

Practical Use of AQPI Products



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Contra Costa County Flood Control &
Water Conservation District



BAWAC Presentation
November 1, 2021

Practical Use of AQPI Products



Since January 2021, the FD District has been using AQPI forecast data on an hourly basis.

The data is put on a cloud server on a scheduled basis and we read it from there.

The data is in agreed upon formats.

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Polygon Data

```
dateTime:202110262000
numPoints,numForecasts,forecastPeriod,units
5,18,1hx18,mm
PointID,Latitude(degrees),Longitude(degrees),forecastValue1,forecastValue2, ...,forecastValuenumForecasts
Point1,37.952,-122.284,0,0,0,0,0.004,0.007,0.011,0,0,0,0,0,0,0,0,0,0,0
Point2,37.974,-122.002,0,0,0,0,0,0,0.001,0,0,0,0,0,0,0,0,0,0,0
Point3,37.869,-122.09,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Point4,37.791,-121.869,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
Point5,37.922,-121.758,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```



Short and Long Range Model
Not used yet. Should look like point data

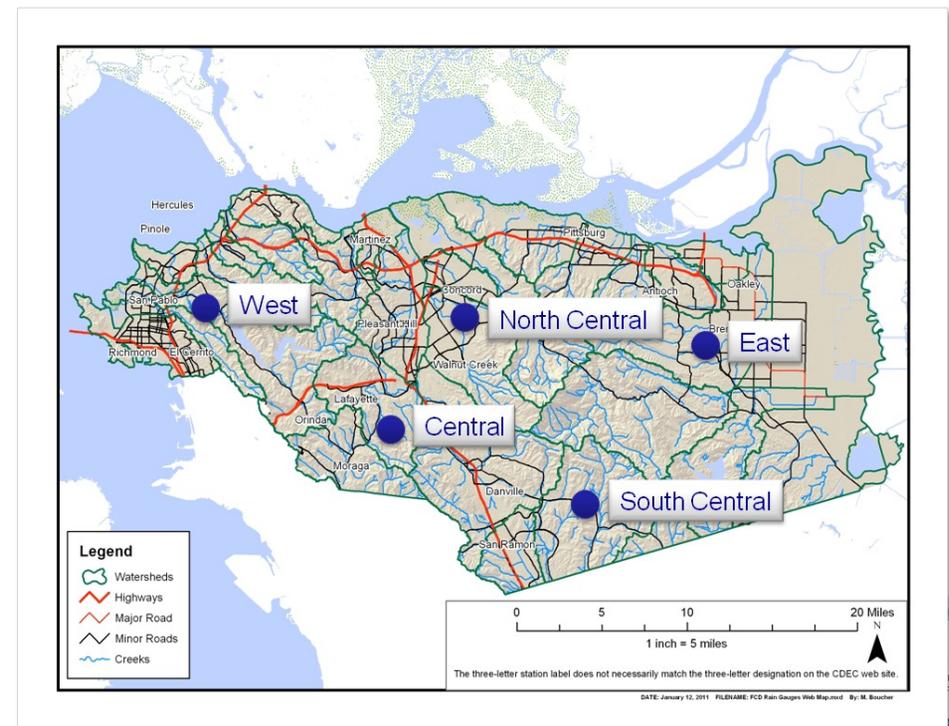
This should provide the average precipitation over an area (ex. Watershed).



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Point Data

- The data is for 5 specific points we have been using in our 7532 Flood! protocols.



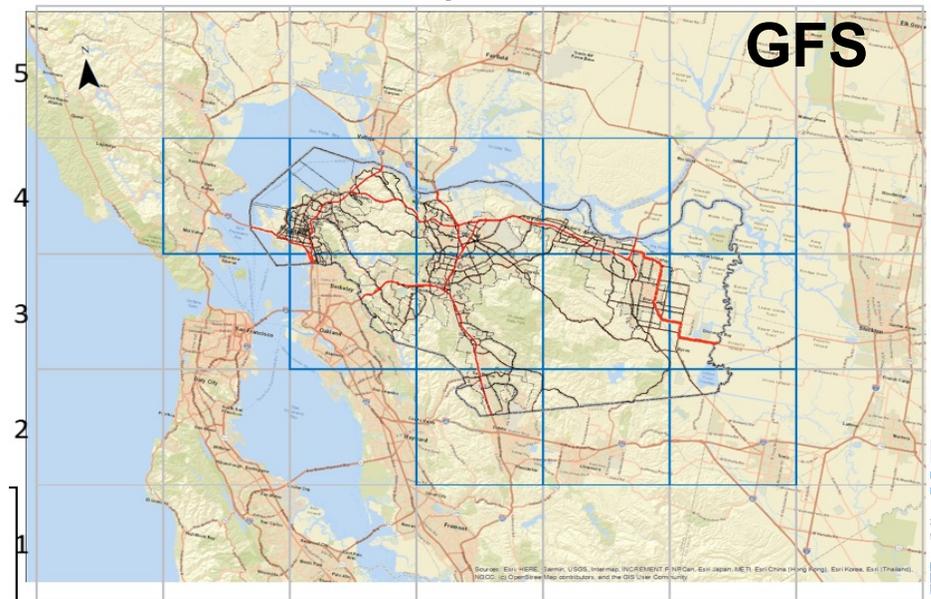
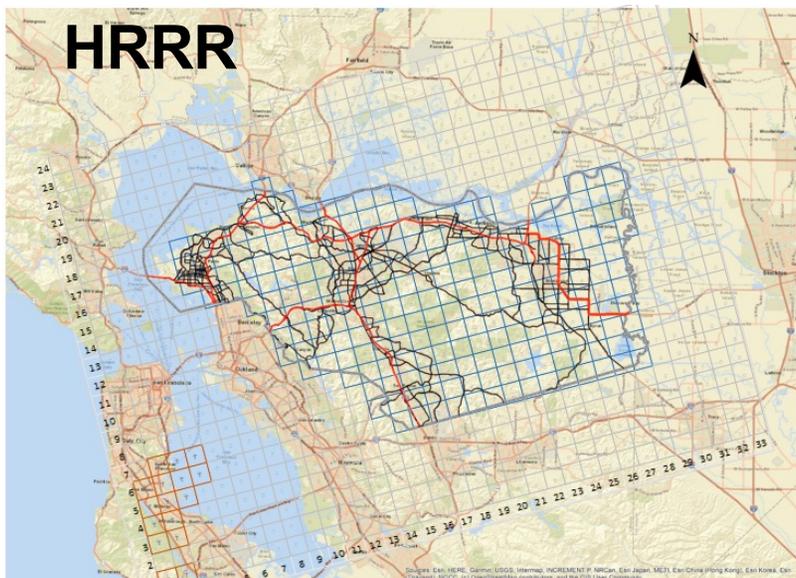
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Grid Data

AQPI “gridded” format forecast. Points that can be interpolated

~1.8 miles square

between ~12.3 miles square



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High-Resolution Rapid Refresh Forecast - (HRRR)

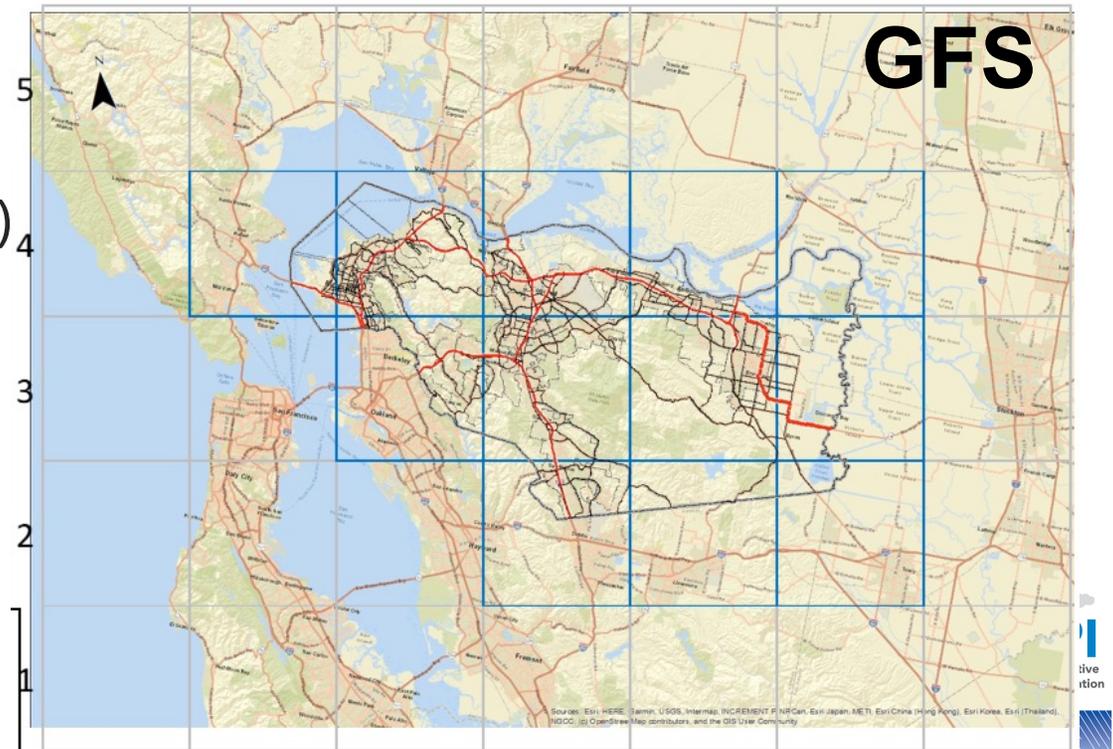
- 18 x 1 hour quantitative forecast updated every 1 hour.
- Updated every hour.



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Global Forecast System Forecast - (GFS)

- 28 x 3 hours for (3.5 days) then 26 x 6 hours for (6.5 days):
Total of **10 days**.
- Updated every 6 hours at 4 and 10 AM/PM (PST)



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The screenshot displays the RainMap web application interface. The browser address bar shows ccflood.us/rainmap.html. The interface includes a navigation menu with options: Datasets, Layers, Radar, More, and Reset. The main map area shows a geographical view of the San Francisco Bay Area, with various data layers overlaid. A sidebar on the right contains several menu items: AQPI Forecast Table, AQPI Forecast Grid, Sandbag Info, Satellite Images & Maps, Data Plots, 7532 Plots, and 11 Year Plot. Two red arrows point from the right towards the 'AQPI Forecast Table' and '7532 Plots 11 Year Plot' items. Below the main map, there are smaller thumbnail images for '53', 'QPF Maps', and '753 FLOOD!'. A second screenshot below the first shows a similar view but with a '0.03' value displayed on the map and a '753 FLOOD!' warning icon.

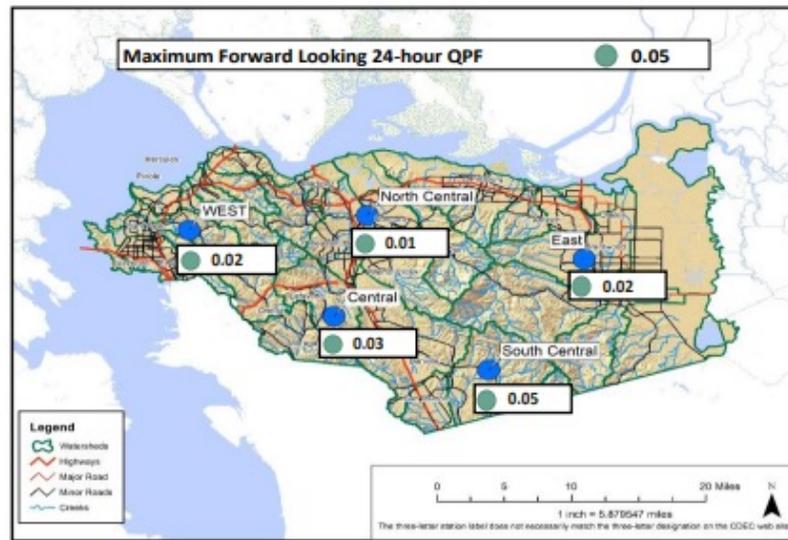
www.ccflood.us/rainmap.html
or
www.contracosta.ca.gov/rainmap



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Point Data Forecast Table

Experimental Forecast Table		Model Results Updated Periodically		Published: Mon 02/14/22 7:25 AM (02/14 03:25 PM UTC)		 v22.01.18		
HRRR: Mon 5:00 AM HRRR: Mon 6:45 AM HRRR: Mon 6:00 AM HRRR: Mon 7:45 AM		GFS: Sun 10:00 PM GFS: Mon 4:00 AM GFS: Mon 4:00 AM GFS: Mon 10:00 AM		<- Time model started for displayed data. <- Time results were available for displayed data. <- Next scheduled model start time. <- Next time results will be available.		Max rain is at time step ending at Sun 02/20/2022 7:00 PM		
Legend = Time step Change = Trace of rain < 0.01" = Time of max rain.		= timestep rate ≥ 2"/24 hr. or 0.083"/hr. = rainfall ≥ 2" forecast over the next 24 hours. = rainfall depth (relative scale)						
HRRR OK	GFS OK	End of time step		Incremental Rain Forecast (inches)				
Forecast Source	Time Step (hours)	Times are for PST		West	North Central	Central	South Central	East
Test if 75% flood conditions met using current rainfall readings and next 24 hours -> Latest 24 hour forecast ->								
				0.00	0.00	0.00	0.00	0.00
Incremental Rain Forecast	HRRR Model	1	Mon 2/14/22 5:00 AM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 6:00 AM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 7:00 AM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 8:00 AM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 9:00 AM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 10:00 AM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 11:00 AM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 12:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 1:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 2:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 3:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 4:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 5:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 6:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 7:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 8:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 9:00 PM	-	-	-	-	-
	HRRR Model	1	Mon 2/14/22 10:00 PM	-	-	-	-	-
	GFS Model	3	Tue 2/15/22 1:00 AM	-	-	-	-	-
	GFS Model	3	Tue 2/15/22 4:00 AM	-	-	-	-	-
GFS Model	3	Tue 2/15/22 7:00 AM	-	-	-	-	-	
GFS Model	3	Tue 2/15/22 10:00 AM	-	-	-	-	-	
GFS Model	3	Tue 2/15/22 1:00 PM	-	-	-	-	-	
GFS Model	3	Tue 2/15/22 4:00 PM	-	-	-	-	-	
GFS Model	3	Tue 2/15/22 7:00 PM	-	-	-	-	-	
GFS Model	3	Tue 2/15/22 10:00 PM	-	-	-	-	-	
GFS Model	3	Wed 2/16/22 1:00 AM	-	-	-	-	-	
GFS Model	3	Wed 2/16/22 4:00 AM	-	-	-	-	-	
GFS Model	3	Wed 2/16/22 7:00 AM	-	-	-	-	-	
GFS Model	3	Wed 2/16/22 10:00 AM	-	-	-	-	-	



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Forecast Table

- The data is downloaded and the table updated on an hourly basis.
- We are still testing and tweaking this “experimental” table and hope to get confident it what it is telling us.

Experimental Forecast Table		Model Results Updated Periodically		v21.10.29 Published: 11/1/21 9:46 AM			
HRRR: Mon 8:00 AM GFS: Sun 11:00 PM HRRR: Mon 9:45 AM GFS: Mon 5:00 AM HRRR: Mon 9:00 AM GFS: Mon 5:00 AM HRRR: Mon 10:45 AM GFS: Mon 11:00 AM Updated Hourly Updated Every 6 Hours		No Guarantee of accuracy is intended or implied. <- Time model started for displayed data. <- Time results were available for displayed data. <- Next scheduled model start time. <- Next time results will be available.		Forecast source: NOAA experimental AQPI forecasts.			
Legend		* = Time step Change Trace: < 0.0075" = Rain depth relative to 0.01" or MaxRain1.2"		= timestep rate ≥ 2"/24 hr. or 0.083 "/hr. = rainfall ≥ 2" forecast over the next 24 hours.			
HRRR Forecast Problem	GFS OK	Shaded Values = Past	Incremental Rain Forecast (inches) Faded Values < 0.005				
Forecast Source	Time Step (hours)	HRRR or GFS Time	West	North Central	Central	South Central	East
HRRR Model	1	Mon 11/1/21 8:00 AM			Trace		
HRRR Model	1	Mon 11/1/21 9:00 AM	Trace		Trace	Trace	
HRRR Model	1	Mon 11/1/21 10:00 AM	0.024	0.019	0.024	0.027	Trace
GFS Model	1	Mon 11/1/21 11:00 AM	0.059	0.063	0.063	0.058	0.064
GFS Model	3	Mon 11/1/21 2:00 PM	0.027	Trace	Trace	Trace	Trace
GFS Model	3	Mon 11/1/21 5:00 PM	0.015	Trace	Trace	Trace	
GFS Model	3	Mon 11/1/21 8:00 PM	Trace	Trace	Trace		
GFS Model	3	Mon 11/1/21 11:00 PM					Trace
GFS Model	3	Tue 11/2/21 2:00 AM	Trace			Trace	
GFS Model	3	Tue 11/2/21 5:00 AM		Trace	Trace		
GFS Model	3	Tue 11/2/21 8:00 AM					
GFS Model	3	Tue 11/2/21 11:00 AM					
GFS Model	3	Tue 11/2/21 2:00 PM					
GFS Model	3	Tue 11/2/21 5:00 PM					
GFS Model	3	Tue 11/2/21 8:00 PM					
GFS Model	3	Tue 11/2/21 11:00 PM					
GFS Model	3	Wed 11/3/21 2:00 AM					
GFS Model	3	Wed 11/3/21 5:00 AM					
GFS Model	3	Wed 11/3/21 8:00 AM					
GFS Model	3	Wed 11/3/21 11:00 AM					
GFS Model	3	Wed 11/3/21 2:00 PM					
GFS Model	3	Wed 11/3/21 5:00 PM					
GFS Model	3	Wed 11/3/21 8:00 PM					
GFS Model	3	Wed 11/3/21 11:00 PM					
GFS Model	3	Thu 11/4/21 2:00 AM	0.062	0.015	0.015	0.012	Trace
GFS Model	3	Thu 11/4/21 5:00 AM	0.049	0.030	0.030	0.027	0.030
GFS Model	3	Thu 11/4/21 8:00 AM	0.010	0.010	0.010	0.015	Trace
GFS Model	6	Thu 11/4/21 2:00 PM					

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AQPI data used on 10/23/2021 for the 10/24-10/25 storm.

- Formatted to color cells **red** when the values looking 24 hour in the future sum to $\geq 2''$
- Cells are colored **orange** if the intensity during that time step are $\geq 2''/24$ hours or $0.083''/hr.$

Experimental Forecast Table			Model Results Updated Periodically			v21.10.19 Published: 10/23/21 11:43 AM	
No Guarantee of accuracy is intended or implied.			Forecast source: NOAA experimental AQPI forecasts.				
HRRR: Sat 9:00 AM HRRR: Sat 10:45 AM HRRR: Sat 12:00 PM HRRR: Sat 11:45 AM			GFS: Sat 5:00 AM GFS: Sat 11:00 AM GFS: Sat 11:00 AM GFS: Sat 5:00 PM			< Time model started for displayed data. < Time results were available for displayed data. < Next scheduled model start time. < Next time results will be available.	
Legend = Time step Change = Rain depth relative to 0.01" or MaxRain*1.2			Trace: < 0.0075" = timestep rate $\geq 2''/24$ hr. or 0.083"/hr.			= rainfall $\geq 2''$ forecast over the next 24 hours.	
HRRR OK	GFS Forecast Problem	Shaded Values = Past	Incremental Rain Forecast (inches)				
Forecast Source	Time Step (hours)	HRRR or GFS Time	West	North Central	Central	South Central	East
HRRR Model	1	Sat 10/23/21 9:00 AM	Trace				
HRRR Model	1	Sat 10/23/21 10:00 AM	Trace				
HRRR Model	1	Sat 10/23/21 11:00 AM	Trace				
HRRR Model	1	Sat 10/23/21 12:00 PM	Trace				
HRRR Model	1	Sat 10/23/21 1:00 PM	Trace				
HRRR Model	1	Sat 10/23/21 2:00 PM	Trace				
HRRR Model	1	Sat 10/23/21 3:00 PM	Trace				
HRRR Model	1	Sat 10/23/21 4:00 PM	Trace				
HRRR Model	1	Sat 10/23/21 5:00 PM	Trace	Trace	Trace	Trace	
HRRR Model	1	Sat 10/23/21 6:00 PM	Trace	Trace	Trace	Trace	0.0083
HRRR Model	1	Sat 10/23/21 7:00 PM	0.0524	0.0102	Trace	Trace	Trace
HRRR Model	1	Sat 10/23/21 8:00 PM	0.0618	Trace	0.0394	Trace	Trace
HRRR Model	1	Sat 10/23/21 9:00 PM	0.2437	0.1240	0.1236	0.0953	0.0157
HRRR Model	1	Sat 10/23/21 10:00 PM	0.1551	0.0571	0.0350	0.0988	0.0744
HRRR Model	1	Sat 10/23/21 11:00 PM	0.1661	0.0244	0.0579	0.0323	0.0114
HRRR Model	1	Sun 10/24/21 12:00 AM	0.3177	0.0724	0.1409	0.0394	0.0307
HRRR Model	1	Sun 10/24/21 1:00 AM	0.1228	0.0327	0.0772	0.0185	0.0122
HRRR Model	1	Sun 10/24/21 2:00 AM	0.2142	0.0421	0.0772	Trace	Trace
GFS Model	3	Sun 10/24/21 5:00 AM	0.6718	0.4281	0.4281	0.2854	0.3199
GFS Model	3	Sun 10/24/21 8:00 AM	0.3765	0.1673	0.1673	0.0664	0.1230
GFS Model	3	Sun 10/24/21 11:00 AM	0.7800	0.6964	0.6964	0.5266	0.5241
GFS Model	3	Sun 10/24/21 2:00 PM	0.7037	0.7357	0.7357	0.6521	0.6570
GFS Model	3	Sun 10/24/21 5:00 PM	0.6127	0.7751	0.7751	0.7382	0.7456
GFS Model	3	Sun 10/24/21 8:00 PM	0.6545	0.6791	0.6791	0.7111	0.7185
GFS Model	3	Sun 10/24/21 11:00 PM	0.4281	0.5266	0.5266	0.6004	0.5192
GFS Model	3	Mon 10/25/21 2:00 AM	0.1846	0.2805	0.2805	0.3716	0.3272
GFS Model	3	Mon 10/25/21 5:00 AM	Trace	Trace	Trace	0.0197	0.0222
GFS Model	3	Mon 10/25/21 8:00 AM	Trace	Trace	Trace	Trace	Trace
GFS Model	3	Mon 10/25/21 11:00 AM	Trace	Trace	Trace	Trace	Trace
GFS Model	3	Mon 10/25/21 2:00 PM	Trace	Trace	Trace	Trace	Trace
GFS Model	3	Mon 10/25/21 5:00 PM	Trace	Trace	Trace	Trace	Trace
GFS Model	3	Mon 10/25/21 8:00 PM	Trace	Trace	Trace	Trace	Trace
GFS Model	3	Mon 10/25/21 11:00 PM	Trace	Trace	Trace	Trace	Trace



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AQPI data used on 10/24/2021 for the 10/24-10/25 storm.

- For the October 24-25 storm, we used a table we were developing to present the **HRRR** and **GFS** data with conditional formatting.
- This showed us that the 2" forecast would be met before the rain began.

Model Results Updated Periodically

1 of 16 Accuracy is [redacted]

v21.10.19
Published: 10/24/21 11:43 AM

Forecast source: NOAA experimental AQPI forecasts.

= Time step Change Trace: < 0.0075 " = timestep rate ≥ 2"/24 hr. or 0.083 "/hr.
 = Rain depth relative to 0.01" or MaxRain*1.2 = rainfall ≥ 2" forecast over the next 24 hours.

HRRR or GFS Time	Incremental Rain Forecast (inches)				
	West	North Central	Central	South Central	East
Sun 10/24/21 9:00 AM		0.0240	0.0976	0.0260	0.0181
Sun 10/24/21 10:00 AM	0.0582	0.0191	0.0593	0.0123	Trace
Sun 10/24/21 11:00 AM	0.1000	0.0374	0.0783	0.0146	0.0165
Sun 10/24/21 12:00 PM	0.7047	0.3528	0.4220	0.0122	Trace
Sun 10/24/21 1:00 PM	0.4953	0.5260	0.5374	0.3626	0.2528
Sun 10/24/21 2:00 PM	0.4614	0.5669	0.4575	0.4701	0.2642
Sun 10/24/21 3:00 PM	0.5291	0.4441	0.4106	0.7461	0.2768
Sun 10/24/21 4:00 PM	0.2804	0.4965	0.4753	0.5676	0.2206
Sun 10/24/21 5:00 PM	0.2689	0.3496	0.4858	0.3902	0.2386
Sun 10/24/21 6:00 PM	0.2551	0.1902	0.2488	0.6154	0.2933
Sun 10/24/21 7:00 PM	0.2622	0.2425	0.3780	0.5303	0.1874
Sun 10/24/21 8:00 PM	0.2807	0.2228	0.1819	0.3303	0.1882
Sun 10/24/21 9:00 PM	0.1823	0.1402	0.1799	0.2272	0.1028
Sun 10/24/21 10:00 PM	0.1496	0.1835	0.2642	0.1654	0.1358
Sun 10/24/21 11:00 PM	0.1744	0.1094	0.1665	0.1894	0.1106
Mon 10/25/21 12:00 AM	0.1622	0.1039	0.1642	0.1752	0.1709
Mon 10/25/21 1:00 AM	0.0614	0.0843	0.1047	0.1177	0.1004
Mon 10/25/21 2:00 AM	0.0854	0.0705	0.0752	0.1457	0.0563



Practical Use of AQPI Products

7532 Plots

- We put the data in some graphics that display the status of the **7532 Flood!** Protocols.
- In this image the “Flood Forecast Meter” shows there is no threat of flooding.

7-5-3-2 Forecast Analysis Summary Plots

These plots summarize the past rainfall measurements and 24-hour forecast for the "7-5-3-2 Flood!" protocols.

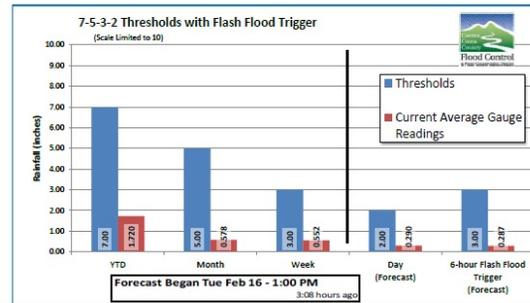
Based on Average Gauge Readings

Information for the "Thresholds" plot	Year to Date+ (inches)	Avg 30 Days+ (inches)	Avg 7 Days+ (inches)	Avg or Max 24-hr Rainfall Forecast+ (inches)	6-hour Flash Flood Trigger (Forecast)
Thresholds	7.00	5.00	3.00	2.00	3.00
Current Average Gauge Readings	1.72	0.58	0.55	0.29	0.29

Based on Average Gauge Readings **Plus** Forecasts

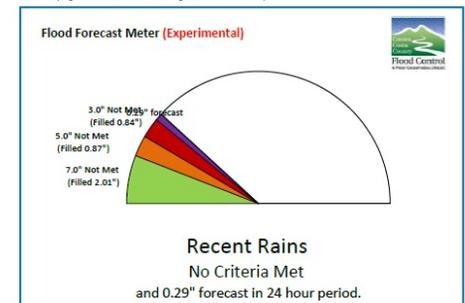
Projected Average by Fri Oct. 22 - 5:00 PM Forecast Began Thu Oct 21 - 3:00 PM	Year to Date+ (inches)	Avg 30 Days+ (inches)	Avg 7 Days+ (inches)	Avg or Max 24-hr Rainfall Forecast+ (inches)
Compare to Protocol:	7.00	5.00	3.00	2.00
Highlighted if current Average Data + Average Cum. Forecast meets Protocols	2.01	0.87	0.84	0.29

+Values based on Average Gauge plus Average forecast Values in Total Cumulative Table.
++Max(Avg 24-hr QPF from above or Avg Max 24-hr QPF sheet)



Data for some plots is on a hidden worksheet tab.

Published:
Thursday 10/21/2021 5:43 PM



This meter is experimental. For comments and questions, contact Mark Boucher at 925-913-2274.

These tables and charts are Experimental

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7532 Plots

- As of October 26, 2021 our watershed were primed and wet. The forecast was relatively clear.

7-5-3-2 Forecast Analysis Summary Plots

These plots summarize the past rainfall measurements and 24-hour forecast for the "7-5-3-2 Flood!" protocols.

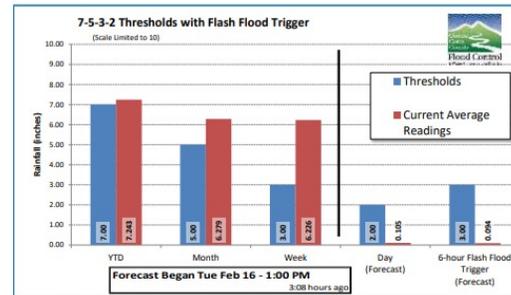
Based on Average Gauge Readings

Information for the "Thresholds" plot	Year to Date+ (inches)	Aug 30 Days+ (inches)	Aug 7 Days+ (inches)	Avg or Max 24-hr Rainfall Forecast+ (inches)	6-hour Flash Flood Trigger (Forecast)
Thresholds	7.00	5.00	3.00	2.00	3.00
Current Average Readings	7.24	6.28	6.23	0.11	0.09

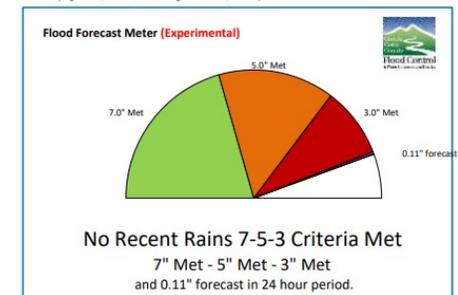
Based on Average Gauge Readings Plus Forecasts

Projected Average by Thu Nov. 04 - 8:00 AM Forecast Began Tue Oct 26 - 7:00 AM	Year to Date+ (inches)	Aug 30 Days+ (inches)	Aug 7 Days+ (inches)	Avg or Max 24-hr Rainfall Forecast+ (inches)
Compare to Protocol:	7.00	5.00	3.00	2.00
Highlighted if current Average Data + Average Cum. Forecast meets Protocols	7.35	6.39	6.33	0.11

+Values based on Average Gauge plus Average forecast Values in Total Cumulative Table.
 ++Max(Avg 24-hr QPF from above or Avg Max 24-hr QPF sheet)



Data for some plots is on a hidden worksheet tab.



This meter is experimental. For comments and questions, contact Mark Boucher at 925-313-2274.

Published:
 Tuesday 10/26/2021 9:43 AM

These tables and charts are Experimental

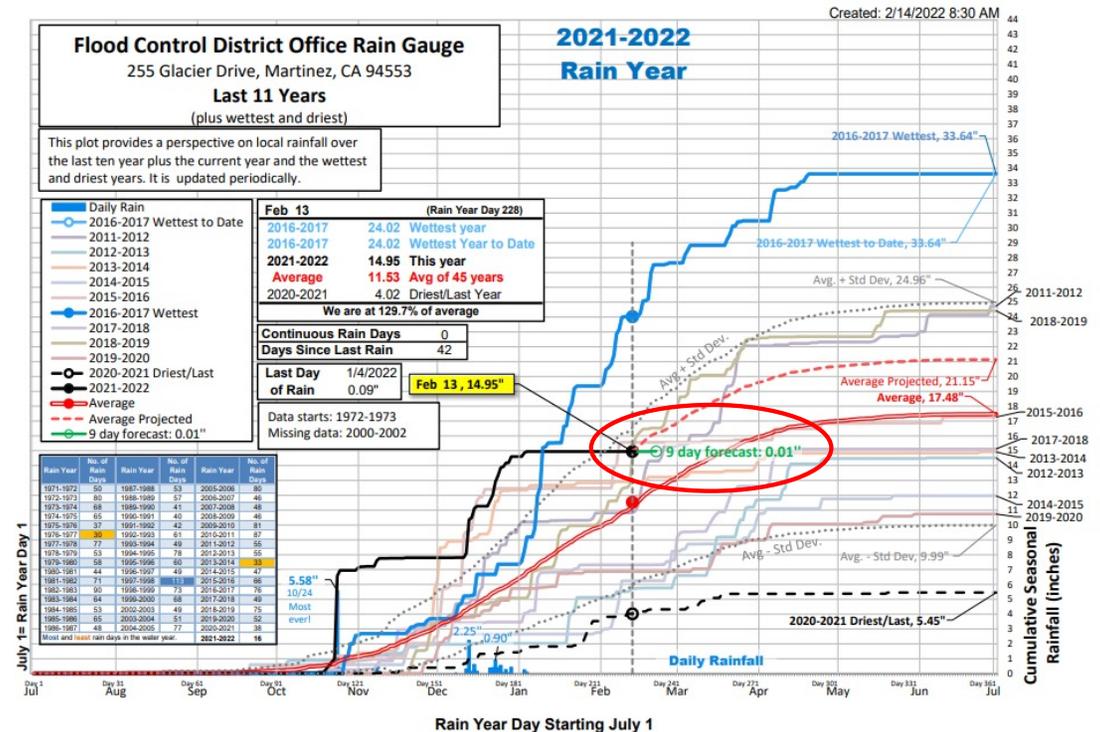
Timing

Severity

Practical Use of AQPI Products

11 Year Plot

- I figured out a way to put the forecast in our "11 year plot".
- See green projection from the black line of this years rainfall.



All 11 year plots: <https://www.ccflood.us/11YearPlots/11yrplots.html>

30 Days of Data: <https://www.ccflood.us/bt/30day/rainData11.txt>

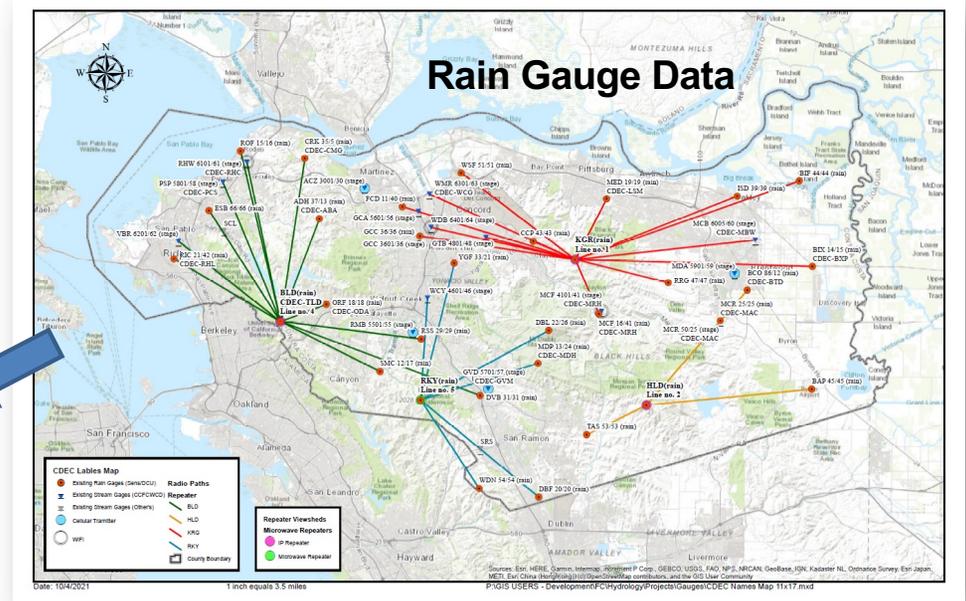
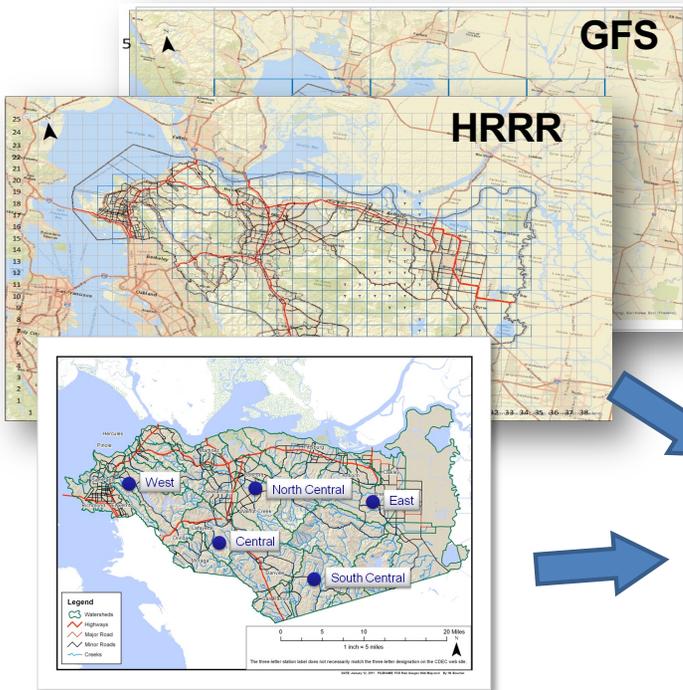
Forecast Data Source: https://www.ccflood.us/AQPI/Plots/CCCo_Experimental_Forecast_Table.pdf

Richmond Gauge: <https://www.ccflood.us/11%20Year%20Plots%20Plots%201%20RIC%20tracking%202021-22.pdf>

RainMap: <https://www.ccflood.us/rainmap.html>

(Next long-term forecast update: Monday 10:00 AM)

Practical Use of AQPI Products



AQPI
Advanced Quantitative
Precipitation Information



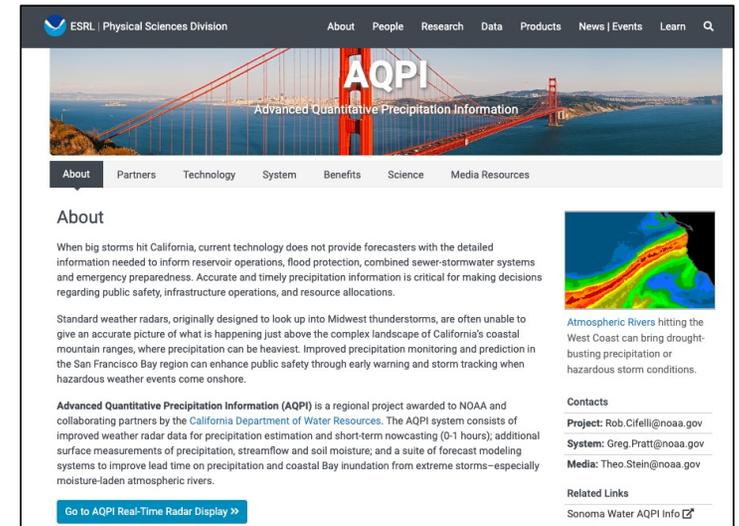
Practical Use of AQPI Products

- The AQPI radar system, once fully implemented, will feed the radar data into the models making them much more accurate in time and space.



AQPI and other Web Sites

- **Sonoma Water**
<https://www.sonomawater.org/aqpi/>
- **Contra Costa County Flood Control's RainMap**
<https://ccflood.us/rainmap.html>
- **National Water Model Map**
<https://water.noaa.gov/map>



Q&A



Flood Control
& Water Conservation District

Mark Boucher, PE

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www.contracosta.ca.us/RainMap



BAWAC Presentation February 14, 2022