



PUBLIC
VENTURA COUNTY
WORKS



Tools to Store and Analyze Historic Rainfall Data for Public Web Sites

Bruce Rindahl – Ventura County

Demand for Data

“I am a
(student/professor/consultant/lawyer)”
“What rainfall data do you have?”

“We have rainfall records back to
1873. What year, station and
interval do you need?”

“All of it....”

Need for High Resolution Rainfall Data

Camarillo Springs Flood

- December 12, 2014
- 0.50 inches of rain in 5 min
- 13 homes damaged/destroyed
- PCH closed over 1 month

Need for High Resolution Rainfall Data

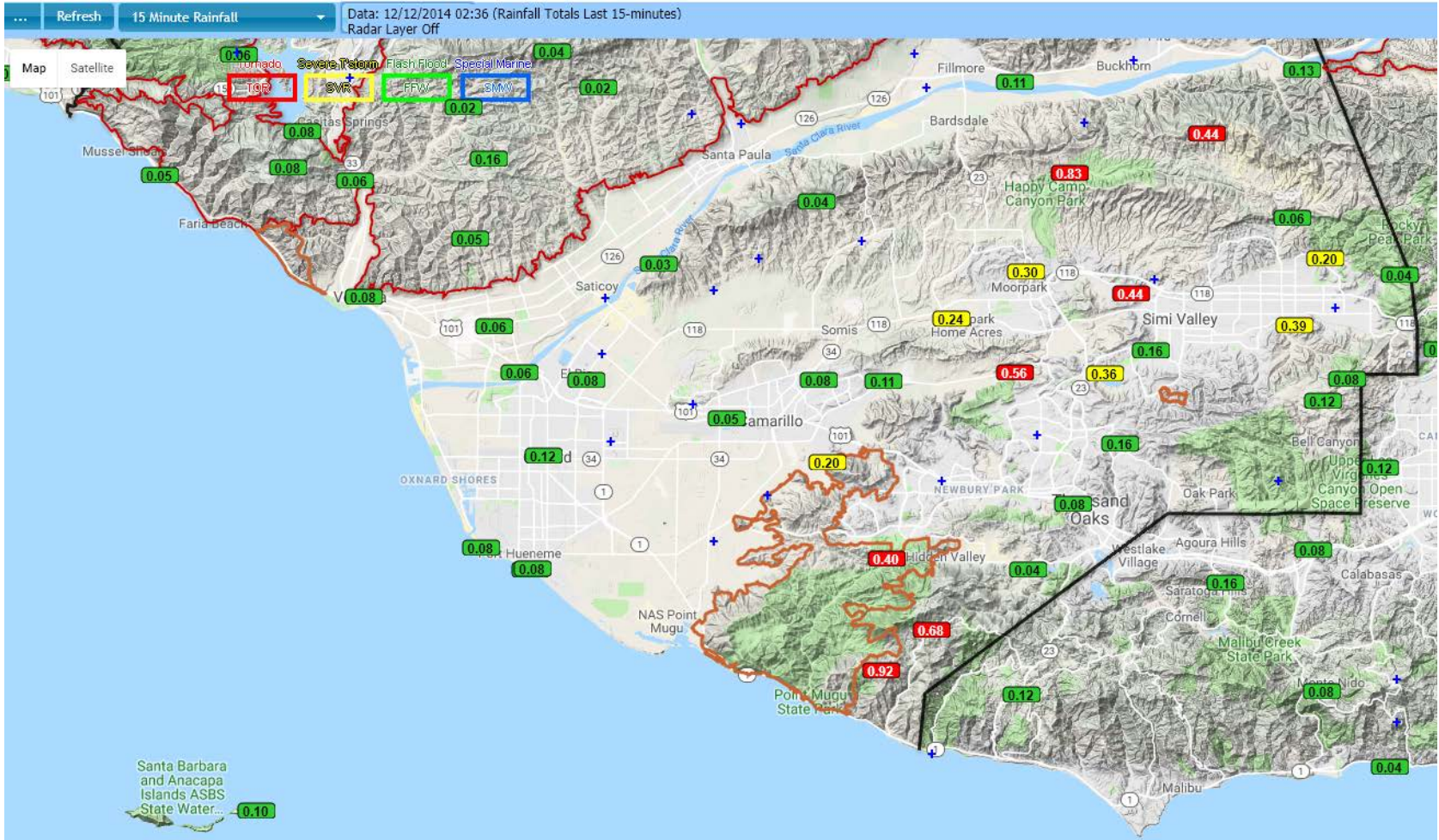
Montecito Flood

- January 9, 2018
- 0.54 inches of rain in 5 min
- 100+ homes damaged/destroyed
- US-101 closed for 13 days

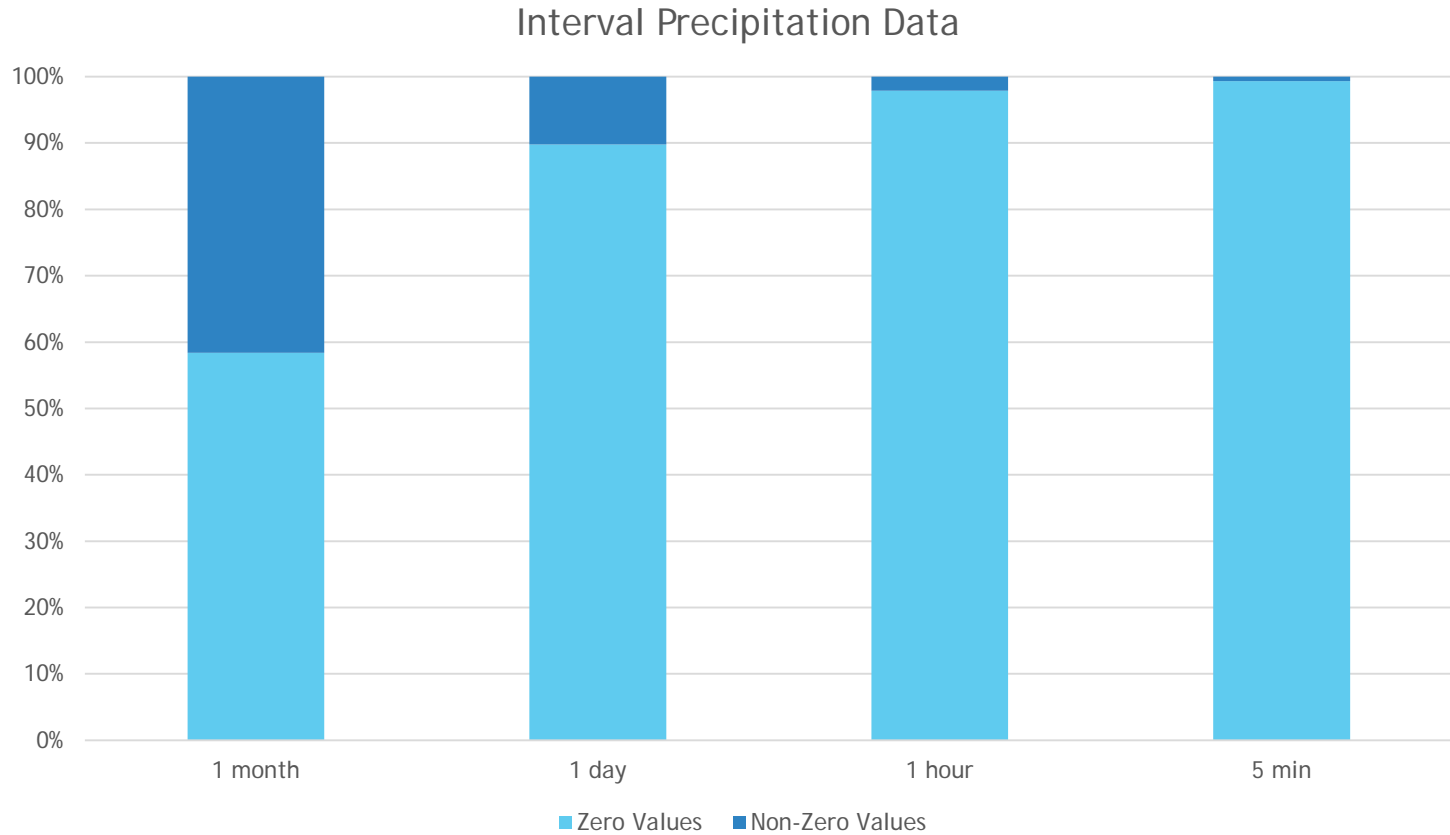
Camarillo Springs 12-12-2014



December 12, 2014



'Wasted Space'



99.3 % of 5 min data is zero

*However, we
are not alone...*

Time-series data is everywhere, but there are environments where it is especially being created in torrents. *from TimescaleDB*

Monitoring computer systems: VM, server, container metrics (CPU, free memory, net/disk IOPs), service and application metrics (request rates, request latency).

Financial trading systems: Classic securities, newer cryptocurrencies, payments, transaction events.

Internet of Things: Data from sensors on industrial machines and equipment, wearable devices, vehicles, physical containers, pallets, consumer devices for smart homes, etc.

Eventing applications: User/customer interaction data like clickstreams, pageviews, logins, signups, etc.

Business intelligence: Tracking key metrics and the overall health of the business.

Environmental monitoring: Temperature, humidity, pressure, pH, pollen count, air flow, carbon monoxide (CO), nitrogen dioxide (NO₂), particulate matter (PM₁₀).

Ventura County Data Server

Postgresql database server

- Free and Open Source
- Multiple operating systems
- Cloud Server Automatic options
- Numerous servers installed throughout the county
- But Separate tables for each time interval for speed.

Exported from VCWPD Hydrologic Data Server

Requested: 10/23/2018 17:41:18

Requested daily rainfall report for station: 273A

Period of Record: 2014-12-01 00:00 to 2015-01-01 00:00

Hourly Rainfall Data for December, 2014																												
Station:		273A		Oxnard NWS																								
Station Type:		Recording Precip Gage																										
Latitude:		34° 12' 25.9" N						Longitude:		119° 8' 14.6" W						Elevation (ft):		63										
Day	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total			
1	0.00		
2	2	20	11	19	21	10	14	15	10	2	1	.	.	.	.	.	.	1	1	1.27		
3	8	2	.	4	1	.	.	.	.	.	1	2	.	2	2	1	.	.	.	.	.	.	.	1	.	0.24
4	0.00		
5	0.00		
6	0.00		
7	0.00		
8	0.00		
9	0.00		
10	0.00		
11	0.00		
12	.	113	34	18	26	23	17	13	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	2	1	0.03
13	0.00		
14	0.00		
15	5	1	3	0.09
16	15	1	1	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.19
17	4	10	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.19
18	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	0.01		
19	0.00		
20	0.00		
21	0.00		

Ventura County Data Server

Reduce storage and increase performance

- Partitioned tables
 - Already in NovaStar database
 - Partition by time and sensor
- Dedicated time series functions
- TimescaleDB extension
 - Time_bucket function

Ventura County Data Server



hydrodata on postgres@watershedweb

```
1 select * from data_rain where site_id = '273A'  
2 and obs_date > '2014-12-12'  
3 order by obs_date
```

Data Output Explain Messages Notifications Query History

	site_id character varying (8)	obs_date timestamp with time zone	value double precision	qc integer	publish character varying (1)
1	273A	2014-12-12 01:15:22-08	0.01	1	A
2	273A	2014-12-12 01:33:41-08	0.01	1	A
3	273A	2014-12-12 01:34:51-08	0.01	1	A
4	273A	2014-12-12 01:35:22-08	0.01	1	A
5	273A	2014-12-12 01:35:44-08	0.01	1	A
6	273A	2014-12-12 01:36:00-08	0.01	1	A
7	273A	2014-12-12 01:36:14-08	0.01	1	A
8	273A	2014-12-12 01:36:25-08	0.01	1	A
9	273A	2014-12-12 01:36:37-08	0.01	1	A
10	273A	2014-12-12 01:36:40-08	0.01	1	A
11	273A	2014-12-12 01:36:49-08	0.01	1	A
12	273A	2014-12-12 01:37:00-08	0.01	1	A

Ventura County Data Server

hydrodata on postgres@watershedweb

```
1 select * from
2 get_rainfall('273A','2014-12-11','2014-12-15','1 day')
```

Data Output Explain Messages Notifications Query History

	site_id character varying	ending_time timestamp without time zone	precip numeric	qc integer	publish text
1	273A	2014-12-11 00:00:00	0	[null]	[null]
2	273A	2014-12-12 00:00:00	0.03	2	A
3	273A	2014-12-13 00:00:00	2.47	1	A
4	273A	2014-12-14 00:00:00	0	[null]	[null]
5	273A	2014-12-15 00:00:00	0	[null]	[null]

Ventura County Data Server

hydrodata on postgres@watershedweb

```
1 select * from
2 get_rainfall('273A','2014-12-12','2014-12-13','1 hour')
```

Data Output Explain Messages Notifications Query History

	site_id character varying	ending_time timestamp without time zone	precip numeric	qc integer	publish text
1	273A	2014-12-12 00:00:00	0	[null]	[null]
2	273A	2014-12-12 01:00:00	0	[null]	[null]
3	273A	2014-12-12 02:00:00	1.13	1	A
4	273A	2014-12-12 03:00:00	0.34	1	A
5	273A	2014-12-12 04:00:00	0.18	1	A
6	273A	2014-12-12 05:00:00	0.26	1	A
7	273A	2014-12-12 06:00:00	0.23	1	A
8	273A	2014-12-12 07:00:00	0.17	1	A
9	273A	2014-12-12 08:00:00	0.13	1	A

Ventura County Data Server

hydrodata on postgres@watershedweb

```
1 select * from
2 get_rainfall('273A','2014-12-12','2014-12-13','5 min',false)
```

Data Output Explain Messages Notifications Query History

	site_id character varying	ending_time timestamp without time zone	precip numeric	qc integer	publish text
1	273A	2014-12-12 01:20:00	0.01	1	A
2	273A	2014-12-12 01:35:00	0.02	1	A
3	273A	2014-12-12 01:40:00	0.39	1	A
4	273A	2014-12-12 01:45:00	0.38	1	A
5	273A	2014-12-12 01:50:00	0.23	1	A
6	273A	2014-12-12 01:55:00	0.05	1	A

Ventura County Data Server



hydrodata on postgres@watershedweb

```
1 select * from  
2 get_rainfall('273A','2014-12-12','2014-12-13','1 min',false)
```

Data Output

[Explain](#)

[Messages](#)

[Notifications](#)

[Query History](#)

	site_id character varying	ending_time timestamp without time zone	precip numeric	qc integer	publish text
1	273A	2014-12-12 01:16:00	0.01	1	A
2	273A	2014-12-12 01:34:00	0.01	1	A
3	273A	2014-12-12 01:35:00	0.01	1	A
4	273A	2014-12-12 01:36:00	0.02	1	A
5	273A	2014-12-12 01:37:00	0.06	1	A
6	273A	2014-12-12 01:38:00	0.08	1	A
7	273A	2014-12-12 01:39:00	0.12	1	A
8	273A	2014-12-12 01:40:00	0.11	1	A
9	273A	2014-12-12 01:41:00	0.10	1	A
10	273A	2014-12-12 01:42:00	0.09	1	A
11	273A	2014-12-12 01:43:00	0.06	1	A

Ventura County Data Server

```
hydrodata on postgres@watershedweb  
1 select * from  
2 get_rainfall('273A','2014-12-12','2014-12-13','5 min','2 min',false)
```

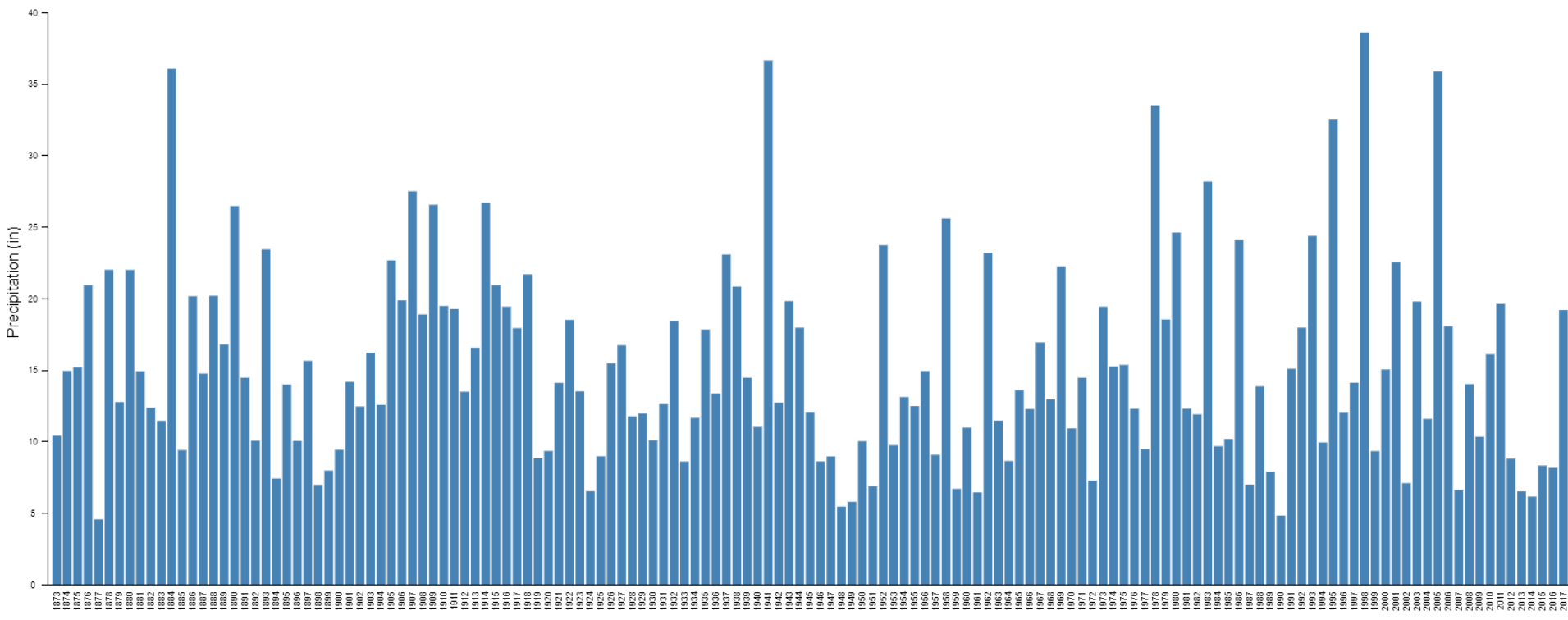
Data Output Explain Messages Notifications Query History

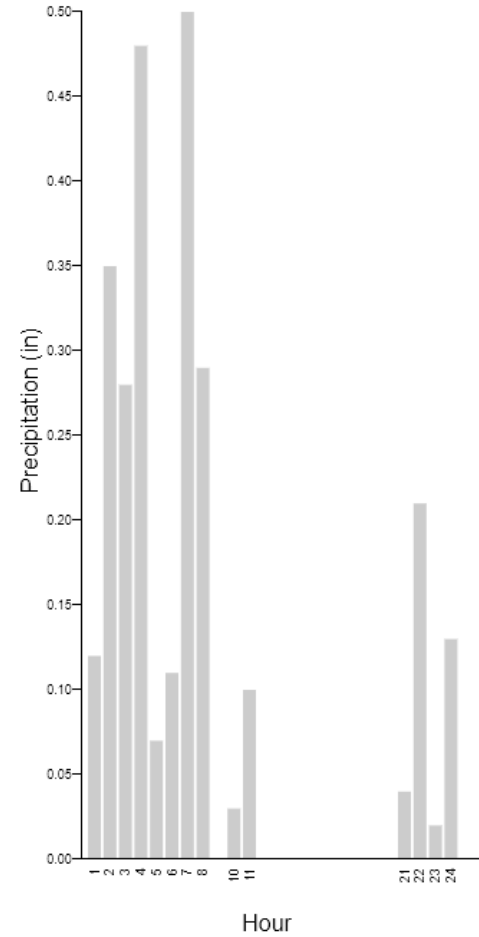
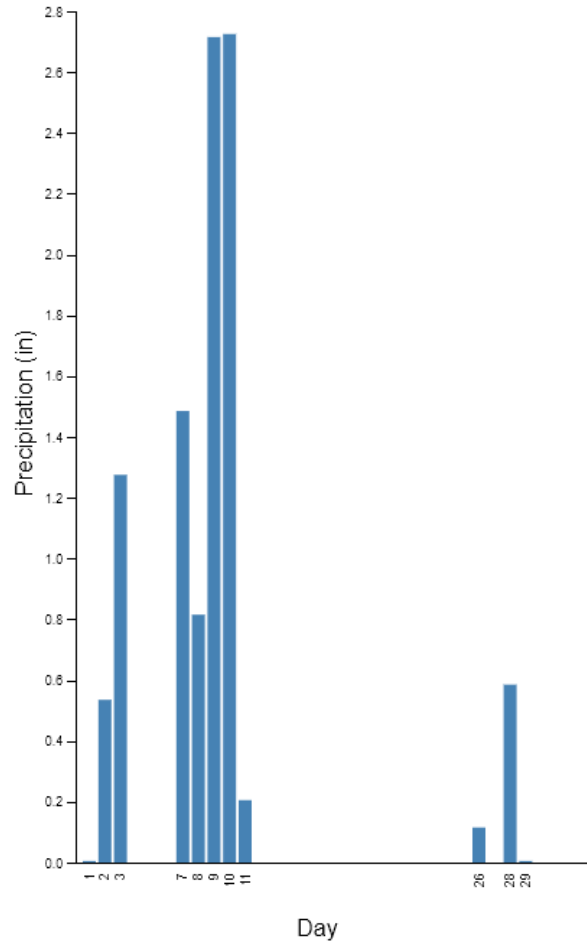
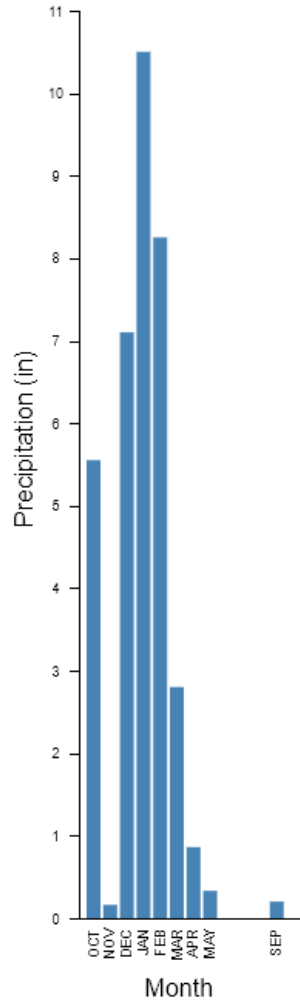
	site_id character varying	ending_time timestamp without time zone	precip numeric	qc integer	publish text
1	273A	2014-12-12 01:17:00	0.01	1	A
2	273A	2014-12-12 01:37:00	0.10	1	A
3	273A	2014-12-12 01:42:00	0.50	1	A
4	273A	2014-12-12 01:47:00	0.33	1	A
5	273A	2014-12-12 01:52:00	0.11	1	A
6	273A	2014-12-12 01:57:00	0.04	1	A

Web Based Tools for Data Analysis / Display

Let the user's computer do all the work

Ventura-Downtown (City Hall-Historic Courthouse)







PUBLIC **VENTURA COUNTY** **WORKS**



Any Questions?