

Supplementary Information to

Rock glaciers across the United States predominantly accelerate coincident with rise in air temperatures

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Air temperatures at SNOTEL stations close to rock glaciers

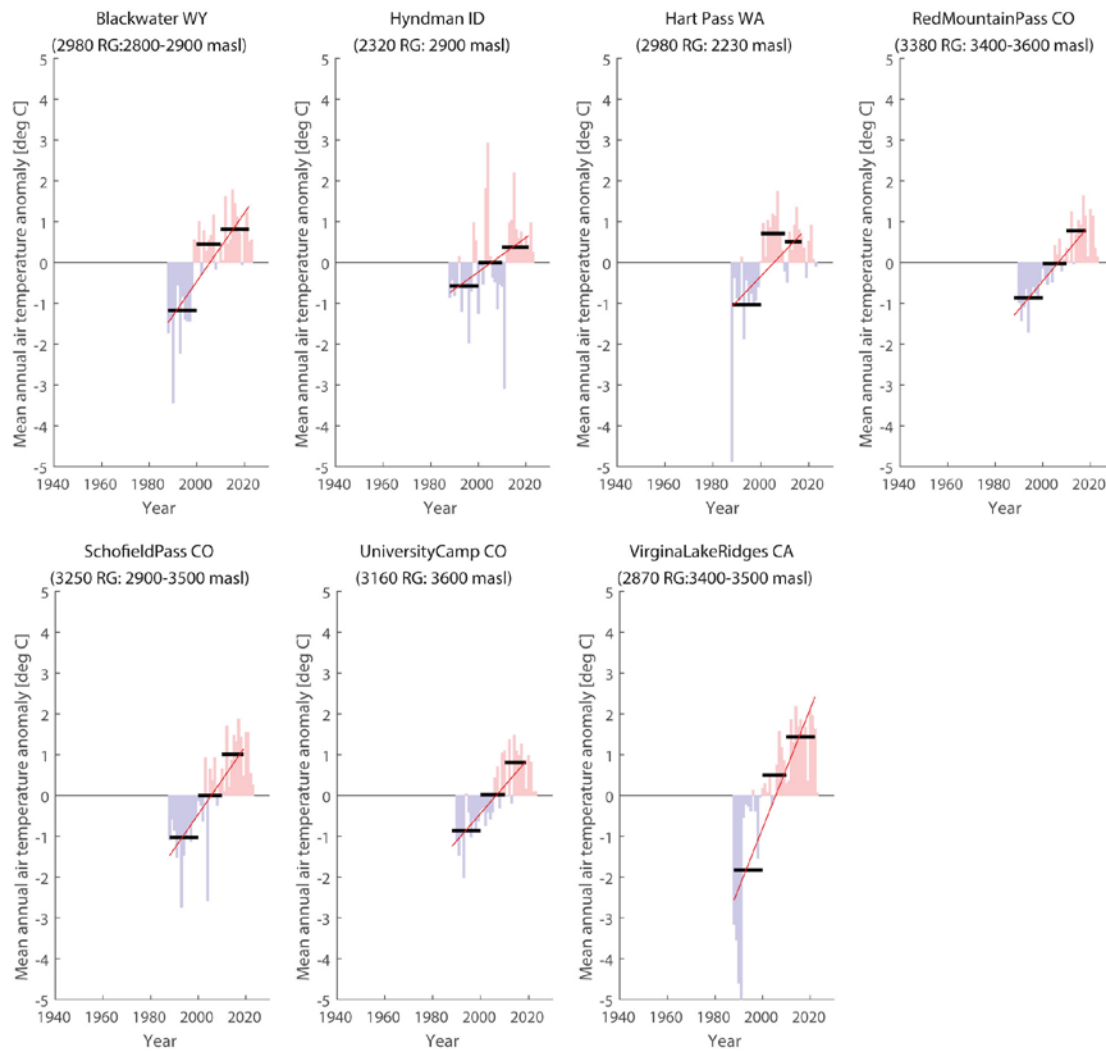


Figure S1: Annual mean air temperature anomalies at Snow Telemetry Network (SNOTEL) stations against average of entire measurement period (1988–2023), decadal means (black lines), and trend lines (red lines). The numbers below the station name are the station elevation, and the elevation range of the closest rock glacier (RG). Approximate horizontal distances between SNOTEL stations and rock glaciers: Blackwater (station) – Galena/Sulphur/Crater (rock glaciers): 30-40 km, Hyndman – Old Hyndman: 7 km, Harts Pass – Star Peak: 50 km, Red Mountain Pass – Sneffels/Teakettle/Mears/Twin Sisters: 15 km, Schofield Pass – Ferguson/Thomas: 30 km, South Lake (Fig S2) – Pine/Birch/Cardinal: 15-22 km, Virginia Lake Ridges – Pine/Birch/Cardinal: 120 km, University Camp – Arapaho: 5 km. SNOTEL data are obtained from the National Water and Climate Center (NWCC) by the Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture. WA: Washington, CA: California, ID: Idaho, WY: Wyoming, CO: Colorado.

Snow cover data

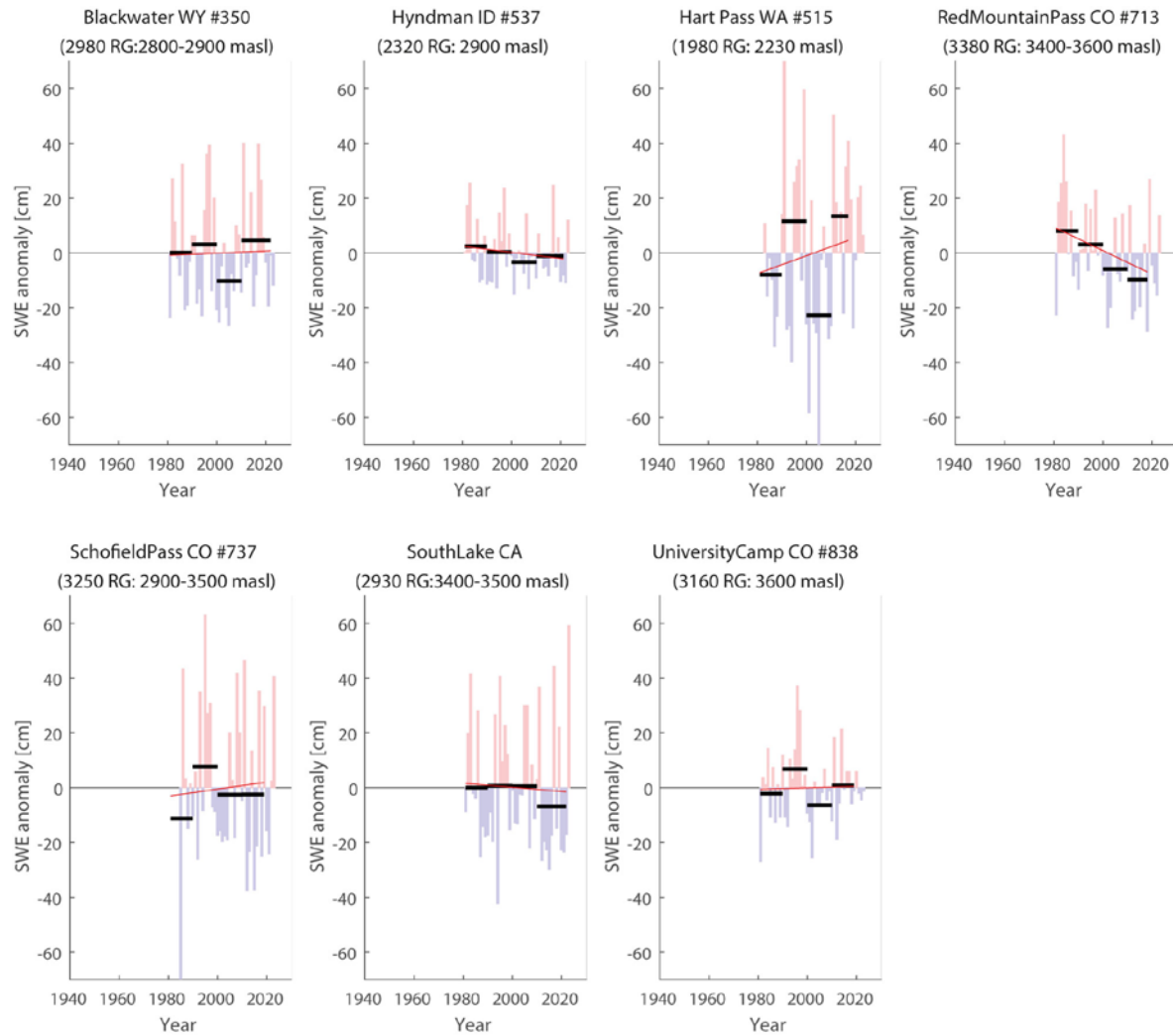


Figure S2: Maximum monthly snow water equivalent (SWE) per water year at SNOTEL stations against average of entire measurement period (1981–2023), decadal means (black lines), and trend lines (red lines). The numbers below the station name are the station elevation, and the elevation (range) of the closest rock glacier (RG). For horizontal distances to rock glaciers and data source see caption of Fig. S1.

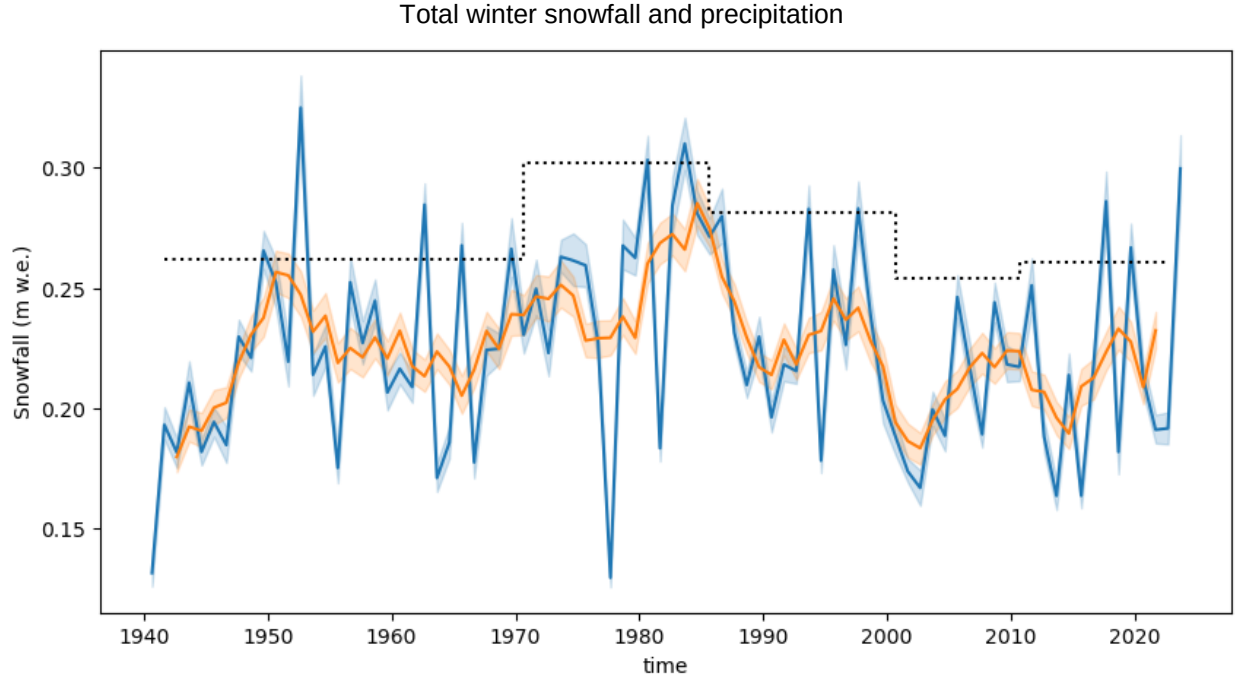


Figure S3: European Centre for Medium-Range Weather Forecasts Reanalysis (ERA) 5 total winter (Oct-Mar) snowfall above 2000m for the Western U.S. (blue) with error band from all cells above 2000m. 5-year rolling mean (orange) with error band from all cells above 2000m. Binned temporal average is of winter precipitation (not only snowfall; dotted black). ERA5 data from Hersbach et al. (2023) (see reference list of main article).

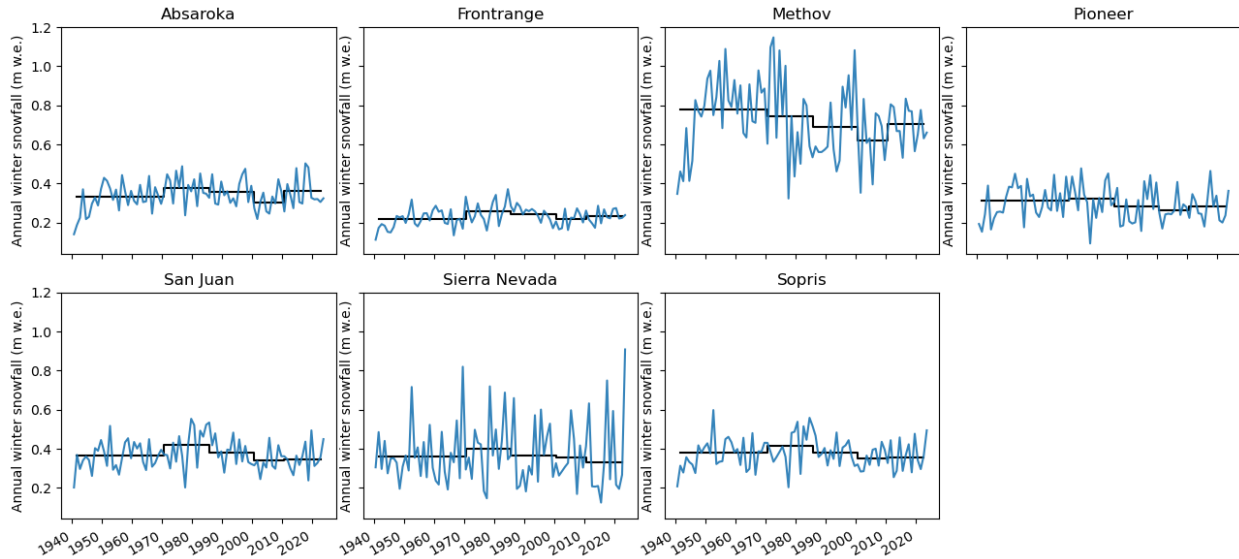


Figure S4: Total winter snowfall for closest ERA5-cell to given mountain range location (blue). Binned temporal average of winter snowfall (black). ERA5 data from Hersbach et al. (2023) (see reference list of main article).

Air temperatures and precipitation from the PRISM data set

Anomalies of mean annual air temperatures

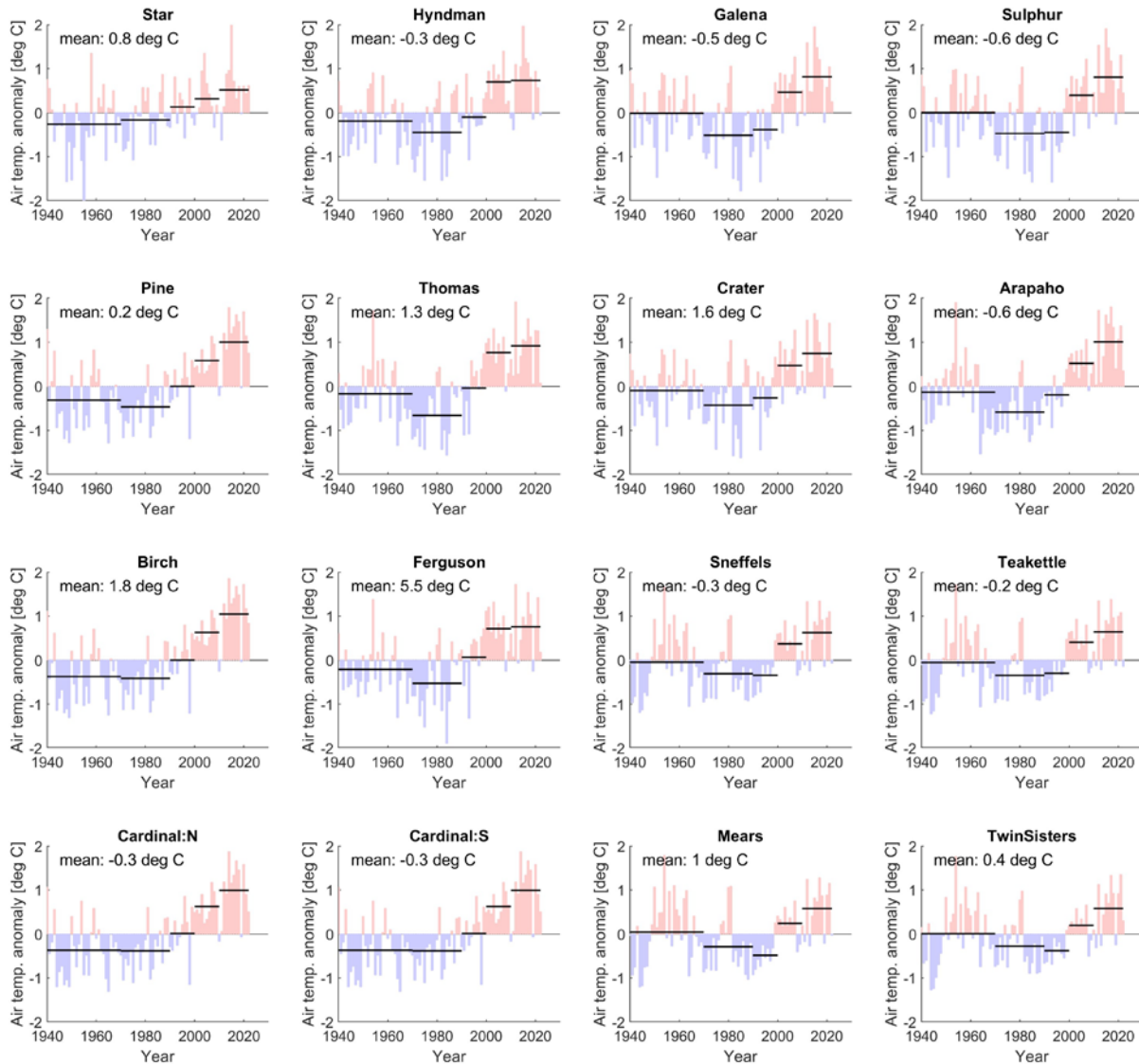


Figure S5: Anomalies of mean annual air temperatures and their decadal-scale means (black lines; 1940-1970, 1970-1990, 1990-2000, 2000-2010, 2010-2022) interpolated at rock glacier locations from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) data set (PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu>, accessed 6 Jun 2024). Mean temperatures are means of PRISM monthly means. N: North, S: South.

Anomalies of mean May-Oct air temperatures

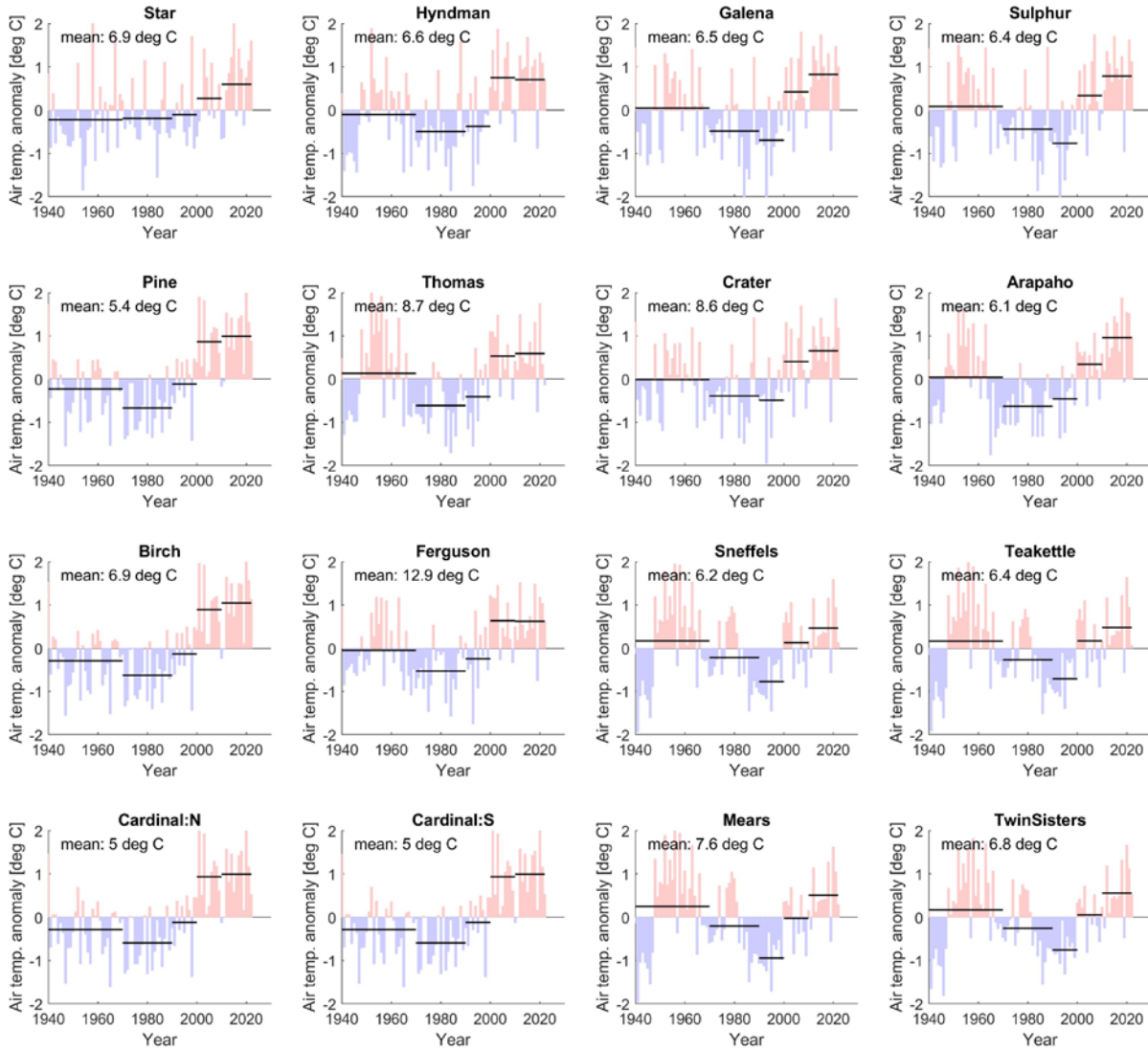


Figure S6: Anomalies of mean May-Oct air temperatures and their decadal means (black lines; 1940-1970, 1970-1990, 1990-2000, 2000-2010, 2010-2022) interpolated at rock glacier locations from the PRISM data set (PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu>). Mean temperatures are means of PRISM monthly means.

Anomalies of mean Nov-Apr air temperatures

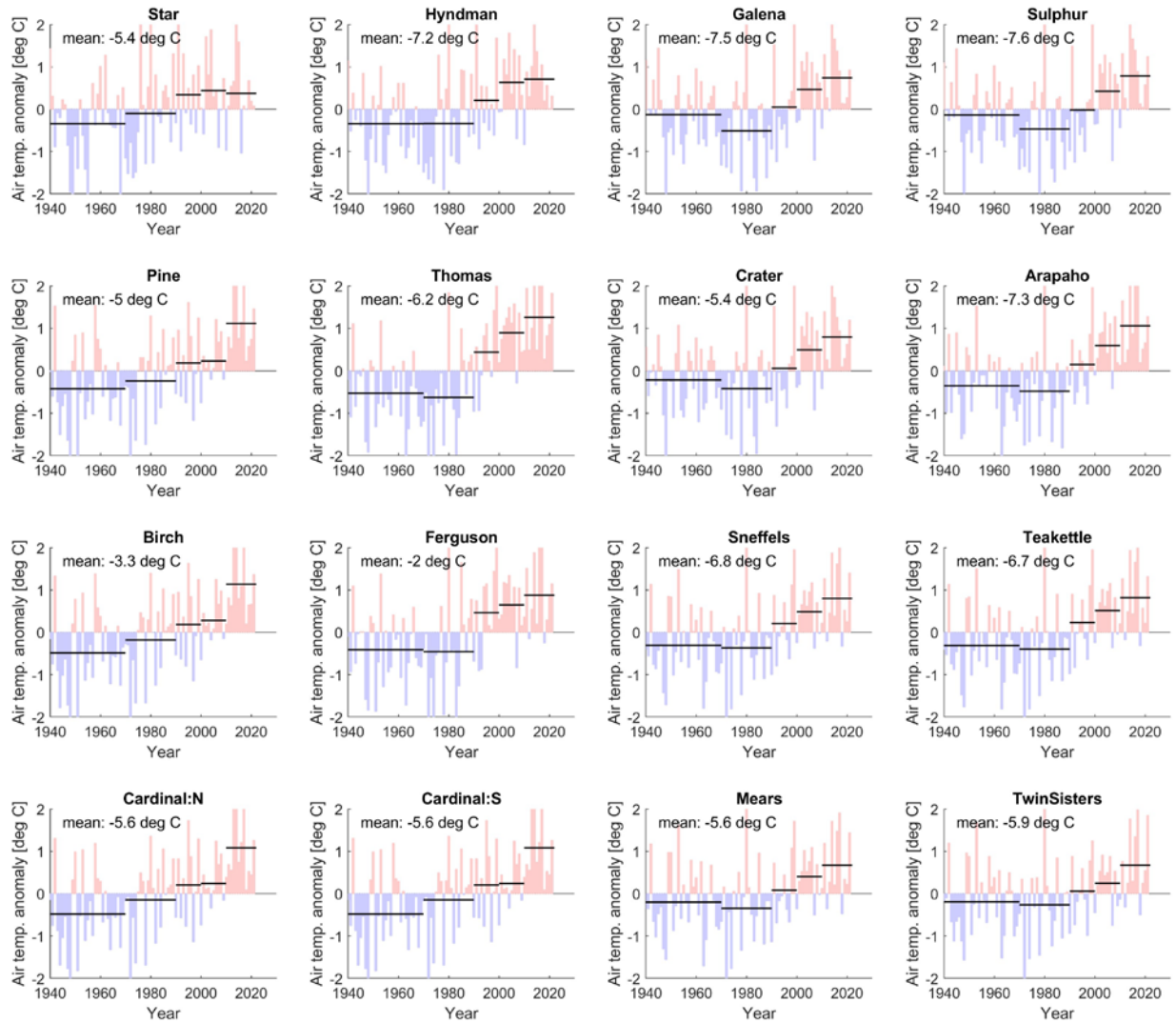


Figure S7: Anomalies of mean Nov-Apr air temperatures and their decadal means (black lines; 1940-1970, 1970-1990, 1990-2000, 2000-2010, 2010-2022) interpolated at rock glacier locations from the PRISM data set (PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu>). Mean temperatures are means of PRISM monthly means.

Anomalies of total annual precipitation

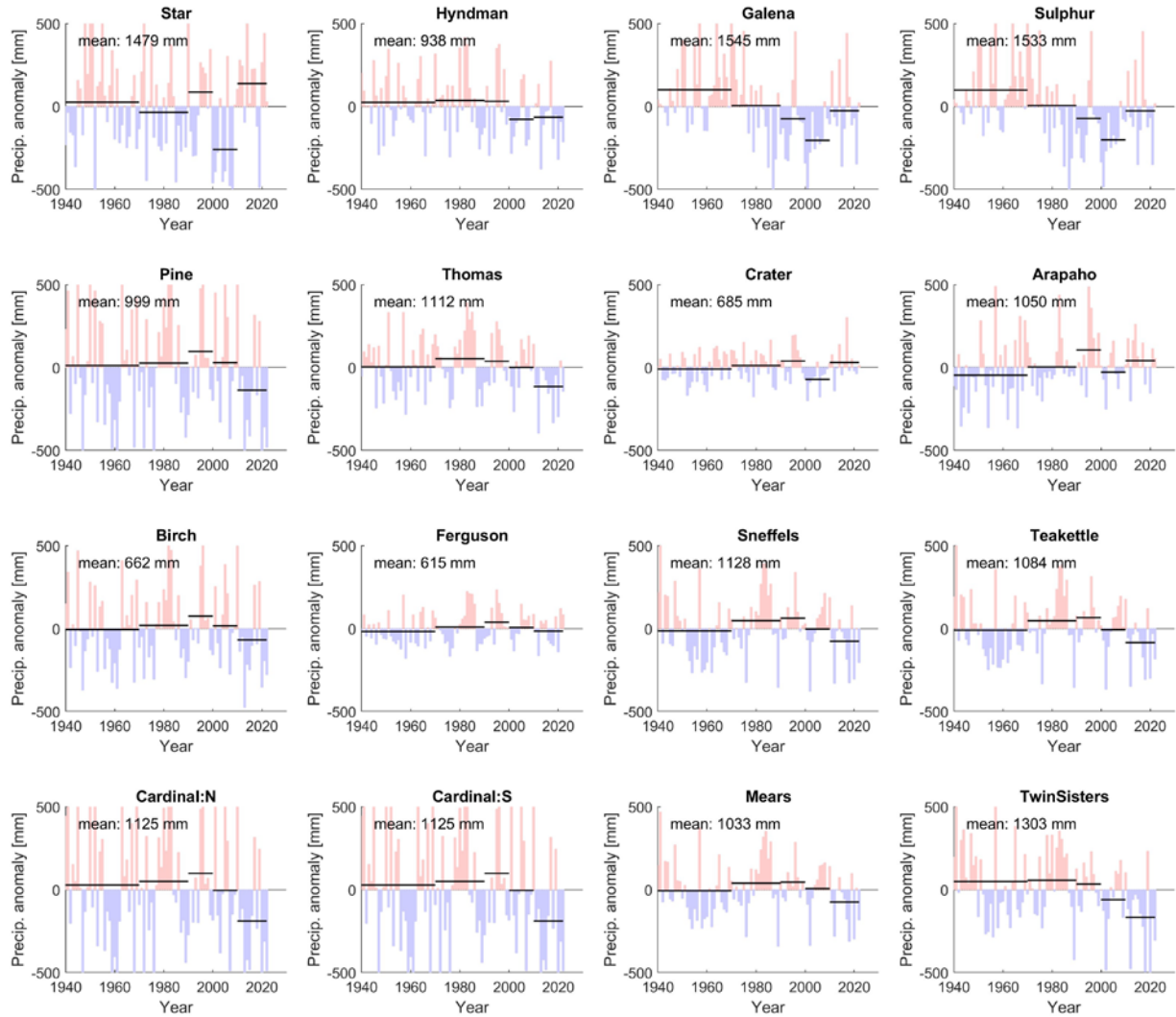


Figure S8: Anomalies of total annual precipitation and their decadal means (black lines; 1940-1970, 1970-1990, 1990-2000, 2000-2010, 2010-2022) interpolated at rock glacier locations from the PRISM data set (PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu>). Total precipitations are the sum of PRISM monthly means.

Anomalies of total May-Oct precipitation

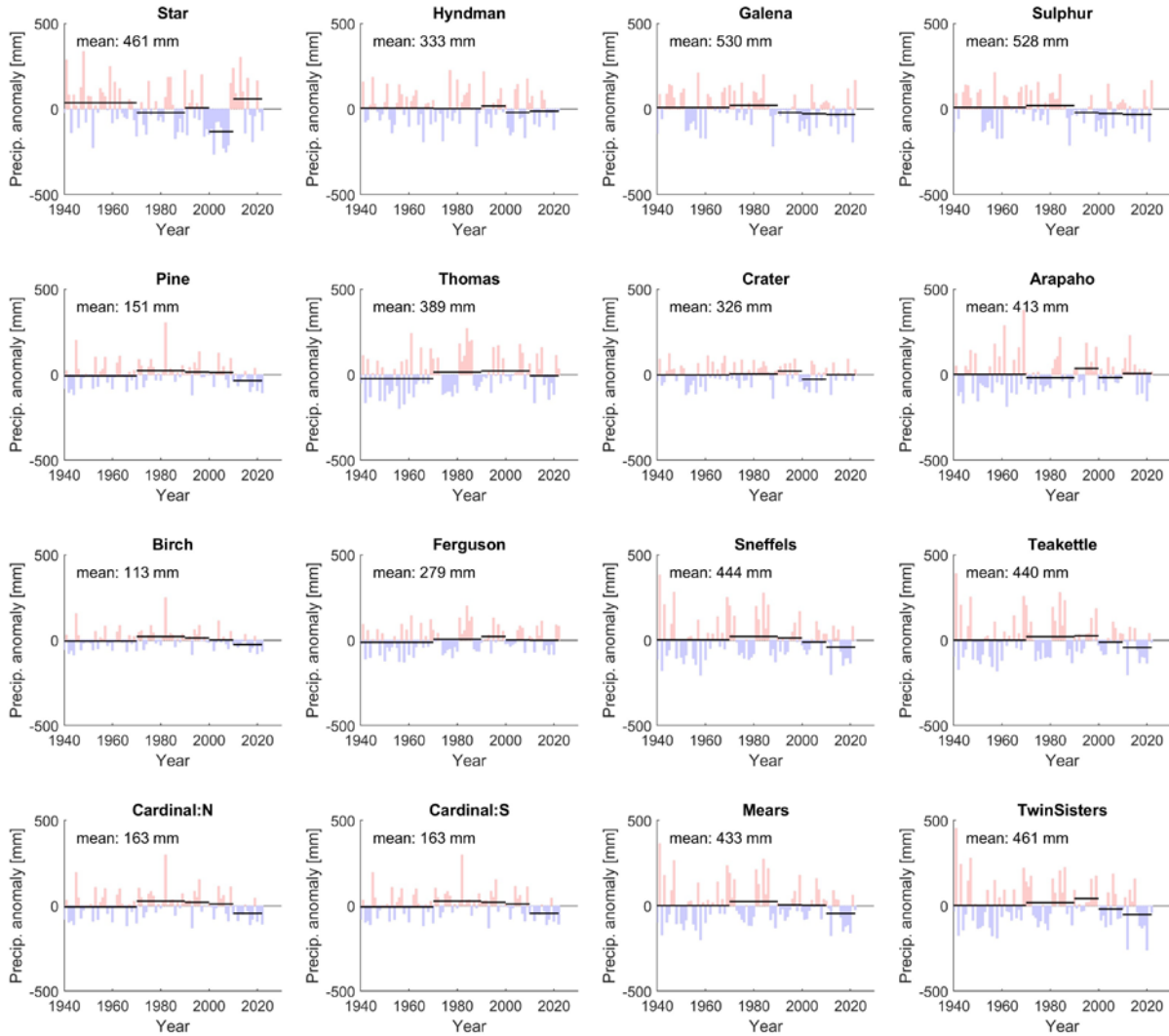


Figure S9: Anomalies of total May-Oct precipitation and their decadal means (black lines; 1940-1970, 1970-1990, 1990-2000, 2000-2010, 2010-2022) interpolated at rock glacier locations from the PRISM data set (PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu>). Total precipitations are the sum of PRISM monthly means.

Anomalies of total Nov-Apr precipitation

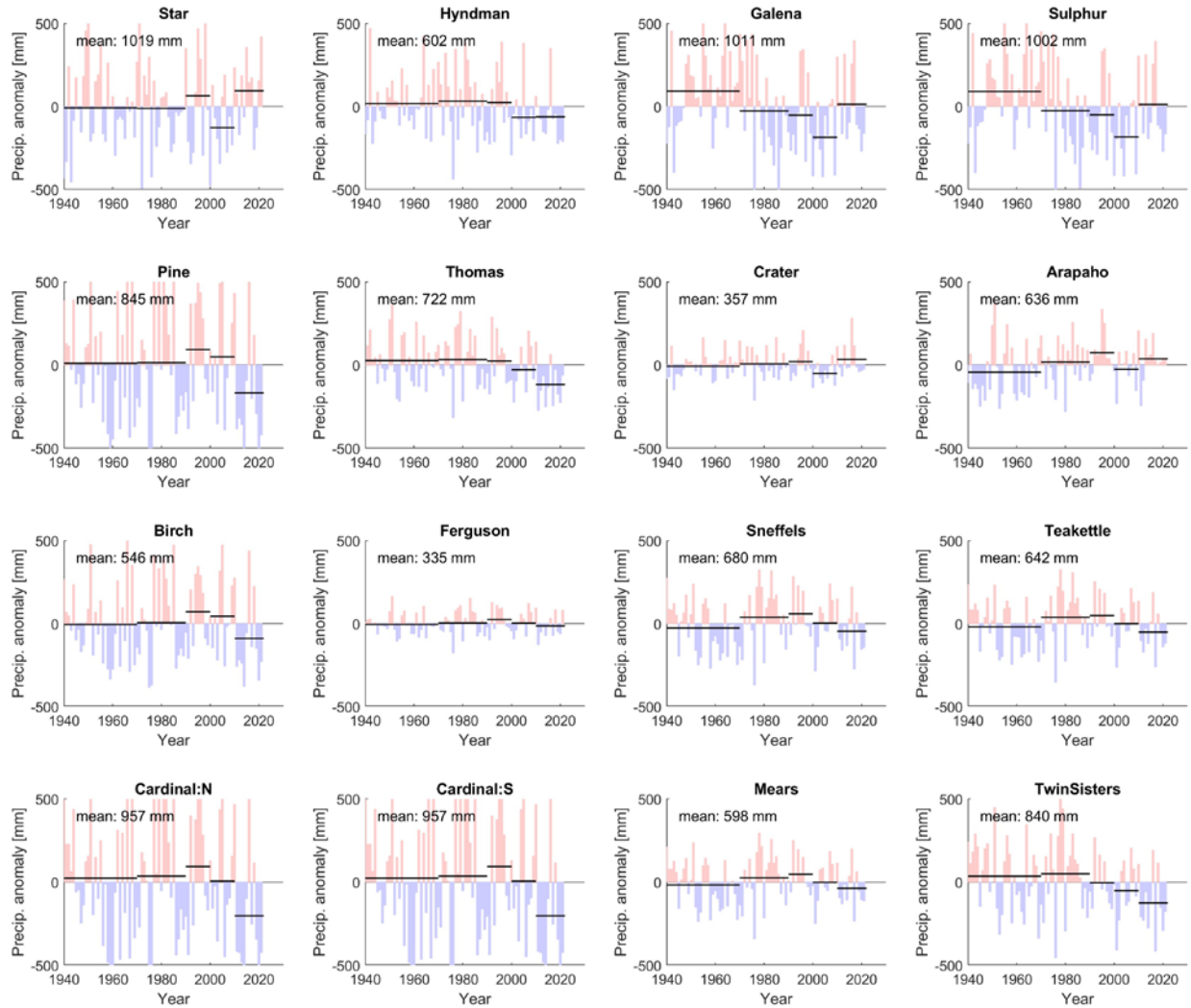


Figure S10: Anomalies of total Nov-Apr precipitation and their decadal means (black lines; 1940-1970, 1970-1990, 1990-2000, 2000-2010, 2010-2022) interpolated at rock glacier locations from the PRISM data set (PRISM Climate Group, Oregon State University, <https://prism.oregonstate.edu>). Total precipitations are the sum of PRISM monthly means.

Comparison between rock glaciers speeds and meteorological data

Rock glacier speeds and anomalies of mean annual air temperature

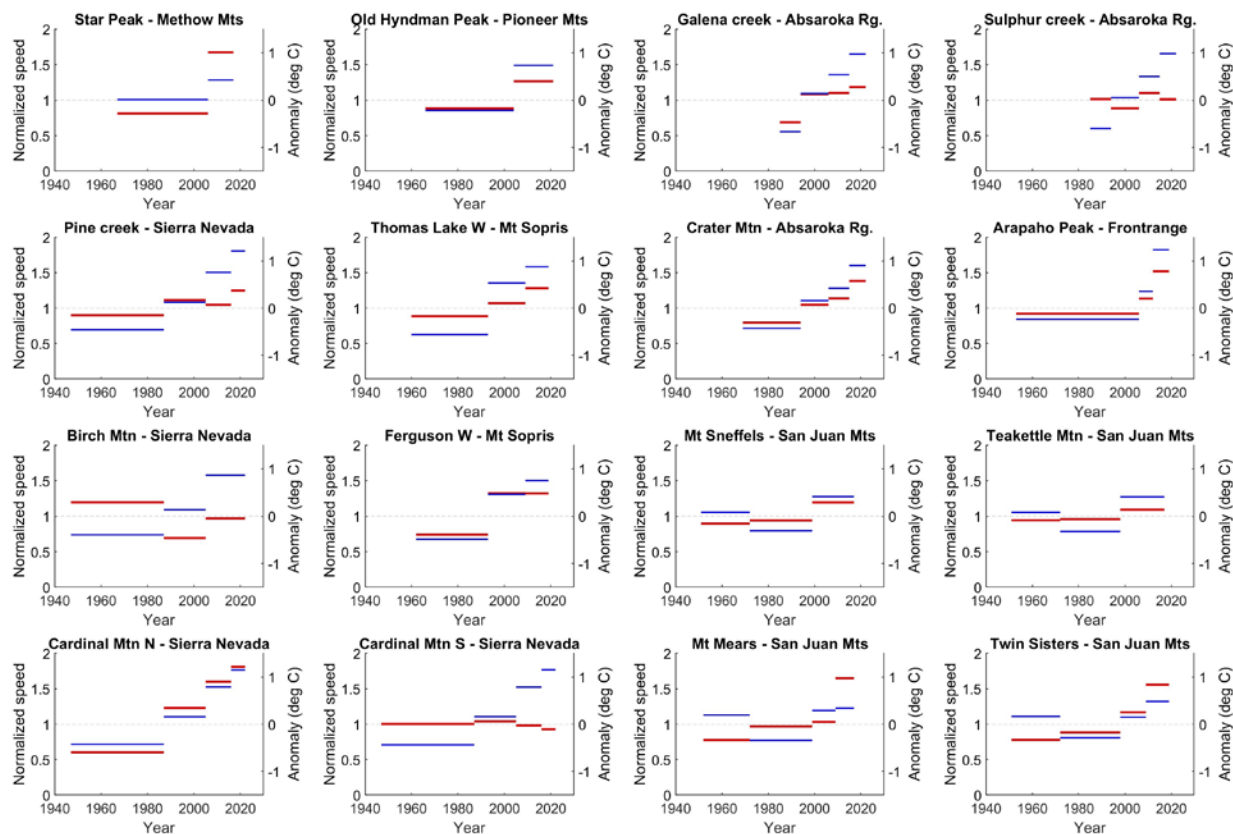


Figure S11: Rock glacier speed changes (red) and anomalies of mean annual air temperatures for the intervals of the speed measurements (blue). Rock glacier speeds are the same as in Fig.2, the air temperature anomaly means are computed for different intervals than in Fig. S5.

Rock glacier speeds and anomalies of mean May-Oct air temperature

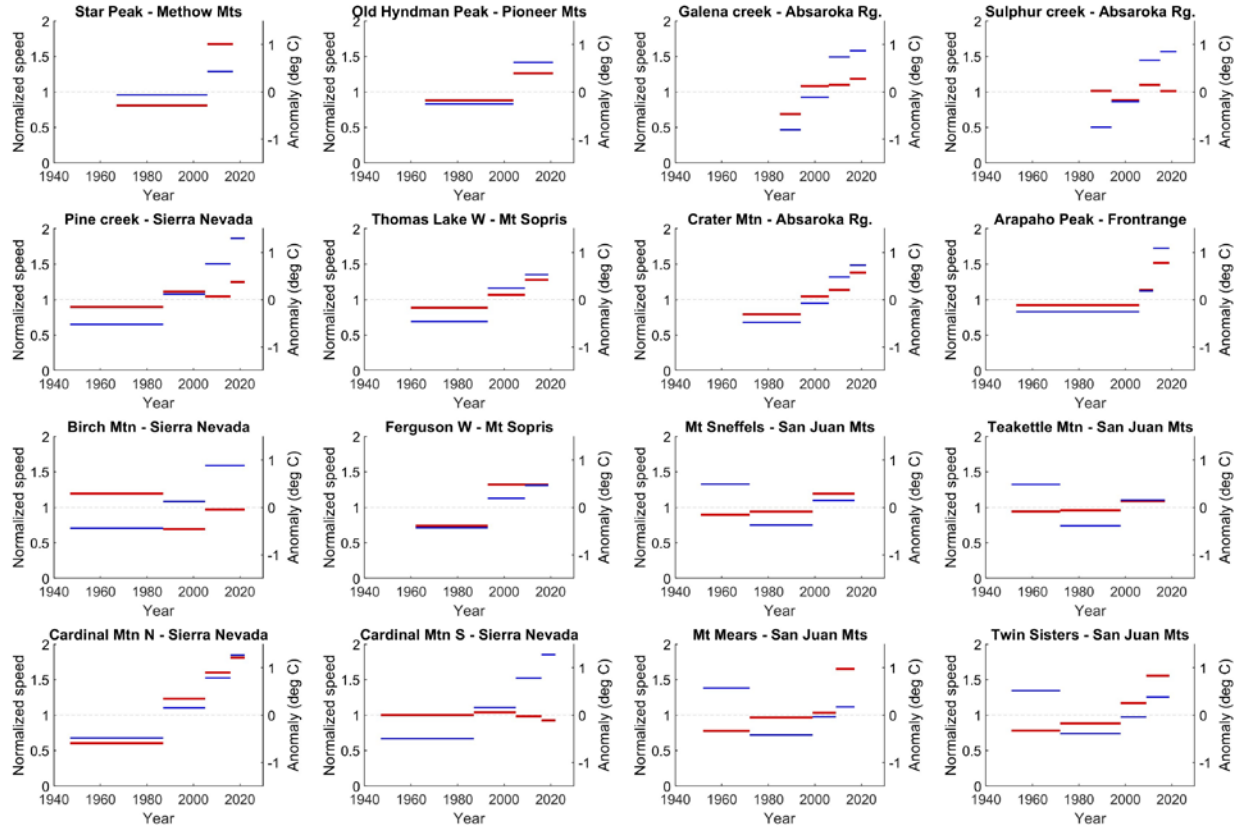


Figure S12: Rock glacier speed changes (red) and anomalies of mean May-Oct air temperatures for the intervals of the speed measurements (blue). Rock glacier speeds are the same as in Fig.2, air temperature anomaly means computed for different intervals than in Fig. S6.

Rock glacier speeds and anomalies of mean Nov-Apr air temperature

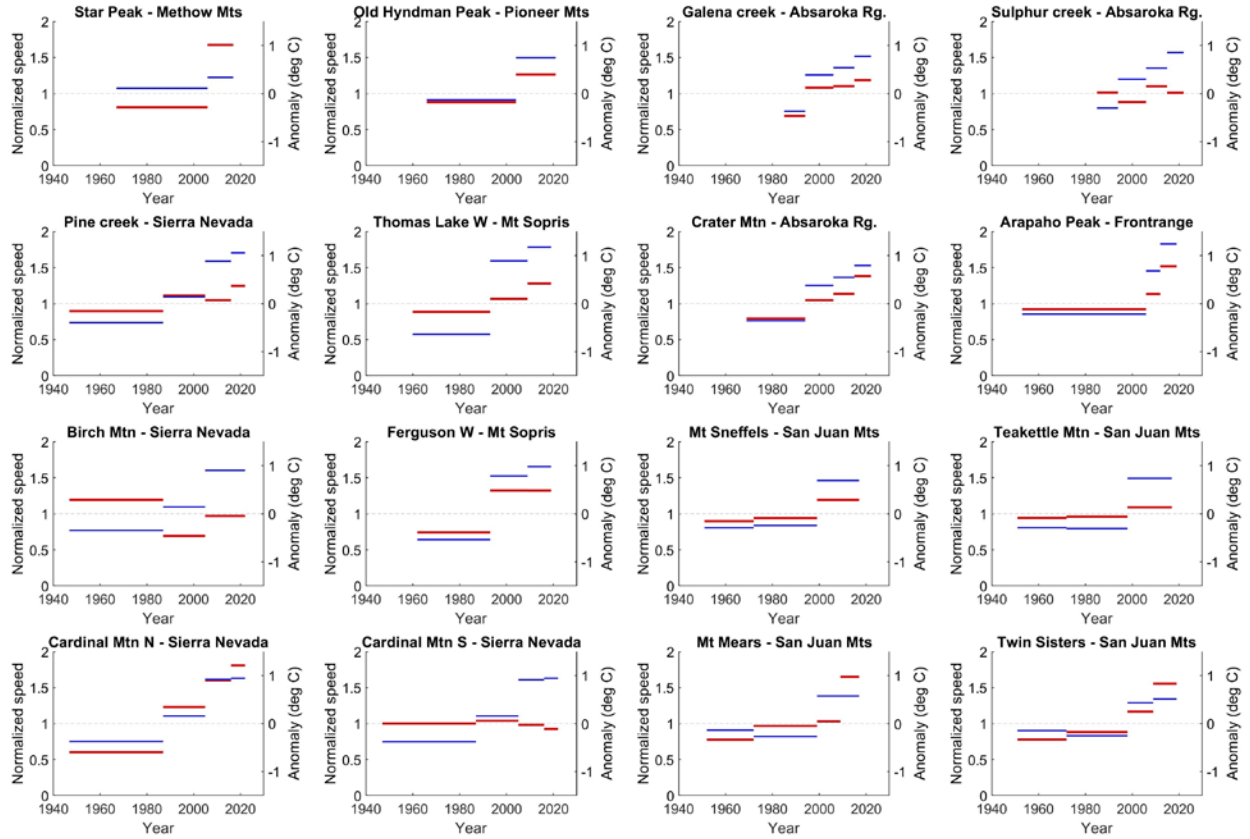


Figure S13: Rock glacier speed changes (red) and anomalies of mean Nov-Apr air temperatures for the intervals of the speed measurements (blue). Rock glacier speeds are the same as in Fig.2, air temperature anomaly means computed for different intervals than in Fig. S7.

Rock glacier speeds and anomalies of total annual precipitation

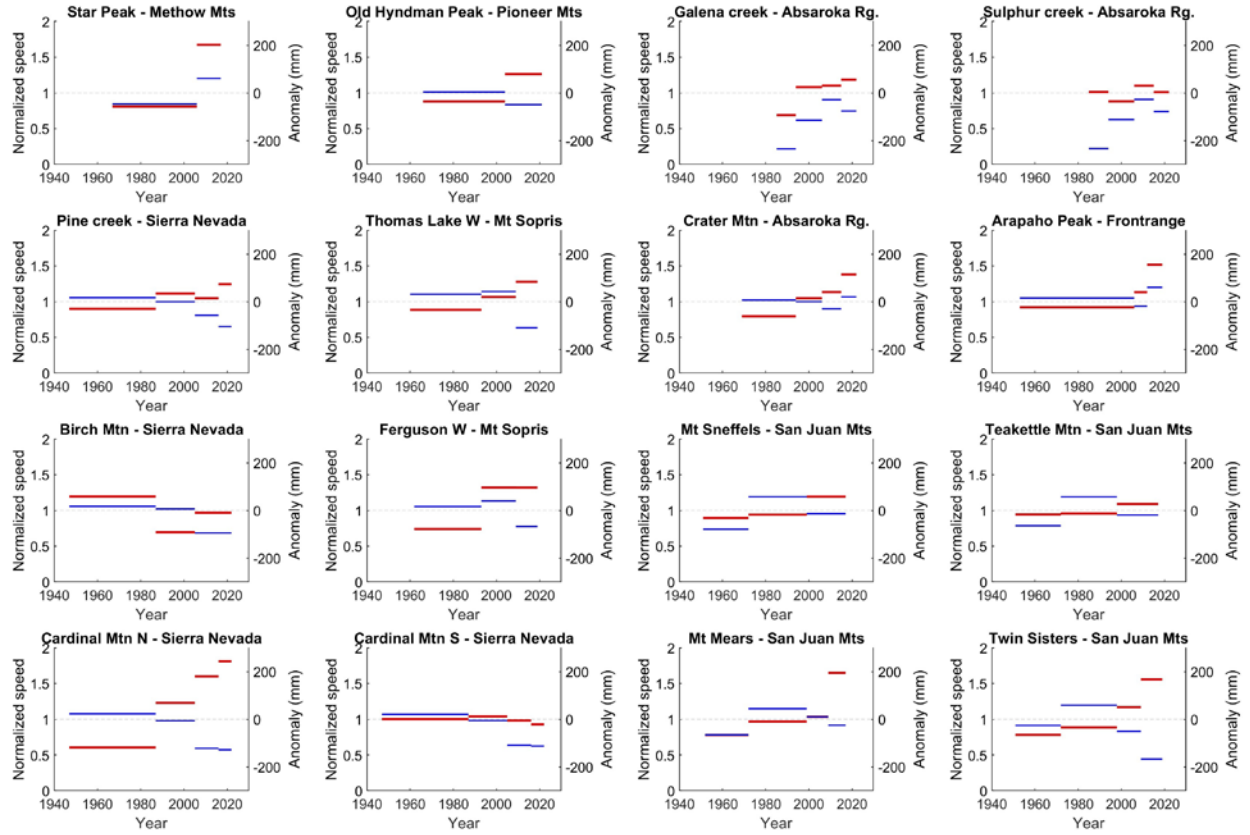


Figure S14: Rock glacier speed changes (red) and anomalies of total annual precipitation for the intervals of the speed measurements (blue). Rock glacier speeds are the same as in Fig.2, air temperature anomaly means computed for different intervals than in Fig. S8.

Rock glacier speeds and anomalies of total May-Oct precipitation

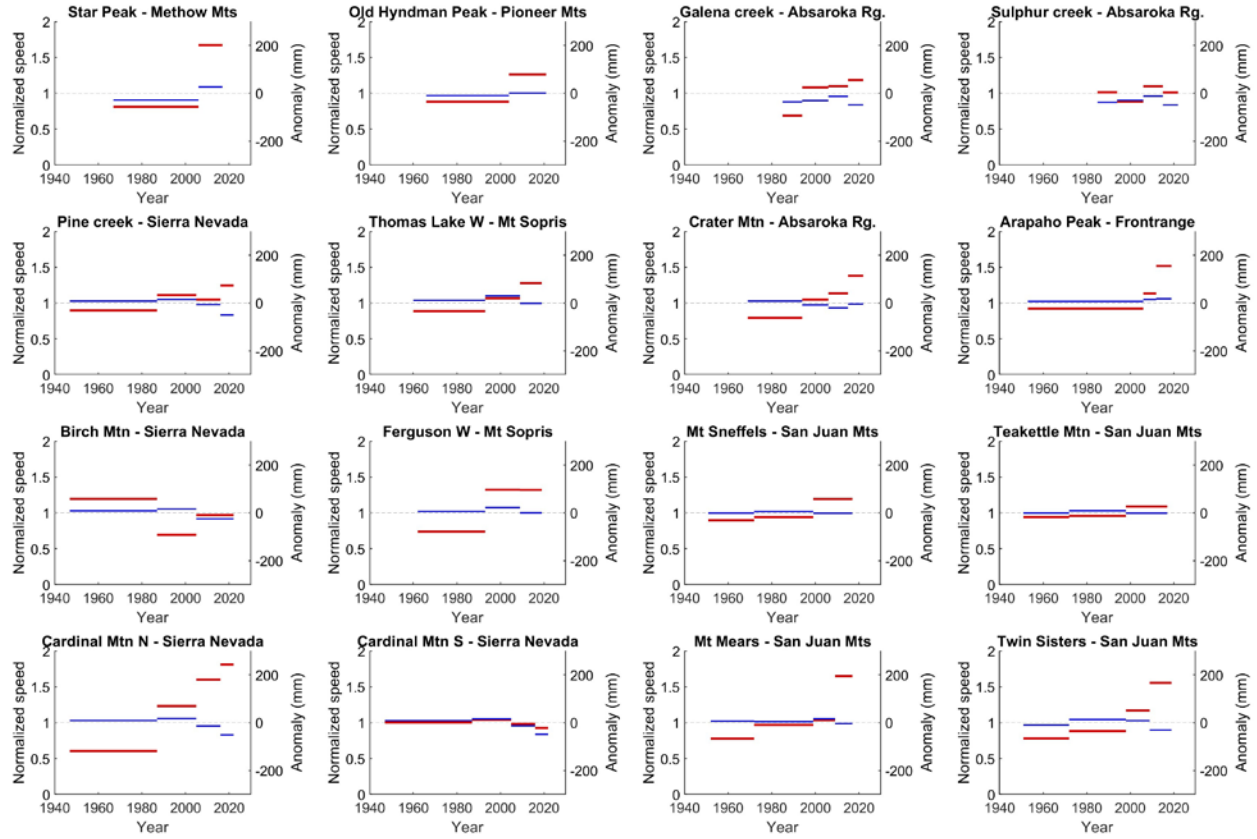


Figure S15: Rock glacier speed changes (red) and anomalies of total May-Oct precipitation for the intervals of the speed measurements (blue). Rock glacier speeds are the same as in Fig.2, air temperature anomaly means computed for different intervals than in Fig. S9.

Rock glacier speeds and anomalies of total Nov-Apr precipitation

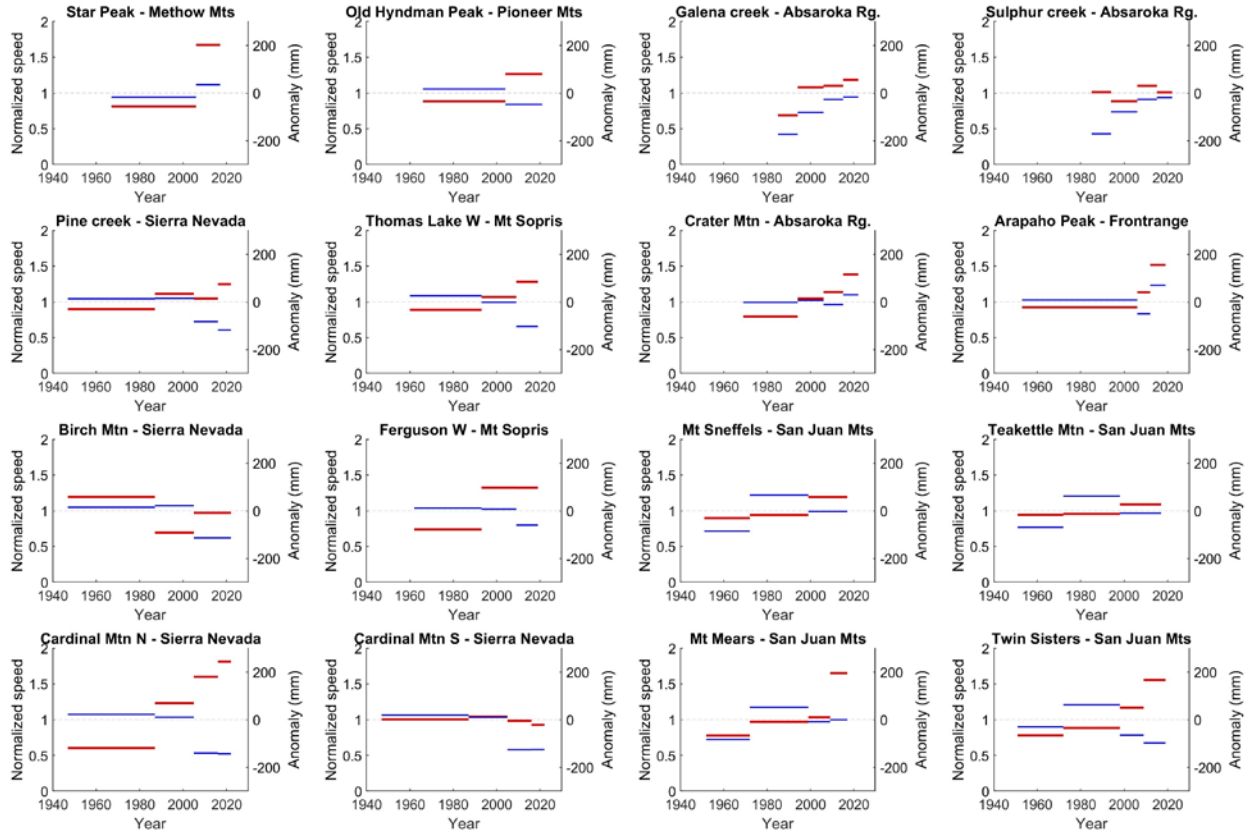


Figure S16: Rock glacier speed changes (red) and anomalies of total Nov-Oct precipitation for the intervals of the speed measurements (blue). Rock glacier speeds are the same as in Fig.2, air temperature anomaly means computed for different intervals than in Fig. S9.

Speed time series

Table S1: Median and normalized median speeds per time interval for all rock glaciers, and notches, as shown in Fig. 2. Mtn: Mountain, Mts: Mountains, Mt: Mount, N: North, S: South, W: West, Rg: Range.

Star Peak - Methow Mts					
Years	1967	2006	2017		
Med. speed (m/yr)	0,07	0,12			
Norm. med speed	0,81	1,67			
Notch	0,023	0,081			
Old Hyndman Peak - Pioneer Mts					
Years	1966	2004	2021		
Med. speed (m/yr)	0,21	0,28			
Norm. med speed	0,88	1,26			
Notch	0,033	0,073			
Galena creek - Absaroka Rg.					
Years	1985	1994	2006	2015	2022
Med. speed (m/yr)	0,33	0,53	0,55	0,61	
Norm. med speed	0,69	1,08	1,10	1,18	
Notch	0,090	0,099	0,080	0,068	
Sulphur creek - Absaroka Rg.					
Years	1985	1994	2006	2015	2022
Med. speed (m/yr)	0,42	0,38	0,49	0,33	
Norm. med speed	1,01	0,88	1,10	1,01	
Notch	0,105	0,049	0,089	0,106	
Crater Mtn - Absaroka Rg.					
Years	1969	1994	2006	2015	2022
Med. speed (m/yr)	0,35	0,46	0,50	0,57	
Norm. med speed	0,79	1,05	1,14	1,38	
Notch	0,013	0,028	0,02	0,031	
Arapaho Peak - Frontrange					
Years	1953	2006	2012	2019	
Med. speed (m/yr)	0,11	0,14	0,19		
Norm. med speed	0,92	1,13	1,52		
Notch	0,015	0,073	0,088		
Thomas Lake W - Mt Sopris					
Years	1960	1993	2009	2019	
Med. speed (m/yr)	0,56	0,62	0,83		
Norm. med speed	0,89	1,07	1,28		
Notch	0,011	0,03	0,05		
Ferguson ranch W - Mt Sopris					
Years	1962	1993	2009	2019	
Med. speed (m/yr)	0,52	0,89	0,97		
Norm. med speed	0,74	1,32	1,32		
Notch	0,077	0,107	0,088		
Mt Mears - San Juan Mts					
Years	1952	1972	1999	2009	2017
Med. speed (m/yr)	0,52	0,64	0,62	1,02	
Norm. med speed	0,78	0,97	1,03	1,65	
Notch	0,037	0,038	0,084	0,172	

Tab. S1 cont

Mt Sneffels - San Juan Mts					
Years	1951	1972	1999	2017	
Med. speed (m/yr)	0,43	0,42	0,59		
Norm. med speed	0,90	0,94	1,19		
Notch	0,025	0,014	0,029		
Teakettle Mtn - San Juan Mts					
Years	1951	1972	1998	2017	
Med. speed (m/yr)	0,21	0,20	0,23		
Norm. med speed	0,94	0,96	1,09		
Notch	0,017	0,013	0,015		
Twin Sisters - San Juan Mts					
Years	1951	1972	1998	2009	2019
Med. speed (m/yr)	0,37	0,43	0,59	0,77	
Norm. med speed	0,78	0,88	1,17	1,56	
Notch	0,056	0,026	0,033	0,094	
Pine creek - Sierra Nevada					
Years	1947	1987	2005	2016	2022
Med. speed (m/yr)	0,35	0,42	0,39	0,46	
Norm. med speed	0,90	1,11	1,05	1,25	
Notch	0,011	0,015	0,033	0,026	
Birch Mtn - Sierra Nevada					
Years	1947	1987	2005	2022	
Med. speed (m/yr)	0,44	0,24	0,35		
Norm. med speed	1,19	0,69	0,97		
Notch	0,035	0,045	0,080		
Cardinal Mtn N - Sierra Nevada					
Years	1947	1987	2005	2016	2022
Med. speed (m/yr)	0,35	0,74	0,85	0,82	
Norm. med speed	0,60	1,23	1,60	1,81	
Notch	0,027	0,017	0,038	0,082	
Cardinal Mtn S - Sierra Nevada					
Years	1947	1987	2005	2016	2022
Med. speed (m/yr)	0,61	0,61	0,59	0,53	
Norm. med speed	1,00	1,04	0,98	0,93	
Notch	0,015	0,017	0,036	0,039	

Information sheets for all rock glaciers

In the following, information sheets for all rock glaciers investigated are presented. The orthophoto maps are based on the U.S. Geological Survey / U.S. Department of Agriculture National Agricultural Imagery Program (USGS/USDA NAIP). White or black points indicate the measurement locations that were used to construct the speed time series. Topographic and climatic data are extracted from the rock glacier inventory by Johnson et al. (2021). Mean annual ground temperature is interpolated from the northern hemisphere permafrost model by Obu et al. (2019). The climate data in Johnsen et al. (2021) and the permafrost data by Obu et al. (2019) are both based on regional-scale data of 1 km spatial resolution and are thus *not* expected to precisely represent specific climatic and ground thermal conditions at individual rock glaciers. (For references see reference list in main text).

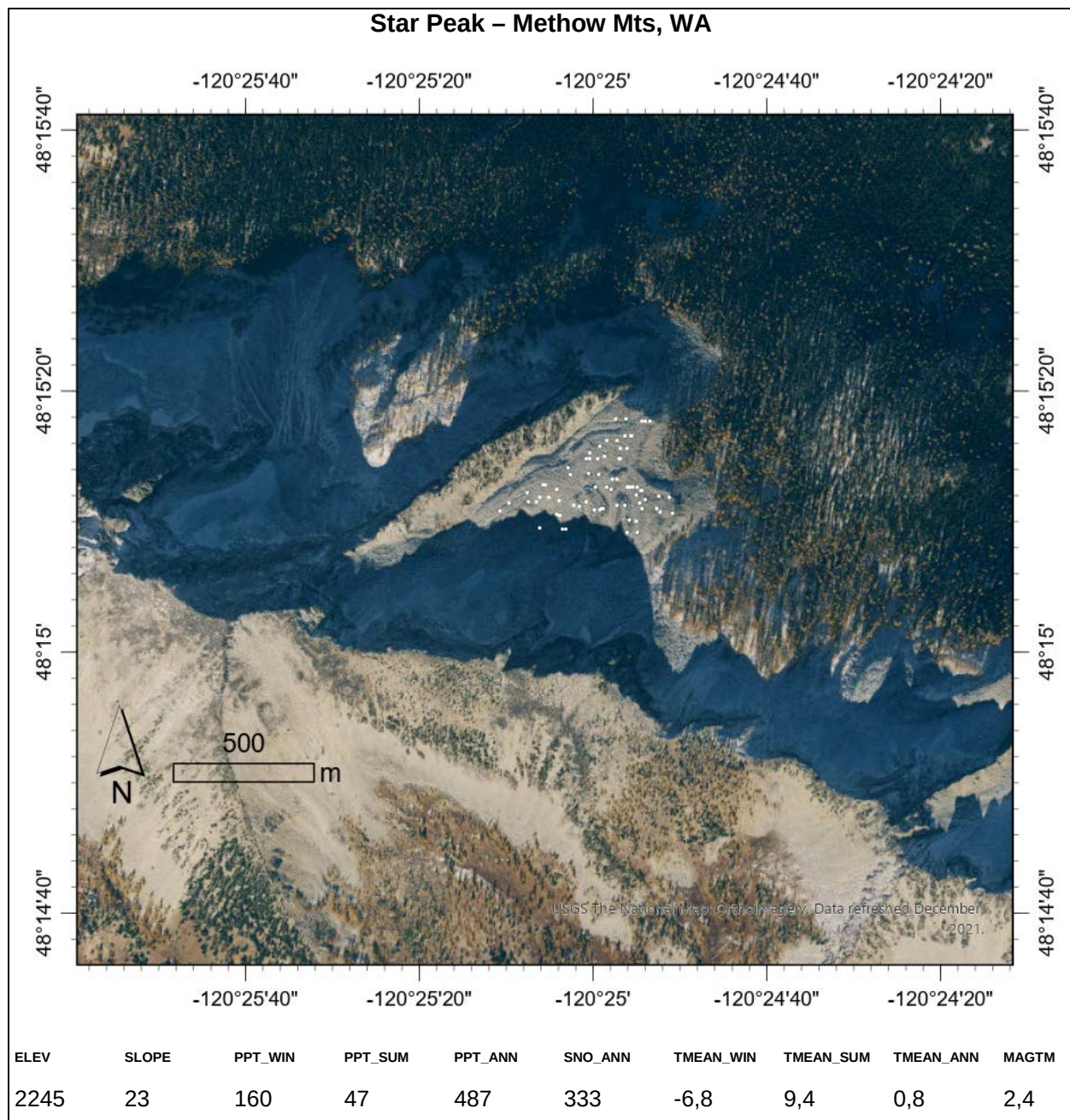


Figure S17: Star Peak – Methow Mts, WA. White points indicate the measurement locations that are compiled to the speed time series. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

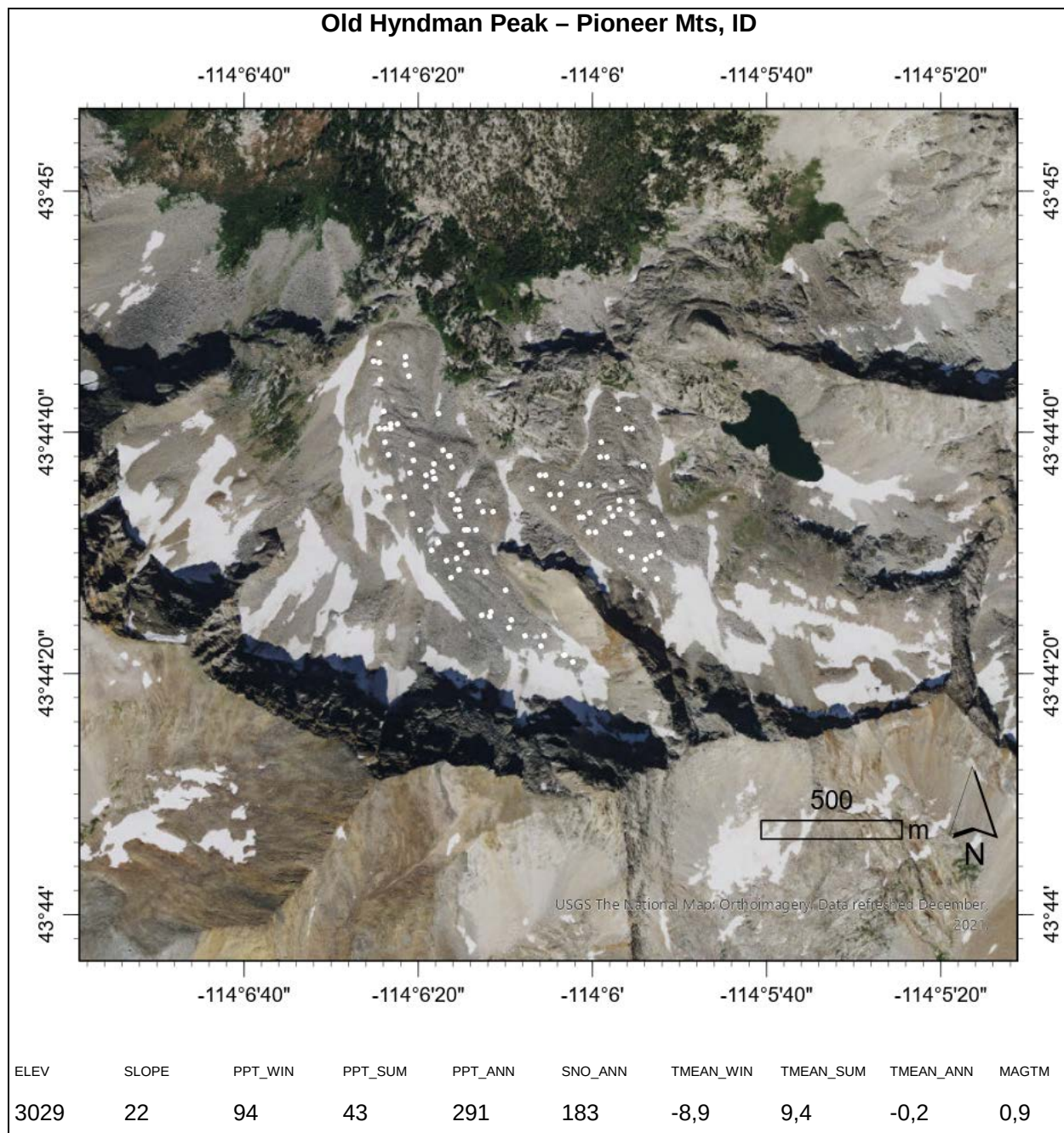


Figure S18: Old Hyndman Peak – Pioneer Mts, ID. White points indicate the measurement locations that are compiled to the speed time series. Points on both rock glaciers are included as they show similar behaviour. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

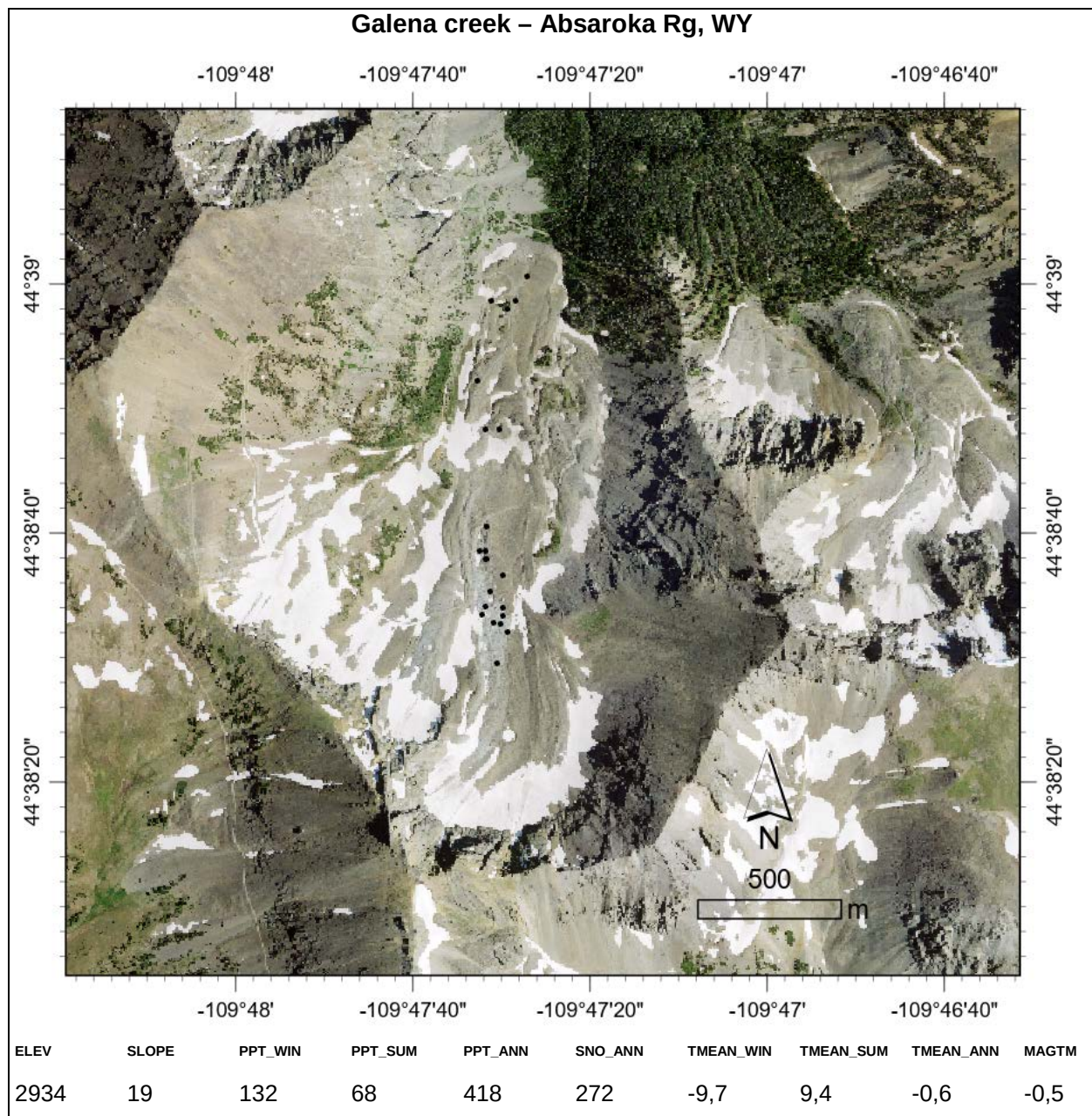


Figure S19: Galena Creek – Absaroka Range, WY. Black points indicate the measurement locations that are compiled to the speed time series. Over large parts of the rock glacier surface debris is too fine to represent features that can be tracked in all airphotos. There is a rich body of research about Galena creek rock glacier (and also Sulphur rock glacier; see reference list of main text and references therein). Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

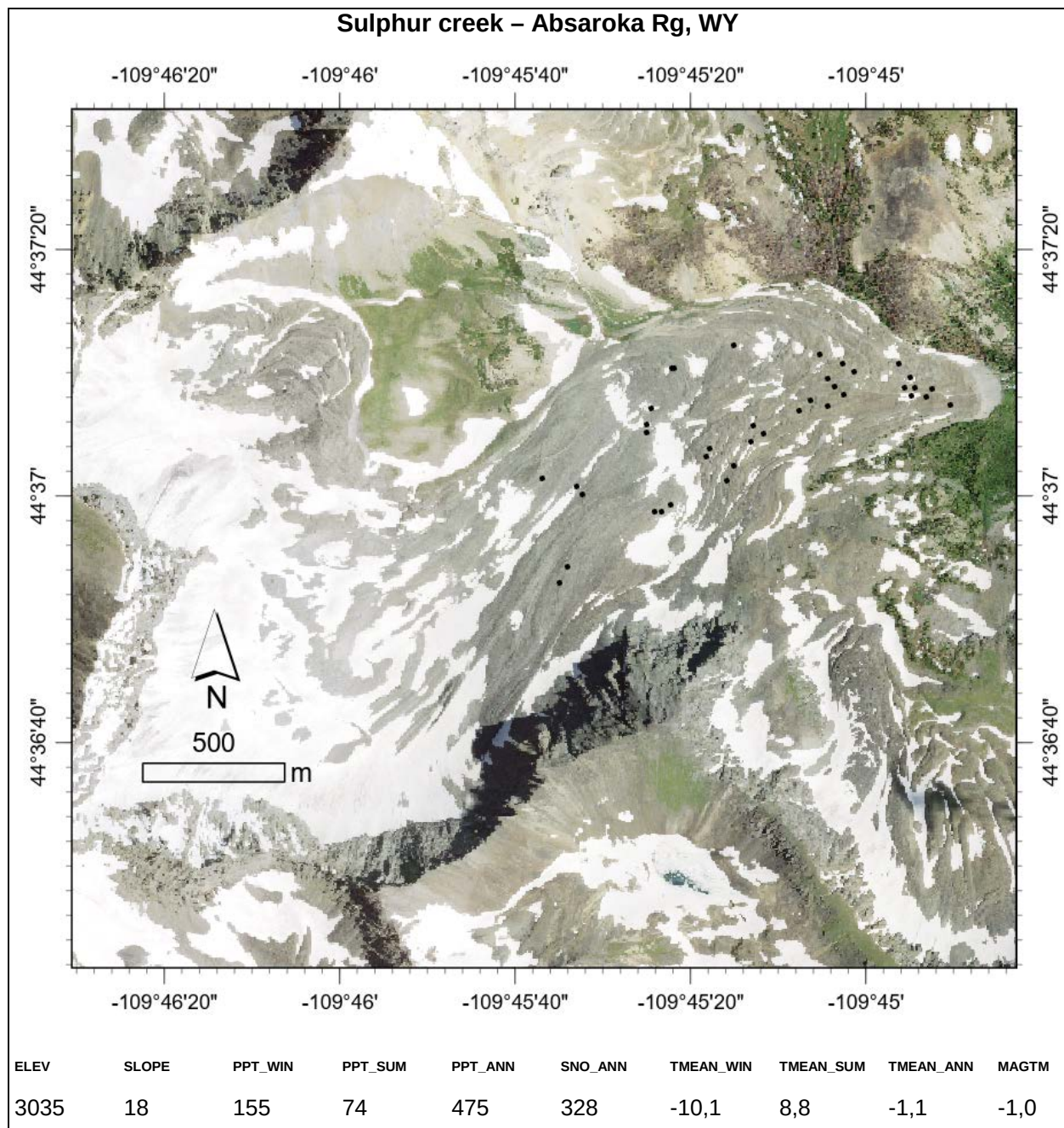


Figure S20: Sulphur Creek – Absaroka Range, WY. Black points indicate the measurement locations that are compiled to the speed time series. Over large parts of the rock glacier surface debris is too fine to represent features that can be tracked in all airphotos. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

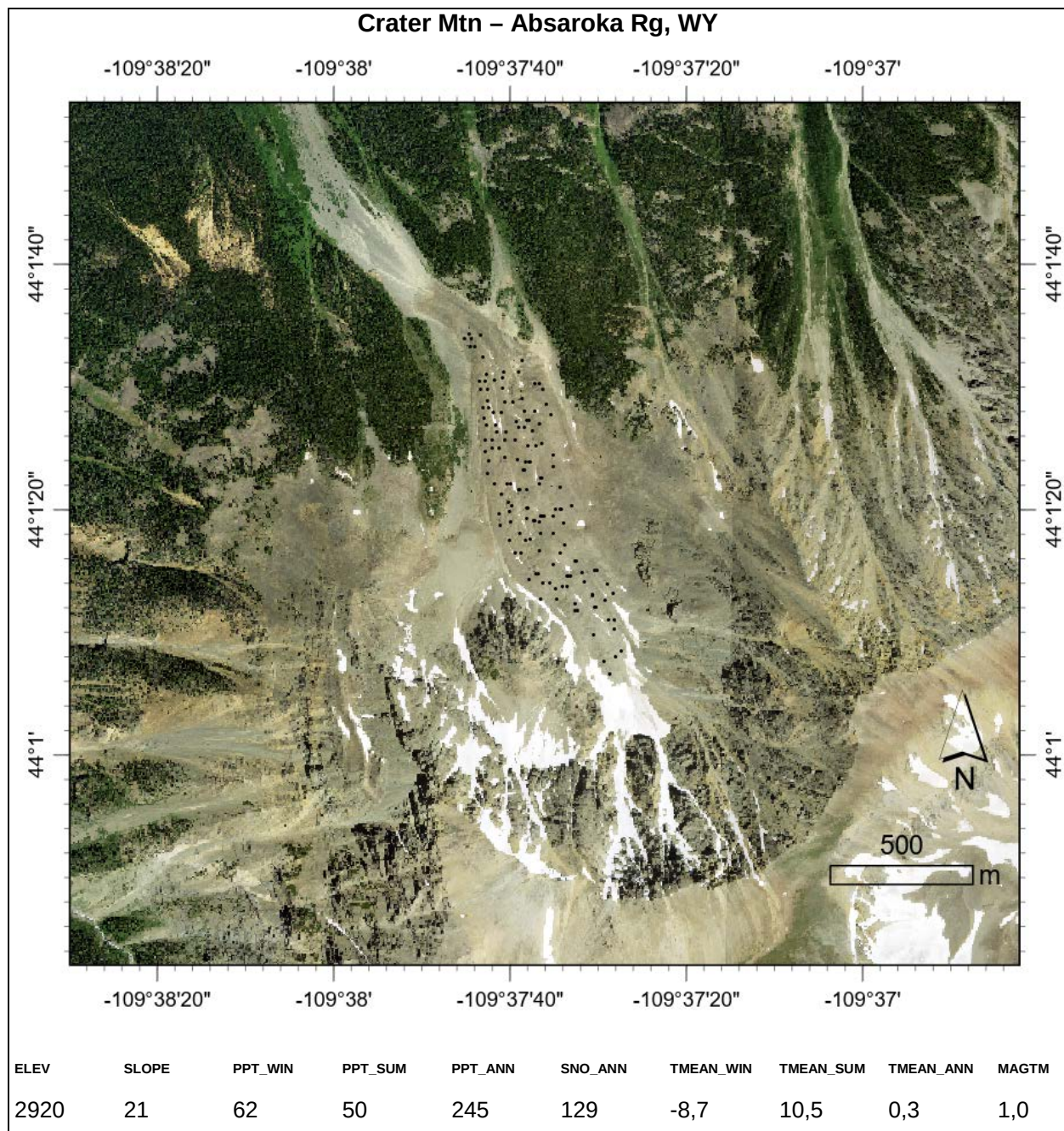


Figure S21: Crater Mountain – Absaroka Range, WY. Black points indicate the measurement locations that are compiled to the speed time series. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

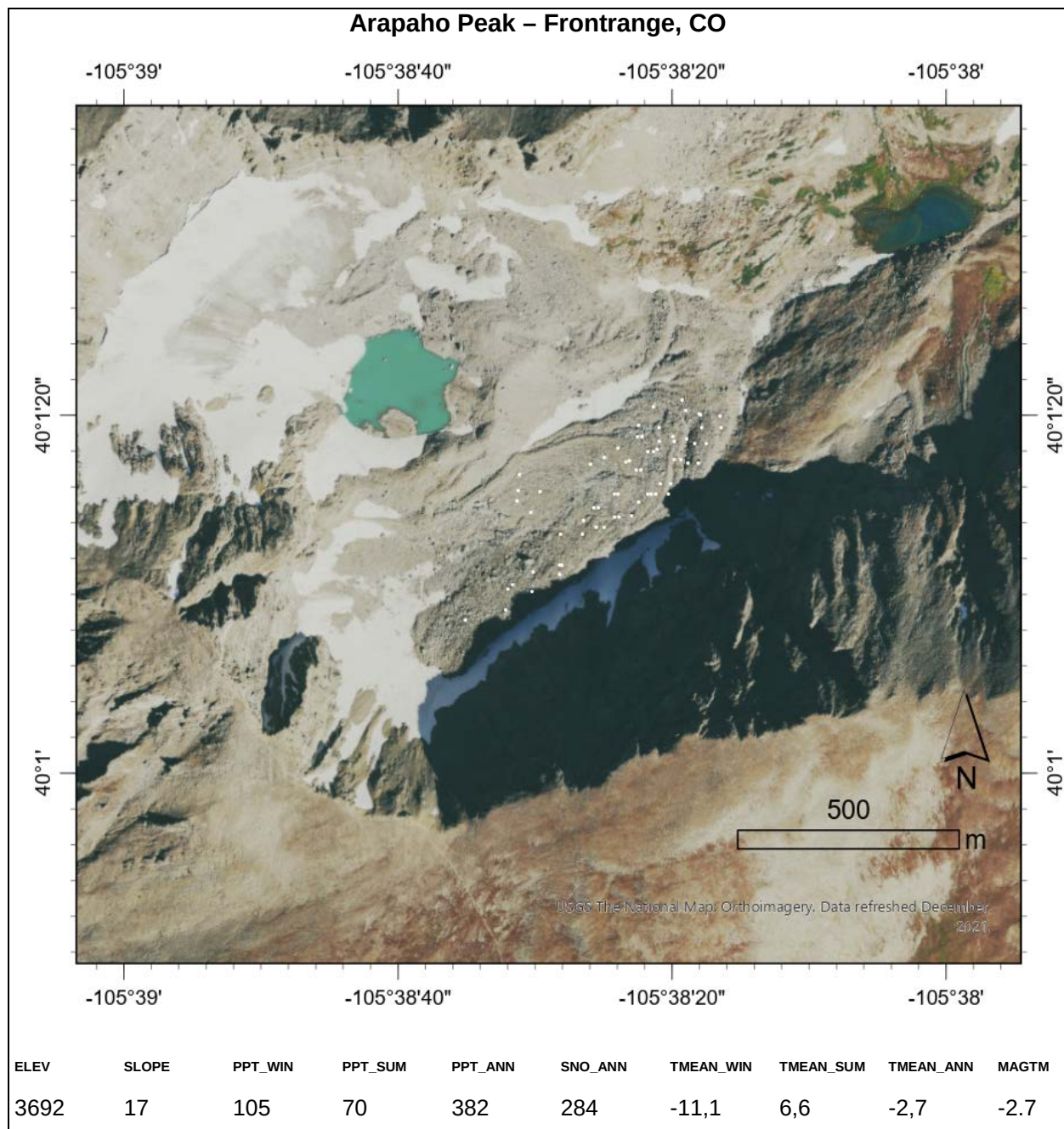


Figure S22: Arapaho Peak – Frontrange, CO. White points indicate the measurement locations that are compiled to the speed time series. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

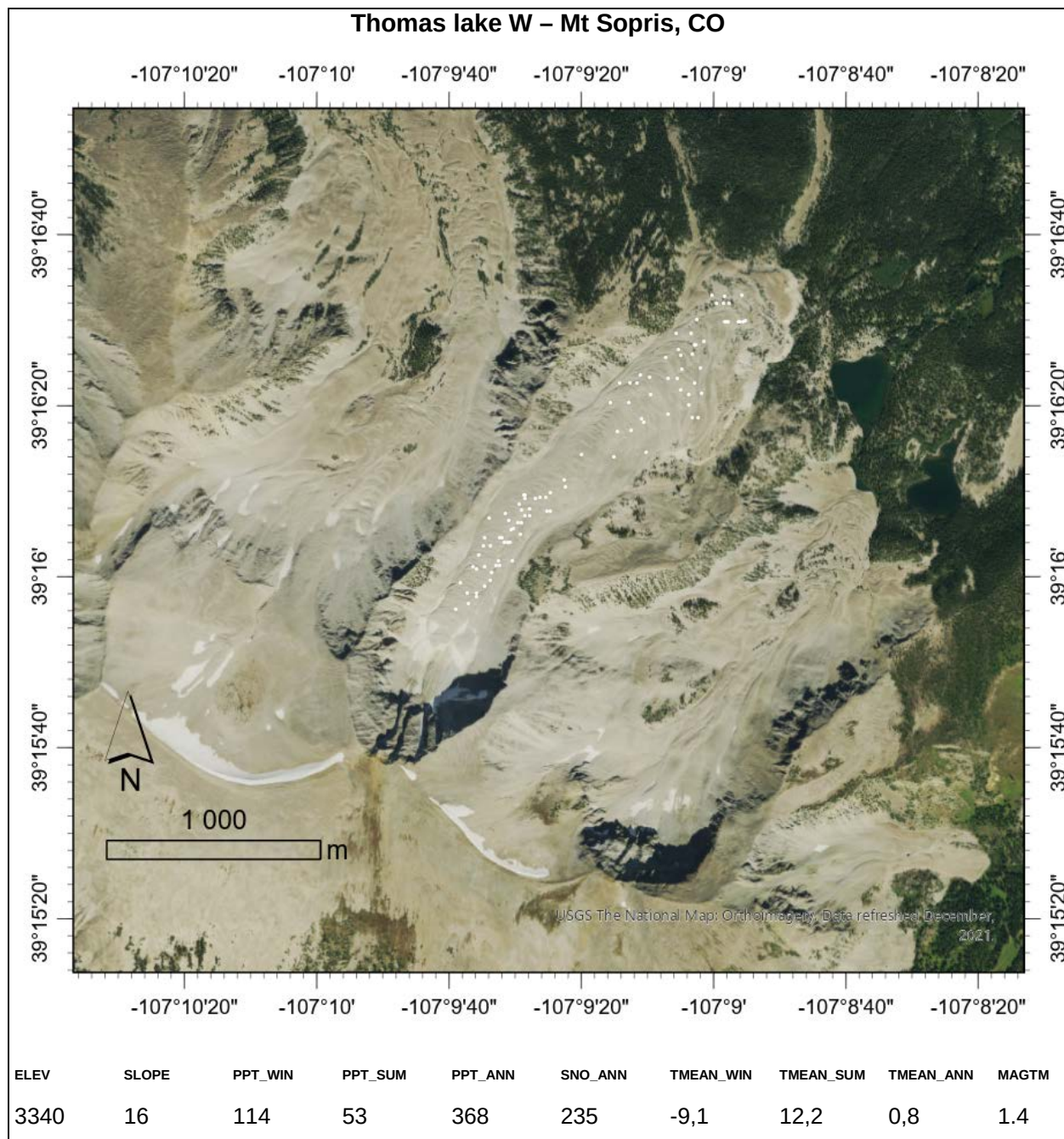


Figure S23: Thomas lake West – Mount Sopris, CO. White points indicate the measurement locations that are compiled to the speed time series. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

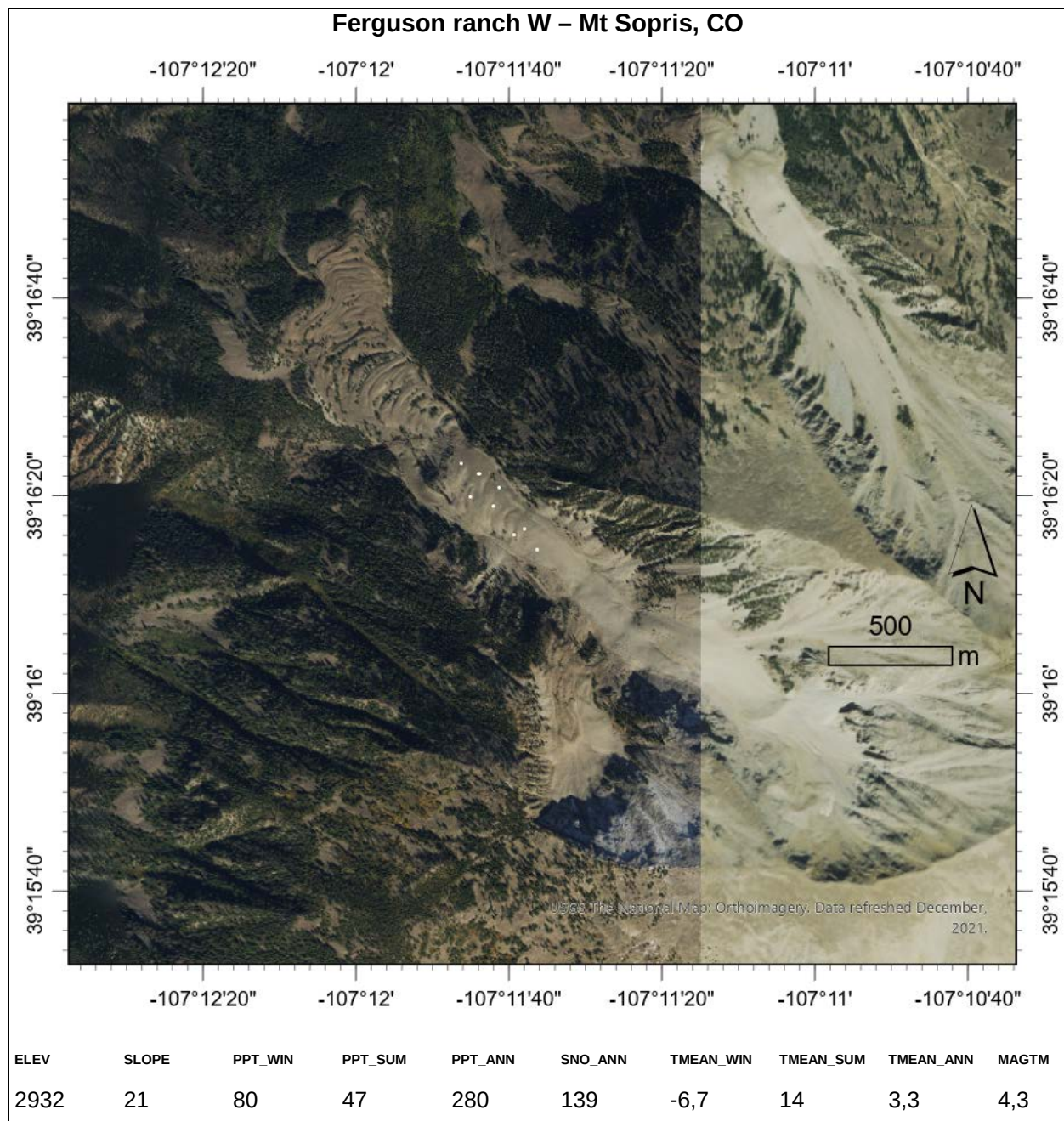


Figure S24: Ferguson ranch West – Mount Sopris, CO. White points indicate the measurement locations that are compiled to the speed time series. Over large parts of the rock glacier surface debris is too fine to represent features that can be tracked in all airphotos. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

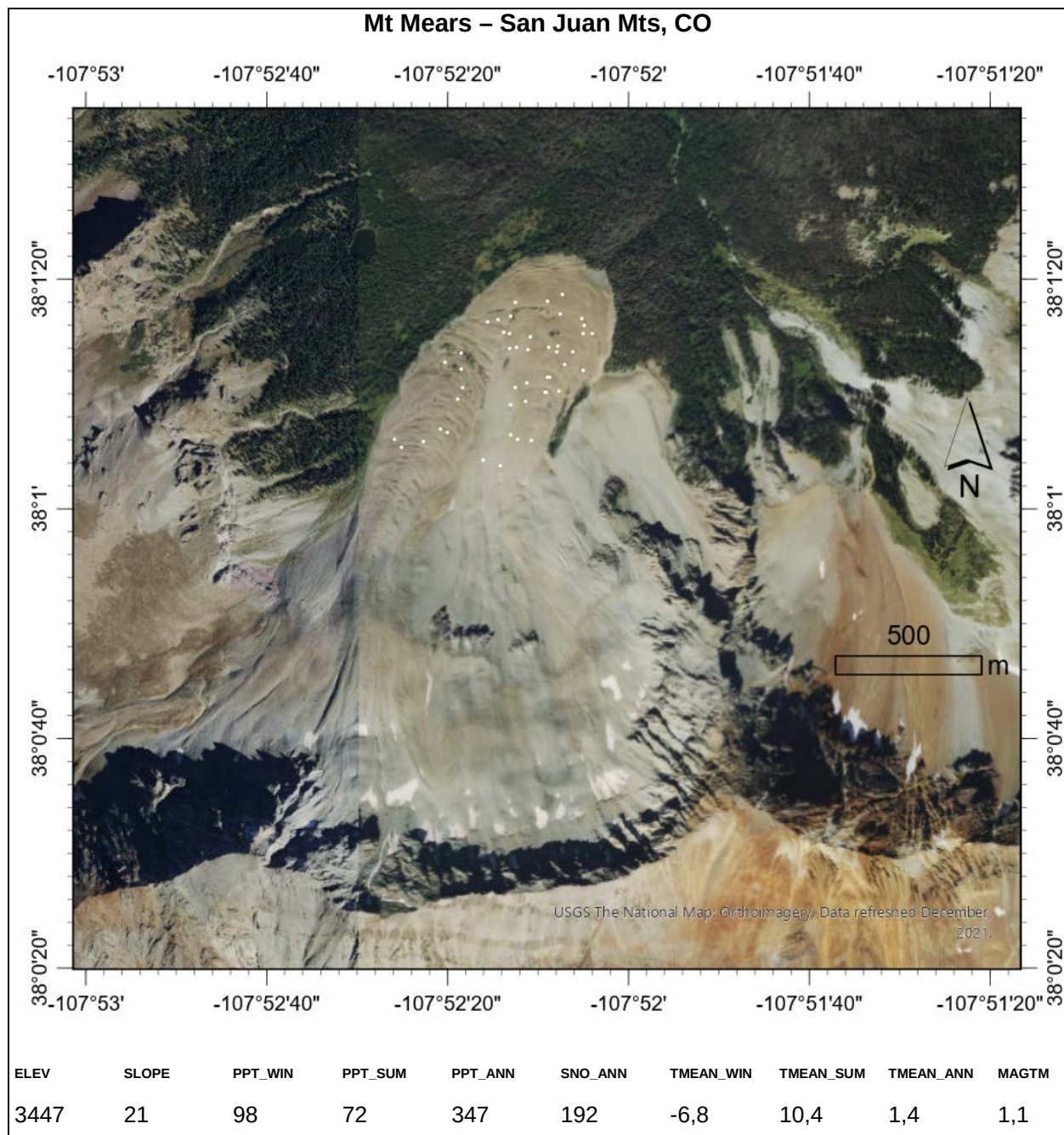


Figure S25: Mount Mears – San Juan Mountains, CO. White points indicate the measurement locations that are compiled to the speed time series. Over large parts of the rock glacier surface debris is too fine to represent features that can be tracked in all airphotos. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

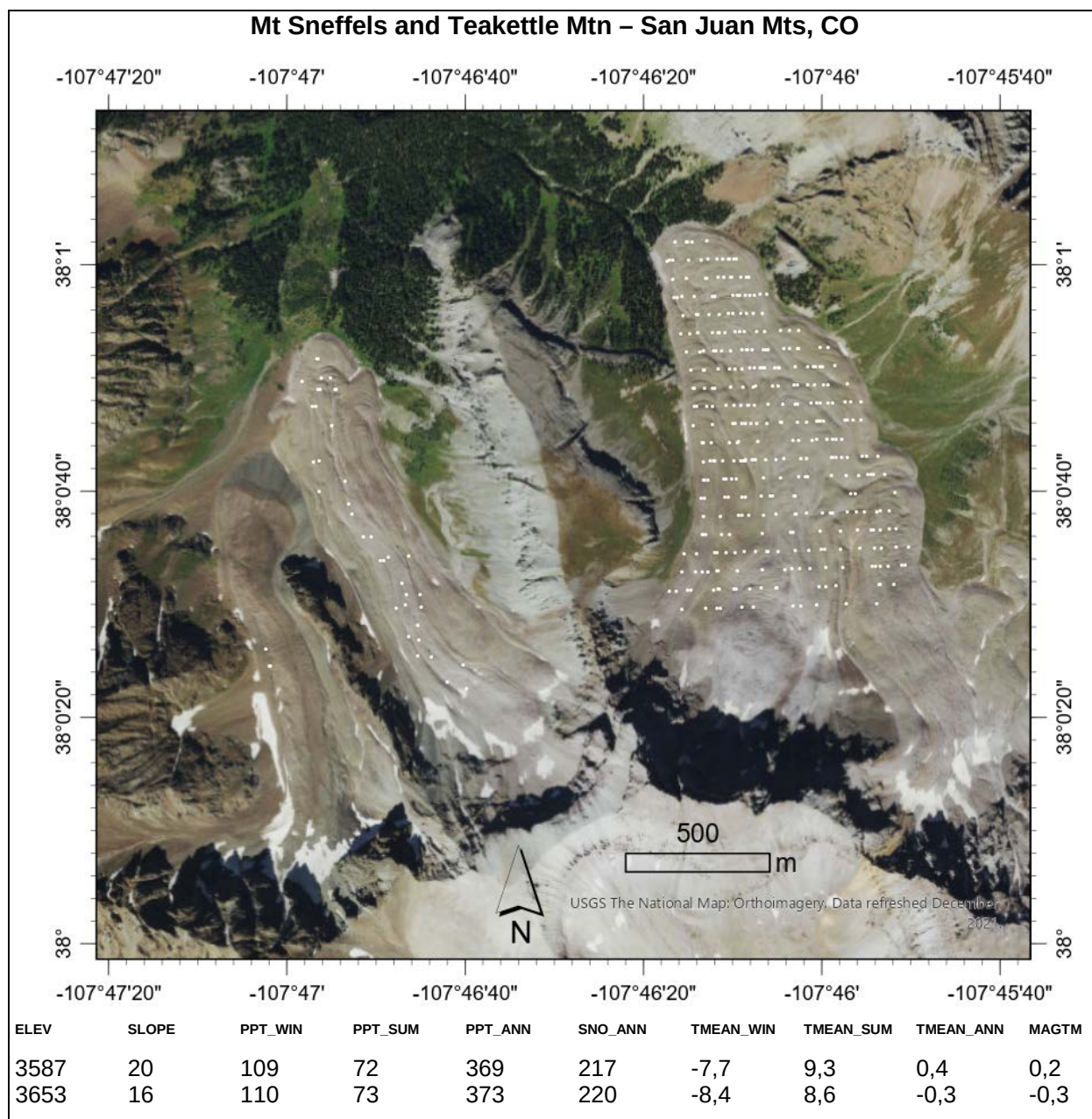


Figure S26: Mount Sneffels and Teakettle Mountain – San Juan Mountains, CO. Sneffels rock glacier left, Teakettle rock glacier right. White points indicate the measurement locations that are compiled to the speed time series. Over large parts of the Sneffels rock glacier surface debris is too fine to represent features that can be tracked in all airphotos. Teakettle Mtn rock glacier was the only rock glacier of the study where raster-based measurement locations were partially successful. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C). Sneffels rock glacier upper line, Teakettle rock glacier lower line.

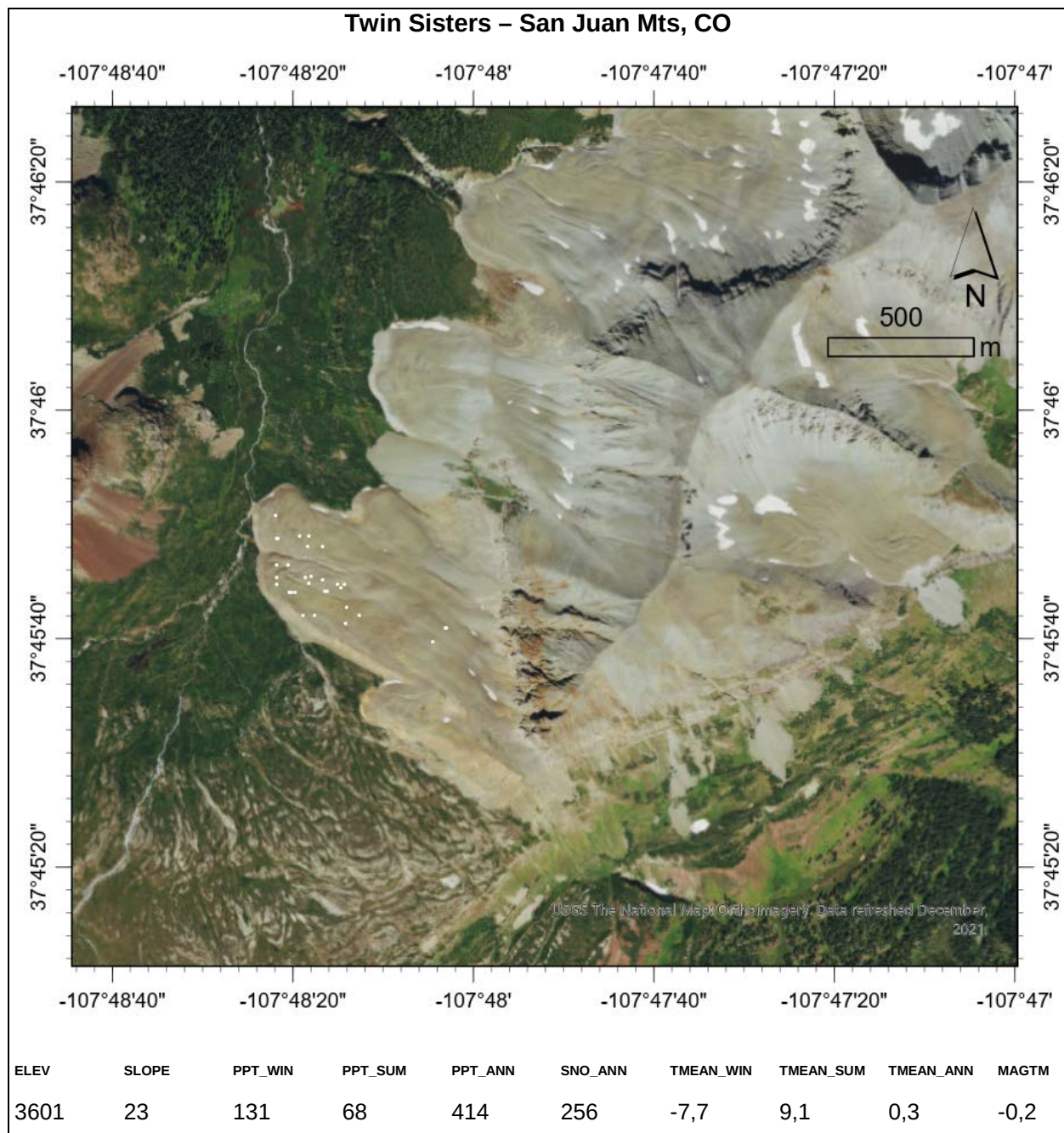


Figure S27: Twin Sisters – San Juan Mountains, CO. Twin Sisters rock glacier to the lower left. White points indicate the measurement locations that are compiled to the speed time series. Over large parts of the rock glacier surface debris is too fine to represent features that can be tracked in all airphotos. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C).

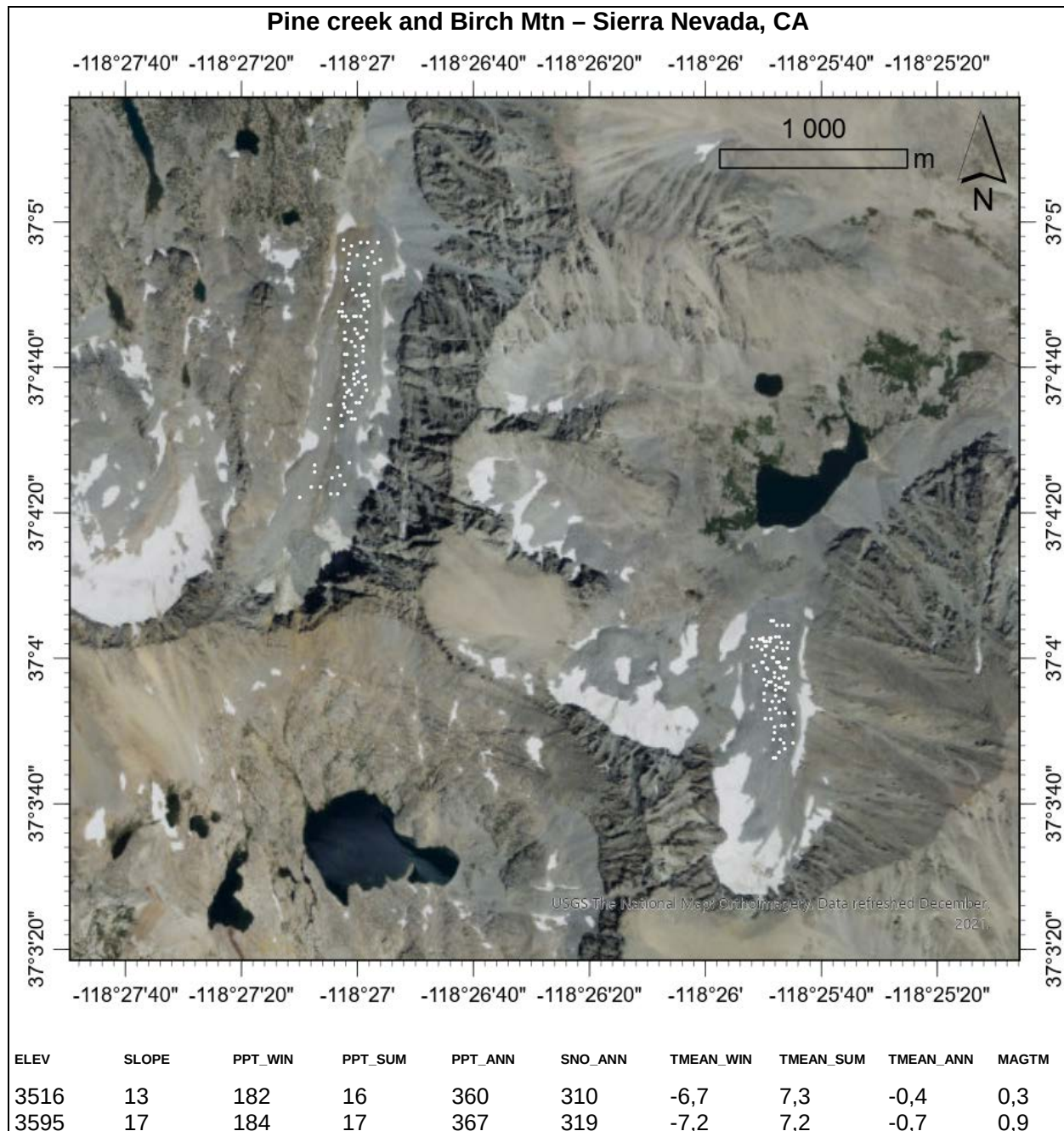


Figure S28: Pine creek and Birch Mountain – Sierra Nevada, CA. Pine creek is left, Birch Mtn is right rock glacier. White points indicate the measurement locations that are compiled to the speed time series. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C). Pine creek upper line, Birch Mtn lower line.

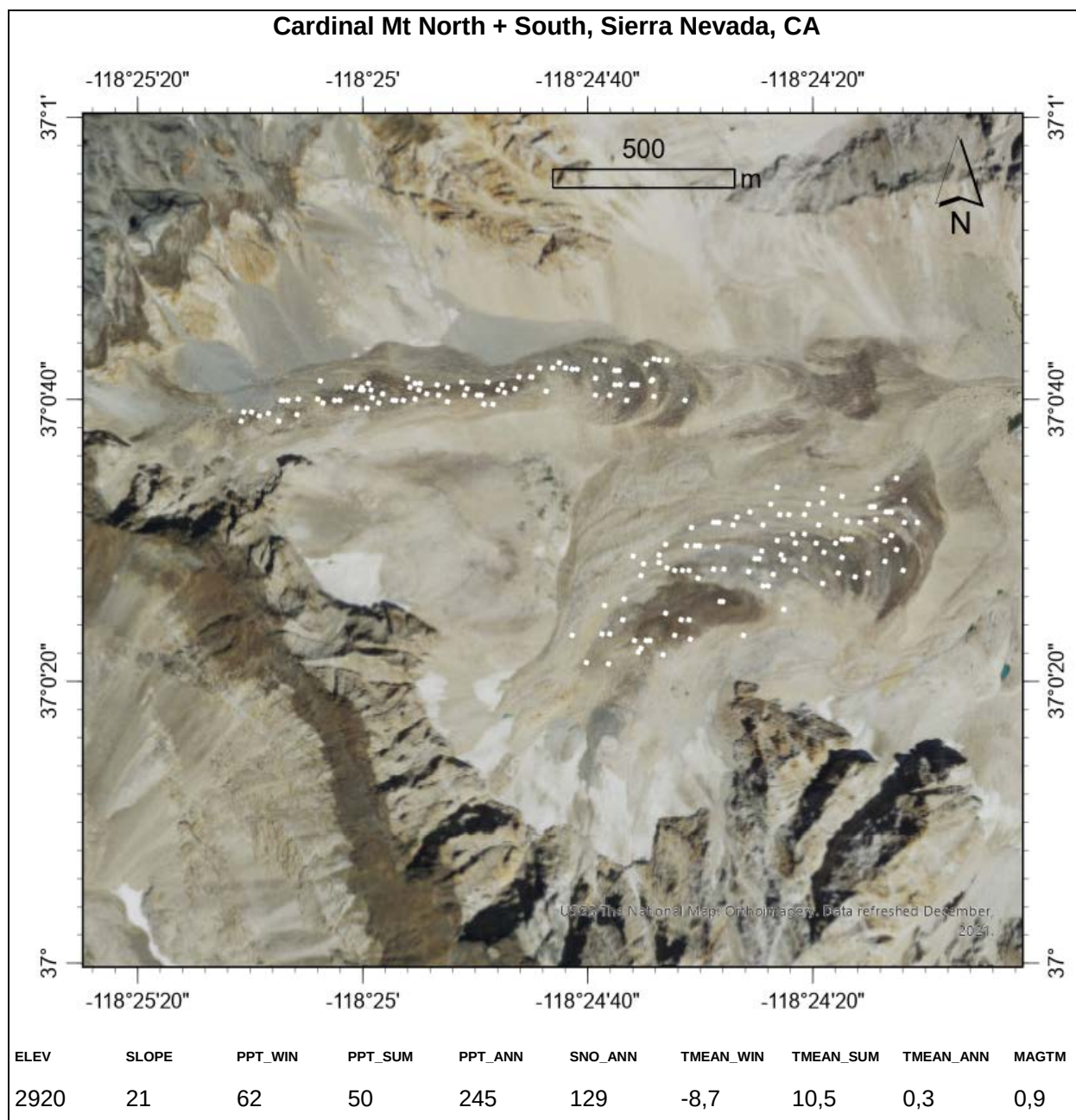


Figure S29: Cardinal Mountain North + South – Sierra Nevada, CA. Cardinal North is upper, Cardinal South is lower rock glacier. White points indicate the measurement locations that are averaged to the speed time series. Airphoto courtesy of the U.S. Geological Survey (USDA NAIP). Data in the bottom row are from Johnson et al. (2021), from left to right: elevation (m), slope (deg), precipitation winter (mm, dec-feb), precipitation summer (mm, jun-aug), precipitation annual (mm), snow annual (mm SWE), mean temperature winter (deg C, dec-feb), mean temperature summer (deg C, jun-aug), mean temperature annual (deg C); from Obu et al. (2019): mean annual ground temperature (deg C). Values apply to both rock glaciers.

List of airphotos

Table S2: Years of photography and USGS identifiers of all airphotos used from the USGS Earth Explorer data base. Airphotos are from the following programmes and collections: National Agricultural Imagery Program (NAIP); National Aerial Photography Program (NAPP) and Aerial Photo Single Frames. For Arapaho and Star Peak also special acquisitions from the High Resolution Orthoimagery collection are available. See USGS Earth Explorer documentation for information about these programmes and collections.

Year	Image ID
Star Peak - Methow Mts	
1967	1VBTU00010230
2006	n_4812045_se_10_1_20060701
2017	m_4812045_se_10_1_20171015
Old Hyndman Peak - Pioneer Mts	
1966	1VBNS00020225
2004	n_4311424_nw_11_1_20040807
2021	m_4311424_nw_11_060_20210915
Galena and Sulphur creek - Absaroka Rg.	
1985	1VFGJC0040035
1994	O4410926.NES.831145; O4410918.SES.831159; n_4410918_se_12_1_20060902;
2006	n_4410926_ne_12_1_20060902 m_4410926_ne_12_h_20150924;
2015	m_4410918_se_12_h_20150924 m_4410918_se_12_060_20220716;
2022	m_4410926_ne_12_060_20220716
Crater Mtn - Absaroka Rg.	
1969	1VCFV00010063
1994	O4410959.SES.833213
2006	n_4410959_se_12_1_20060902
2015	m_4410959_se_12_h_20150923
2022	m_4410959_se_12_060_20220710
Arapaho Peak - Frontrange	
1953	1VAP000030162
2006	O4010559.SES.1147654
2012	001n074w026
2019	m_4010559_se_13_060_20190926
Ferguson ranch W and Thomas Lake W - Mt Sopris	
1962/60	1VAMZ00010125; 1VAAM00020122
1993	O3910747.SWS.1023248; O3910747.SES.1023247
2009	m_3910747_sw_13_1_20090717; m_3910747_se_13_1_20090812
2019	m_3910747_sw_13_060_20190914; m_3910747_se_13_060_20190914;
Mt Mears - San Juan Mts	
1952	1VC0000010075
1972	6213005900050
1999	N10NAPPW11654130
2009	m_3810758_sw_13_1_20090727
2017	m_3810758_sw_13_1_20170921
Mt Sneffels and Teakettle Mtn - San Juan Mts	
1951	1PR0000010124
1972	6213005900097
1999	N10NAPPW11392069
2009	m_3810758_se_13_1_20090727
2017	m_3810758_se_13_1_20170925

Tab S2 cont.

Twin Sisters - San Juan Mts	
1951	1PR0000010005
1972	6213005900069
1998	1998_O3710710.SES.1022243
2009	m_3710710_se_13_1_20090727
2019	m_3710710_se_13_060_20190909
Pine creek and Birch Mtn- Sierra Nevada	
1947	1CQ0000060149; 1CQ0000060150; 1CQ0000060151; 1CQ0000060152
1987	C3711861.NWS.865921; C3711861.NES.865917
2005	n_3711861_nw_11_1_2005082; n_3711861_ne_11_1_20050828
2016	m_3711861_nw_11_h_20160726; m_3711861_ne_11_h_20160726
2022	m_3711861_nw_11_060_20220709; m_3711861_ne_11_060_20220709
Cardinal Mtn N and S - Sierra Nevada	
1947	1CQ0000060149; 1CQ0000060150; 1CQ0000060151; 1CQ0000060152;
1987	C3711861.SES.865926
2005	n_3711861_se_11_1_20050828
2016	m_3711861_se_11_h_20160726
2022	m_3711861_se_11_060_20220709