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An Advanced Quantitative Precipitation Information (AQPI) System for the San Francisco Bay Area

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FIRO Workshop
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AQPI Overview

- 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 County Water Agency 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 7)
- 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 (CIRA)

- USGS
  - Pacific Coastal and Marine Science Center
- Colorado State University
  - Department of Economics/Resource Economics
- Scripps Institution of Oceanography
  - CW3E

AQPI Components

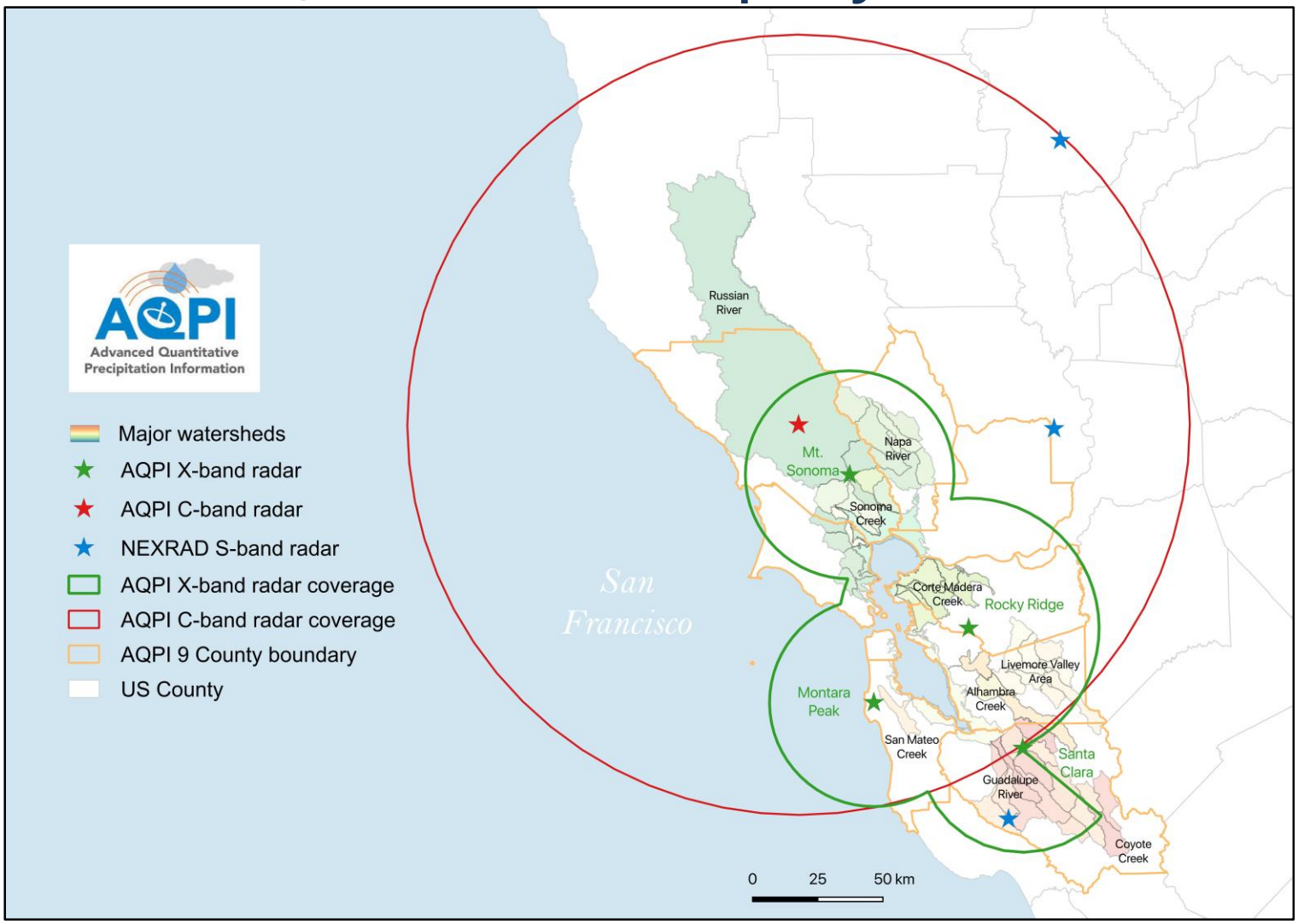
- New weather radars and surface meteorology deployments
- Integration of observations and forecast models
- Precipitation, streamflow, and coastal storm surge forecasts
- Integrate and disseminate observations and forecast information (the AQPI System)

X-band Radar

C-band Radar

Surface Met

AQPI Radar Deployments



Current Use of AQPI System

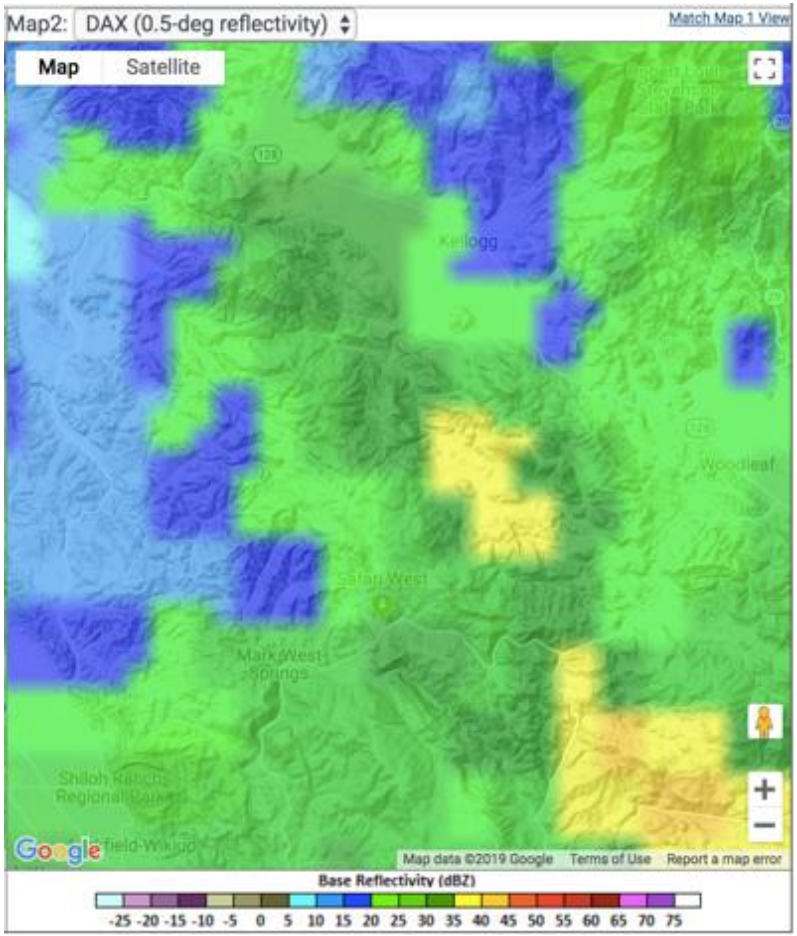
- Valley Water
  - Real-time radar data to inform operational decisions
  - Real-time precipitation forecasts to drive local hydrology model
  - Archive data for local model calibration and validation
- SFPUC
  - Real time precipitation forecasts to project water usage needs
  - Real time temperature forecasts to project water usage needs
  - Archive data for evaluation of National Water Model streamflow forecasts
  - Real time precipitation forecasts to drive local hydrology model
  - Archive temperature data for calibrating water usage model
- Sonoma Water
  - Risk reduction host for real time radar displays
- Working with Contra Costa and Sonoma to provide similar services
- Data flow to National Weather Service
  - Surface observations
  - AQPI radar data
  - Precipitation forecast model improvements

Current Status and Next Steps

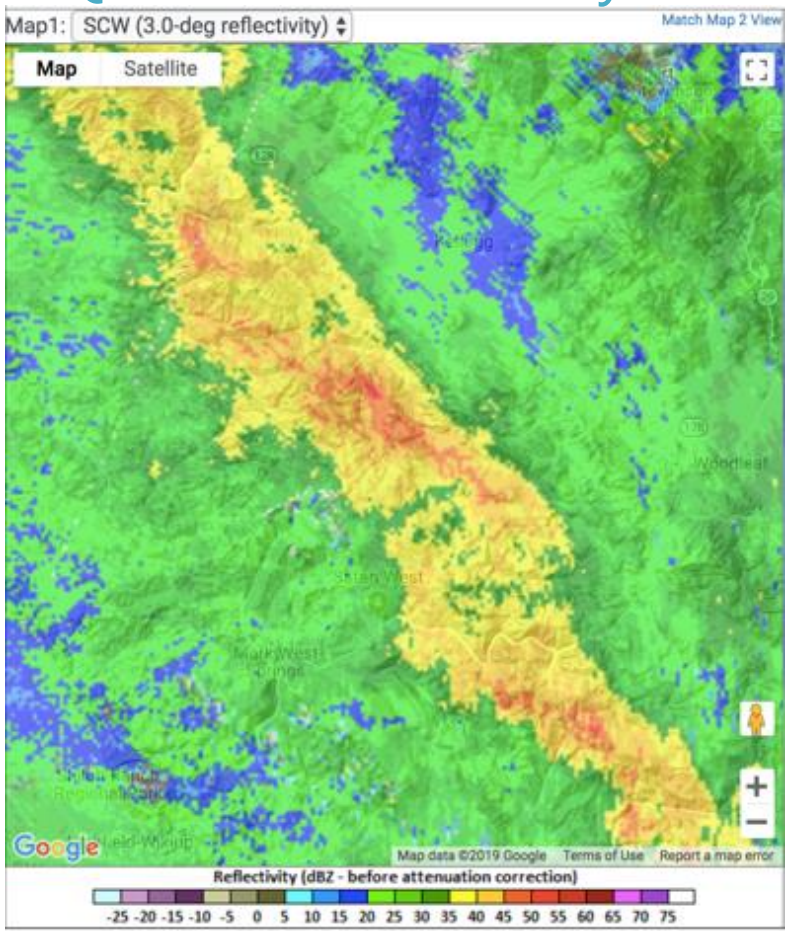
- AQPI Radars
  - 2 (out of 5) radars deployed
  - 1-2 more planned for fall 2019
  - Sonoma Water FEMA grant conditionally accepted
    - 2 additional X-band radars
  - City of Santa Cruz deploying an X-band radar
- AQPI System
  - Completed initial needs and requirements gathering
  - Data capture 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 fall 2019
- AQPI Benefits and Evaluation of Products
  - Working with local partners

Value of AQPI Radar

KDAX NEXRAD Radar



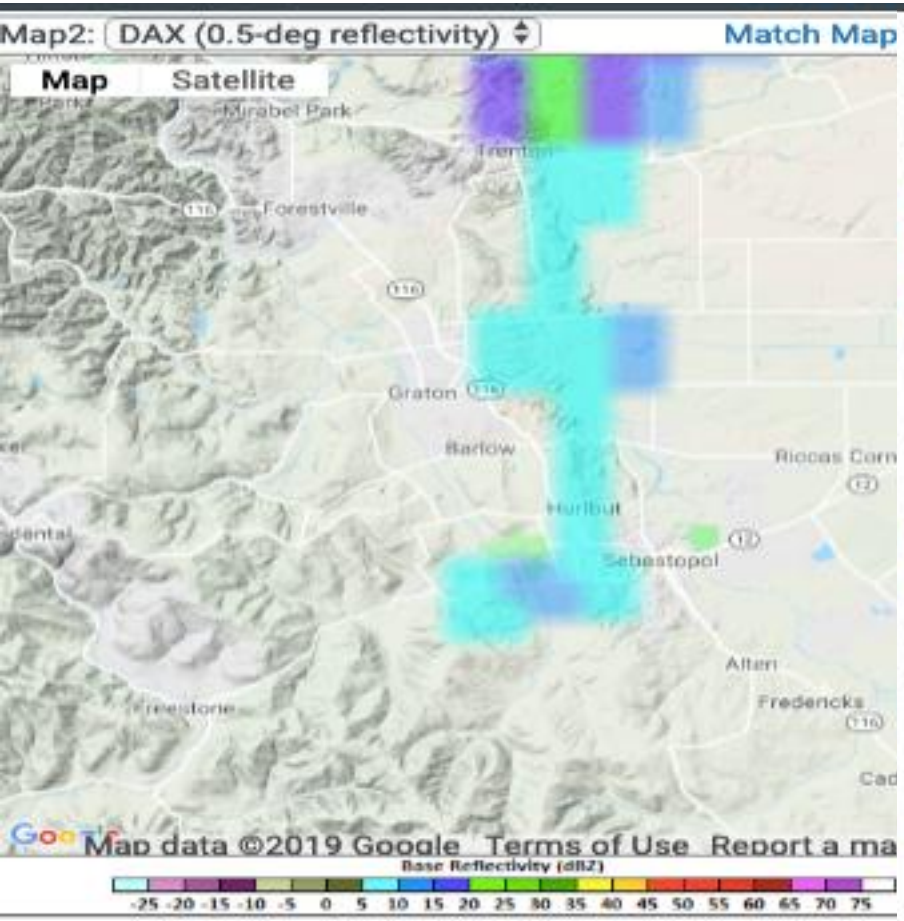
AQPI Sonoma County Radar



February 2, 2019 04:32 PST

Value of AQPI Radar

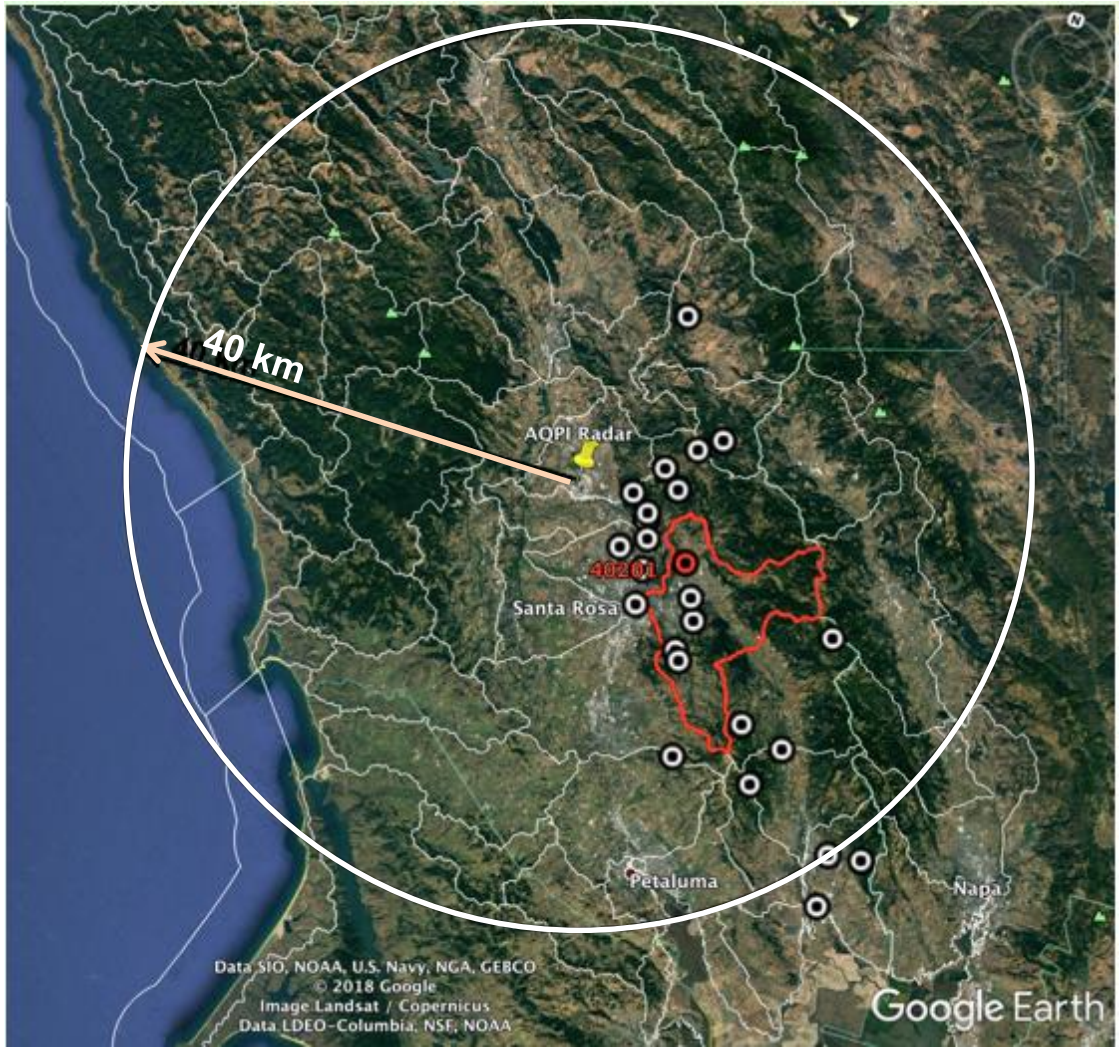
KDAX NEXRAD Radar

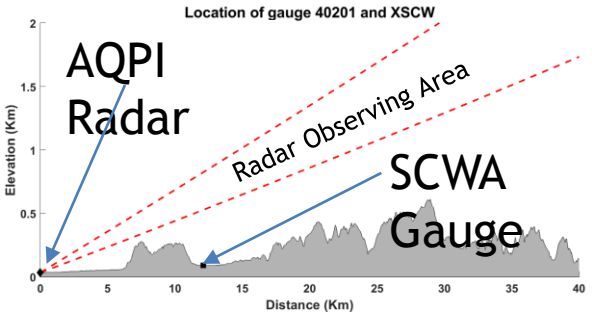


AQPI Sonoma County Radar

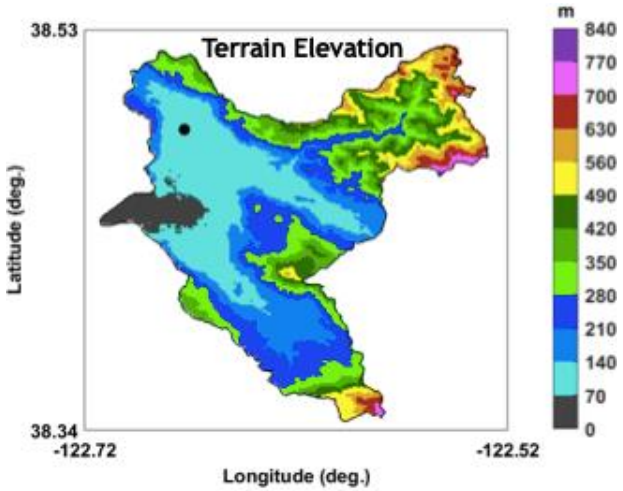
March 25, 2019 14:16 PDT

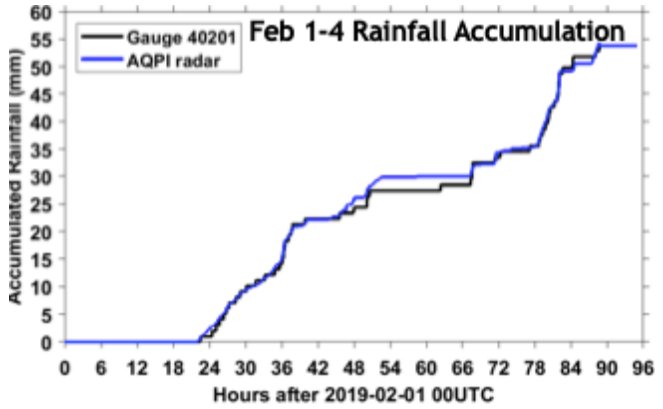
Sonoma AQPI Radar Rainfall Analysis

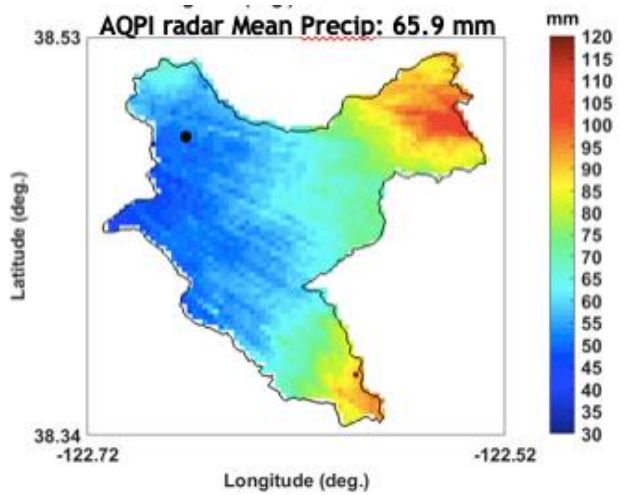


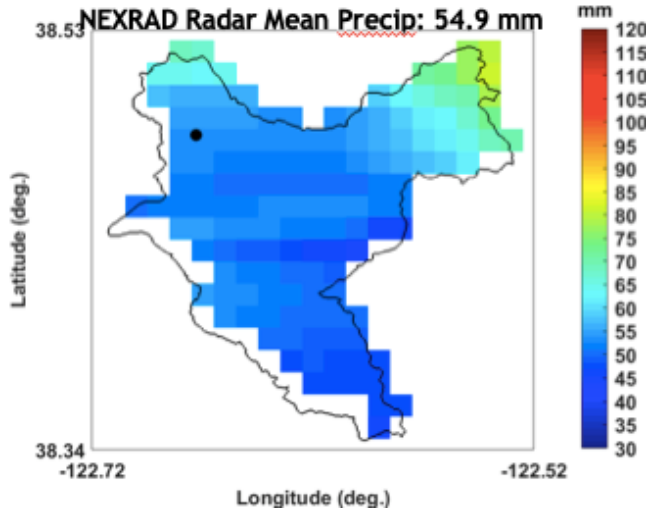


Radar Rainfall Comparison

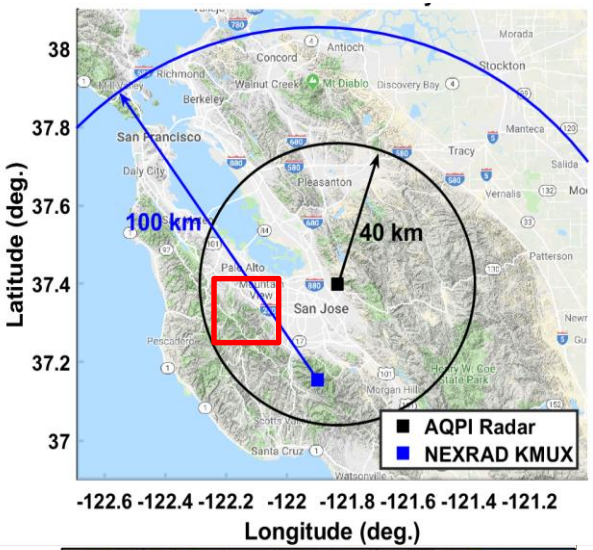


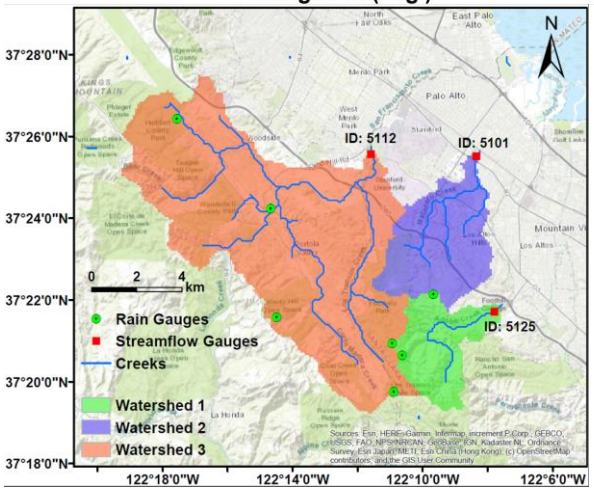






Sensitivity of Streamflow to Precipitation Forcing

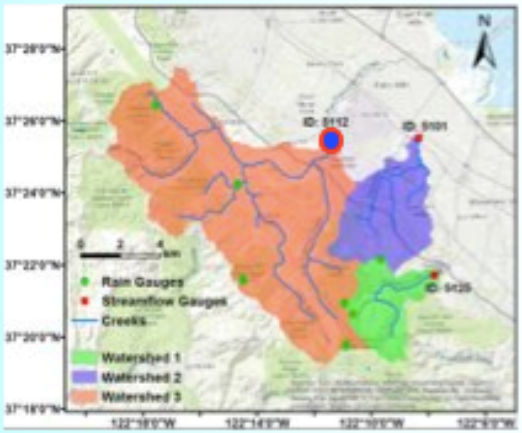


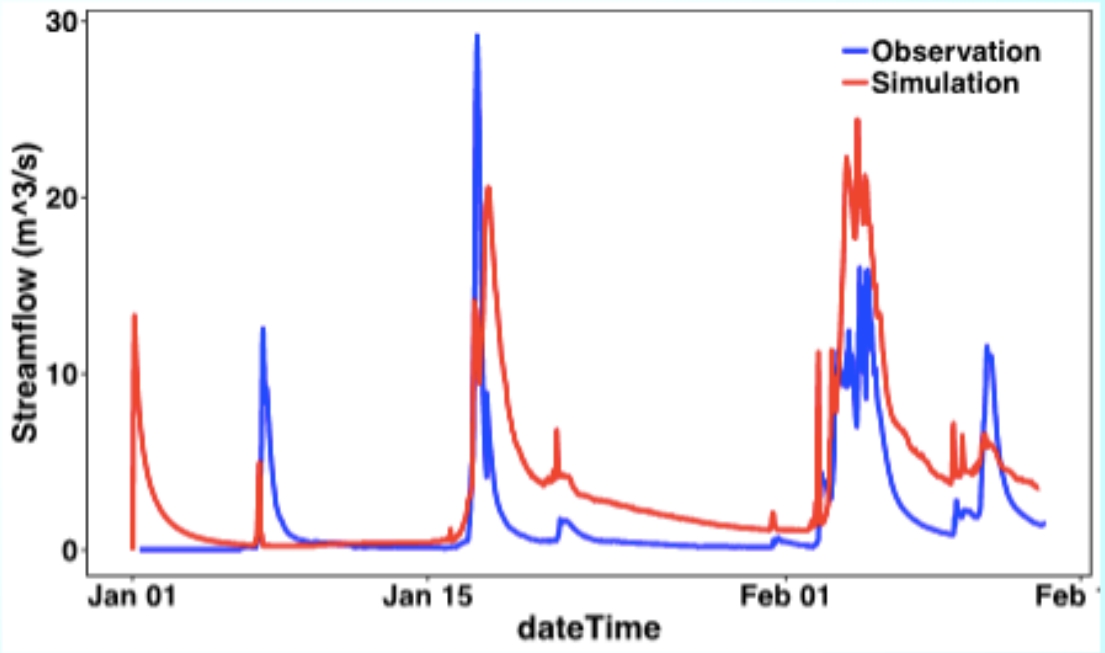


- Three watersheds used for examining the impact of AQPI X-band radar vs. other precipitation on streamflow processes
- WRF-Hydro framework used for hydrologic analysis
- Work is just starting…

Images courtesy of Yingzhao Ma, Colorado State University

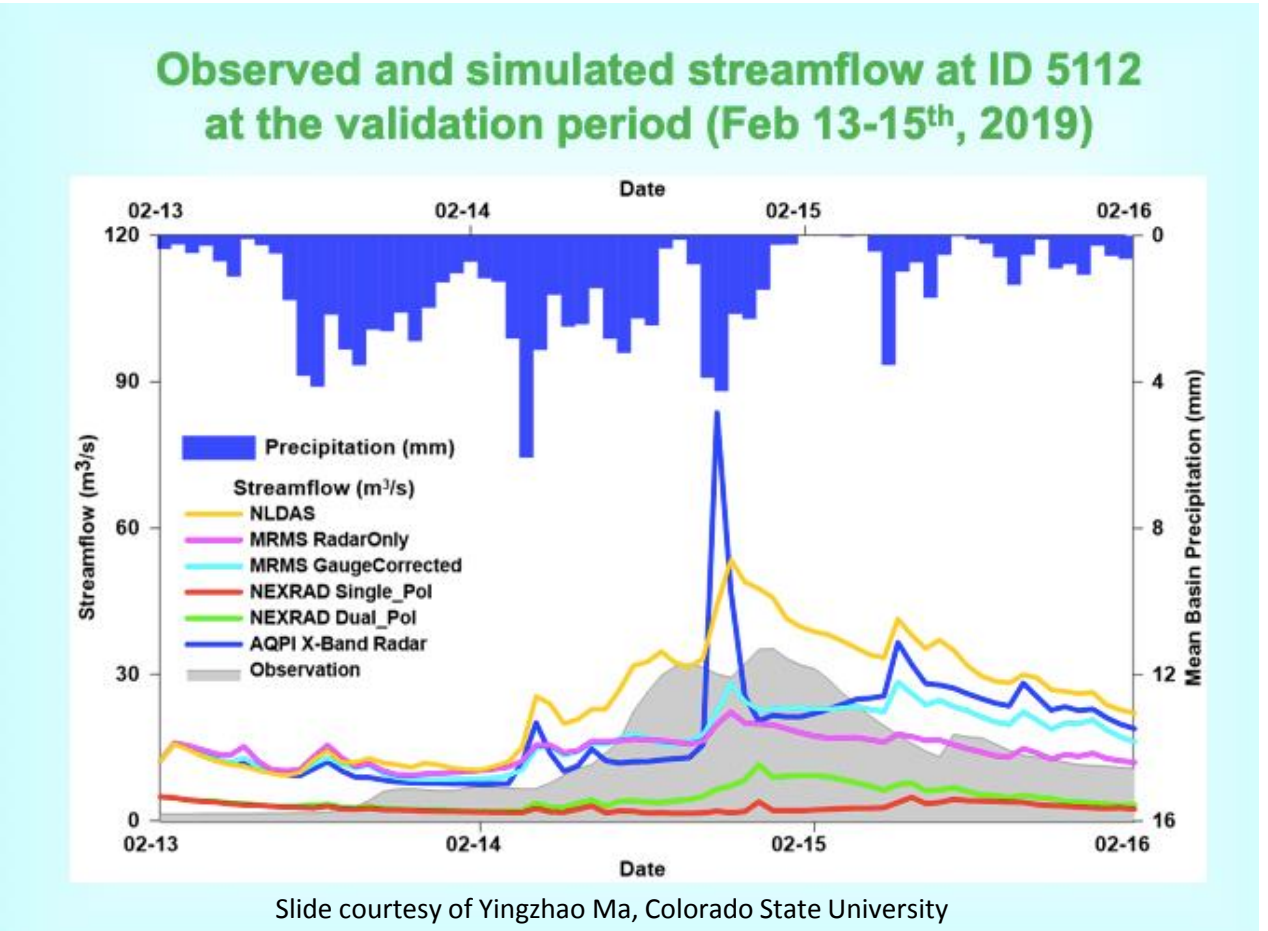
Simulated and Observed streamflow at ID 5112 at the Calibration period (Jan 1st – Feb 12th, 2019)





Forcing Data: North American Land Data Assimilation System (NLDAS)

Slide courtesy of Yingzhao Ma, Colorado State University



Slide courtesy of Yingzhao Ma, Colorado State University

AQPI Web Sites

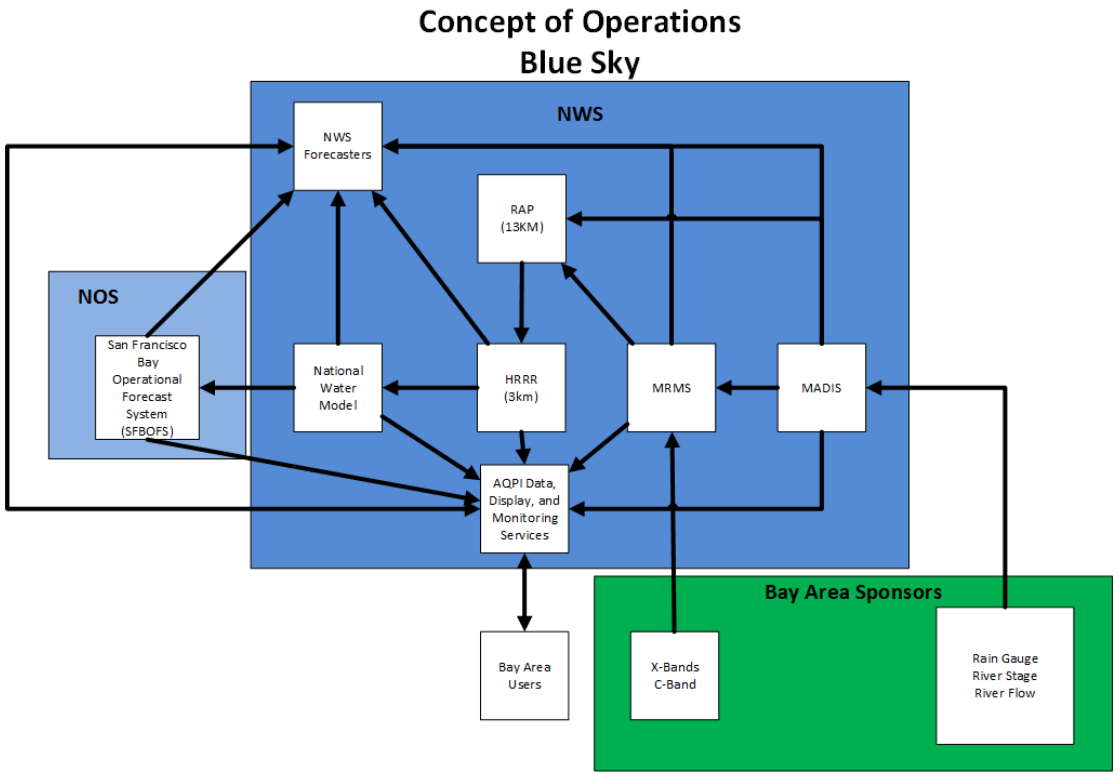
- NOAA

  https://esrl.noaa.gov/psd/aqpi
- Sonoma Water

  https://www.sonomawater.org/aqpi/

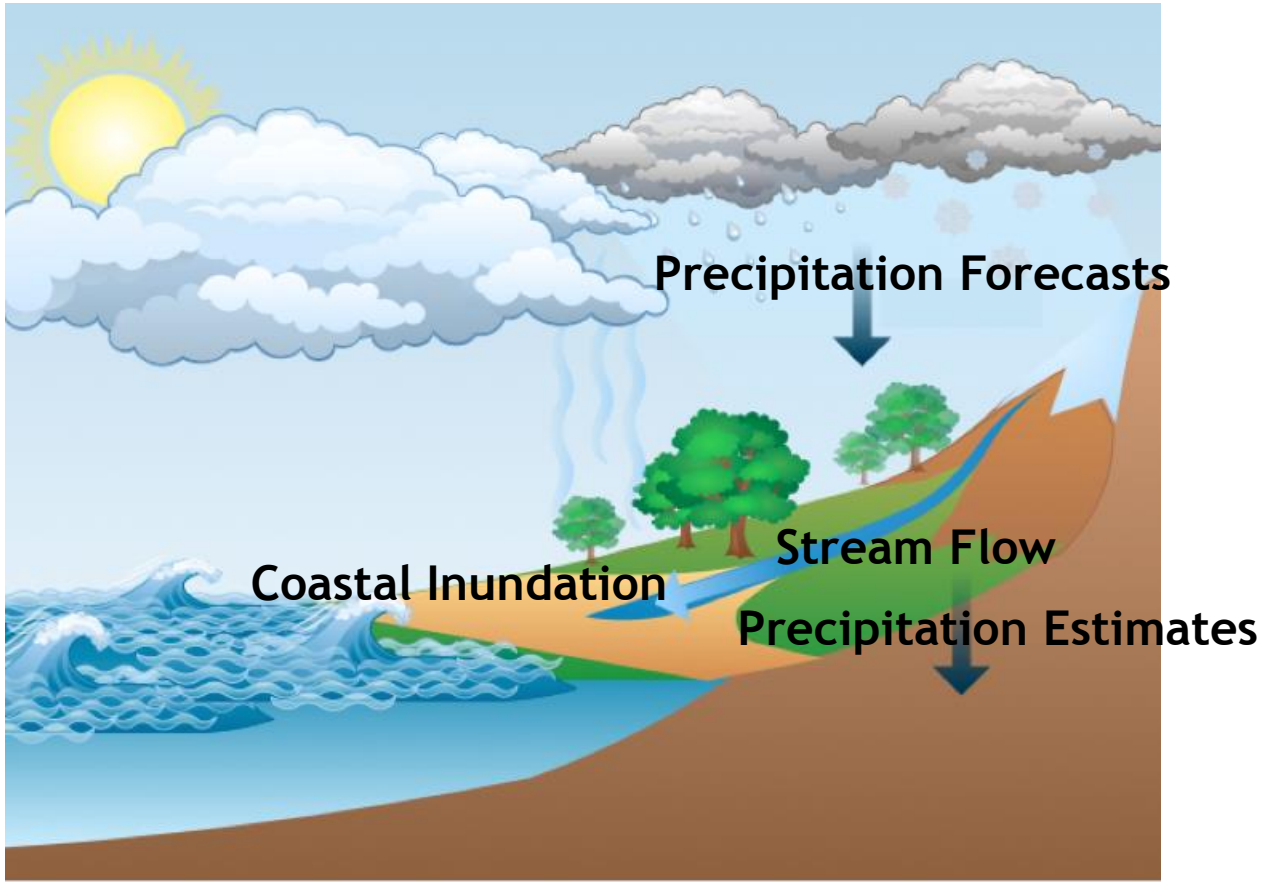
Backup Slides

AQPI Local and National Template



AQPI System

What is it?



AQPI System

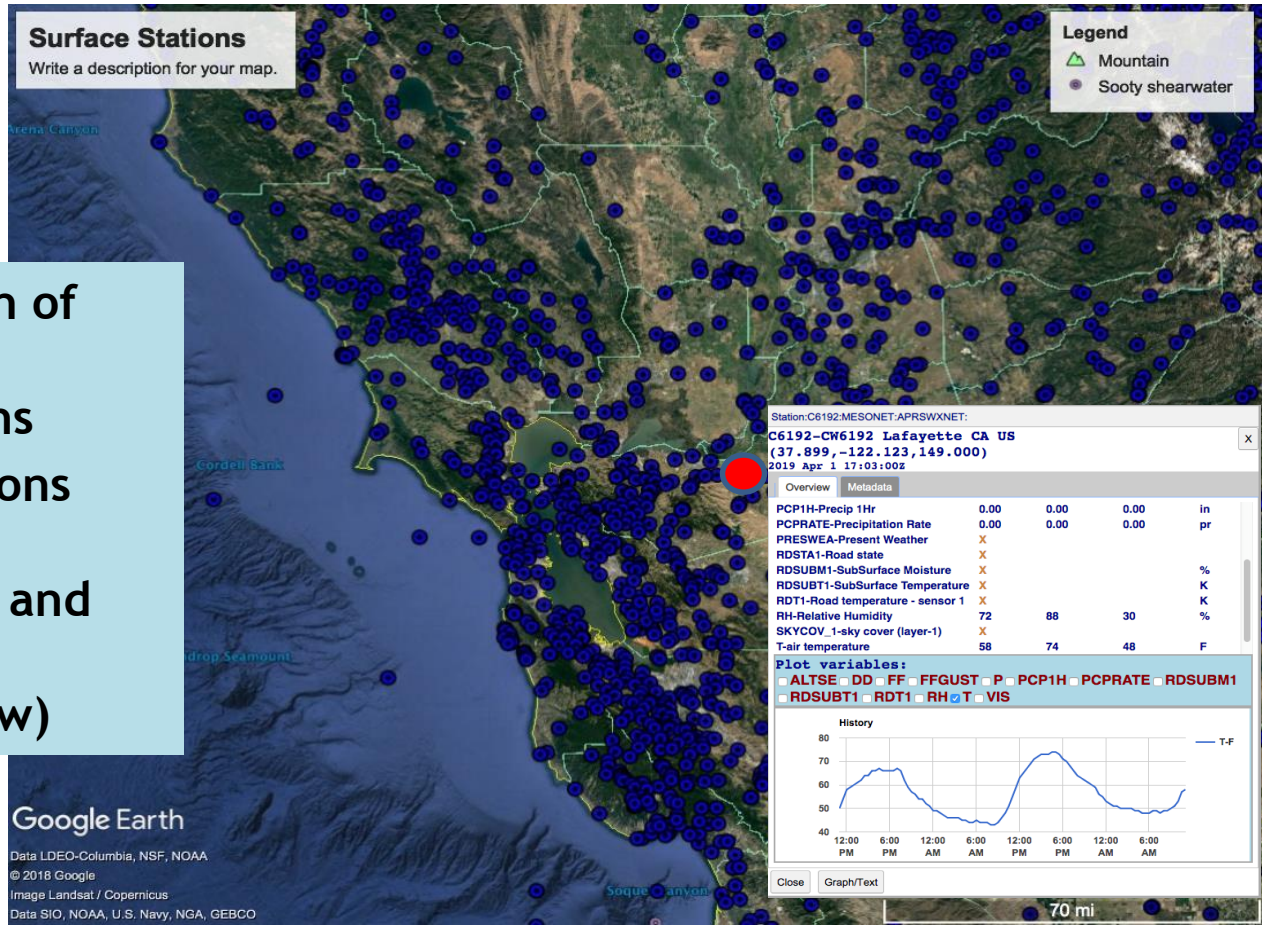
Observations

Surface Observations

1. A centralized collection of data:
   - Surface Observations

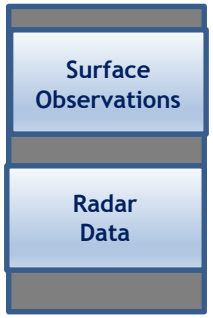
Providing current conditions for:

- Precipitation (rates and accumulation)
- River (stage and flow)

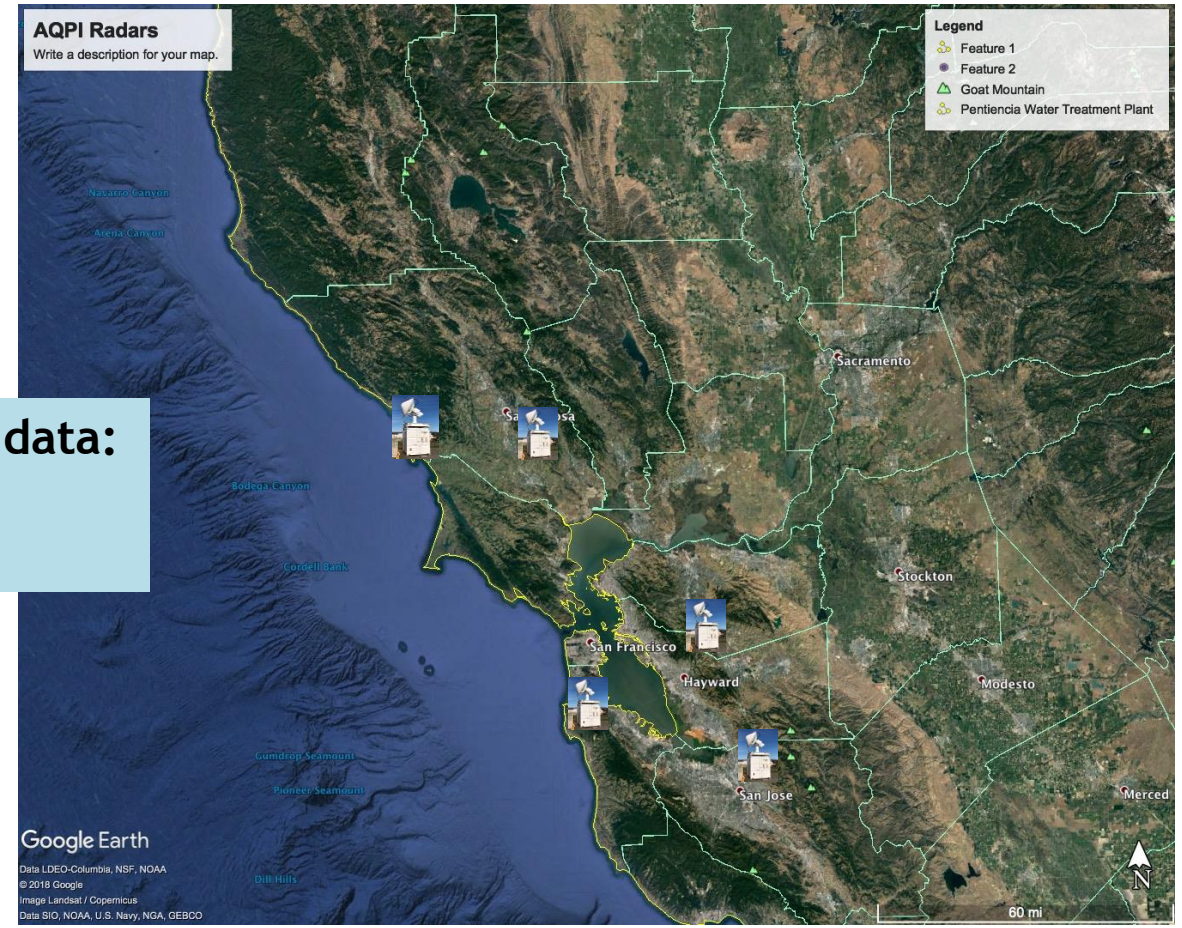


AQPI System

Observations



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



AQPI System

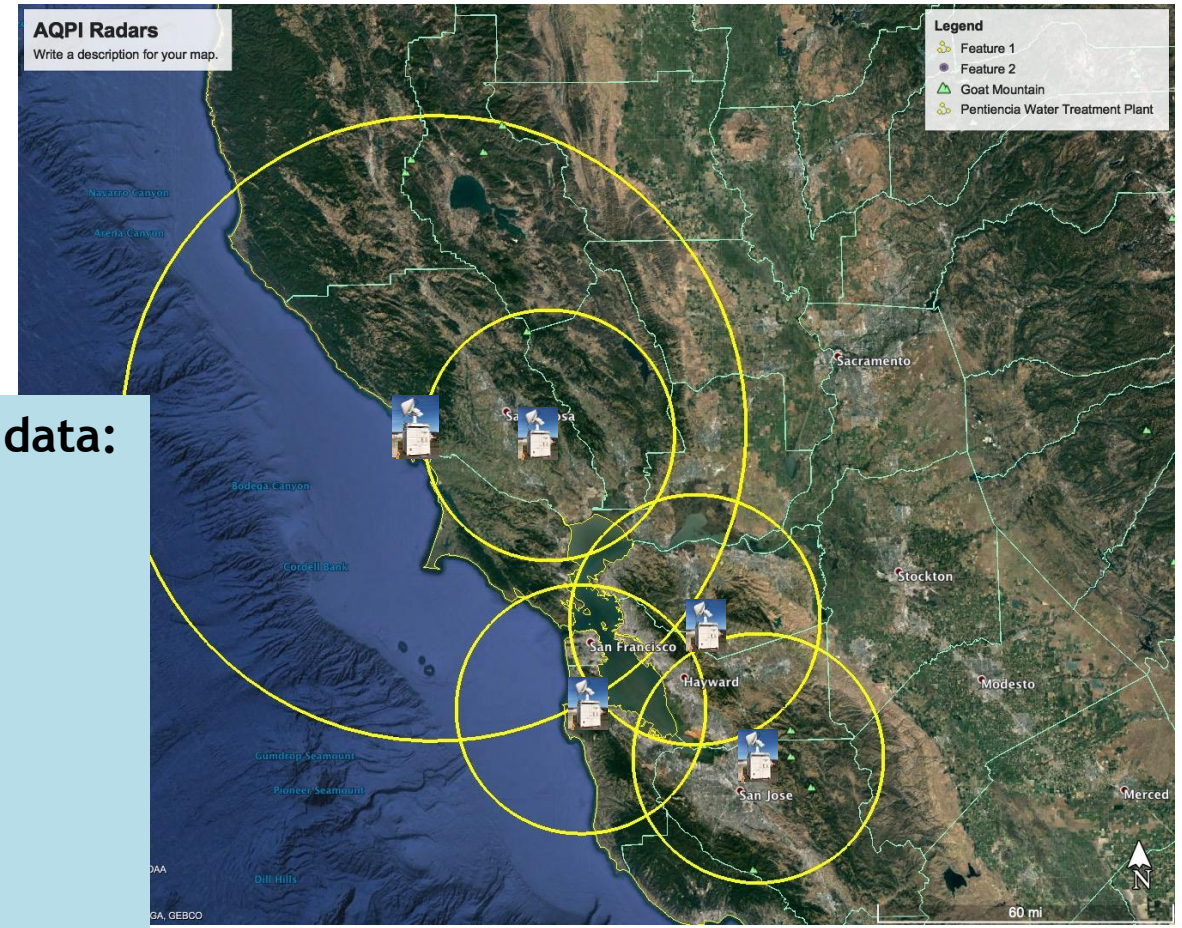
Observations

- Surface Observations
- Radar Data

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

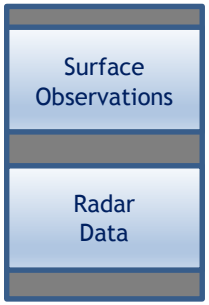
Radars will be sited at:

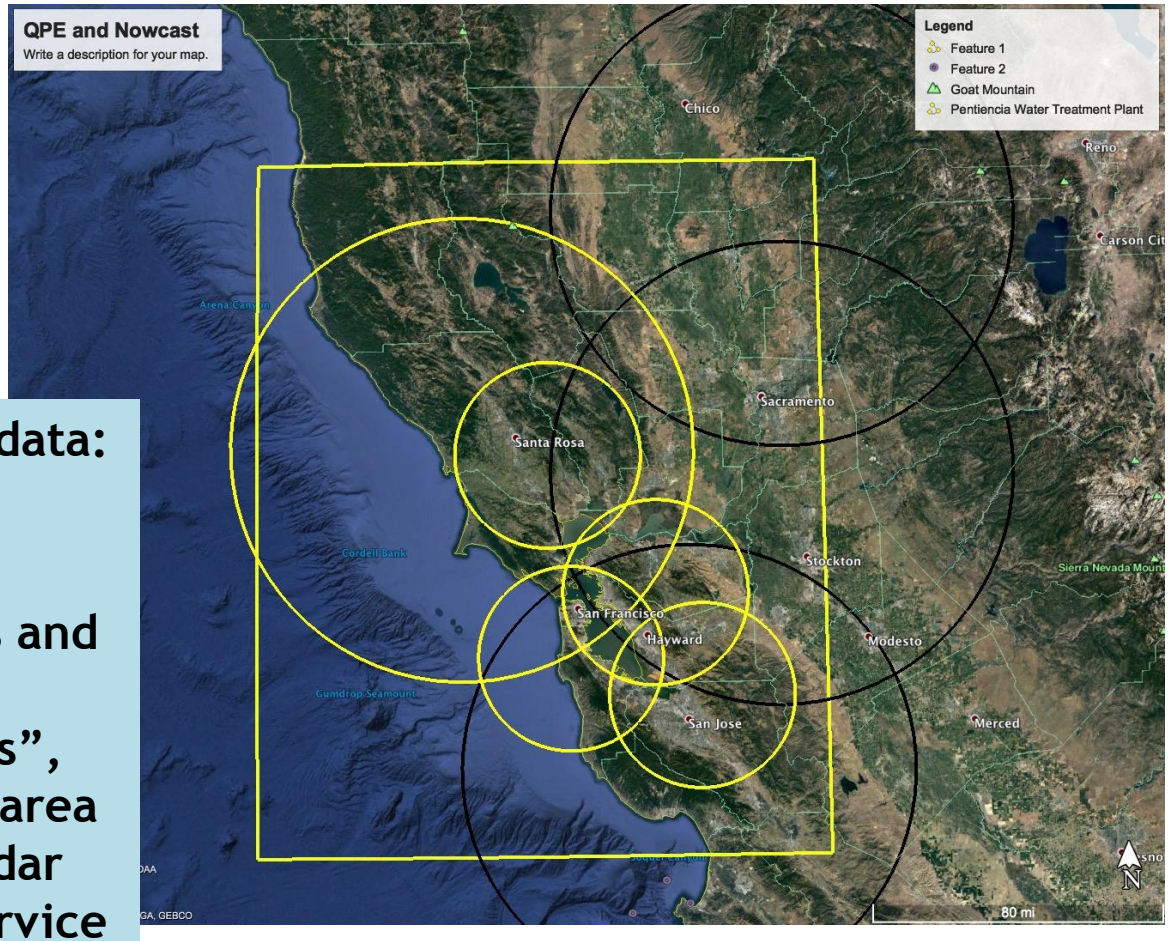
- Sonoma county
- Santa Clara county
- Montara Peak
- Rocky Ridge
- Bay Hill



AQPI System

Observations





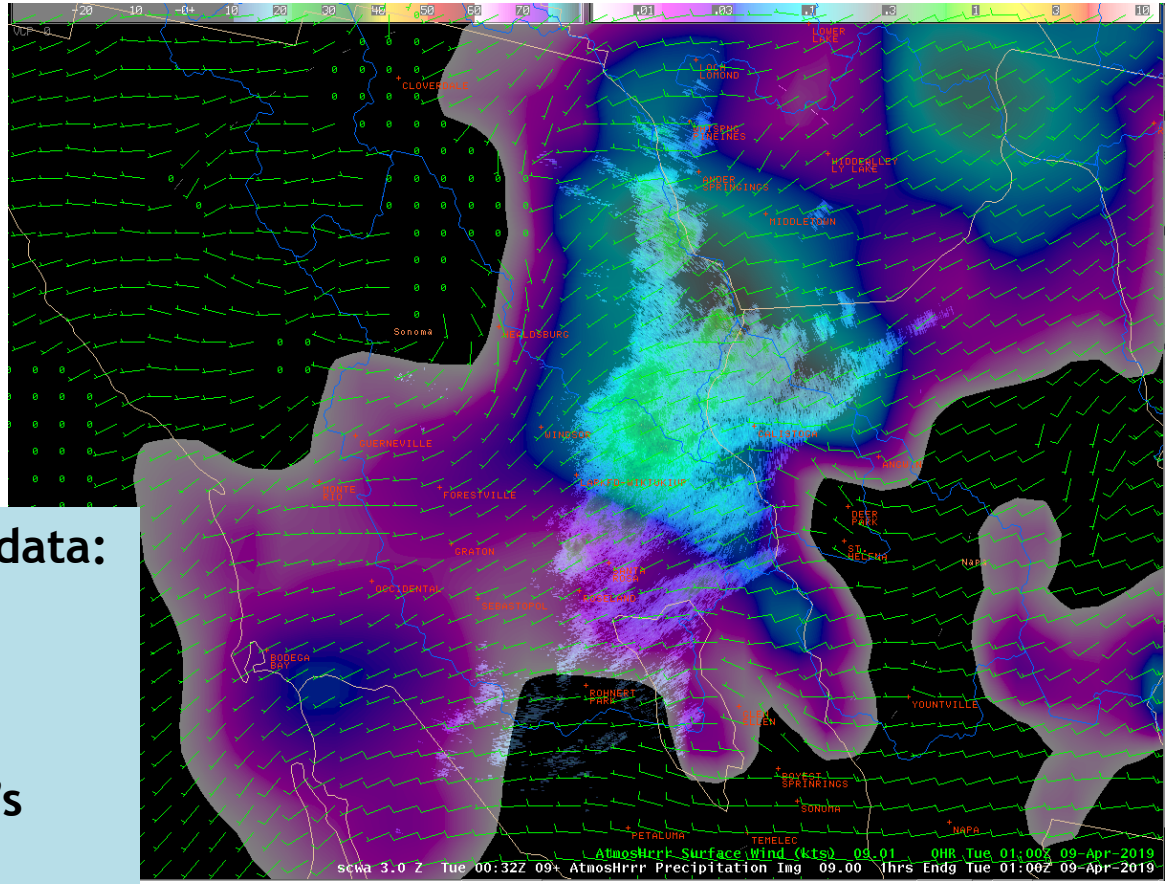
1. A centralized collection of data:
   - Surface observations
   - Gap-fill radars

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

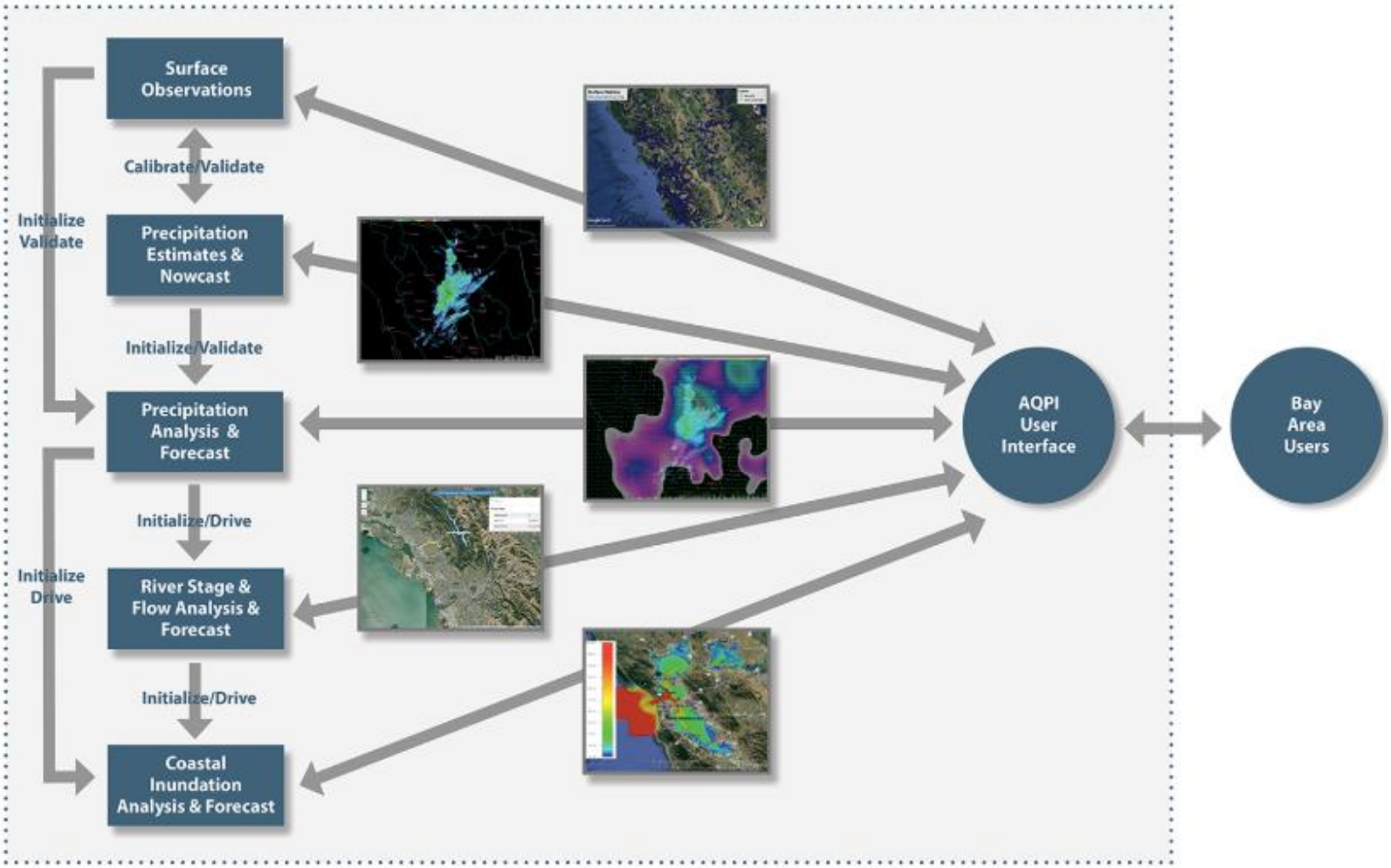
- Surface Observations
- Radars
  - X-Band
  - C-Band
- Precip forecast model



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.

AQPI System


Surface Observations
Calibrate/Validate
Initialize Validate
Precipitation Estimates & Nowcast
Initialize/Validate
Precipitation Analysis & Forecast
Initialize/Drive
Initialize Drive
River Stage & Flow Analysis & Forecast
Initialize/Drive
Coastal Inundation Analysis & Forecast
AQPI User Interface
Bay Area Users