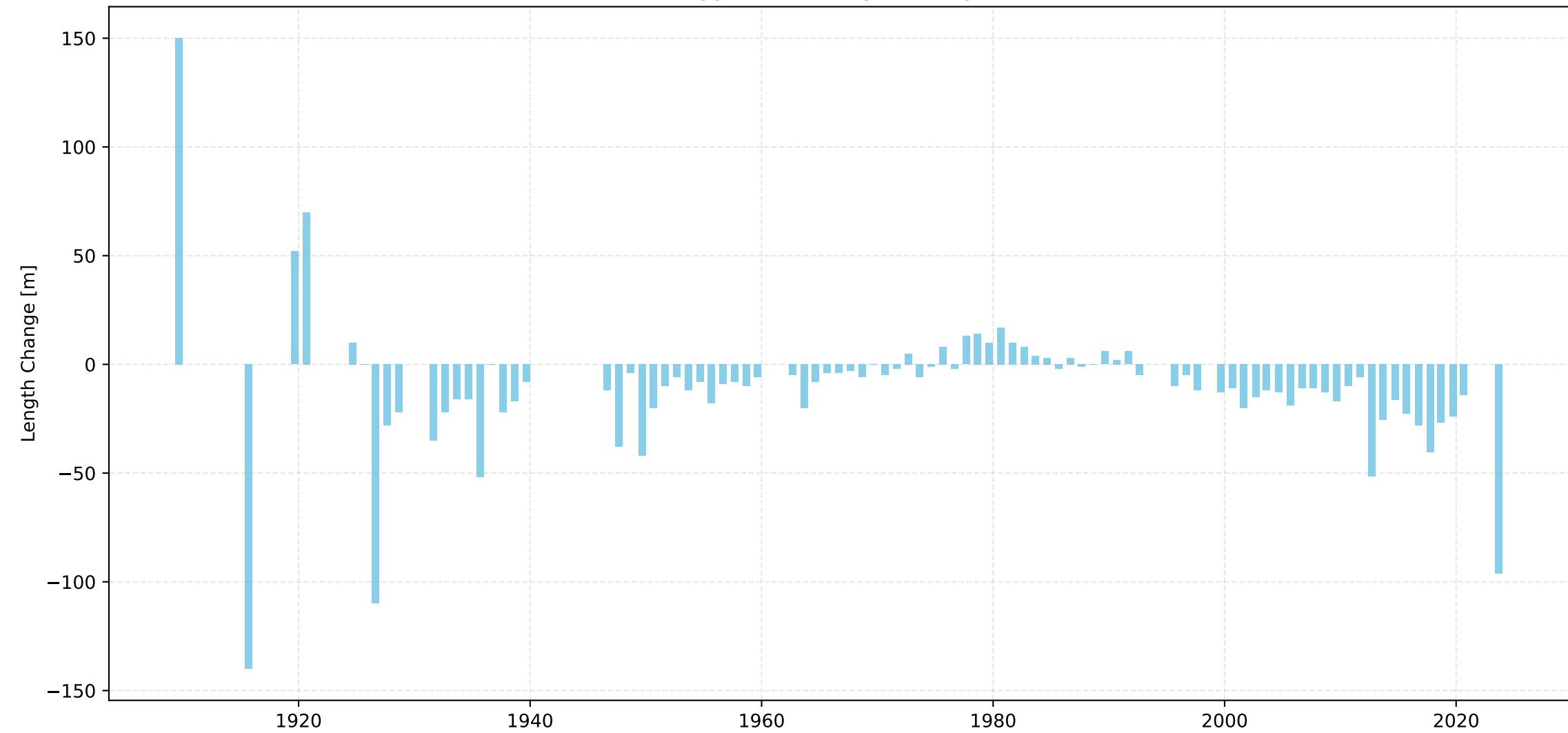
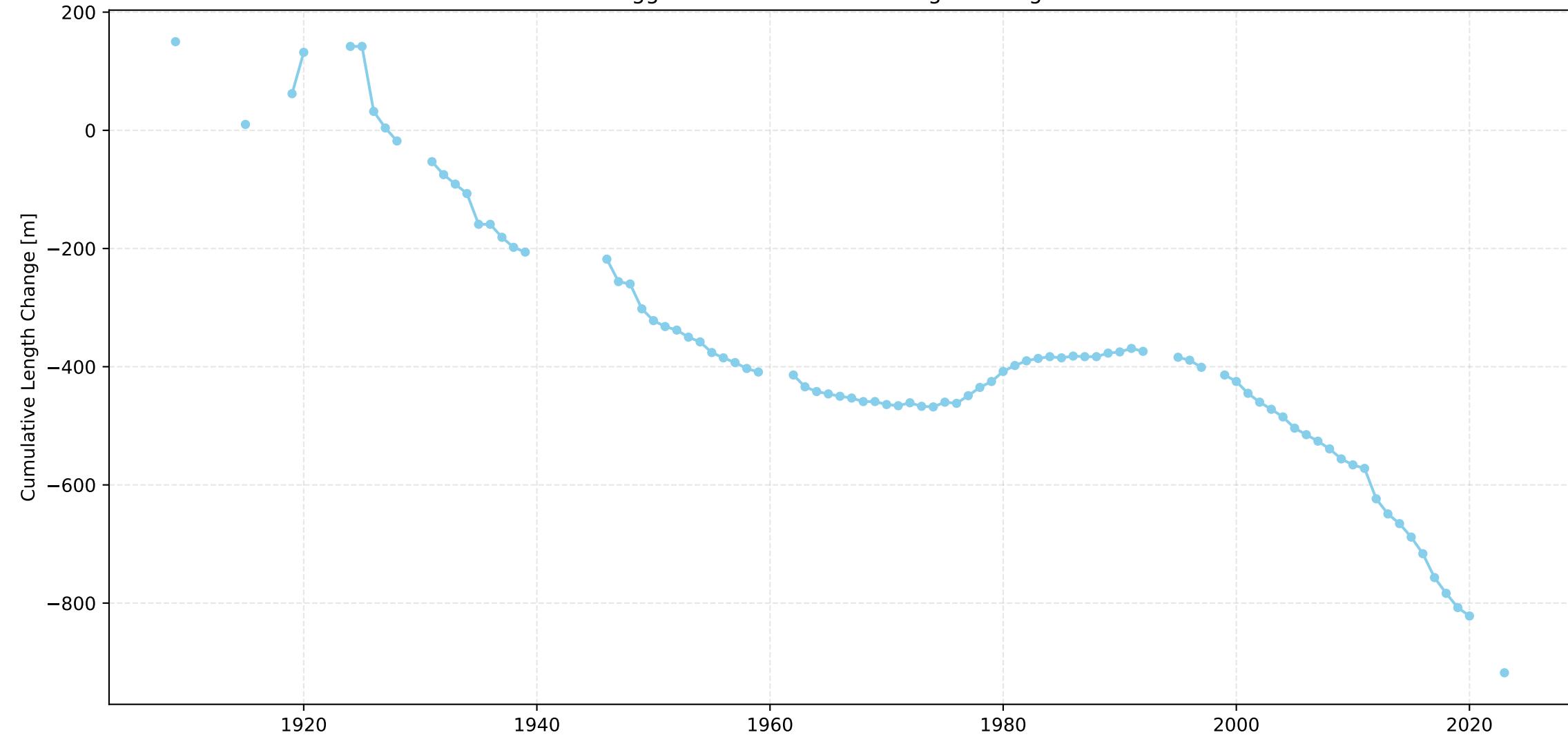


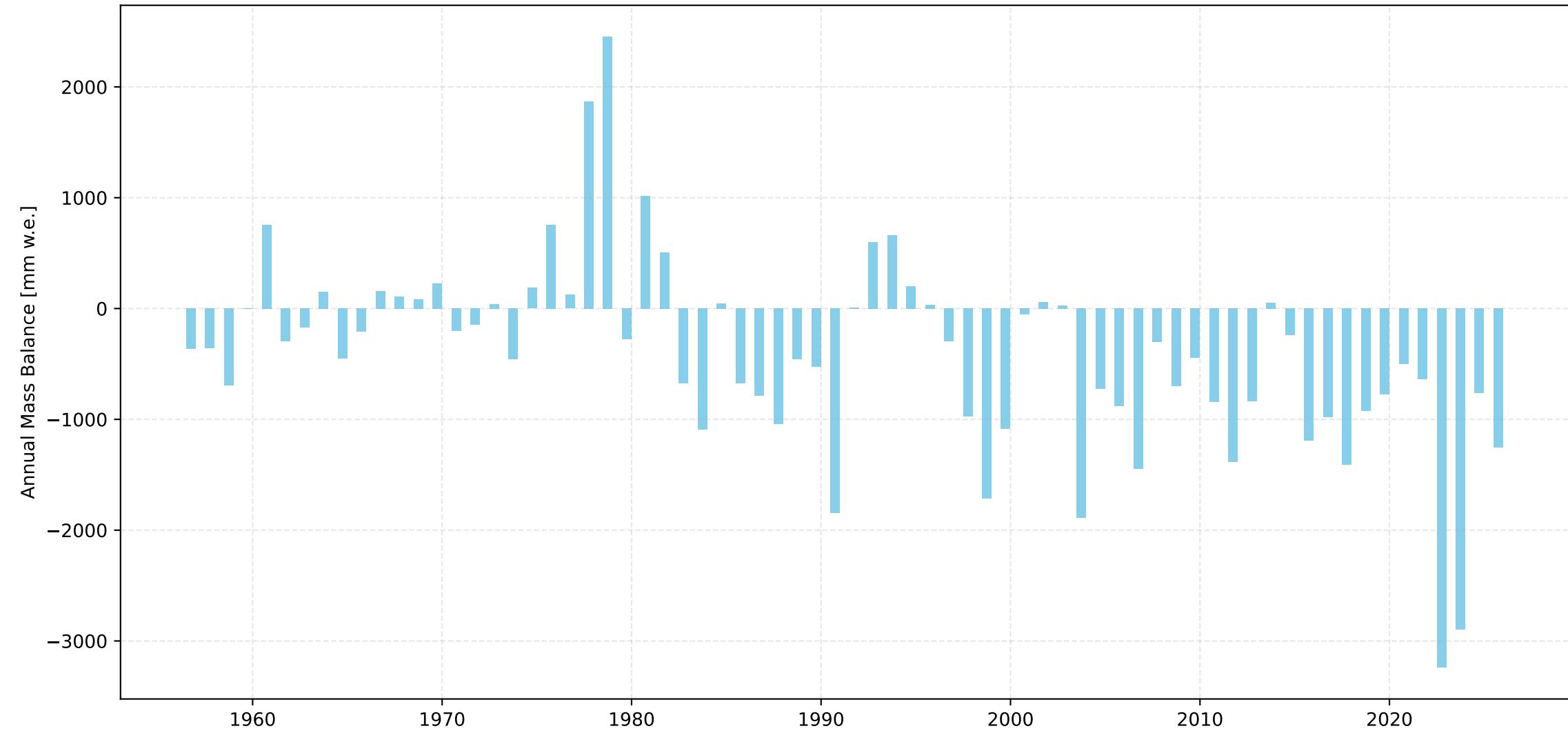
## Schwarzberggletscher Length Change Over Time



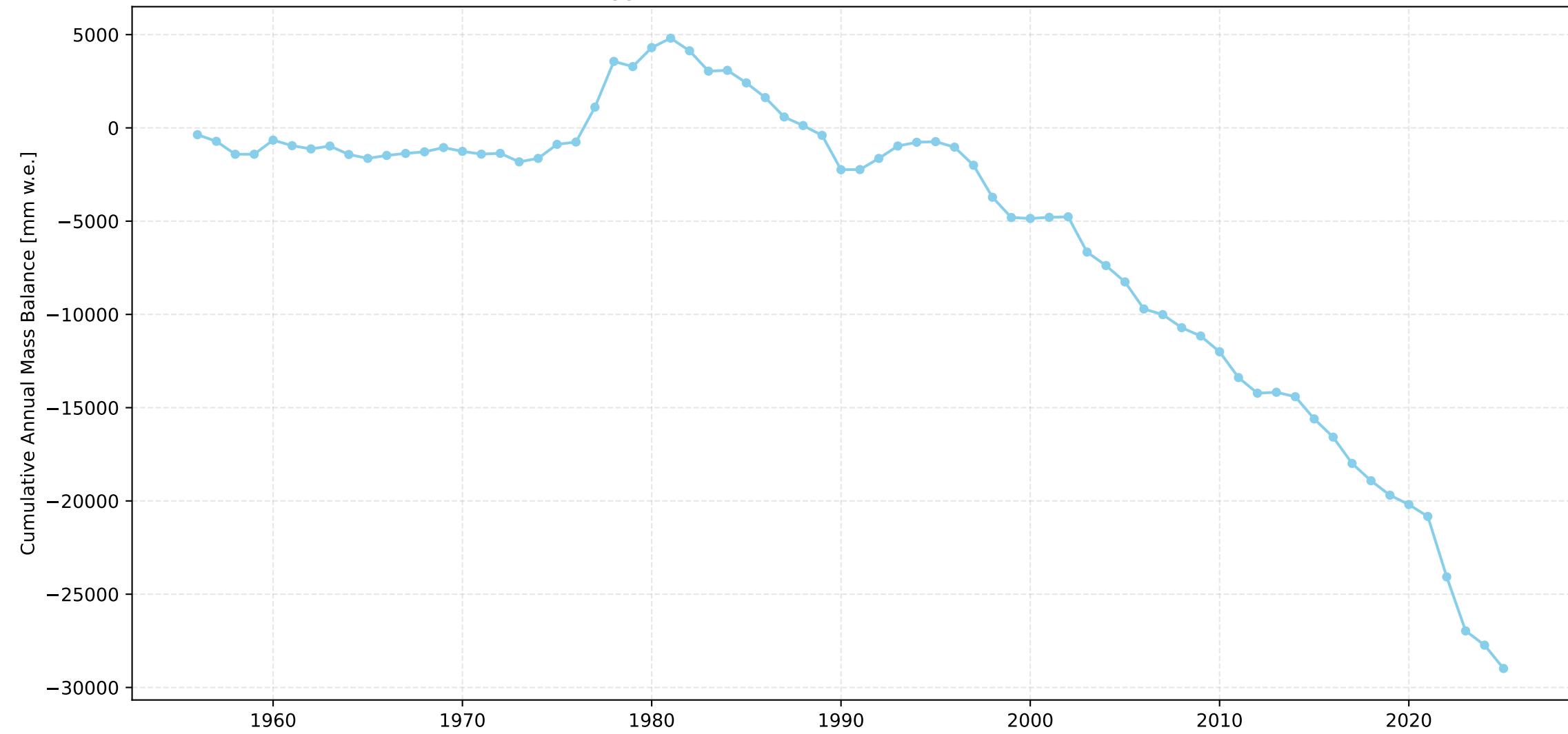
## Schwarzberggletscher Cumulative Length Change Over Time



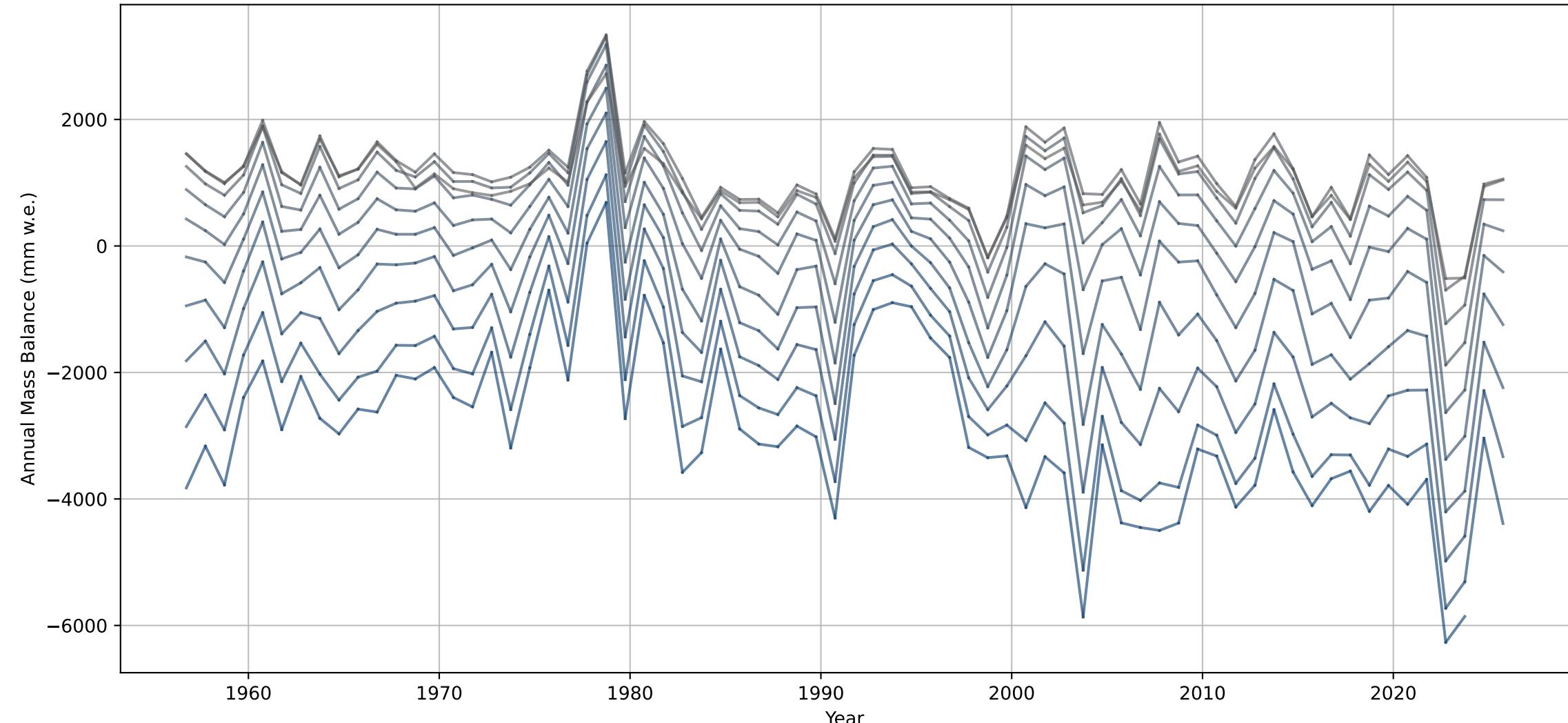
## Schwarzberggletscher Annual Mass Balance Over Time



## Schwarzberggletscher Cumulative Annual Mass Balance Over Time



# Annual Mass Balance for each Elevation Bin over Time - Schwarzberggletscher



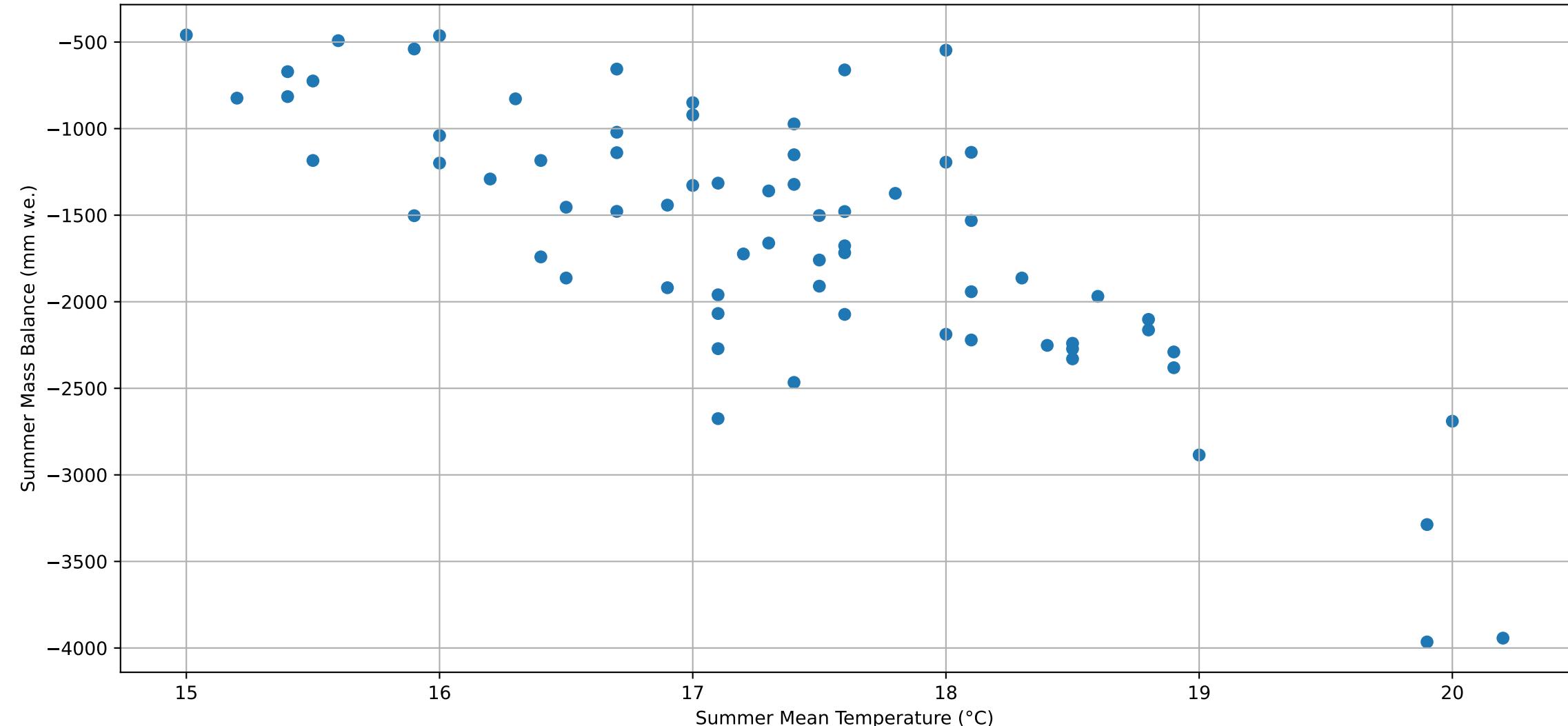
## Sion Summer Mean Temperature



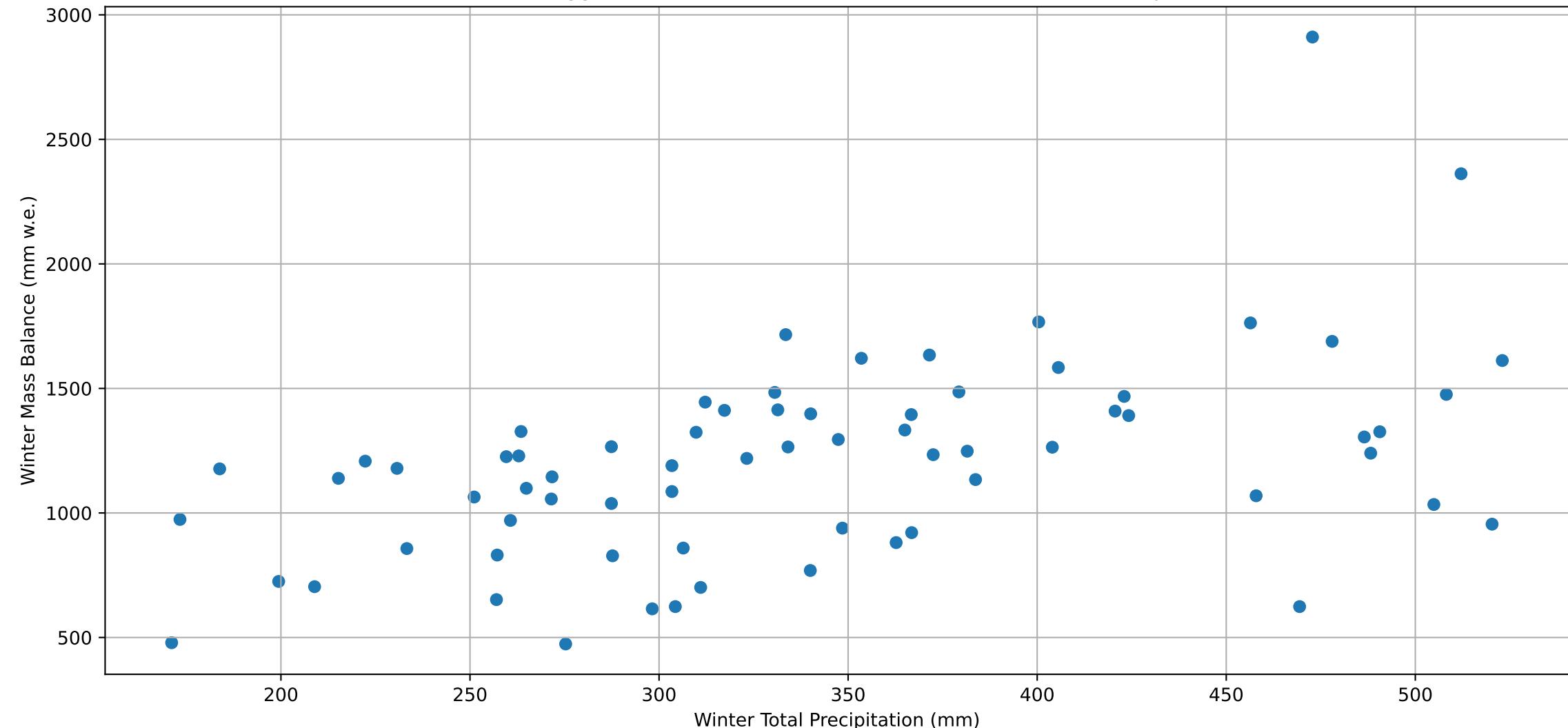
## Sion Winter Total Precipitation



### Schwarzberggletscher Summer Mass Balance with relation to Temperature



# Schwarzberggletscher Winter Mass Balance with relation to Precipitation



# Regression: Monthly 1961-1990

=====  
MONTHLY DEVIATIONS for Schwarzberggletscher 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	-0.570124	2.579128e-07	True
1	june_td	-0.544123	1.123852e-06	True
3	august_td	-0.517207	4.552076e-06	True
4	september_td	-0.453572	8.035801e-05	True
0	may_td	-0.437913	1.499031e-04	True
5	october_pd	0.136419	2.601277e-01	False
10	march_pd	0.125403	3.009506e-01	False
6	november_pd	0.122187	3.136170e-01	False
9	february_pd	0.101011	4.053910e-01	False
7	december_pd	0.070149	5.639044e-01	False
8	january_pd	0.060120	6.210324e-01	False
11	april_pd	-0.053554	6.597125e-01	False

Number of observations: 70

Regression Summary:

## OLS Regression Results

Dep. Variable:	annual mass balance (mm w.e.)	R-squared:	0.582
Model:	OLS	Adj. R-squared:	0.494
Method:	Least Squares	F-statistic:	6.623
Date:	Fri, 19 Dec 2025	Prob (F-statistic):	3.05e-07
Time:	16:02:39	Log-Likelihood:	-543.16
No. Observations:	70	AIC:	1112.
Df Residuals:	57	BIC:	1142.
Df Model:	12		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	81.2746	97.680	0.832	0.409	-114.327	276.876
may_td	-93.5242	60.040	-1.558	0.125	-213.752	26.704
june_td	-87.6040	56.599	-1.548	0.127	-200.941	25.733
july_td	-161.3010	60.725	-2.656	0.010	-282.901	-39.701
august_td	-83.2476	71.653	-1.162	0.250	-226.730	60.234
september_td	-141.9432	57.014	-2.490	0.016	-256.111	-27.775
october_pd	2.2736	2.793	0.814	0.419	-3.319	7.866
november_pd	3.1229	2.075	1.505	0.138	-1.033	7.278
december_pd	3.7424	1.734	2.158	0.035	0.269	7.215
january_pd	2.0974	2.111	0.994	0.325	-2.129	6.324
february_pd	-0.6711	1.639	-0.409	0.684	-3.953	2.611
march_pd	1.7394	2.413	0.721	0.474	-3.092	6.571
april_pd	2.0444	3.685	0.555	0.581	-5.335	9.424

Omnibus:	0.273	Durbin-Watson:	1.180
Prob(Omnibus):	0.872	Jarque-Bera (JB):	0.042
Skew:	-0.051	Prob(JB):	0.979
Kurtosis:	3.063	Cond. No.	68.7

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

# Regression: Optimal 1961-1990

=====  
OPTIMAL SEASONAL DEVIATIONS for Schwarzberggletscher 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	-0.673903	1.617824e-10	True
1	opt_season_pd	0.241944	4.360289e-02	True

Number of observations: 70

Regression Summary:

## OLS Regression Results

Dep. Variable:	annual mass balance (mm w.e.)	R-squared:	0.484
Model:	OLS	Adj. R-squared:	0.469
Method:	Least Squares	F-statistic:	31.45
Date:	Fri, 19 Dec 2025	Prob (F-statistic):	2.34e-10
Time:	16:02:39	Log-Likelihood:	-550.54
No. Observations:	70	AIC:	1107.
Df Residuals:	67	BIC:	1114.
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	37.4196	96.002	0.390	0.698	-154.201	229.040
opt_season_td	-452.9618	60.918	-7.436	0.000	-574.554	-331.370
opt_season_pd	1.8855	0.954	1.975	0.052	-0.020	3.791

Omnibus:	0.847	Durbin-Watson:	1.175
Prob(Omnibus):	0.655	Jarque-Bera (JB):	0.312
Skew:	-0.020	Prob(JB):	0.856
Kurtosis:	3.325	Cond. No.	111.

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

# Regression: Seasonal 1961-1990

=====  
SUMMER/WINTER SEASONAL DEVIATIONS for Schwarzberggletscher 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	-0.704085	1.048873e-11	True
1 winter_pd	0.245330	4.065650e-02	True

Number of observations: 70

Regression Summary:

## OLS Regression Results

Dep. Variable:	annual mass balance (mm w.e.)	R-squared:	0.537
Model:	OLS	Adj. R-squared:	0.523
Method:	Least Squares	F-statistic:	38.87
Date:	Fri, 19 Dec 2025	Prob (F-statistic):	6.23e-12
Time:	16:02:39	Log-Likelihood:	-546.76
No. Observations:	70	AIC:	1100.
Df Residuals:	67	BIC:	1106.
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	83.7591	92.237	0.908	0.367	-100.347	267.865
summer_td	-518.3643	62.394	-8.308	0.000	-642.904	-393.825
winter_pd	1.9387	0.793	2.446	0.017	0.357	3.521

Omnibus:	1.179	Durbin-Watson:	1.253
Prob(Omnibus):	0.555	Jarque-Bera (JB):	0.579
Skew:	-0.128	Prob(JB):	0.748
Kurtosis:	3.364	Cond. No.	132.

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

# Regression: Monthly 1991-2020

=====  
MONTHLY DEVIATIONS for Schwarzberggletscher 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	-0.570124	2.579128e-07	True
1	june_td	-0.544123	1.123852e-06	True
3	august_td	-0.517207	4.552076e-06	True
4	september_td	-0.453572	8.035801e-05	True
0	may_td	-0.437913	1.499031e-04	True
5	october_pd	0.136419	2.601277e-01	False
10	march_pd	0.125403	3.009506e-01	False
6	november_pd	0.122187	3.136170e-01	False
9	february_pd	0.101011	4.053910e-01	False
7	december_pd	0.070149	5.639044e-01	False
8	january_pd	0.060120	6.210324e-01	False
11	april_pd	-0.053554	6.597125e-01	False

Number of observations: 70

Regression Summary:

## OLS Regression Results

Dep. Variable:	annual mass balance (mm w.e.)	R-squared:	0.582
Model:	OLS	Adj. R-squared:	0.494
Method:	Least Squares	F-statistic:	6.623
Date:	Fri, 19 Dec 2025	Prob (F-statistic):	3.05e-07
Time:	16:02:39	Log-Likelihood:	-543.16
No. Observations:	70	AIC:	1112.
Df Residuals:	57	BIC:	1142.
Df Model:	12		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	-843.0152	91.842	-9.179	0.000	-1026.926	-659.104
may_td	-93.5242	60.040	-1.558	0.125	-213.752	26.704
june_td	-87.6040	56.599	-1.548	0.127	-200.941	25.733
july_td	-161.3010	60.725	-2.656	0.010	-282.901	-39.701
august_td	-83.2476	71.653	-1.162	0.250	-226.730	60.234
september_td	-141.9432	57.014	-2.490	0.016	-256.111	-27.775
october_pd	2.2736	2.793	0.814	0.419	-3.319	7.866
november_pd	3.1229	2.075	1.505	0.138	-1.033	7.278
december_pd	3.7424	1.734	2.158	0.035	0.269	7.215
january_pd	2.0974	2.111	0.994	0.325	-2.129	6.324
february_pd	-0.6711	1.639	-0.409	0.684	-3.953	2.611
march_pd	1.7394	2.413	0.721	0.474	-3.092	6.571
april_pd	2.0444	3.685	0.555	0.581	-5.335	9.424

Omnibus:	0.273	Durbin-Watson:	1.180
Prob(Omnibus):	0.872	Jarque-Bera (JB):	0.042
Skew:	-0.051	Prob(JB):	0.979
Kurtosis:	3.063	Cond. No.	65.8

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

# Regression: Optimal 1991-2020

=====  
OPTIMAL SEASONAL DEVIATIONS for Schwarzberggletscher 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	-0.676153	1.334027e-10	True
1	opt_season_pd	0.241944	4.360289e-02	True

Number of observations: 70

Regression Summary:

## OLS Regression Results

Dep. Variable:	annual mass balance (mm w.e.)	R-squared:	0.485
Model:	OLS	Adj. R-squared:	0.470
Method:	Least Squares	F-statistic:	31.59
Date:	Fri, 19 Dec 2025	Prob (F-statistic):	2.17e-10
Time:	16:02:39	Log-Likelihood:	-550.47
No. Observations:	70	AIC:	1107.
Df Residuals:	67	BIC:	1114.
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	-822.2518	92.603	-8.879	0.000	-1007.088	-637.415
opt_season_td	-457.0050	61.315	-7.453	0.000	-579.390	-334.620
opt_season_pd	1.8258	0.954	1.913	0.060	-0.079	3.731

Omnibus:	0.687	Durbin-Watson:	1.161
Prob(Omnibus):	0.709	Jarque-Bera (JB):	0.208
Skew:	-0.004	Prob(JB):	0.901
Kurtosis:	3.267	Cond. No.	107.

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

# Regression: Seasonal 1991-2020

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=====
SUMMER/WINTER SEASONAL DEVIATIONS for Schwarzberggletscher using 1991-2020 climate norms
=====
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Correlation Analysis with Significance Testing:

Skipping constant column: const

Variable	Correlation Coefficient	P-value	Significant (p < 0.05)
0 summer_td	-0.702701	1.198032e-11	True
1 winter_pd	0.245330	4.065650e-02	True

Number of observations: 70

Regression Summary:

## OLS Regression Results

Dep. Variable:	annual mass balance (mm w.e.)	R-squared:	0.534
Model:	OLS	Adj. R-squared:	0.520
Method:	Least Squares	F-statistic:	38.40
Date:	Fri, 19 Dec 2025	Prob (F-statistic):	7.75e-12
Time:	16:02:39	Log-Likelihood:	-546.99
No. Observations:	70	AIC:	1100.
Df Residuals:	67	BIC:	1107.
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	-842.3214	88.023	-9.569	0.000	-1018.016	-666.627
summer_td	-516.2801	62.546	-8.254	0.000	-641.122	-391.439
winter_pd	1.9136	0.795	2.406	0.019	0.326	3.501

Omnibus:	1.147	Durbin-Watson:	1.229
Prob(Omnibus):	0.564	Jarque-Bera (JB):	0.548
Skew:	-0.105	Prob(JB):	0.760
Kurtosis:	3.379	Cond. No.	124.

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