Monsoon 2011

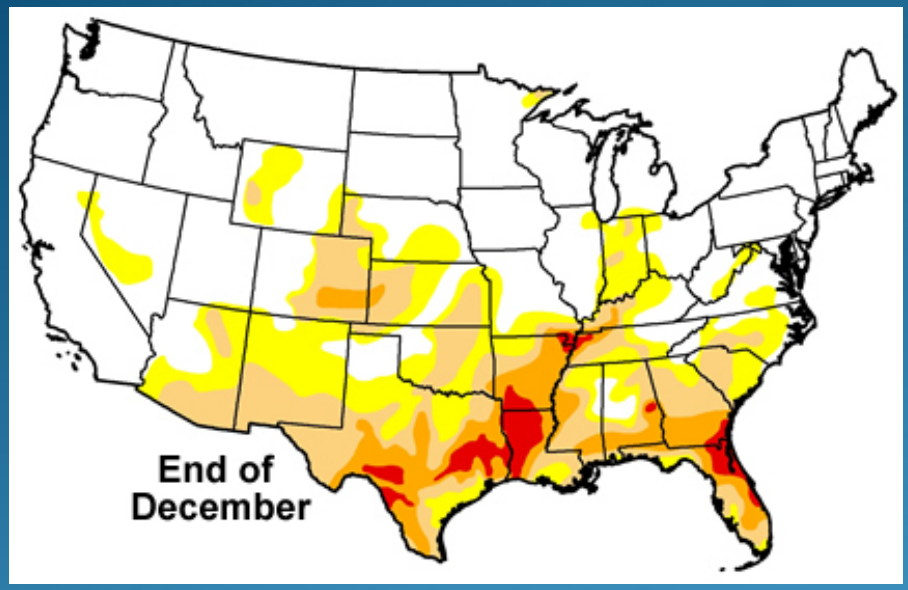
Pima County Local Drought Impact Group meeting
Wednesday September 14, 2011

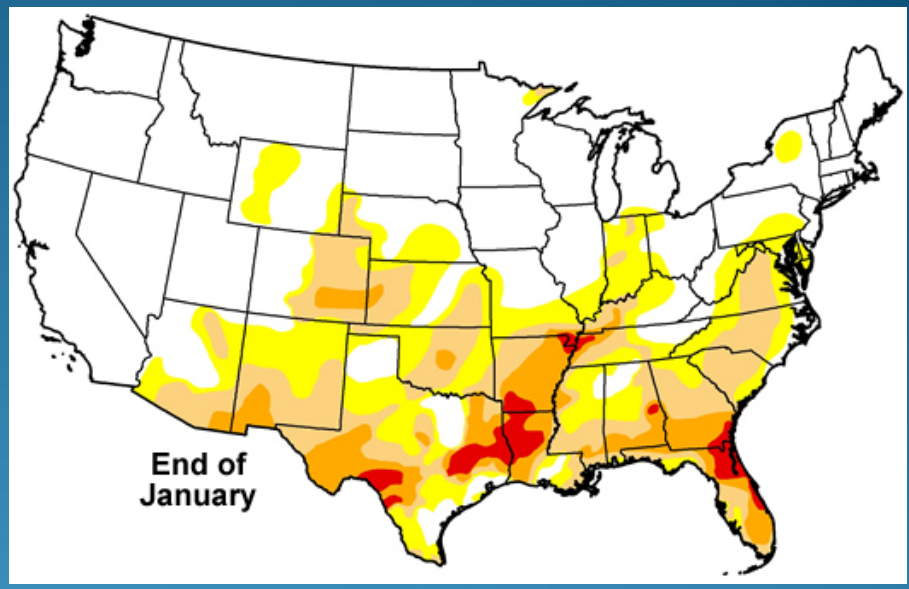
John Glueck
NWS Tucson

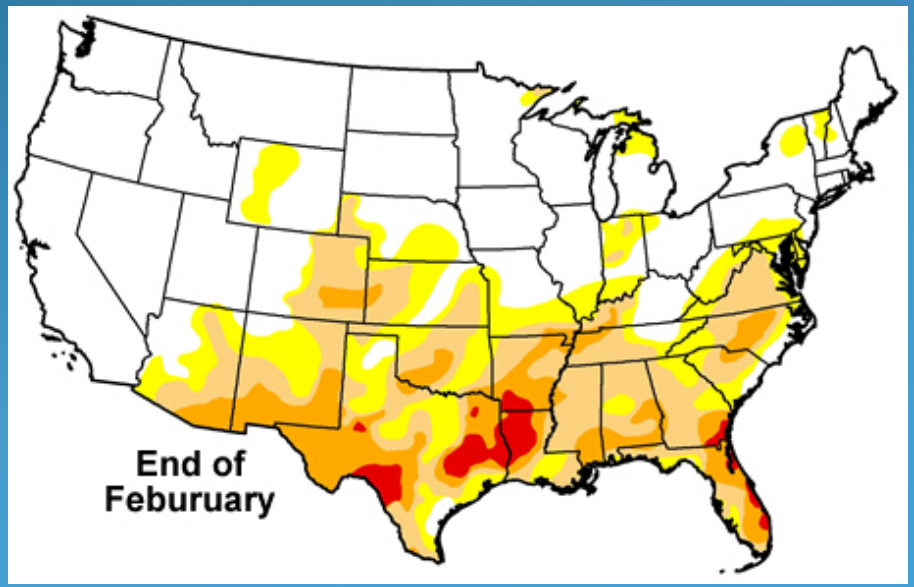
Outline

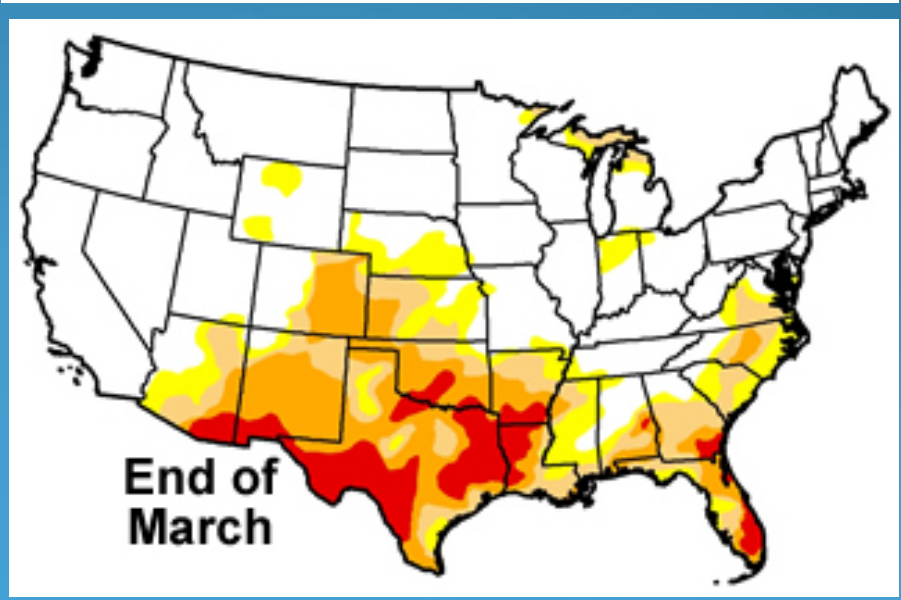
- Look back at winter drought conditions
- Outlook for the monsoon
- Month-by-month and season recap
- Another La Nina Winter? OH NO!!!!

Drought expansion: December thru March due to strong La Niña



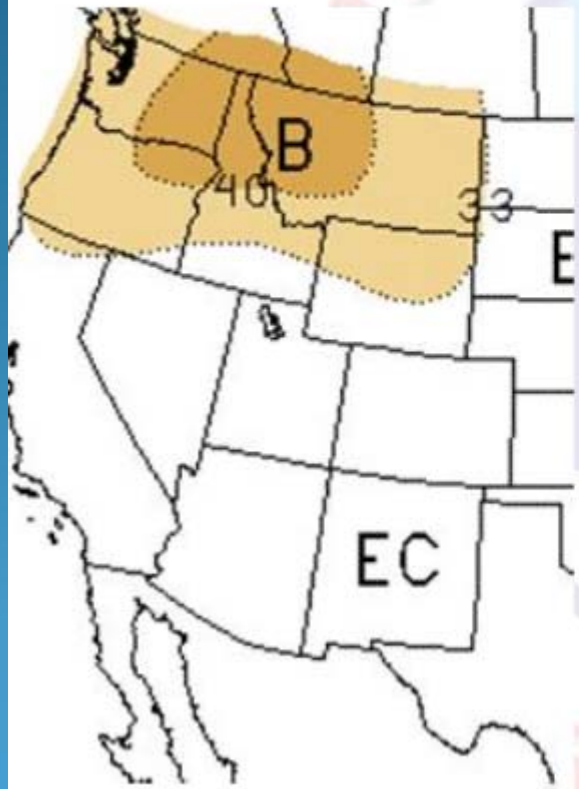






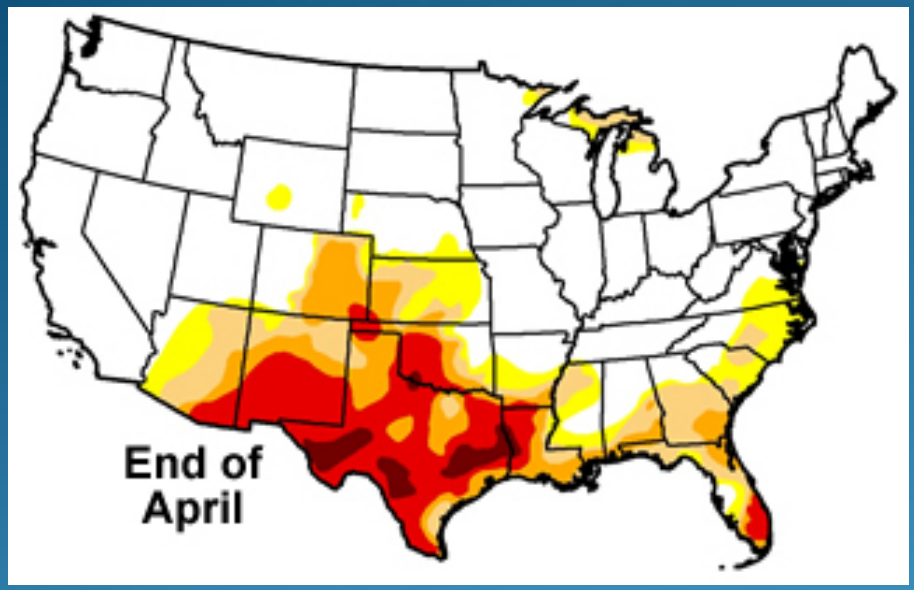
Pre-monsoon forecast

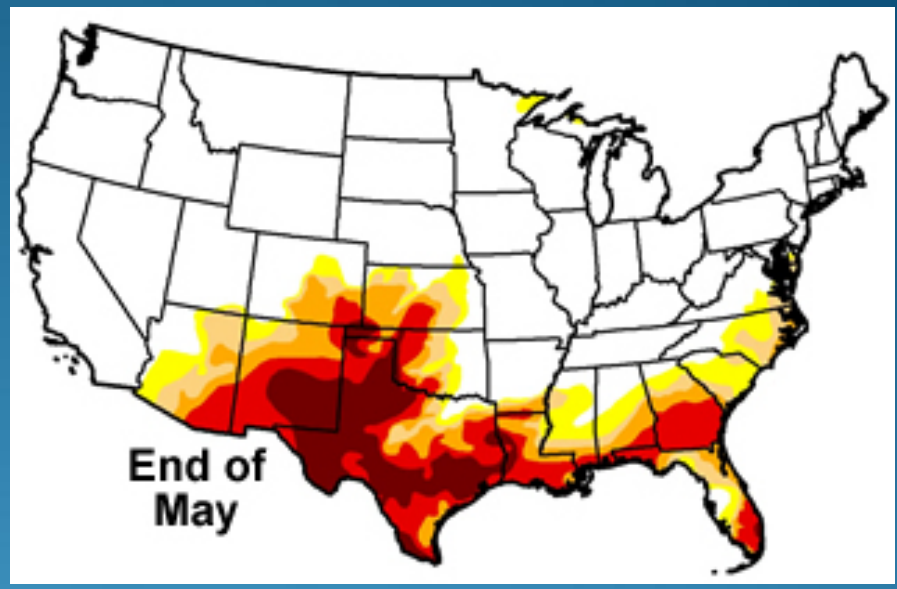
Official Forecast from Climate Prediction Center

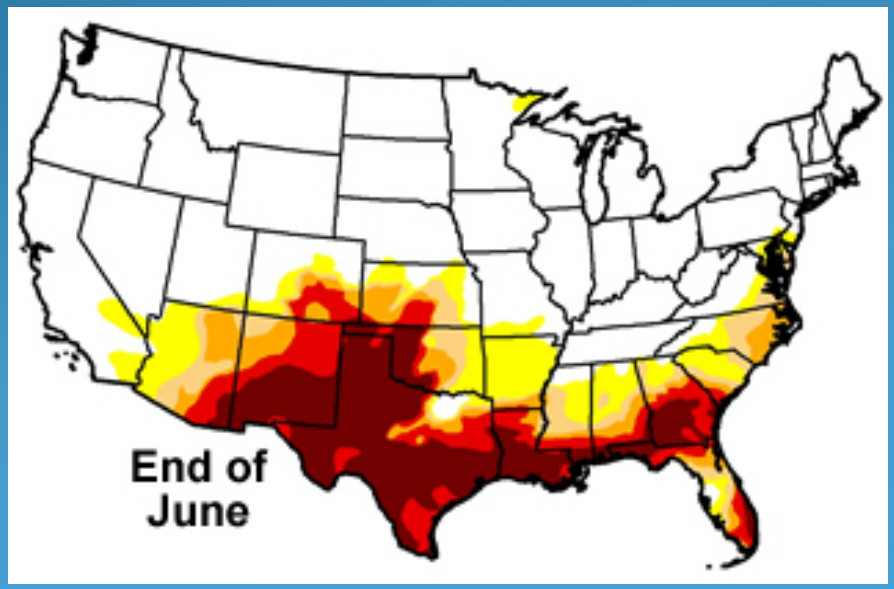


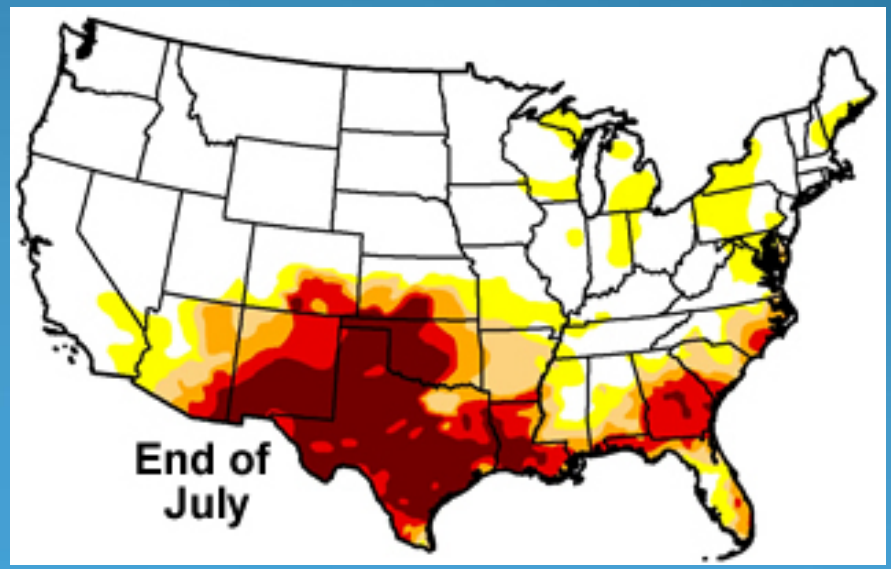
- Equal Chances
- Or –
  - 1/3 chance of being wetter than normal
  - 1/3 chance of being drier than normal
  - 1/3 chance of being near normal

Drought expansion: April thru July

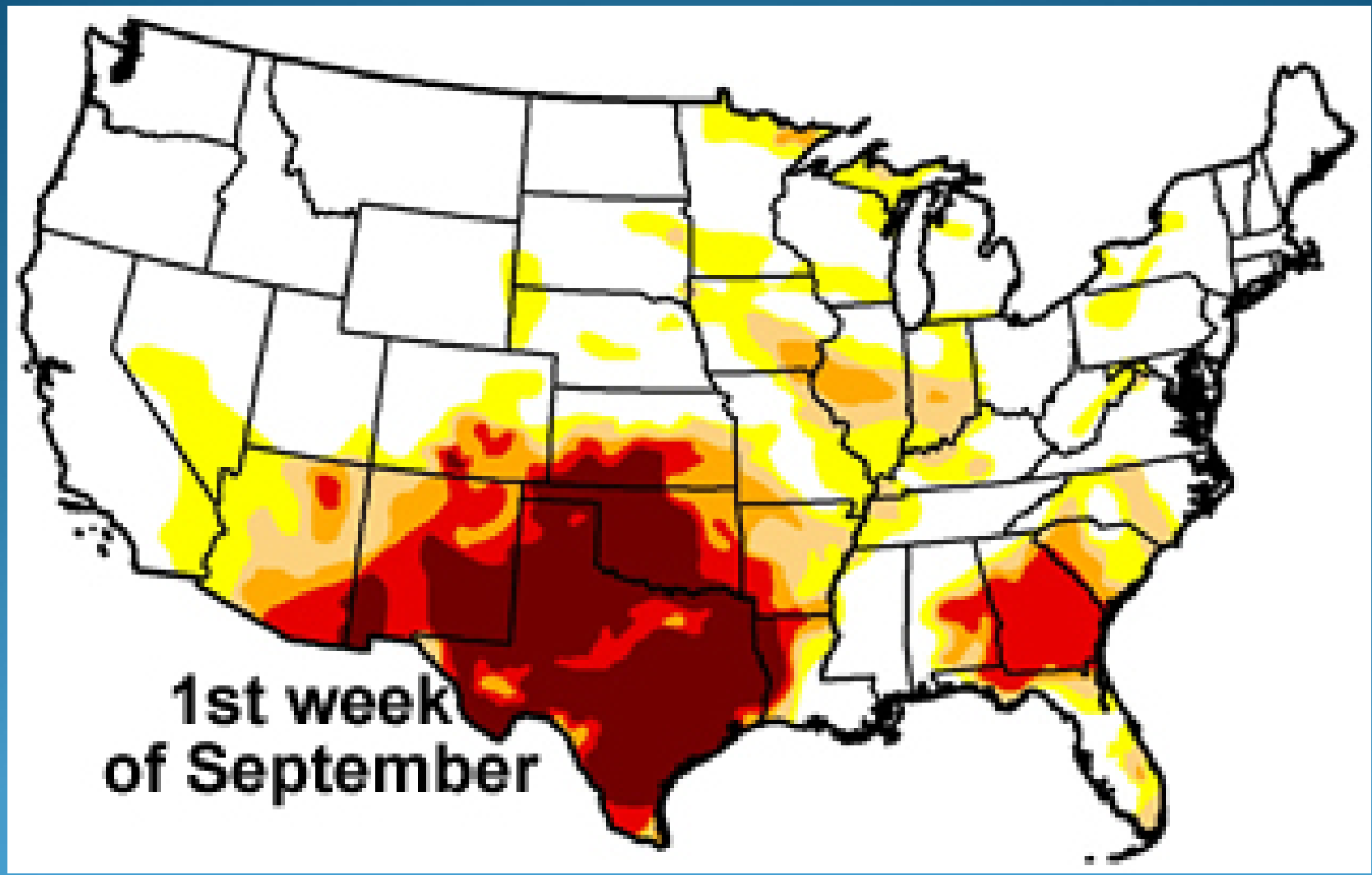




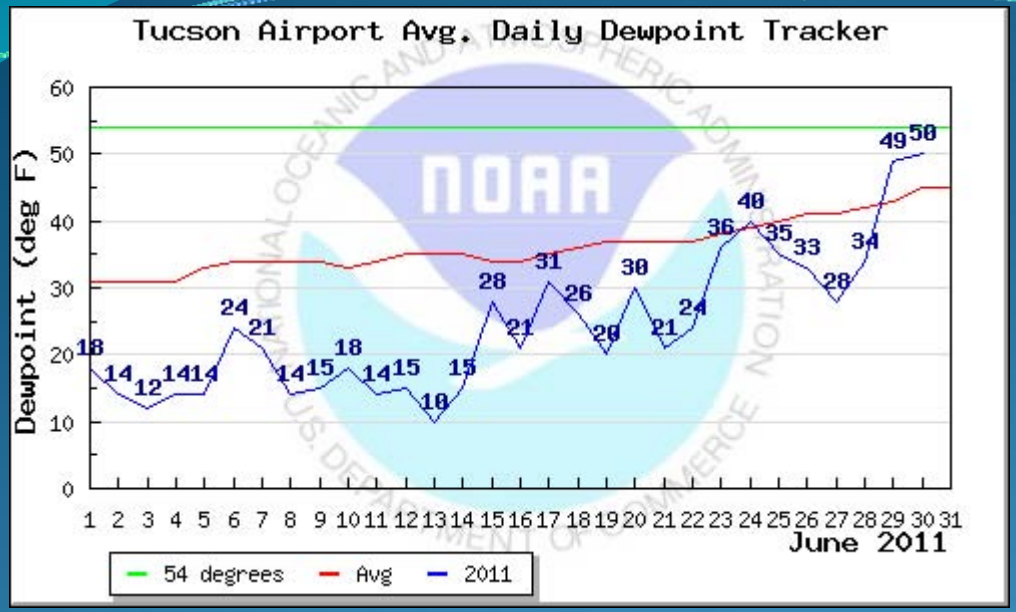




Current drought status

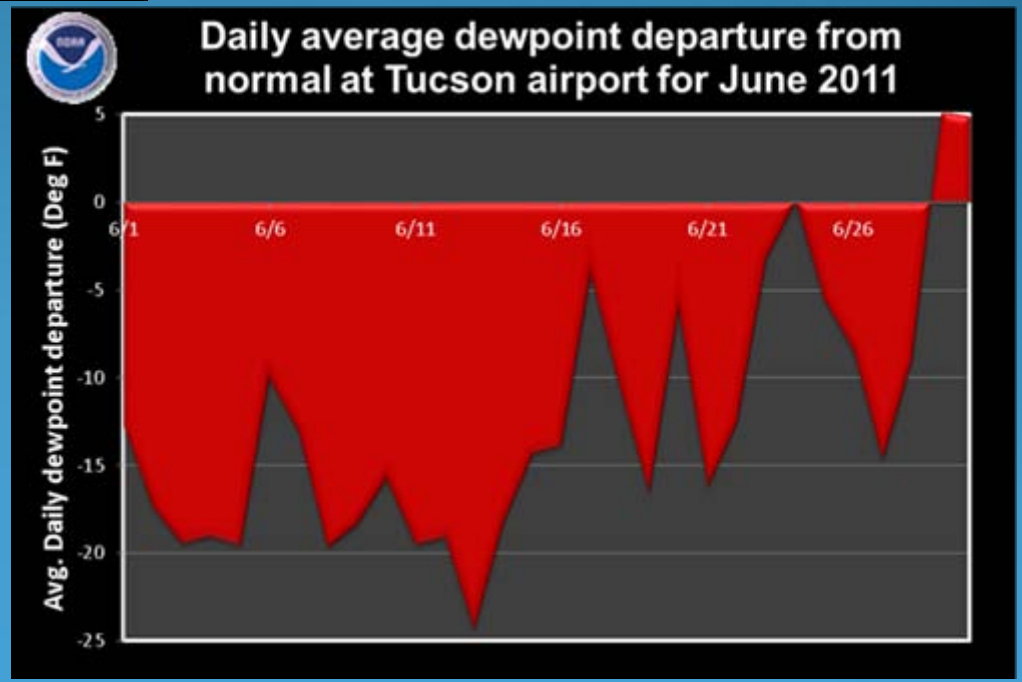


June

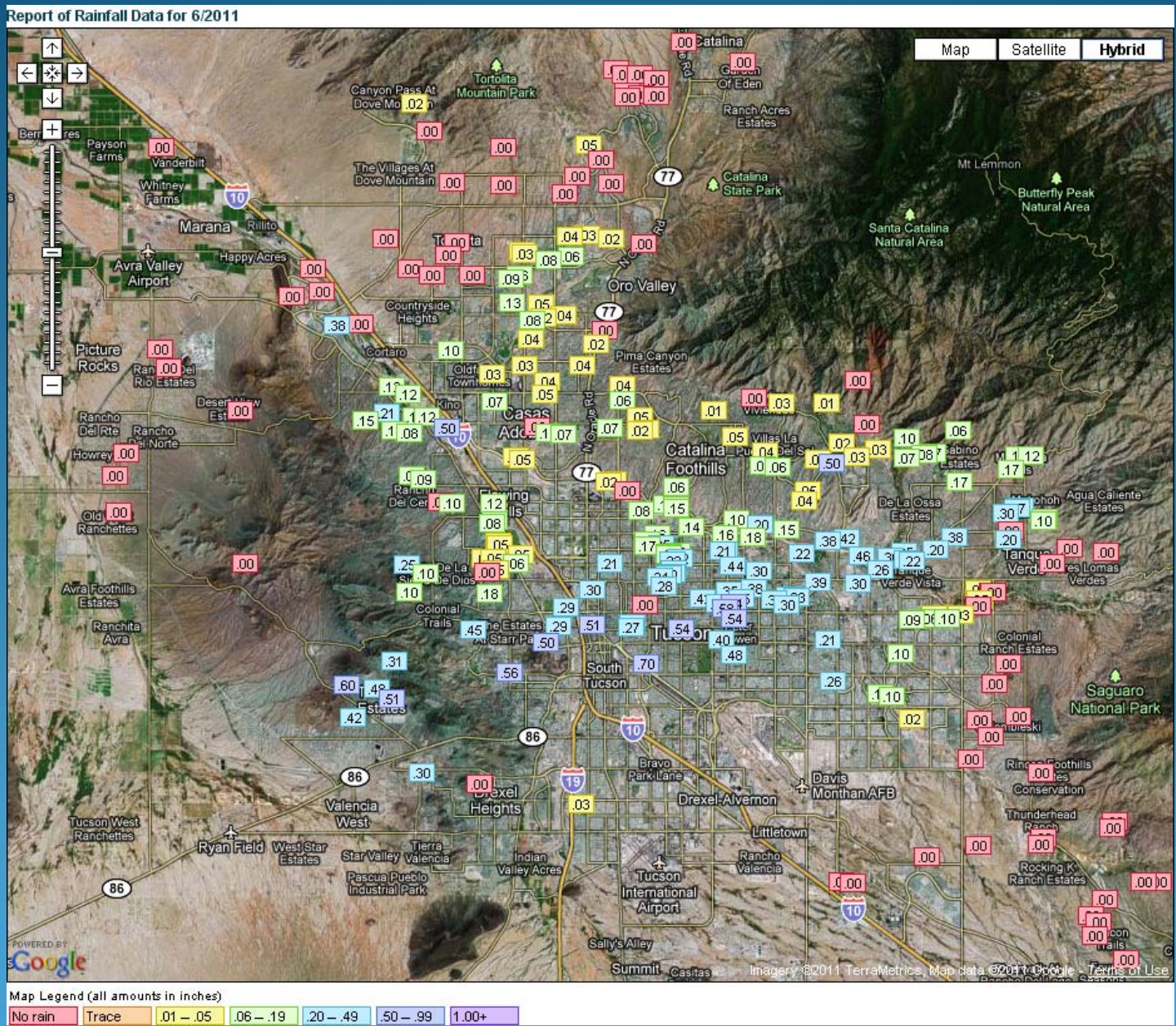


- Very dry with low average daily dewpoints
- Hot with Tucson airport hitting 112° for first time since 1995. 16th hottest day on record.
- Eight straight days of 107° or hotter. 5th longest such streak on record.

- Monsoonal moisture started to work its way across southeast Arizona toward the end of the month.
- Showers and thunderstorms moved across the Tucson metro area on the morning of the 30th, bringing 0.20" to 0.75“ to the area.
- This ended 81 straight days of no rain at TIA, 4th longest stretch on record.

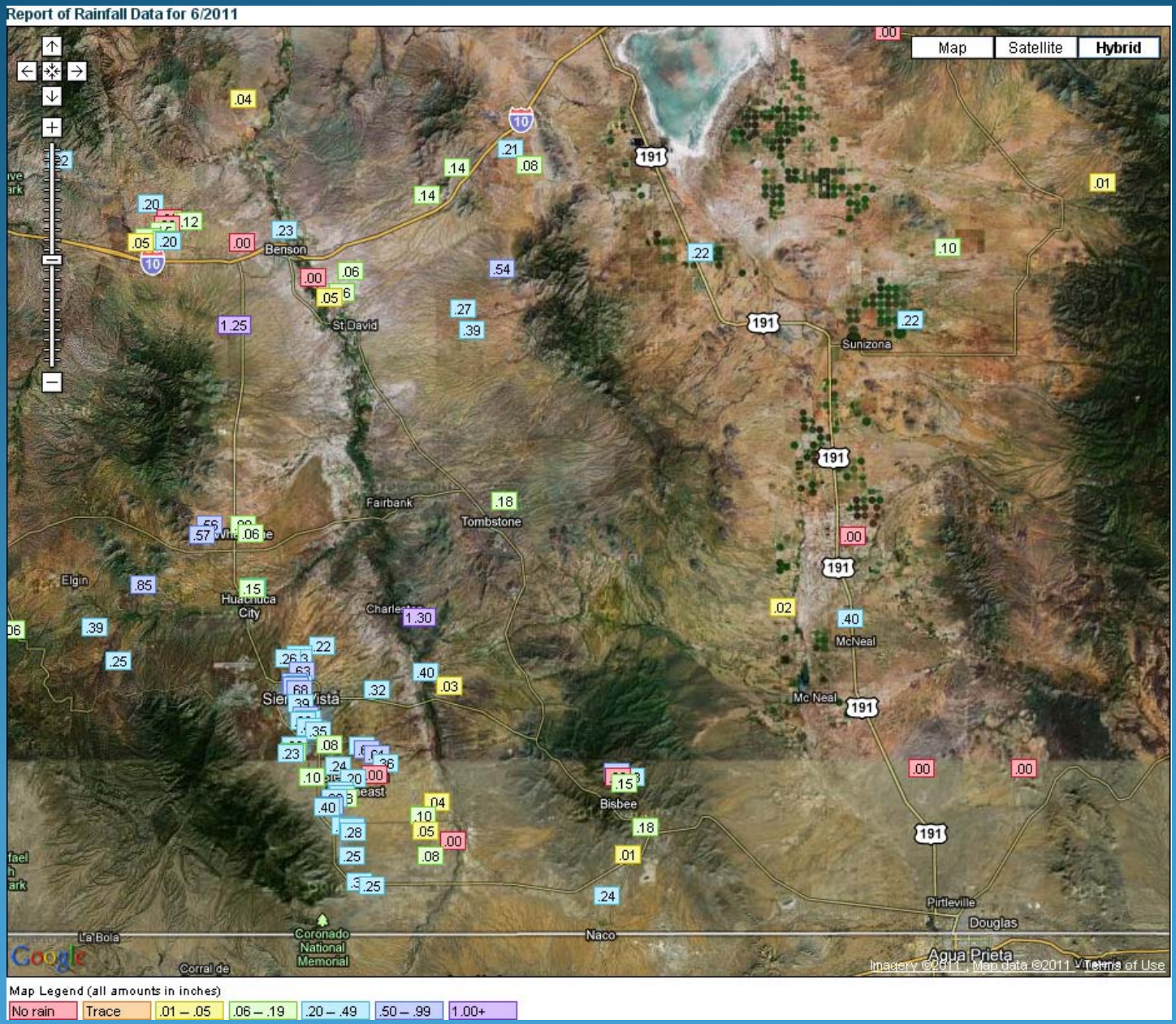


June rainfall - Tucson vicinity

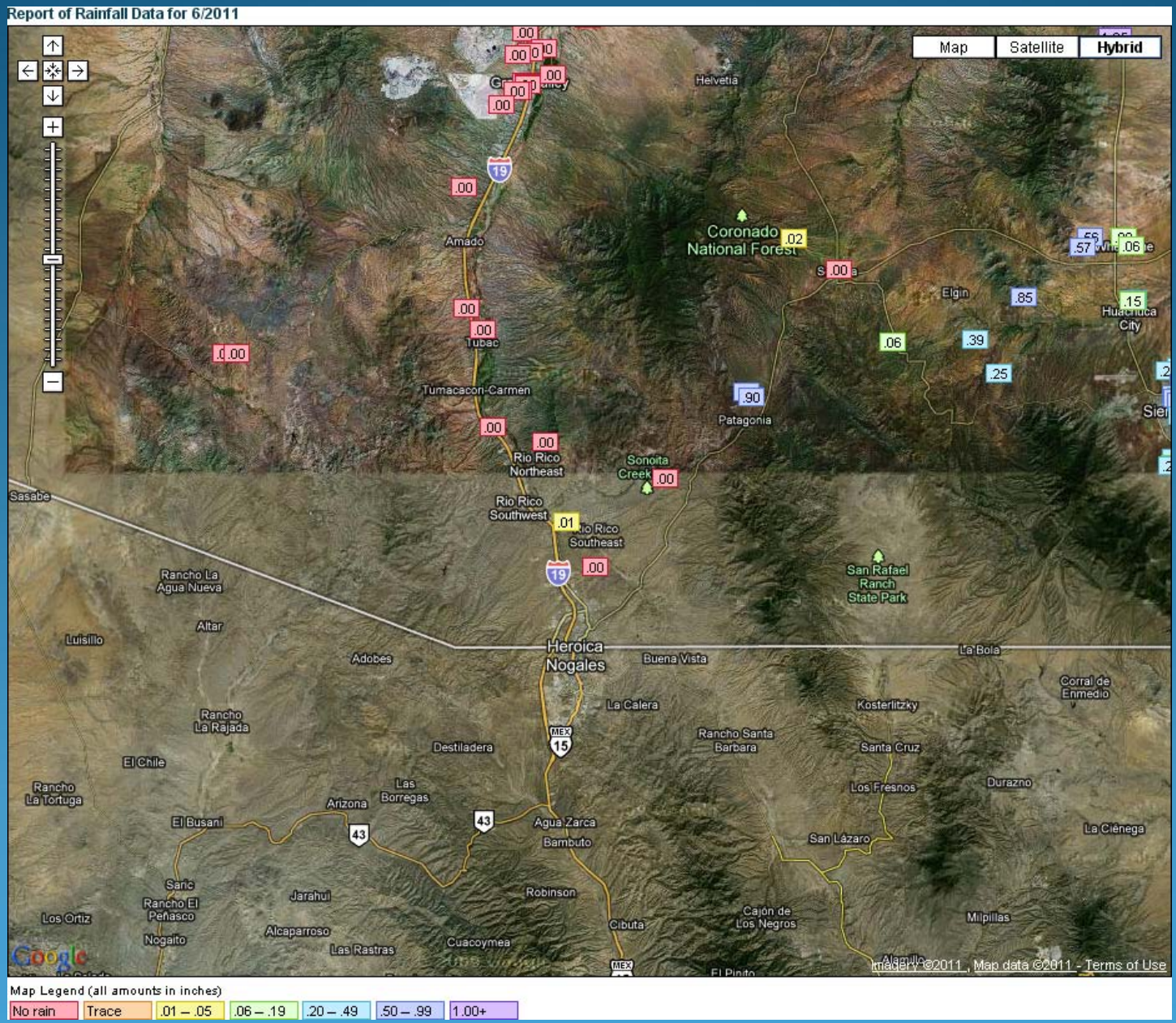


TIA 0.03”

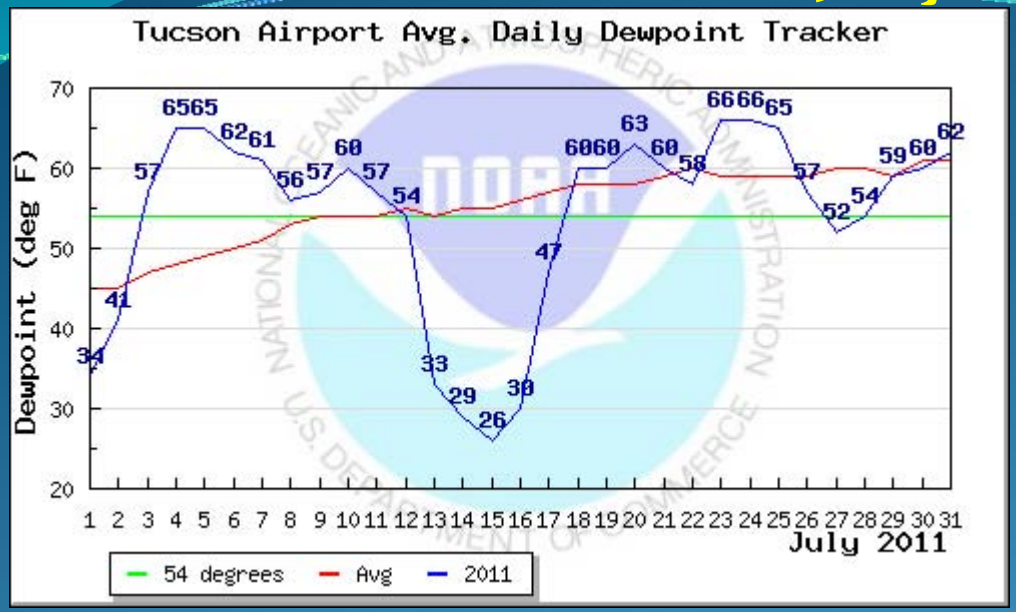
June rainfall - Cochise



June rainfall – Santa Cruz

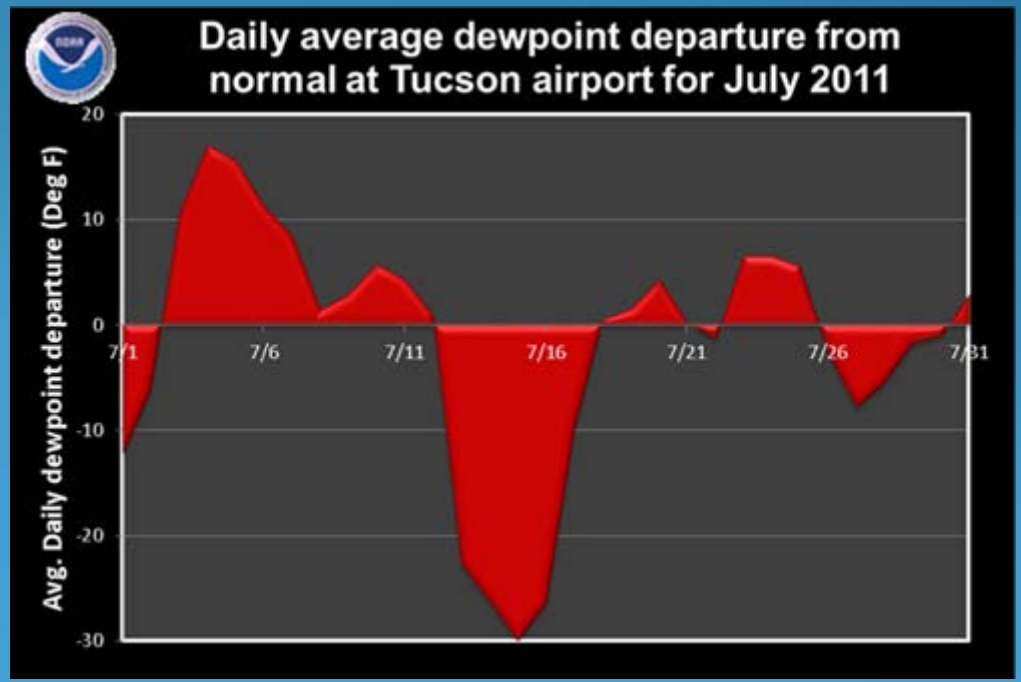


July

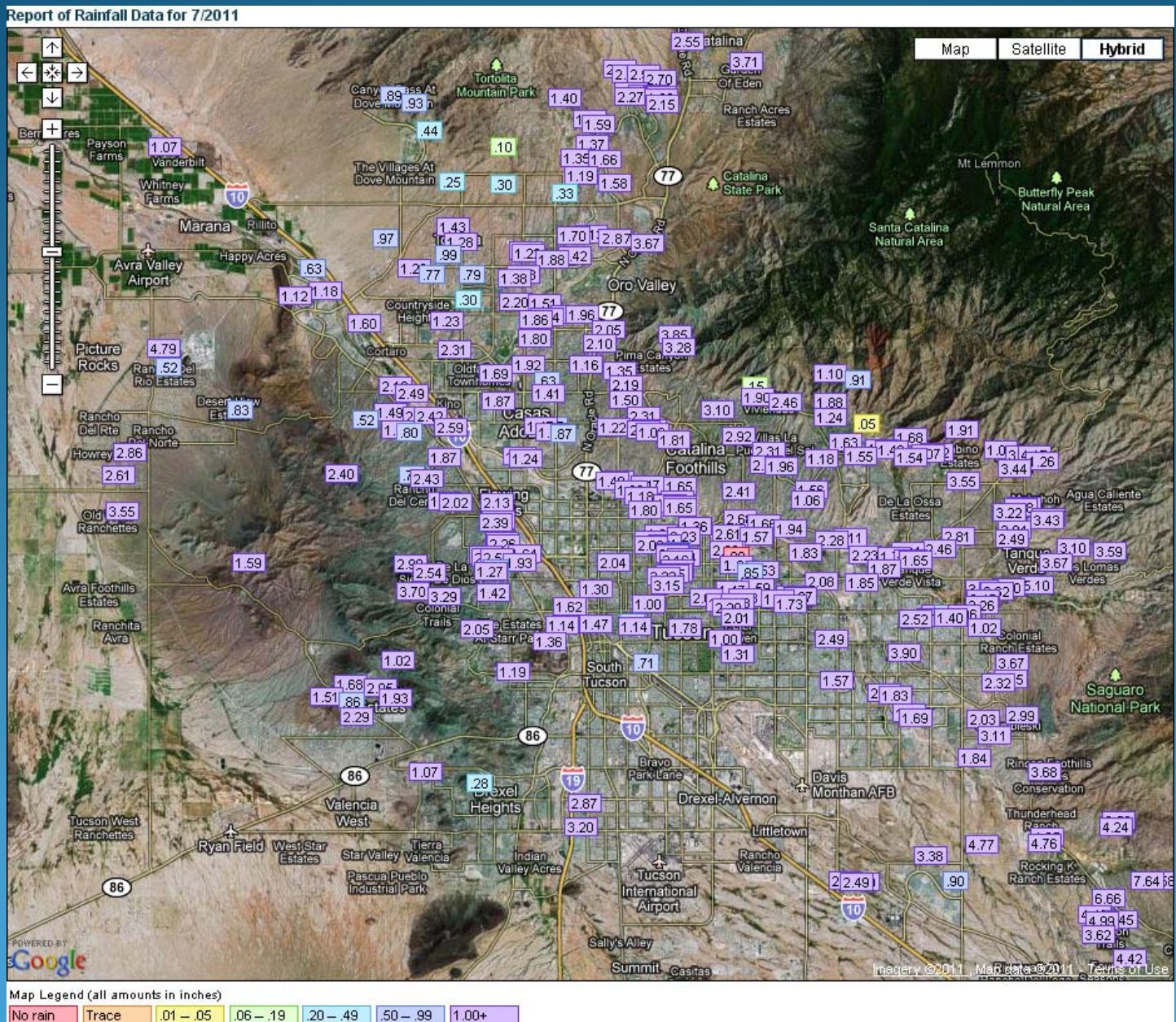


- Very hot start to the month with 111° on 2nd. 5th hottest July day on record.
- Deep monsoonal moisture pushes into the area on the 3rd.
- Mother Nature provided her own fireworks on the 4th with strong to severe thunderstorms and heavy rain.
- The "Great Phoenix Haboob" on the 5th had its origins in eastern Pima county.
- Remained active for another week before significantly drier air pushed into the area.

- First break of the monsoon with record to near record breaking low daily average dew points on the 13th to 16th .
- Monsoon moisture returned to the area during the 2nd half of the month and showed its usual ebb and flow.
- TIA recorded 16th warmest and 46th driest July on record.

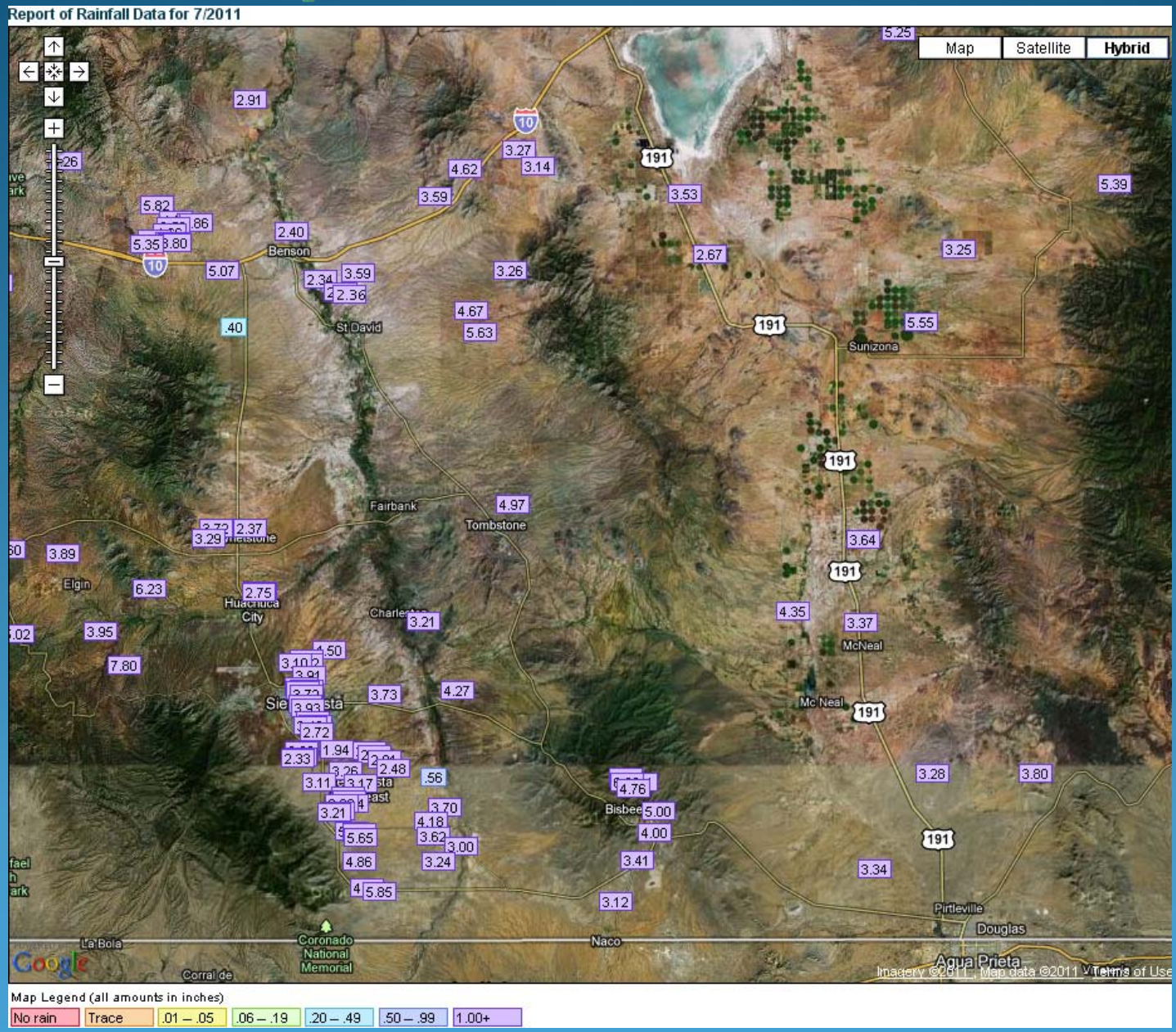


July rainfall - Tucson vicinity

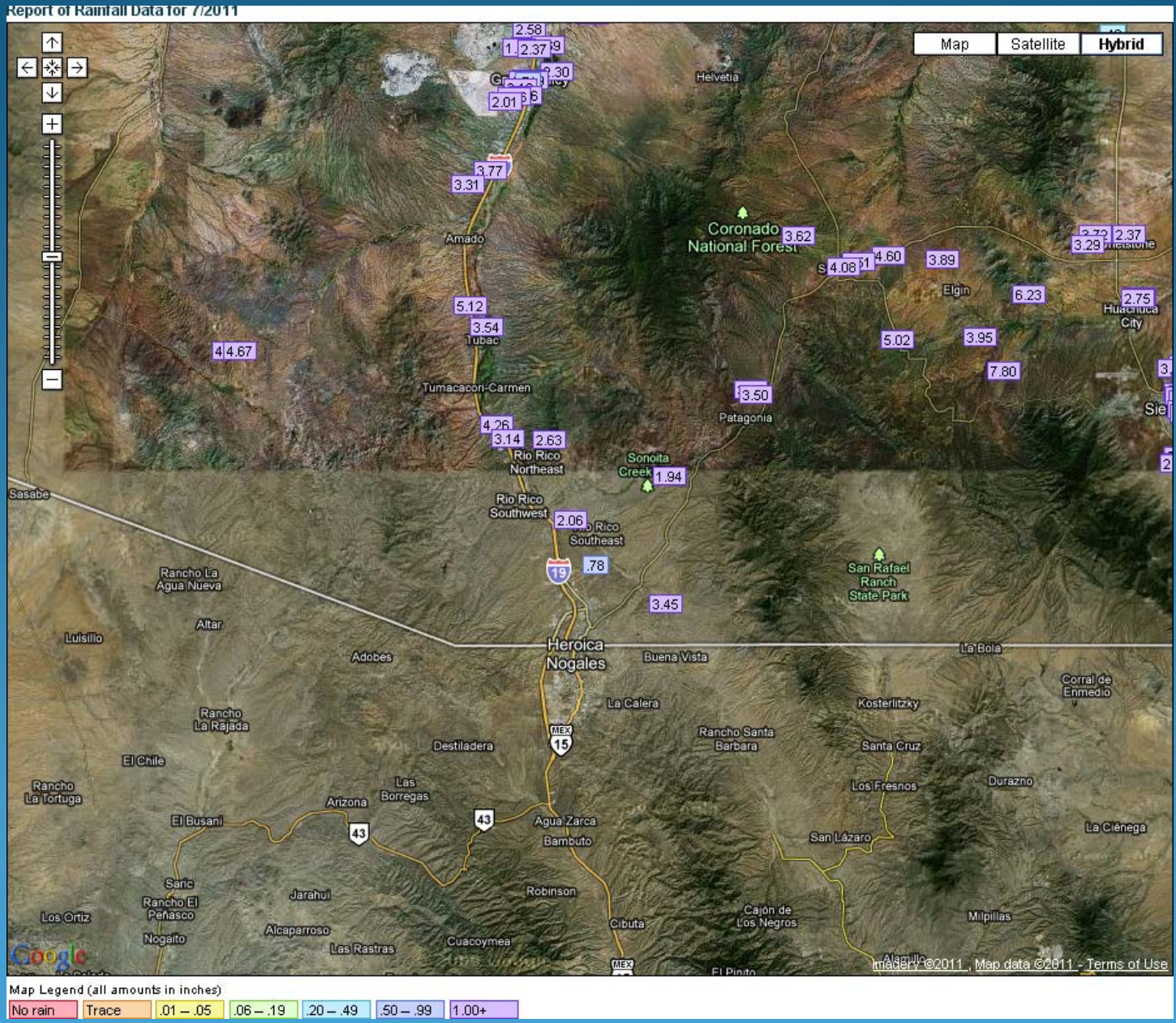


TIA 1.64”

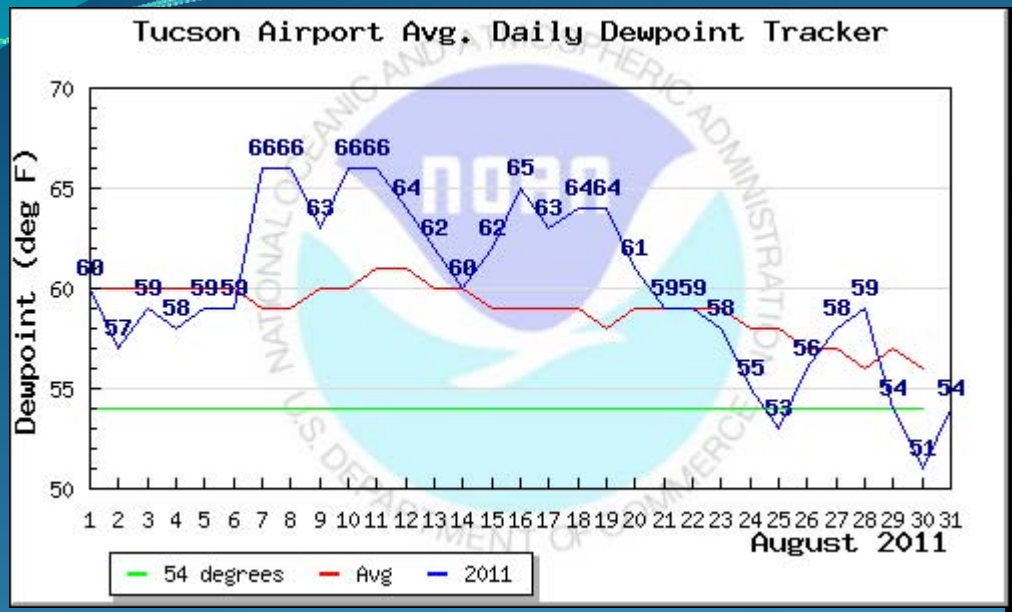
July rainfall - Cochise

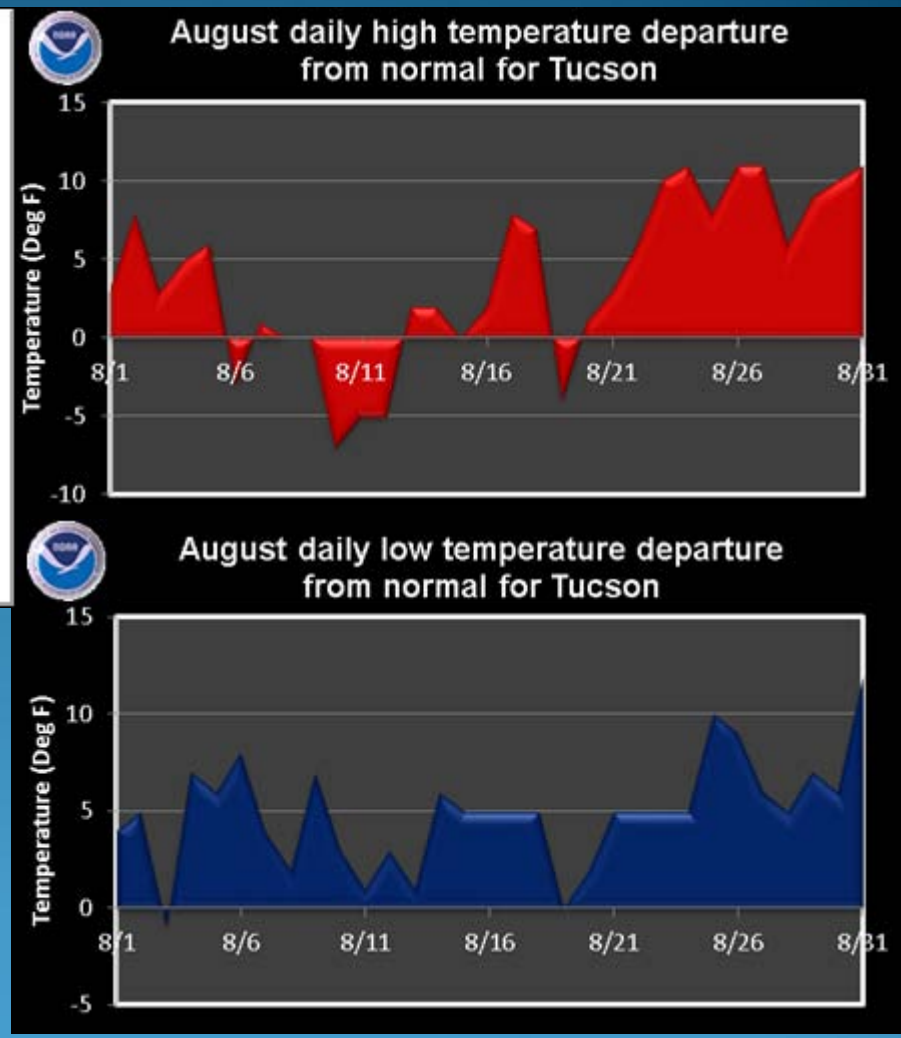


July rainfall – Santa Cruz



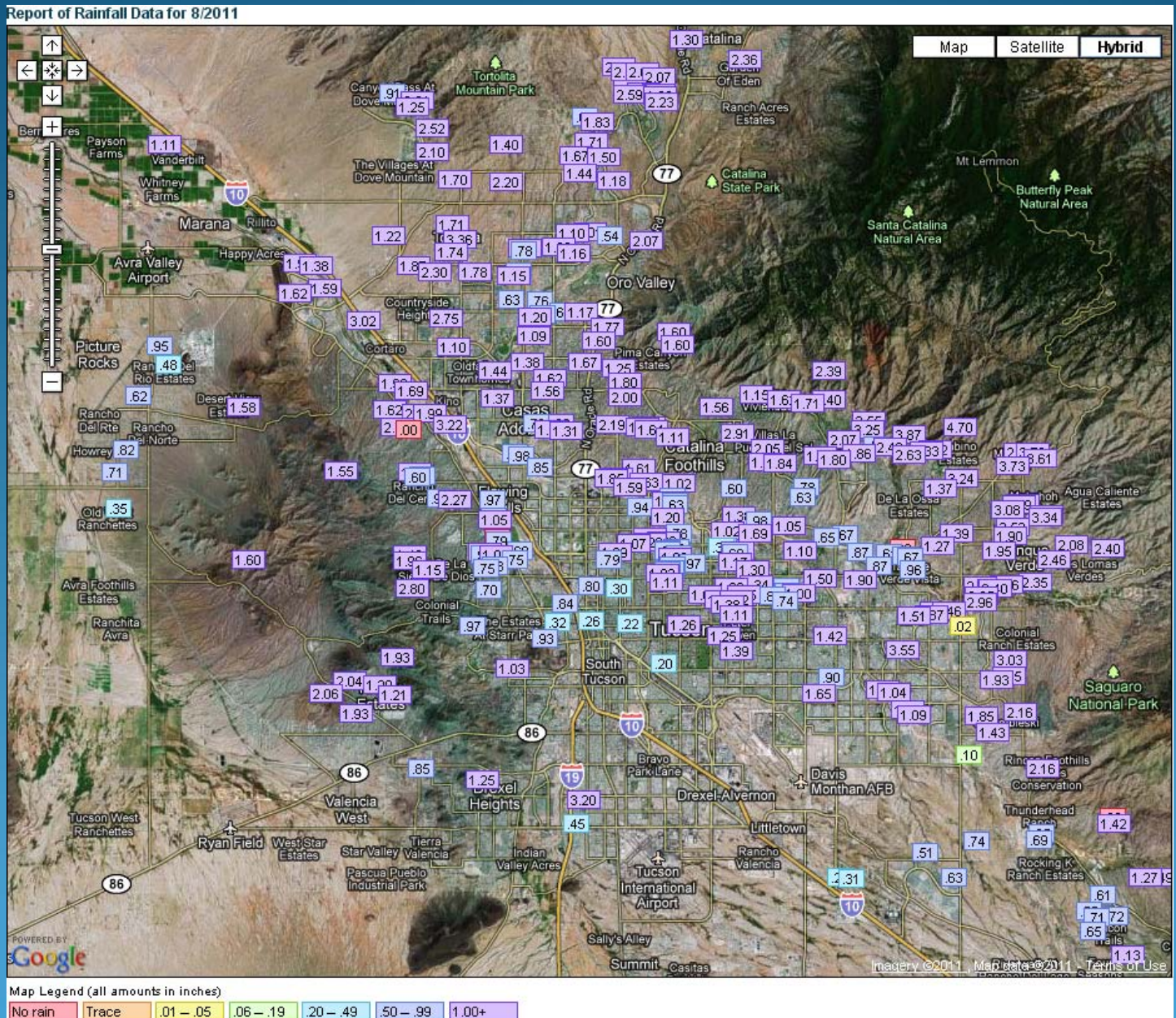
August





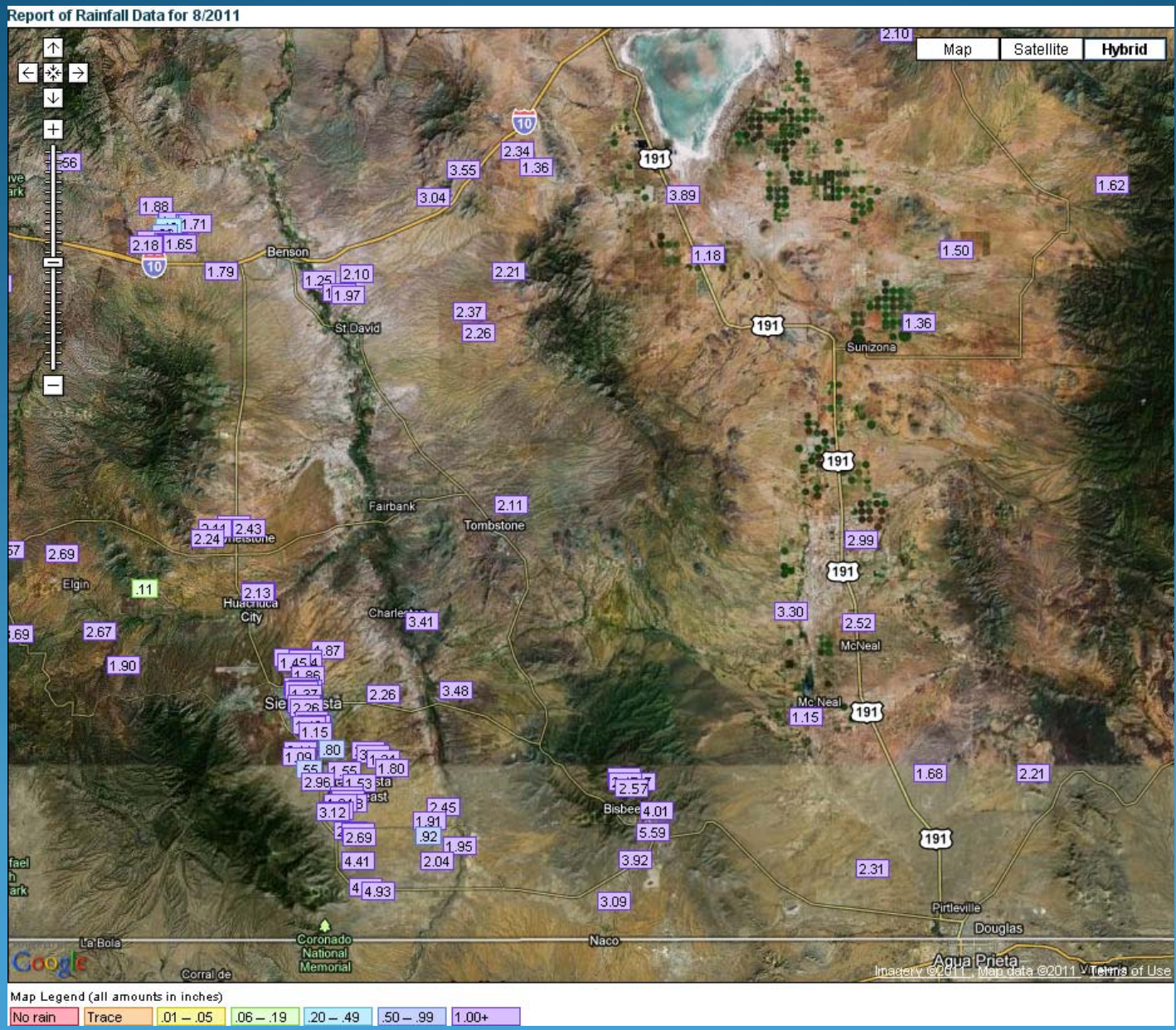
- Heat, isolated severe thunderstorms, heat, isolated flash flooding, more heat.
- Below average rainfall across most of eastern Pima county.
- 6 record highs and 3 record high minimums were recorded between the 23rd and 31st.
- 2nd hottest August and 7th hottest any month on record with an average temperature of 89.3°

August rainfall - Tucson vicinity

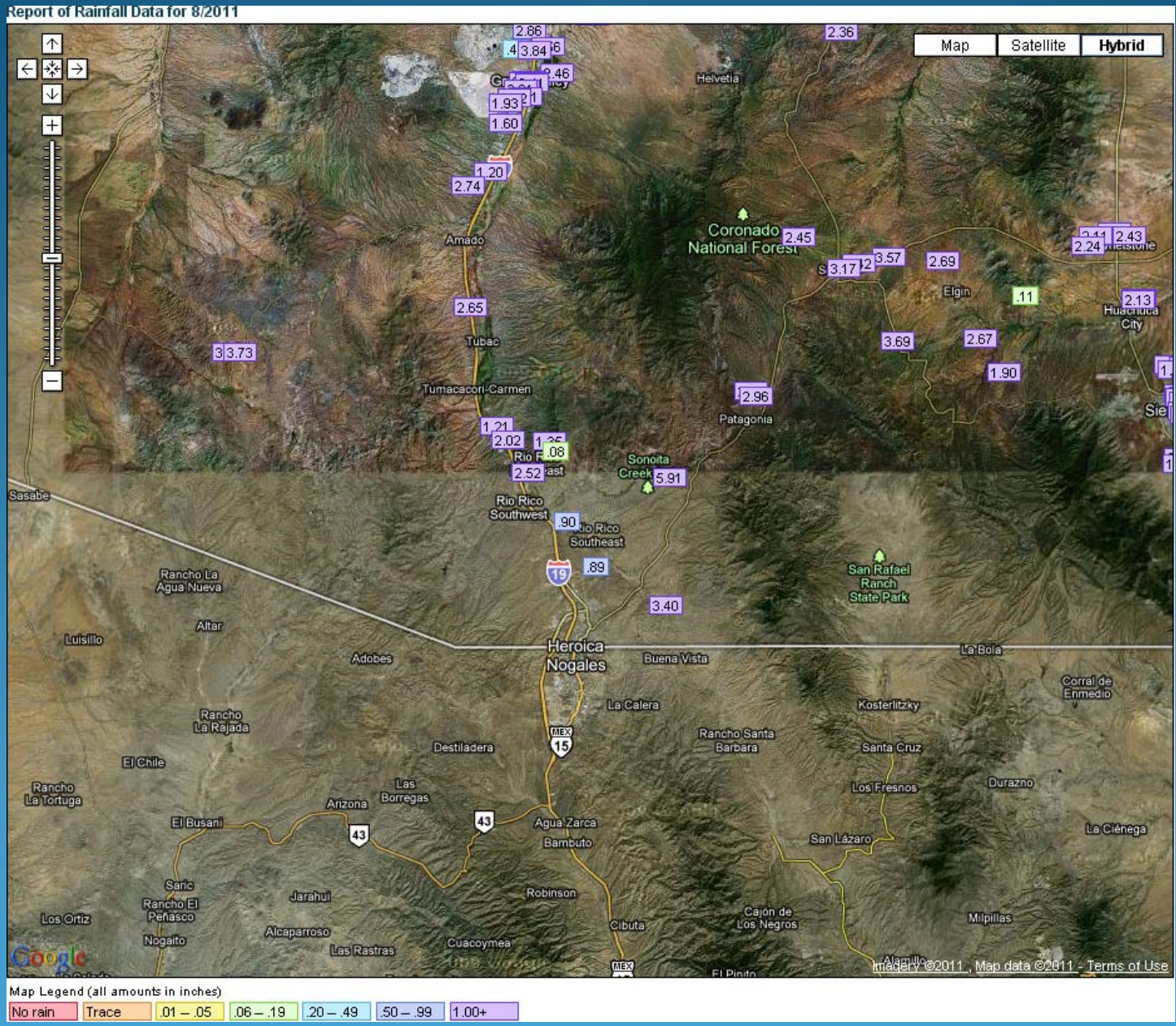


TIA 1.35”

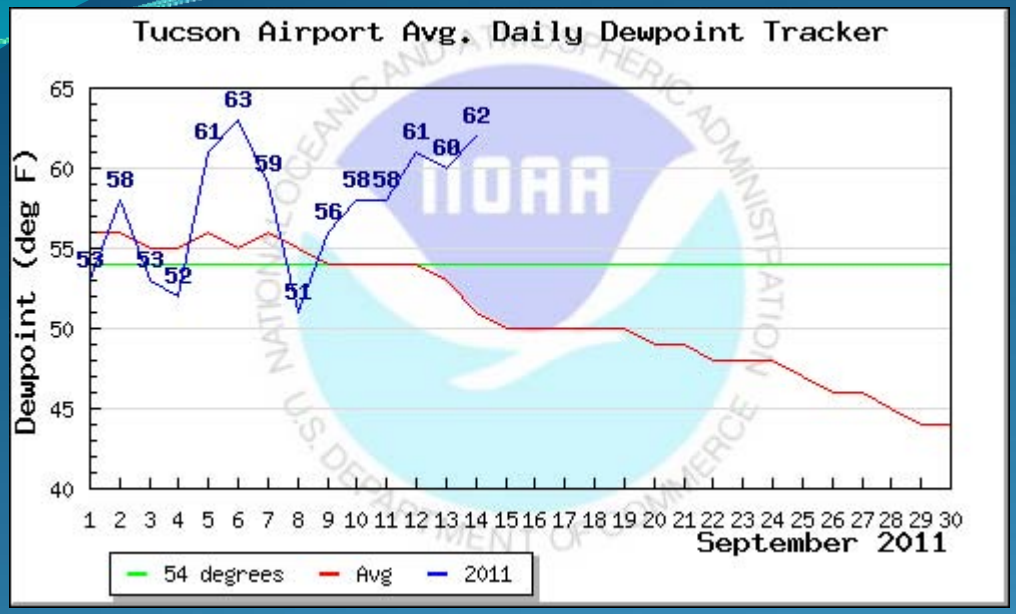
August rainfall - Cochise



August rainfall – Santa Cruz

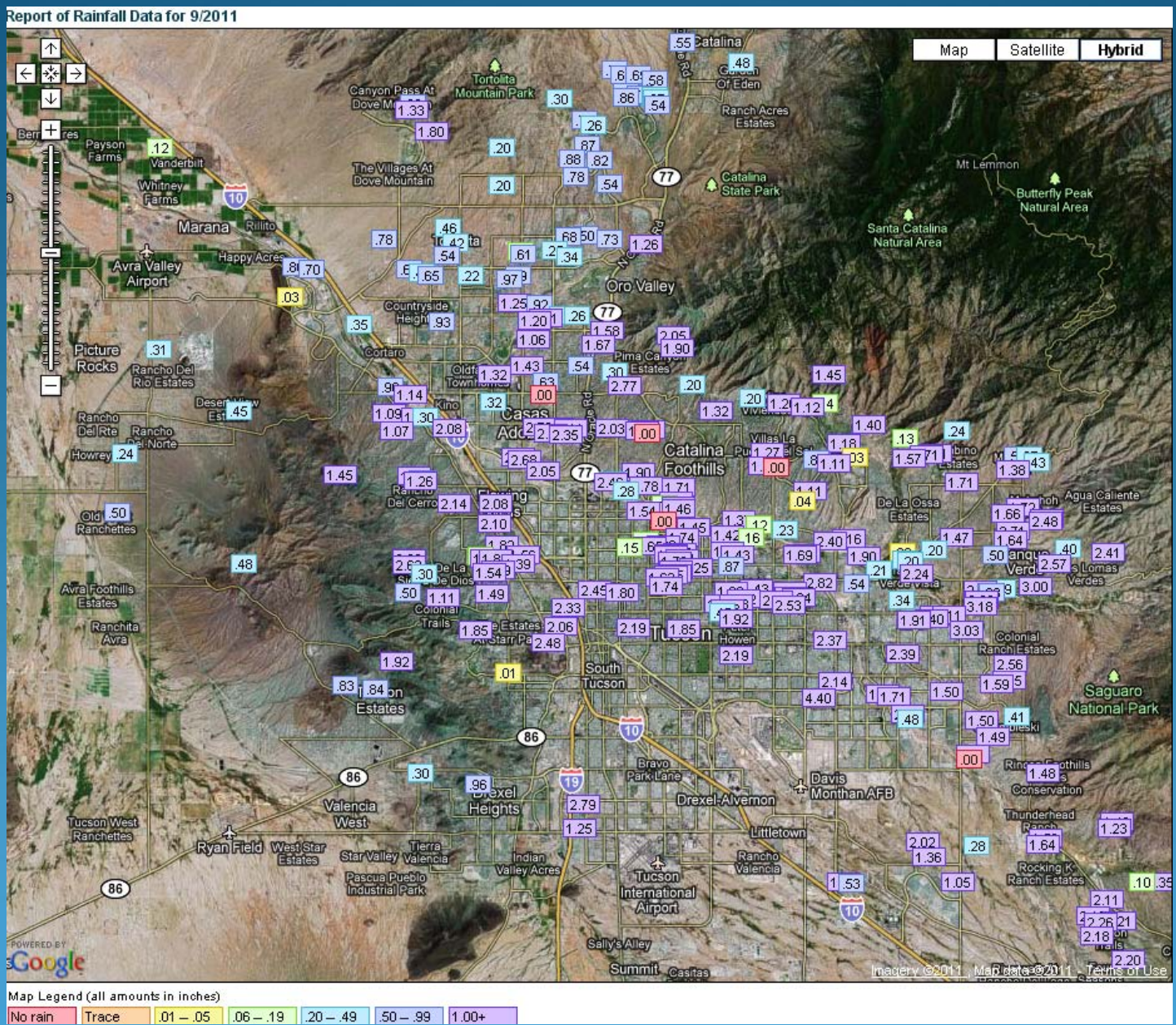


September



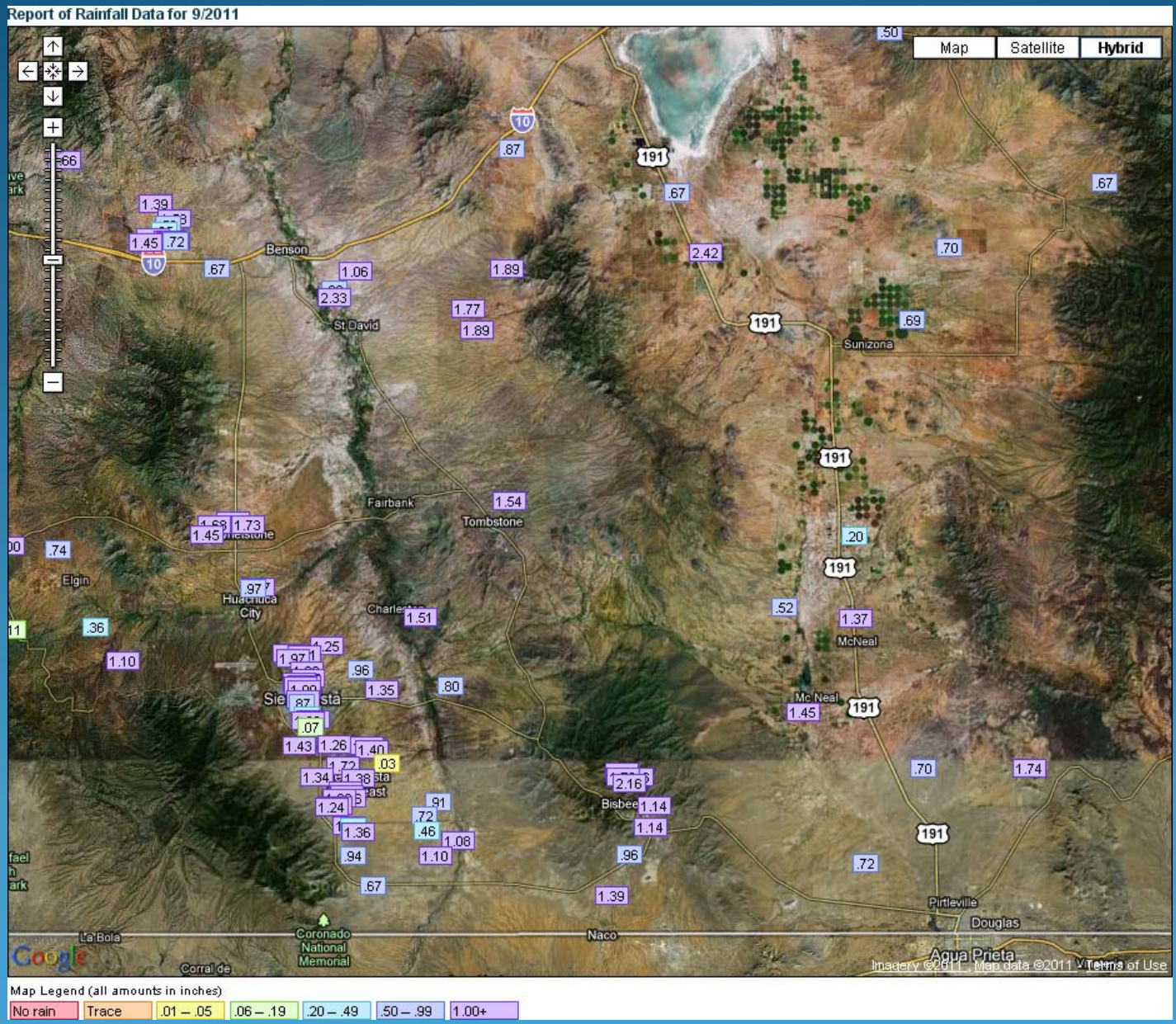
- Record to near record heat continued during the four days of the month. 106° on 4th was one degrees off all-time September record high.
- Low pressure over/near southern California pretty much saved the 2011 monsoon in most areas.
- Strong to severe storms and heavy rain was associated with the low from 8th to the 13th.
- TIA September total, thru the 13th, of 2.61” ranks as the 19th wettest September on record.

September rainfall - Tucson vicinity

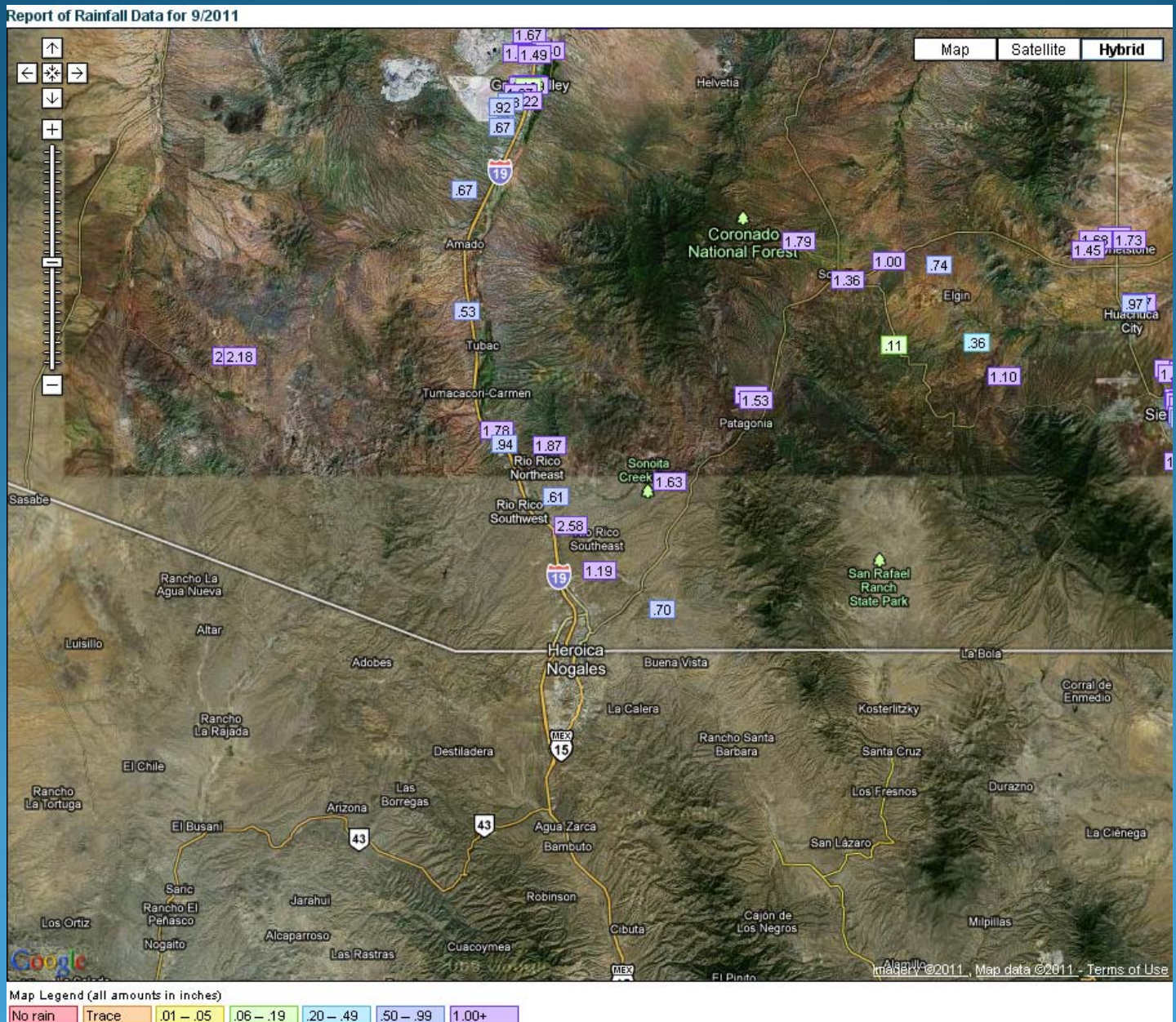


TIA 2.61”

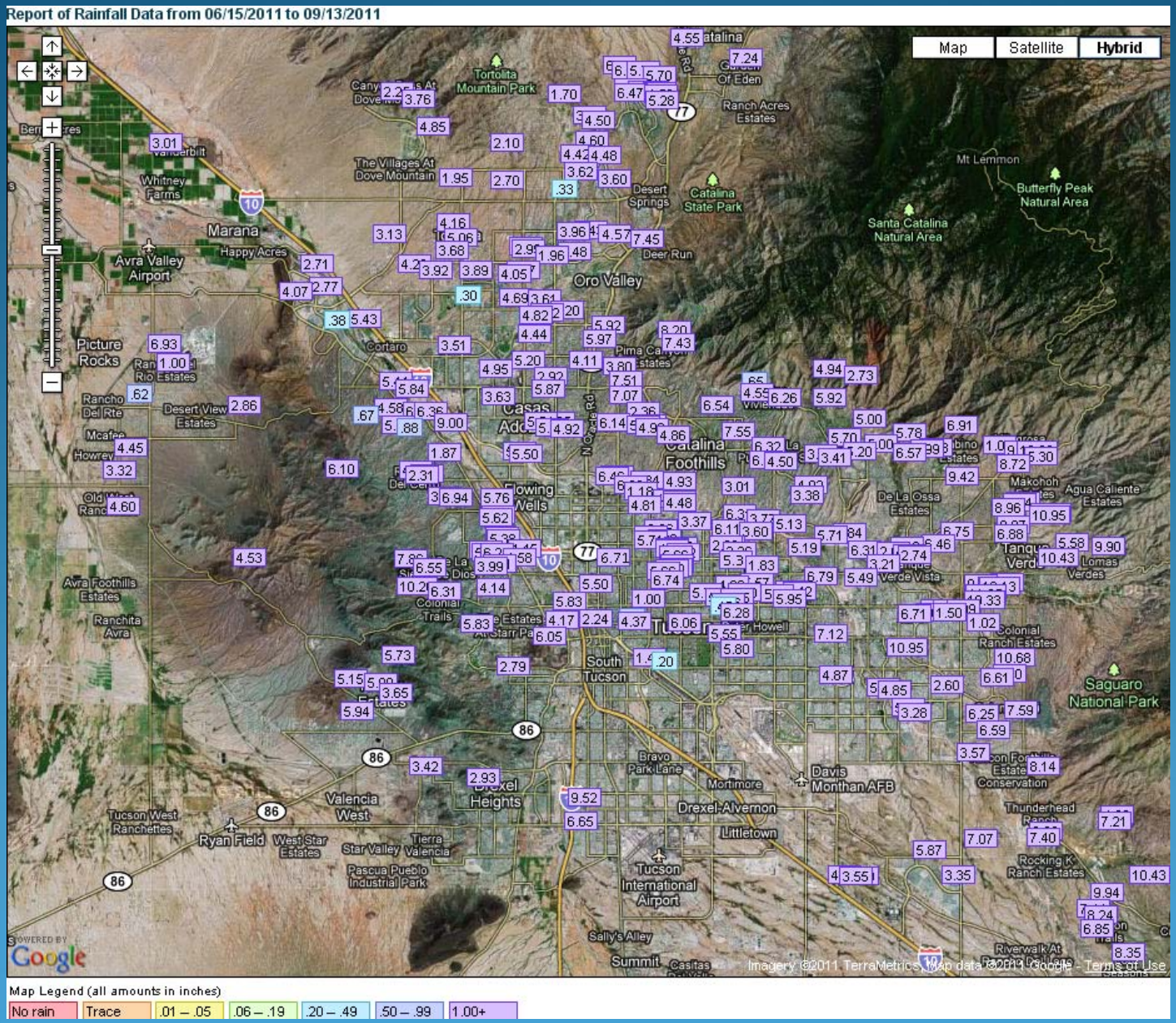
September rainfall - Cochise



September rainfall – Santa Cruz

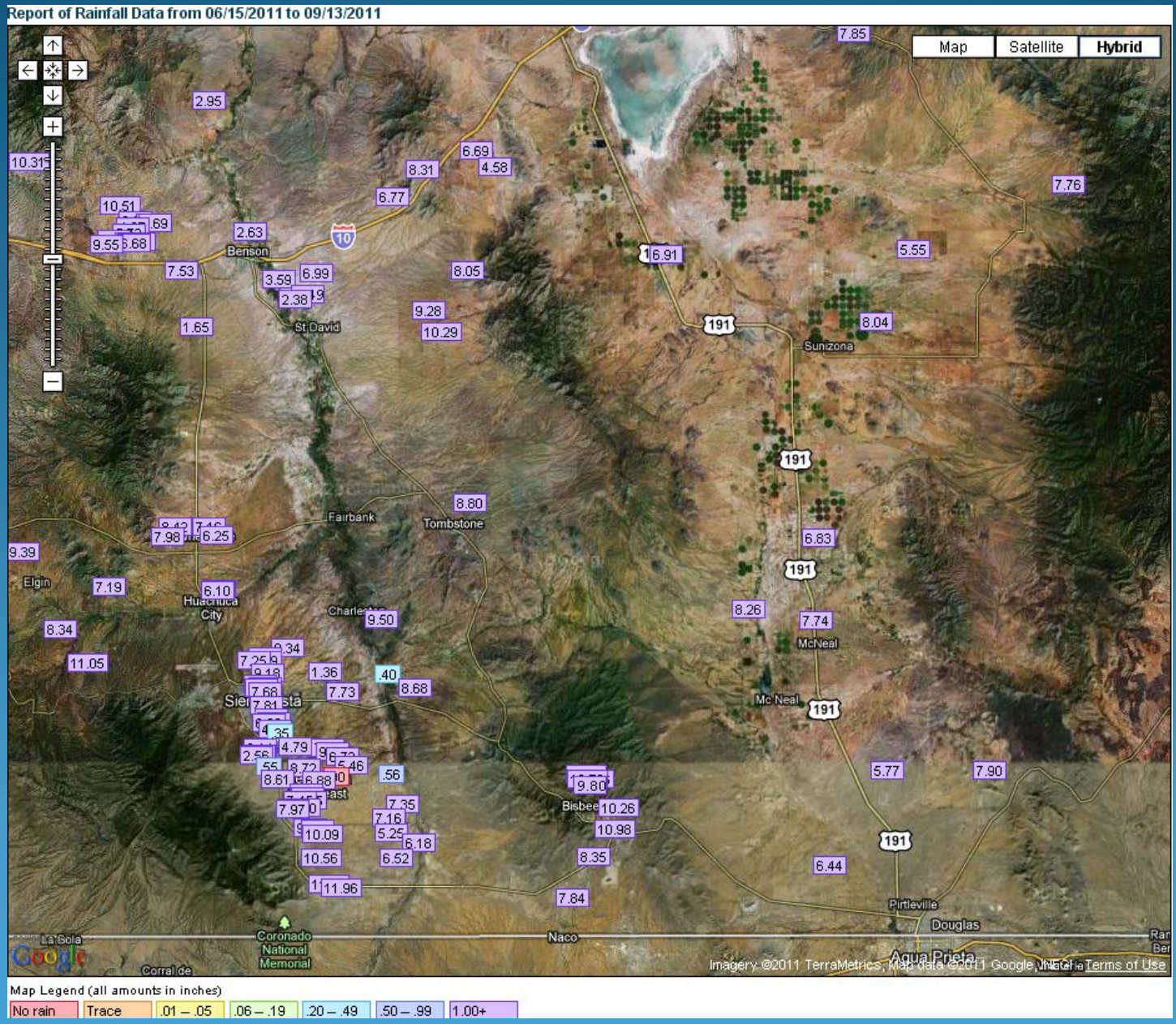


Monsoon 2011 – Tucson vicinity

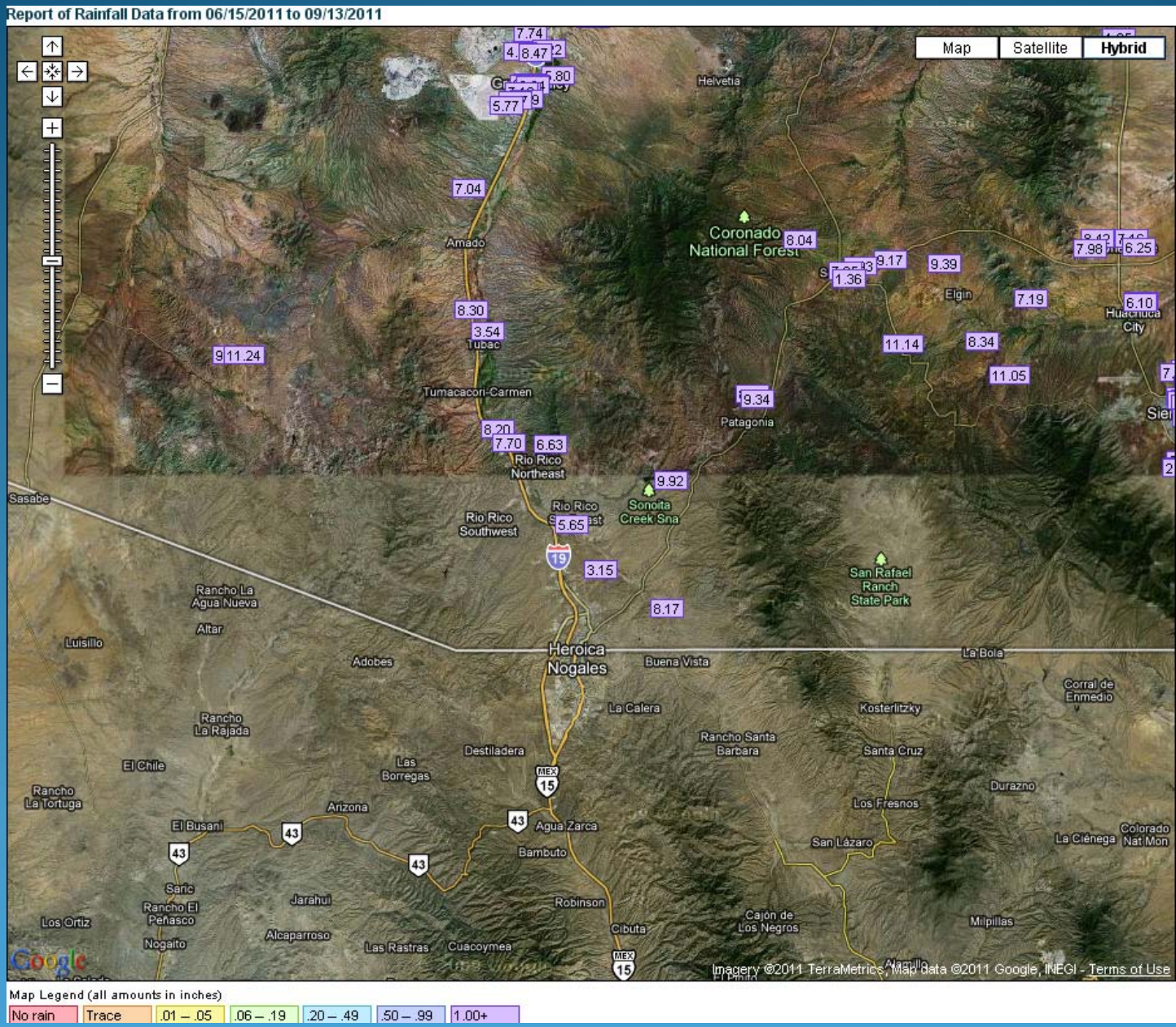


TIA 5.61”

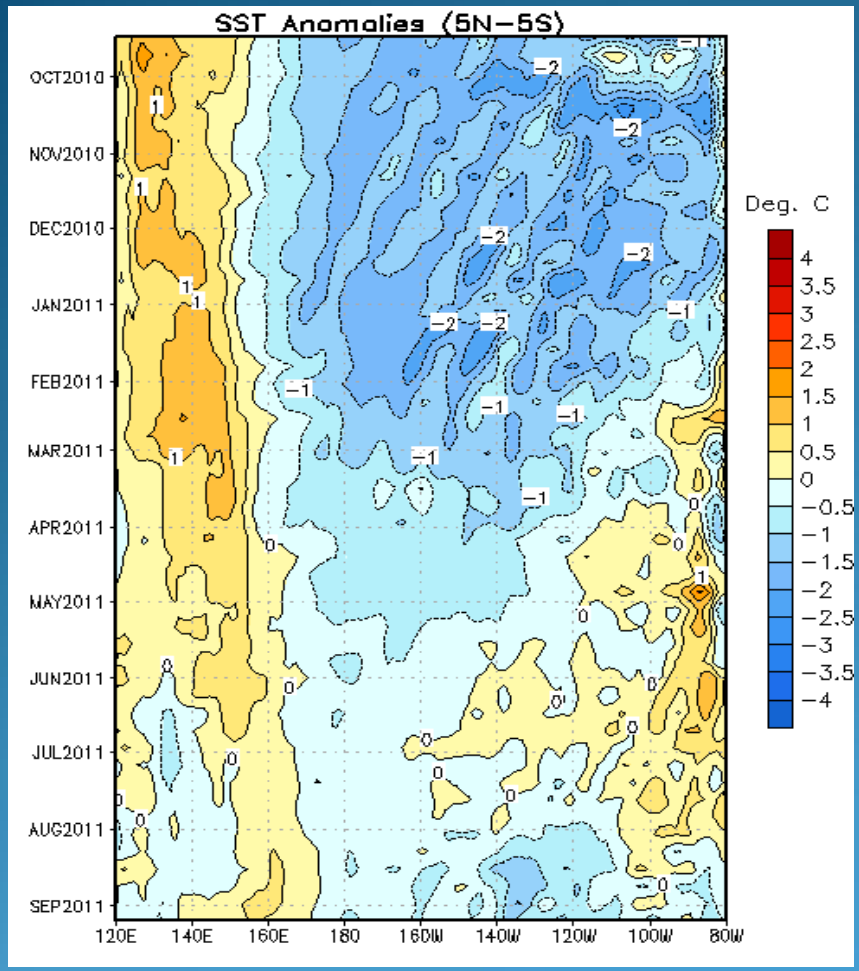
Monsoon 2011 - Cochise

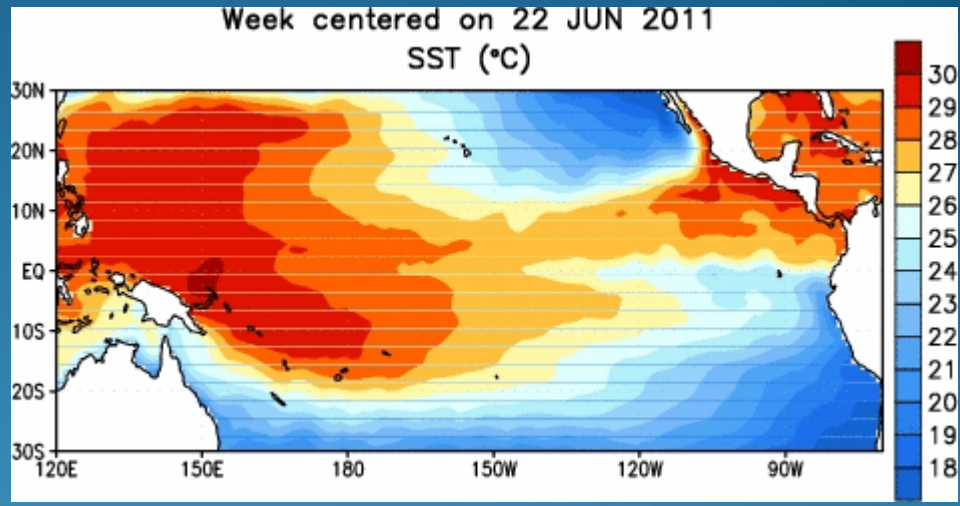


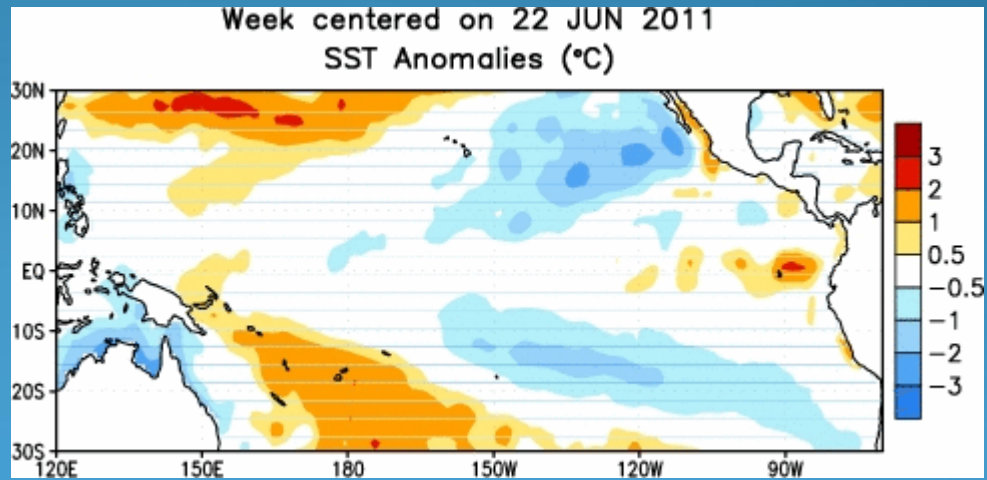
Monsoon 2011 – Santa Cruz

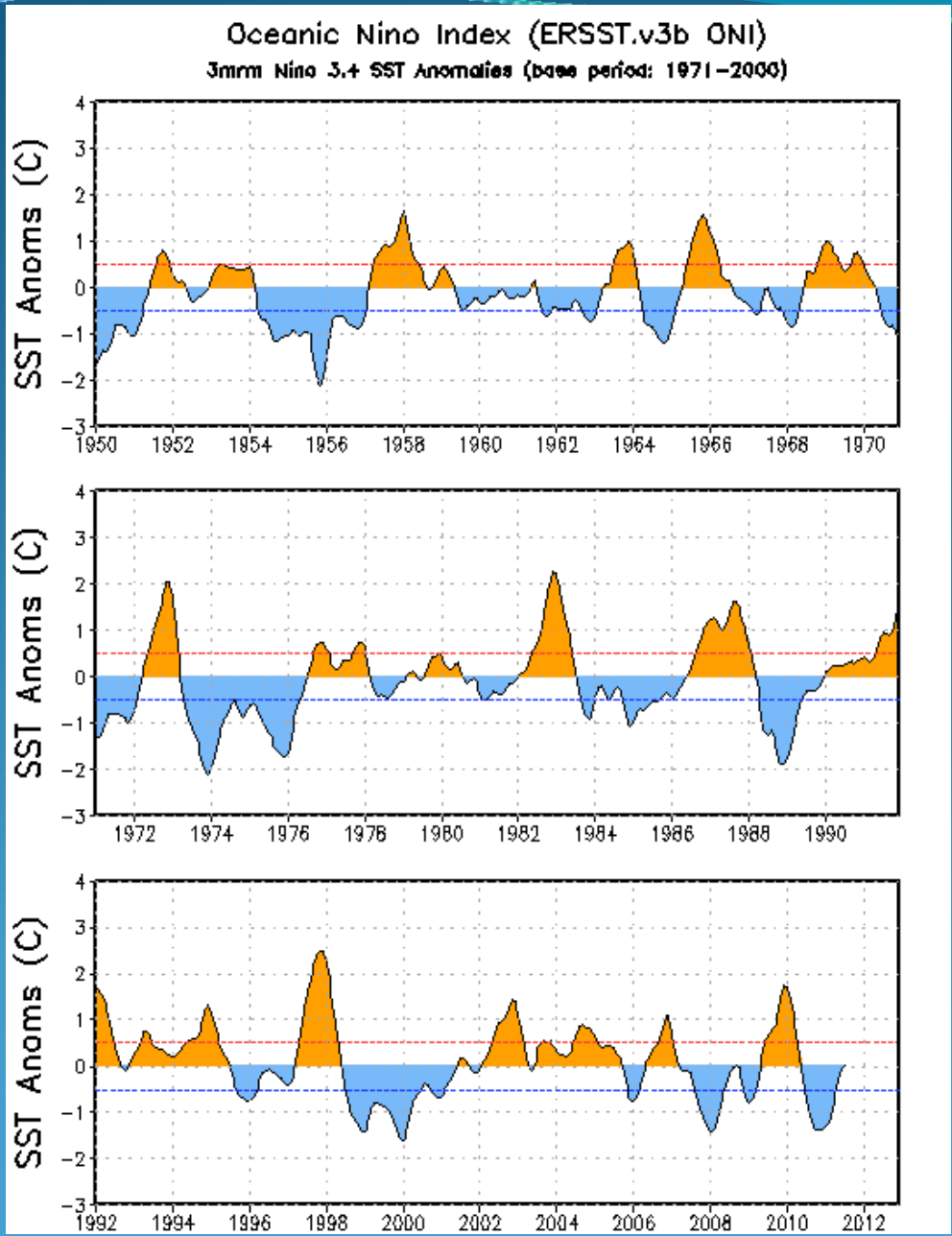


La Niña (part 2)


SST Anomalies (5N-5S)
OCT2010
NOV2010
DEC2010
JAN2011
FEB2011
MAR2011
APR2011
MAY2011
JUN2011
JUL2011
AUG2011
SEP2011
120E
140E
160E
180
160W
140W
120W
100W
80W
Deg. C
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4


Week centered on 22 JUN 2011
SST (°C)
30N
20N
10N
EQ
10S
20S
30S
120E
150E
180
150W
120W
90W
30
29
28
27
26
25
24
23
22
21
20
19
18


Week centered on 22 JUN 2011
SST Anomalies (°C)
30N
20N
10N
EQ
10S
20S
30S
120E
150E
180
150W
120W
90W
3
2
1
0.5
-0.5
-1
-2
-3


Oceanic Nino Index (ERSST.v3b ONI)
3mrm Nino 3.4 SST Anomalies (base period: 1971-2000)
SST Anoms (C)
4
3
2
1
0
-1
-2
-3
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
SST Anoms (C)
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
SST Anoms (C)
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012

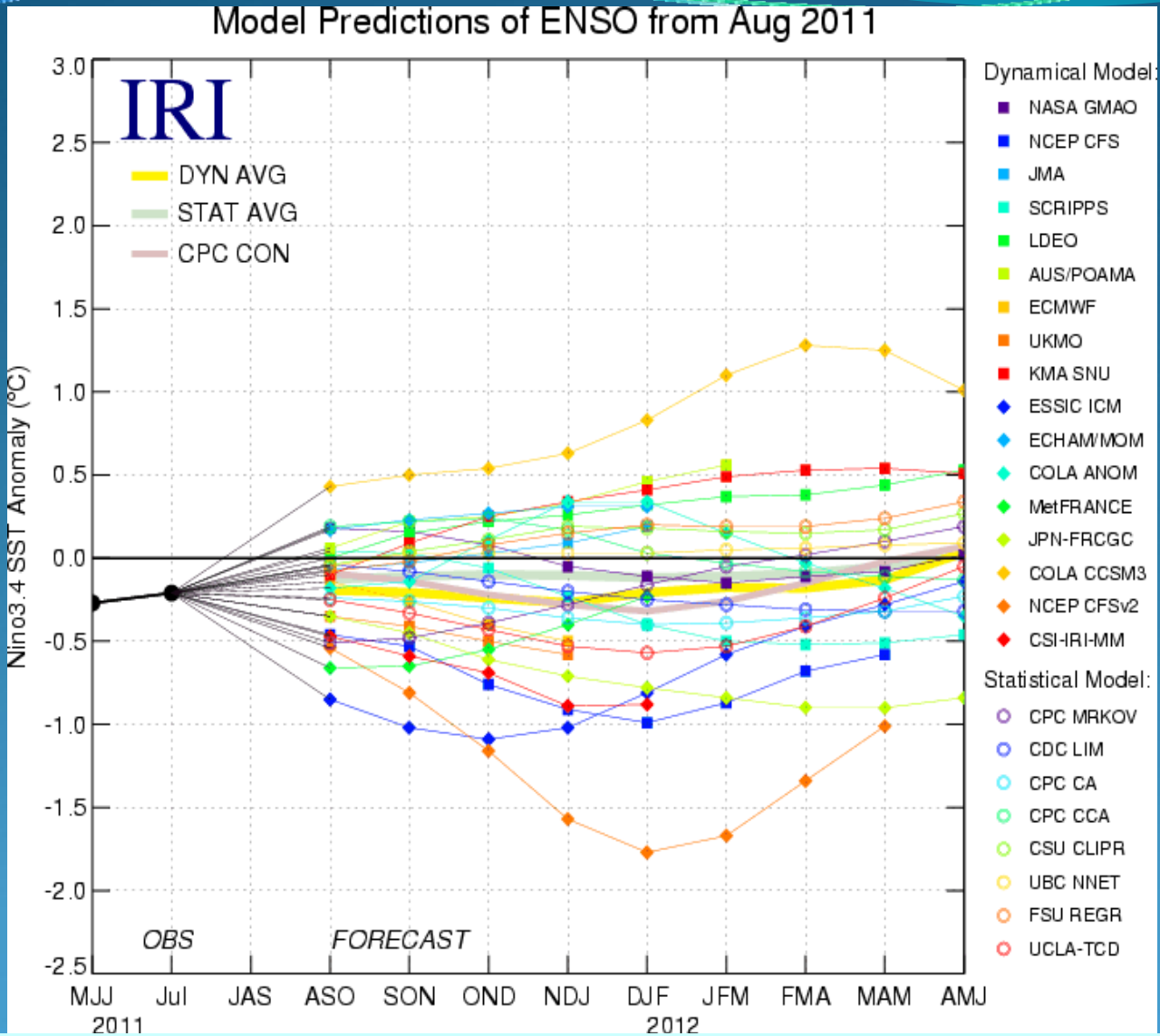
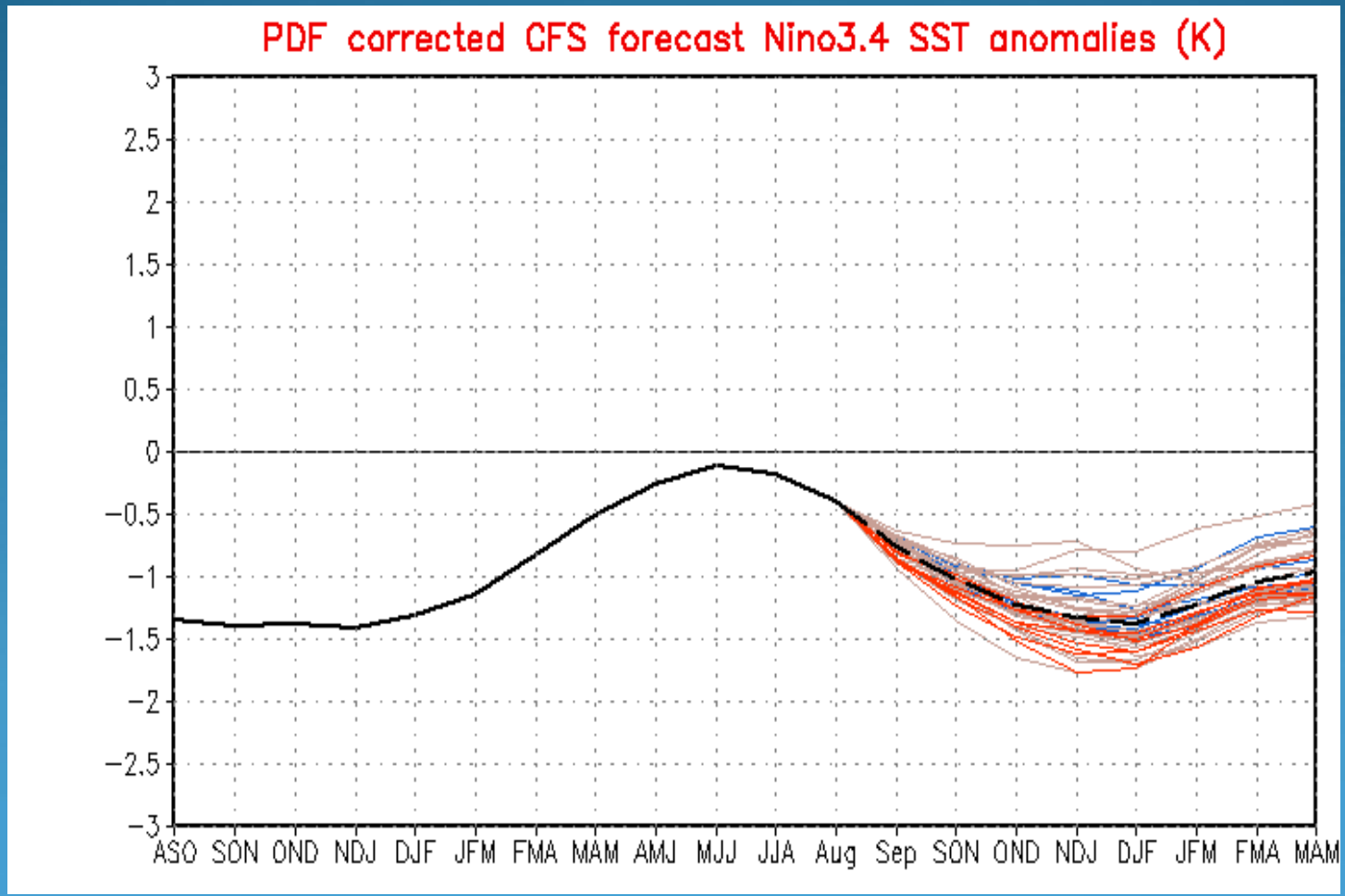
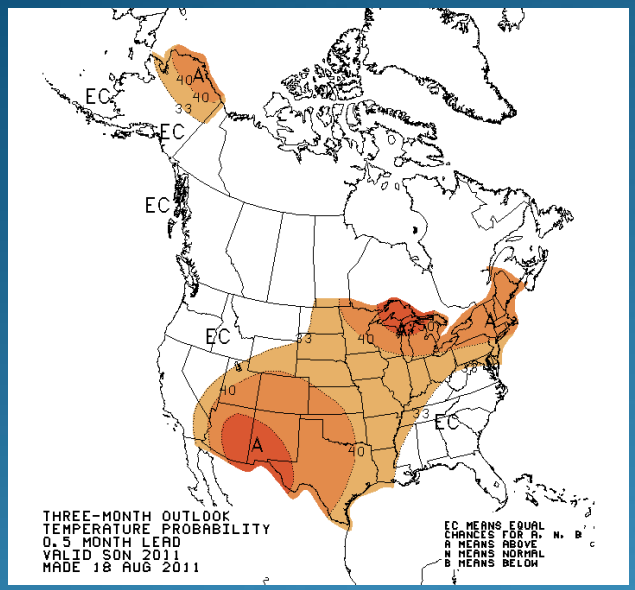


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 16 August 2011).

The CFS.v1 ensemble mean (black dashed line) predicts La Niña conditions to strengthen and continue into the Northern Hemisphere winter 2011-12.

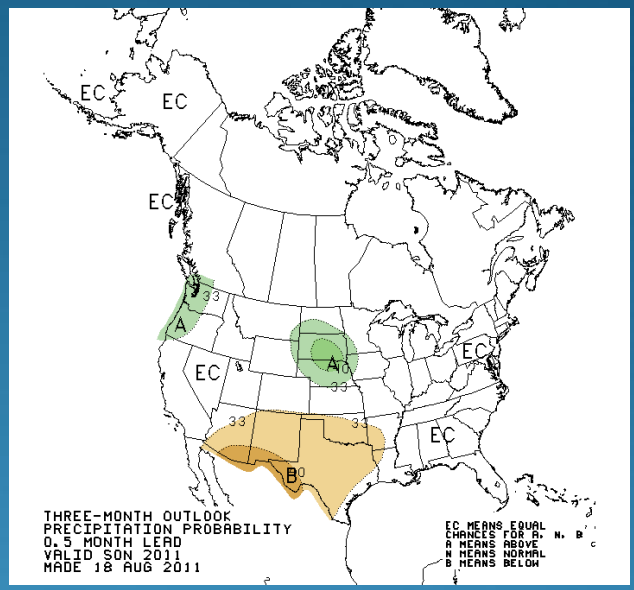


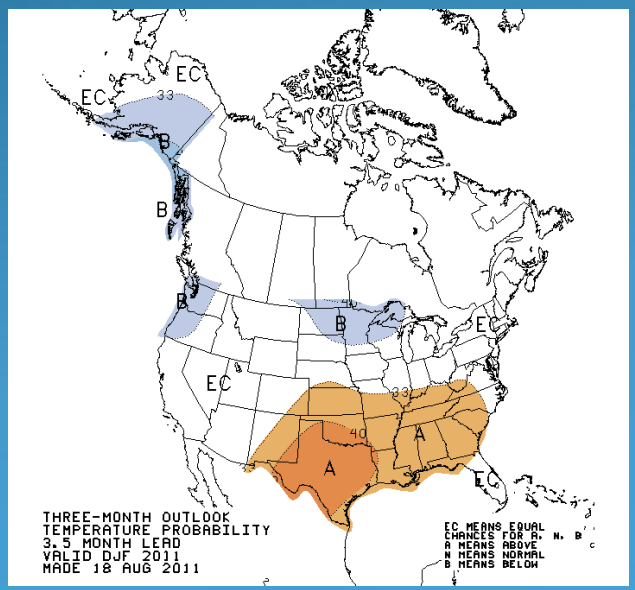


September

October

November

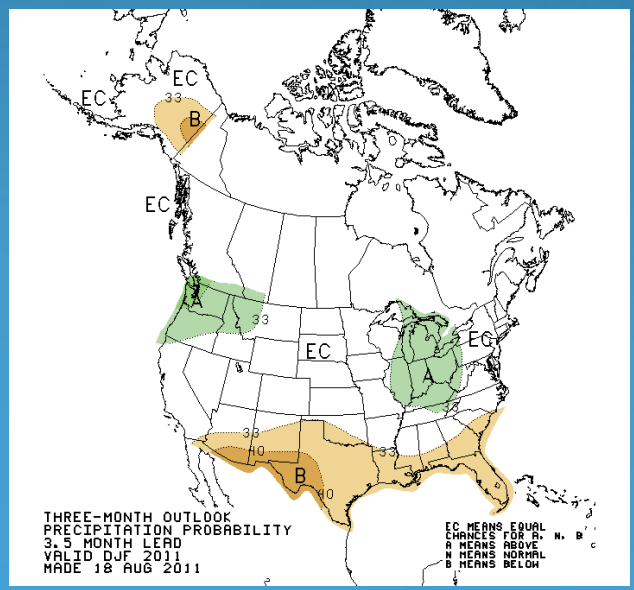




December

January

February



Precipitation totals at TIA for the past 10 moderate to strong La Niña events (ONI ≥ 1.0)

Winter (Dec-Mar)	Precip	Max ONI index
1955-56	1.95"	2.0
1964-65	2.17"	1.2
1970-71	0.97"	1.3
1973-74	1.48"	2.1
1975-76	1.49"	1.7
1988-89	1.86"	1.7
1998-99	0.46"	1.4
1999-2000	1.22"	1.6
2007-08	2.52"	1.4
2010-11	0.73"	1.4
1981-2010 Normal	**3.46"**	

In summary

- Strong La Niña from the past winter led to severe to exceptional drought conditions across southeast Arizona.
- Monsoonal moisture arrived in last June with, based on the old monsoon start definition, the season starting on the average date, July 3rd.
- Very active start to the season, became rather lackluster through early September, then picked up again due to upper low over/near southern California.
- The upper high really didn't set up shop near the four corners area for a period of time. This lead to no good "rim" shot events.
- As usual, rainfall amounts were highly variable.
- Looks like another La Niña will be around this upcoming winter.

Thank you

I will be giving an expanded Monsoon 2011 talk at next weeks meeting of the local chapter of the American Meteorological Society.

Place: USGS/NWS building

Time: 6:30 pm