

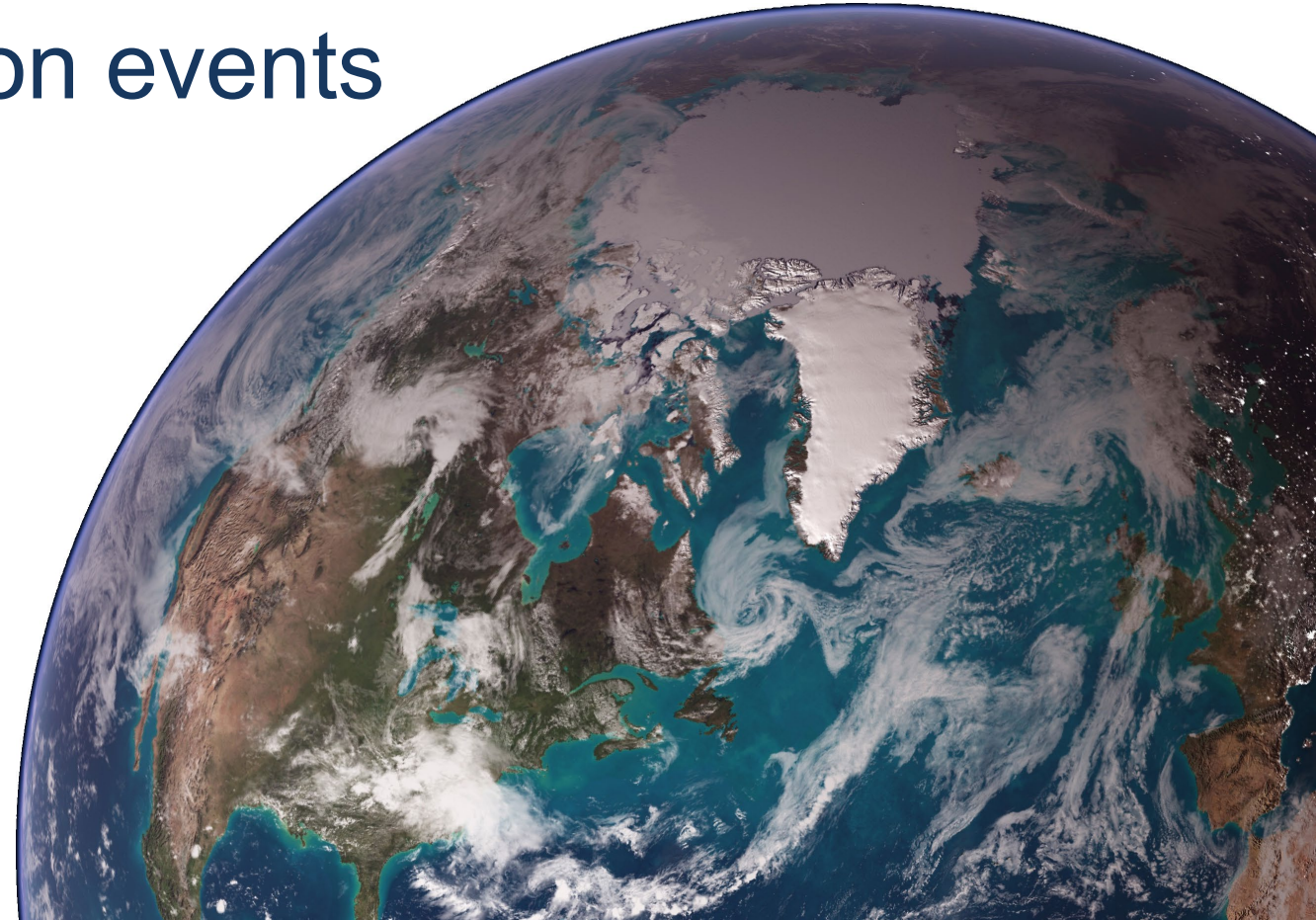


NOAA RESEARCH • ESRL • PHYSICAL SCIENCES DIVISION

Taming rivers in the sky: A state-of-the-art system to help California weather extreme precipitation events

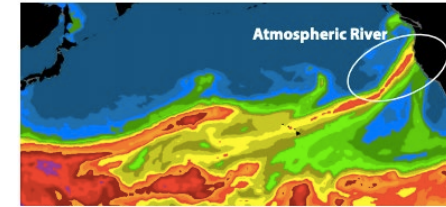
Rob Cifelli
NOAA Earth System
Research Laboratory
Boulder, CO

AGU 2019 NOAA Exhibit
Presentation

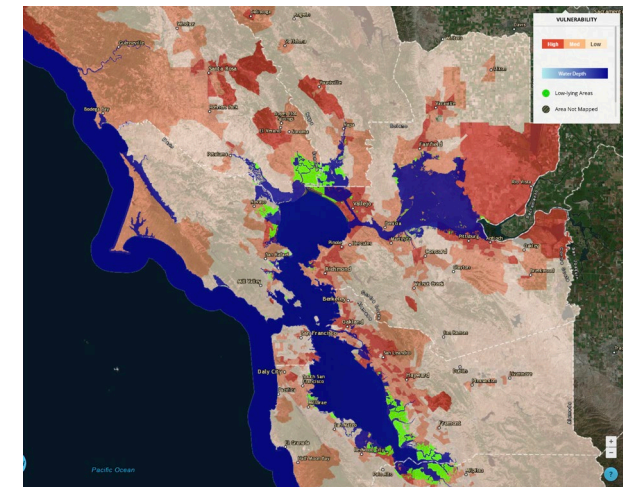


The Challenge of Extreme Precipitation in CA

- 30-50% of CA's annual precipitation comes from a handful of AR events
- Vital for replenishing water supplies but...
- ARs often cause flooding
 - ✧ Responsible for >80% of flood damages in the western US, including CA
 - ✧ On average, >\$1B in annual damage costs
- SF Bay Area is particularly vulnerable
 - ✧ 7+ million people (5th largest in US)
 - >350,000 people in 100 year flood plain (\$46B in exposed structures)
 - >1 million people in 500 year flood plain (\$134B in exposed structures)
- Sea level rise and urbanization will exacerbate the problem



Satellite image of an atmospheric river in February 2017.



Vulnerability to flooding around San Francisco Bay (from NOAA Office of Coastal Management)



Meeting the Challenge: The Advanced Quantitative Precipitation Information (AQPI) Project

- Goal to improve early warning through monitoring, and prediction of precipitation, streamflow, and storm surge
 - ✧ Integration of capabilities for many users
 - ✧ Benefits for flood mitigation, waste water management, water supply, water quality, emergency management, transportation
- Grant awarded by California Dept. Water Resources (Prop 84)
 - ✧ 4 year project, started Oct 2017
 - ✧ Sonoma Water is local sponsor

Project Team

Bay Area Partners

- California Department of Water Resources 
- Sonoma Water 
- Valley Water 
- San Francisco Public Utilities Commission 
- East Bay Municipal Utilities District 
 - Discharge and Parks
- Alameda County (Public Works, Water, District)  -Alameda County
- Contra Costa County 
- Marin County Flood Control, Municipal Water District 
- Napa County 
- San Mateo County 
- Solano County 
- Bay Area Flood Protection Agency Association 
- National Weather Service 

Technical Partners

- NOAA
 - Earth System Research Laboratory
 - National Severe Storm Laboratory
 - Cooperative Institute for Research in the Atmosphere (CIARA)
- USGS
 - Pacific Coastal and Marine Science Center
- Colorado State University
 - Department of Economics/Resource Economics
- Scripps Institution of Oceanography
 - Center for Western Weather and Water Extremes



AQPI Components

- New weather radars and surface meteorology deployments
- Integration of observations and forecast models
- Precipitation, streamflow, and coastal storm surge forecasts
- Integrate and disseminate observations and forecast information (the AQPI System)



X-band Radar



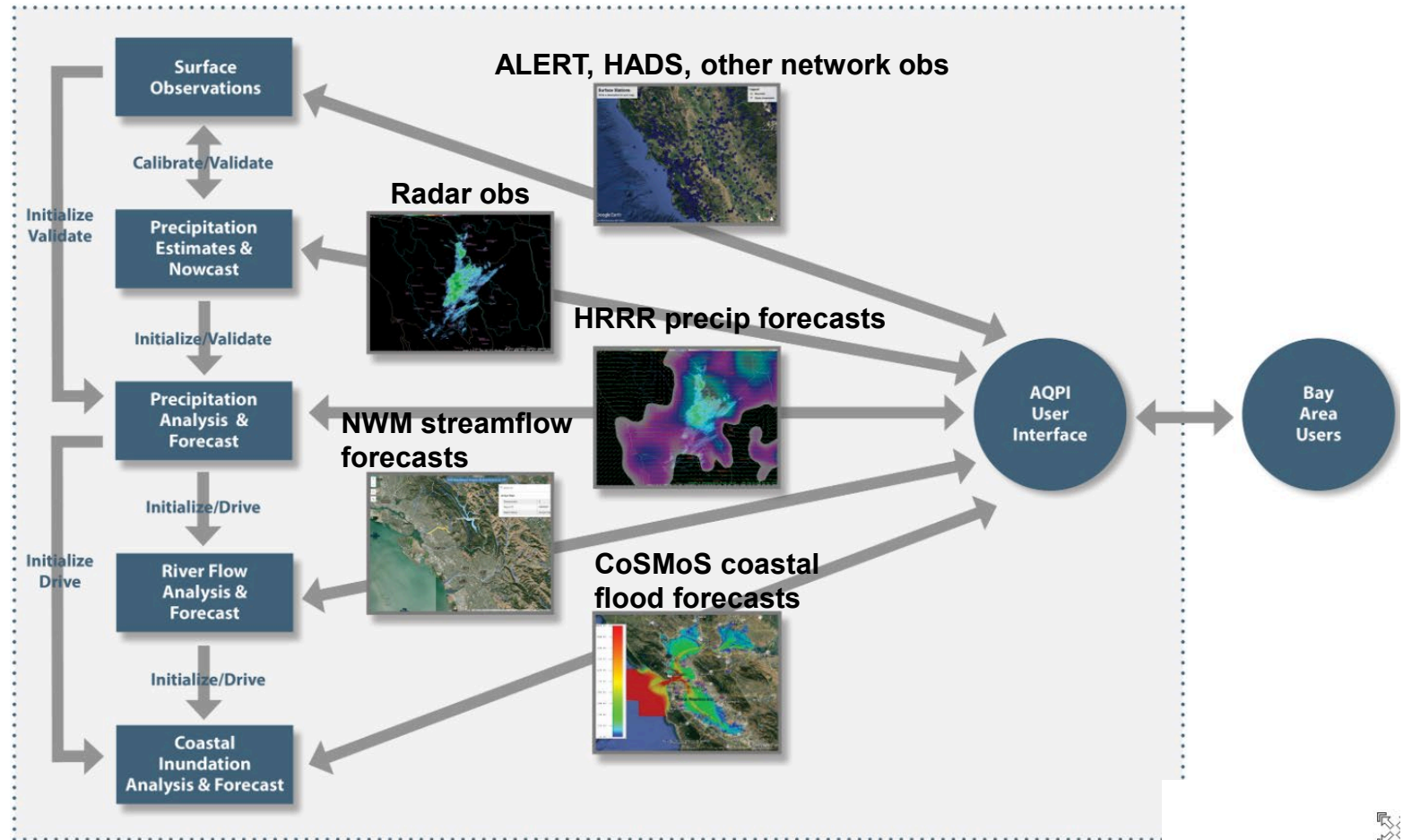
C-band Radar



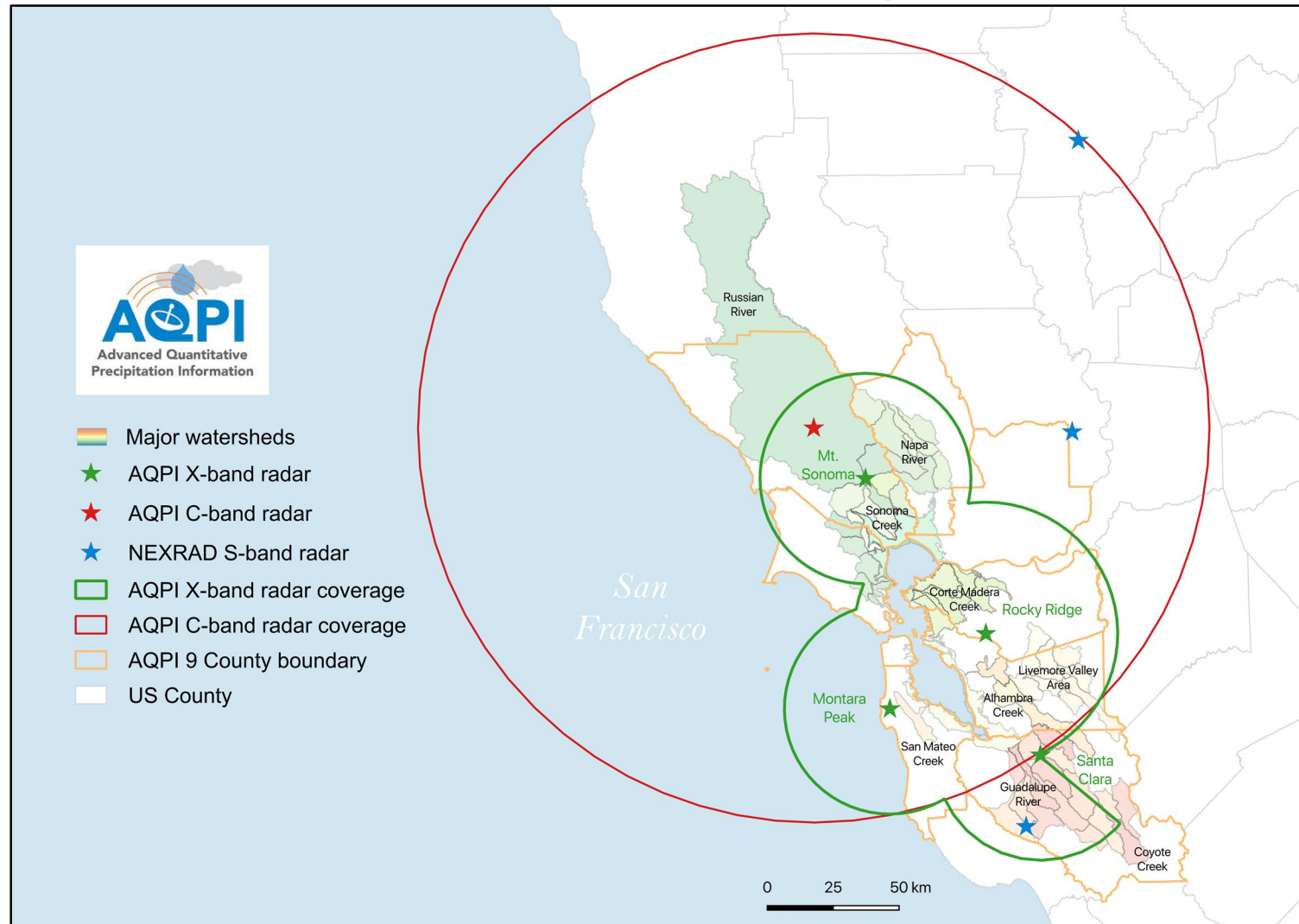
Surface Met

AQPI System

- Precipitation Estimates
- ↓
- Precipitation Forecasts
- ↓
- Streamflow Forecasts
- ↓
- Coastal Flood Forecasts



AQPI Radar Deployments



Current Status and Next Steps

- AQPI Radars

- ✧ 2 (out of 5) radars deployed
- ✧ 1-2 more planned for 2019-2020 wet season
- ✧ Sonoma Water FEMA grant conditionally accepted
 - 2 additional X-band radars
- ✧ City of Santa Cruz deploying an X-band radar

- AQPI System

- ✧ Completed initial needs and requirements gathering
- ✧ Data capture and 1st iteration data delivery
 - Focus on precipitation forecasts
- ✧ Next iteration to include visualizations for radar monitoring, streamflow, and coastal flooding forecasts
 - User Groups starting January 2020

- AQPI Benefits and Evaluation of Products

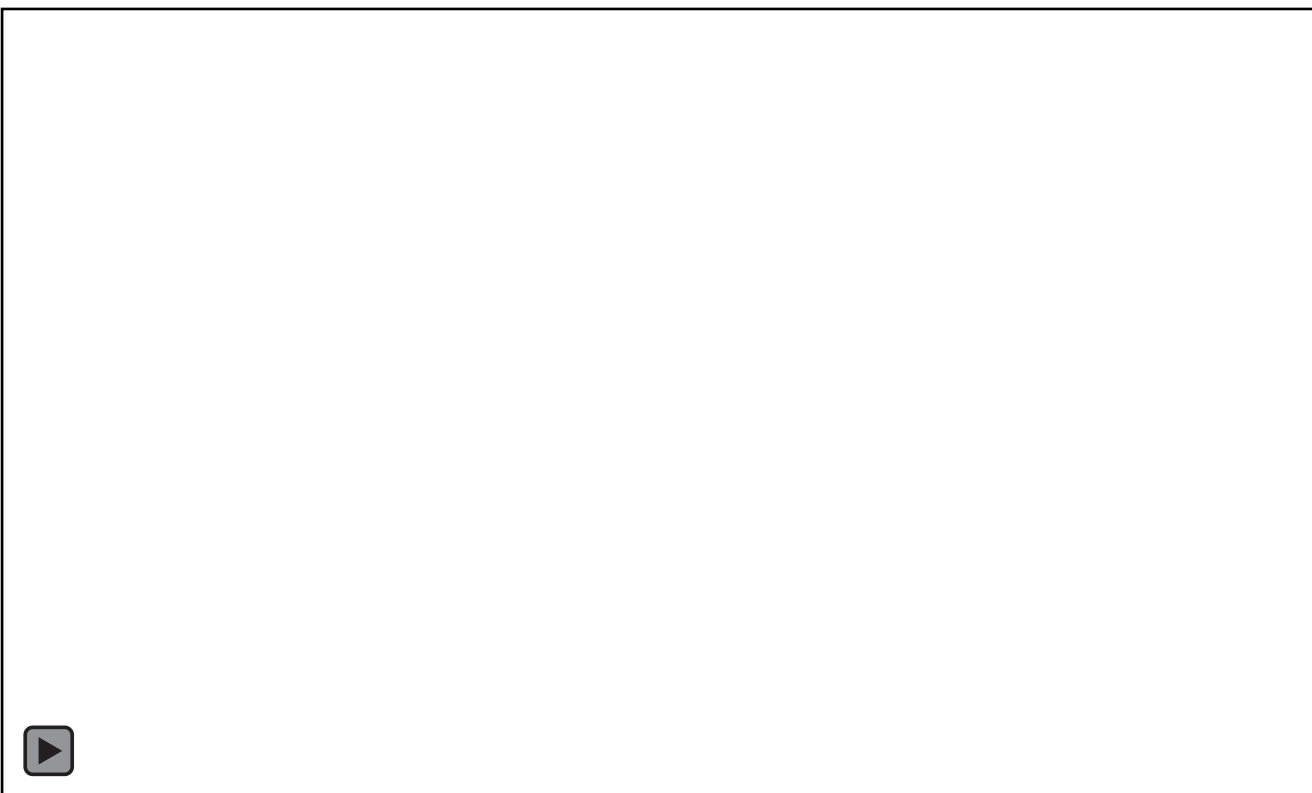
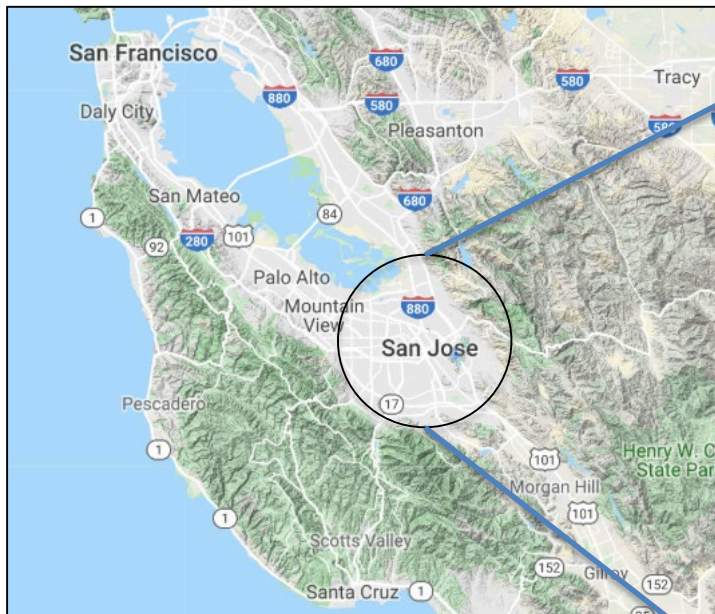
- ✧ Working with local partners to quantify impacts of improved monitoring and forecasts



Value of AQPI Radar in the South Bay

AQPI Santa Clara Radar

KMUX NEXRAD Radar



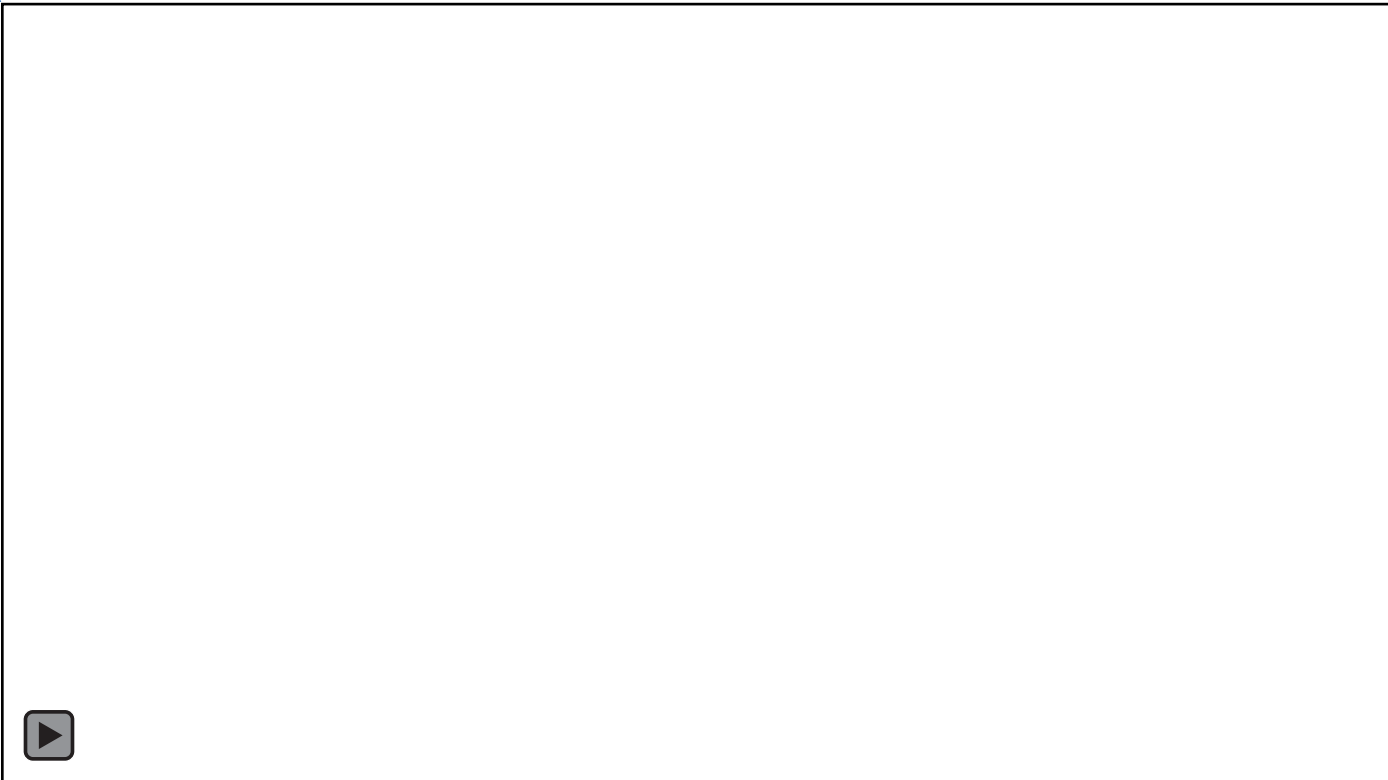
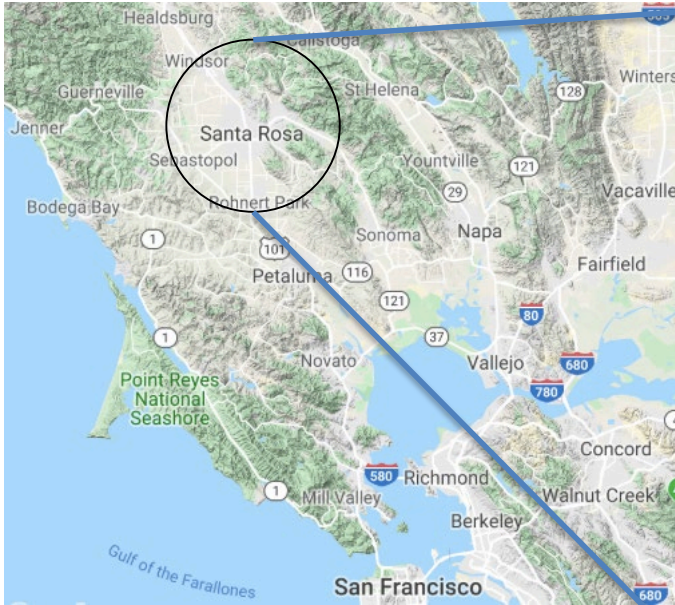
- AQPI radar has higher space and time resolution - better picture of the overall rainfall pattern
- AQPI radar sees closer to the ground – more accurate rainfall estimates

February 14, 2019

Value of AQPI Radar in the North Bay

AQPI Sonoma County Radar

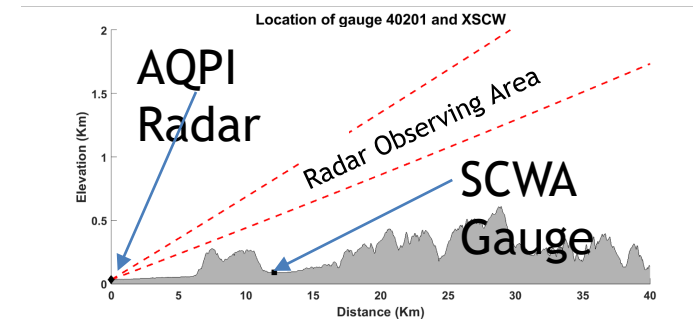
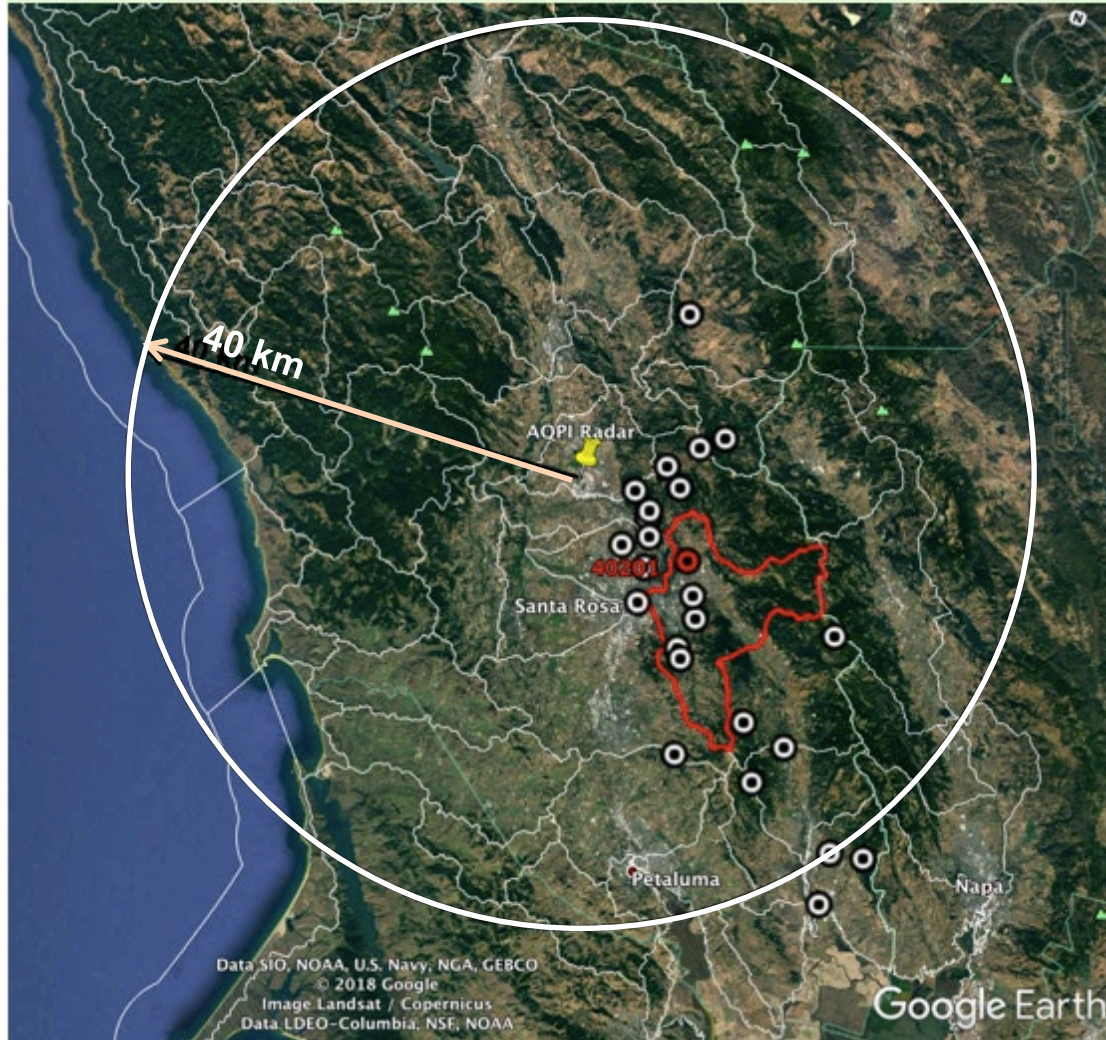
KDAX NEXRAD Radar



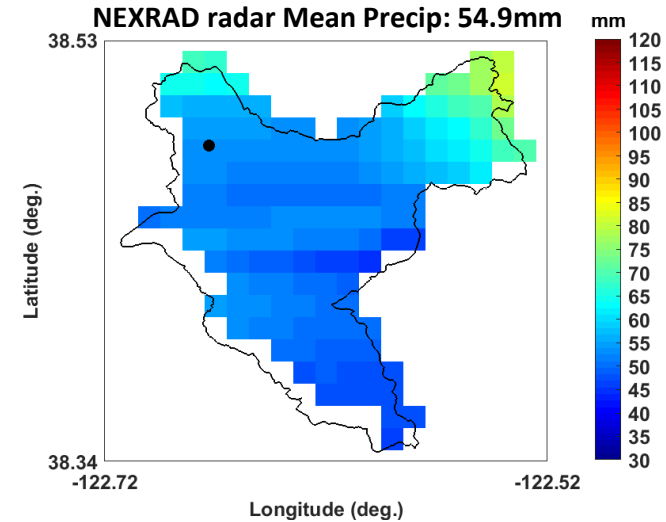
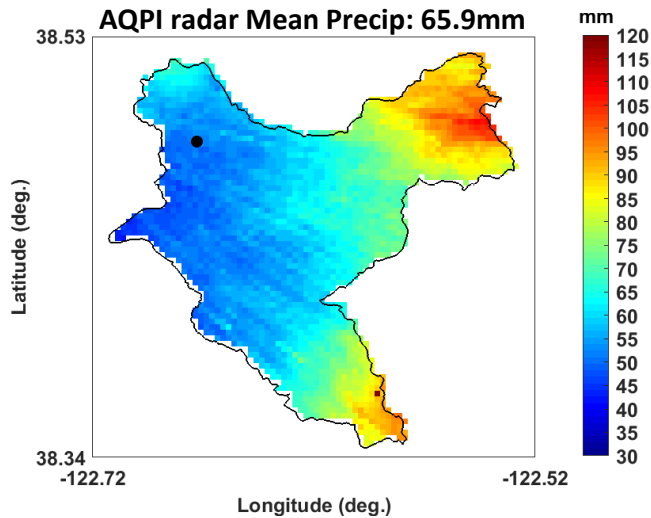
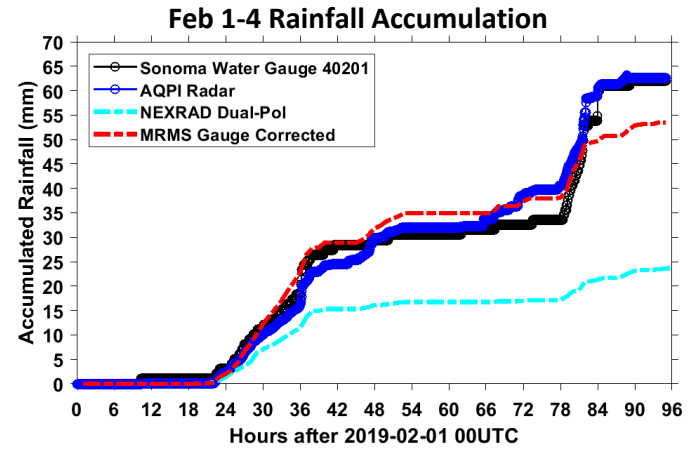
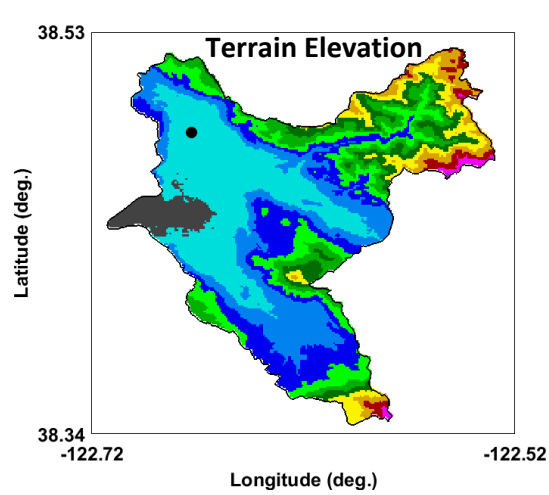
- AQPI radar fills a gap not covered by NEXRAD
- AQPI radar covers several wildfire burn areas near Santa Rosa

November 26, 2019

Sonoma AQPI Radar Rainfall Analysis



Radar Rainfall Comparison



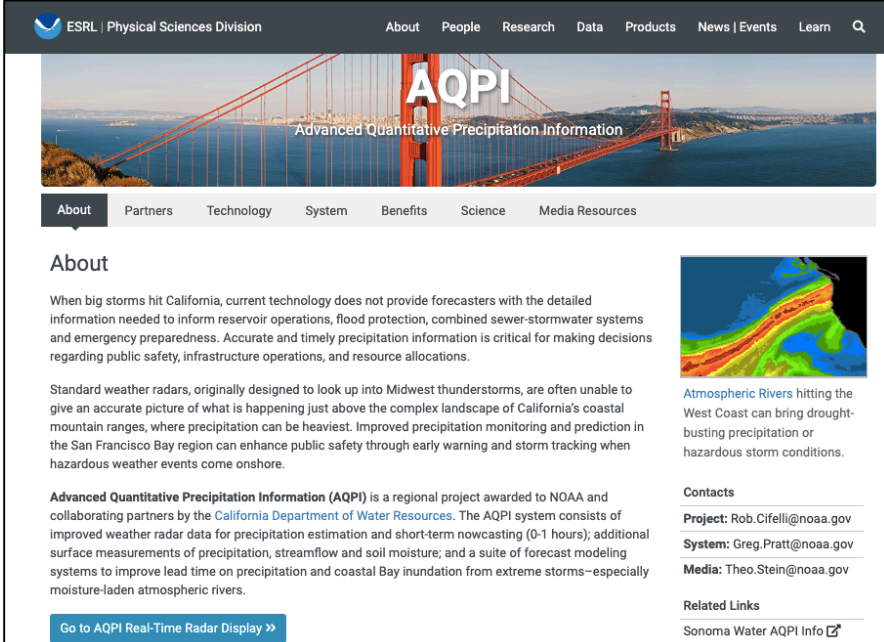
Summary

- AQPI is an experimental prototype to improve early warning through monitoring, and prediction of precipitation*, streamflow, and storm surge
 - Integration of information from many sources
 - Monitoring and alerting based on local partner needs
- Supports NOAA's Weather Ready Nation Initiative
 - Impact-Based Decision Support Services

* See NOAA exhibit talk by Jason English, Wednesday Dec. 11 at 10:45 am

AQPI Web Sites

- NOAA
<https://esrl.noaa.gov/psd/aqpi>
- Sonoma Water
<https://www.sonomawater.org/aqpi/>



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AQPI

Advanced Quantitative Precipitation Information

About Partners Technology System Benefits Science Media Resources

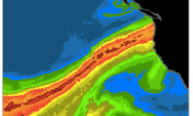
About

When big storms hit California, current technology does not provide forecasters with the detailed information needed to inform reservoir operations, flood protection, combined sewer-stormwater systems and emergency preparedness. Accurate and timely precipitation information is critical for making decisions regarding public safety, infrastructure operations, and resource allocations.

Standard weather radars, originally designed to look up into Midwest thunderstorms, are often unable to give an accurate picture of what is happening just above the complex landscape of California's coastal mountain ranges, where precipitation can be heaviest. Improved precipitation monitoring and prediction in the San Francisco Bay region can enhance public safety through early warning and storm tracking when hazardous weather events come onshore.

Advanced Quantitative Precipitation Information (AQPI) is a regional project awarded to NOAA and collaborating partners by the [California Department of Water Resources](#). The AQPI system consists of improved weather radar data for precipitation estimation and short-term nowcasting (0-1 hours); additional surface measurements of precipitation, streamflow and soil moisture; and a suite of forecast modeling systems to improve lead time on precipitation and coastal Bay inundation from extreme storms—especially moisture-laden atmospheric rivers.

[Go to AQPI Real-Time Radar Display >>](#)



Atmospheric Rivers hitting the West Coast can bring drought-busting precipitation or hazardous storm conditions.

Contacts

Project: Rob.Cifelli@noaa.gov

System: Greg.Pratt@noaa.gov

Media: Theo.Stein@noaa.gov

Related Links

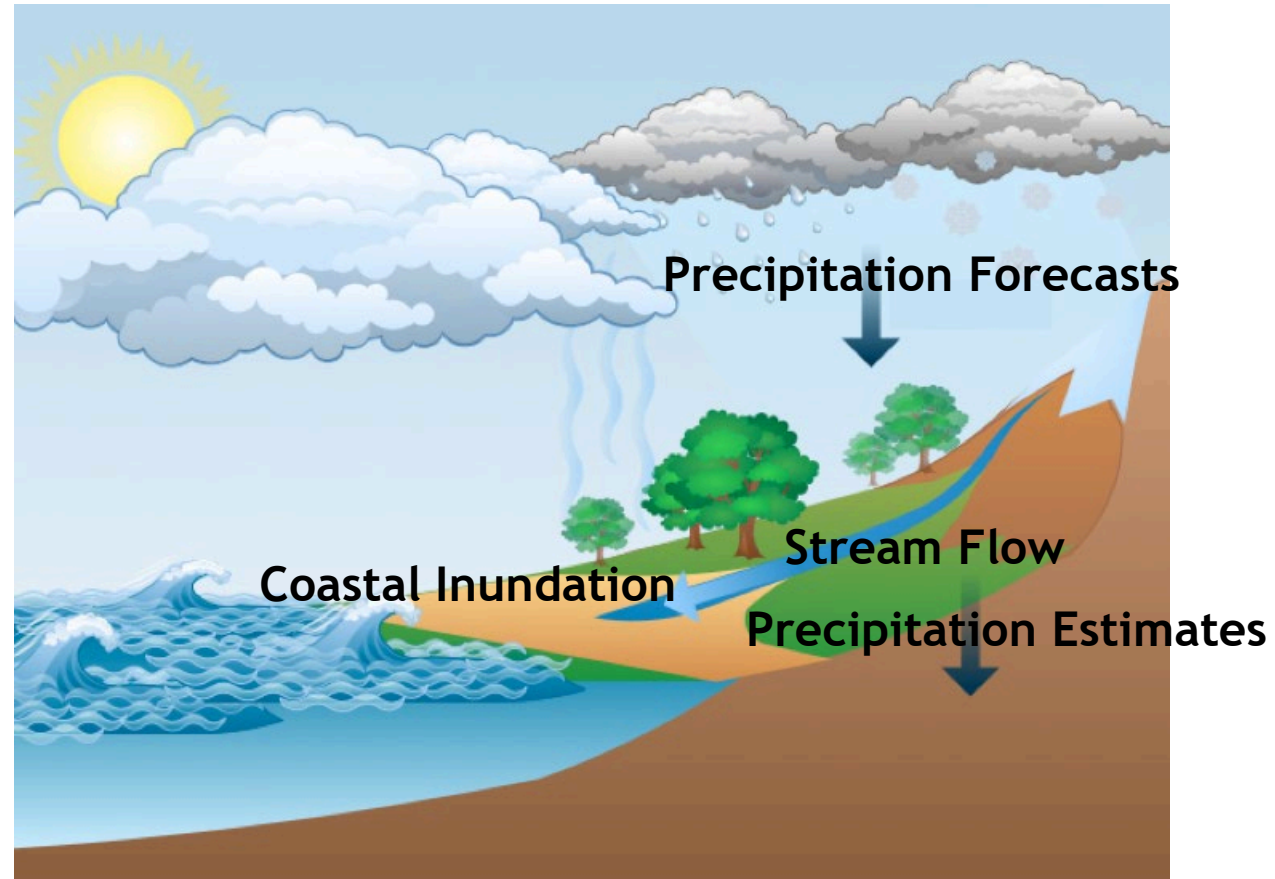
[Sonoma Water AQPI Info](#)

Thank You!

Backup Slides

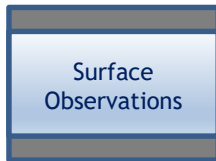
AQPI System

What is it?

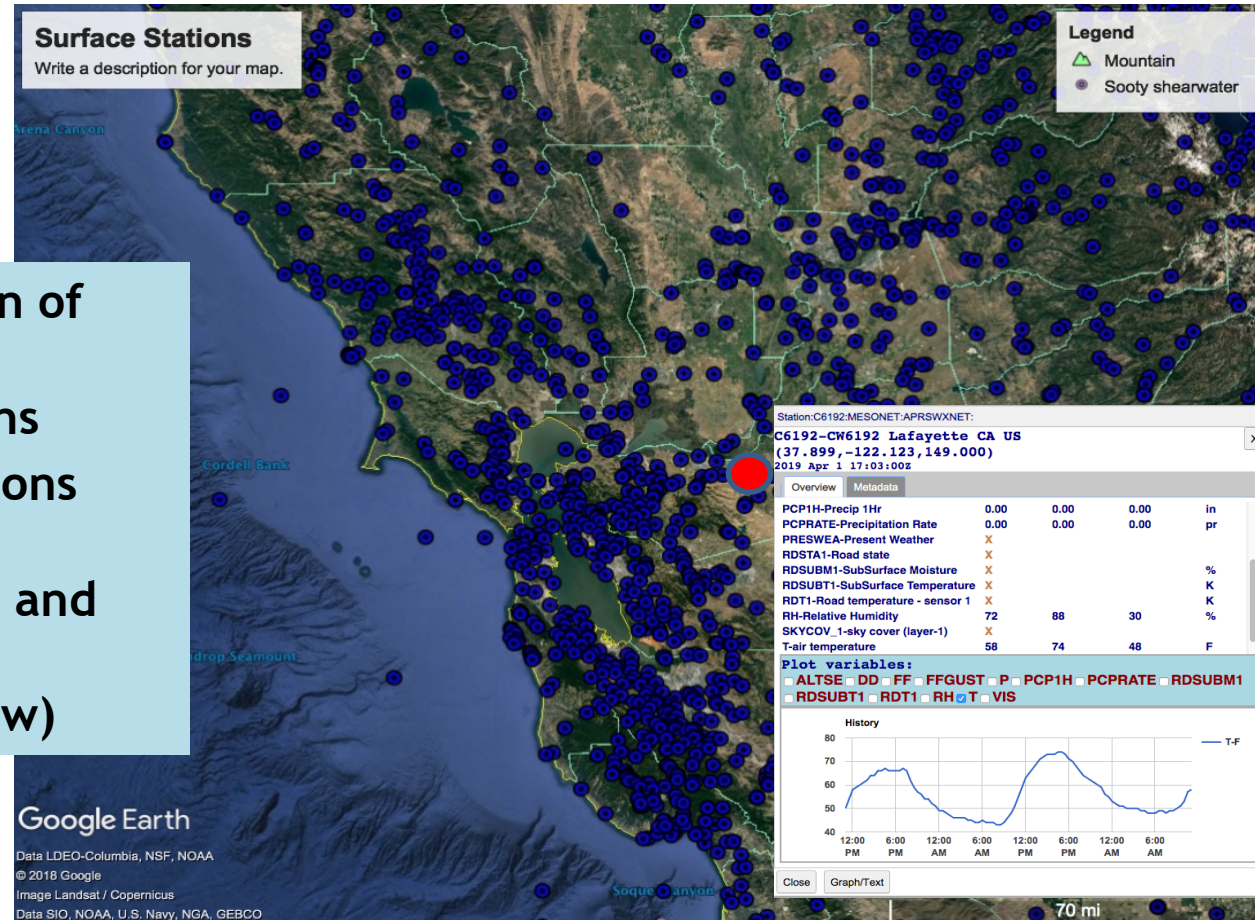


AQPI System

Observations

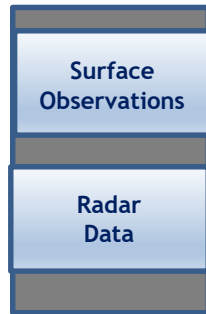


1. A centralized collection of data:
 - Surface Observations
- Providing current conditions for:
- Precipitation (rates and accumulation)
 - River (stage and flow)

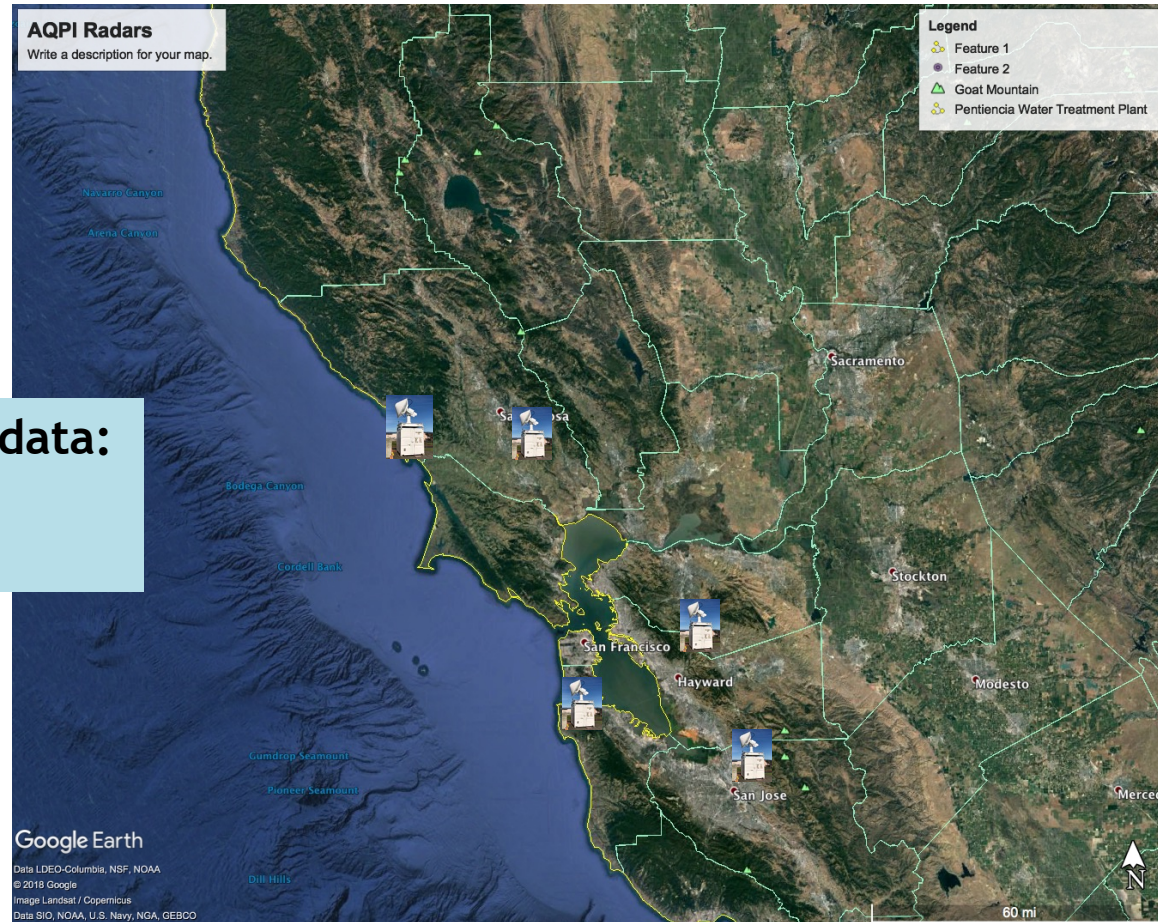


AQPI System

Observations

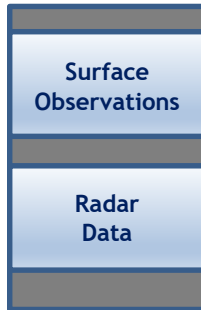


1. A centralized collection of data:
 - Surface observations
 - Gap-filling radars



AQPI System

Observations

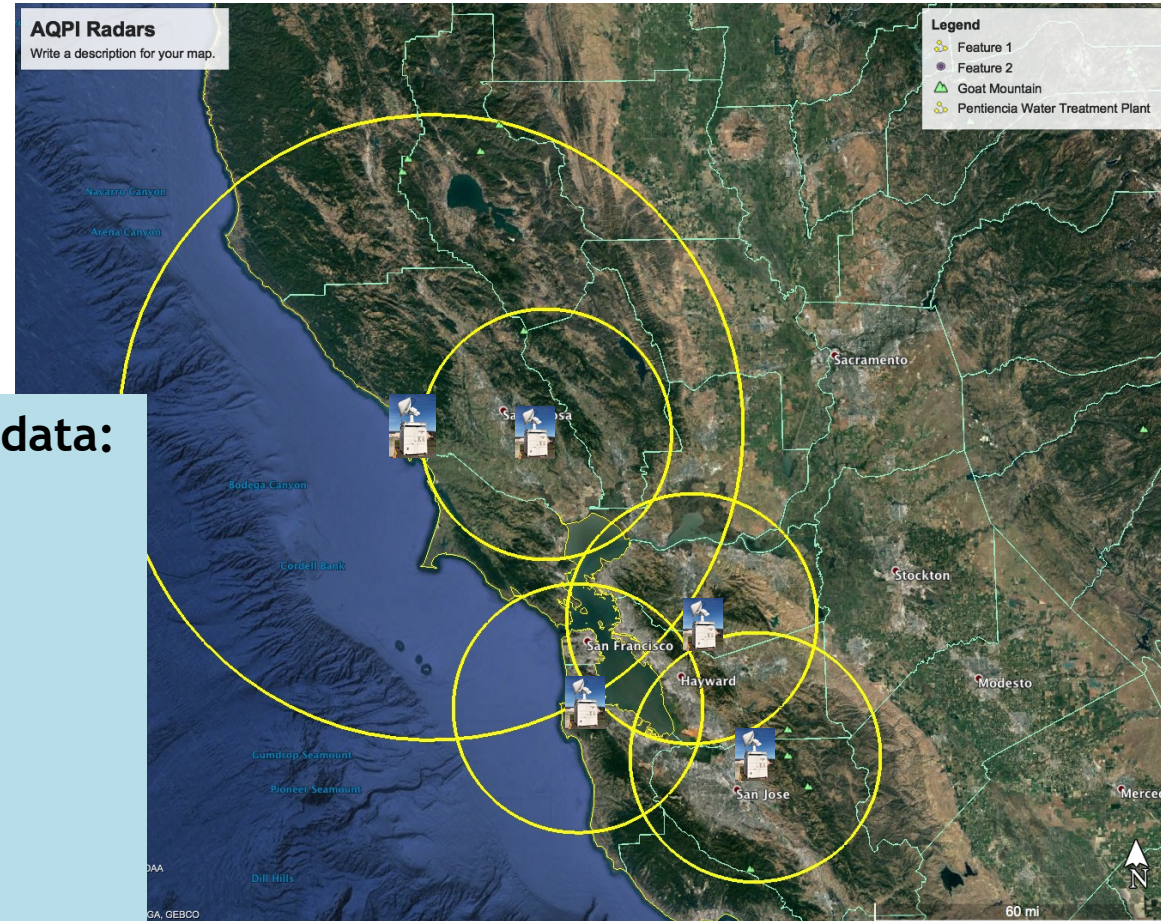


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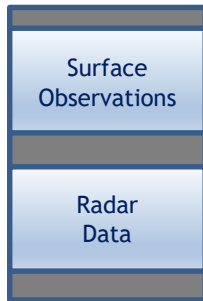
Radars will be sited at:

- Sonoma county
- Santa Clara county
- Montara Peak
- Rocky Ridge
- Bay Hill



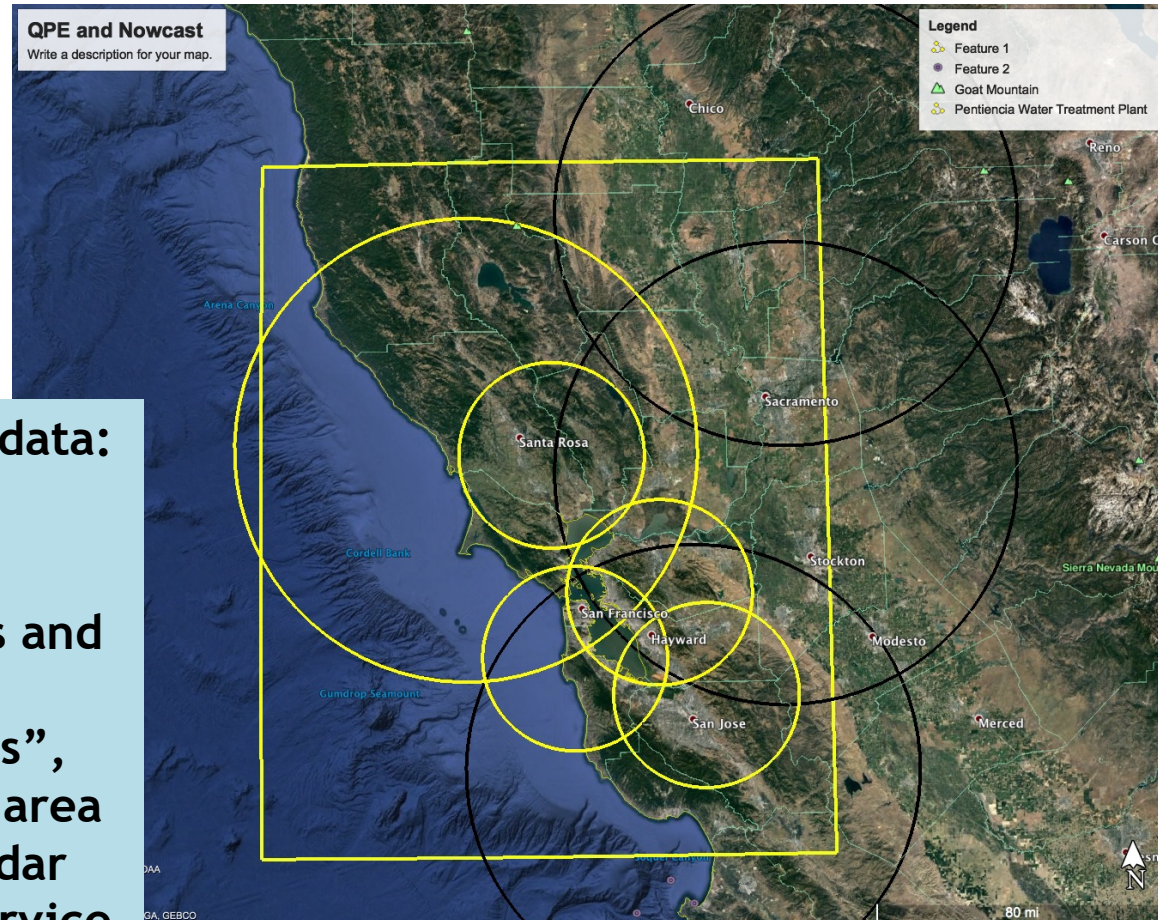
AQPI System

Observations



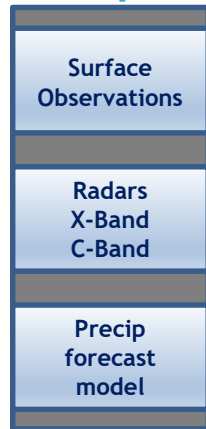
1. A centralized collection of data:
 - Surface observations
 - Gap-fill radars

Better precipitation estimates and short-term forecasts of precipitation, called “Nowcasts”, will be produced in the boxed area by combining the gap filling radar data with National Weather Service radars.



AQPI System

Precipitation Forecasts



1. A centralized collection of data:
 - Surface observations
 - Gap-filling radars
 - Precipitation Forecasts

The National Weather Service's High-Resolution Rapid Refresh model will provide precipitation forecasts out to 12 hours.

