

REGIONAL CLIMATE

DR. DAVE DUBOIS

ASSOCIATE PROFESSOR, NEW MEXICO STATE UNIVERSITY

STATE CLIMATOLOGIST OF NEW MEXICO



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WEATHER VS. CLIMATE

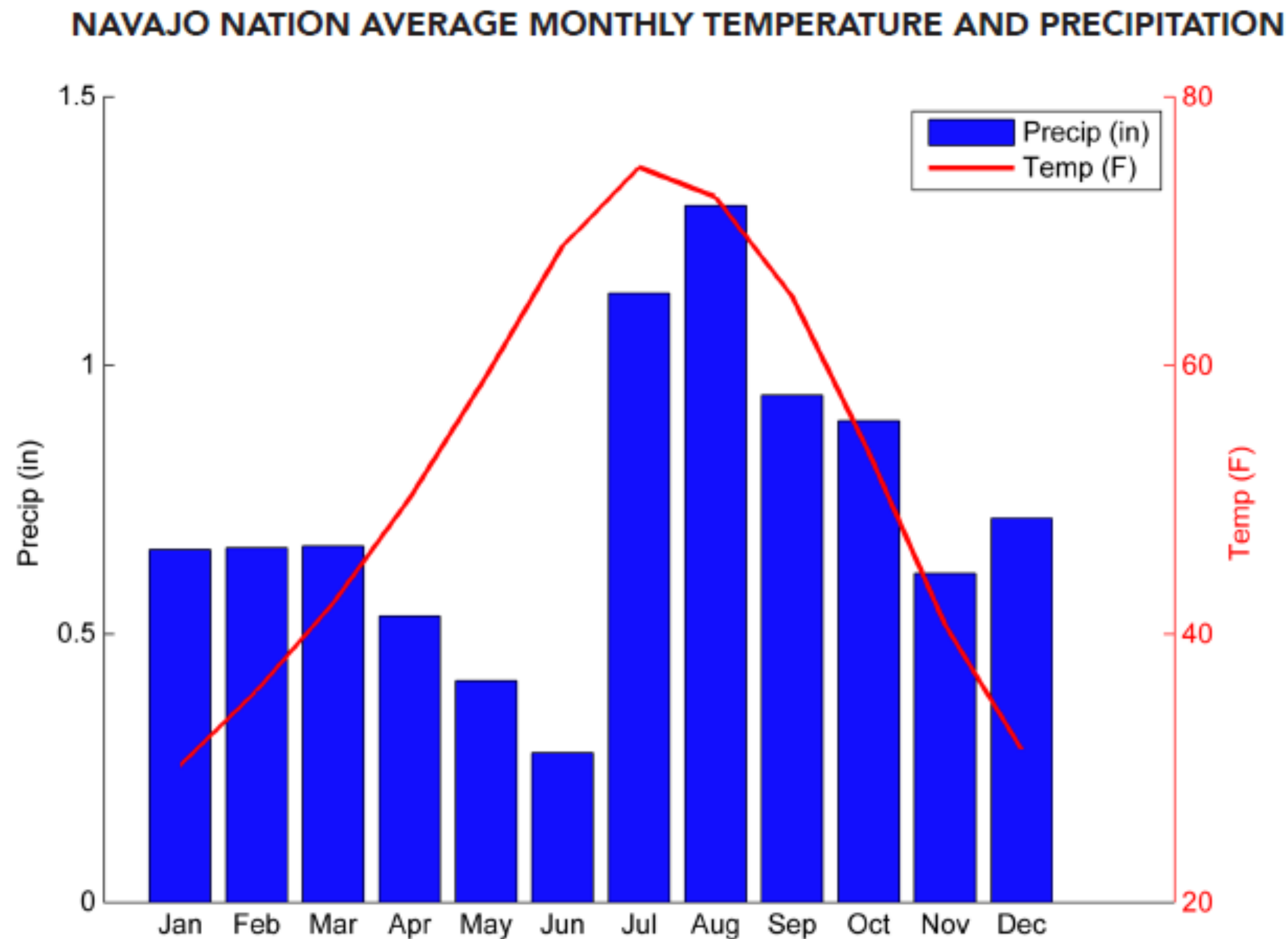
Weather – state of the atmosphere with respect to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness; short-term

Climate – statistical collection of weather conditions at a place over a period of years; long-term

“Climate is what you expect. Weather is what you get.”



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from Crimmins et al. 2013

Two wet seasons: winter & summer
Winter – frontal storms, snow to mountains
Summer – monsoon, high variability

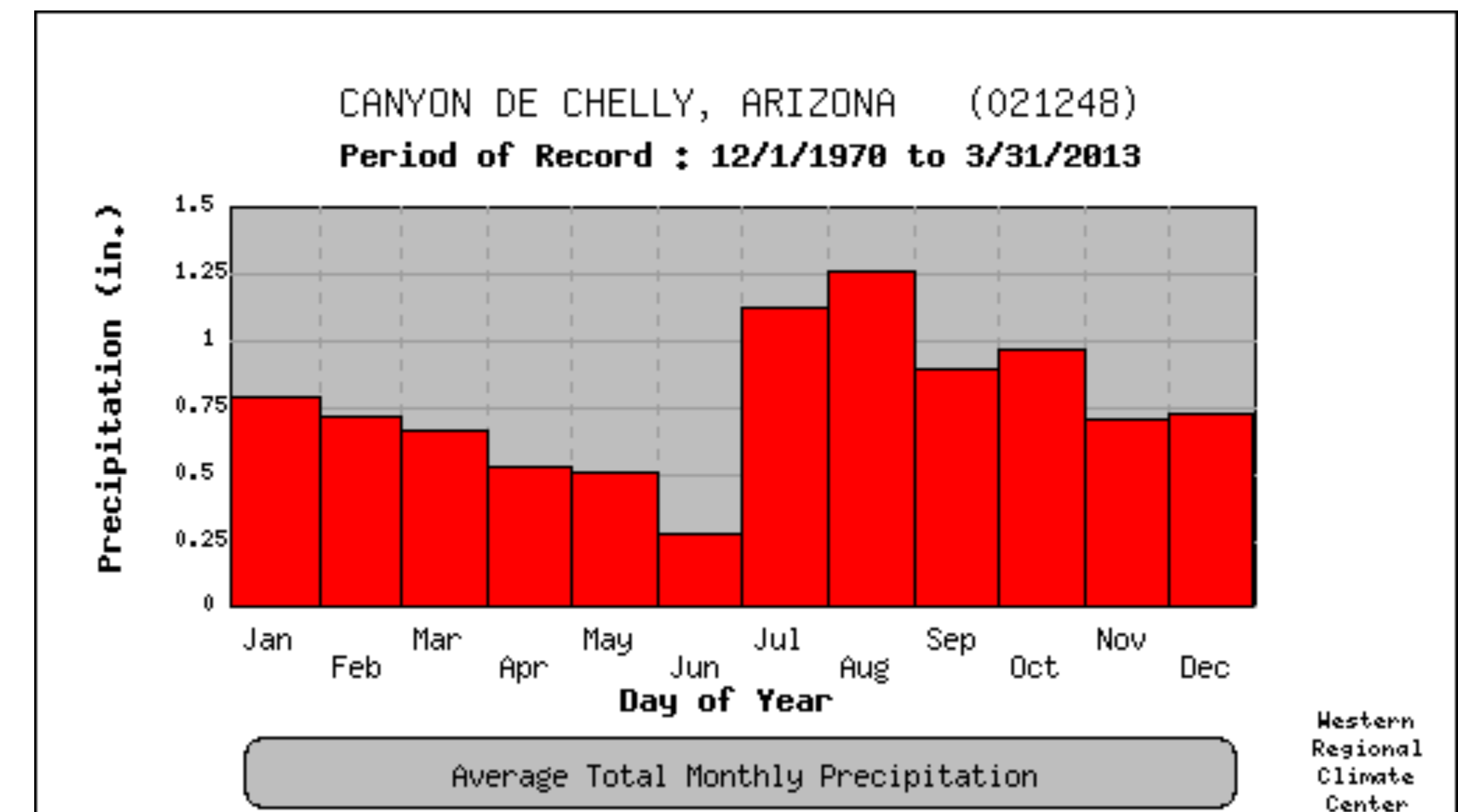
June is driest month

Inter-annual variability of precipitation mainly from El Niño (cooler & wetter) & La Niñas (warm and drier)

CANYON DE CHELLY CLIMATOLOGY

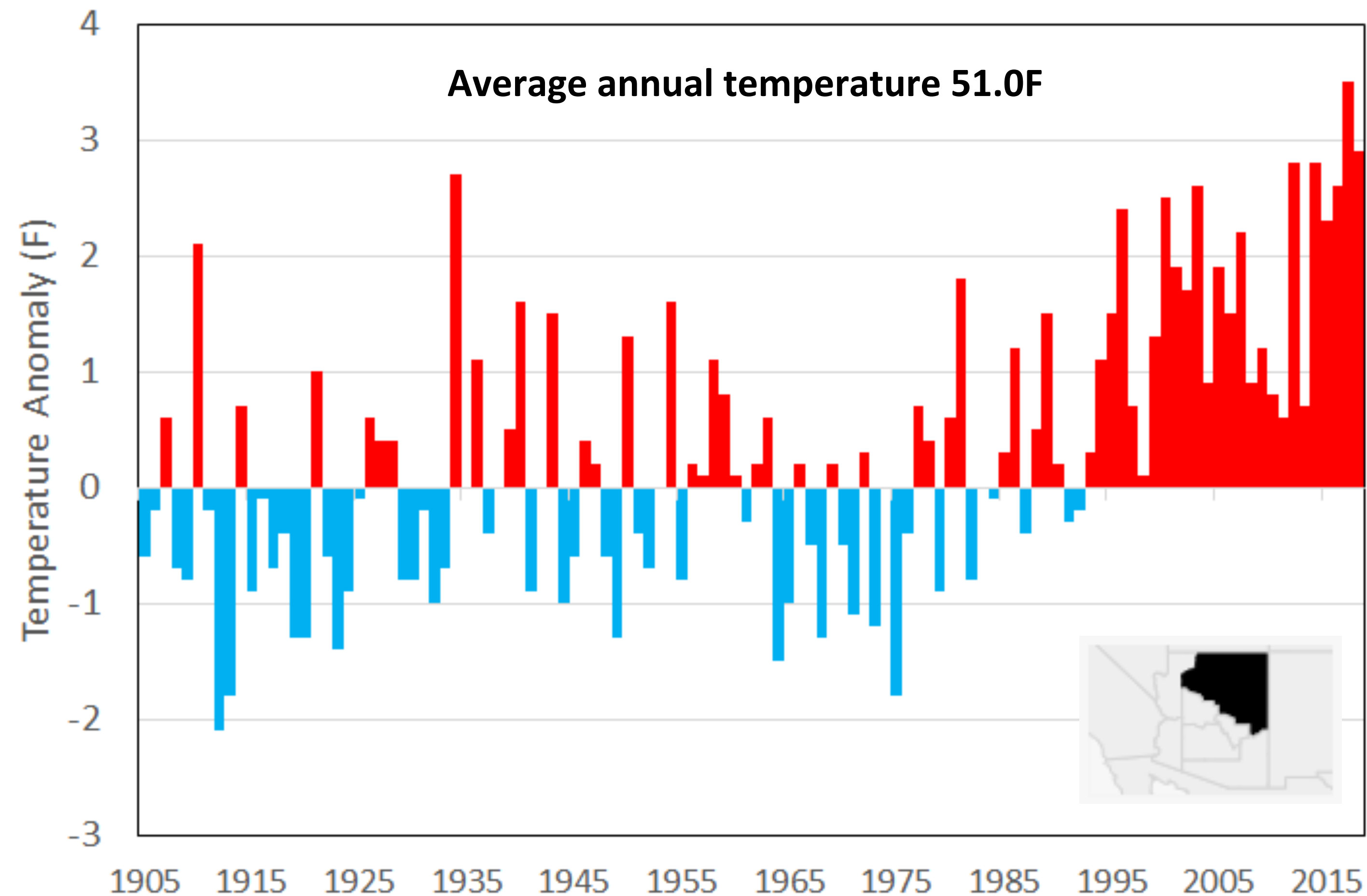
- Period of record 1908-present (111 years)
- Extreme cold -32°F (1/2/1919)
- Extreme hot 105°F (6/21/16, 7/14/03, 7/2/02)
- Most 24-hr precipitation 2.50" (1/24/1943)
- Snowiest year was 1964 (27.5")

Elev. 5610'



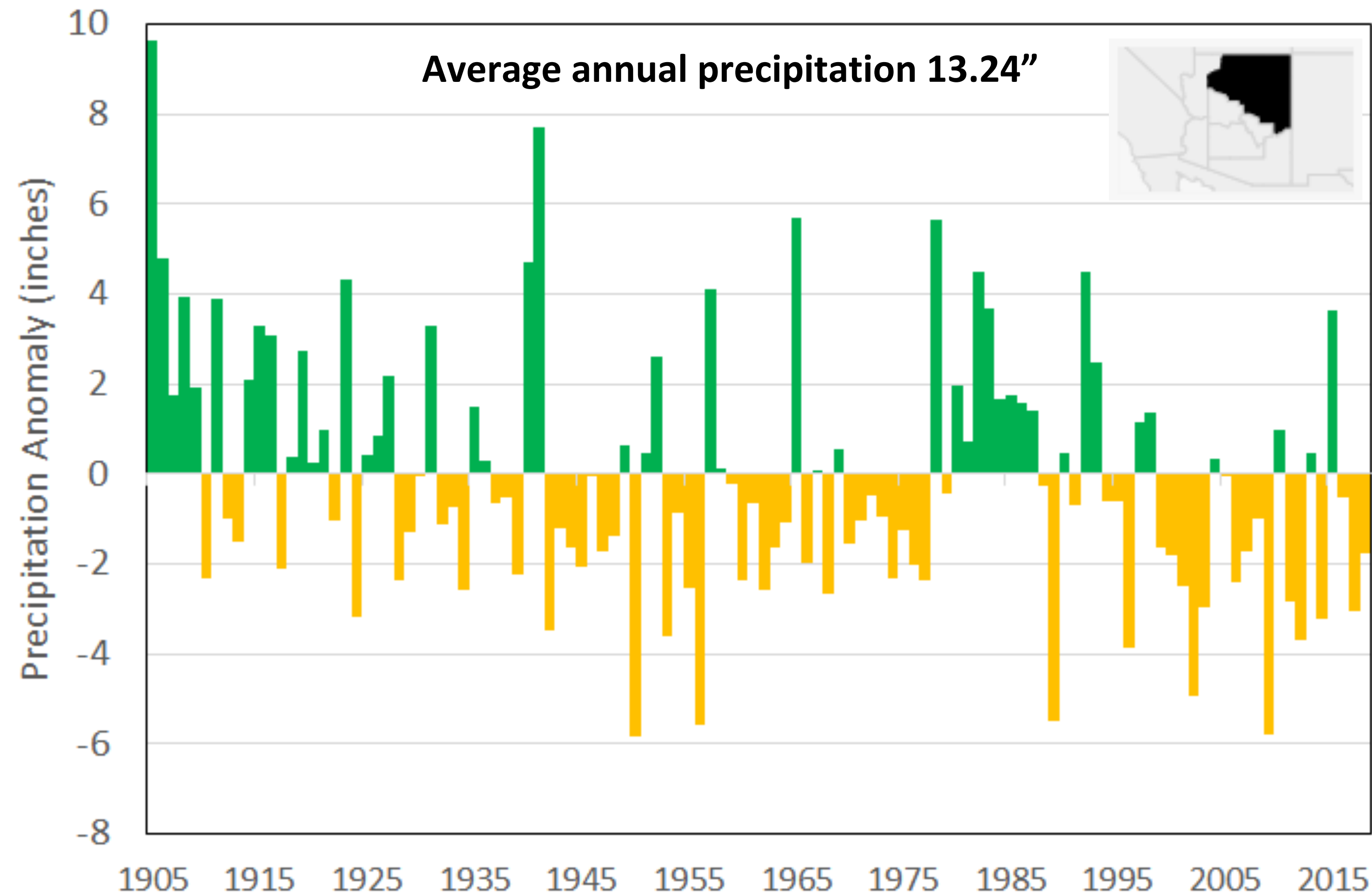
Annual Temperatures over the past 113 years

Arizona climate division 2 departure from average (1901-2000)



Annual Precipitation over the past 113 years

Arizona climate division 2 departure from average (1901-2000)



EXTREME WEATHER EVENTS

- Heat waves
- Extreme cold
- Intense precipitation, flooding
- High winds & blowing dust
- Drought

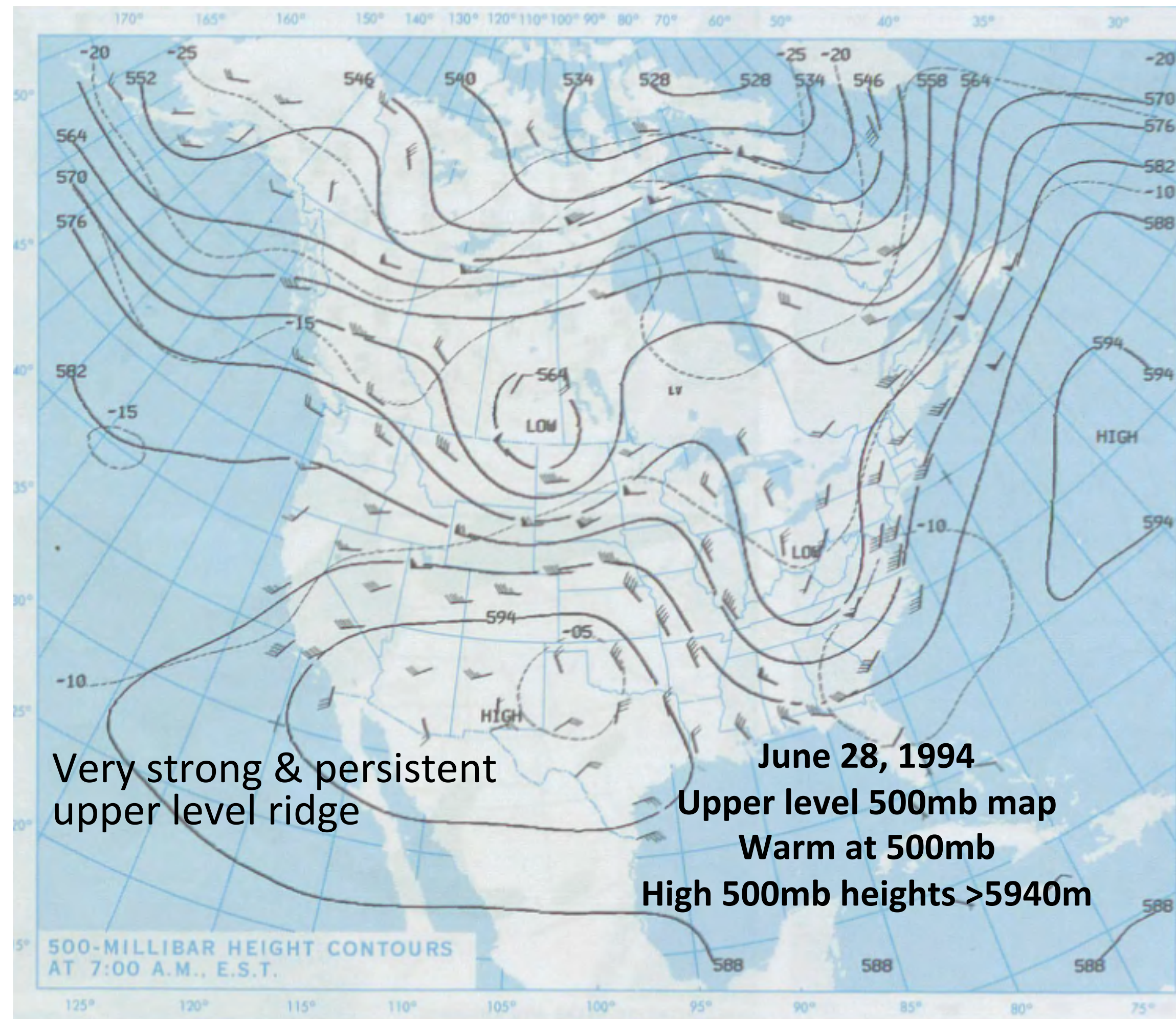


IMPACTS OF EXTREME WEATHER

- Flooding, flash flooding
- Transportation shutdown - roads blocked, closed, washed out, cut-off (erosion/debris flows)
- Loss of supply lines for food
- Loss of power and water
- Medical emergencies
- Economic losses - agriculture



JUNE 1994 HEAT WAVE



High Obs. on 6/27

Carlsbad 122°F

Tuba City 101°

Holbrook 105°

Page 103°

Canyon de Chelly 100 °

Teec Nos Pos 100

Window Rock 95

Cochiti Dam 106°

Shiprock 101 °

Jemez Springs 99°

Red River 87°



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HEAT WAVES

Consecutive hot days at Canyon de Chelly

- For example **5 day** average of 103.6°F in 2003

**Maximum 5-Day Mean Max Temperature
for CANYON DE CHELLY, AZ**

Rank	Value	Ending Date	Missing Days
1	103.6	2003-07-15	0
2	103.2	2003-07-14	0
3	102.8	2003-07-16	0
4	102.8	1989-07-08	1
5	102.5	1989-07-07	1
Period of record: 1908-12-02 to 2019-08-08			



EXTREME COLD EVENTS

- High impacts from individual and consecutive days of extreme cold

**Minimum 1-Day Mean Min Temperature
for WINDOW ROCK AP, AZ**

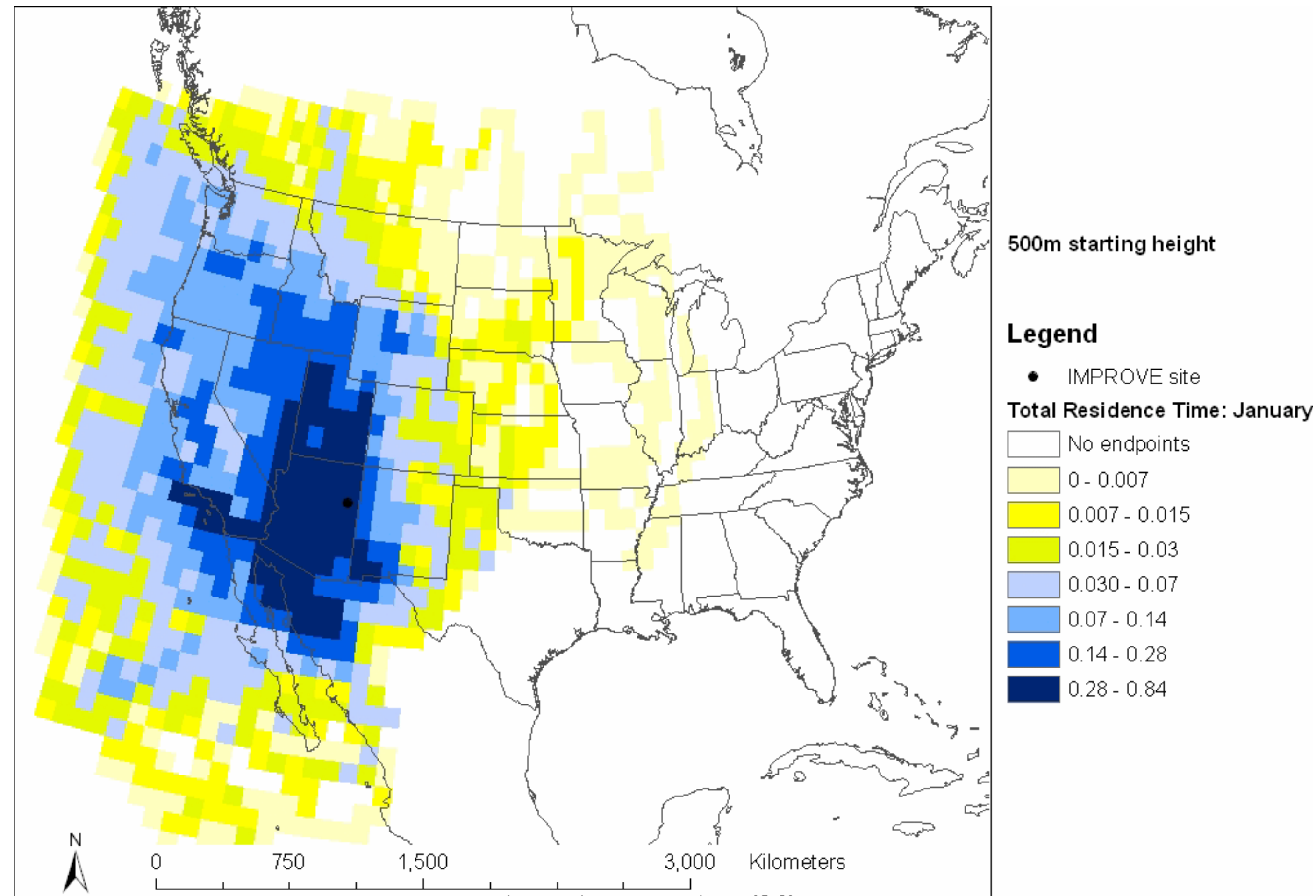
Rank	Value	Dates
1	-25.0	2011-01-01 through 2011-01-01
2	-23.0	2011-02-03 through 2011-02-03
3	-22.0	2013-01-15 through 2013-01-15
4	-20.0	2011-01-02 through 2011-01-02
5	-18.0	2013-01-12 through 2013-01-12
Period of record: 1998-08-14 to 2016-03-28		

**Minimum 5-Day Mean Min Temperature
for CANYON DE CHELLY, AZ**

Rank	Value	Dates	Missing Days
1	-25.4	1919-01-01 through 1919-01-05	0
2	-25.2	1919-01-02 through 1919-01-06	0
3	-23.6	1919-01-03 through 1919-01-07	0
4	-22.6	1919-01-05 through 1919-01-09	0
5	-22.4	1919-01-04 through 1919-01-08	0
Period of record: 1908-12-02 to 2016-03-28			



WHERE DO OUR WINTER AIRMASSES COME FROM?



3-yr backtrajectories from
Bandelier in January. Run every 3-
hr using Hysplit at 500m with EDAS
winds

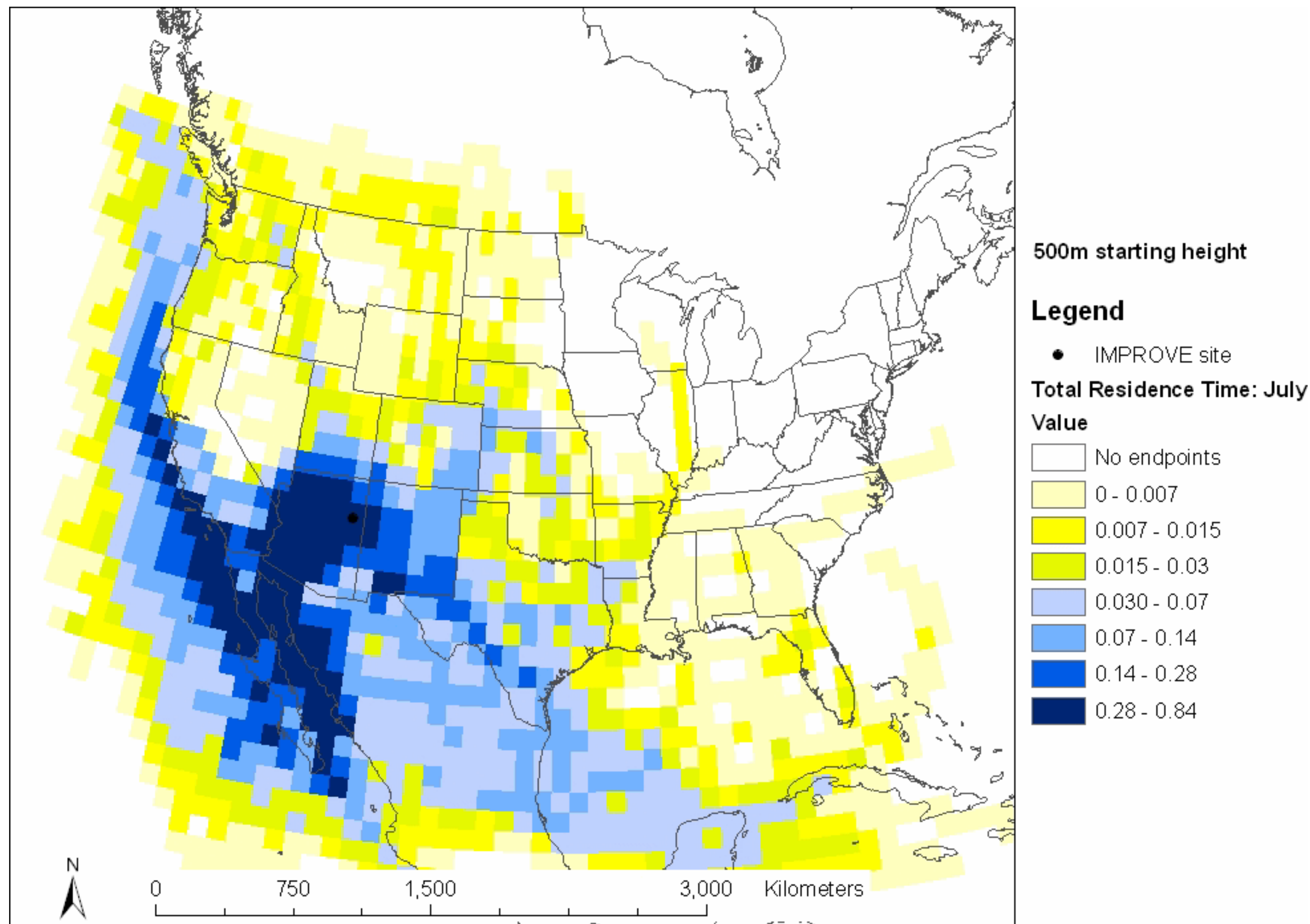
**Shows westerly and
northwesterly flow.
Very little from the
east.**



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OUR SUMMER MONSOON PATTERN

3-yr backtrajectories from Petrified Forest NP in July. Run every 3-hr using Hysplit at 500m with EDAS winds



**Shows
southwesterly flow
from Baja and up
the Pacific coast**



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DAILY PRECIPITATION EXTREMES

Painted Desert NP

Rank	Value	Ending Date
1	1.95	1982-09-06
2	1.80	2006-08-12
3	1.74	2005-08-10
4	1.71	1992-05-28
5	1.65	2006-07-31
6	1.61	1993-01-08
7	1.56	2010-09-22
8	1.52	1988-08-15
9	1.51	2017-07-27
10	1.50	2004-10-25
Last value also occurred in one or more previous years.		
Period of record: 1973-10-01 to 2019-07-31		

Gallup Airport

Rank	Value	Ending Date
1	2.36	1988-04-16
2	2.02	1981-07-17
3	1.94	2009-09-05
4	1.91	2008-07-11
5	1.88	1977-07-19
6	1.80	1975-08-11
7	1.76	1997-09-08
8	1.62	1974-07-16
9	1.54	2016-08-05
-	1.54	1978-10-21
Period of record: 1973-01-08 to 2019-08-18		

Canyon de Chelly

Rank	Value	Ending Date
1	2.50	1943-01-24
2	1.94	1943-08-12
3	1.92	1988-07-11
4	1.85	1943-08-30
5	1.77	1937-09-30
6	1.65	1959-08-11
7	1.64	1994-08-19
8	1.60	1963-08-06
9	1.55	1923-09-18
10	1.54	1994-09-03
Period of record: 1908-12-02 to 2019-08-08		

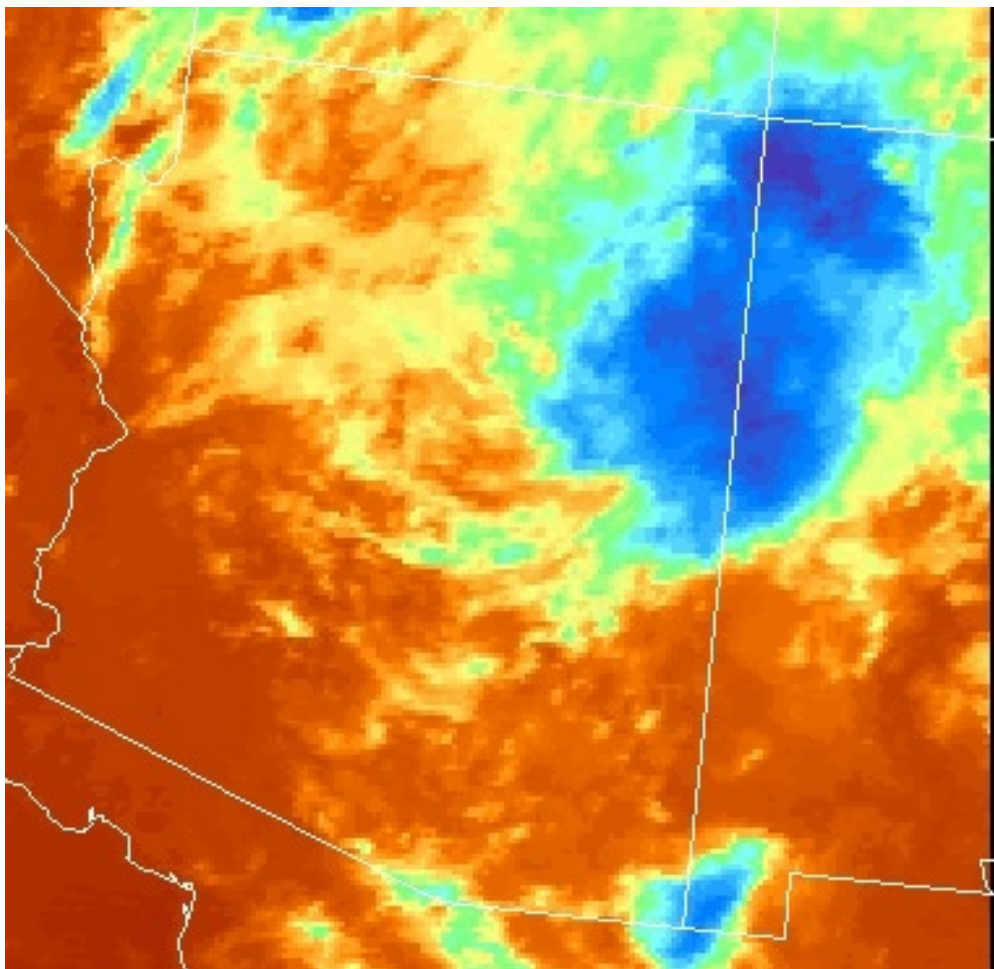


24-HR EXTREME PRECIPITATION

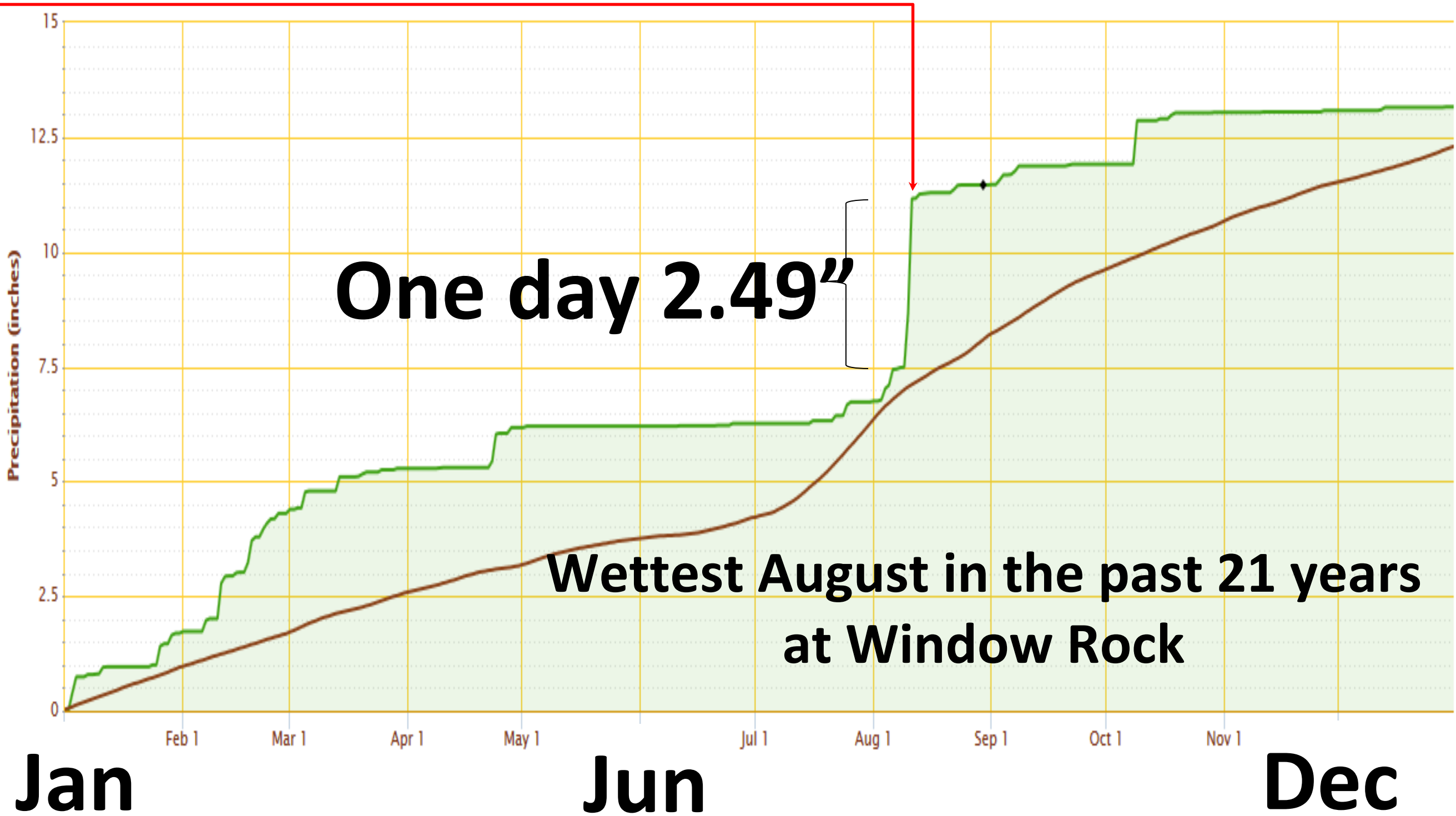
Maximum 1-Day Total Precipitation
for WINDOW ROCK AP, AZ

Rank	Value	Ending Date
1	2.49	2005-08-11
2	1.68	2010-01-21
3	1.63	2011-08-01
4	1.51	2010-09-22
5	1.45	2004-09-29

Period of record: 1998-08-14 to 2016-03-27



Window Rock, August 11, 2005



“The most severely hit areas were along the Tse Bonito Wash just across the Arizona-New Mexico border next to the Navajo capital of Window Rock. Water in the wash rose to a estimated 28 feet Thursday evening, tearing out two bridges and stranding about 100 residents on the west side of the wash.” Navajo-Hopi Observer (Aug 18, 2005)

24-HR EXTREME PRECIPITATION

Maximum 1-Day Total Precipitation
for MEXICAN SPRINGS, NM

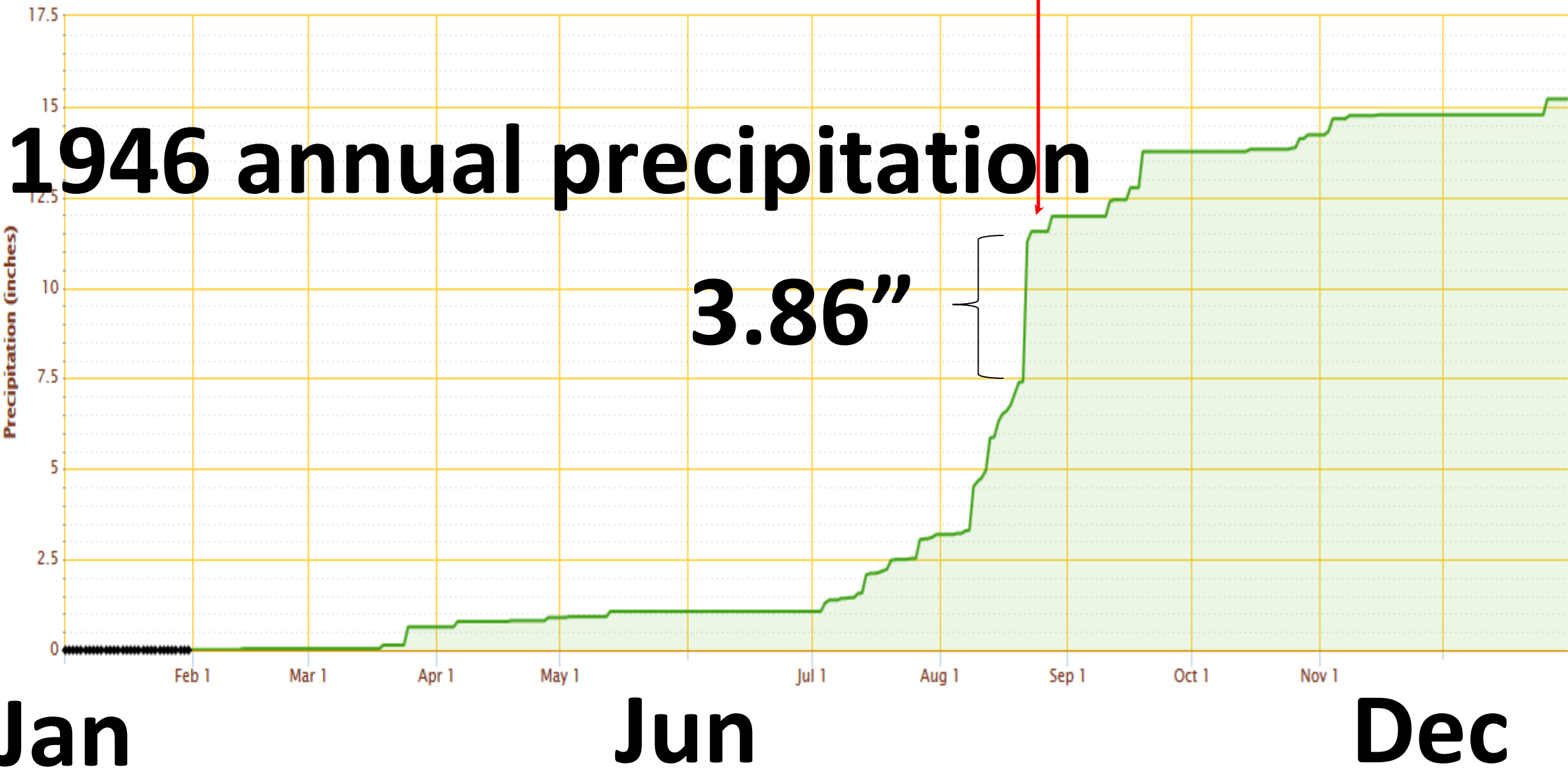
Rank	Value	Ending Date
1	3.86	1946-08-22
2	2.59	1934-05-30
3	2.07	1971-09-30
4	1.98	1965-12-23
5	1.75	1941-10-04

Period of record: 1934-05-01 to 1972-03-31

Ave. annual
precipitation 9.99"
(WRCC)

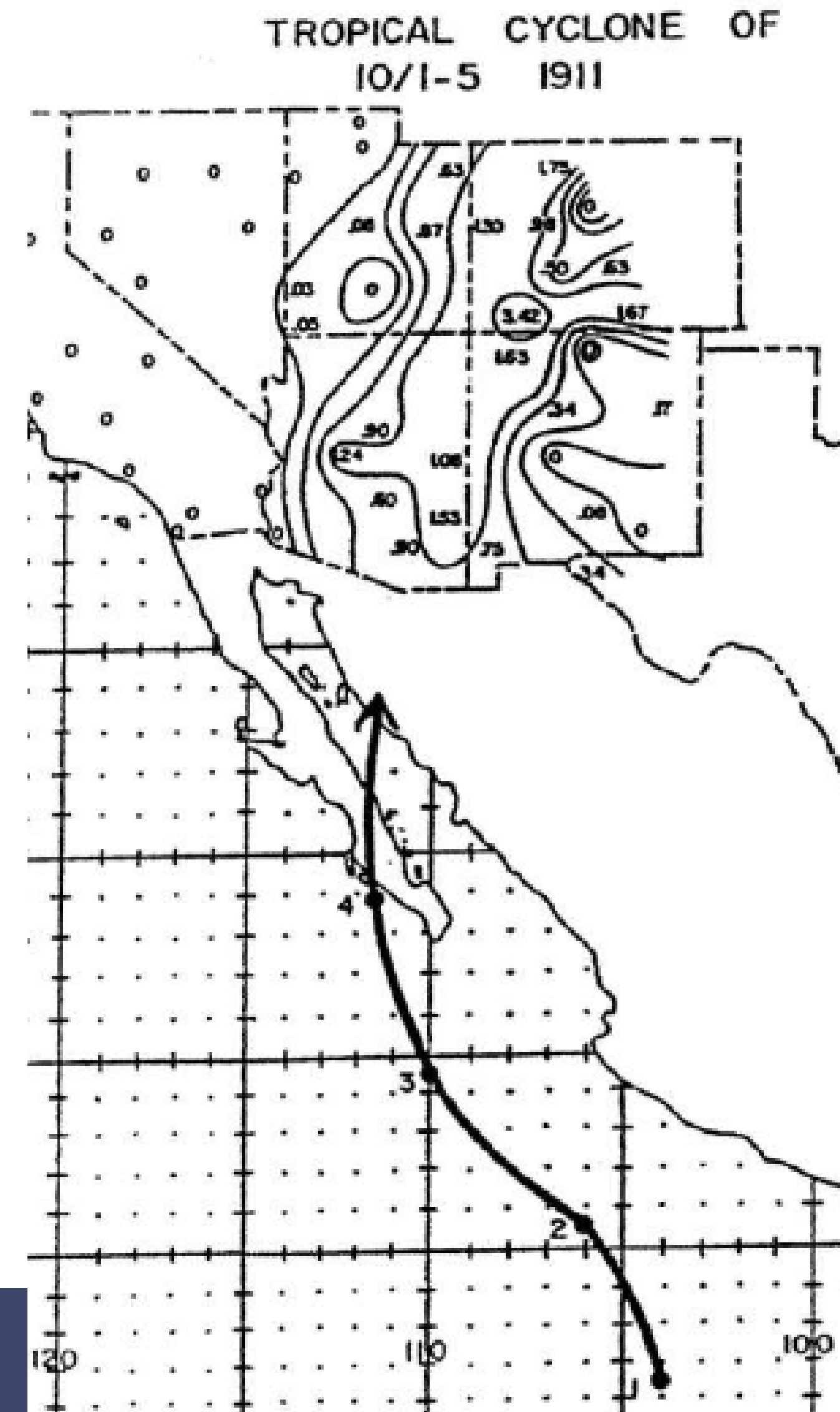
This represents about
39% of annual rain in
one day

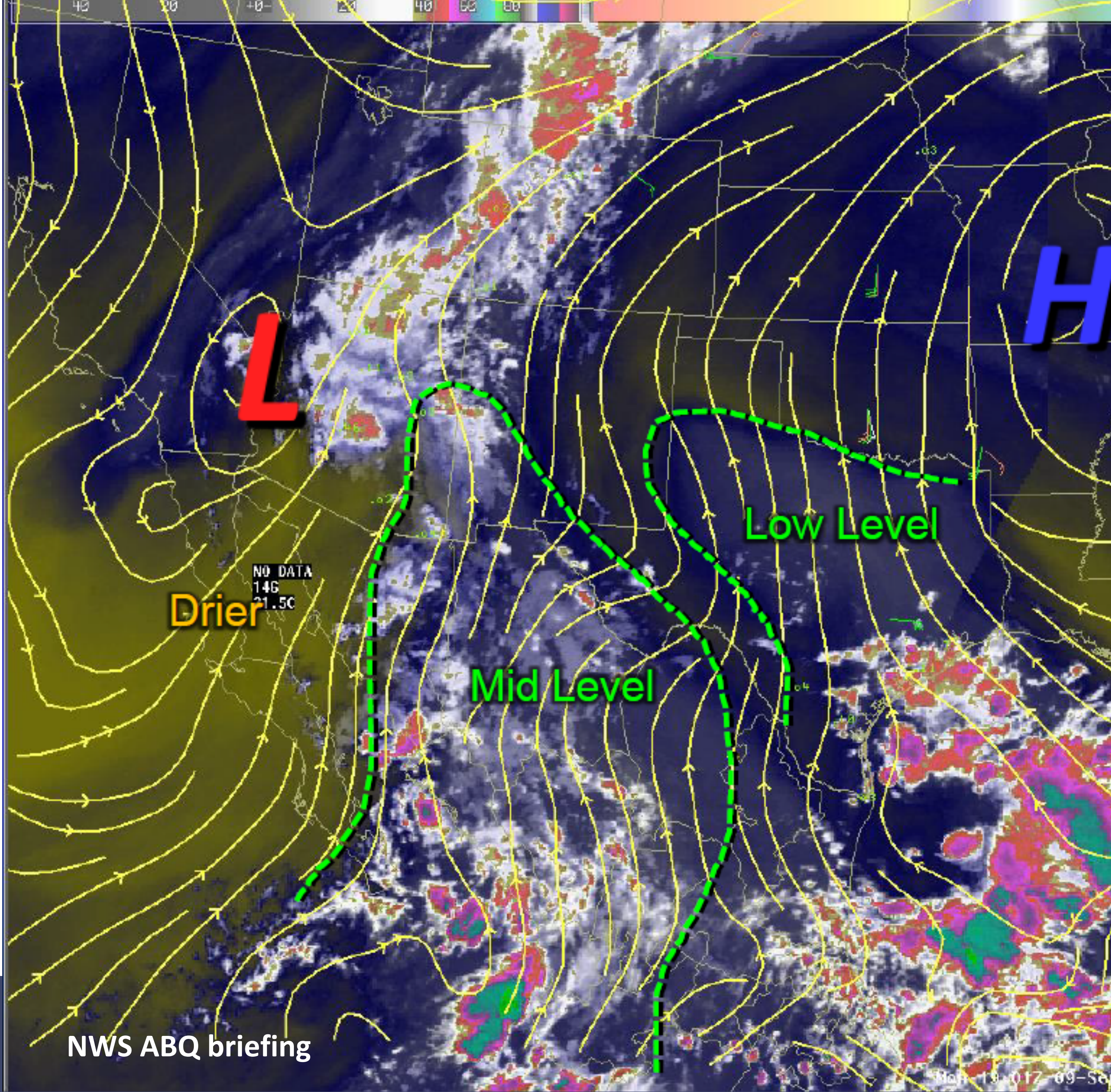
Mexican Springs one day total
3.86"



EXTREMES FROM TROPICAL REMNANTS

- September 1941
- September 1942
- October 1911
- Flood of record for the Animas River at Farmington (estimated 30,000+ cfs)

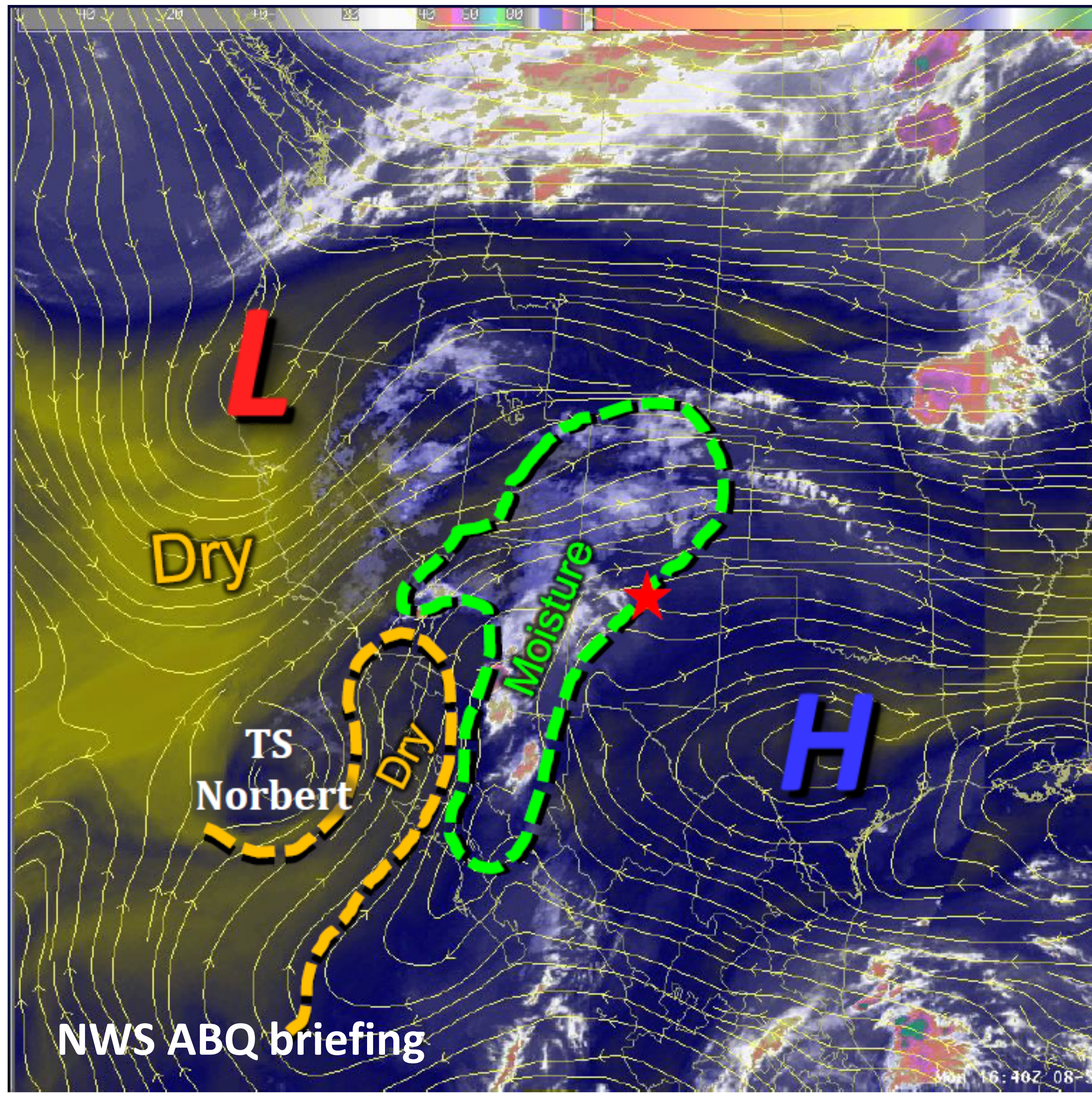




LATE SEASON
MOISTURE
POSSIBLE

SEPT. 9, 2013

**Tropical
Depression Lorena
off the coast of
Baja earlier**

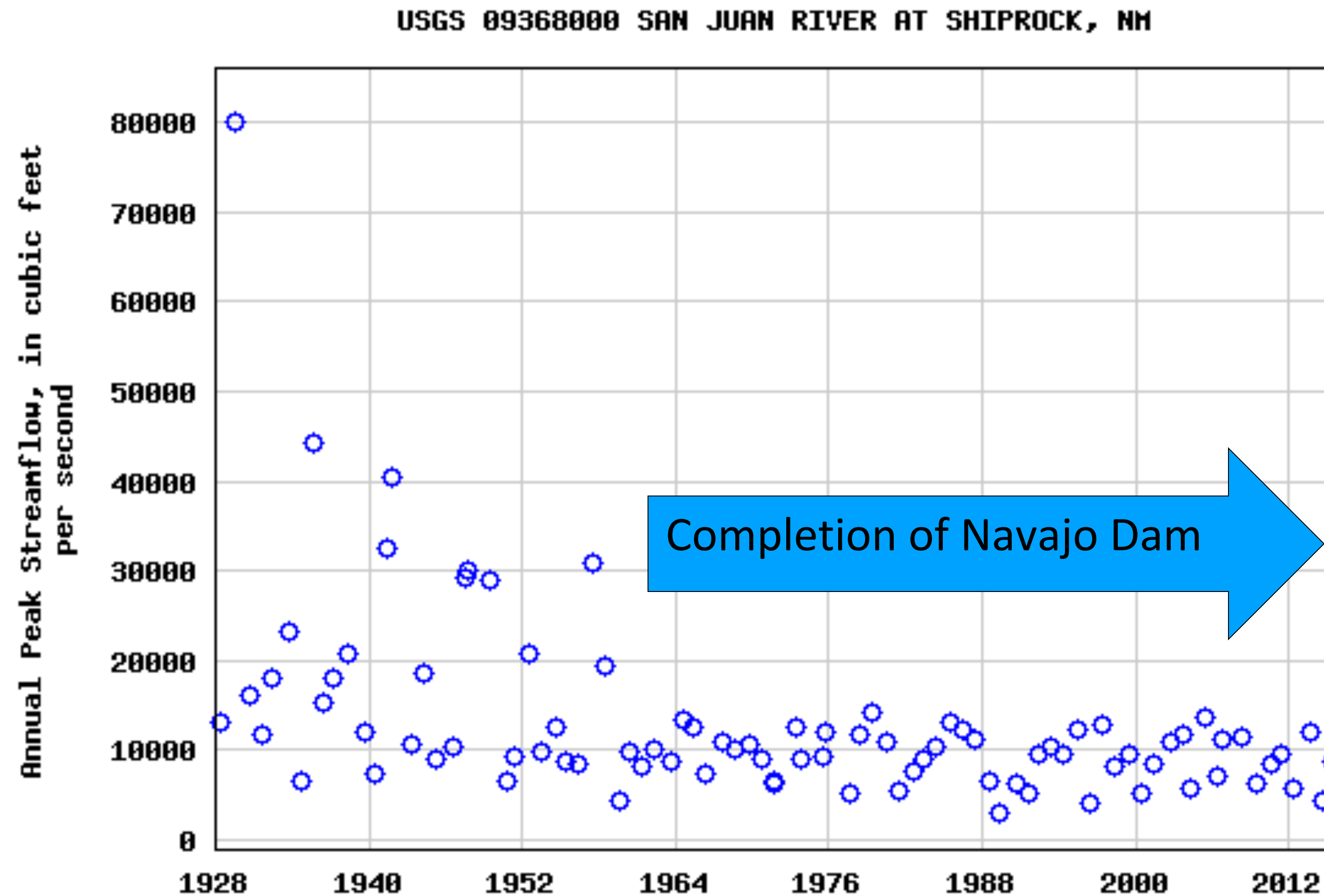


Tropical Storm Norbert Sept. 8, 2014

NWS ABQ briefing

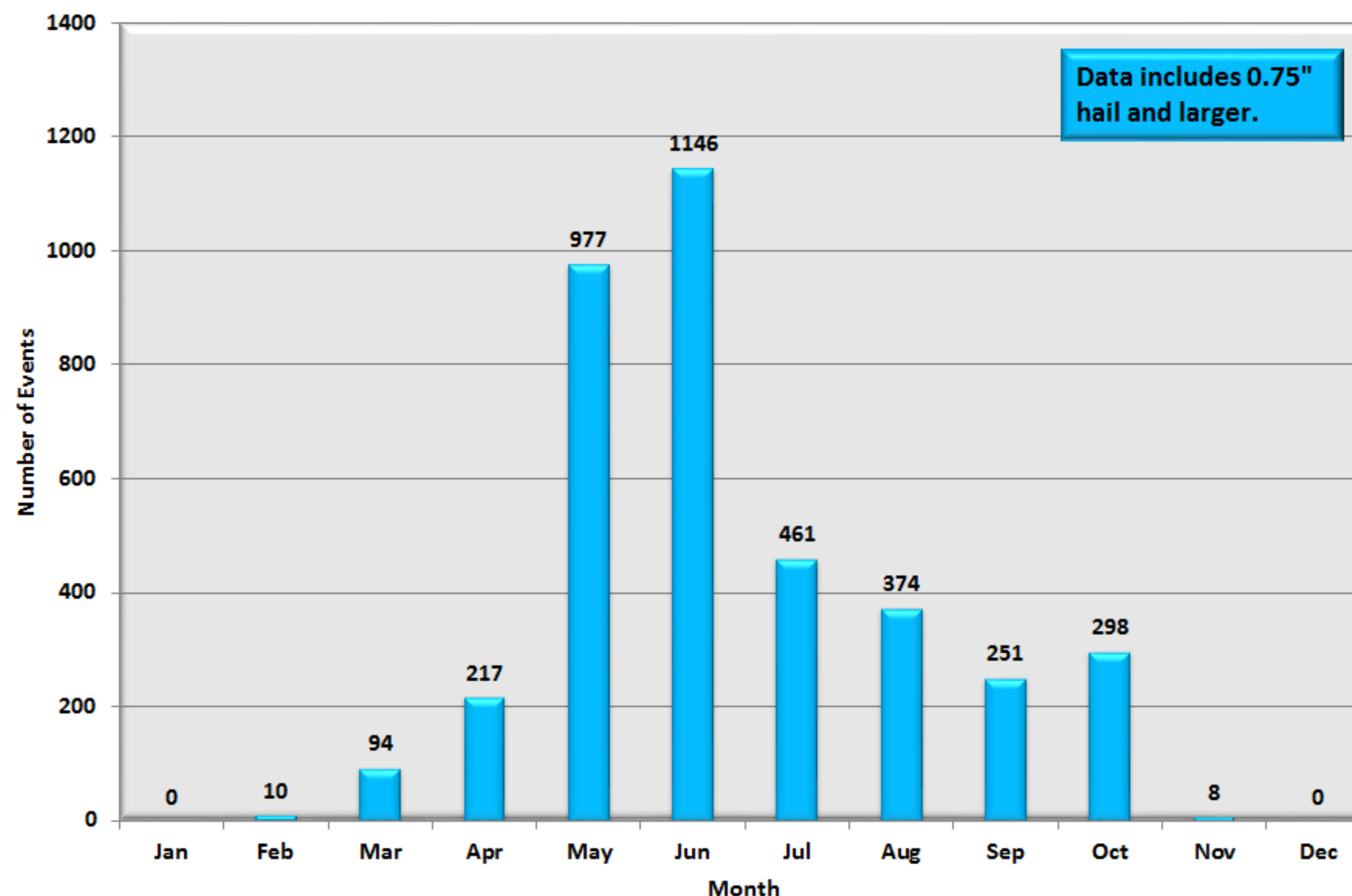
Mon 16:40Z 08-Sep

STREAMFLOWS ON SAN JUAN RIVER 1928 TO PRESENT



SEVERE WEATHER AND HAIL

NM Hail Events by Month
Storm Data (1955-2015)



Majority of hail events occur in eastern counties of NM but found in all areas of the region.

Most probable time is between 3 to 6 pm.

Most common to get small hail (rice to pea) but can be as large as 4.5"

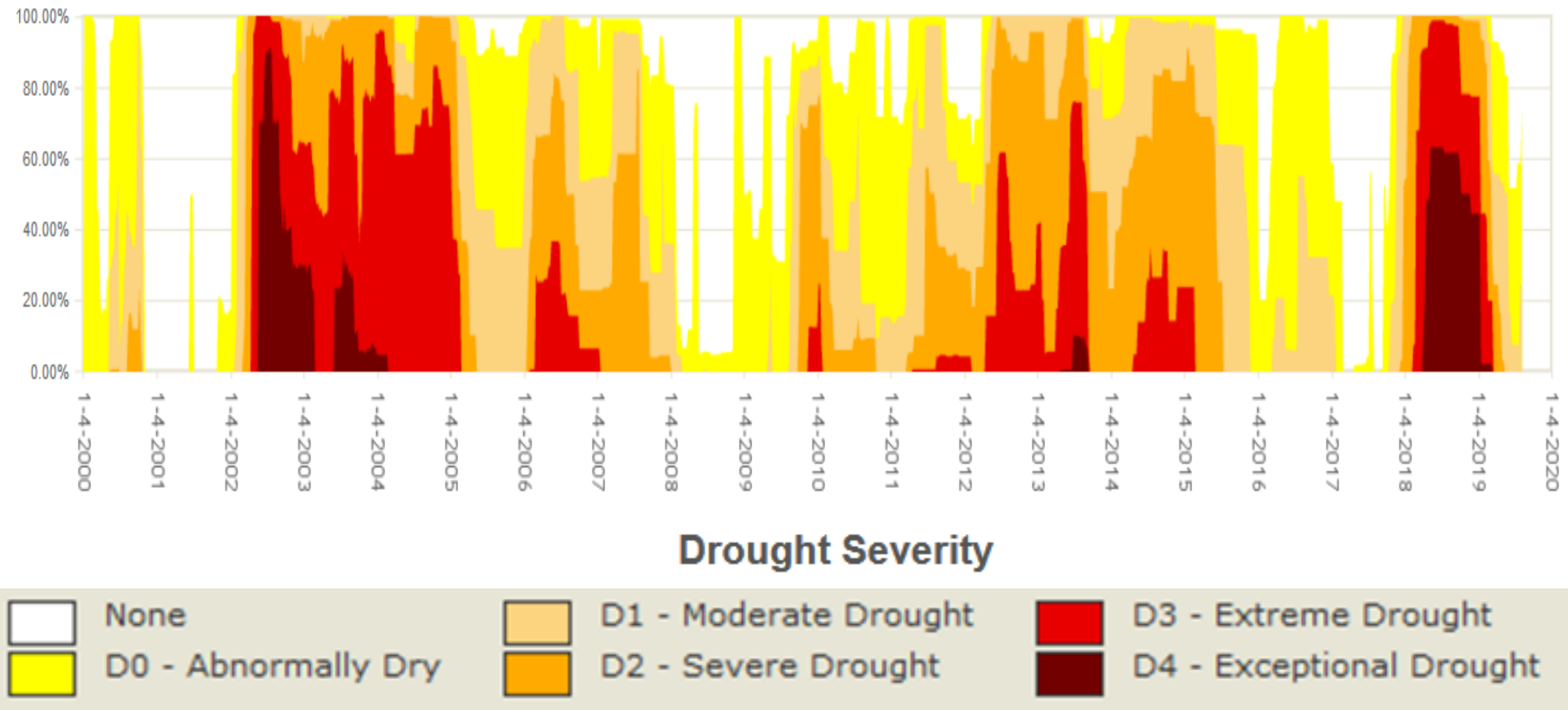
Source: Albuquerque NWS and CoCoRaHS



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US DROUGHT MONITOR: NAVAJO NATION

Percent area in each drought category



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CONDITIONS FOR WIND EROSION

- Dry, loose, and finely divided soil
- Smooth and exposed surface
 - Large open areas without obstructions
- Strong winds
- Soil conditions
 - Soil disturbance
 - Moisture
 - Time of year



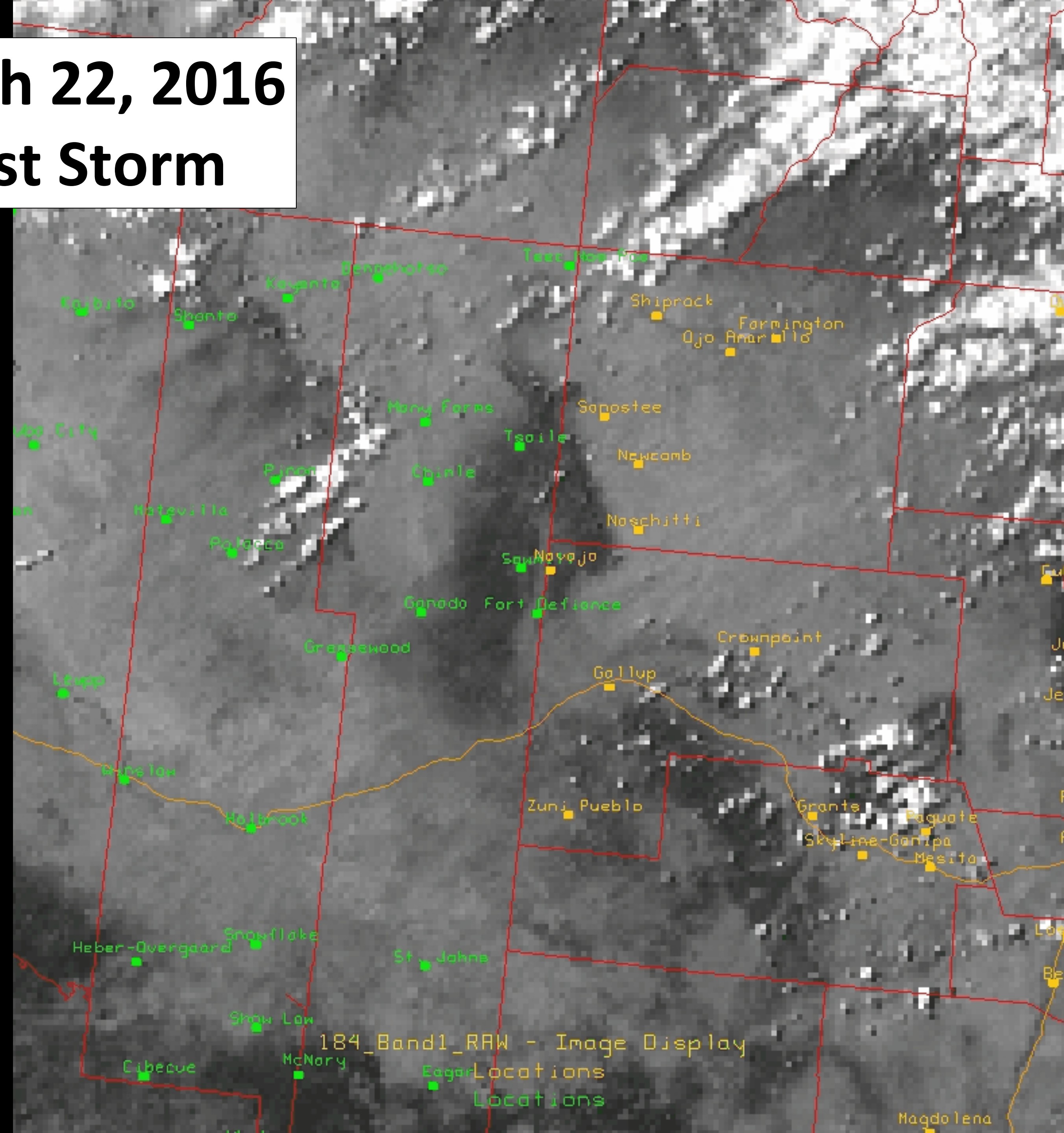
ROLE OF THE CLIMATE & WEATHER

- Climate shows what is possible, weather controls what happens
- For example, high winds and drought enhance dust
- Rain “cleans” the atmosphere, revealing crystal clear vistas

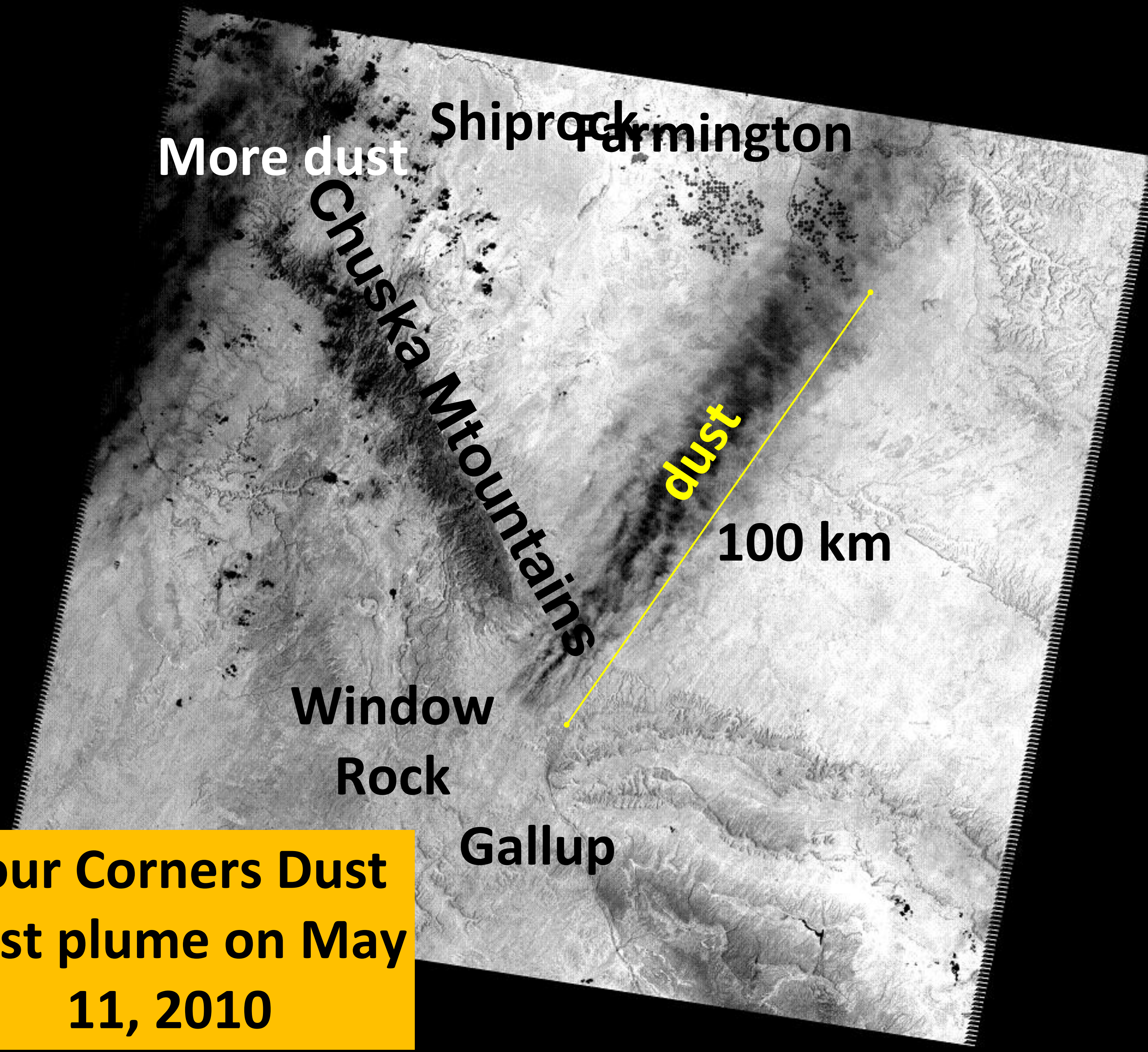


March 22, 2016

Dust Storm



**Four Corners Dust
Dust plume on May
11, 2010**



Dust on Snow 2009

May 19.

San Juan Mountains

Dust source from NW

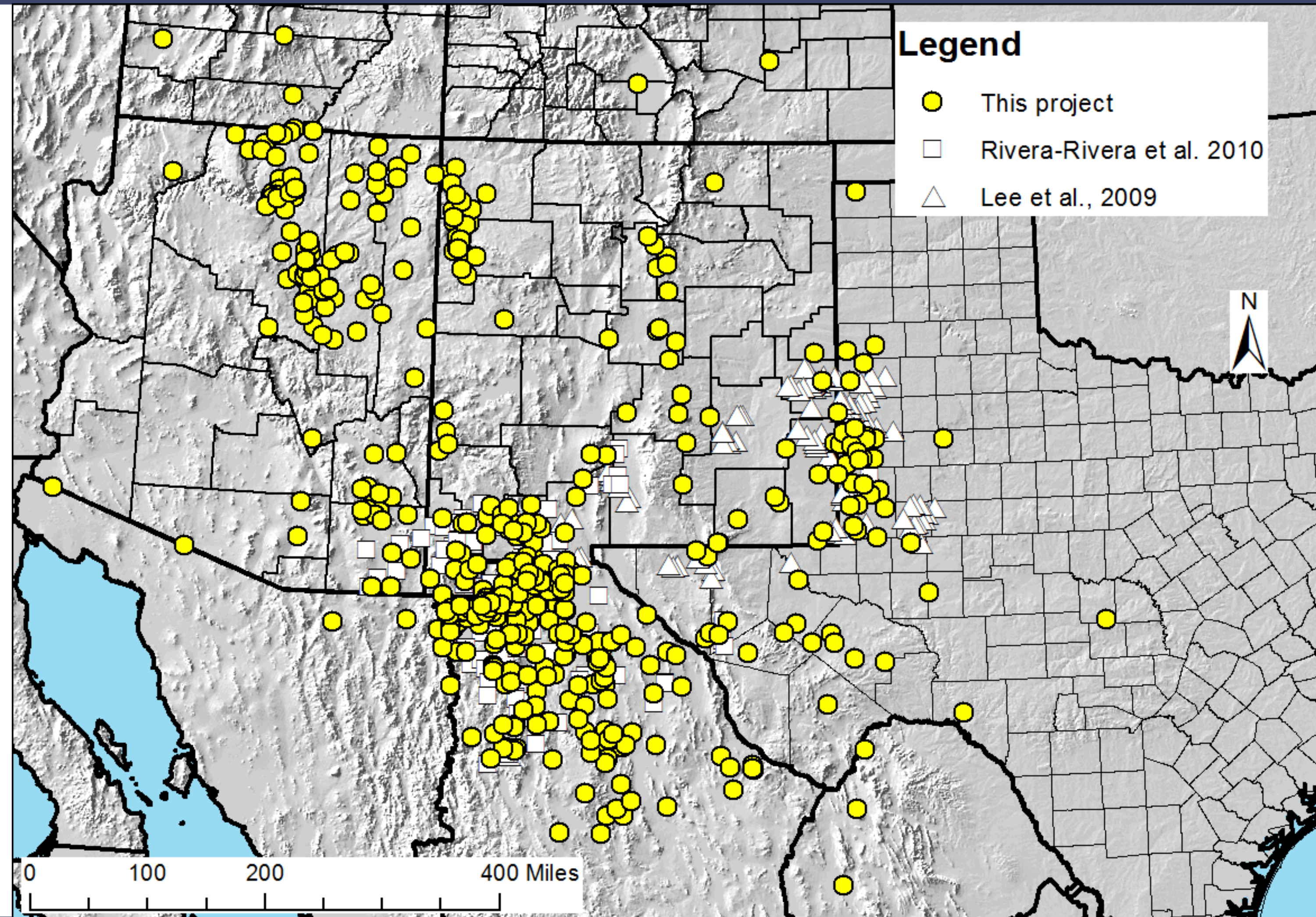
NM and NE AZ

Snow Optics Lab - JPL

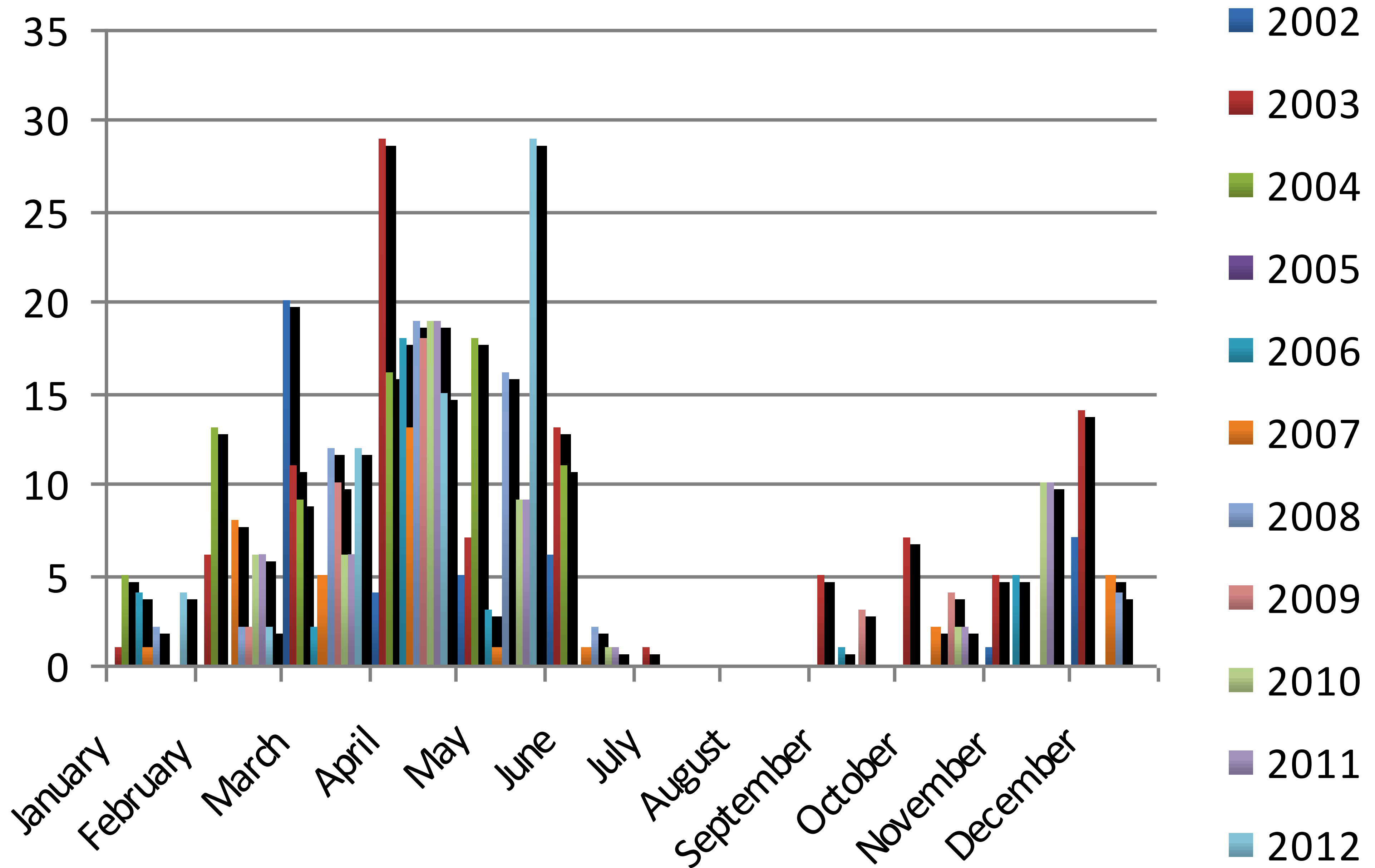


DUST SOURCE LOCATIONS

- 2000-2012 database from satellite imagery



Synoptic dust storm frequency based on imagery





NMSU
Agricultural
Experiment
Station

Dr. Dave DuBois
NM State Climatologist

dwdubois@nmsu.edu
weather.nmsu.edu
@nmclimate