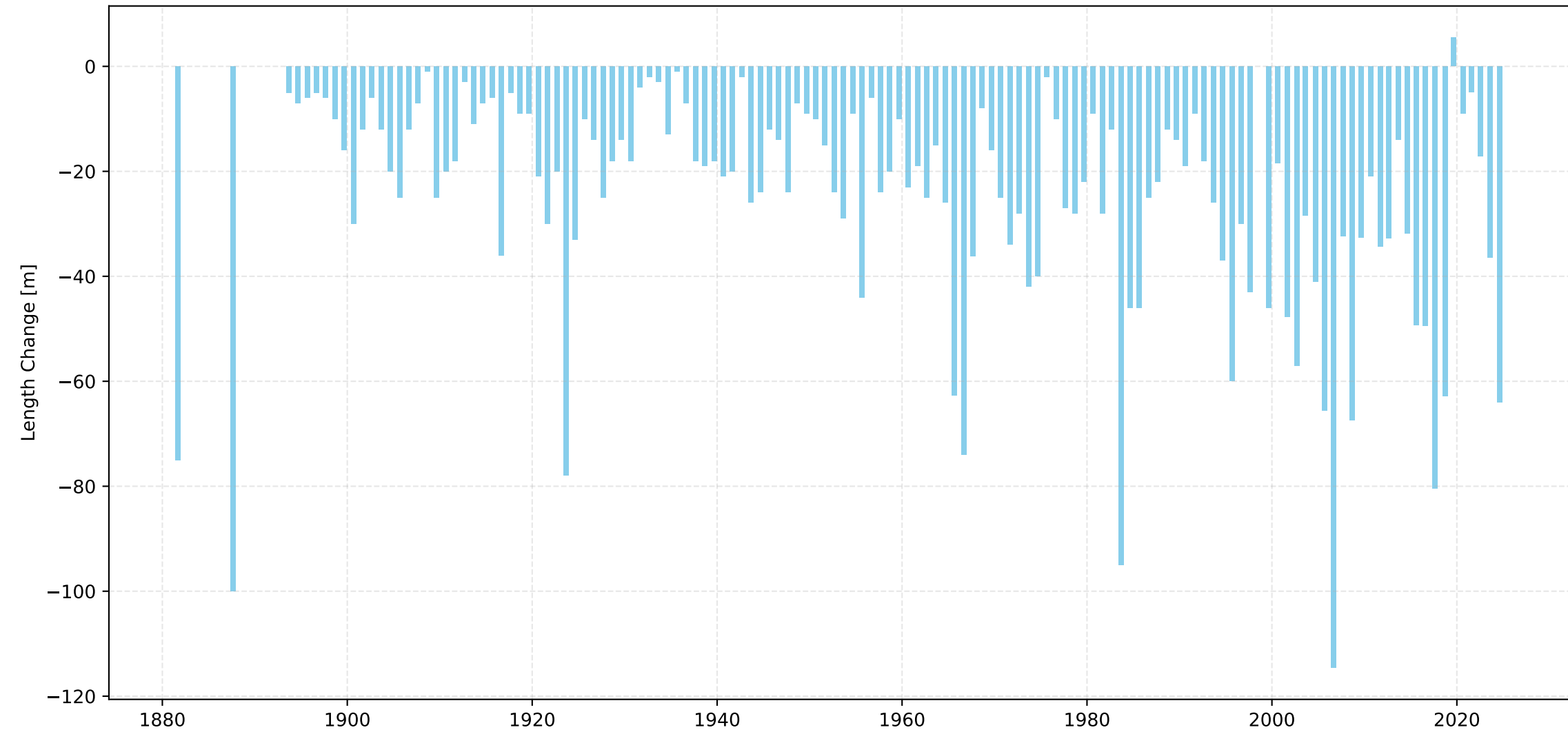
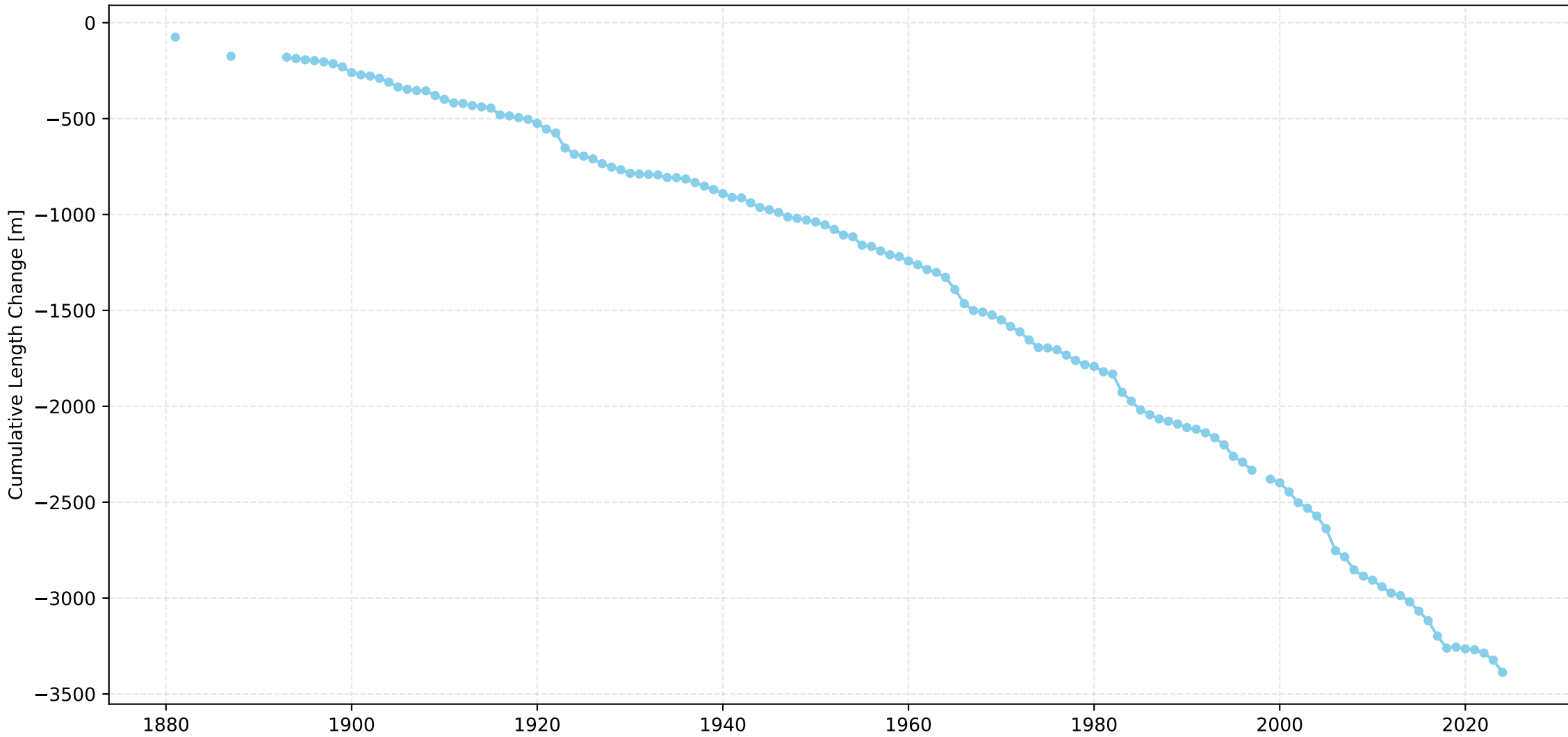


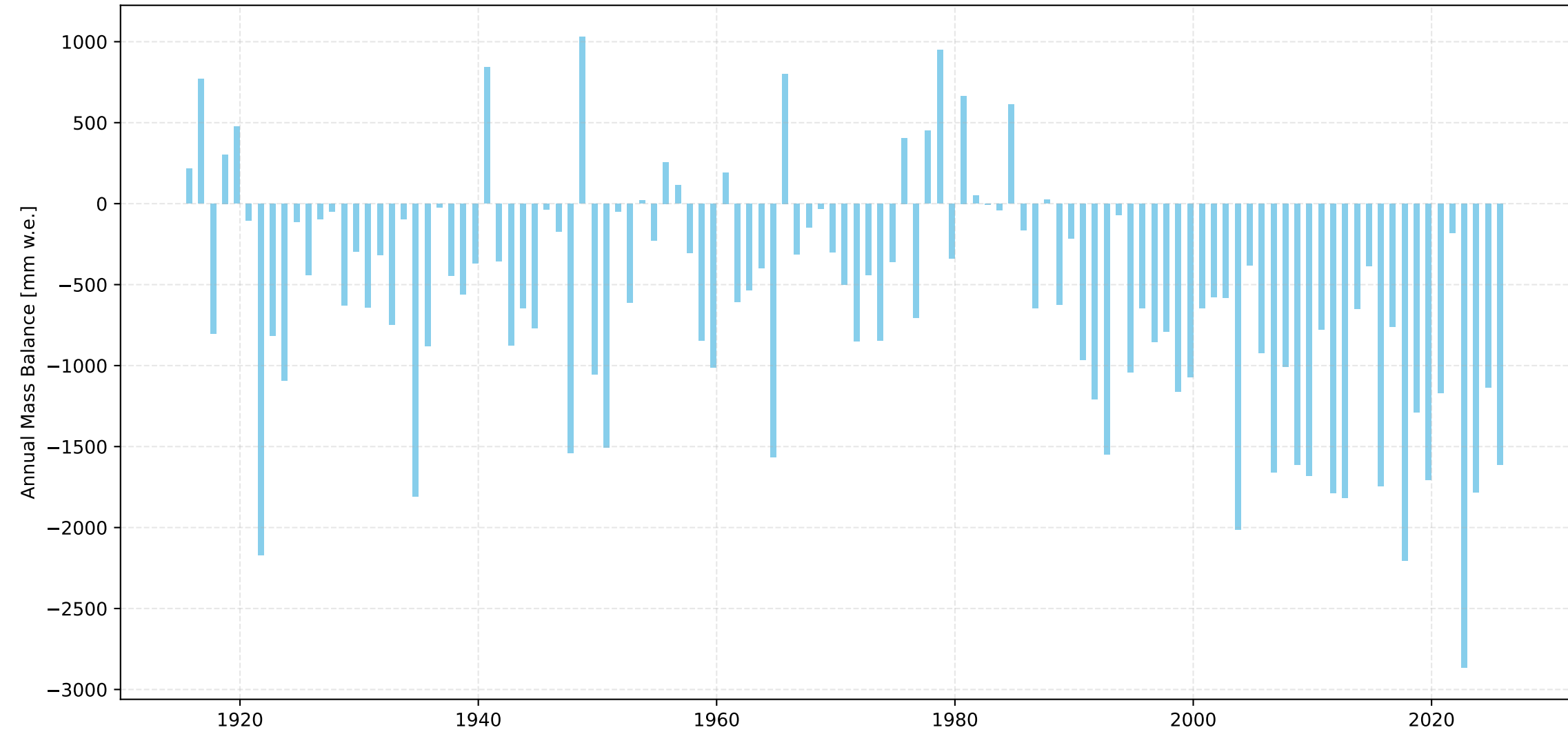
Grosser Aletschgletscher Length Change Over Time



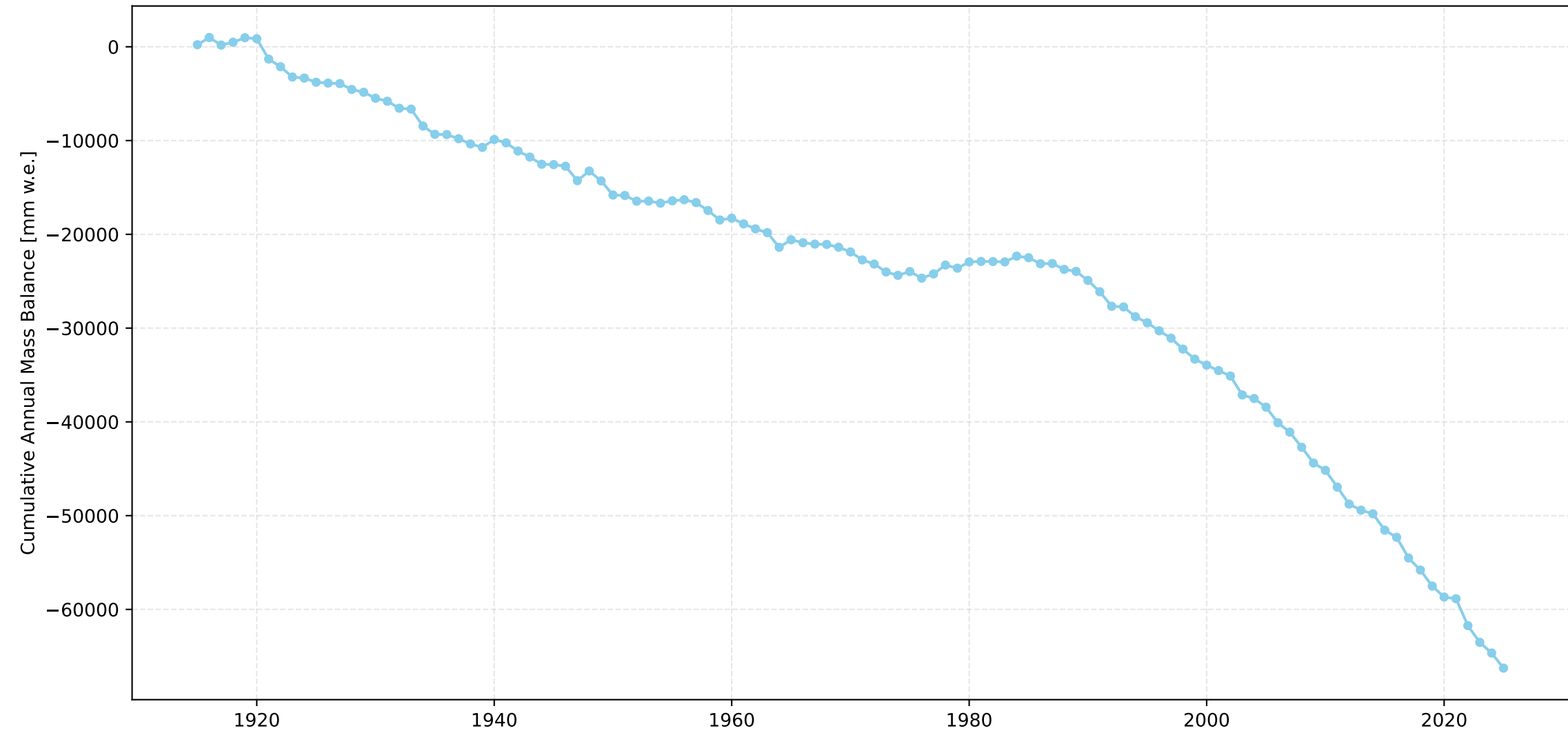
Grosser Aletschgletscher Cumulative Length Change Over Time



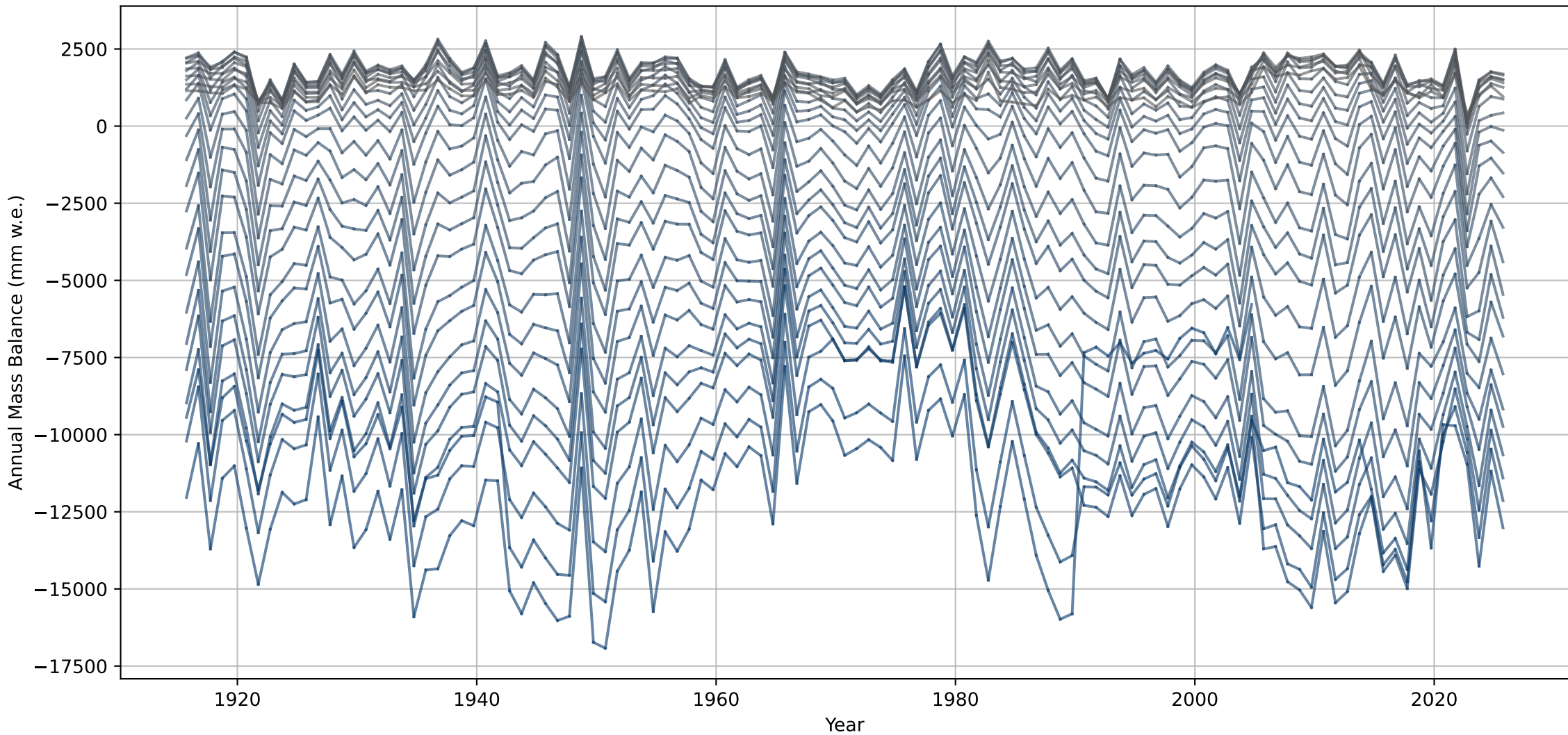
Grosser Aletschgletscher Annual Mass Balance Over Time



Grosser Aletschgletscher Cumulative Annual Mass Balance Over Time



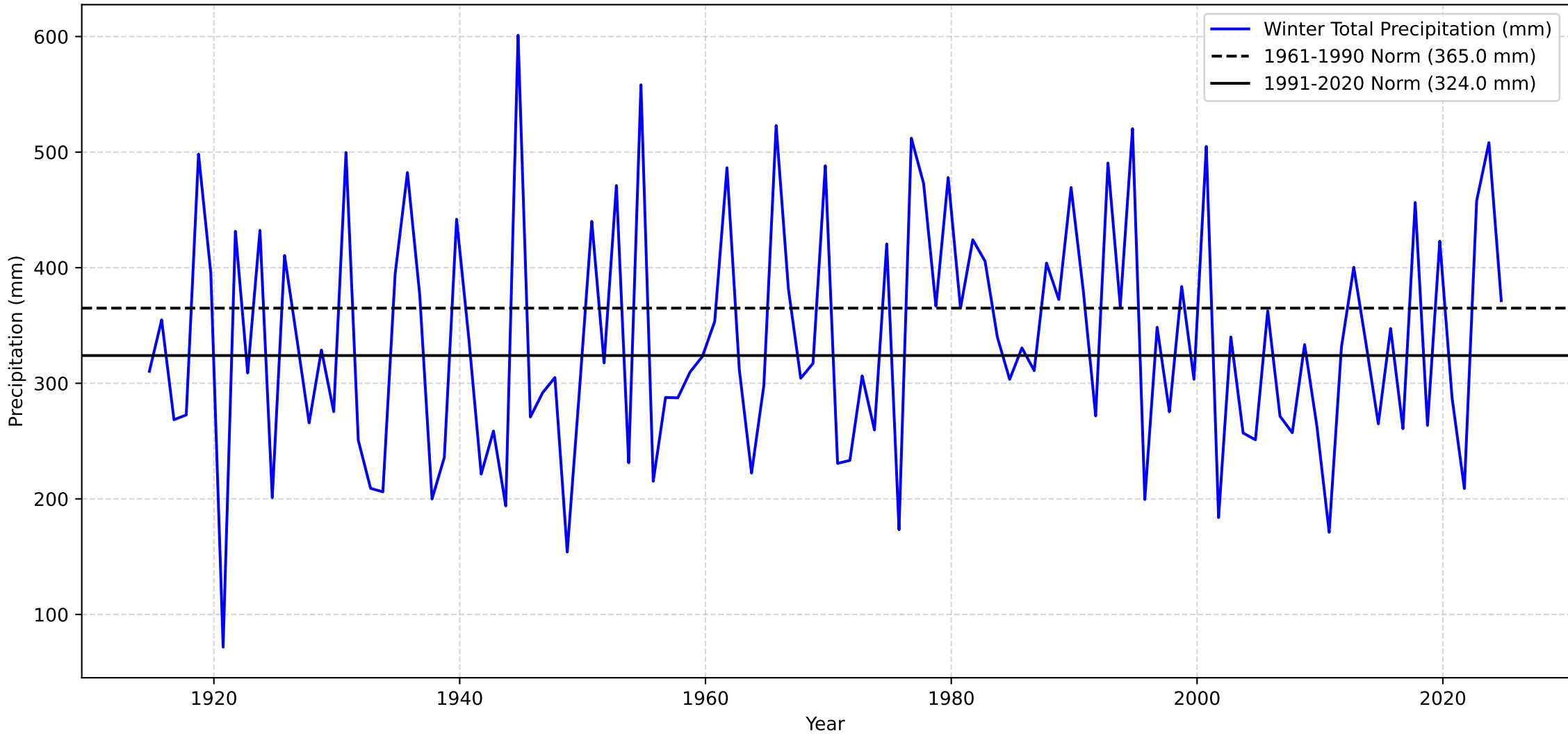
Annual Mass Balance for each Elevation Bin over Time - Grosser Aletschgletscher



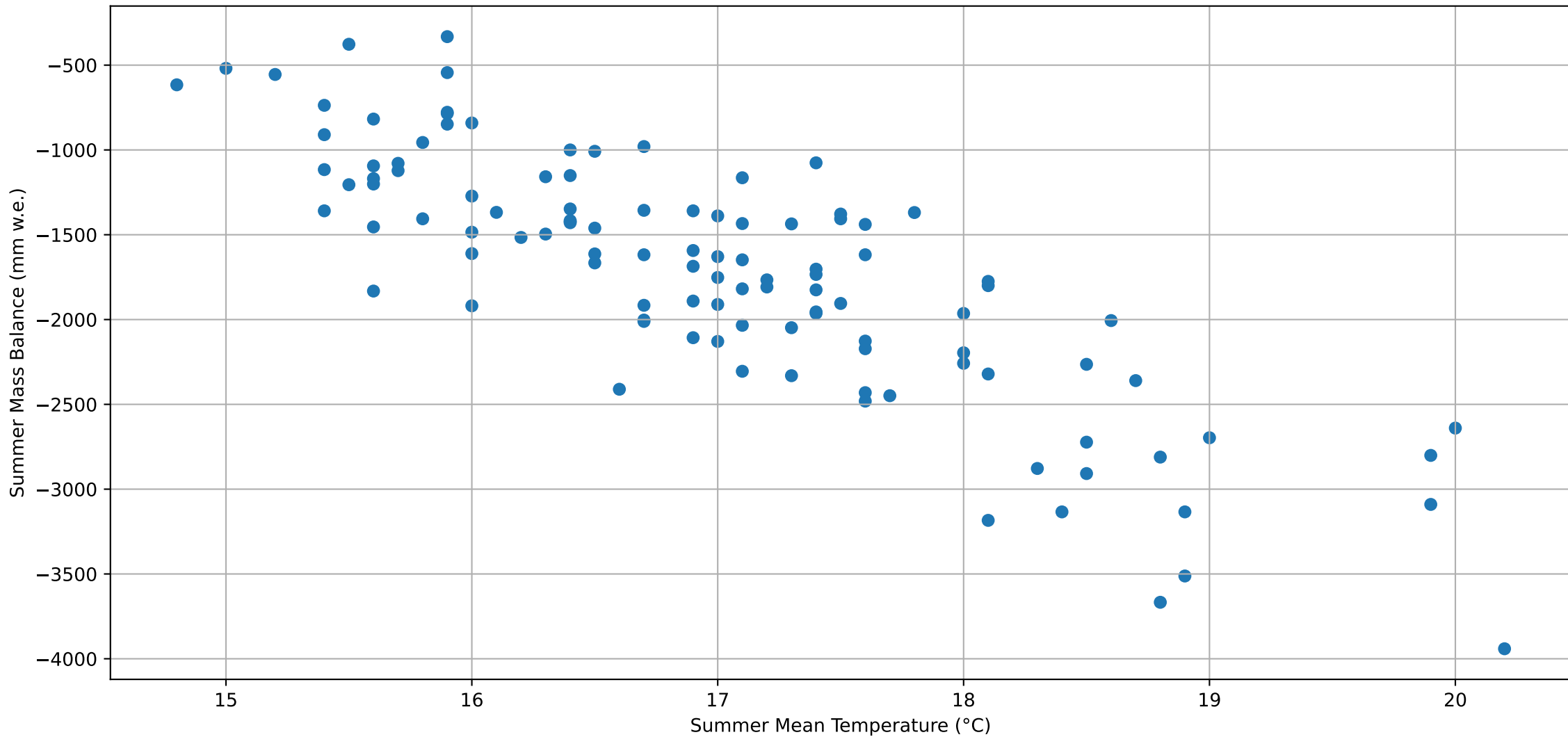
Sion Summer Mean Temperature



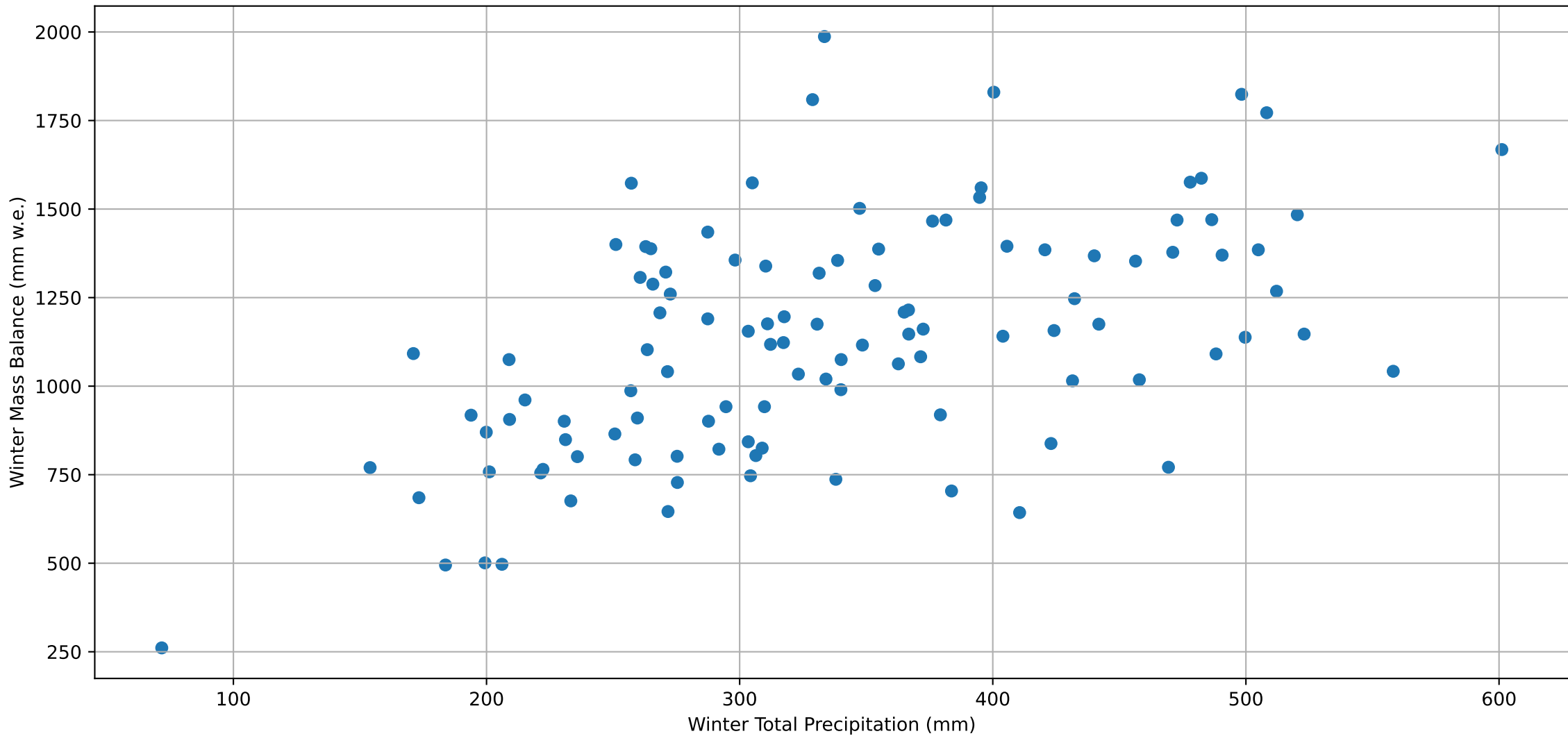
Sion Winter Total Precipitation



Grosser Aletschgletscher Summer Mass Balance with relation to Temperature



Grosser Aletschgletscher Winter Mass Balance with relation to Precipitation



Regression: Monthly 1961-1990

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MONTHLY DEVIATIONS for Grosser Aletschglletscher using 1961-1990 climate norms
=====

Correlation Analysis with Significance Testing:
Skipping constant column: const
Table with 5 columns: Variable, Correlation Coefficient, P-value, Significant (p < 0.05), and an unlabeled column. Rows include months from July to April.

Number of observations: 111

Regression Summary:

OLS Regression Results
Table with 2 columns: Label and Value. Rows include Dep. Variable, Model, Method, Date, Time, No. Observations, Df Residuals, Df Model, Covariance Type, R-squared, Adj. R-squared, F-statistic, Prob (F-statistic), Log-Likelihood, AIC, and BIC.

Table with 7 columns: Variable, coef, std err, t, P>|t|, [0.025, 0.975]. Rows include const and months from May to April.

Table with 4 columns: Statistic, Value, Statistic, Value. Rows include Omnibus, Prob(Omnibus), Skew, Kurtosis, Durbin-Watson, Jarque-Bera (JB), Prob(JB), and Cond. No.

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

Regression: Optimal 1961-1990

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OPTIMAL SEASONAL DEVIATIONS for Grosser Aletschgletscher 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	-0.798823	8.306912e-26	True
1	opt_season_pd	0.369735	6.502864e-05	True

Number of observations: 111

Regression Summary:

OLS Regression Results						
=====						
Dep. Variable:	annual mass balance (mm w.e.)			R-squared:	0.730	
Model:	OLS			Adj. R-squared:	0.725	
Method:	Least Squares			F-statistic:	146.2	
Date:	Mon, 15 Dec 2025			Prob (F-statistic):	1.85e-31	
Time:	10:29:48			Log-Likelihood:	-816.96	
No. Observations:	111			AIC:	1640.	
Df Residuals:	108			BIC:	1648.	
Df Model:	2					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

const	-279.1853	41.055	-6.800	0.000	-360.562	-197.808
opt_season_td	-465.2580	30.177	-15.417	0.000	-525.075	-405.441
opt_season_pd	2.3955	0.394	6.075	0.000	1.614	3.177
=====						
Omnibus:	0.082		Durbin-Watson:		1.808	
Prob(Omnibus):	0.960		Jarque-Bera (JB):		0.202	
Skew:	0.055		Prob(JB):		0.904	
Kurtosis:	2.823		Cond. No.		114.	
=====						

Notes:

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

Regression: Seasonal 1961-1990

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SUMMER/WINTER SEASONAL DEVIATIONS for Grosser Aletschglletscher 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 -0.789128 8.141774e-25 True
1 winter_pd 0.356799 1.211095e-04 True

Number of observations: 111

Regression Summary:

OLS Regression Results						
=====						
Dep. Variable:	annual mass balance (mm w.e.)			R-squared:	0.711	
Model:	OLS			Adj. R-squared:	0.706	
Method:	Least Squares			F-statistic:	133.2	
Date:	Mon, 15 Dec 2025			Prob (F-statistic):	7.05e-30	
Time:	10:29:48			Log-Likelihood:	-820.70	
No. Observations:	111			AIC:	1647.	
Df Residuals:	108			BIC:	1656.	
Df Model:	2					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

const	-275.4478	42.750	-6.443	0.000	-360.186	-190.710
summer_td	-493.6561	33.382	-14.788	0.000	-559.825	-427.487
winter_pd	2.1660	0.376	5.765	0.000	1.421	2.911
=====						
Omnibus:	0.638		Durbin-Watson:		1.749	
Prob(Omnibus):	0.727		Jarque-Bera (JB):		0.258	
Skew:	-0.043		Prob(JB):		0.879	
Kurtosis:	3.220		Cond. No.		128.	
=====						

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

Regression: Monthly 1991-2020

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MONTHLY DEVIATIONS for Grosser Aletschgletscher 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)
2	july_td	-0.658611	3.951726e-15	True
3	august_td	-0.601941	2.795118e-12	True
1	june_td	-0.601370	2.966760e-12	True
0	may_td	-0.476302	1.264350e-07	True
4	september_td	-0.386431	2.800089e-05	True
5	october_pd	0.257259	6.415710e-03	True
9	february_pd	0.185586	5.116320e-02	False
8	january_pd	0.171998	7.106367e-02	False
6	november_pd	0.140863	1.403069e-01	False
7	december_pd	0.106127	2.676038e-01	False
10	march_pd	0.067017	4.846355e-01	False
11	april_pd	-0.018161	8.499417e-01	False

Number of observations: 111

Regression Summary:

OLS Regression Results

Dep. Variable:	annual mass balance (mm w.e.)	R-squared:	0.760
Model:	OLS	Adj. R-squared:	0.731
Method:	Least Squares	F-statistic:	25.86
Date:	Mon, 15 Dec 2025	Prob (F-statistic):	3.55e-25
Time:	10:29:48	Log-Likelihood:	-810.49
No. Observations:	111	AIC:	1647.
Df Residuals:	98	BIC:	1682.
Df Model:	12		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	-1177.4733	51.689	-22.780	0.000	-1280.048	-1074.899
may_td	-112.0230	26.694	-4.197	0.000	-164.996	-59.050
june_td	-98.1723	25.746	-3.813	0.000	-149.264	-47.081
july_td	-140.9470	26.832	-5.253	0.000	-194.194	-87.700
august_td	-94.1784	29.398	-3.204	0.002	-152.519	-35.838
september_td	-43.2964	26.343	-1.644	0.103	-95.573	8.980
october_pd	4.1218	1.144	3.604	0.000	1.852	6.391
november_pd	2.5133	0.864	2.910	0.004	0.799	4.227
december_pd	1.9253	0.778	2.475	0.015	0.381	3.469
january_pd	3.5573	1.036	3.433	0.001	1.501	5.614
february_pd	1.2807	0.816	1.570	0.120	-0.338	2.899
march_pd	0.7875	1.203	0.654	0.514	-1.601	3.176
april_pd	-0.7447	1.477	-0.504	0.615	-3.675	2.186

Omnibus:	0.127	Durbin-Watson:	1.760
Prob(Omnibus):	0.939	Jarque-Bera (JB):	0.216
Skew:	-0.077	Prob(JB):	0.898
Kurtosis:	2.848	Cond. No.	70.6

Notes:

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

Regression: Optimal 1991-2020

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OPTIMAL SEASONAL DEVIATIONS for Grosser Aletschgletscher 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	-0.797374	1.177630e-25	True
1	opt_season_pd	0.369735	6.502864e-05	True

Number of observations: 111

Regression Summary:

OLS Regression Results

=====

Dep. Variable:	annual mass balance (mm w.e.)	R-squared:	0.727
Model:	OLS	Adj. R-squared:	0.722
Method:	Least Squares	F-statistic:	143.8
Date:	Mon, 15 Dec 2025	Prob (F-statistic):	3.55e-31
Time:	10:29:48	Log-Likelihood:	-817.63
No. Observations:	111	AIC:	1641.
Df Residuals:	108	BIC:	1649.
Df Model:	2		
Covariance Type:	nonrobust		

=====

	coef	std err	t	P> t	[0.025	0.975]
const	-1174.4716	51.607	-22.758	0.000	-1276.765	-1072.178
opt_season_td	-466.7401	30.540	-15.283	0.000	-527.276	-406.204
opt_season_pd	2.3835	0.397	6.008	0.000	1.597	3.170

=====

Omnibus:	0.086	Durbin-Watson:	1.805
Prob(Omnibus):	0.958	Jarque-Bera (JB):	0.082
Skew:	0.057	Prob(JB):	0.960
Kurtosis:	2.929	Cond. No.	144.

=====

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 Grosser Aletschglletscher 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 -0.790691 5.681560e-25 True
1 winter_pd 0.356799 1.211095e-04 True

Number of observations: 111

Regression Summary:

OLS Regression Results						
=====						
Dep. Variable:	annual mass balance (mm w.e.)			R-squared:	0.710	
Model:	OLS			Adj. R-squared:	0.705	
Method:	Least Squares			F-statistic:	132.3	
Date:	Mon, 15 Dec 2025			Prob (F-statistic):	9.16e-30	
Time:	10:29:48			Log-Likelihood:	-820.97	
No. Observations:	111			AIC:	1648.	
Df Residuals:	108			BIC:	1656.	
Df Model:	2					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

const	-1170.9339	53.040	-22.076	0.000	-1276.069	-1065.799
summer_td	-492.1145	33.399	-14.735	0.000	-558.316	-425.913
winter_pd	2.1197	0.377	5.624	0.000	1.373	2.867
=====						
Omnibus:	0.462		Durbin-Watson:		1.778	
Prob(Omnibus):	0.794		Jarque-Bera (JB):		0.137	
Skew:	-0.004		Prob(JB):		0.934	
Kurtosis:	3.172		Cond. No.		158.	
=====						

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