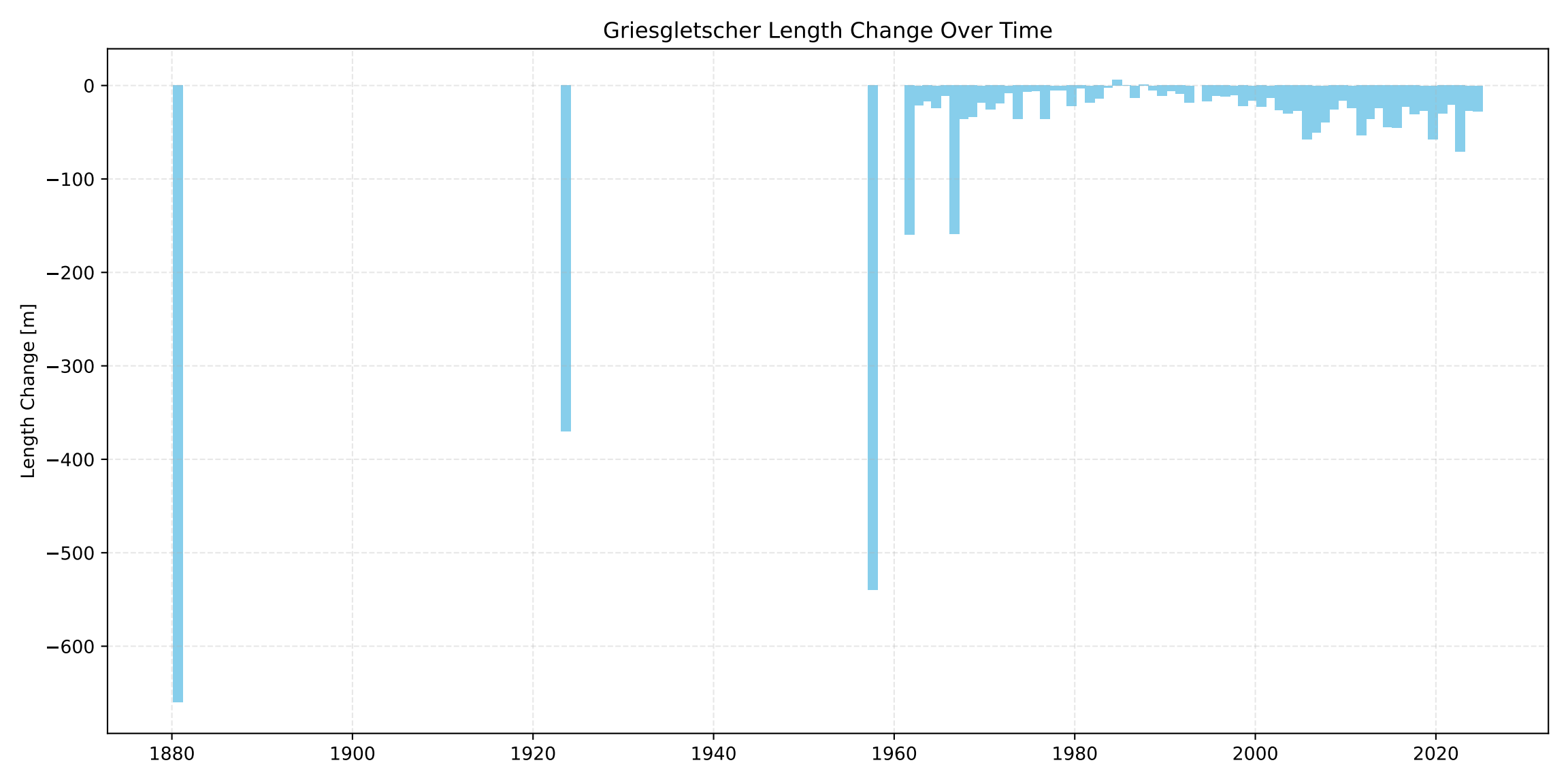
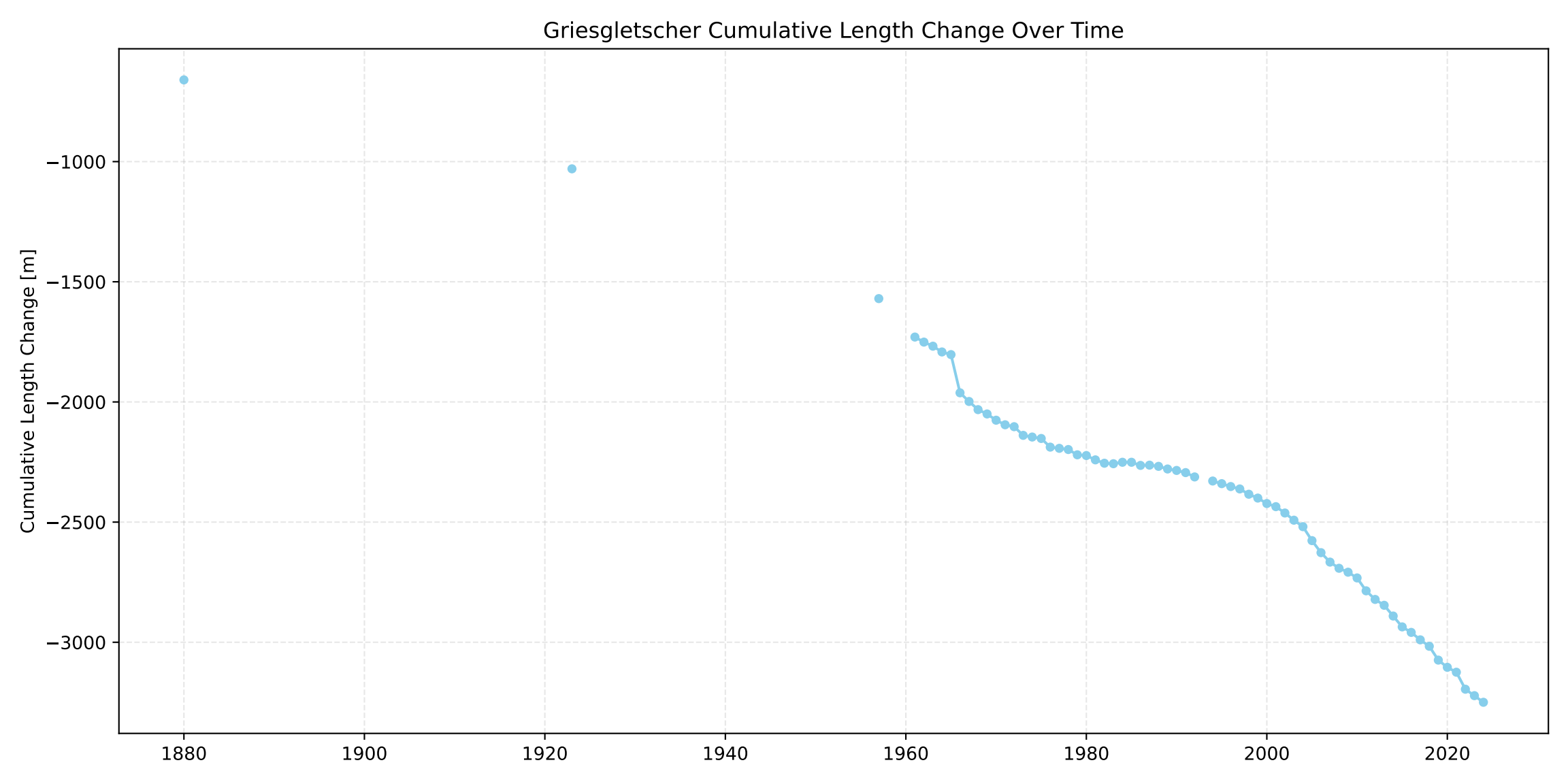
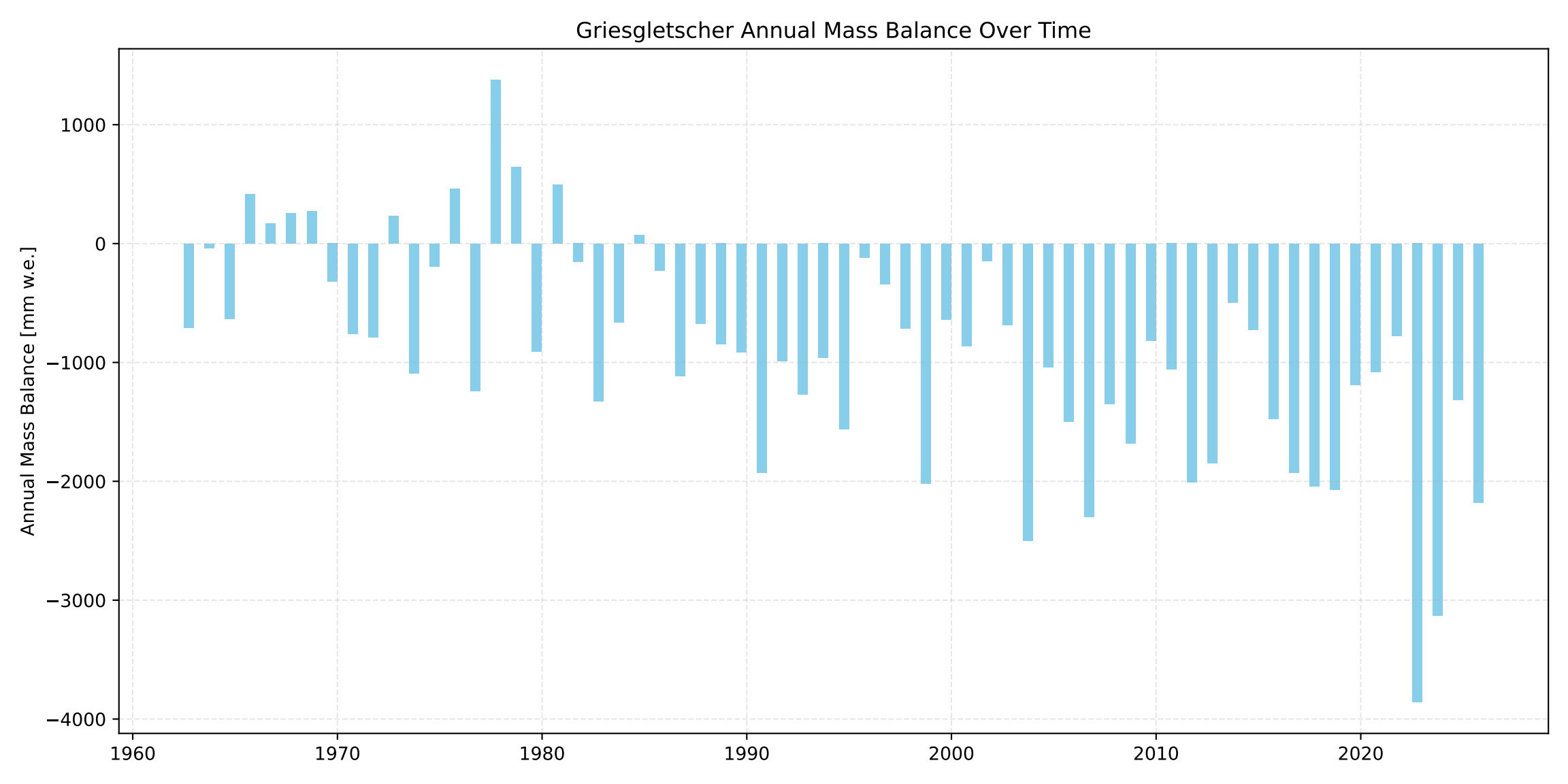
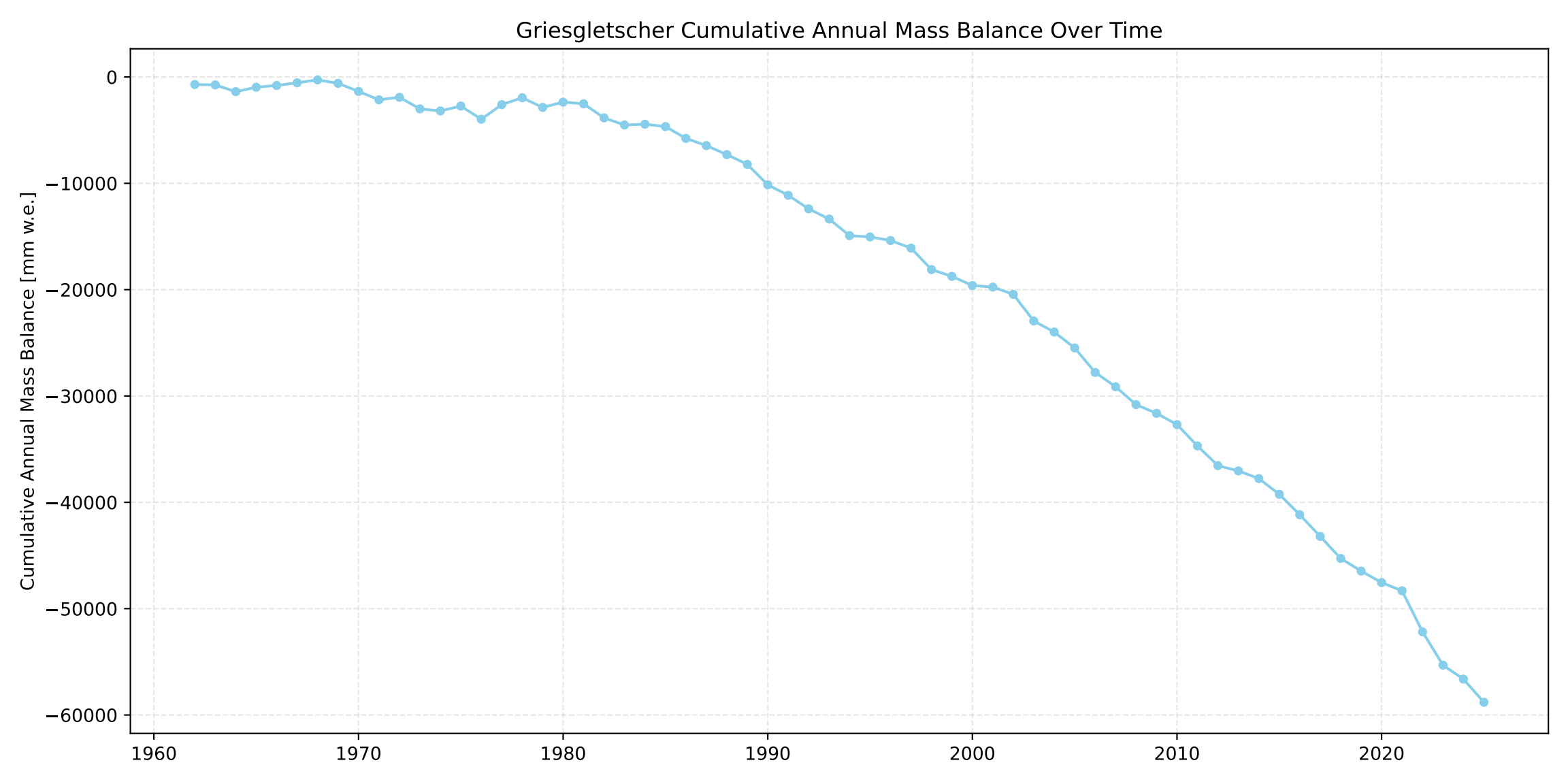
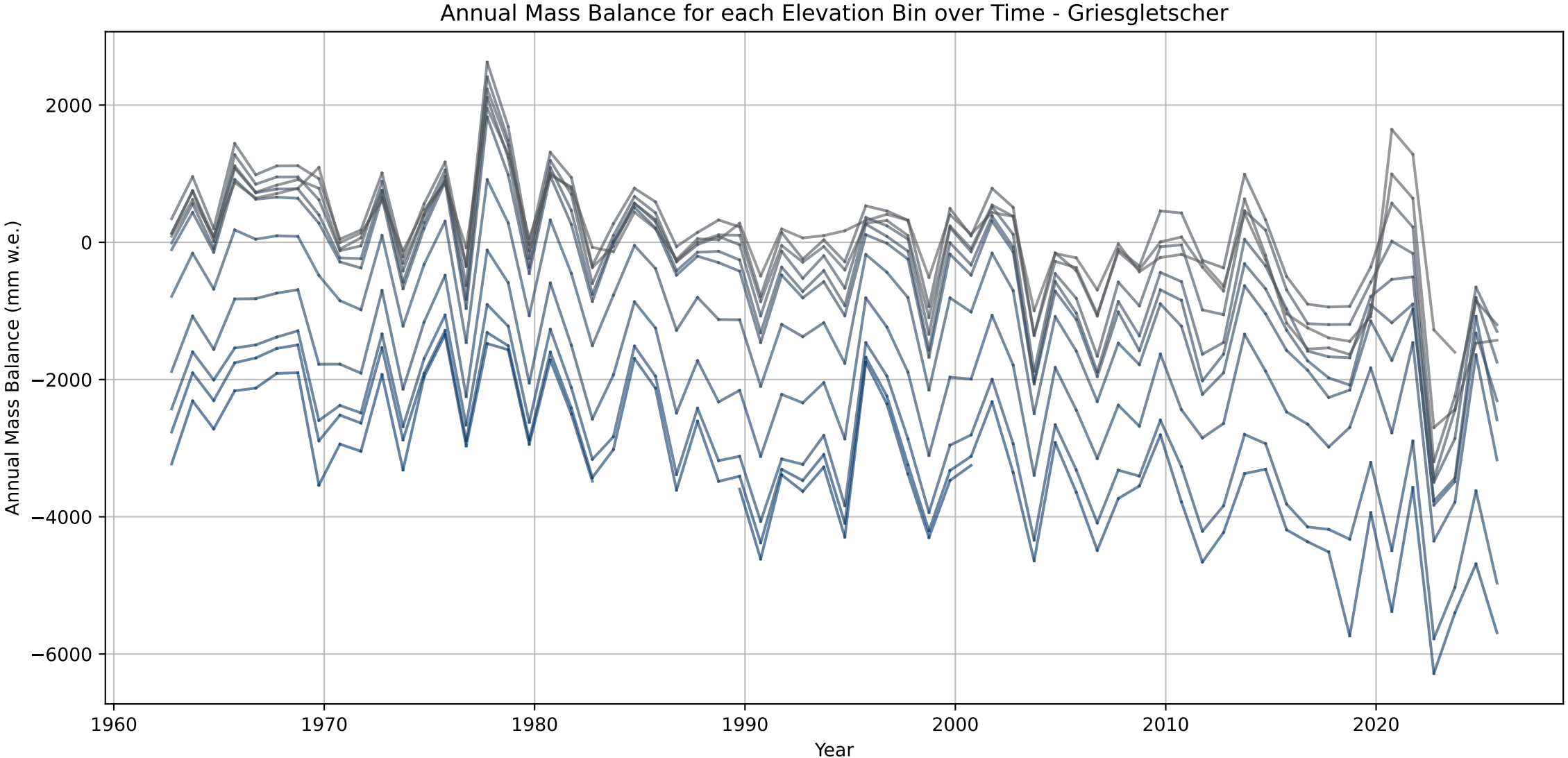
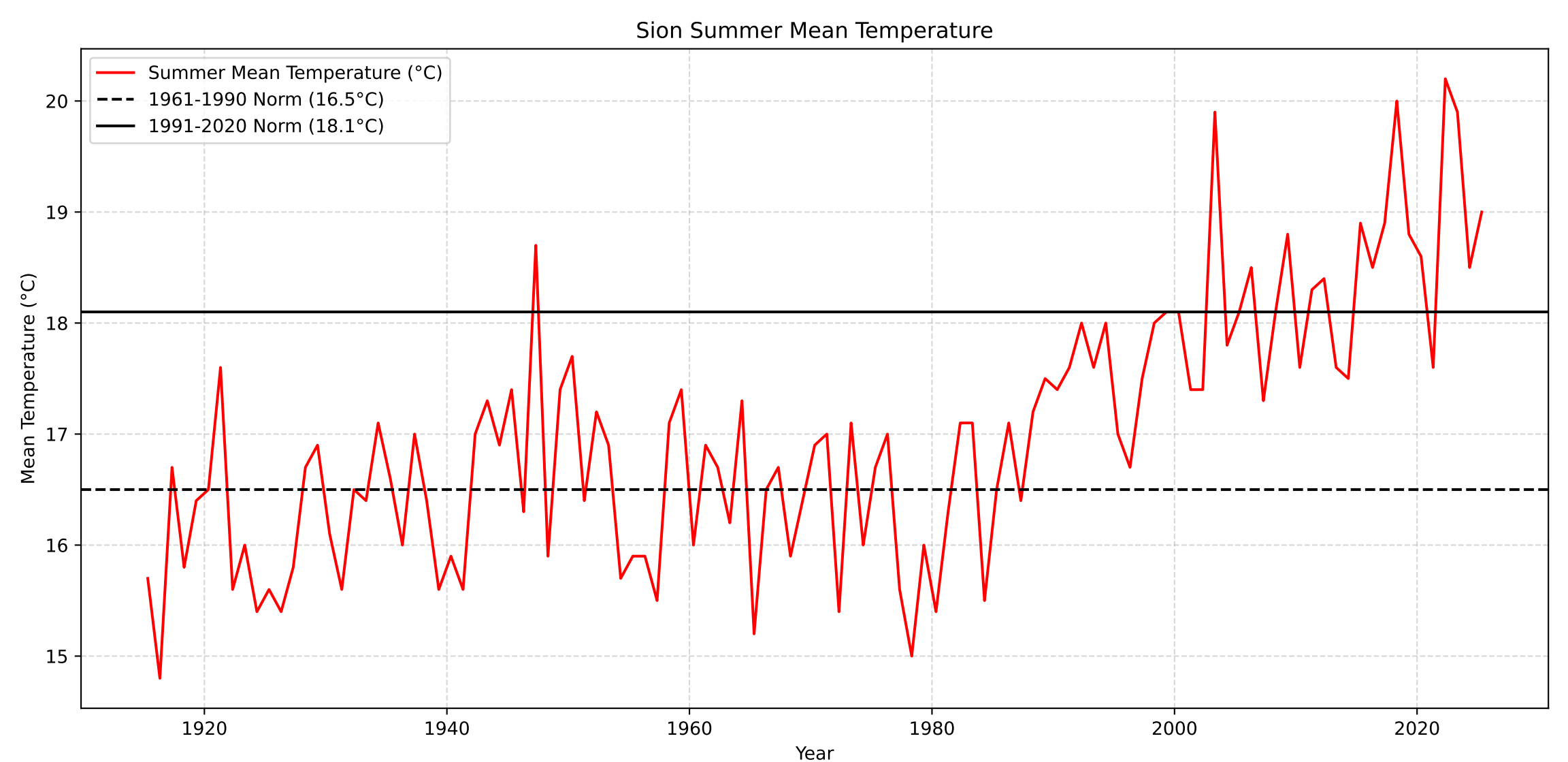

Griesgletscher Length Change Over Time
Length Change [m]
0
−100
−200
−300
−400
−500
−600
1880
1900
1920
1940
1960
1980
2000
2020

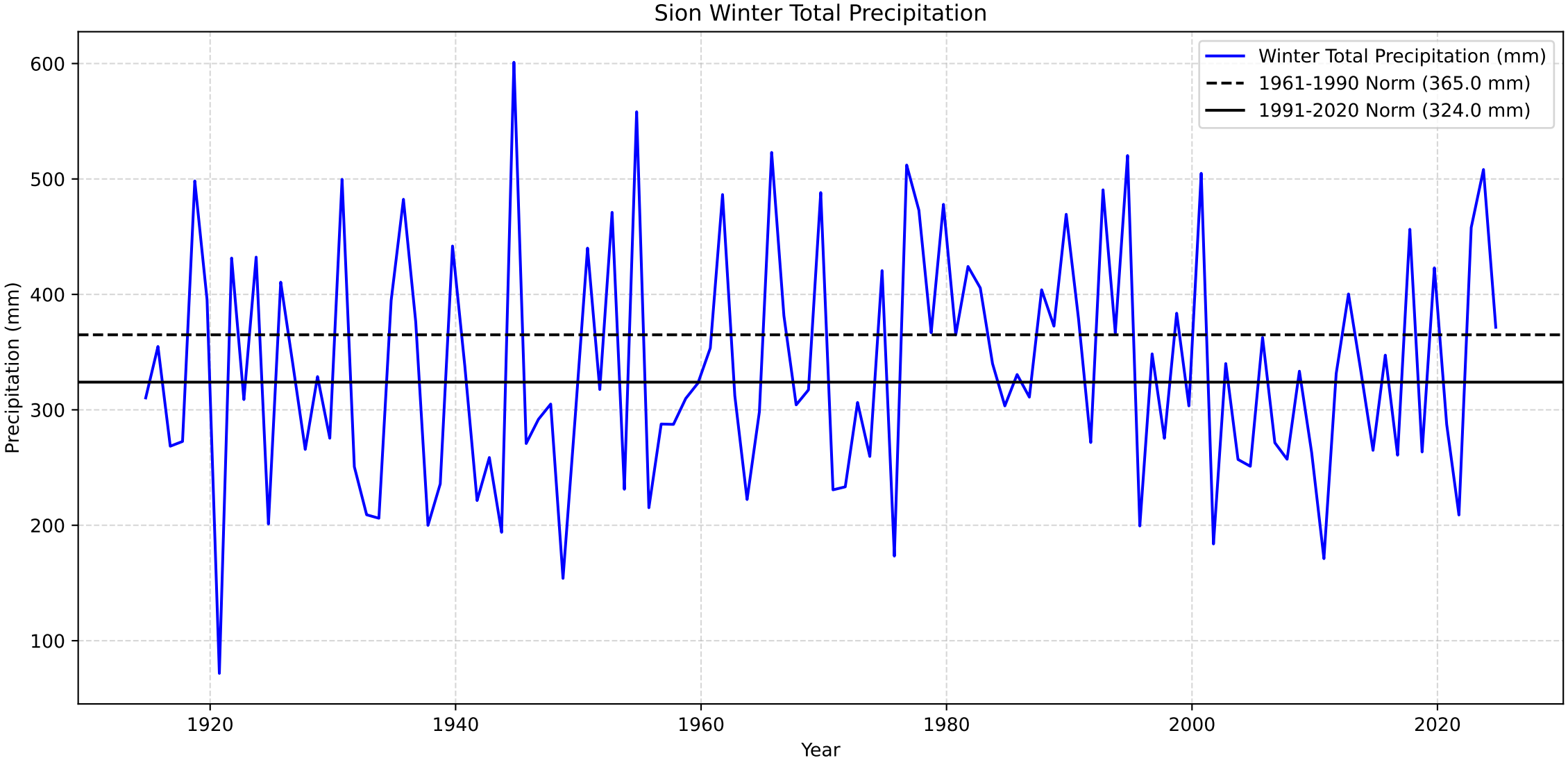

Griesgletscher Cumulative Length Change Over Time
Cumulative Length Change [m]
−1000
−1500
−2000
−2500
−3000
1880
1900
1920
1940
1960
1980
2000
2020

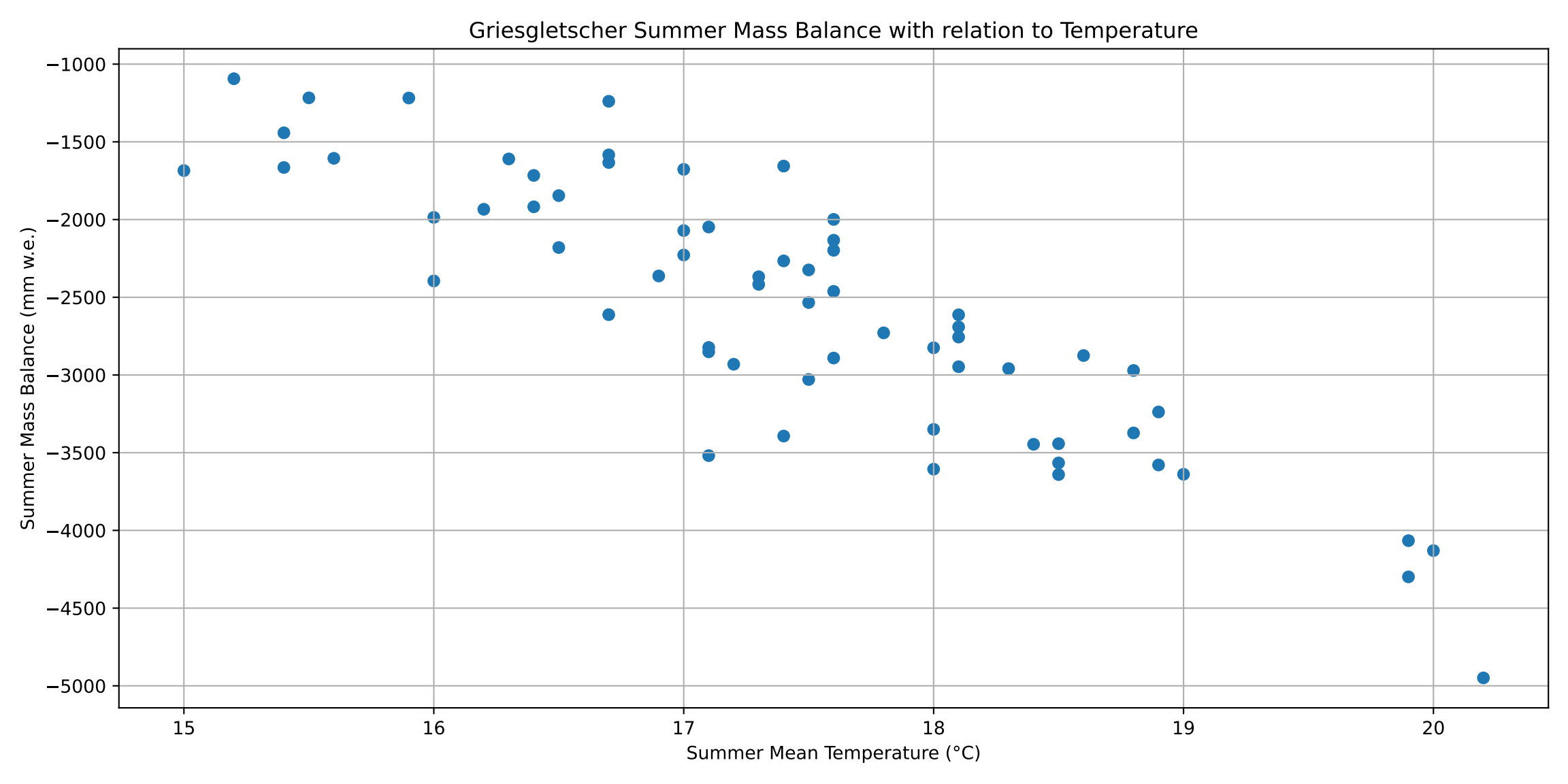

Griesgletscher Annual Mass Balance Over Time
Annual Mass Balance [mm w.e.]
1000
0
−1000
−2000
−3000
−4000
1960
1970
1980
1990
2000
2010
2020

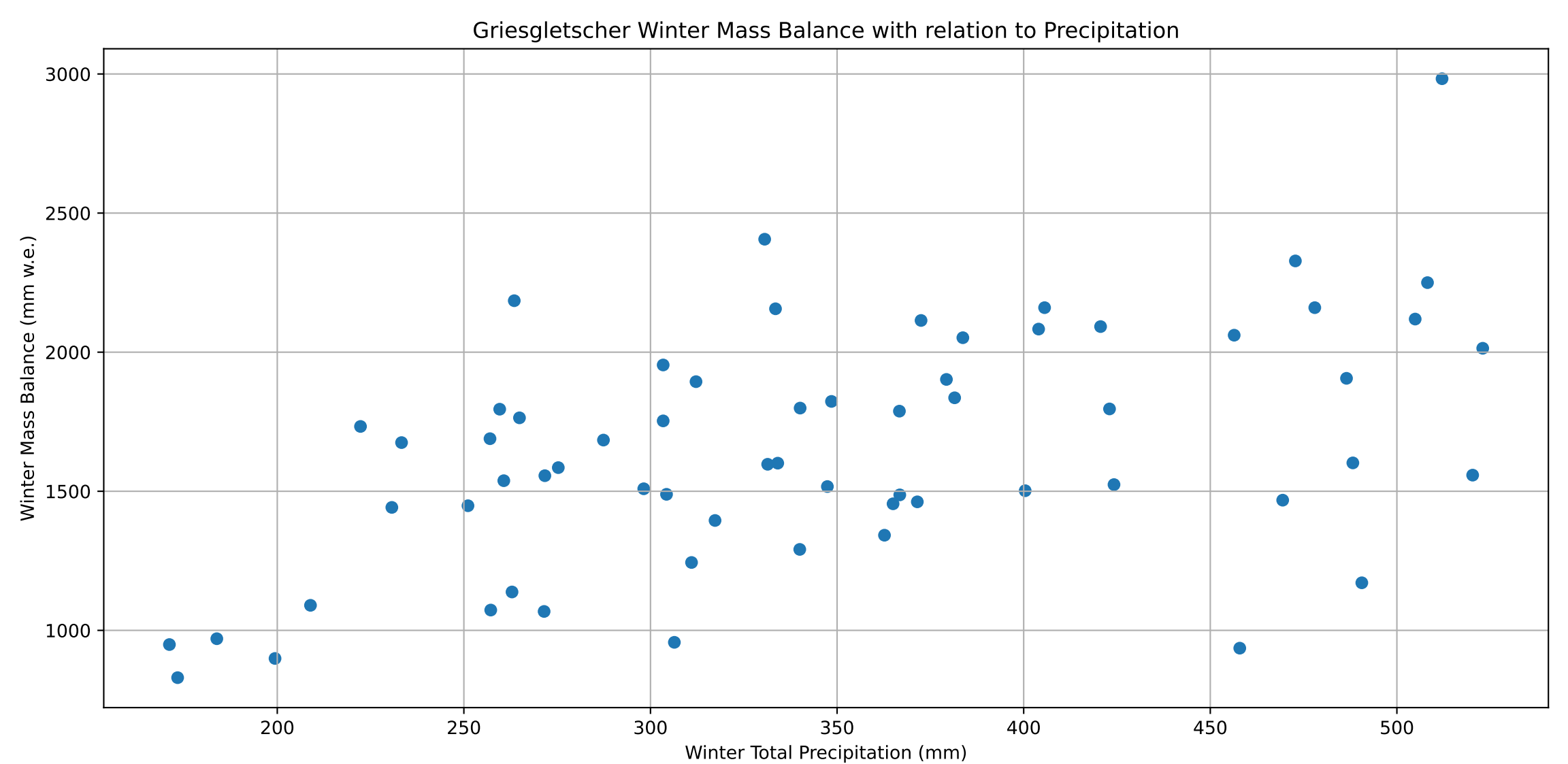

Griesgletscher Cumulative Annual Mass Balance Over Time
Cumulative Annual Mass Balance [mm w.e.]
0
−10000
−20000
−30000
−40000
−50000
−60000
1960
1970
1980
1990
2000
2010
2020


Annual Mass Balance for each Elevation Bin over Time - Griesgletscher
Annual Mass Balance (mm w.e.)
2000
0
−2000
−4000
−6000
1960
1970
1980
1990
2000
2010
2020
Year


Sion Summer Mean Temperature
Summer Mean Temperature (°C)
1961-1990 Norm (16.5°C)
1991-2020 Norm (18.1°C)
Mean Temperature (°C)
Year
15
16
17
18
19
20
1920
1940
1960
1980
2000
2020


Sion Winter Total Precipitation
Winter Total Precipitation (mm)
1961-1990 Norm (365.0 mm)
1991-2020 Norm (324.0 mm)
Precipitation (mm)
600
500
400
300
200
100
1920
1940
1960
1980
2000
2020
Year


Griesgletscher Summer Mass Balance with relation to Temperature
Summer Mass Balance (mm w.e.)
−1000
−1500
−2000
−2500
−3000
−3500
−4000
−4500
−5000
15
16
17
18
19
20
Summer Mean Temperature (°C)


Griesgletscher Winter Mass Balance with relation to Precipitation
Winter Mass Balance (mm w.e.)
3000
2500
2000
1500
1000
200
250
300
350
400
450
500
Winter Total Precipitation (mm)

Regression: Monthly 1961-1990

```
================================================================================
MONTHLY DEVIATIONS for Griesgletscher using 1961-1990 climate norms
================================================================================

Correlation Analysis with Significance Testing:
Skipping constant column: const
        Variable  Correlation Coefficient       P-value  Significant (p < 0.05)
1        june_td                -0.698060  1.443175e-10                    True
3      august_td                -0.655278  4.221977e-09                    True
0         may_td                -0.625149  3.351914e-08                    True
2        july_td                -0.616048  6.005828e-08                    True
4   september_td                -0.508344  1.799456e-05                    True
9    february_pd                 0.192294  1.279396e-01                   False
6    november_pd                 0.156378  2.172118e-01                   False
5     october_pd                 0.140020  2.697968e-01                   False
10      march_pd                 0.131427  3.005778e-01                   False
8     january_pd                 0.085564  5.014223e-01                   False
11      april_pd                -0.075242  5.545815e-01                   False
7    december_pd                -0.068362  5.914439e-01                   False

Number of observations: 64

Regression Summary:
                                OLS Regression Results
================================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:                       0.773
Model:                                       OLS   Adj. R-squared:                  0.719
Method:                            Least Squares   F-statistic:                     14.46
Date:                           Mon, 15 Dec 2025   Prob (F-statistic):           1.74e-12
Time:                                   10:30:12   Log-Likelihood:                -480.43
No. Observations:                             64   AIC:                             986.9
Df Residuals:                                 51   BIC:                             1015.
Df Model:                                     12
Covariance Type:                       nonrobust
================================================================================
                  coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------
const         -253.5128     80.999     -3.130      0.003    -416.125     -90.901
may_td        -152.9150     51.327     -2.979      0.004    -255.957     -49.873
june_td       -142.2344     47.185     -3.014      0.004    -236.963     -47.506
july_td       -106.0656     49.078     -2.161      0.035    -204.593      -7.538
august_td     -148.2455     58.751     -2.523      0.015    -266.194     -30.297
september_td  -119.6194     47.846     -2.500      0.016    -215.674     -23.565
october_pd       2.3939      2.245      1.066      0.291      -2.113       6.900
november_pd      3.3629      1.687      1.994      0.052      -0.023       6.749
december_pd      1.1490      1.424      0.807      0.424      -1.710       4.008
january_pd       2.1679      1.700      1.275      0.208      -1.245       5.581
february_pd      0.2412      1.452      0.166      0.869      -2.673       3.156
march_pd        -0.1632      1.979     -0.082      0.935      -4.137       3.811
april_pd         0.8314      3.074      0.270      0.788      -5.341       7.004
==============================================================================
Omnibus:                        0.563   Durbin-Watson:                   1.566
Prob(Omnibus):                  0.755   Jarque-Bera (JB):                0.705
Skew:                           0.160   Prob(JB):                        0.703
Kurtosis:                       2.597   Cond. No.                         65.0
==============================================================================

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

Regression: Optimal 1961-1990

```
================================================================================
OPTIMAL SEASONAL DEVIATIONS for Griesgletscher using 1961-1990 climate norms
================================================================================

Correlation Analysis with Significance Testing:
Skipping constant column: const
        Variable  Correlation Coefficient       P-value  Significant (p < 0.05)
0  opt_season_td                -0.842259  2.741200e-18                    True
1  opt_season_pd                 0.237420  5.888798e-02                   False

Number of observations: 64

Regression Summary:
                            OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:                       0.726
Model:                                       OLS   Adj. R-squared:                  0.717
Method:                            Least Squares   F-statistic:                     80.84
Date:                           Mon, 15 Dec 2025   Prob (F-statistic):           7.04e-18
Time:                                   10:30:12   Log-Likelihood:                -486.43
No. Observations:                             64   AIC:                             978.9
Df Residuals:                                 61   BIC:                             985.3
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          -274.3677     80.189     -3.422      0.001    -434.715    -114.020
opt_season_td  -602.0175     49.297    -12.212      0.000    -700.593    -503.442
opt_season_pd     1.4376      0.746      1.927      0.059      -0.054       2.930
==============================================================================
Omnibus:                        0.547   Durbin-Watson:                   1.614
Prob(Omnibus):                  0.761   Jarque-Bera (JB):                0.597
Skew:                          -0.208   Prob(JB):                        0.742
Kurtosis:                       2.773   Cond. No.                         119.
==============================================================================

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

Regression: Seasonal 1961-1990

```
================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS for Griesgletscher using 1961-1990 climate norms
================================================================================

Correlation Analysis with Significance Testing:
Skipping constant column: const
    Variable  Correlation Coefficient       P-value  Significant (p < 0.05)
0  summer_td                -0.855394  2.273303e-19                    True
1  winter_pd                 0.240352  5.574003e-02                   False

Number of observations: 64

Regression Summary:
                                OLS Regression Results
================================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:                       0.753
Model:                                       OLS   Adj. R-squared:                  0.745
Method:                            Least Squares   F-statistic:                     93.11
Date:                           Mon, 15 Dec 2025   Prob (F-statistic):           2.91e-19
Time:                                   10:30:12   Log-Likelihood:                -483.09
No. Observations:                             64   AIC:                             972.2
Df Residuals:                                 61   BIC:                             978.6
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const       -262.7624     75.959     -3.459      0.001    -414.651    -110.874
summer_td   -659.9391     50.330    -13.112      0.000    -760.580    -559.298
winter_pd      1.4463      0.627      2.308      0.024       0.193       2.699
==============================================================================
Omnibus:                        0.715   Durbin-Watson:                   1.725
Prob(Omnibus):                  0.699   Jarque-Bera (JB):                0.563
Skew:                          -0.227   Prob(JB):                        0.755
Kurtosis:                       2.934   Cond. No.                         137.
==============================================================================

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

Regression: Monthly 1991-2020

```
================================================================================
MONTHLY DEVIATIONS for Griesgletscher using 1991-2020 climate norms
================================================================================

Correlation Analysis with Significance Testing:
Skipping constant column: const
        Variable  Correlation Coefficient       P-value  Significant (p < 0.05)
1        june_td                -0.698060  1.443175e-10                    True
3      august_td                -0.655278  4.221977e-09                    True
0         may_td                -0.625149  3.351914e-08                    True
2        july_td                -0.616048  6.005828e-08                    True
4   september_td                -0.508344  1.799456e-05                    True
9    february_pd                 0.192294  1.279396e-01                   False
6    november_pd                 0.156378  2.172118e-01                   False
5     october_pd                 0.140020  2.697968e-01                   False
10      march_pd                 0.131427  3.005778e-01                   False
8     january_pd                 0.085564  5.014223e-01                   False
11      april_pd                -0.075242  5.545815e-01                   False
7    december_pd                -0.068362  5.914439e-01                   False

Number of observations: 64

Regression Summary:
                                OLS Regression Results
================================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:                       0.773
Model:                                       OLS   Adj. R-squared:                  0.719
Method:                            Least Squares   F-statistic:                     14.46
Date:                           Mon, 15 Dec 2025   Prob (F-statistic):           1.74e-12
Time:                                   10:30:12   Log-Likelihood:                -480.43
No. Observations:                             64   AIC:                             986.9
Df Residuals:                                 51   BIC:                             1015.
Df Model:                                     12
Covariance Type:                       nonrobust
================================================================================
                   coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------
const        -1418.2957     73.361    -19.333      0.000   -1565.574   -1271.017
may_td        -152.9150     51.327     -2.979      0.004    -255.957     -49.873
june_td       -142.2344     47.185     -3.014      0.004    -236.963     -47.506
july_td       -106.0656     49.078     -2.161      0.035    -204.593      -7.538
august_td     -148.2455     58.751     -2.523      0.015    -266.194     -30.297
september_td  -119.6194     47.846     -2.500      0.016    -215.674     -23.565
october_pd       2.3939      2.245      1.066      0.291      -2.113       6.900
november_pd      3.3629      1.687      1.994      0.052      -0.023       6.749
december_pd      1.1490      1.424      0.807      0.424      -1.710       4.008
january_pd       2.1679      1.700      1.275      0.208      -1.245       5.581
february_pd      0.2412      1.452      0.166      0.869      -2.673       3.156
march_pd        -0.1632      1.979     -0.082      0.935      -4.137       3.811
april_pd         0.8314      3.074      0.270      0.788      -5.341       7.004
==============================================================================
Omnibus:                        0.563   Durbin-Watson:                   1.566
Prob(Omnibus):                  0.755   Jarque-Bera (JB):                0.705
Skew:                           0.160   Prob(JB):                        0.703
Kurtosis:                       2.597   Cond. No.                         57.9
==============================================================================

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

Regression: Optimal 1991-2020

```
================================================================================
OPTIMAL SEASONAL DEVIATIONS for Griesgletscher using 1991-2020 climate norms
================================================================================

Correlation Analysis with Significance Testing:
Skipping constant column: const
        Variable  Correlation Coefficient       P-value  Significant (p < 0.05)
0  opt_season_td                -0.844729  1.747008e-18                    True
1  opt_season_pd                 0.237420  5.888798e-02                   False

Number of observations: 64

Regression Summary:
                                OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:                       0.728
Model:                                       OLS   Adj. R-squared:                  0.719
Method:                            Least Squares   F-statistic:                     81.73
Date:                           Mon, 15 Dec 2025   Prob (F-statistic):           5.53e-18
Time:                                   10:30:12   Log-Likelihood:                -486.17
No. Observations:                             64   AIC:                             978.3
Df Residuals:                                 61   BIC:                             984.8
Df Model:                                      2
Covariance Type:                       nonrobust
================================================================================
                    coef    std err          t      P>|t|      [0.025      0.975]
--------------------------------------------------------------------------------
const         -1387.5375     71.772    -19.333      0.000   -1531.054   -1244.021
opt_season_td  -608.4661     49.547    -12.281      0.000    -707.542    -509.391
opt_season_pd     1.3504      0.744      1.815      0.074      -0.137       2.838
==============================================================================
Omnibus:                        0.389   Durbin-Watson:                   1.612
Prob(Omnibus):                  0.823   Jarque-Bera (JB):                0.461
Skew:                          -0.175   Prob(JB):                        0.794
Kurtosis:                       2.774   Cond. No.                         107.
==============================================================================

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

Regression: Seasonal 1991-2020

```
================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS for Griesgletscher using 1991-2020 climate norms
================================================================================

Correlation Analysis with Significance Testing:
Skipping constant column: const
    Variable  Correlation Coefficient       P-value  Significant (p < 0.05)
0  summer_td                -0.860874  7.474647e-20                    True
1  winter_pd                 0.240352  5.574003e-02                   False

Number of observations: 64

Regression Summary:
                                OLS Regression Results
================================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:                       0.761
Model:                                       OLS   Adj. R-squared:                  0.753
Method:                            Least Squares   F-statistic:                     97.21
Date:                           Mon, 15 Dec 2025   Prob (F-statistic):           1.07e-19
Time:                                   10:30:12   Log-Likelihood:                -482.04
No. Observations:                             64   AIC:                             970.1
Df Residuals:                                 61   BIC:                             976.6
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const      -1402.5838     67.574    -20.756      0.000   -1537.707   -1267.460
summer_td   -664.4016     49.568    -13.404      0.000    -763.518    -565.285
winter_pd      1.3968      0.617      2.264      0.027       0.163       2.630
==============================================================================
Omnibus:                        0.605   Durbin-Watson:                   1.692
Prob(Omnibus):                  0.739   Jarque-Bera (JB):                0.494
Skew:                          -0.211   Prob(JB):                        0.781
Kurtosis:                       2.912   Cond. No.                         124.
==============================================================================

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