

State Climate Extremes Committee Memorandum

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SUBJECT: Potential Record-tying Utah Maximum Temperature Event at St. George, UT

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Summary

In mid-July, 2021, an extremely anomalous heat wave impacted the Great Basin. Multiple all-time station records were broken. Of interest to the SCEC, a high temperature reading of 117°F was recorded at the St. George, UT Cooperative Observer Program station on 10 July 2021, tying the all-time Utah maximum temperature record.

An SCEC team was initially assembled in July 2021 to investigate the potential record. Testing of the SGUU1 (St. George) Cooperative Observer Program (COOP) station (ID: 427516) was completed on 15 July 2021 by Al Martinelli, Information Technology Officer, National Weather Service (NWS) Weather Forecast Office (WFO) Salt Lake City, UT (SLC). After a hiatus, the SCEC was reconvened to evaluate the potential record event. A virtual meeting was held on 10 June 2022. The task of this team was somewhat challenging given that there were a number of reported temperatures of 118°F or higher, and that most of these reports came from non-NWS sources.

After considering the validation of the equipment, surrounding observations, and the meteorological scenario, the members of the SCEC voted 5-0 to accept the observation taken at the SGUU1 (St. George)

COOP station site as tying the official maximum temperature record for the State of Utah. Thus, the Maximum Temperature Record for the State of Utah that is true and valid is:

Location: St. George
Site Type: COOP (ID: 427516)
Maximum Temperature Record: 117°F
Date: 10 July 2021

Established Record:
Location: St. George
Site Type: COOP
Maximum Temperature Record: 117°F
Date: 5 July 1985

About the State Climate Extremes Committee

The SCEC was composed of members representing the National Weather Service Forecast Office in Salt Lake City, Utah, National Weather Service's Western Region Headquarters Integrated Services Division in Salt Lake City, Utah, the Utah Climate Center in Logan, Utah, the Western Regional Climate Center in Reno, Nevada, and the National Centers for Environmental Information in Asheville, North Carolina. SCECs are convened to adjudicate potential records for validity. If validated, observations are considered the state record for that record type. More details about the SCEC are available online at <https://www.ncei.noaa.gov/access/monitoring/scec/details>.

About the Utah Maximum Temperature Record

Established Record:
Location: St. George
Site Type: COOP
Maximum Temperature Record: 117°F
Date: 5 July 1985

The established maximum temperature record of 117°F for Utah was originally set on 5 July 1985. The COOP station has been in use since 1877, with a nearly continuous period of record. The location of the COOP station on 5 July 1985 was 781 East 100 South, St. George, Utah, near Utah Tech University. The COOP station location as of 10 July 2021 was 2.58 miles to the northwest of the 1985 location, in a residential area. The terrain and geography of both locations is similar.

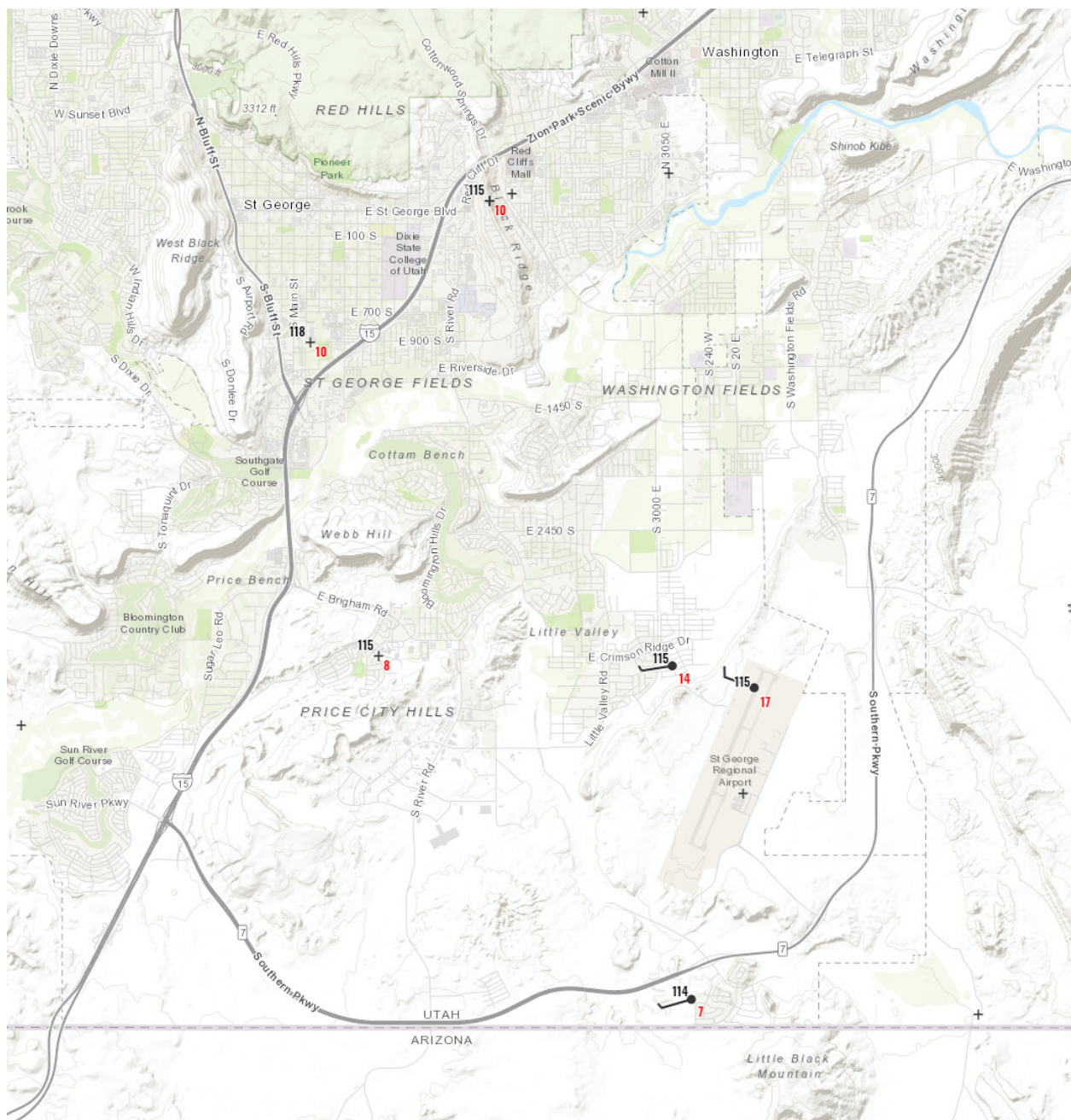
A temperature of 118°F was recorded south of St. George near the Arizona border on 4 July 2007. This was recorded at a now decommissioned Remote Automatic Weather Station (RAWS) site located at the Port of Entry along I-15 just north of the Utah/Arizona border. The equipment was determined to be insufficient to support a record of this magnitude by a committee in 2007.



Photograph of the decommissioned RAWS site courtesy of the Western Region Climate Center and Greg McCurdy.



Locations of the St. George COOP station in 1985 (red dot) when the previous record was set, location of the current COOP station (blue dot), and the location of discounted St. George RAWS station (green dot).



Map of stations in the St. George area that reported temperatures near to or exceeding the COOP maximum temperature value at around 5 PM MDT on 10 July 2021.

About the Utah Maximum Temperature Record Observation Station

The Utah maximum temperature record observation was recorded at the SGUU1 (St. George) COOP station. This station has been in existence since 1 January 1893, and has been at its present location since 19 November 2014. The station rests at an elevation of 2,857 feet ASL. The latitude and longitude coordinates are 37.11900 and -113.60680, respectively.

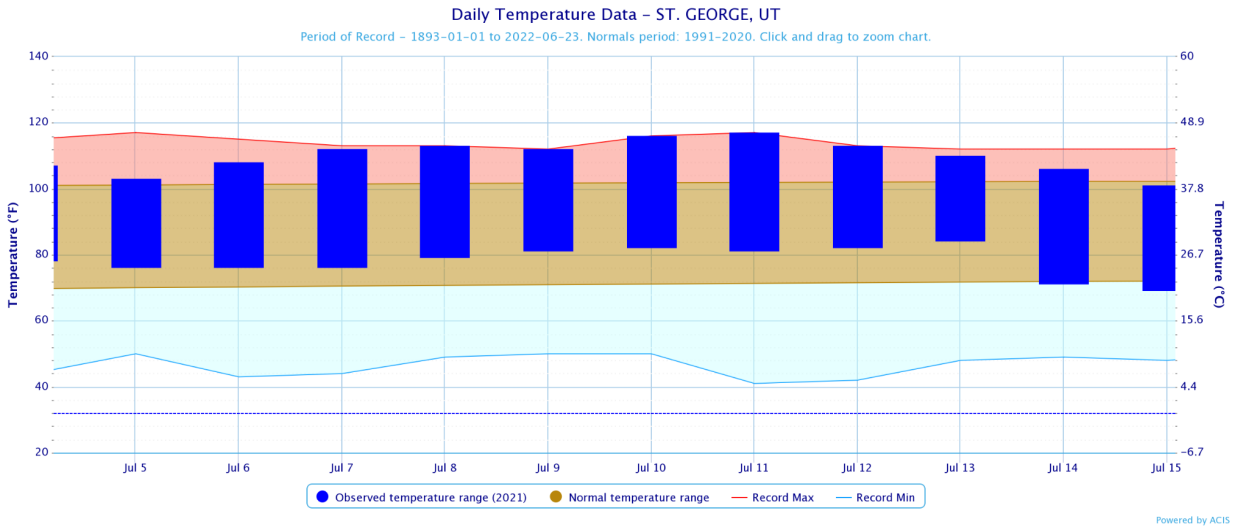
The temperature observation was recorded via an MMTS-SNSR-NWS-Max/Min Temperature Sensor. Equipment testing was completed on 15 July 2021, from 12 PM to 12:30 PM, by Al Martinelli, Information Technology Officer, National Weather Service (NWS) Weather Forecast Office (WFO) Salt Lake City, UT (SLC). A battery-operated, mechanically-aspirated, psychrometer (ASOS standard) read between 86 and 86.5°F, after 5 minutes. The MMTS display ranged between 85.2 and 85.4°F during the test period. Additionally, a multimeter was also used to validate the MMTS accuracy.



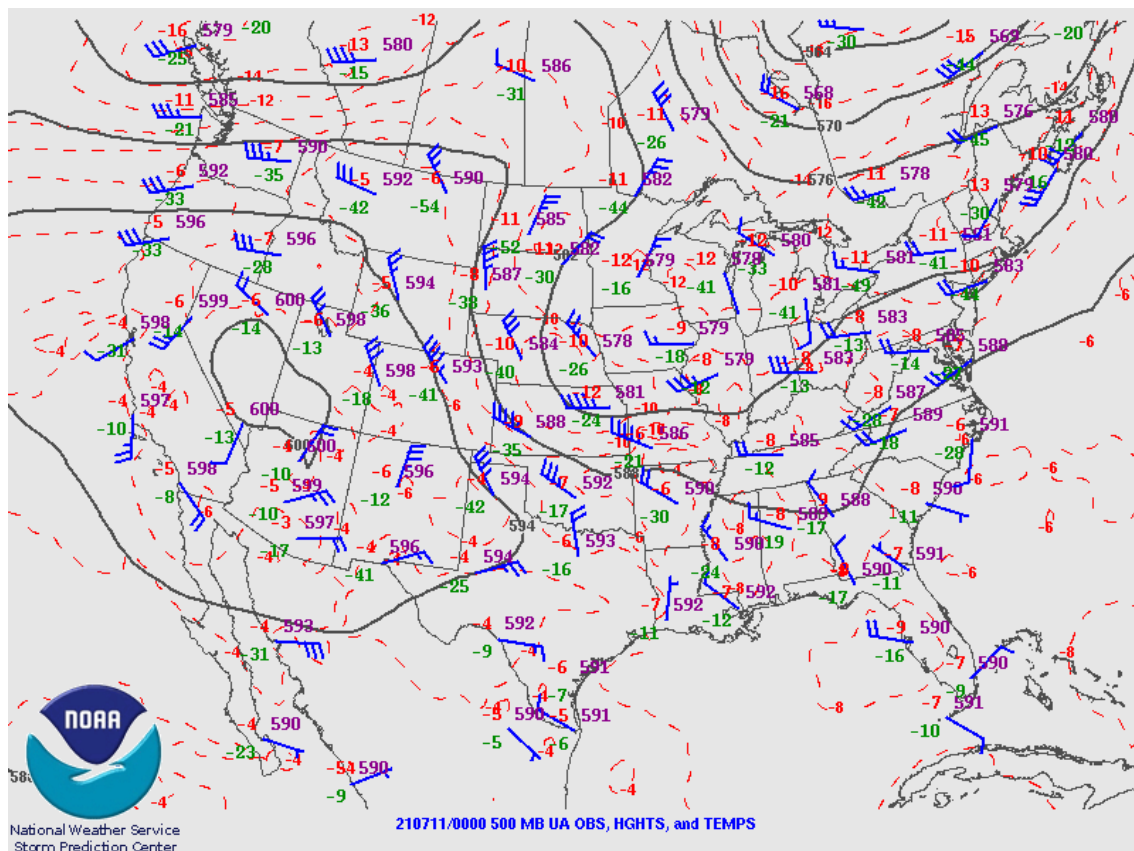
Location and placement of the SGU1 (St. George) COOP station temperature sensor on 15 July 2021.

Meteorological Plausibility of the Utah Maximum Temperature Record Observation

An expansive ridge of high pressure was located across the Desert Southwest, with the 600 DM center nearly directly over St. George, Utah. From the U.S. Drought Monitor, the region was in D4 Exceptional Drought, with soil moisture levels at or below record levels for the time of year. St. George and southwestern Utah had received little to no rainfall through most of the spring and into early summer. Temperatures had exceeded 110°F for four days prior to the record, with a high temperature the day prior of 116°F. The minimum temperature on the days preceding the temperature record ranged between 81–82°F (approximately 10°F hotter than normal minimum temperatures for this time in July), indicating minimal nocturnal cooling.



Daily temperature range during the July 2021 heat wave in St. George, UT showing daily records. Brown box indicates 1991-2020 normals with red and blue lines (and color fill) indicating above or below, respectively, maximum and minimum observed temperatures. Note minimum temperatures during the 9 July 2022 to 12 July 2022 peak heat period approaching normal daily mean temperatures.



500 mb analysis from 00Z 11 July 2021 illustrating an expansive ridge of high pressure across the West.

Climatological Data for ST. GEORGE, UT - July 2021

Click column heading to sort ascending, click again to sort descending.

Date	Max Temperature	Min Temperature	Avg Temperature	Avg Temperature Departure	HDD	CDD	Precipitation	Snowfall	Snow Depth
2021-07-01	94	73	83.5	-1.2	0	19	0.00	0.0	0
2021-07-02	102	72	87.0	2.1	0	22	0.00	0.0	0
2021-07-03	106	77	91.5	6.4	0	27	0.00	0.0	0
2021-07-04	107	78	92.5	7.1	0	28	0.00	0.0	0
2021-07-05	103	76	89.5	3.9	0	25	0.00	0.0	0
2021-07-06	108	76	92.0	6.2	0	27	0.00	0.0	0
2021-07-07	112	76	94.0	8.0	0	29	0.00	0.0	0
2021-07-08	113	79	96.0	9.9	0	31	0.00	0.0	0
2021-07-09	112	81	96.5	10.2	0	32	0.00	0.0	0
2021-07-10	116	82	99.0	12.5	0	34	0.00	0.0	0
2021-07-11	117	81	99.0	12.4	0	34	0.00	0.0	0
2021-07-12	113	82	97.5	10.7	0	33	0.00	0.0	0
2021-07-13	110	84	97.0	10.1	0	32	0.00	0.0	0
2021-07-14	106	71	88.5	1.5	0	24	0.10	0.0	0
2021-07-15	101	69	85.0	-2.1	0	20	0.69	0.0	0
2021-07-16	98	69	83.5	-3.7	0	19	0.10	0.0	0
2021-07-17	101	72	86.5	-0.8	0	22	0.00	0.0	0
2021-07-18	104	78	91.0	3.6	0	26	0.00	0.0	0
2021-07-19	96	76	86.0	-1.5	0	21	0.00	0.0	0
2021-07-20	101	78	89.5	2.0	0	25	0.00	0.0	0
2021-07-21	101	80	90.5	2.9	0	26	0.00	0.0	0
2021-07-22	104	78	91.0	3.4	0	26	0.00	0.0	0
2021-07-23	100	73	86.5	-1.1	0	22	0.02	0.0	0
2021-07-24	100	74	87.0	-0.6	0	22	T	0.0	0
2021-07-25	96	72	84.0	-3.6	0	19	0.01	0.0	0
2021-07-26	98	76	87.0	-0.6	0	22	0.02	0.0	0
2021-07-27	95	70	82.5	-5.1	0	18	0.25	0.0	0
2021-07-28	98	71	84.5	-3.1	0	20	0.00	0.0	0
2021-07-29	104	73	88.5	1.0	0	24	0.00	0.0	0
2021-07-30	103	73	88.0	0.5	0	23	0.04	0.0	0
2021-07-31	96	74	85.0	-2.4	0	20	0.00	0.0	0
Sum	3215	2344	-	-	0	772	1.23	0.0	-
Average	103.7	75.6	89.7	2.9	-	-	-	-	0.0
Normal	101.9	71.7	86.8	-	0	676	0.50	0.0	-

Observations for each day cover the 24 hours ending
at the time given below (Local Standard Time).

Max Temperature : 8am

Min Temperature : 8am

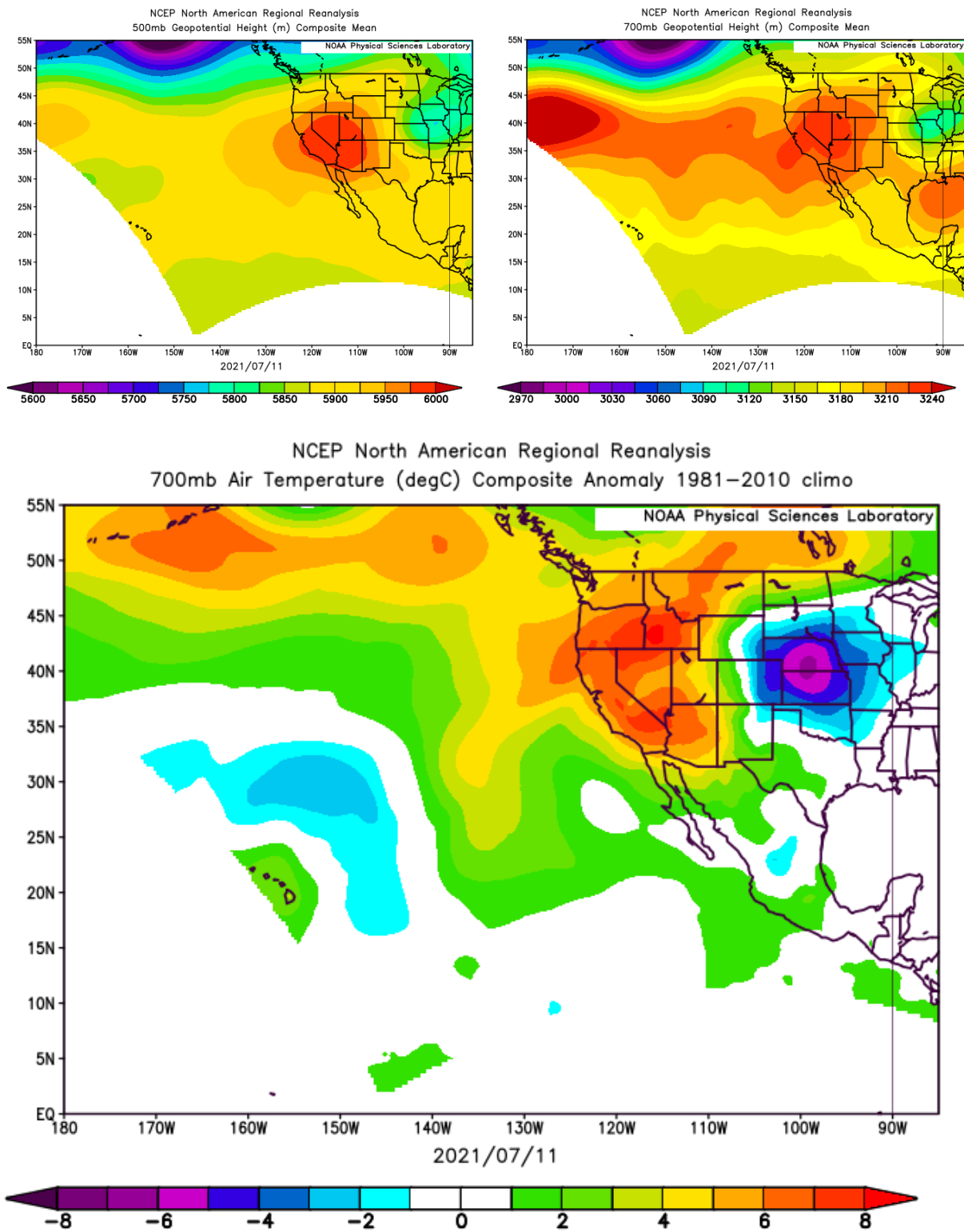
Precipitation : 8am

Snowfall : unknown

Snow Depth : 8am

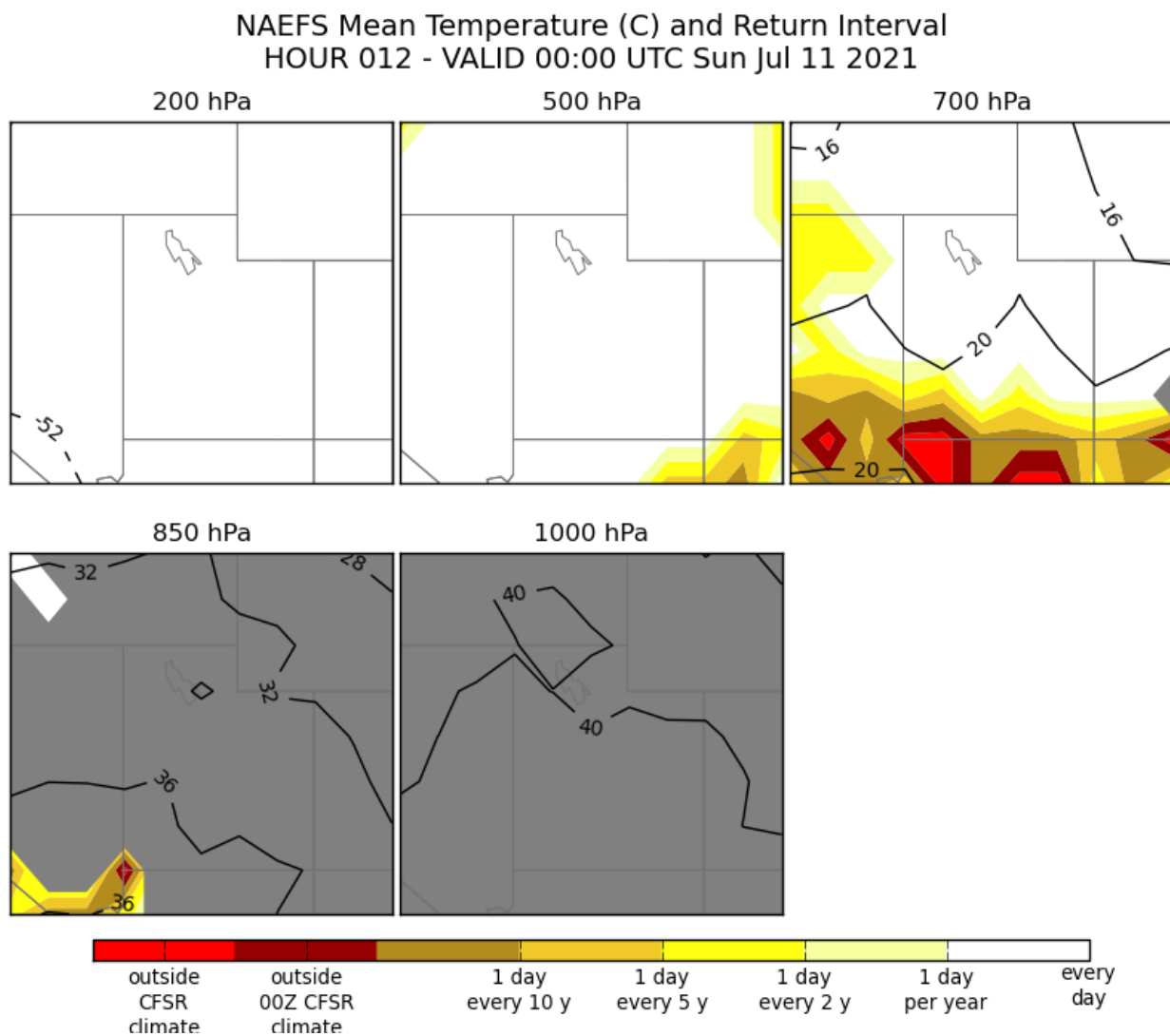
Daily Climatological Data reports for July 2021 at St. George, UT COOP station.

Note: The SGU01 (St. George) COOP station is a morning report station, so for the 24-hour clock, the 117°F reading occurred between 8 AM on 10 July and 8 AM on 11 July, hence is indicated on 11 July 2021 in the table.



Clockwise from upper left: 500 hPa and 700 hPa geopotential heights and 700 hPa temperature anomalies (deviation from 1981-2010 means) from the North American Regional Reanalysis.

As noted above, the extreme heat event occurred during a period of strong ridging throughout the lower troposphere (500 hPa and 700 hPa) centered over the southwestern United States. Consistent with the establishment of a strong high pressure ridge, temperature anomalies at 700 MB were outside of the CFSR climatology for the date across southwestern Utah, with a 700 MB temperature of approximately 20 °F on the afternoon of 10 July 2021 (00 UTC 11 July 2021). Based on anomalies calculated using the North American Regional Reanalysis (NARR), 700 hPa temperature anomalies were on the order of 6-7°C above 1981-2010 averages. While a strong southwest-northeast gradient of 700 hPa temperatures is observed across Utah (anomalies decreasing to the northeast indicated in the NARR figure above), the anomalies over southwestern Utah and into northern Arizona demonstrate increasingly large recurrence intervals as one moves further south into the region of St. George.



Tropospheric temperatures and recurrence intervals from the Climate Forecast System Reanalysis.

Discounted Meteorological Observation

A high temperature reading of 120°F was recorded at the DW7197 St. George Citizen Weather Observer Program station in St. George on 10 July 2021. As the station was sited on the roof of the Washington County School District Information Technology building, it was deemed to be unrepresentative of environmental conditions, and thus discounted from record consideration.



Photograph of the temperature station sited on the roof of the Washington County School District Information Technology building in St. George, UT.

Finding of Committee on Utah Maximum Temperature Observation

The SCEC voted 5-0 to accept the 117°F reading at the SGUU1 (St. George) COOP station as a record-tying Utah Maximum Temperature event. There is clear meteorological evidence to support the record-tying event, as well as confidence in the event due to robust equipment testing and recorded high temperatures from surrounding stations.

The unanimous agreement of the SCEC, based on evidence as stated above, has determined **the 117°F reading at the SGUU1 (St. George) COOP station on 10 July 2021, is indeed valid, and is now accepted as tying the previously recorded Maximum Temperature record for the State of Utah.** The SCEC made their determination during the virtual meeting held on 10 June 2022.

NCEI Climate Monitoring Chief Decision:

Approved

Not approved

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as recommended in boldface above:

returned to SCEC with no action taken:

Committee Members (Voting):

Kevin Barjenbruch, Warning Coordination Meteorologist, NWS Salt Lake City, UT

Andrea Bair, Climate Services Program Manager, NWS Western Region

Robert Gillies, Utah State Climatologist/Director of the Utah Climate Center, Utah Climate Center

Dr. Benjamin Hatchett, Regional Climatologist, Western Regional Climate Center

Karin Gleason, Meteorologist - Monitoring Section, National Centers for Environmental Information

Additional teleconference participant:

Bryant Korzeniewski, Meteorologist/Datzilla Programmer, Federal Government Contractor

Riverside Technology, Inc., Climatic Science and Services Division, National Centers for Environmental Information