Hohlaubgletscher Length Change Over Time
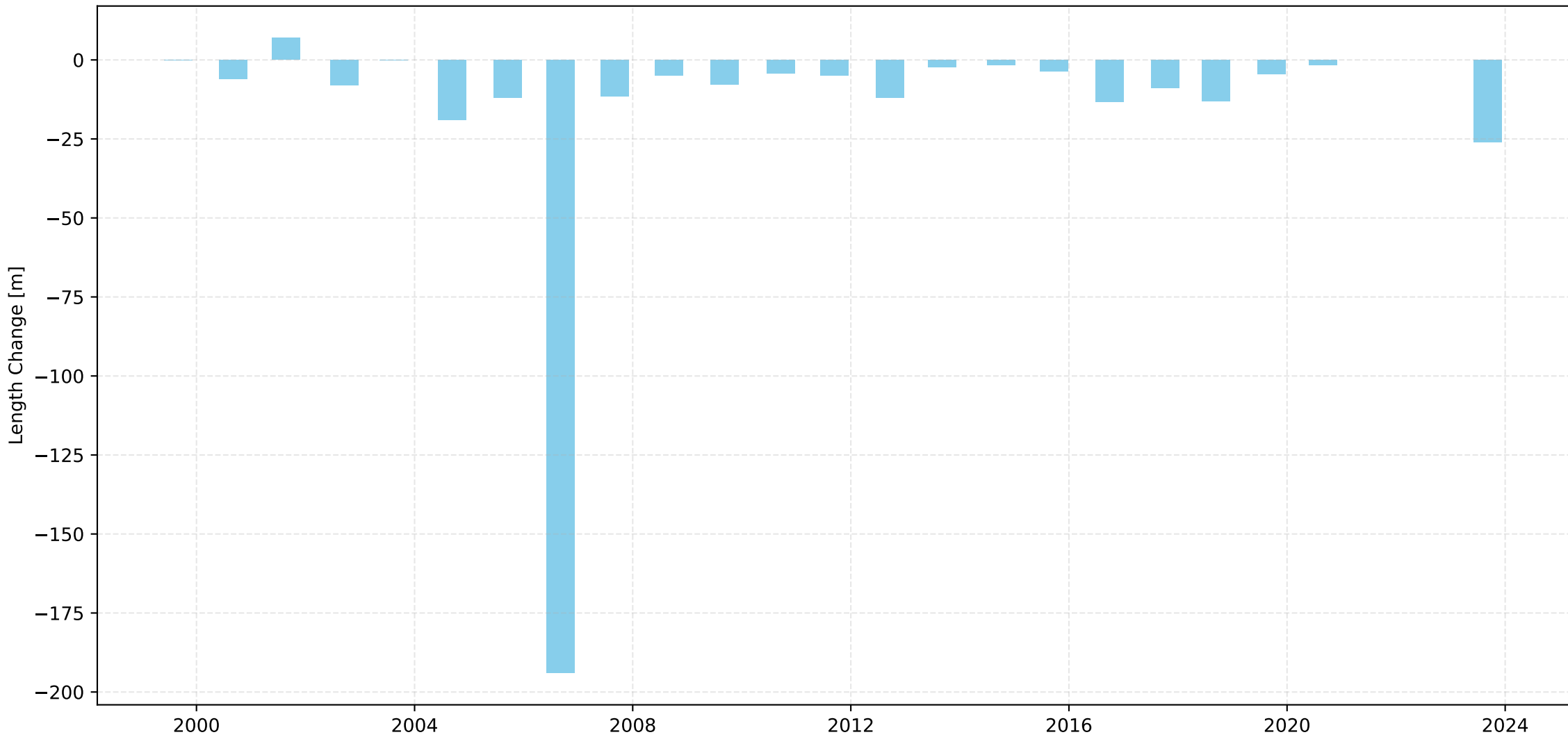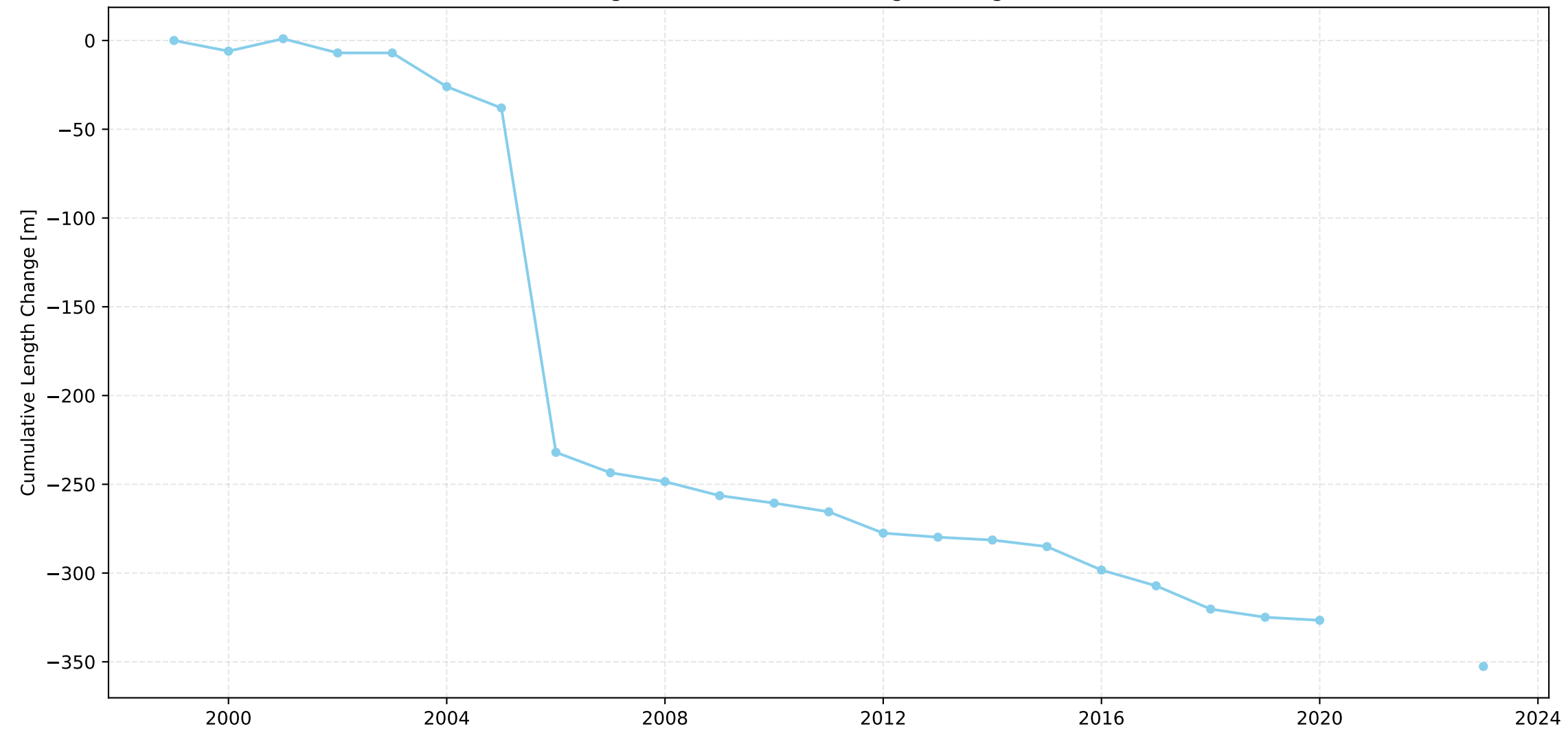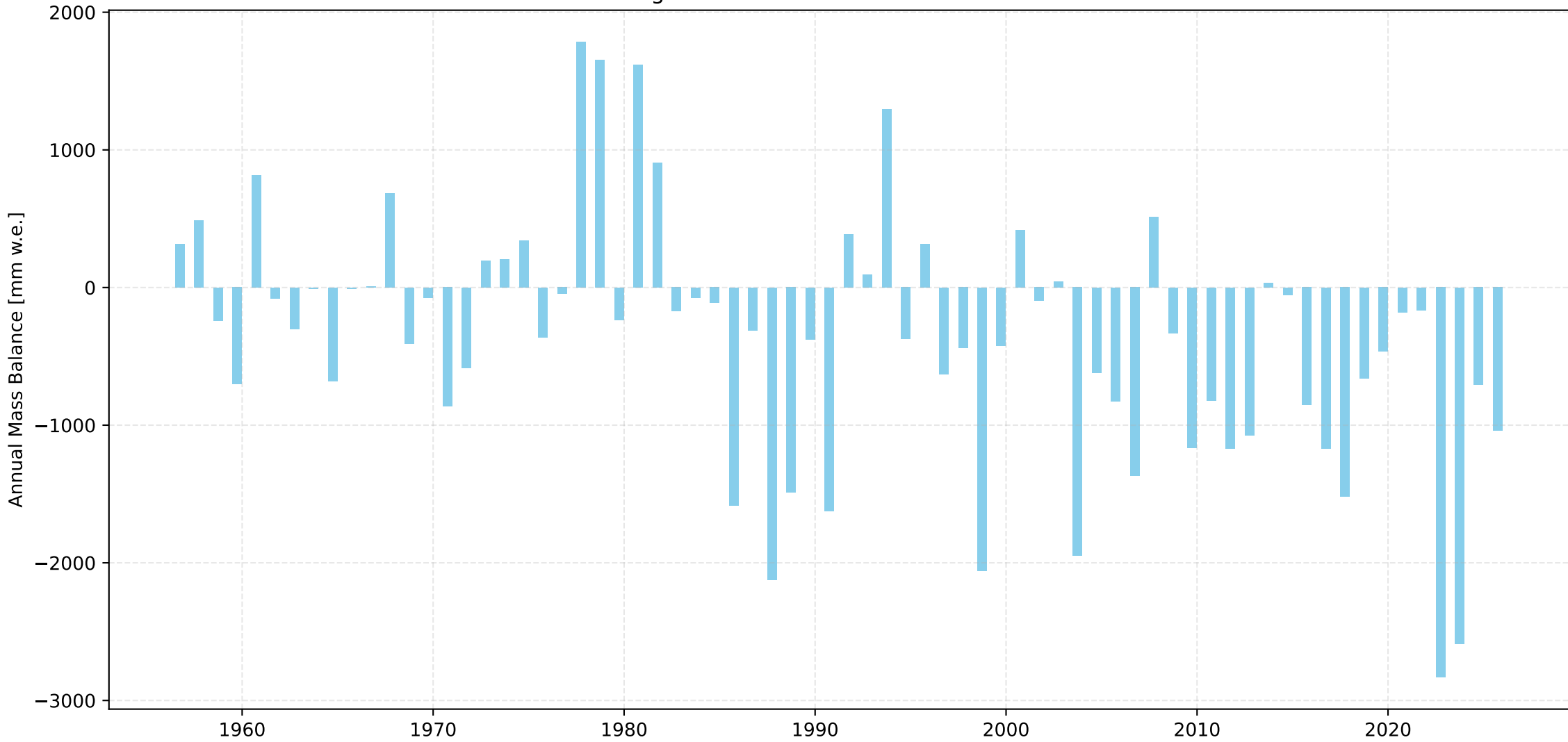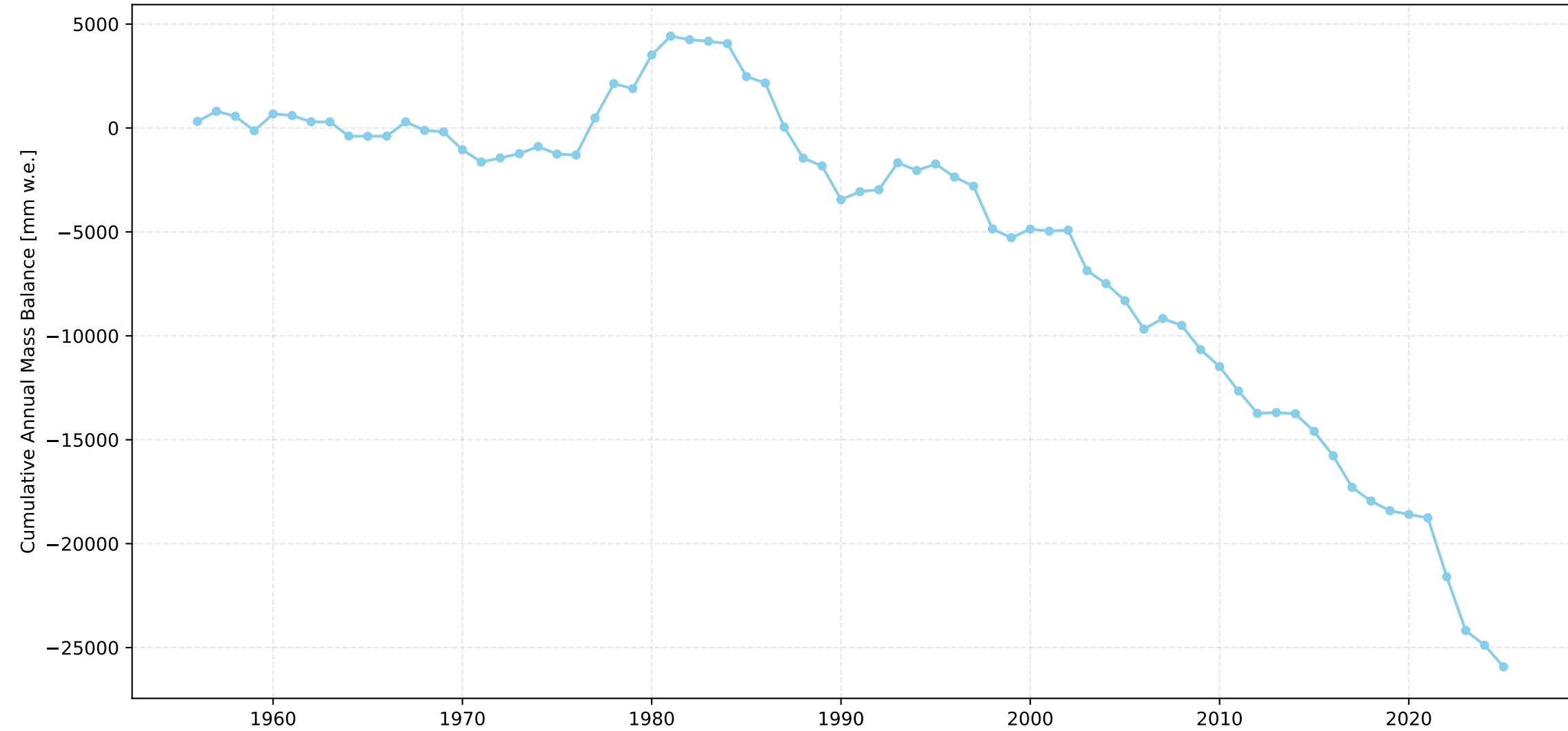
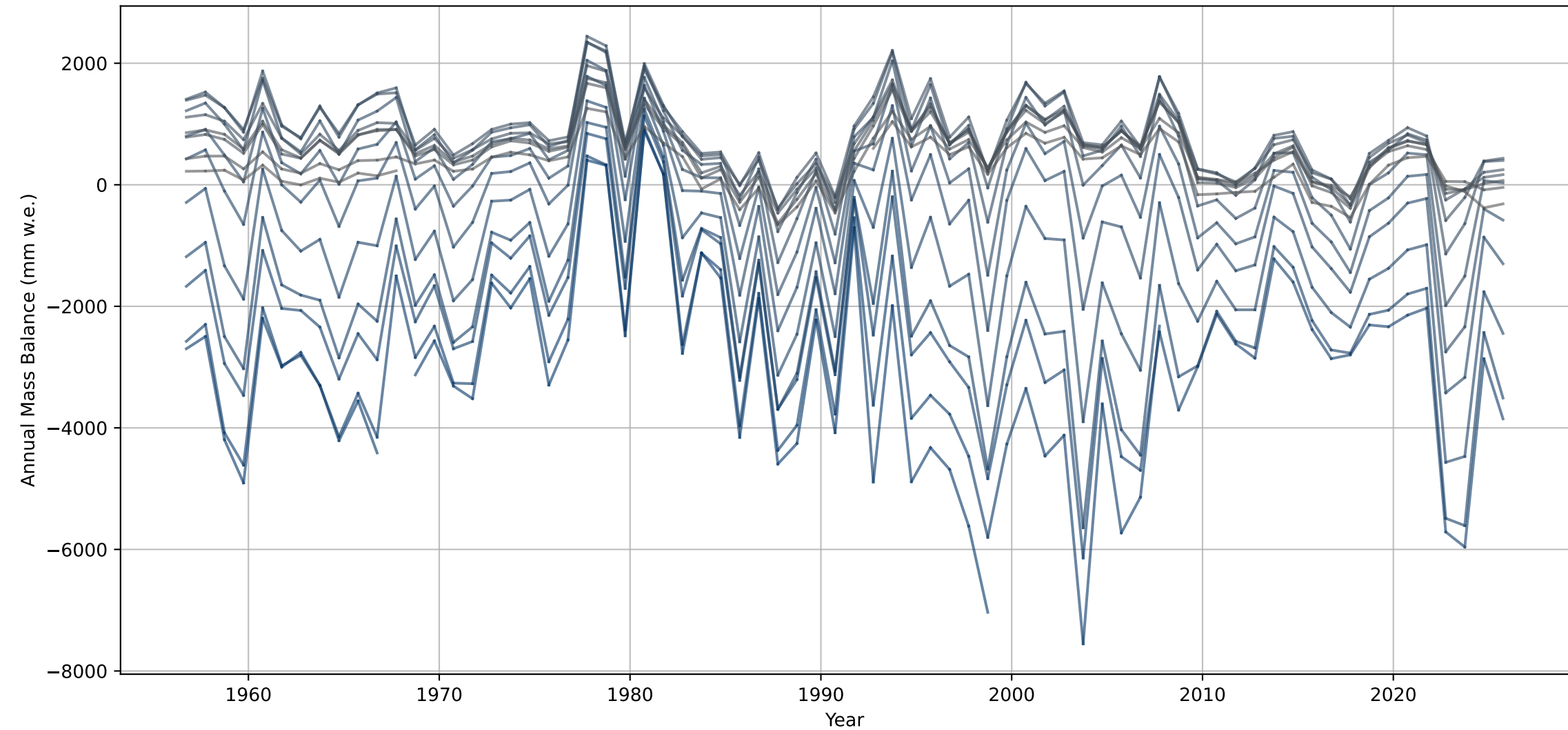# Hohlaubgletscher Cumulative Length Change Over Time

Hohlaubgletscher Annual Mass Balance Over Time

Hohlaubgletscher Cumulative Annual Mass Balance Over Time

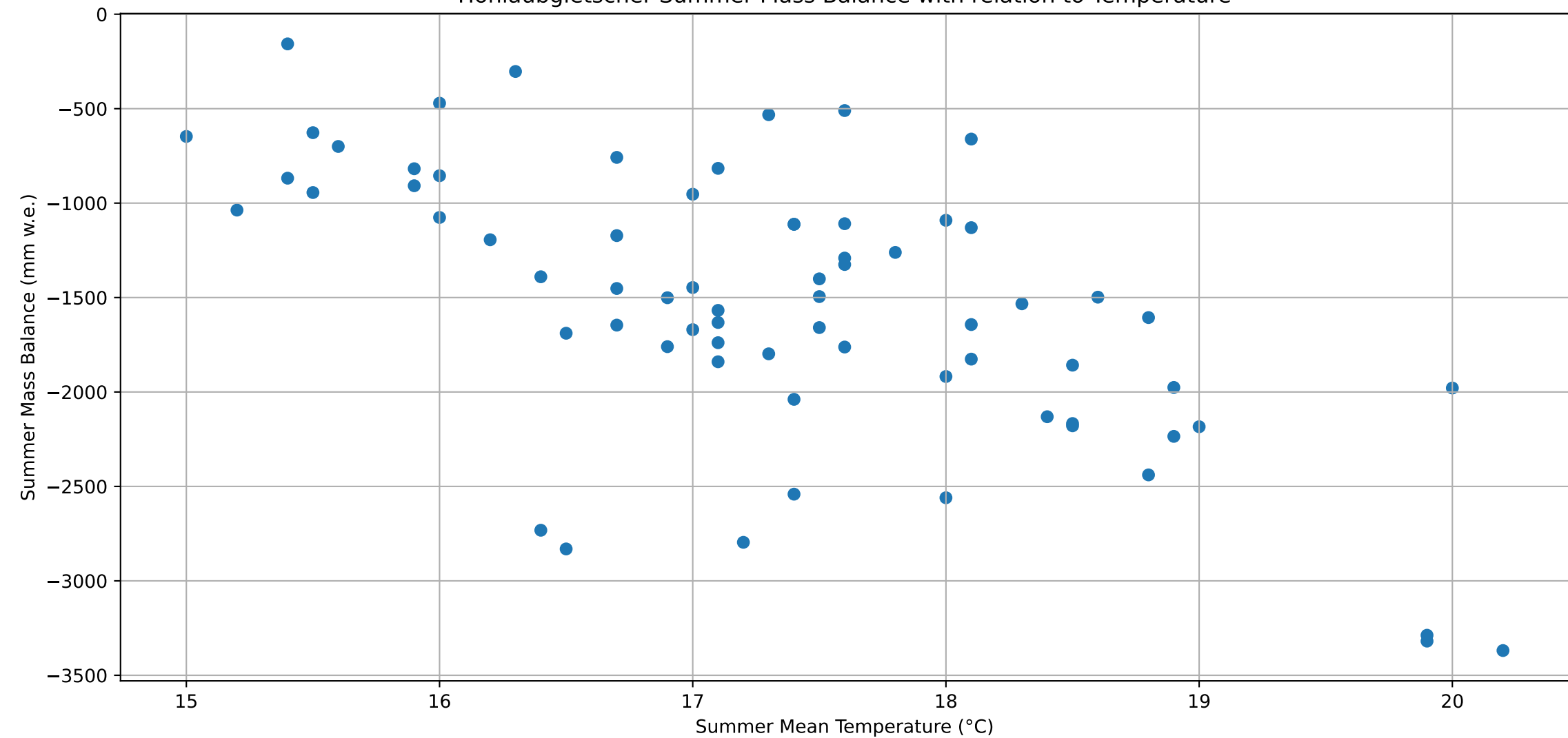Annual Mass Balance for each Elevation Bin over Time - Hohlaubgletscher

Sion Summer Mean Temperature

Sion Winter Total Precipitation

Hohlaubgletscher Summer Mass Balance with relation to Temperature

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


================================================================================
MONTHLY DEVIATIONS for Hohlaubgletscher (1961-1990 norms)
================================================================================

Number of observations: 70

Regression Summary:
                        OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:              0.518
Model:                                      OLS    Adj. R-squared:         0.417
Method:                           Least Squares    F-statistic:            5.105
Date:                          Mon, 08 Dec 2025    Prob (F-statistic):   1.05e-05
Time:                                  00:57:54    Log-Likelihood:        -549.81
No. Observations:                            70    AIC:                     1126.
Df Residuals:                                57    BIC:                     1155.
Df Model:                                    12
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         1.652e+04   2583.727      6.393      0.000    1.13e+04    2.17e+04
may_td         -51.7296     66.025     -0.783      0.437    -183.942      80.483
june_td        -16.4373     62.241     -0.264      0.793    -141.073     108.198
july_td       -161.9487     66.779     -2.425      0.018    -295.671     -28.226
august_td     -132.5787     78.796     -1.683      0.098    -290.364      25.207
september_td  -121.8690     62.697     -1.944      0.057    -247.418       3.680
october_pd       7.0823      3.071      2.306      0.025       0.932      13.232
november_pd      2.8305      2.282      1.240      0.220      -1.739       7.400
december_pd      4.4549      1.907      2.336      0.023       0.636       8.274
january_pd       0.6375      2.321      0.275      0.785      -4.010       5.285
february_pd      1.2869      1.802      0.714      0.478      -2.322       4.896
march_pd        -0.7323      2.653     -0.276      0.784      -6.045       4.581
april_pd        -4.2385      4.053     -1.046      0.300     -12.354       3.877
==============================================================================
Omnibus:                        3.799   Durbin-Watson:                   1.573
Prob(Omnibus):                  0.150   Jarque-Bera (JB):                3.408
Skew:                          -0.540   Prob(JB):                        0.182
Kurtosis:                       3.006   Cond. No.                     2.44e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 2.44e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

Coefficient Interpretation:
Intercept (normal mass balance): 16516.95 (p=0.0000)
may_td: -51.73 (p=0.4366)
june_td: -16.44 (p=0.7927)
july_td: -161.95 (p=0.0185)
august_td: -132.58 (p=0.0979)
september_td: -121.87 (p=0.0569)
october_pd: 7.08 (p=0.0248)
november_pd: 2.83 (p=0.2199)

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


================================================================================
OPTIMAL SEASONAL DEVIATIONS for Hohlaubgletscher (1961-1990 norms)
================================================================================


Number of observations: 70

Regression Summary:
                          OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:            0.410
Model:                                       OLS   Adj. R-squared:       0.393
Method:                            Least Squares   F-statistic:          23.30
Date:                           Mon, 08 Dec 2025   Prob (F-statistic): 2.08e-08
Time:                                   00:57:54   Log-Likelihood:      -556.88
No. Observations:                             70   AIC:                   1120.
Df Residuals:                                 67   BIC:                   1126.
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          1.41e+04   2336.689      6.033      0.000    9434.146    1.88e+04
opt_season_td  -415.0115    67.175     -6.178      0.000    -549.094    -280.929
opt_season_pd    2.3416     1.045       2.241      0.028       0.256       4.427
==============================================================================
Omnibus:                        8.191   Durbin-Watson:                   1.533
Prob(Omnibus):                  0.017   Jarque-Bera (JB):                7.858
Skew:                          -0.655   Prob(JB):                       0.0197
Kurtosis:                       3.989   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): 14098.20 (p=0.0000)
opt_season_td: -415.01 (p=0.0000)
opt_season_pd: 2.34 (p=0.0284)

Variance Inflation Factors (VIF):
        Variable          VIF
0          const   768.775289
1  opt_season_td     1.011060
2  opt_season_pd     1.011060

R-squared: 0.4102
Adjusted R-squared: 0.3926
```

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


================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS for Hohlaubgletscher (1961-1990 norms)
================================================================================


Number of observations: 70

Regression Summary:
                        OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)  R-squared:          0.433
Model:                                     OLS    Adj. R-squared:     0.416
Method:                          Least Squares    F-statistic:        25.54
Date:                         Mon, 08 Dec 2025    Prob (F-statistic): 5.70e-09
Time:                                 00:57:54    Log-Likelihood:     -555.52
No. Observations:                           70    AIC:                1117.
Df Residuals:                               67    BIC:                1124.
Df Model:                                    2
Covariance Type:                     nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const        1.571e+04   2392.403      6.567      0.000    1.09e+04    2.05e+04
summer_td    -474.4156     70.756     -6.705      0.000    -615.645    -333.186
winter_pd       1.8168      0.899      2.022      0.047       0.023       3.610
==============================================================================
Omnibus:                        6.203   Durbin-Watson:                  1.538
Prob(Omnibus):                  0.045   Jarque-Bera (JB):               5.375
Skew:                          -0.591   Prob(JB):                      0.0681
Kurtosis:                       3.668   Cond. No.                    2.76e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 2.76e+03. This might indicate that there are
strong multicollinearity or other numerical problems.

Coefficient Interpretation:
Intercept (normal mass balance): 15711.42 (p=0.0000)
summer_td: -474.42 (p=0.0000)
winter_pd: 1.82 (p=0.0472)

Variance Inflation Factors (VIF):
    Variable         VIF
0      const  837.655805
1  summer_td    1.004453
2  winter_pd    1.004453

R-squared: 0.4326
Adjusted R-squared: 0.4156
```

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


================================================================================
MONTHLY DEVIATIONS for Hohlaubgletscher (1991-2020 norms)
================================================================================

Number of observations: 70

Regression Summary:
                         OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:            0.518
Model:                                      OLS    Adj. R-squared:       0.417
Method:                           Least Squares    F-statistic:          5.105
Date:                          Mon, 08 Dec 2025    Prob (F-statistic): 1.05e-05
Time:                                  00:57:54    Log-Likelihood:     -549.81
No. Observations:                            70    AIC:                   1126.
Df Residuals:                                57    BIC:                   1155.
Df Model:                                    12
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         -761.0987    100.998     -7.536      0.000    -963.343    -558.854
may_td         -51.7296     66.025     -0.783      0.437    -183.942      80.483
june_td        -16.4373     62.241     -0.264      0.793    -141.073     108.198
july_td       -161.9487     66.779     -2.425      0.018    -295.671     -28.226
august_td     -132.5787     78.796     -1.683      0.098    -290.364      25.207
september_td  -121.8690     62.697     -1.944      0.057    -247.418       3.680
october_pd       7.0823      3.071      2.306      0.025       0.932      13.232
november_pd      2.8305      2.282      1.240      0.220      -1.739       7.400
december_pd      4.4549      1.907      2.336      0.023       0.636       8.274
january_pd       0.6375      2.321      0.275      0.785      -4.010       5.285
february_pd      1.2869      1.802      0.714      0.478      -2.322       4.896
march_pd        -0.7323      2.653     -0.276      0.784      -6.045       4.581
april_pd        -4.2385      4.053     -1.046      0.300     -12.354       3.877
==============================================================================
Omnibus:                        3.799   Durbin-Watson:                  1.573
Prob(Omnibus):                  0.150   Jarque-Bera (JB):               3.408
Skew:                          -0.540   Prob(JB):                       0.182
Kurtosis:                       3.006   Cond. No.                        65.8
==============================================================================

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

Coefficient Interpretation:
Intercept (normal mass balance): -761.10 (p=0.0000)
may_td: -51.73 (p=0.4366)
june_td: -16.44 (p=0.7927)
july_td: -161.95 (p=0.0185)
august_td: -132.58 (p=0.0979)
september_td: -121.87 (p=0.0569)
october_pd: 7.08 (p=0.0248)
november_pd: 2.83 (p=0.2199)
december_pd: 4.45 (p=0.0230)
january_pd: 0.64 (p=0.7846)
```

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


================================================================================
OPTIMAL SEASONAL DEVIATIONS for Hohlaubgletscher (1991-2020 norms)
================================================================================


Number of observations: 70

Regression Summary:
                          OLS Regression Results
==============================================================================
Dep. Variable:    annual mass balance (mm w.e.)  R-squared:            0.409
Model:                                      OLS  Adj. R-squared:       0.392
Method:                           Least Squares  F-statistic:          23.21
Date:                          Mon, 08 Dec 2025  Prob (F-statistic):  2.19e-08
Time:                                  00:57:54  Log-Likelihood:     -556.93
No. Observations:                            70  AIC:                  1120.
Df Residuals:                                67  BIC:                  1127.
Df Model:                                     2
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         -749.6822    101.557     -7.382      0.000    -952.390    -546.974
opt_season_td -414.5566     67.243     -6.165      0.000    -548.774    -280.339
opt_season_pd    2.2984      1.047      2.196      0.032       0.209       4.387
==============================================================================
Omnibus:                        7.664   Durbin-Watson:                   1.534
Prob(Omnibus):                  0.022   Jarque-Bera (JB):                7.203
Skew:                          -0.628   Prob(JB):                       0.0273
Kurtosis:                       3.944   Cond. No.                         107.
==============================================================================

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

Coefficient Interpretation:
Intercept (normal mass balance): -749.68 (p=0.0000)
opt_season_td: -414.56 (p=0.0000)
opt_season_pd: 2.30 (p=0.0316)

Variance Inflation Factors (VIF):
        Variable       VIF
0          const  1.449949
1  opt_season_td  1.012557
2  opt_season_pd  1.012557

R-squared: 0.4093
Adjusted R-squared: 0.3917
```

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


================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS for Hohlaubgletscher (1991-2020 norms)
================================================================================


Number of observations: 70

Regression Summary:
                        OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)  R-squared:            0.431
Model:                                      OLS   Adj. R-squared:       0.414
Method:                           Least Squares   F-statistic:          25.33
Date:                          Mon, 08 Dec 2025   Prob (F-statistic):  6.41e-09
Time:                                  00:57:54   Log-Likelihood:      -555.64
No. Observations:                            70   AIC:                   1117.
Df Residuals:                                67   BIC:                   1124.
Df Model:                                     2
Covariance Type:                      nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const       -763.8050     99.610     -7.668      0.000    -962.627    -564.983
summer_td   -472.5222     70.779     -6.676      0.000    -613.797    -331.247
winter_pd      1.8323      0.900      2.036      0.046       0.036       3.629
==============================================================================
Omnibus:                        6.431   Durbin-Watson:                   1.533
Prob(Omnibus):                  0.040   Jarque-Bera (JB):                5.631
Skew:                          -0.599   Prob(JB):                       0.0599
Kurtosis:                       3.704   Cond. No.                         124.
==============================================================================

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

Coefficient Interpretation:
Intercept (normal mass balance): -763.81 (p=0.0000)
summer_td: -472.52 (p=0.0000)
winter_pd: 1.83 (p=0.0457)

Variance Inflation Factors (VIF):
    Variable       VIF
0      const  1.447098
1  summer_td  1.004137
2  winter_pd  1.004137

R-squared: 0.4306
Adjusted R-squared: 0.4136
```