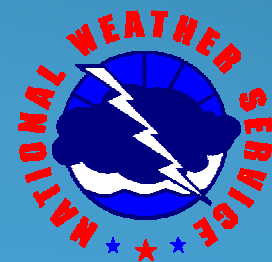
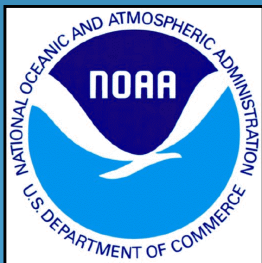


# Forensic Climatology in Alaska

Rick Thoman  
NOAA/National Weather Service  
Fairbanks, Alaska





# What is forensic climatology?

- Subset of instrumental data quality control
- Analysis and evaluation of potentially plausible data
  - Applicable to time scales daily to seasonally
  - Applicable to data from any time period
  - Extreme events especially amenable
- Judgments based on relative value
  - Different people can reasonably drawn different conclusions based on the same information

# Why do this?



- Instrumental climate record is not pristine (especially?) in Alaska
- Highest quality climate record most useful for many applications
  - Science
  - Engineering
  - Public Policy



# Increasing Unknowns

- In general, with greater time depth
  - Decreasing knowledge of specific practice and procedures
  - Decreasing specific geo-spatial knowledge
  - Decreasing data density
  - Decreasing high quality data





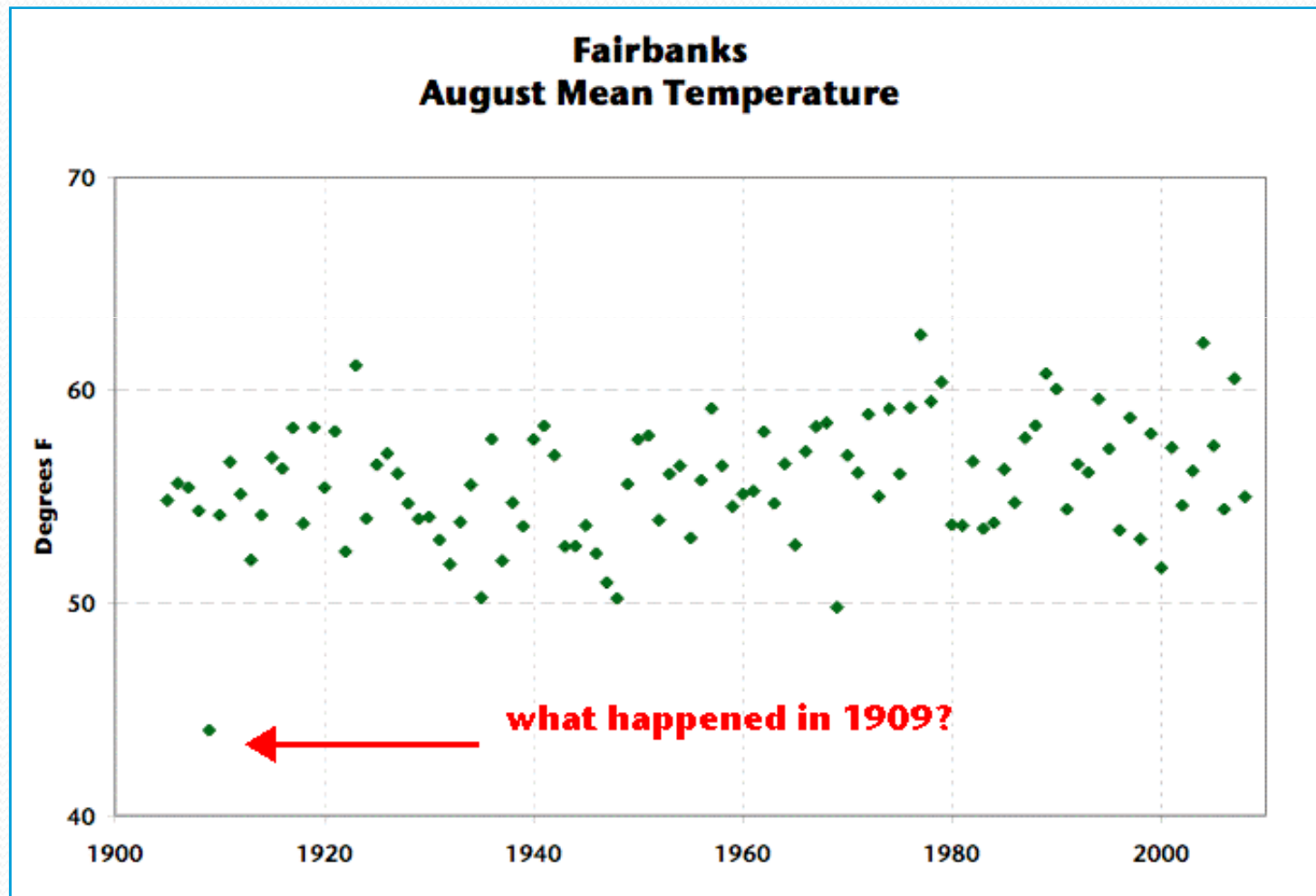
## Tools of the Trade

- Mesoscale climatology & meteorology
- Practices and procedures & how reality can vary
- Original documentation
- Considerations for Interior Alaska
  - Very large spacing of stations
  - Potentially large mesoscale differences
  - No professional observations before late 1929 (Fairbanks)

# Three Examples

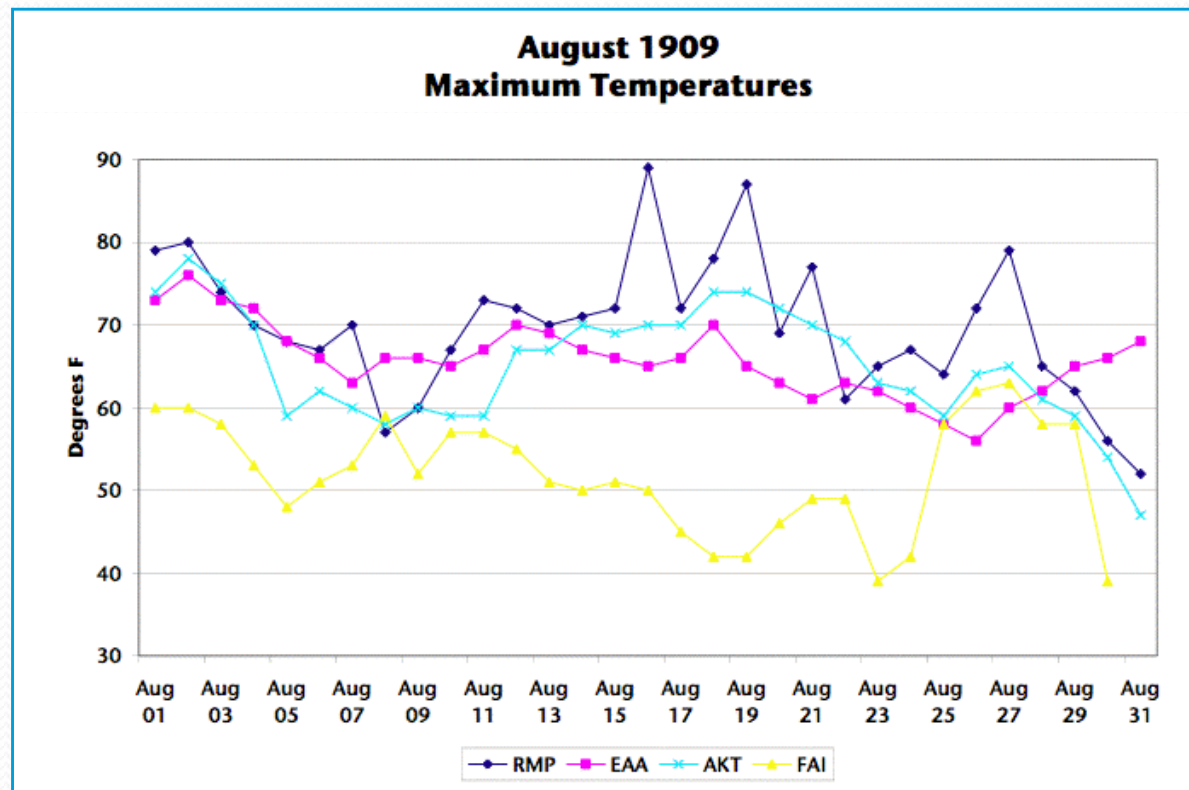


# Cooler August Ever?



# What's Going On?

- Monthly mean temperature 6 to 11 degrees cooler than other Interior locations & correlation of daily data ~zero





# Original Form Provides Answers

Precip data in July and Sept

Only 30 days

Only form signed by Sgt. Edward Merrill

COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD: August 1909 Fairbanks

Month of August, 1909; Station Fairbanks; County Alaska; State Alaska; Latitude 66; Longitude 148

Hour of Observation, University

Time used on this form, University

DATE	TEMPERATURE			PRECIPITATION					CHARACTER OF DAY	NUMBER OF DAYS
	MAX. WIND	MIN. WIND	RAIN	TYPE OF PRECIPITATION	TIME OF BEGINNING	TIME OF ENDING	AMOUNT			
1	63	39	58						0	
2	65	30	58						0	
3	60	32	57						0	
4	55	36	42						0	
5	52	34	49						0	
6	55	35	58						0	
7	54	30	52						0	
8	54	40	49						0	
9	58	39	59						0	
10	60	35	50						0	
11	59	47	57						0	
12	58	47	47						0	
13	51	35	49						0	
14	48	36	51						0	
15	44	35	55						0	
16	55	35	45						0	
17	47	36	47						0	
18	45	39	43						0	
19	45	37	44						0	
20	46	39	45						0	
21	51	36	46						0	
22	45	31	38						0	
23	48	32	47						0	
24	58	30	48						0	
25	61	34	46						0	
26	58	32	55						0	
27	61	34	58						0	
28	59	34	34						0	
29	41	31	38						0	
30	42	32	38						0	
31	42	32	38						0	

Remarks: @ all temperatures recorded a mean temperature of 57.0 has been used for missing days in computing monthly and yearly means closely with mean temperature at similar station.

Sgt. Edward G. Merrill, Cooperative Observer, Fairbanks, Alaska

Note about temps being too low

# Original Form Changed

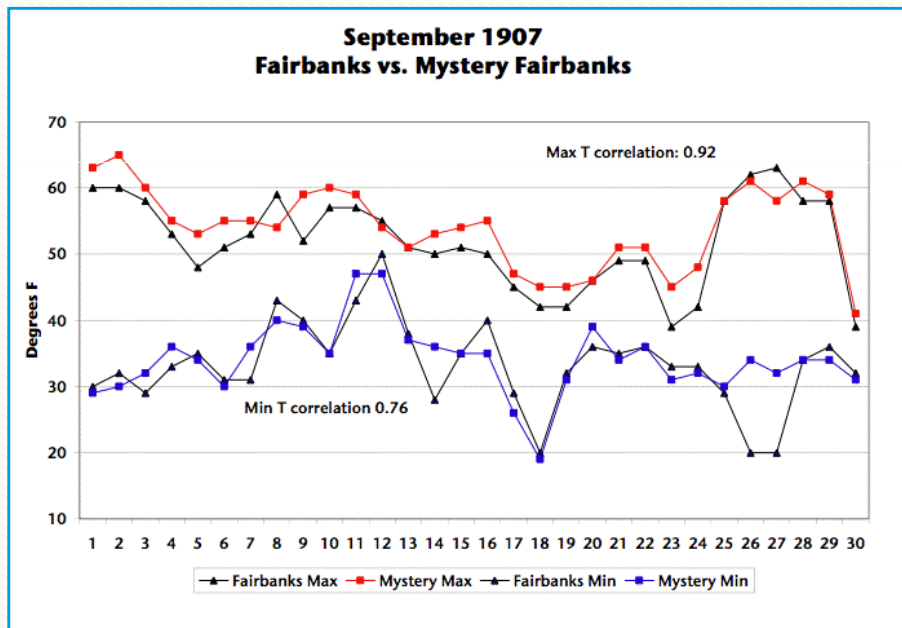
FD  
U. S. Department of Agriculture, Weather Bureau.  
COOPERATIVE OBSERVERS' METEOROLOGICAL RECORD:  
Month of ~~September~~ August, 1909; Station, ~~Univ. of Alaska~~ University; County, Fairbanks  
State, Alaska; Latitude, 64; Longitude, 148  
Hour of Observation, \_\_\_\_\_  
Time used on this form, \_\_\_\_\_  
Mean maximum, \_\_\_\_\_  
Mean minimum, \_\_\_\_\_  
Mean, 65  
**UNIVERSITY**  
TEMPERATURE PRECIPITATION  
DATE 

TEMPERATURE		PRECIPITATION	
MAX.	MIN.	AMOUNT	TYPE

  
DEPT. OF AGRICULTURE, WEATHER BUREAU, WASHINGTON, D. C.

COOPERATIVE OBSERV  
Month of ~~September~~ August, 1909; S  
State, Alaska; Latitude, 64

# Mystery (Mostly) Solved



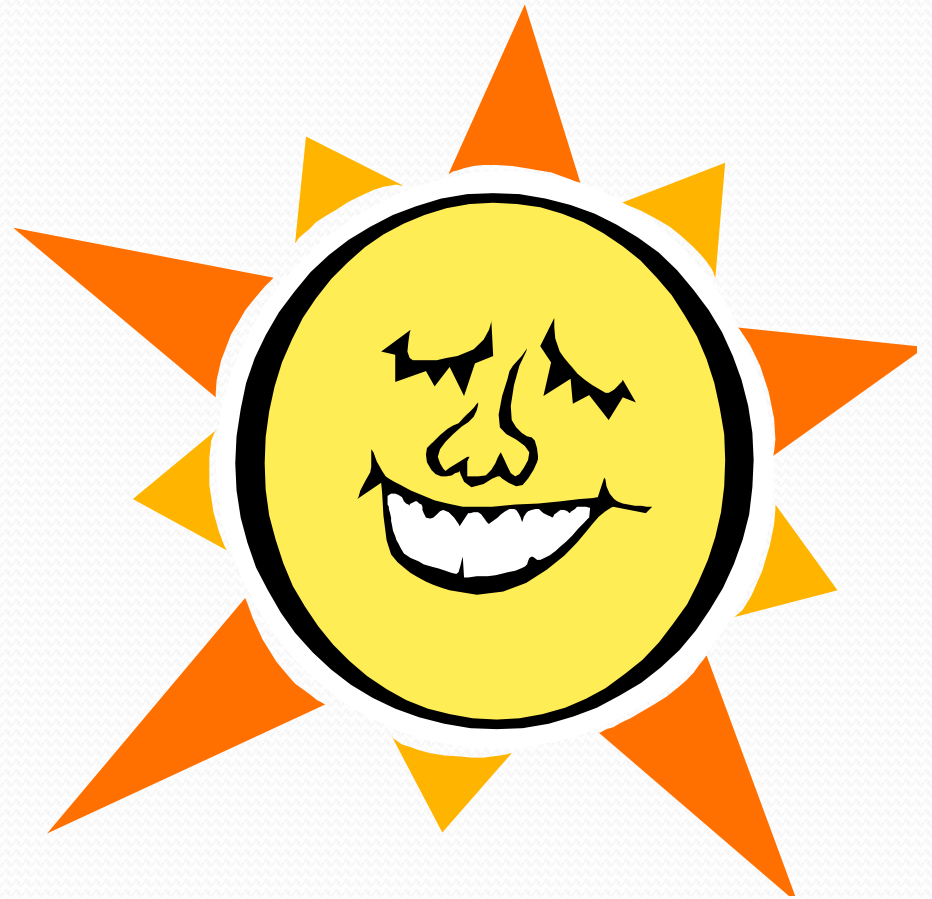
- Data is from September, 1907
- Location is possibly the WAMCATS telegraph station at Fairbanks
- Date was changed to August 1909 before 1924
- Temps noted as too low (possibly) in 1943
- August, 1909 remains missing

# Fairbanks

## Record High Temperature

- 99F on July 28, 1919
- 95F on July 29, 1919 ties third highest temp of record

Is there a problem?

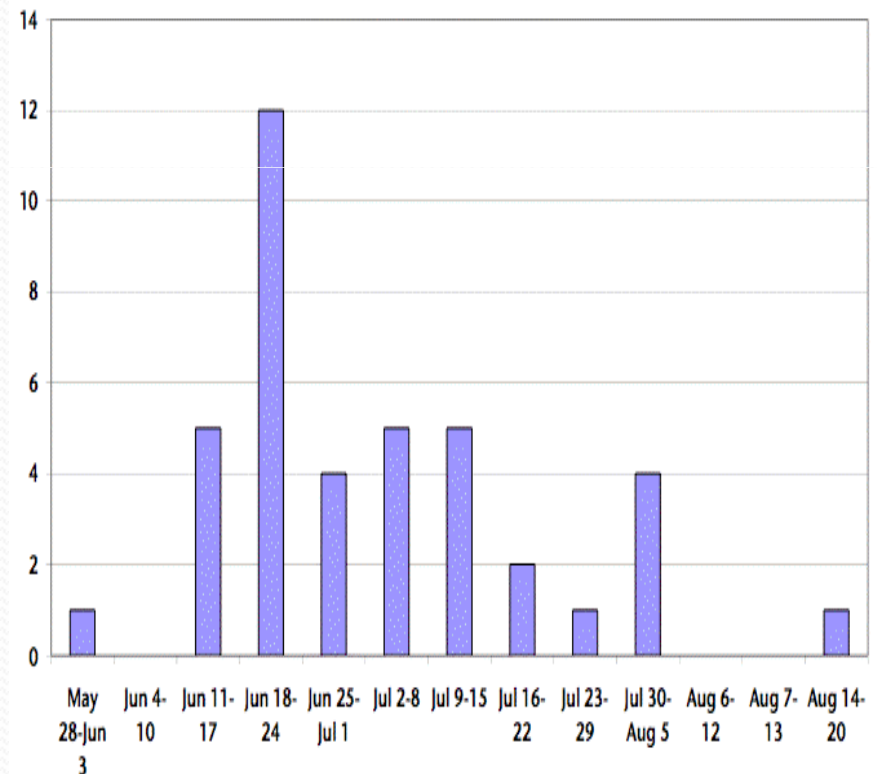




# Internal Suspensions

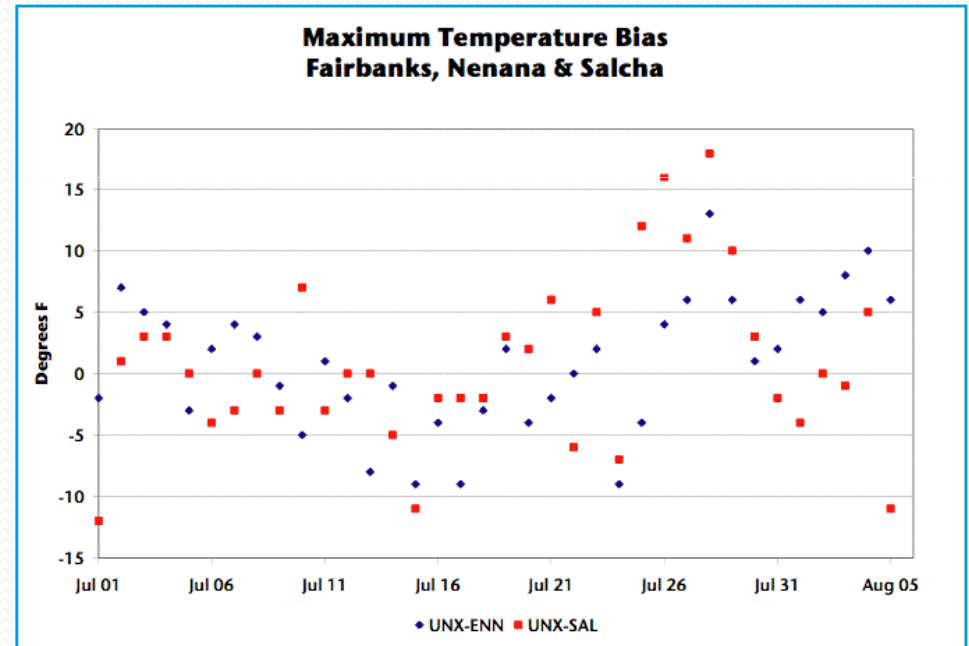
- Late in the summer for 90F heat
- Only occurrences later than July 11th temp >93F
- Part of run of summers with “many hot days”
  - One quarter of all  $\geq 90F$  temps ever recorded are during summers 1915-19 (in 104 summers)

**Fairbanks Frequency Days  $\geq 90F$   
1905-2008 (excluding 1919)**



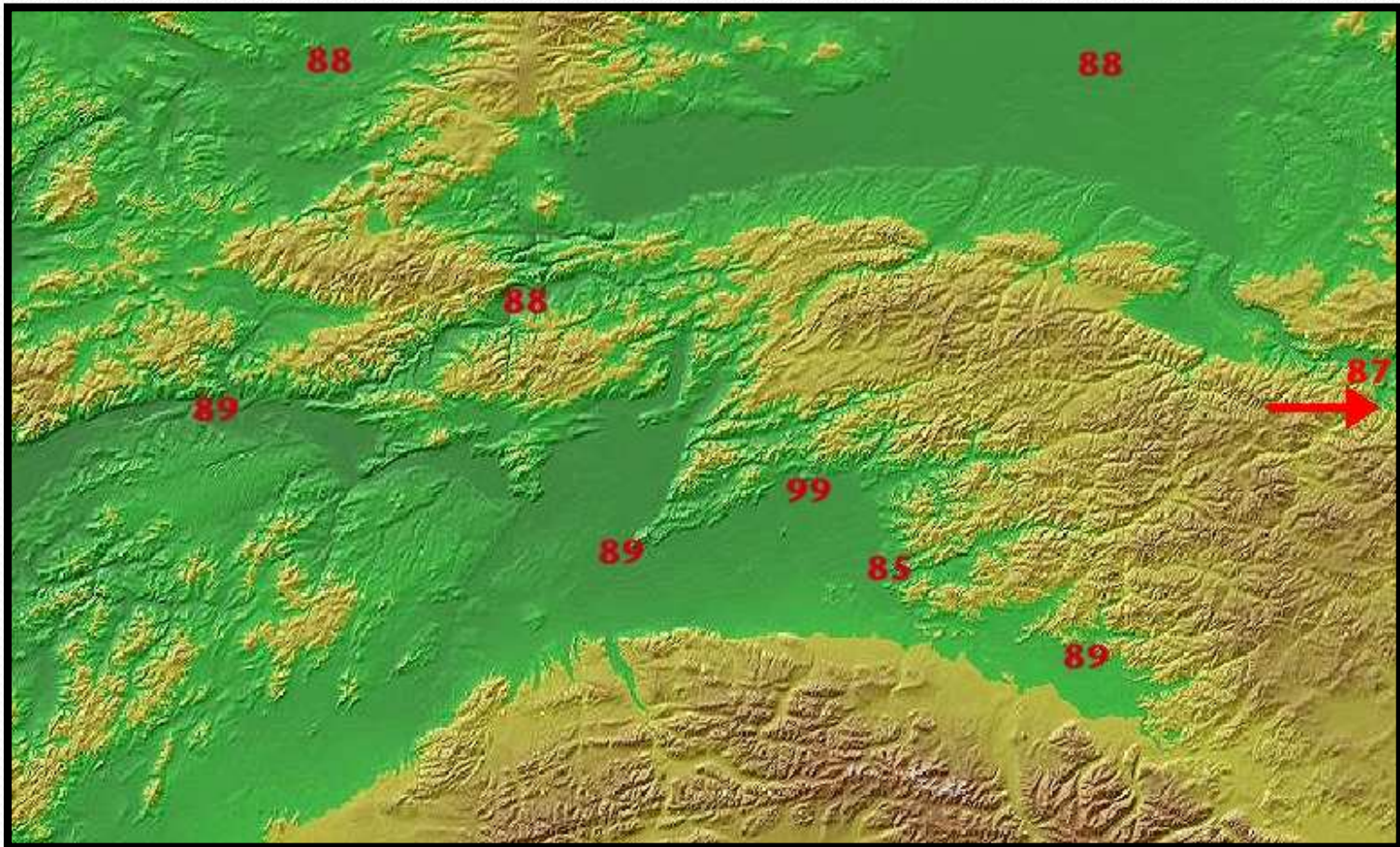
# Comparative Suspensions

- Apparent change in bias when compared to closest neighbors



# Maximum Temperature July 25-31, 1919

Any  
process  
that would  
account  
for this  
spread?



# Comparative Suspensions

- No evidence for convection from any observation

57	53	14	58	DN	9.4	.10	W	cloudy
64	49	15	55	DN	9.4	.08	SE	cloudy
52	50	12	60	DE	11.32	.18	SE	cloudy
62	51	17	55	DE	9.4	.02	W	cloudy
60	48	18	53	DE	9.4	.02	W	cloudy
73	48	25	55				SE	clear
82	45	44	54				W	clear
37	46	43	80				W	clear
88	57	42	75				W	clear
56	60	35	77				SE	clear
68	62	20	76				SE	clear
81	82	52	70				W	clear
234	1576							
744	508							

Readings of maximum, minimum, and mean daily temperature, humidity, rain, wind, and general remarks.

*C. A. ...*

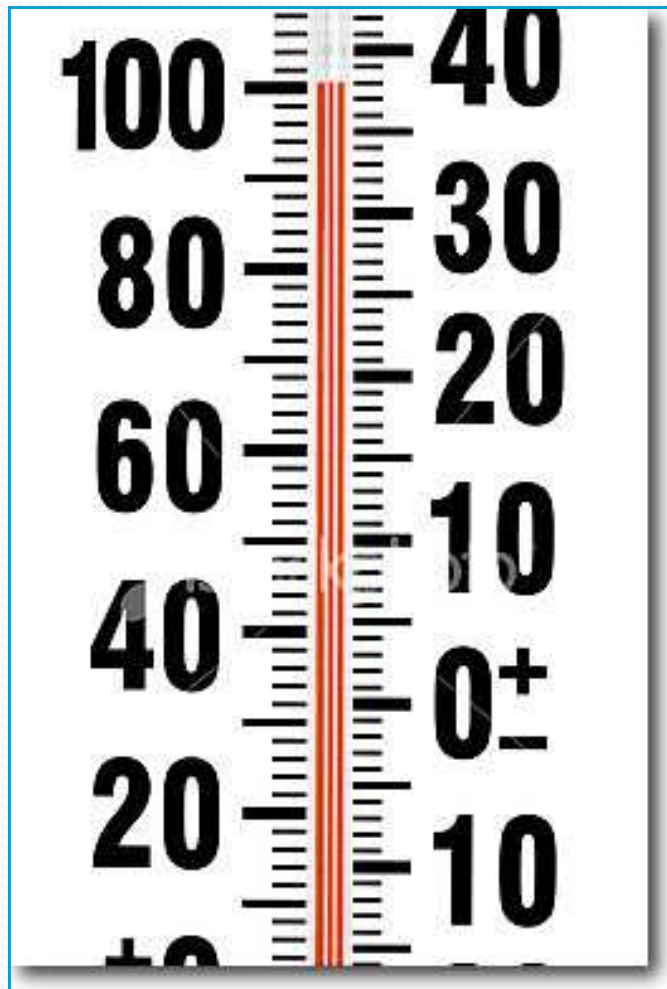


# Evaluation

- Upper 90s at Fairbanks in late July 1919 correspond with near record warm event for late July
- Internal and comparative evidence strongly suggest reported max temps too warm
- No meteorological evidence to support reported max temps
- No WB/NWS era heat wave has this kind of spread

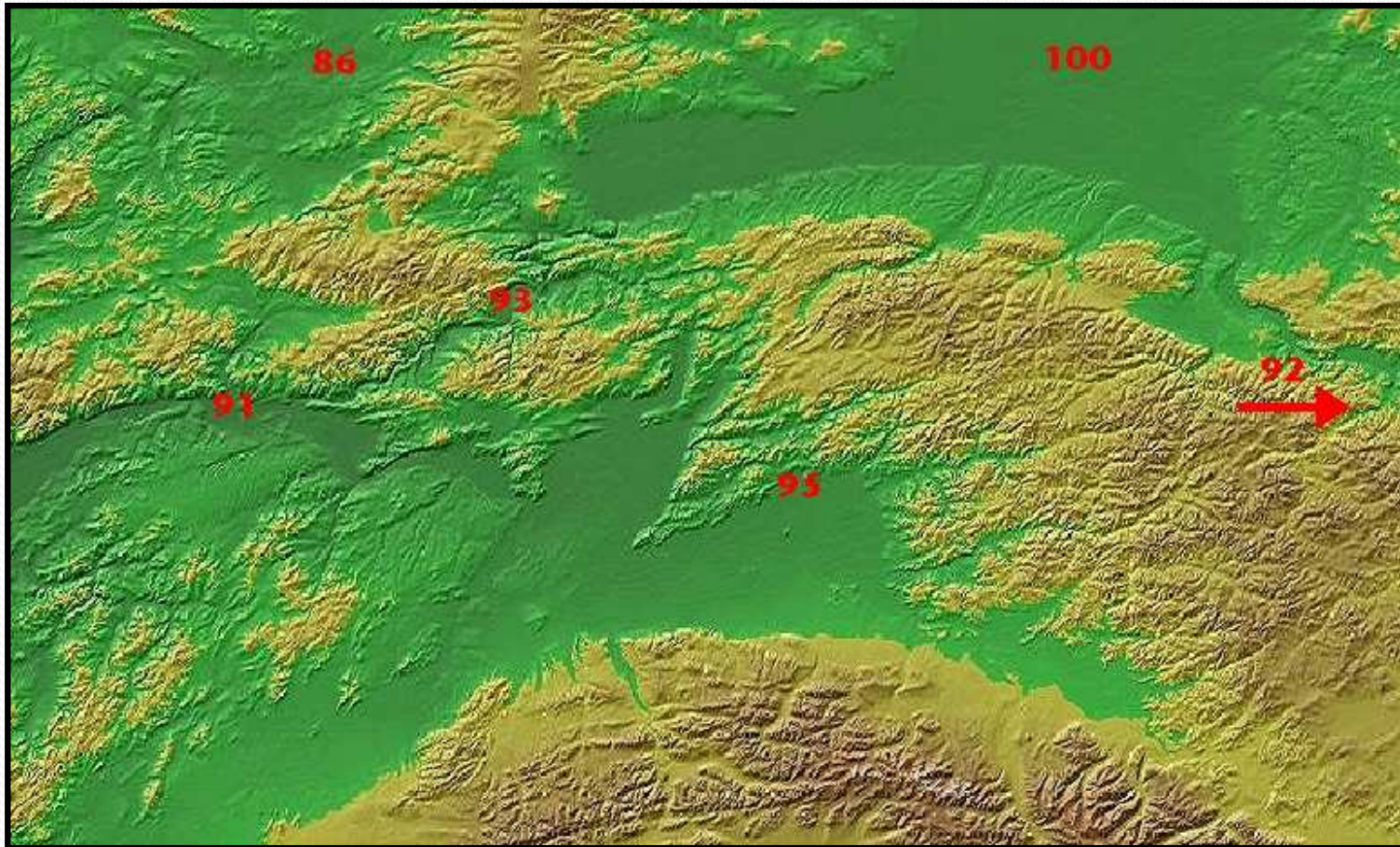


# The Grand Champion



- The highest accepted temperature in Alaska is 100 degrees.
- Could it really have been that hot in Fort Yukon on June 27, 1915?

# Max Temperature June 25-30, 1915





# Evidence

- Pros

- Internal
  - just after summer solstice
  - reliable 97° in July 1955
- Comparative
  - stations with reasonably complete data, this event highest June temperatures in the early 20th century

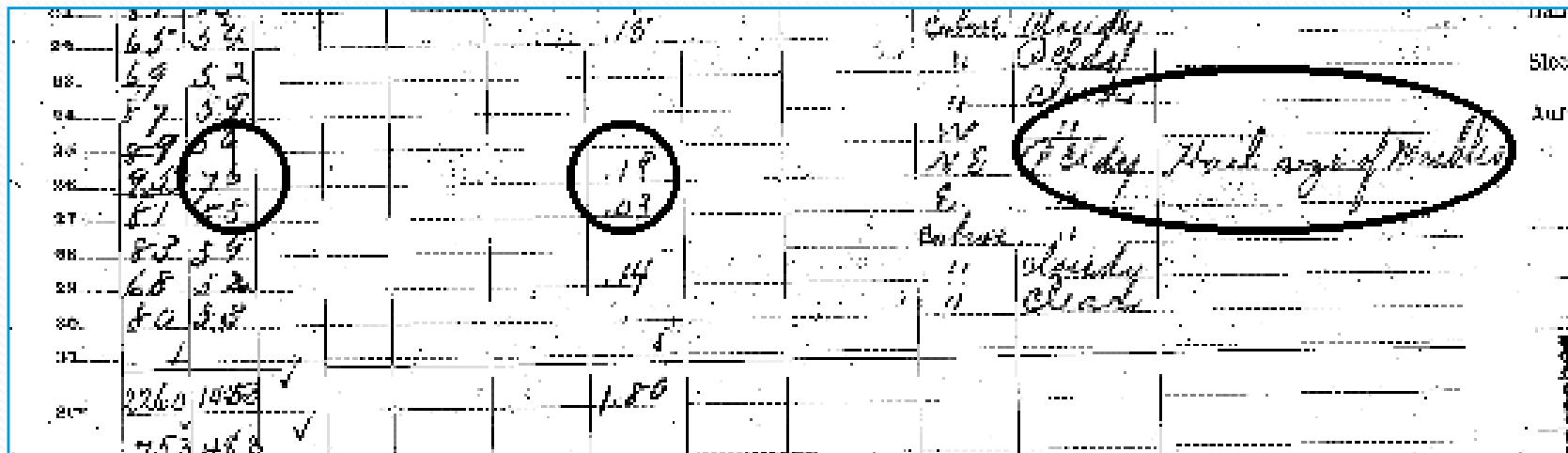
- Cons

- Internal
  - one of only a handful of temperatures above the low 90s,
  - Diurnal ranges ~50°
- Comparative
  - significantly warmer than nearest neighbors: 7° (Rampart) & 8° (Eagle)
  - No other location had 6-day heat wave

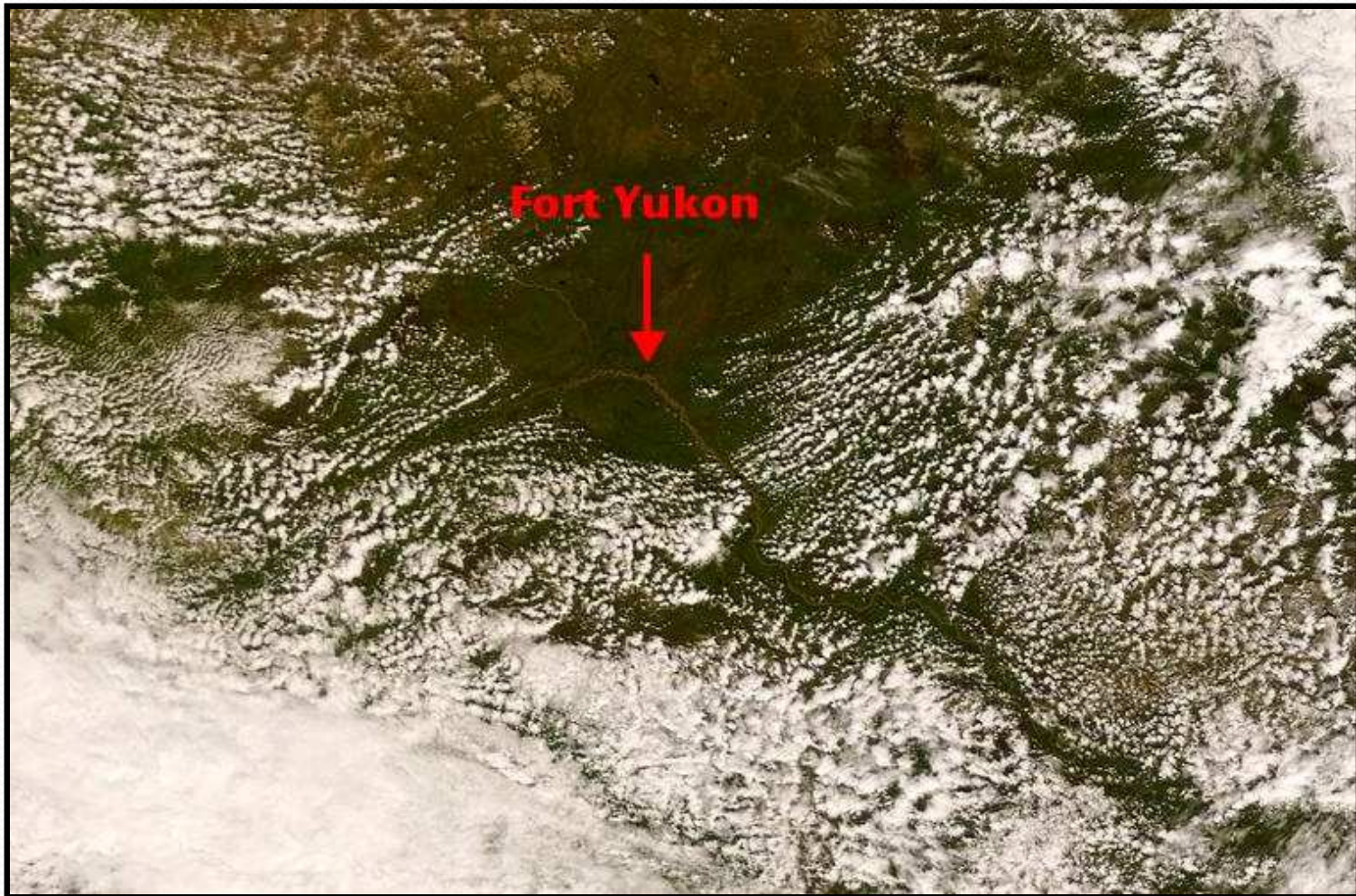


# Additional Information

- Evidence that air mass was exceptionally warm, supporting super-heating
- Evidence of convection, possibly suppressing temps



# Yukon Flats are often devoid of convection



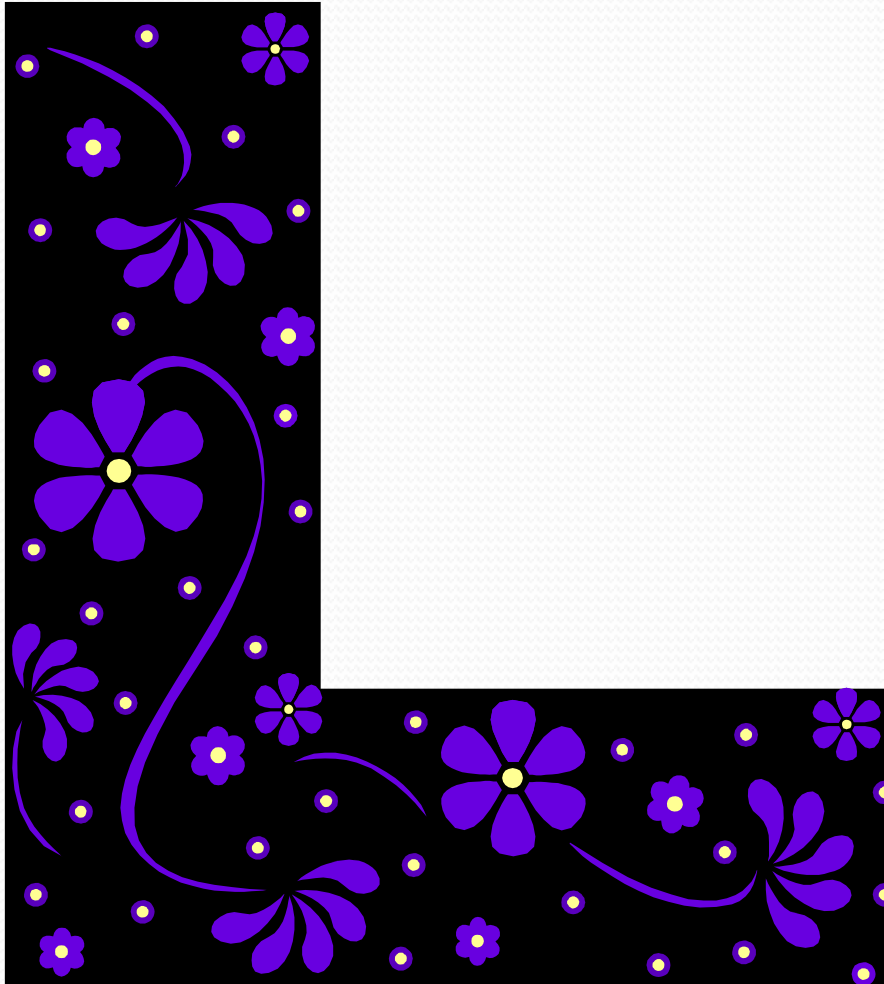
# Evaluation

- Balance of evidence supports analysis of very warm air mass over Interior Alaska last week of June, 1915.
- Meteorologically reasonable that Yukon Flats remained largely convection-free.
- Temperature of 100F at Fort Yukon on or about June 27, 1915 is plausible.



100°

# Summary



- Detailed evaluation of extreme events
- Correct paperwork error
- Expose erroneous data—even that sanctified by time
- Increase confidence in historic events