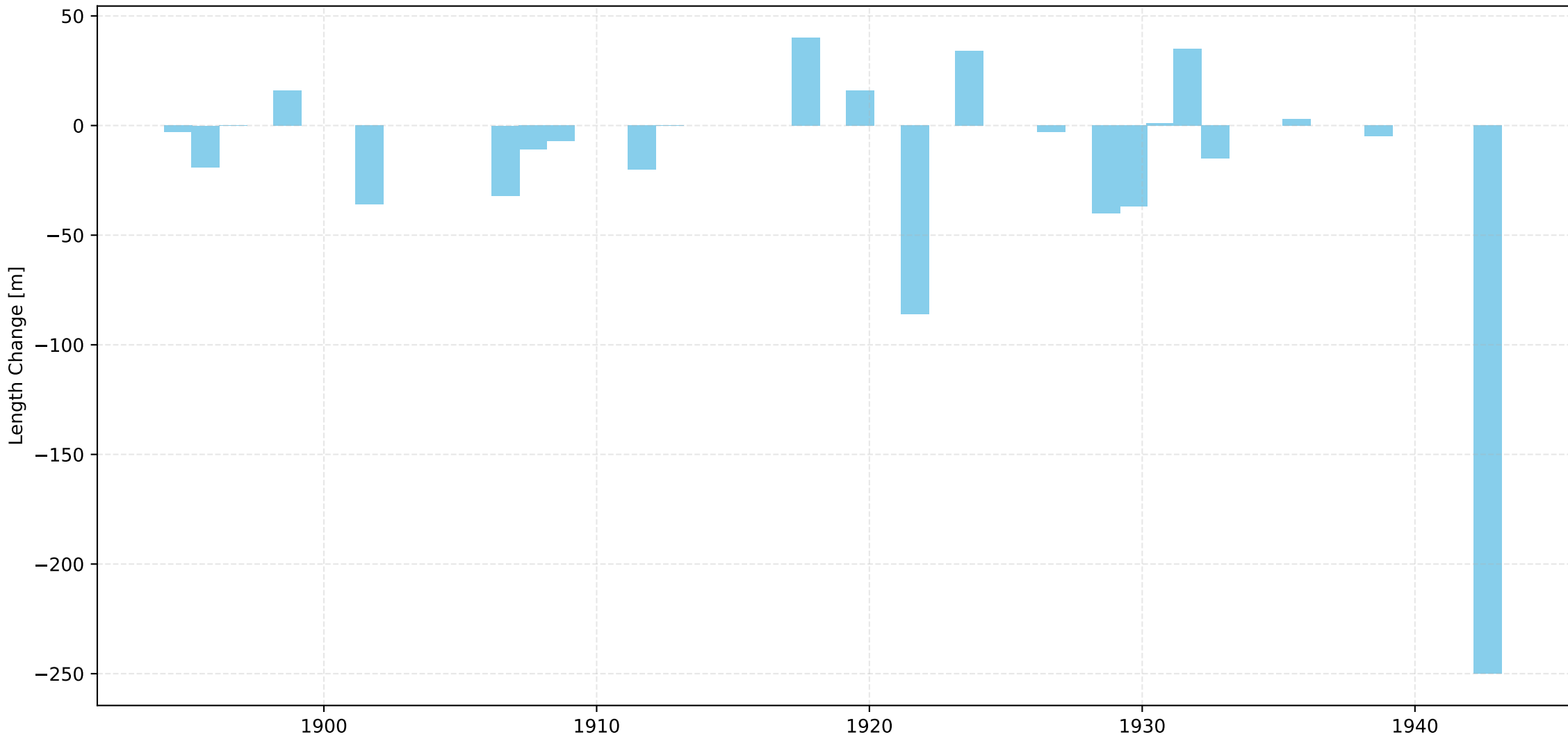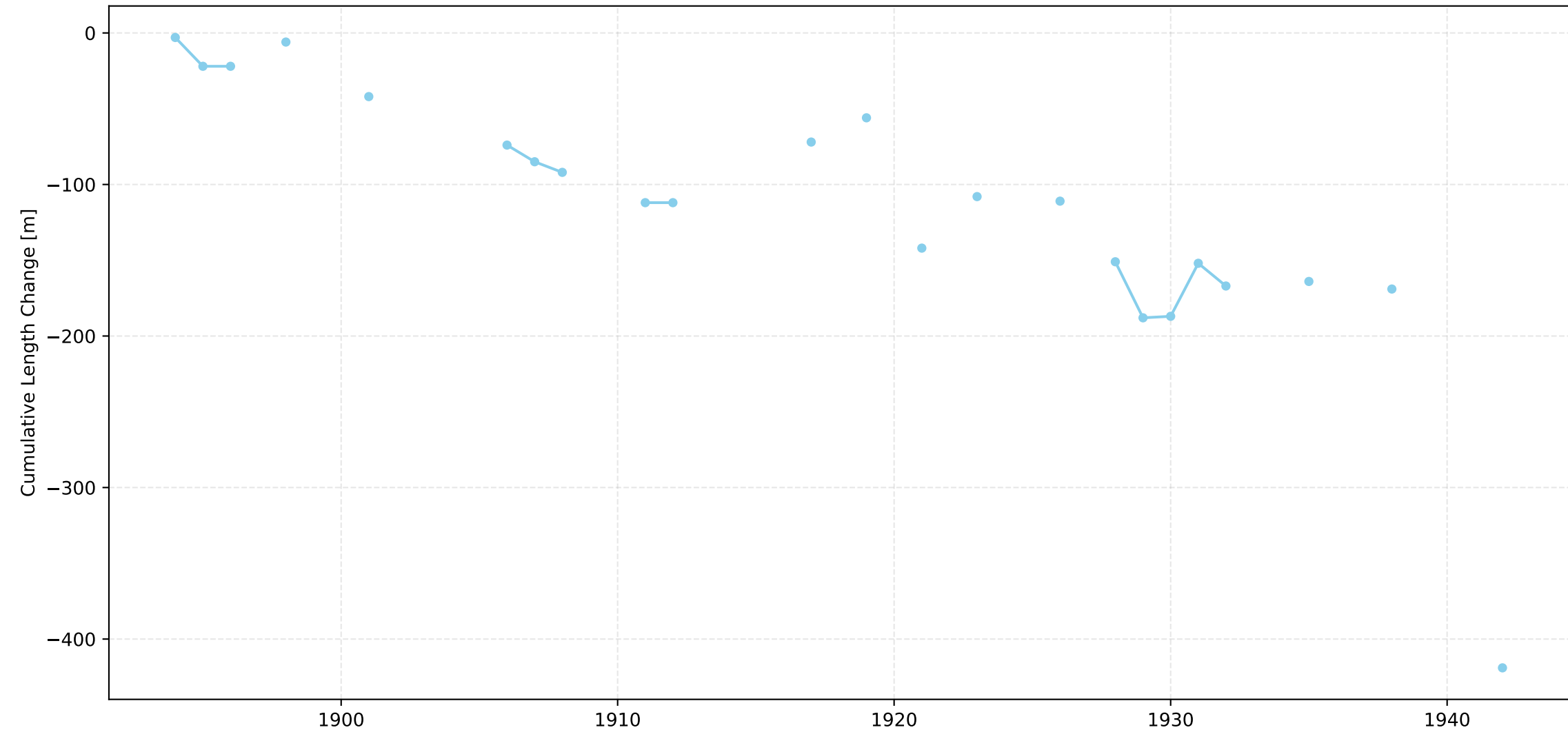Claridenfirn Length Change Over Time

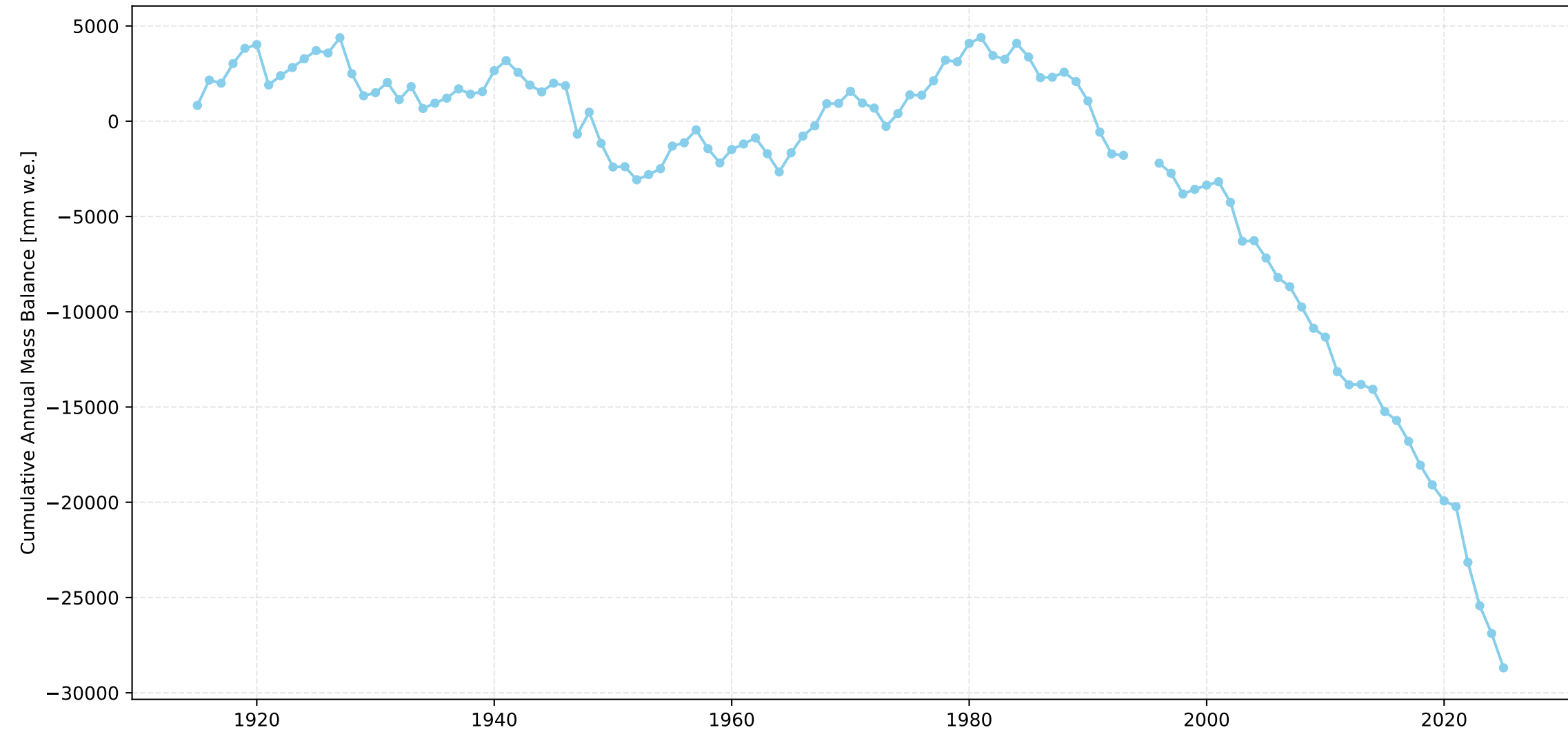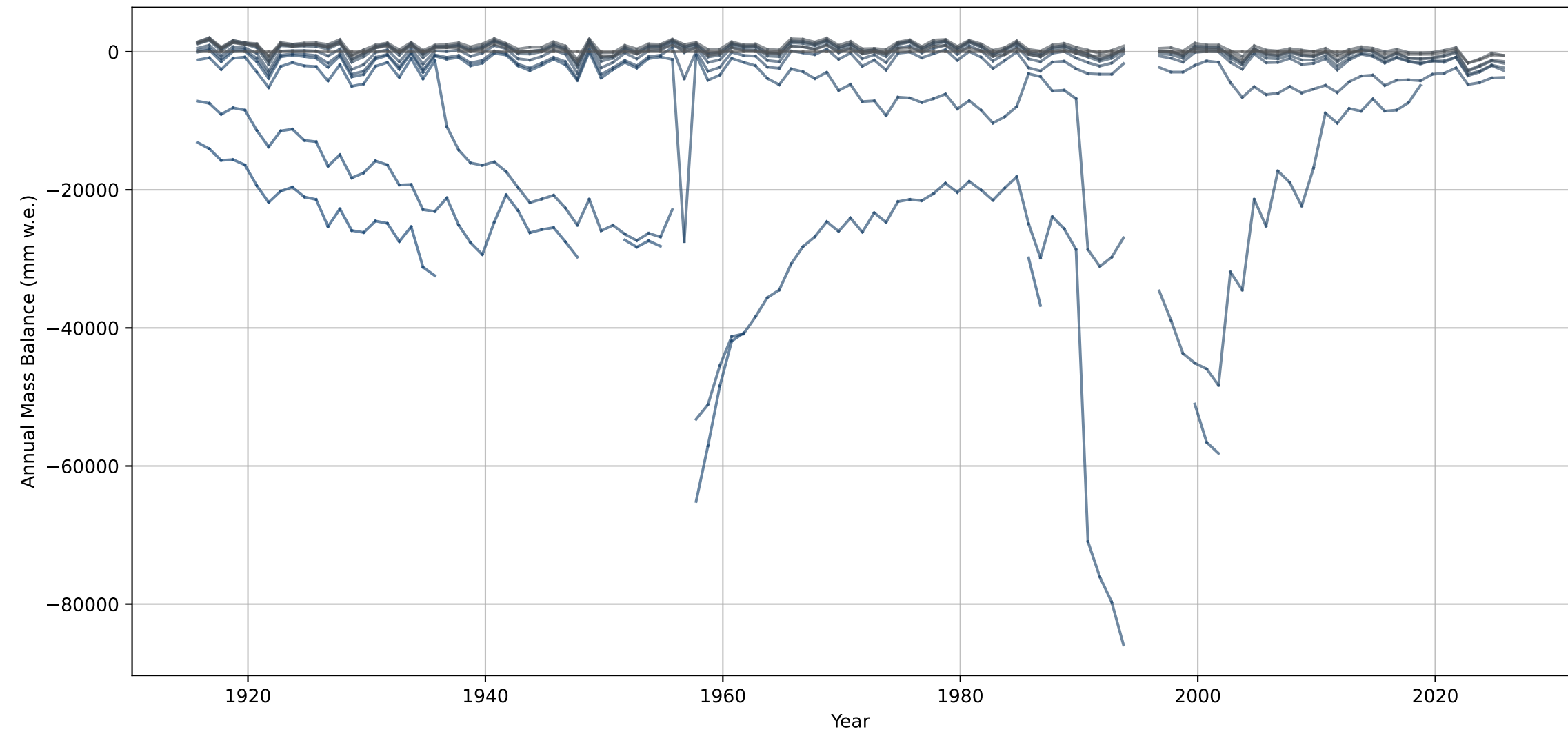Claridenfirn Cumulative Length Change Over Time
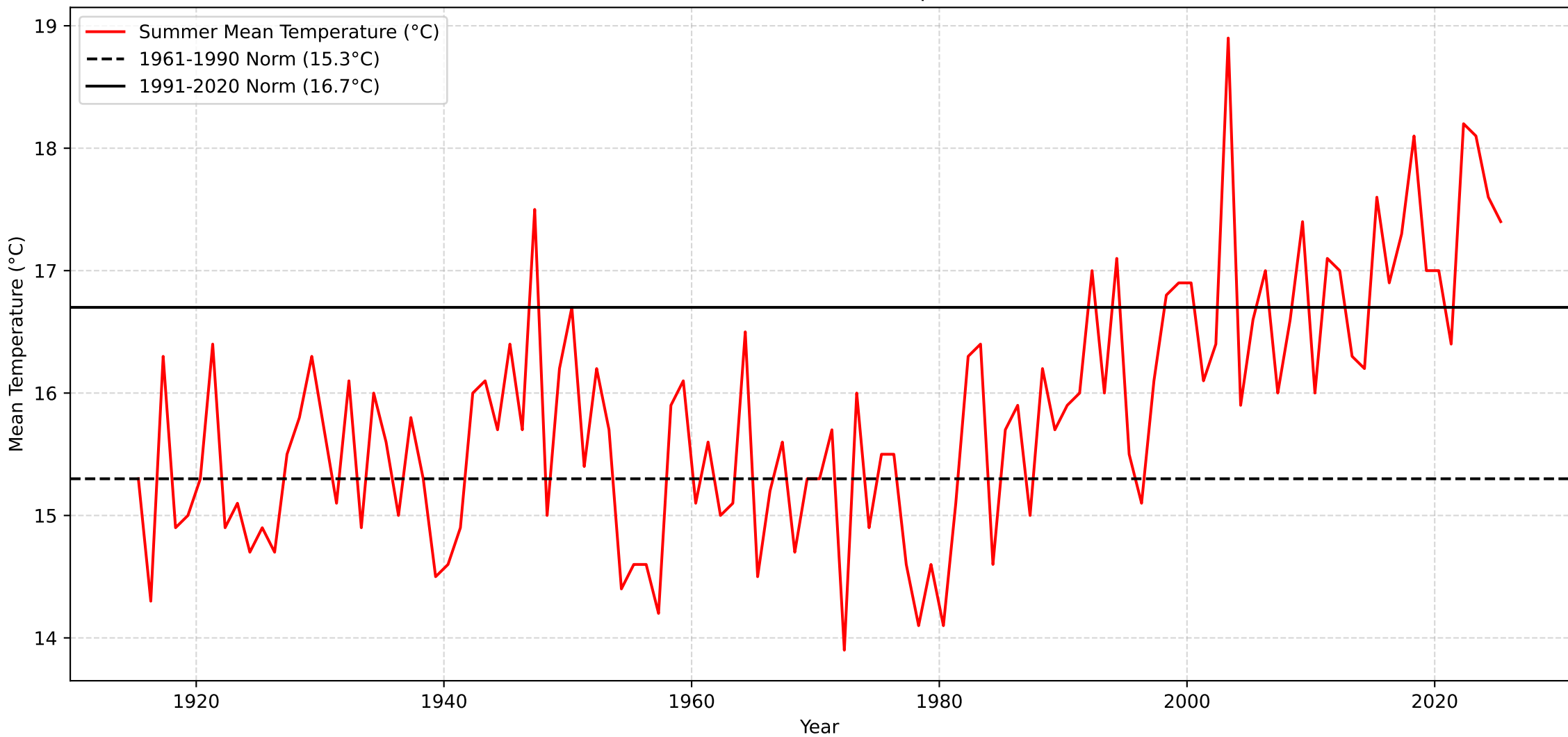
Claridenfirn Annual Mass Balance Over Time

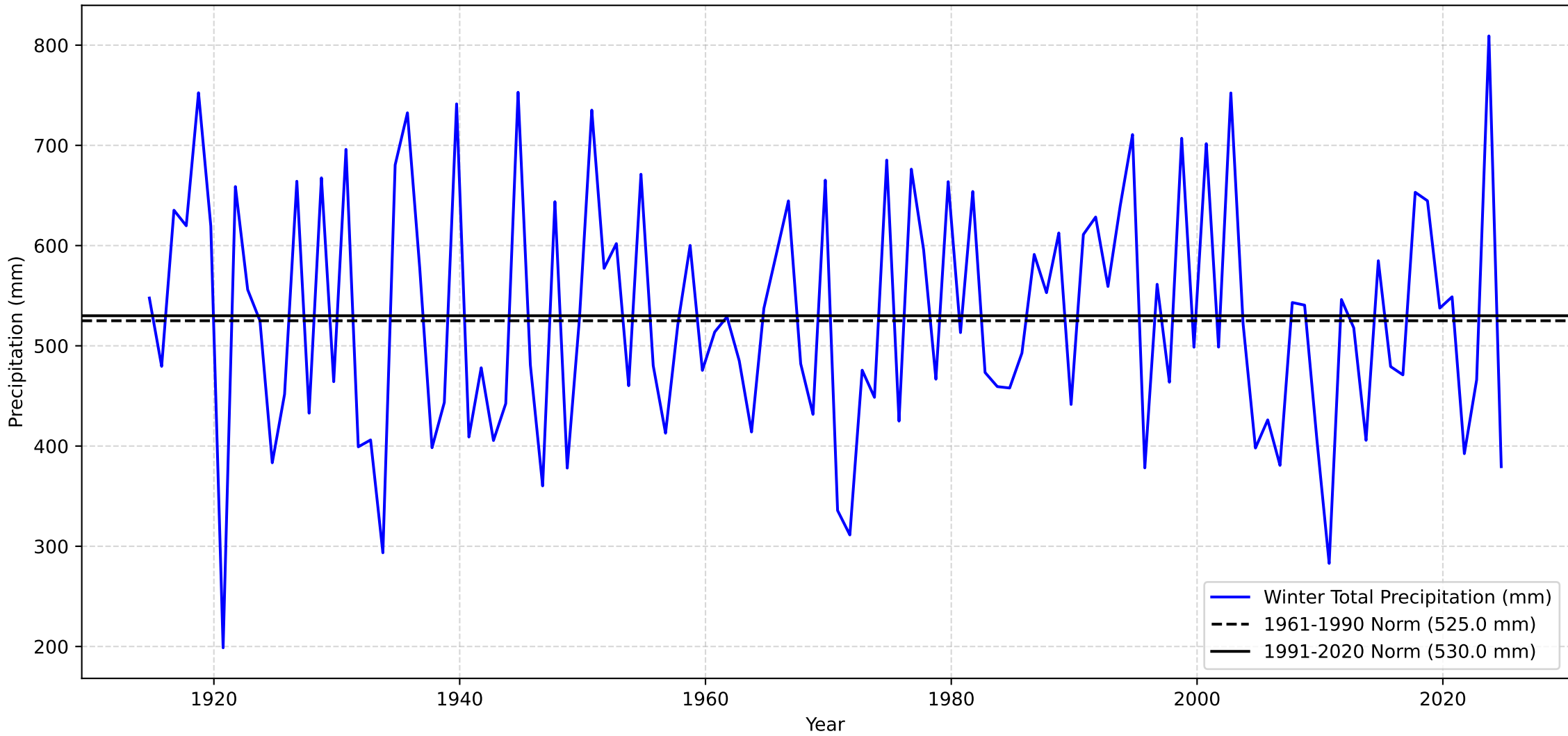Claridenfirn Cumulative Annual Mass Balance Over Time

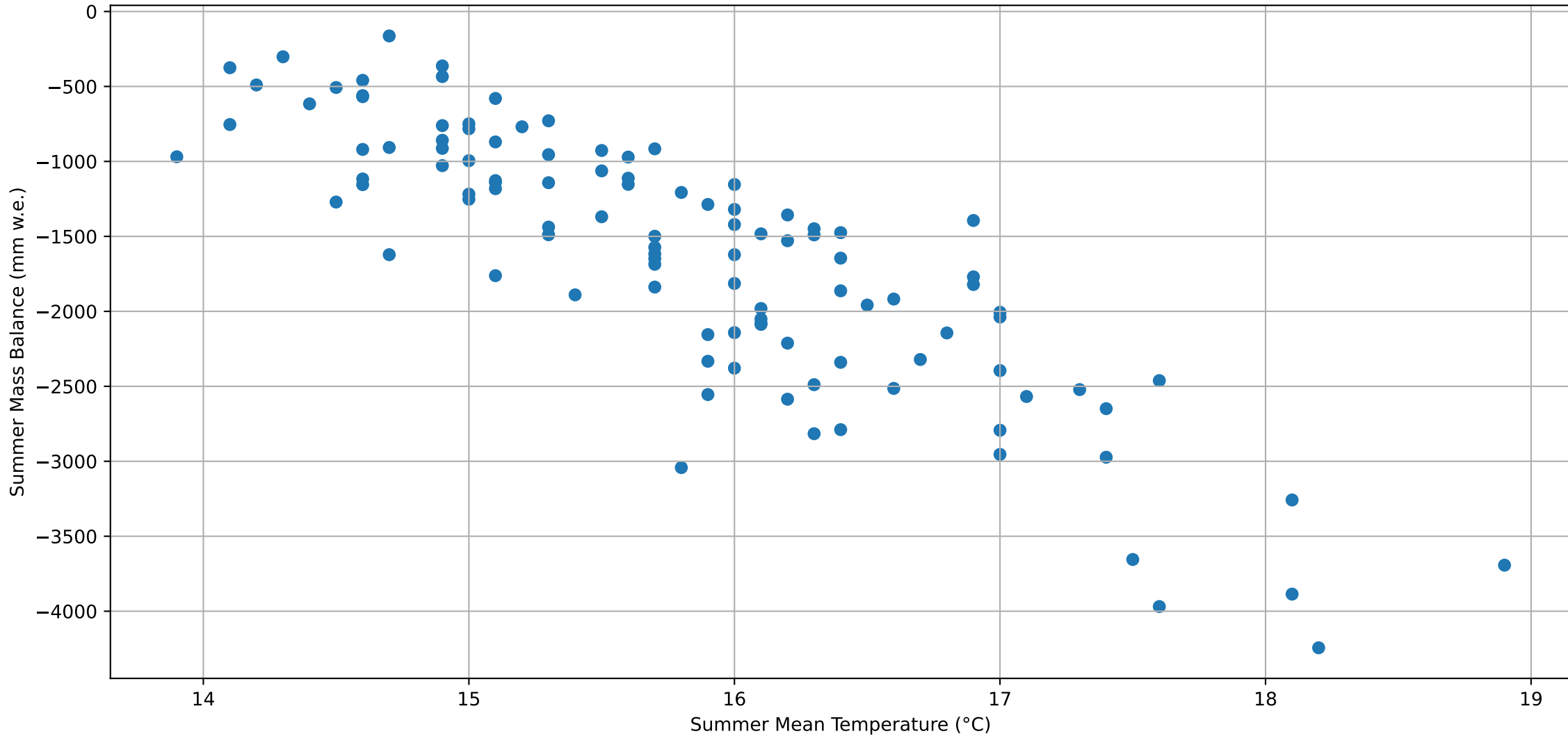Annual Mass Balance for each Elevation Bin over Time - Claridenfirn

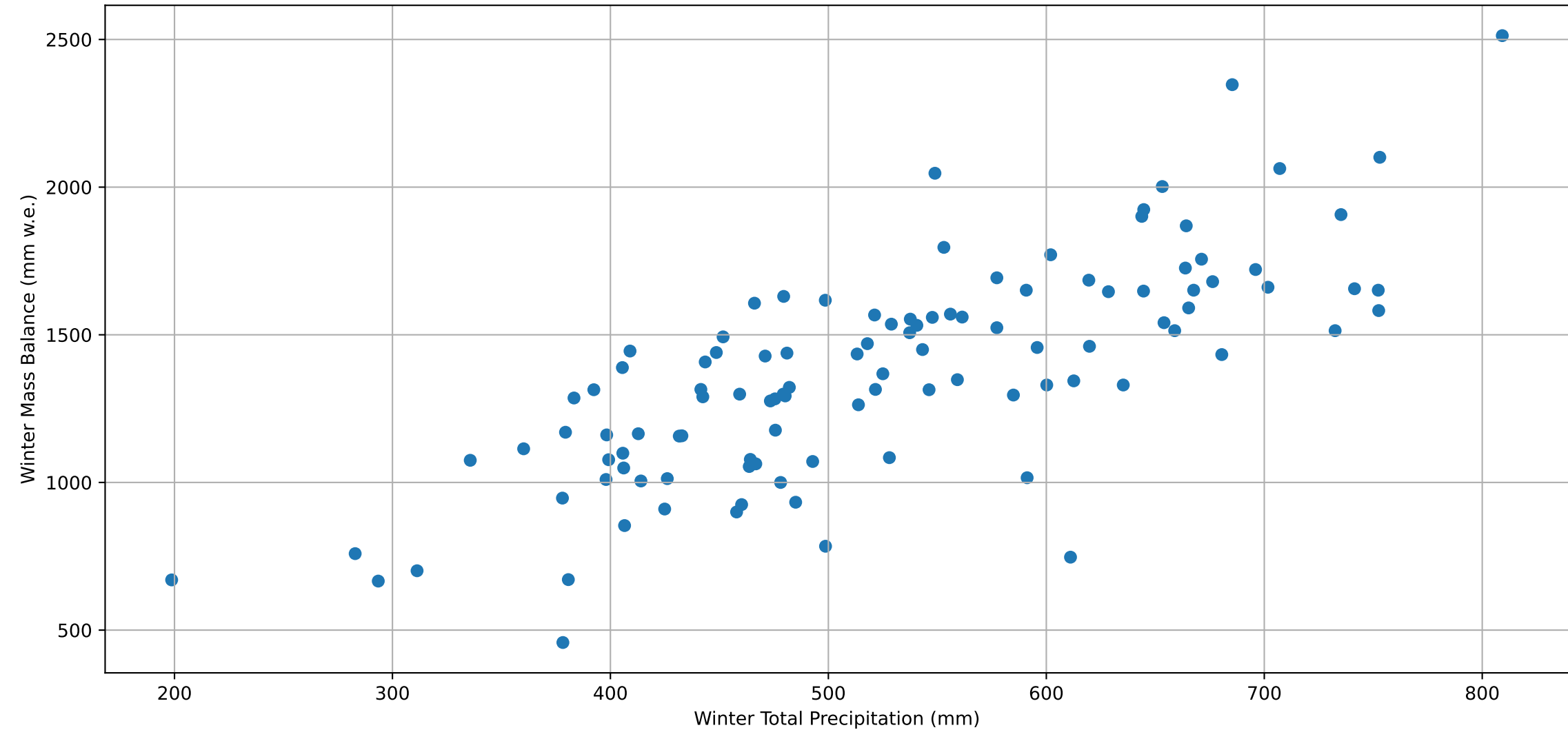Altdorf Summer Mean Temperature

Altdorf Winter Total Precipitation

Claridenfirn Summer Mass Balance with relation to Temperature

Claridenfirn Winter Mass Balance with relation to Precipitation

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


Correlation Analysis with Significance Testing:
Skipping constant column: const
          Variable  Correlation Coefficient      P-value  Significant (p < 0.05)
2          july_td                 -0.642742  4.899987e-14                    True
3        august_td                 -0.603902  3.614537e-12                    True
1          june_td                 -0.470638  2.414525e-07                    True
4     september_td                 -0.440927  1.597990e-06                    True
0           may_td                 -0.327747  5.033976e-04                    True
9      february_pd                  0.272898  4.091815e-03                    True
5        october_pd                 0.155127  1.072529e-01                   False
8        january_pd                 0.149151  1.216468e-01                   False
7       december_pd                 0.094737  3.271420e-01                   False
10         march_pd                 0.082160  3.957002e-01                   False
11         april_pd                 0.081340  4.004488e-01                   False
6      november_pd                  0.071166  4.621182e-01                   False

Number of observations: 109

Regression Summary:
                            OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:               0.768
Model:                                       OLS   Adj. R-squared:          0.739
Method:                            Least Squares   F-statistic:             26.54
Date:                           Mon, 22 Dec 2025   Prob (F-statistic):   2.55e-25
Time:                                   14:57:58   Log-Likelihood:         -818.07
No. Observations:                            109   AIC:                      1662.
Df Residuals:                                 96   BIC:                      1697.
Df Model:                                     12
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          59.2099     53.628      1.104      0.272     -47.241     165.661
may_td        -78.5856     30.615     -2.567      0.012    -139.356     -17.815
june_td       -98.5647     30.860     -3.194      0.002    -159.821     -37.309
july_td      -192.9518     34.689     -5.562      0.000    -261.808    -124.095
august_td    -189.5345     36.611     -5.177      0.000    -262.207    -116.862
september_td -137.7202     34.027     -4.047      0.000    -205.263     -70.178
october_pd      3.7112      0.949      3.911      0.000       1.827       5.595
november_pd     2.0676      0.824      2.509      0.014       0.432       3.703
december_pd     2.2300      0.913      2.443      0.016       0.418       4.042
january_pd      3.4498      1.133      3.046      0.003       1.202       5.698
february_pd     4.5414      1.066      4.258      0.000       2.424       6.658
march_pd        2.7083      1.152      2.350      0.021       0.421       4.996
april_pd       -0.5163      1.286     -0.402      0.689      -3.069       2.036
==============================================================================
Omnibus:                        1.448   Durbin-Watson:                   1.667
Prob(Omnibus):                  0.485   Jarque-Bera (JB):                1.207
Skew:                          -0.039   Prob(JB):                        0.547
Kurtosis:                       2.491   Cond. No.                         72.2
==============================================================================

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

```
================================================================================
OPTIMAL SEASONAL DEVIATIONS for Claridenfirn 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                -0.729232  2.449264e-19                    True
1  opt_season_pd                 0.333928  3.873699e-04                    True

Number of observations: 109

Regression Summary:
                            OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:                       0.640
Model:                                       OLS   Adj. R-squared:                  0.633
Method:                            Least Squares   F-statistic:                     94.27
Date:                           Mon, 22 Dec 2025   Prob (F-statistic):           3.00e-24
Time:                                   14:57:58   Log-Likelihood:                 -842.09
No. Observations:                            109   AIC:                             1690.
Df Residuals:                                106   BIC:                             1698.
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const           83.3856     60.955      1.368      0.174     -37.464     204.236
opt_season_td  -604.5066     48.447    -12.478      0.000    -700.557    -508.456
opt_season_pd     2.8935      0.512      5.649      0.000       1.878       3.909
==============================================================================
Omnibus:                        1.729   Durbin-Watson:                   1.776
Prob(Omnibus):                  0.421   Jarque-Bera (JB):                1.287
Skew:                          -0.250   Prob(JB):                        0.526
Kurtosis:                       3.180   Cond. No.                         133.
==============================================================================

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

```
===============================================================================
SUMMER/WINTER SEASONAL DEVIATIONS for Claridenfirn 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                 -0.772507  7.814267e-23                    True
1   winter_pd                  0.344108  2.485777e-04                    True

Number of observations: 109

Regression Summary:
                        OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:                       0.717
Model:                                       OLS   Adj. R-squared:                  0.712
Method:                            Least Squares   F-statistic:                     134.6
Date:                           Mon, 22 Dec 2025   Prob (F-statistic):           8.03e-30
Time:                                   14:57:58   Log-Likelihood:                -828.90
No. Observations:                            109   AIC:                             1664.
Df Residuals:                                106   BIC:                             1672.
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const        113.6658     53.563      2.122      0.036       7.471     219.860
summer_td   -708.5002     47.257    -14.993      0.000    -802.191    -614.809
winter_pd      2.6683      0.396      6.730      0.000       1.882       3.454
==============================================================================
Omnibus:                        3.151   Durbin-Watson:                   1.635
Prob(Omnibus):                  0.207   Jarque-Bera (JB):                2.632
Skew:                          -0.367   Prob(JB):                        0.268
Kurtosis:                       3.201   Cond. No.                         155.
==============================================================================

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

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

Correlation Analysis with Significance Testing:
Skipping constant column: const
         Variable  Correlation Coefficient      P-value  Significant (p < 0.05)
2          july_td                 -0.642742  4.899987e-14                   True
3        august_td                 -0.603902  3.614537e-12                   True
1          june_td                 -0.470638  2.414525e-07                   True
4     september_td                 -0.440927  1.597990e-06                   True
0           may_td                 -0.327747  5.033976e-04                   True
9      february_pd                  0.272898  4.091815e-03                   True
5       october_pd                  0.155127  1.072529e-01                  False
8       january_pd                  0.149151  1.216468e-01                  False
7      december_pd                  0.094737  3.271420e-01                  False
10        march_pd                  0.082160  3.957002e-01                  False
11        april_pd                  0.081340  4.004488e-01                  False
6     november_pd                  0.071166  4.621182e-01                  False

Number of observations: 109

Regression Summary:
                            OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:               0.768
Model:                                       OLS   Adj. R-squared:          0.739
Method:                            Least Squares   F-statistic:             26.54
Date:                           Mon, 22 Dec 2025   Prob (F-statistic):   2.55e-25
Time:                                   14:57:58   Log-Likelihood:         -818.07
No. Observations:                            109   AIC:                      1662.
Df Residuals:                                 96   BIC:                      1697.
Df Model:                                     12
Covariance Type:                       nonrobust
==============================================================================
                  coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         -885.9051     61.387    -14.432      0.000   -1007.757    -764.054
may_td         -78.5856     30.615     -2.567      0.012    -139.356     -17.815
june_td        -98.5647     30.860     -3.194      0.002    -159.821     -37.309
july_td       -192.9518     34.689     -5.562      0.000    -261.808    -124.095
august_td     -189.5345     36.611     -5.177      0.000    -262.207    -116.862
september_td  -137.7202     34.027     -4.047      0.000    -205.263     -70.178
october_pd       3.7112      0.949      3.911      0.000       1.827       5.595
november_pd      2.0676      0.824      2.509      0.014       0.432       3.703
december_pd      2.2300      0.913      2.443      0.016       0.418       4.042
january_pd       3.4498      1.133      3.046      0.003       1.202       5.698
february_pd      4.5414      1.066      4.258      0.000       2.424       6.658
march_pd         2.7083      1.152      2.350      0.021       0.421       4.996
april_pd        -0.5163      1.286     -0.402      0.689      -3.069       2.036
==============================================================================
Omnibus:                        1.448   Durbin-Watson:                   1.667
Prob(Omnibus):                  0.485   Jarque-Bera (JB):                1.207
Skew:                          -0.039   Prob(JB):                        0.547
Kurtosis:                       2.491   Cond. No.                         83.1
==============================================================================

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

```
================================================================================
OPTIMAL SEASONAL DEVIATIONS for Claridenfirn 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               -0.731612  1.638598e-19                    True
1  opt_season_pd                0.333928  3.873699e-04                    True

Number of observations: 109

Regression Summary:
                            OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:             0.642
Model:                                       OLS   Adj. R-squared:        0.635
Method:                            Least Squares   F-statistic:           94.89
Date:                           Mon, 22 Dec 2025   Prob (F-statistic):  2.40e-24
Time:                                   14:57:58   Log-Likelihood:       -841.86
No. Observations:                            109   AIC:                    1690.
Df Residuals:                                106   BIC:                    1698.
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const         -844.3329     70.849    -11.917      0.000    -984.798    -703.868
opt_season_td -610.0771     48.721    -12.522      0.000    -706.672    -513.482
opt_season_pd    2.8672      0.511      5.609      0.000       1.854       3.881
==============================================================================
Omnibus:                        2.136   Durbin-Watson:                   1.779
Prob(Omnibus):                  0.344   Jarque-Bera (JB):                1.580
Skew:                          -0.252   Prob(JB):                        0.454
Kurtosis:                       3.307   Cond. No.                         156.
==============================================================================


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

```
================================================================================
SUMMER/WINTER SEASONAL DEVIATIONS for Claridenfirn 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                 -0.772507  7.814267e-23                    True
1  winter_pd                  0.344108  2.485777e-04                    True

Number of observations: 109

Regression Summary:
                            OLS Regression Results
==============================================================================
Dep. Variable:     annual mass balance (mm w.e.)   R-squared:           0.717
Model:                                       OLS   Adj. R-squared:      0.712
Method:                            Least Squares   F-statistic:         134.6
Date:                           Mon, 22 Dec 2025   Prob (F-statistic): 8.03e-30
Time:                                   14:57:58   Log-Likelihood:     -828.90
No. Observations:                            109   AIC:                  1664.
Df Residuals:                                106   BIC:                  1672.
Df Model:                                      2
Covariance Type:                       nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const       -864.8931     62.383    -13.864      0.000    -988.574    -741.212
summer_td   -708.5002     47.257    -14.993      0.000    -802.191    -614.809
winter_pd      2.6683      0.396      6.730      0.000       1.882       3.454
==============================================================================
Omnibus:                        3.151   Durbin-Watson:                   1.635
Prob(Omnibus):                  0.207   Jarque-Bera (JB):                2.632
Skew:                          -0.367   Prob(JB):                        0.268
Kurtosis:                       3.201   Cond. No.                         181.
==============================================================================

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