3.030
==============================================================================
Omnibus:                        1.850   Durbin-Watson:                   2.024
Prob(Omnibus):                  0.396   Jarque-Bera (JB):                1.632
Skew:                          -0.402   Prob(JB):                        0.442
Kurtosis:                       2.871   Cond. No.                         99.0
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Coefficient Interpretation:
Intercept (normal mass balance): -852.76 (p=0.0000)
opt_season_td: -448.05 (p=0.0000)
opt_season_pd: 1.44 (p=0.0746)

Variance Inflation Factors (VIF):
        Variable       VIF
0          const  1.279578
1  opt_season_td  1.023234
2  opt_season_pd  1.023234

R-squared: 0.6127
Adjusted R-squared: 0.5989
```

```
================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS ANALYSIS USING 1991-2020 CLIMATE NORMS
================================================================================


================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS for Glacier du Giétro (1991-2020 norms)
================================================================================


Number of observations: 59

Regression Summary:
                          OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:          0.639
Model:                                      OLS    Adj. R-squared:     0.626
Method:                           Least Squares    F-statistic:        49.62
Date:                          Mon, 08 Dec 2025    Prob (F-statistic): 3.99e-13
Time:                                  00:57:57    Log-Likelihood:    -444.64
No. Observations:                            59    AIC:                 895.3
Df Residuals:                                56    BIC:                 901.5
Df Model:                                     2
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const        -863.4615     68.764    -12.557      0.000   -1001.212    -725.711
summer_td    -482.6673     52.371     -9.216      0.000    -587.580    -377.755
winter_pd       1.8040      0.663      2.723      0.009       0.477       3.131
==============================================================================
Omnibus:                        2.461   Durbin-Watson:                   2.051
Prob(Omnibus):                  0.292   Jarque-Bera (JB):                2.309
Skew:                          -0.407   Prob(JB):                        0.315
Kurtosis:                       2.475   Cond. No.                         116.
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Coefficient Interpretation:
Intercept (normal mass balance): -863.46 (p=0.0000)
summer_td: -482.67 (p=0.0000)
winter_pd: 1.80 (p=0.0086)

Variance Inflation Factors (VIF):
    Variable        VIF
0      const   1.286778
1  summer_td   1.012792
2  winter_pd   1.012792

R-squared: 0.6393
Adjusted R-squared: 0.6264
```