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

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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
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
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**
  - 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)
AQPI System

- Precipitation Estimates
- Precipitation Forecasts
- Streamflow Forecasts
- Coastal Flood Forecasts
AQPI Radar Deployments

- Major watersheds
- AQPI X-band radar
- AQPI C-band radar
- NEXRAD S-band radar
- AQPI X-band radar coverage
- AQPI C-band radar coverage
- AQPI 9 County boundary
- US County
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 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 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

Feb 1-4 Rainfall Accumulation

- Sonoma Water Gauge 40201
- AQPI Radar
- NEXRAD Dual-Pol
- MRMS Gauge Corrected

Terrain Elevation

AQPI radar Mean Precip: 65.9mm

NEXRAD radar Mean Precip: 54.9mm
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/
Thank You!
Backup Slides
AQPI System

What is it?

- Precipitation Forecasts
- Stream Flow
- Coastal Inundation
- Precipitation Estimates
Observations

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

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

Radars will be sited at:
   - Sonoma county
   - Santa Clara county
   - Montara Peak
   - Rocky Ridge
   - Bay Hill
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.
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.