# NOAA/NWS Flood Hazard Watch and Warning Capabilities

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# Outline

- NWS hydrologic services
- NWS watch/warning process and capabilities
  - Floods and flash floods
- Communicating the threat
- NOAA/USGS Debris Flow System
- The future
  - Observation opportunities

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Flooding is the most frequent severe weather threat and the costliest natural disaster facing the nation


Ninety percent of all natural disasters in the U.S. involve flooding

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# Key NWS Hydrologic Service Offices

- Hydrologic Prediction Center
  - National precipitation forecasts out to 7 days
  - Excessive precipitation outlooks/discussions
- River Forecast Centers
- Weather Forecast Offices
  - Local watches, warnings, and advisories
  - Precipitation forecasts
  - Using guidance from national and regional centers

# NWS River Forecast Centers

- Hydrologic modeling
- Precipitation observations/forecasts
- Water supply
- River forecasts
- Flash Flood Guidance
- California and Nevada River Forecast Center (CNRFC)

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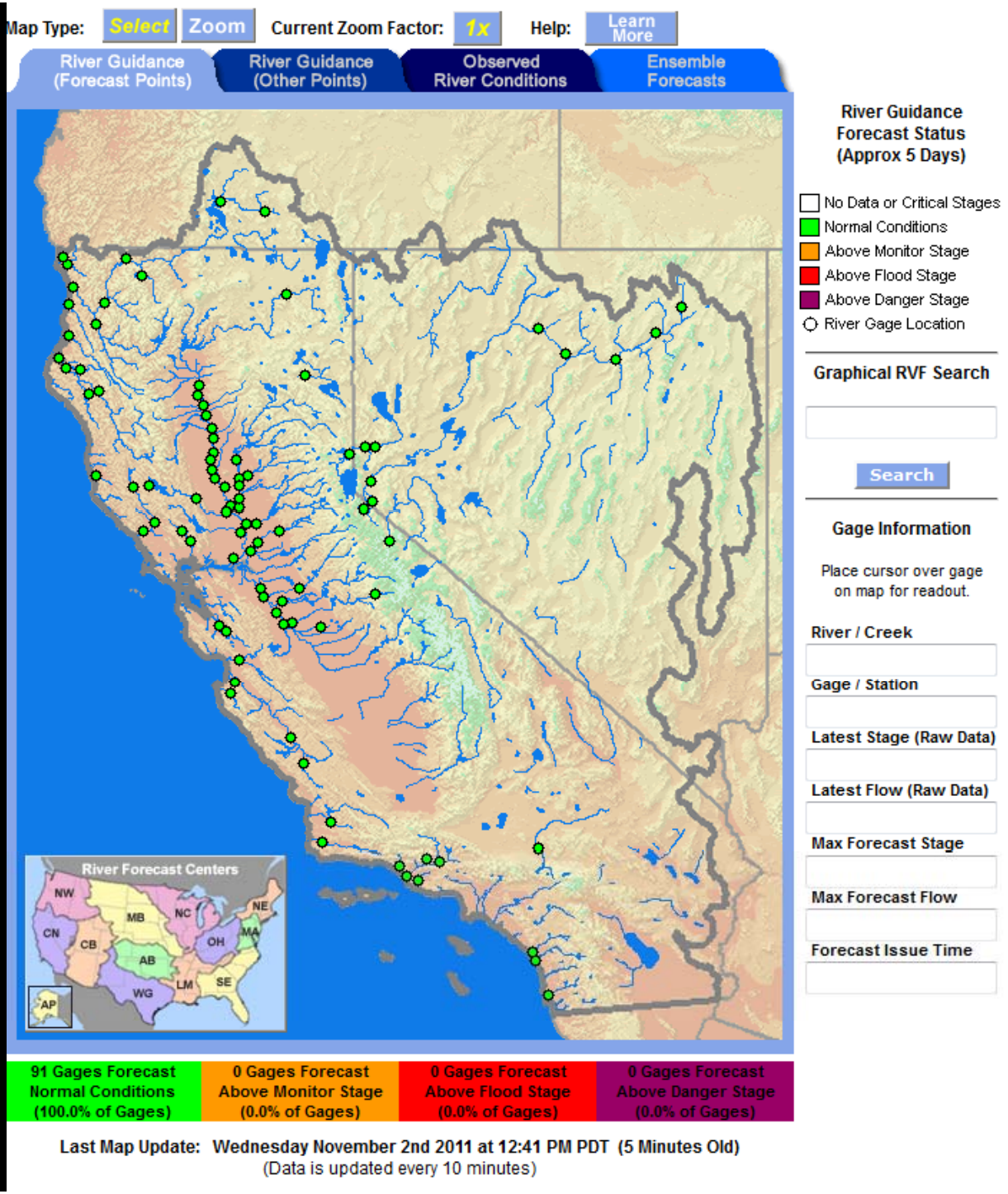
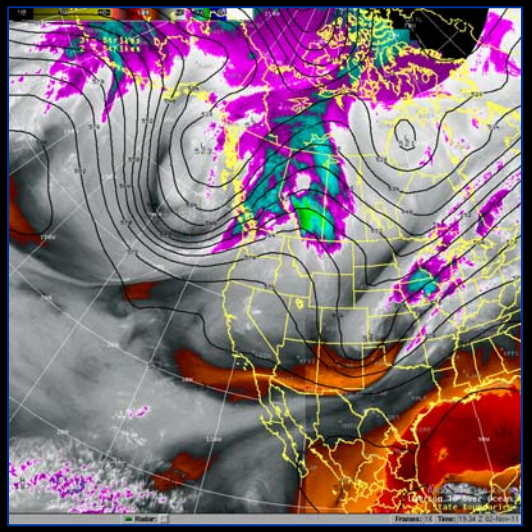
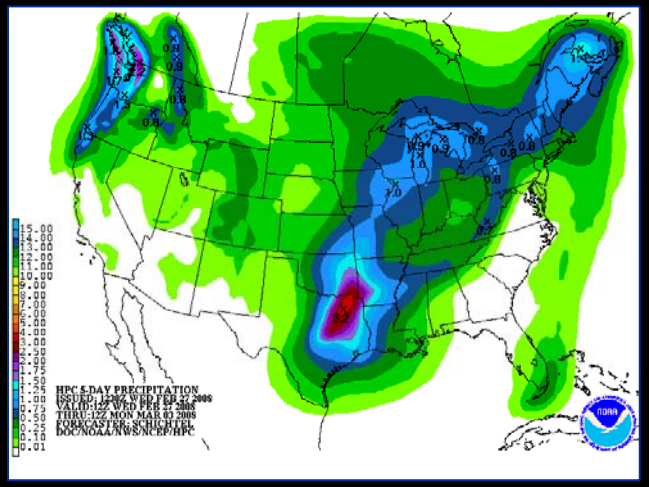
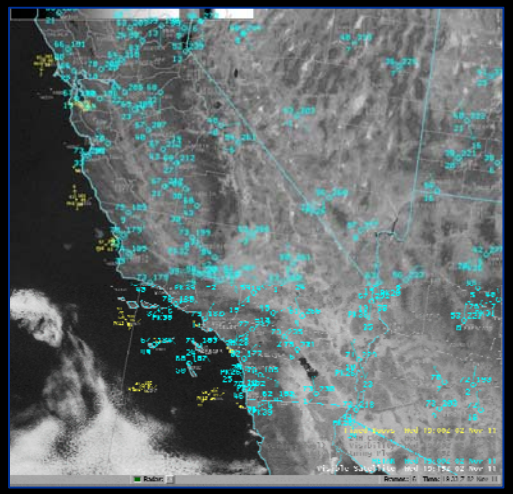


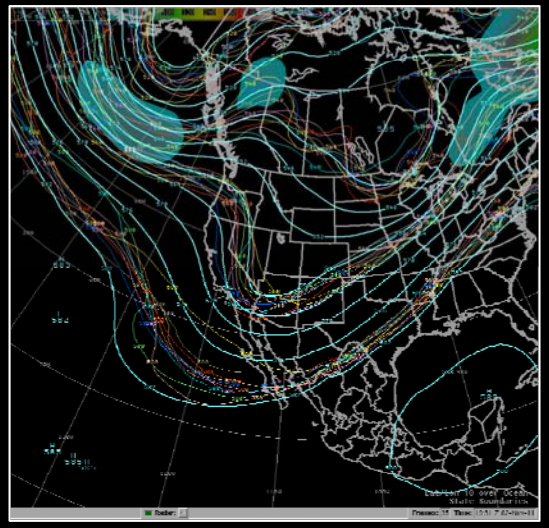
# The Forecast Process

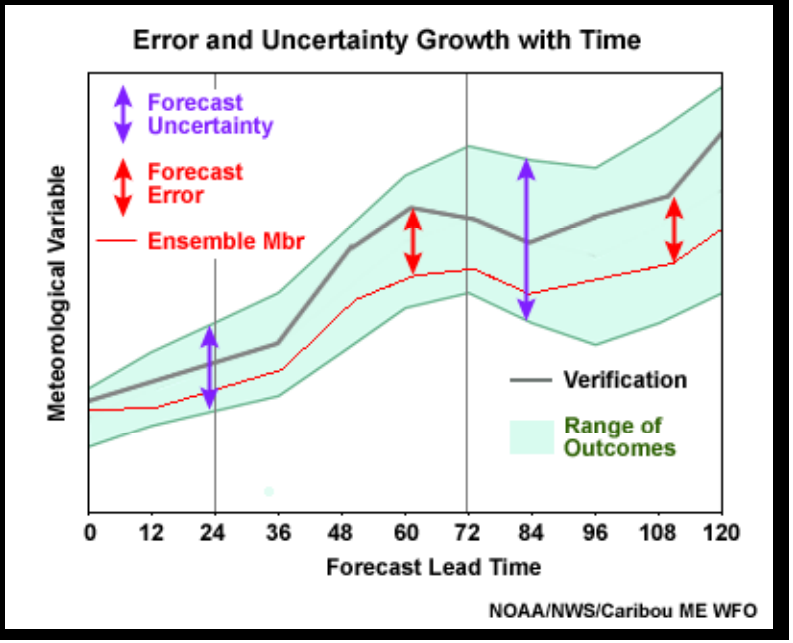










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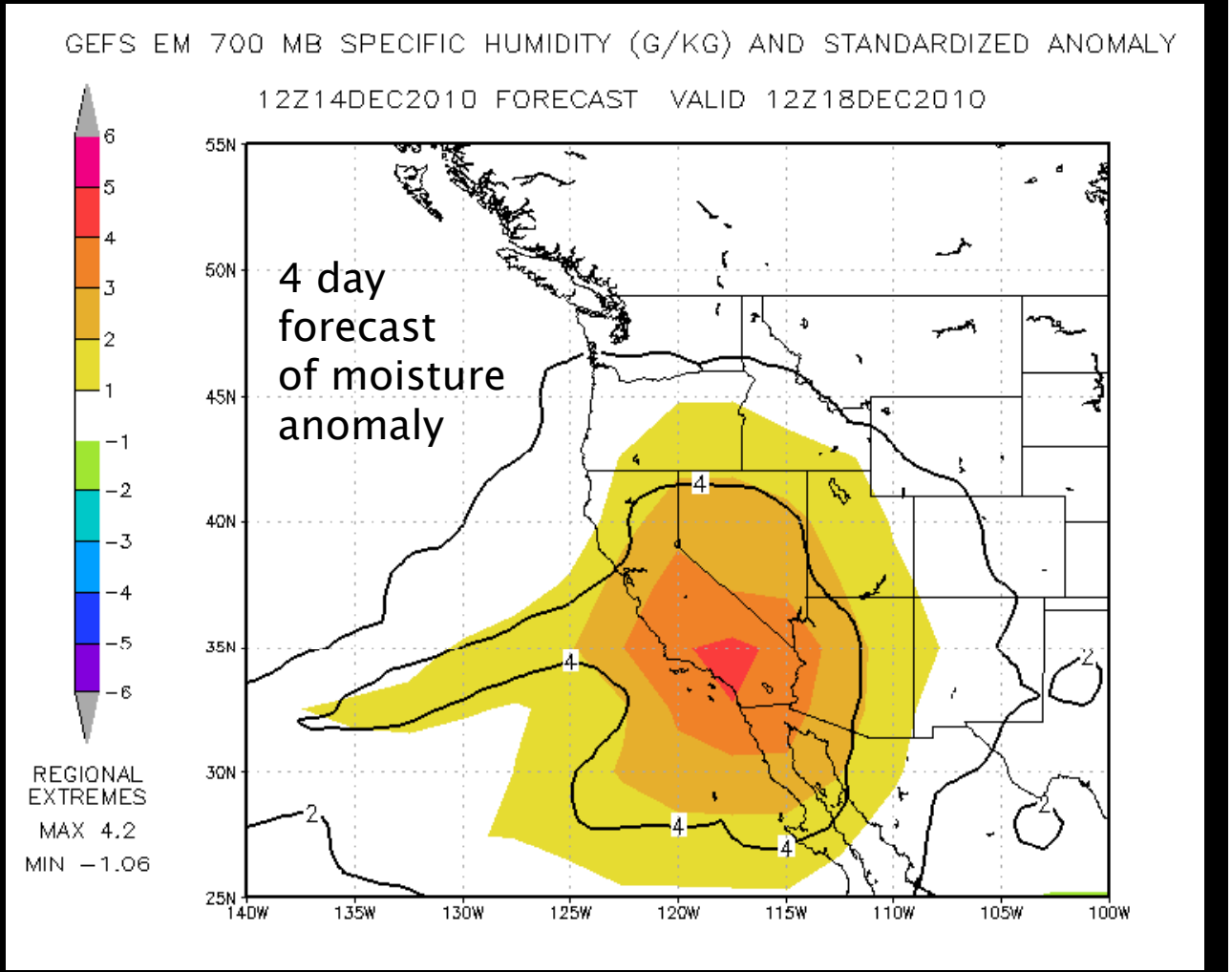
# Tools in the Forecaster's Toolbox

- Ensemble modeling

Plot shows 4-day ensemble forecast of pos/neg moisture anomaly

Provides forecasters with early clues to event severity

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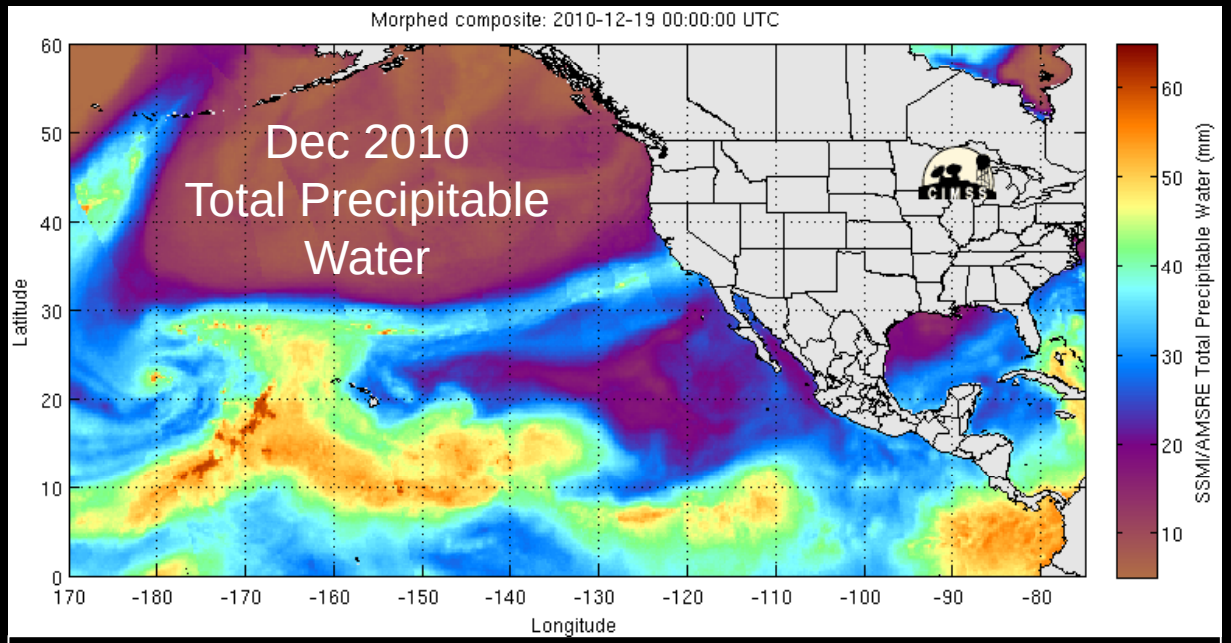
# Contributing the Science of Atmospheric Rivers (AR)

- Understanding how much moisture is available for the event
- Anticipation of days to beyond a week
- NOAA/USGS AR$^{k}$Storm Project




Understanding AR factor can aid in forecasters communicating event severity or rarity

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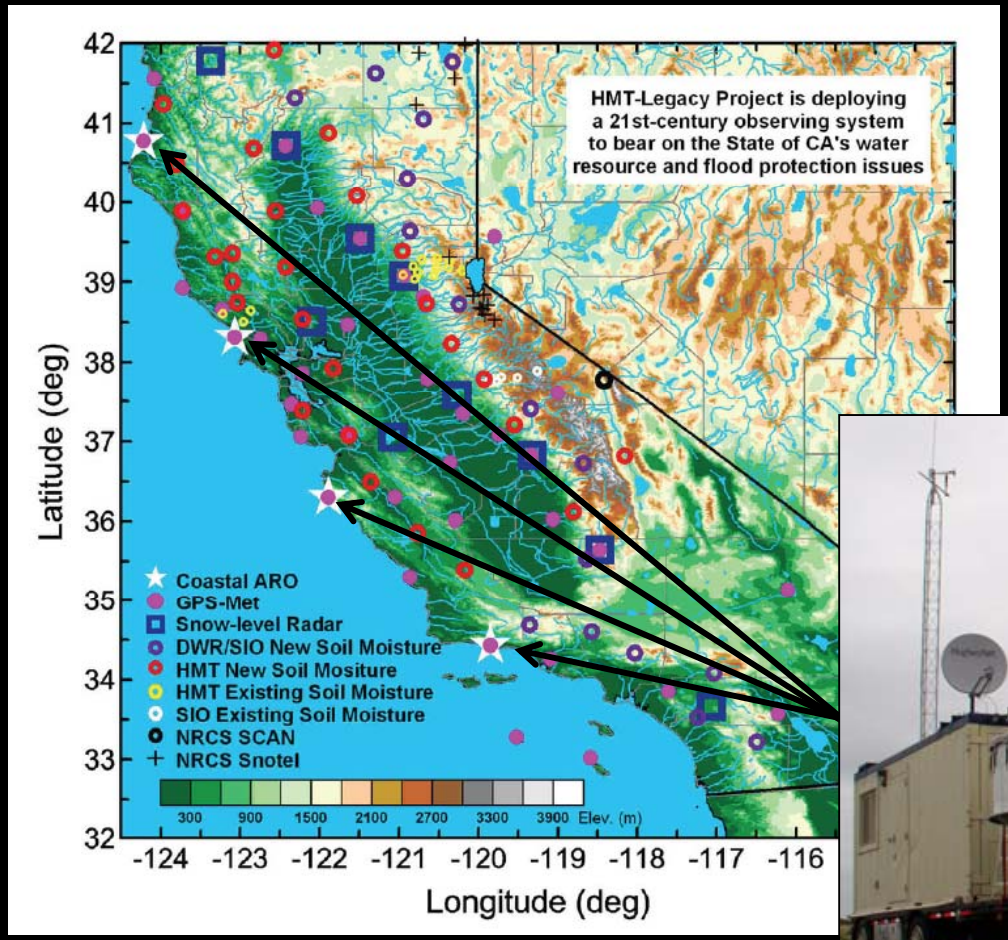
# Atmospheric River Observatories (ARO)

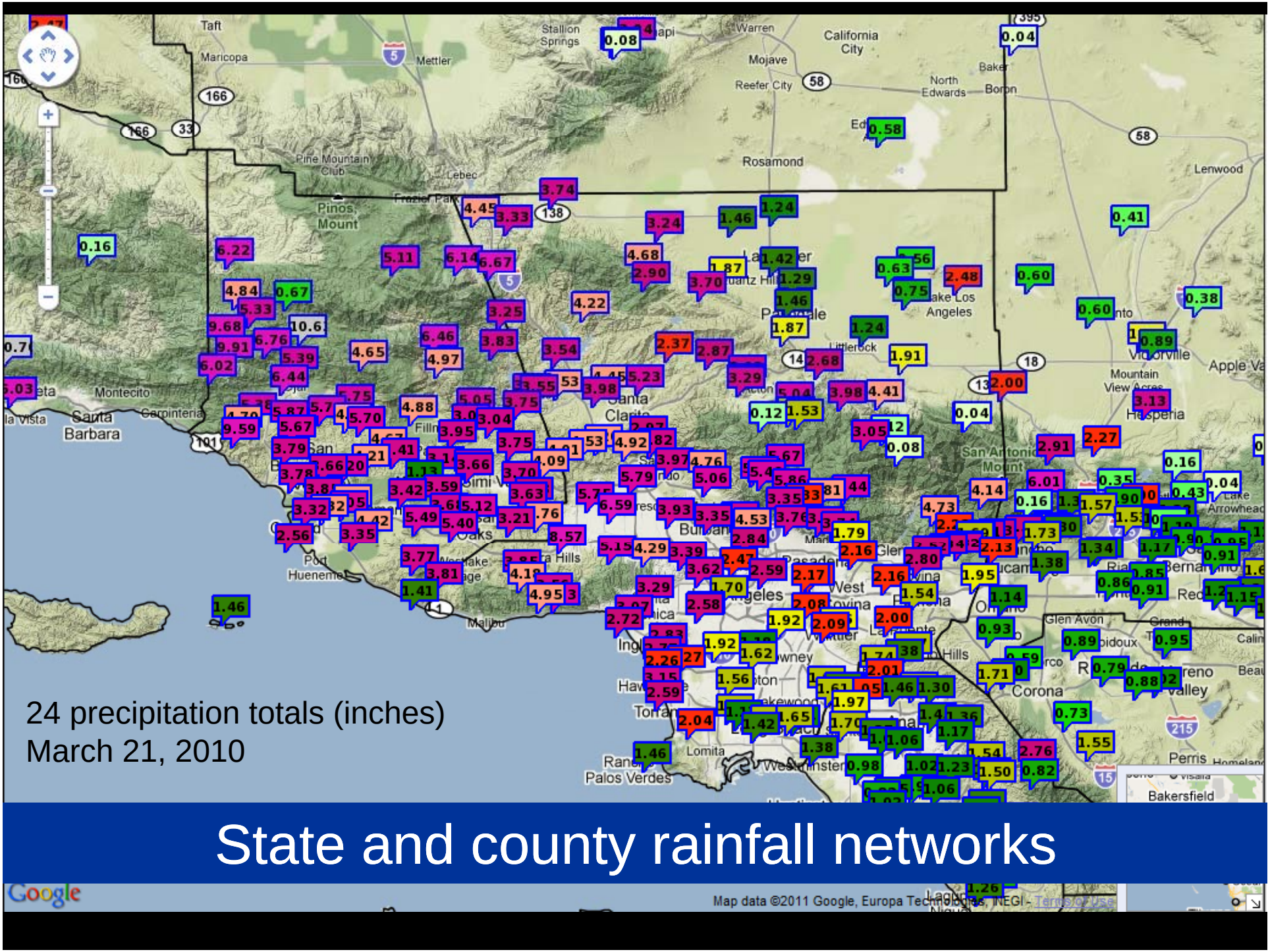



*Improving our understanding of ARs as they impact land*

*Future of observations?*

*Part of the Enhanced Flood Response and Emergency Preparedness (EFREP) program*

*ARO Instrument Site*

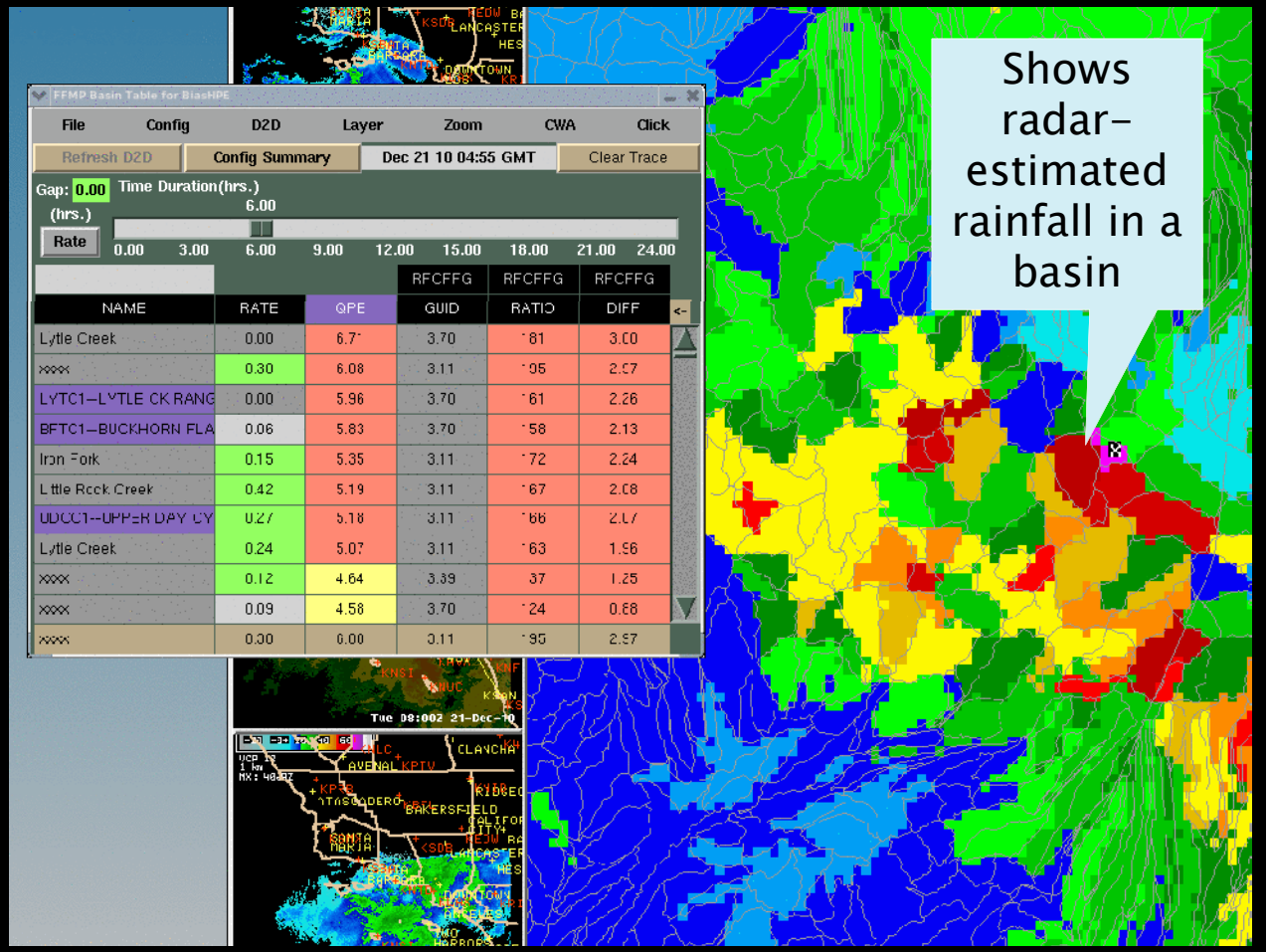



# State and county rainfall networks

# Monitoring Rainfall on a Basin

- Flash Flood Monitoring and Prediction System

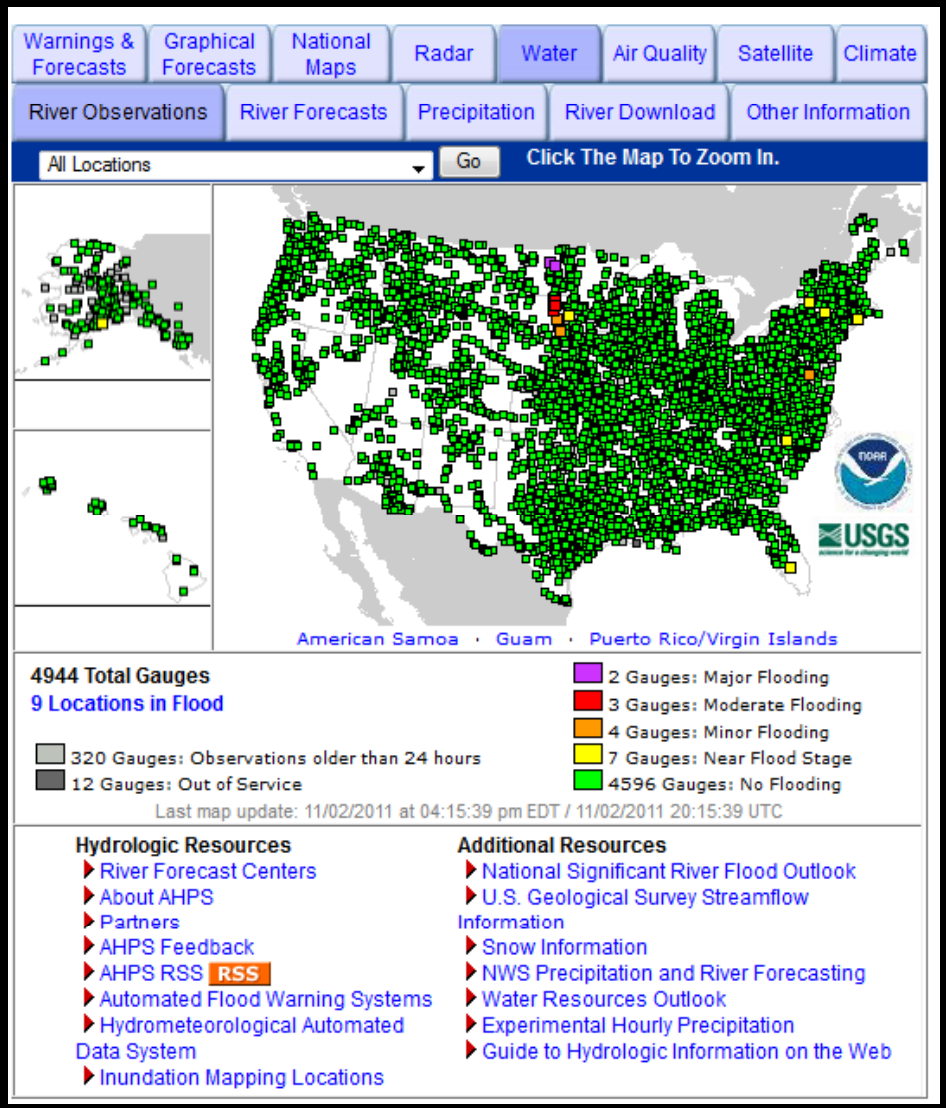
- Rainfall in a basin instead of a point
- Compares to flash flood guidance
- Alerts forecaster when thresholds exceeded



# The Advanced Hydrologic Prediction Service (AHPS)

- Web-based suite of hydrologic information
- Forecasts from hours to months
- Over 4500 river monitoring locations

water.weather.gov/ahps/

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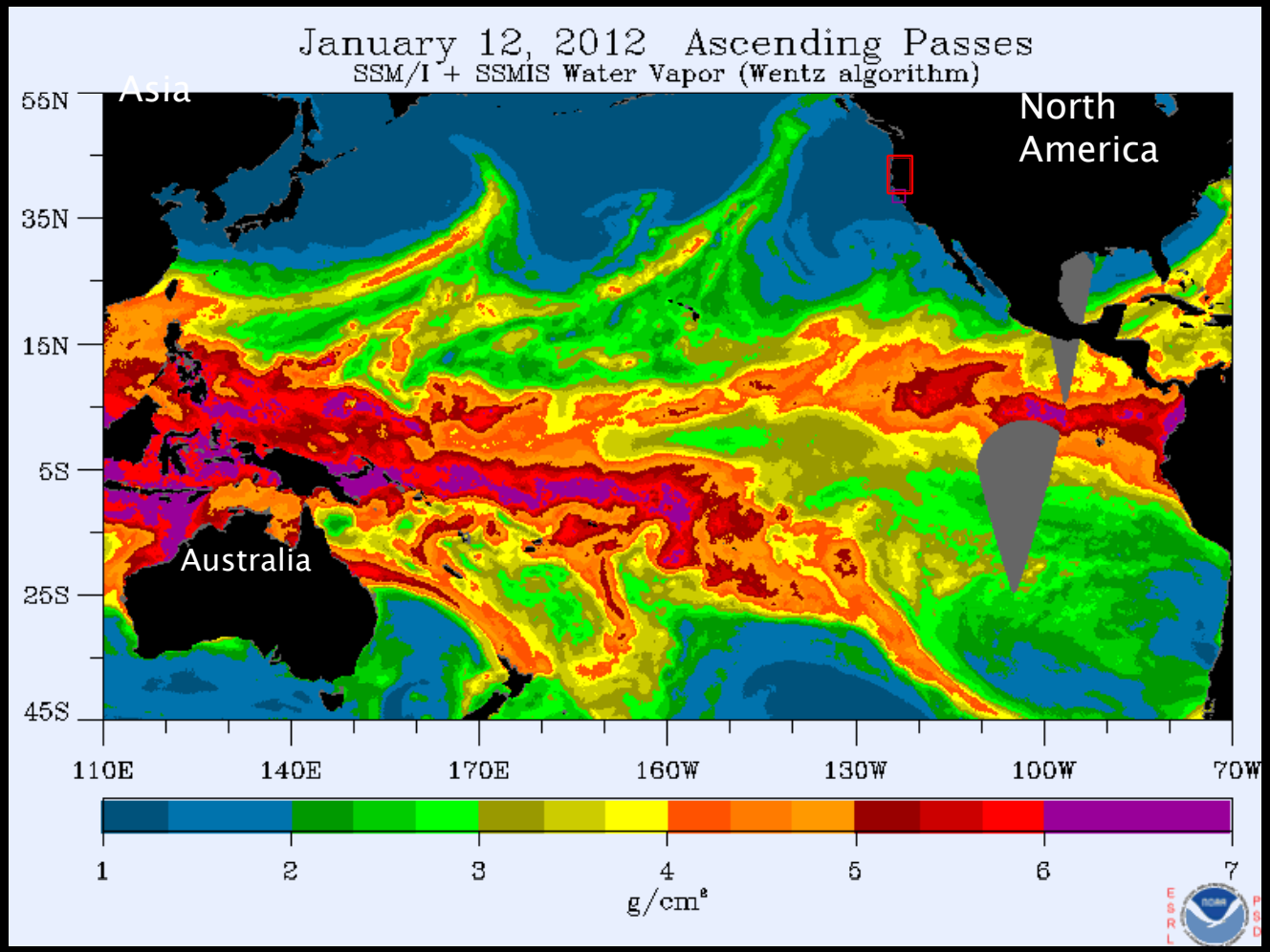
# Oregon Flooding January 19-20, 2012

*Demonstrating AHPS Hygrographs*




This loop shows integrated water vapor, updated twice per day

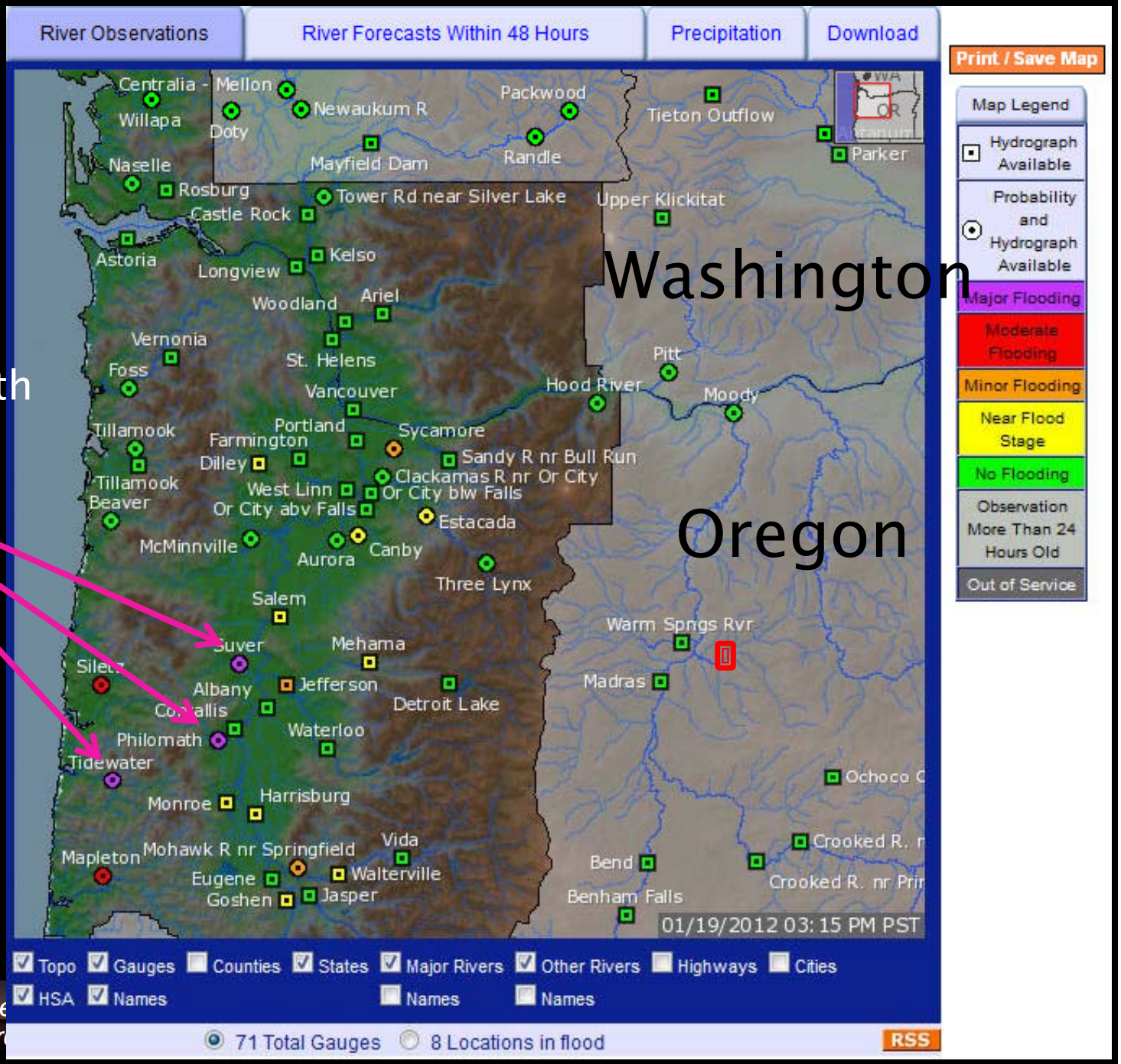
Loop starts:
*January 12*
Loop ends:
*January 19*

▭ indicates area experiencing flooding

# River Status on January 19, 2012

## 3:15 pm PST

Note gauges with major flooding

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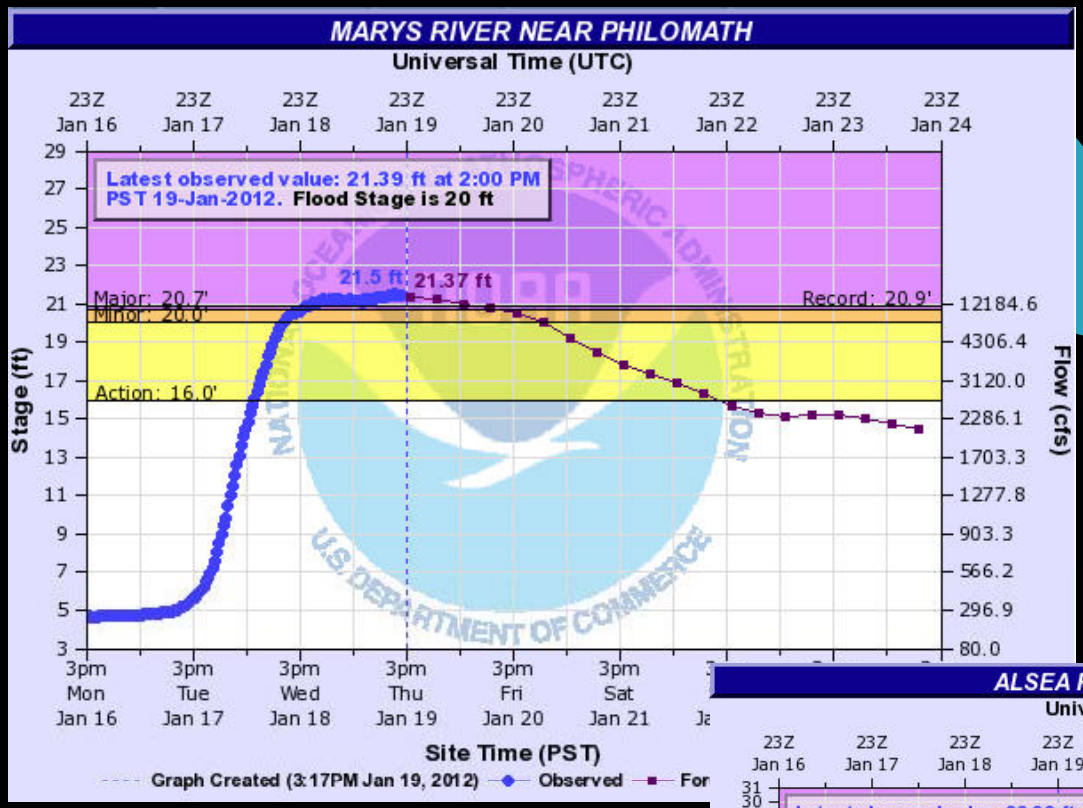


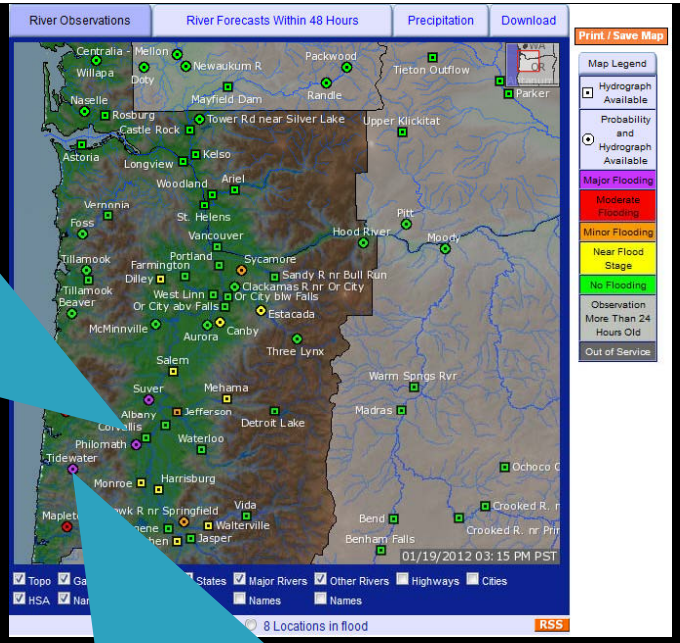



# *River stage graph*

- ✓ Time increasing to right
- ✓ Blue line is observed
- ✓ Purple boxes are forecast

# NWS Flood/Flash Flooding Products

## Ready

2-3 Days Prior

### Hydrologic Outlook

*Highlights the details of potential hydrologic impacts and conveys any uncertainties that exist in extended forecast*

Also issue a Special Weather Statements

## Set

### Watch

*Conditions conducive to flooding or flash flooding are expected within the next 6 to 24 hours*

**Be Prepared**

## Go

### Warning

*Life-threatening flooding of flash flooding conditions are either imminent or are occurring*

Take Action Now!

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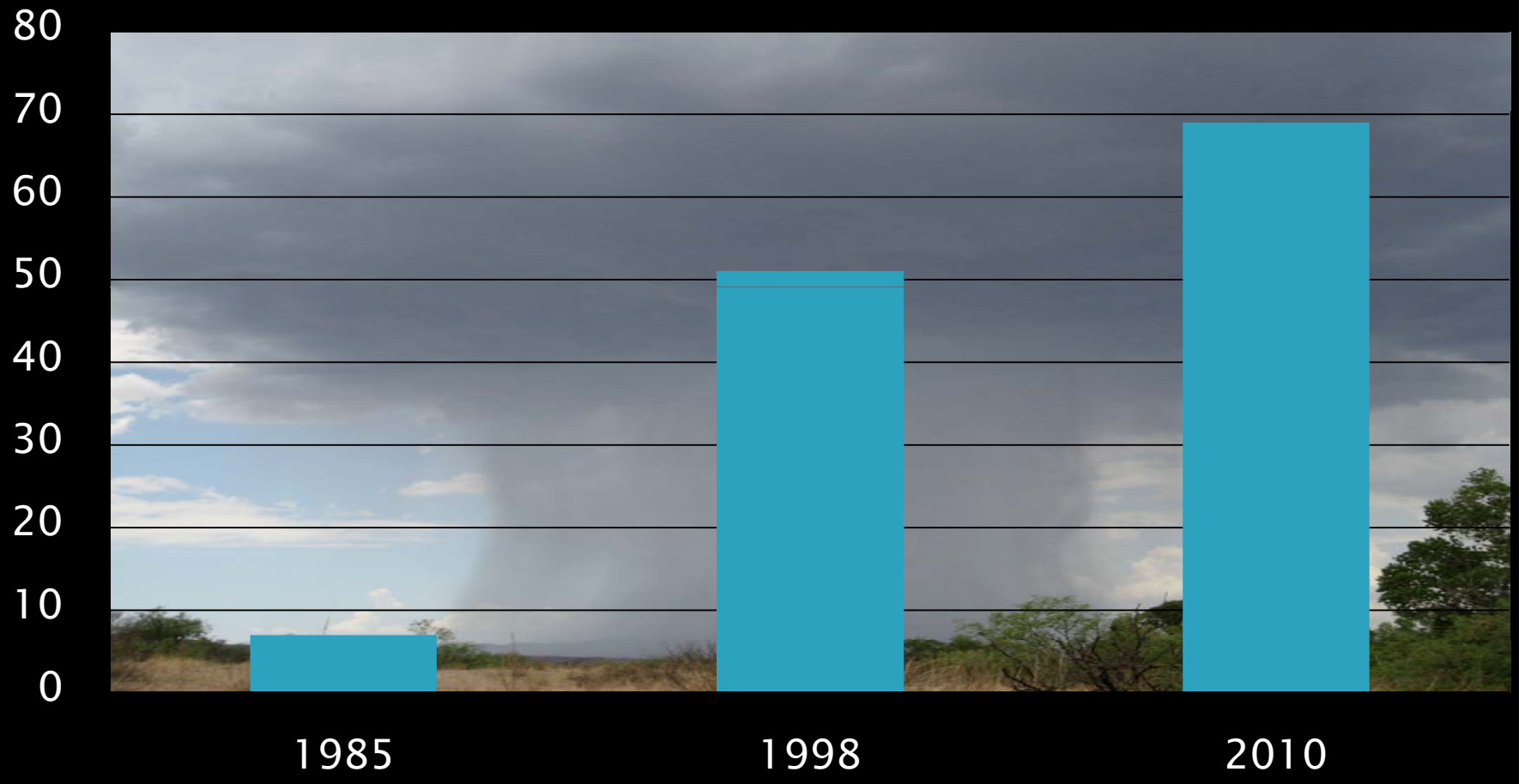
# Flash Flood Warning Lead Time
# National Average (Minutes)

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# Delivering the Information

- Decision Support Services
- Importance of public education!
  - StormReady Program
- Direct communication with emergency managers and responders
- Use of “Flood Emergency” wording in warnings
- Understanding societal responses

# Public Response To Warnings

*NWS Working to Better Understand Societal Response to Severe Weather Warnings*

- Awareness
- Understanding
- Acceptance
- Action, Behavior Change


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# Getting the Word Out to partners

- Many offices have established call lists for events.  For example:
  - Public Works called when flash flood watches and warnings are issued for debris flows
- GoTo Webinars prior to rain events
- Recorded online briefings


*Los Angeles County DPW  deploys k-rails in anticipation of heavy rains*

*(David McNew/Getty Images)*

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# Text Message and Email Alerts

*inws.wrh.noaa.gov*

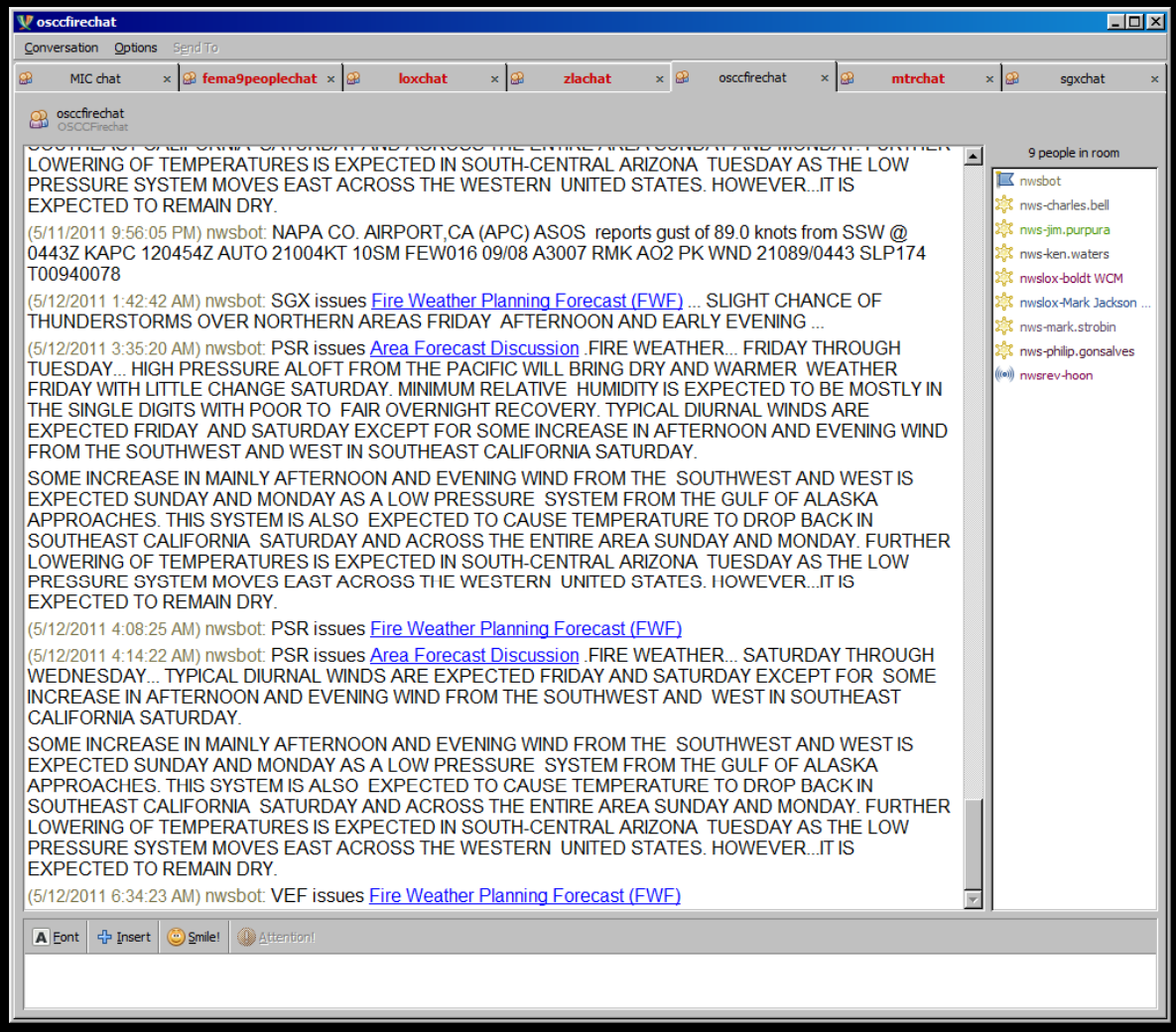
- Intended for NWS core partners only
  - Emergency managers, community leaders, first responders (e.g., fire agencies), and other government partners

**iNWS MOBILE ALERTING**

Receive customized text message and e-mail alerts for National Weather Service products that you care about.

# NWS Chat Program

- Instant messaging with NWS forecasters
- For EMs, government partners, and media




https://nwschat.weather.gov

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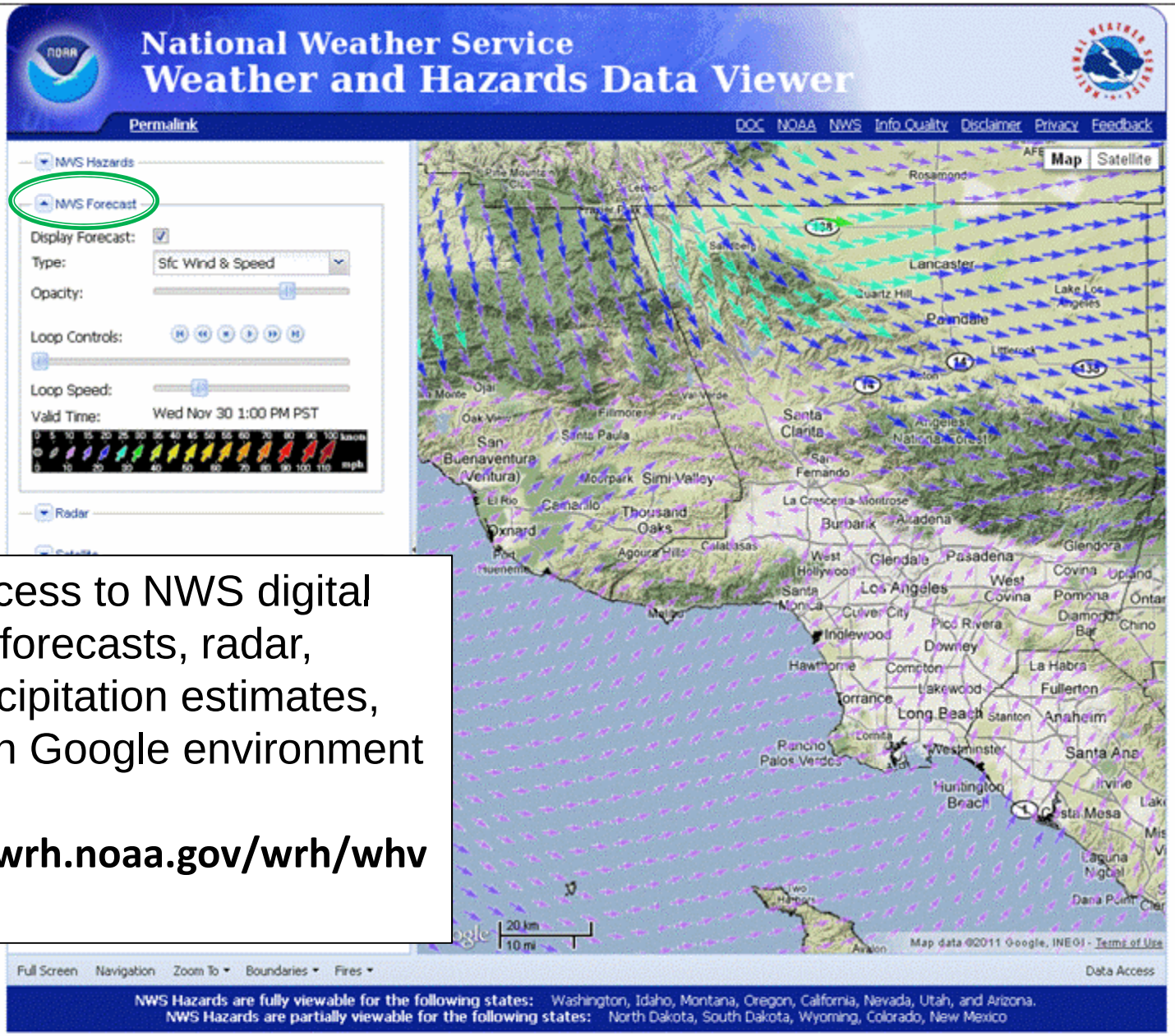


Access to NWS digital forecasts, radar, precipitation estimates, etc., in Google environment

**www.wrh.noaa.gov/wrh/whv**

# NOAA/USGS Debris flow Warning System

- Ongoing NOAA/USGS project to predict, monitor, and warn for debris flows
- Recent burn areas
  - Within 2-3 years
- Warnings based on USGS rainfall rate thresholds

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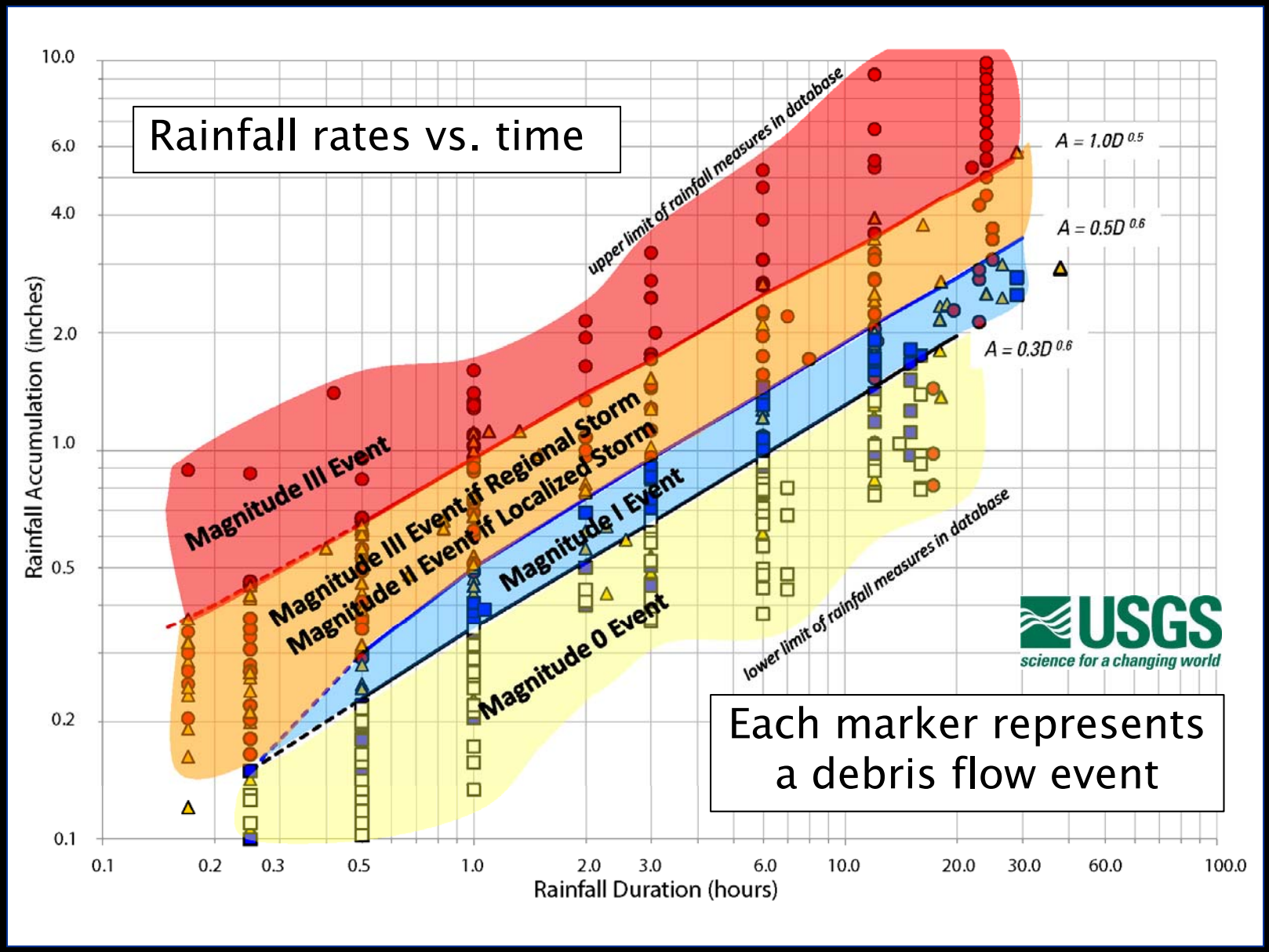
USGS
science for a changing world

Rainfall Accumulation




Rainfall Duration (hours)

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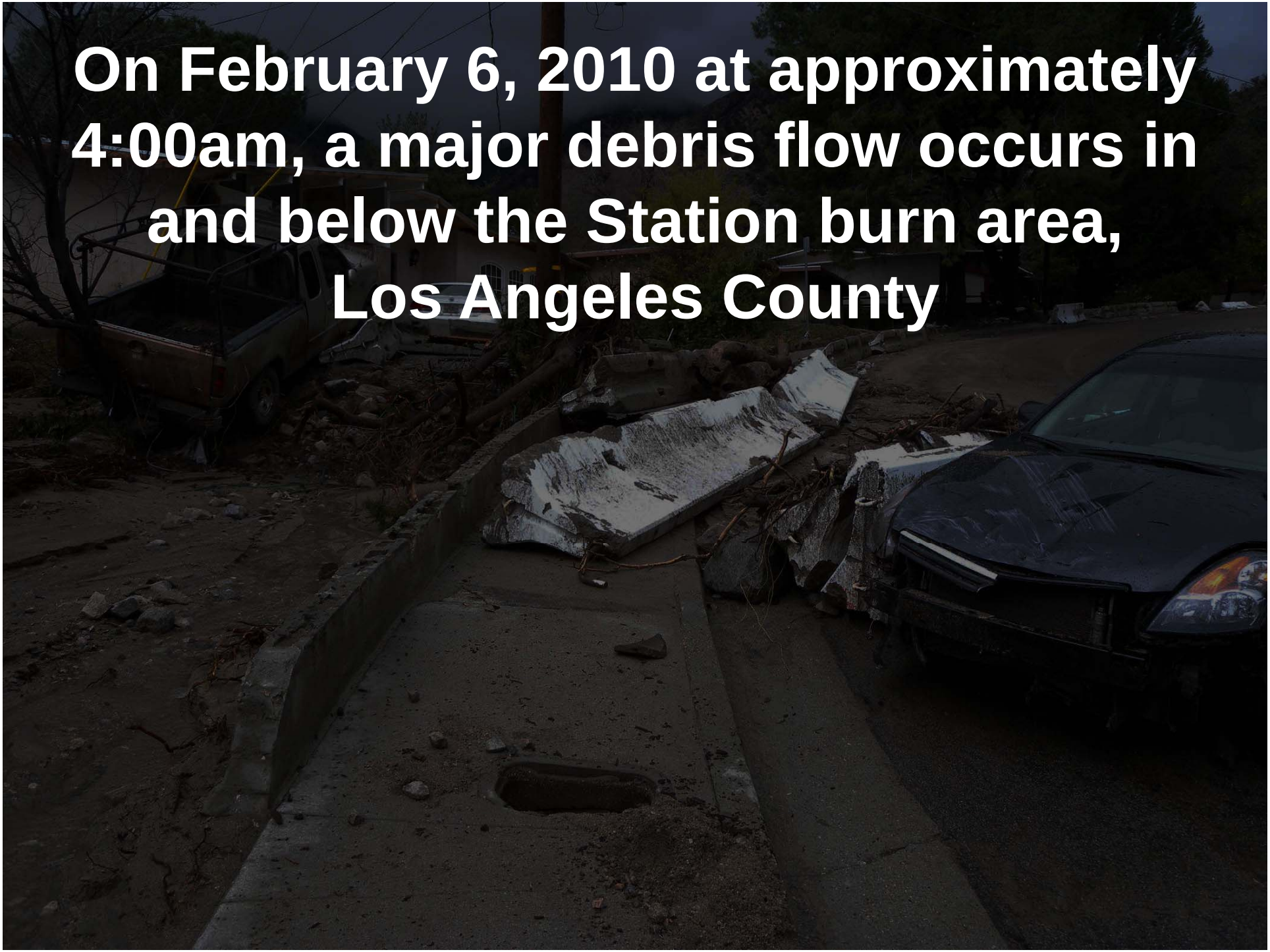
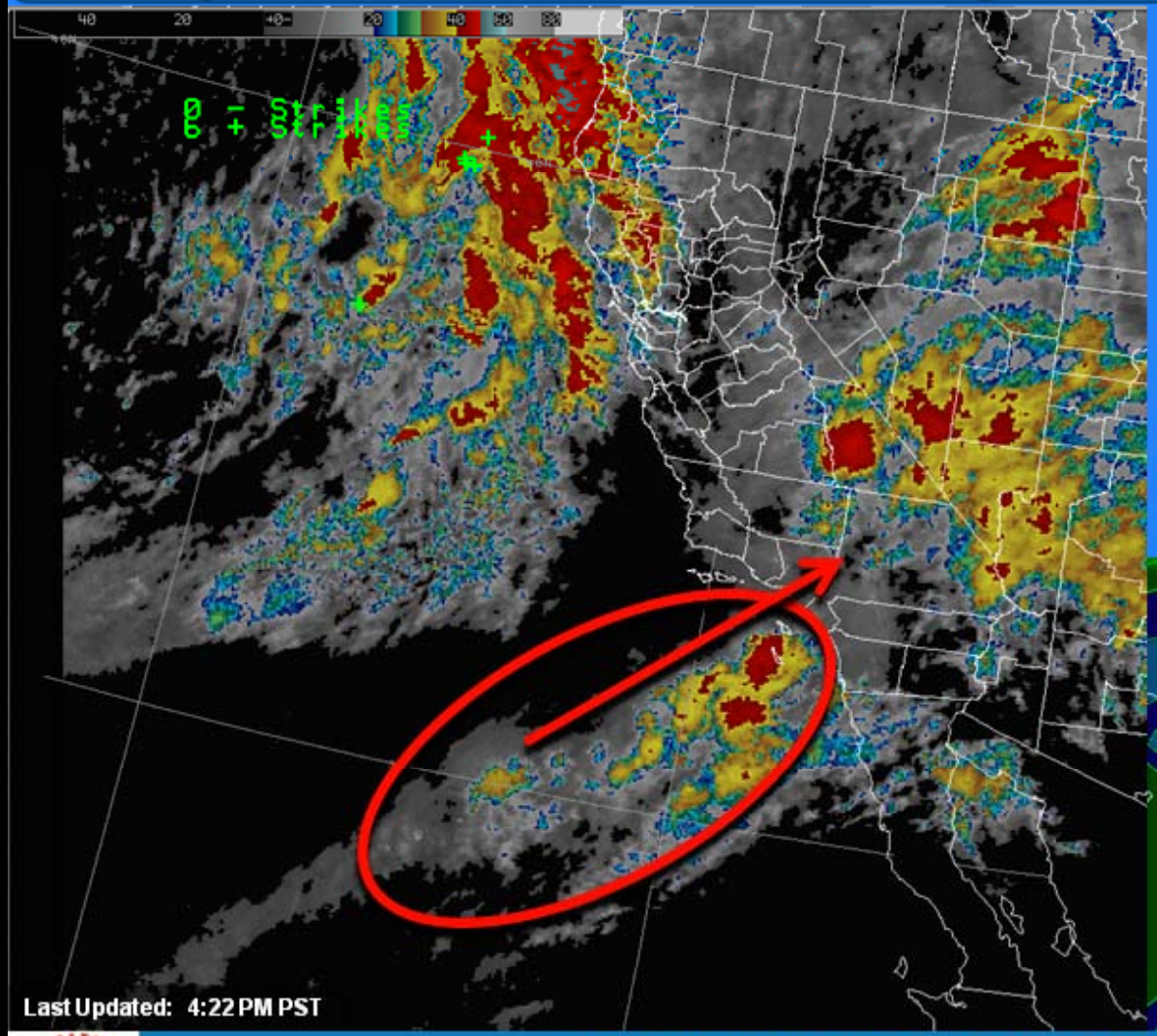

On February 6, 2010 at approximately 4:00am, a major debris flow occurs in and below the Station burn area, Los Angeles County

# Prior to February 6th Debris Flow

- January 28 – Area Forecast Discussion
  - Mentioned expected rain event for Feb. 5-6
- February 3 - Special Weather Statement
  - Discussion of possible heavy rain for early morning of Feb. 6
- February 4 - Flash Flood Watch/GoTo Webinar
  - Watch issued 36-hrs in advance
  - Phone tree to response and preparedness officials
  - Webinar with critical users, including Station Fire Incident Command Team

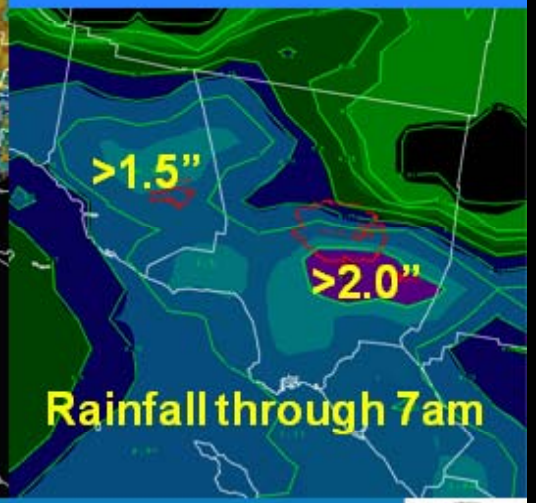
# NWS Weather Story Issued February 5th

## Heavy Rain Possible in Los Angeles County Tonight




**Rain will increase overnight in Los Angeles**

- Additional 1.5-2.5 inches near the Station and Morris Burn areas through 7am Saturday
- Rain rates could exceed 0.5 inches per hour
- Debris flows will be possible near the burn areas.




Friday, February 05, 2010

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# Final NWS Steps Prior to February 6th Debris Flow

- February 6, 2010 @ 12:21am –
  - Special statement issued highlighting threat of strong thunderstorms with heavy downpours
  - Emergency officials contacted
- February 6, 2010 @ 3:15am –
  - Flash flood warning issued for Station Burn Area
  - Activated EAS and NOAA Weather Radio
  - Phone tree to officials

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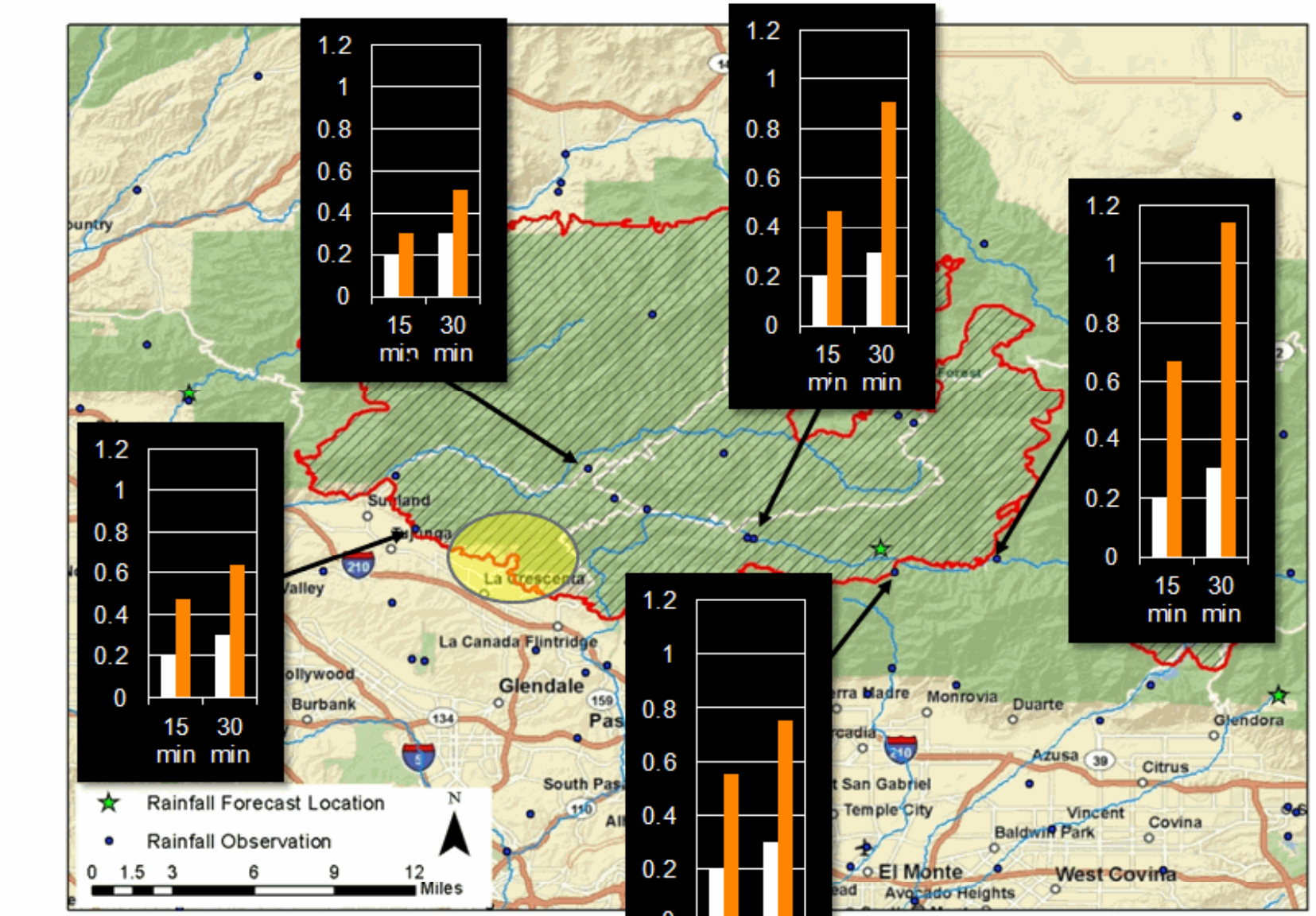
# Peak Observed Precipitation Rates (inches), Feb. 6, 2010

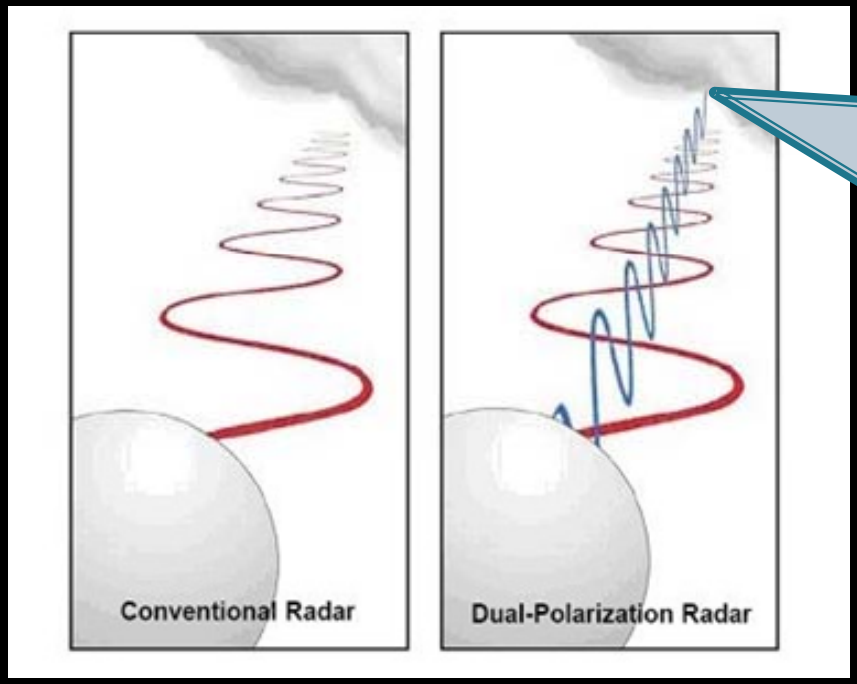


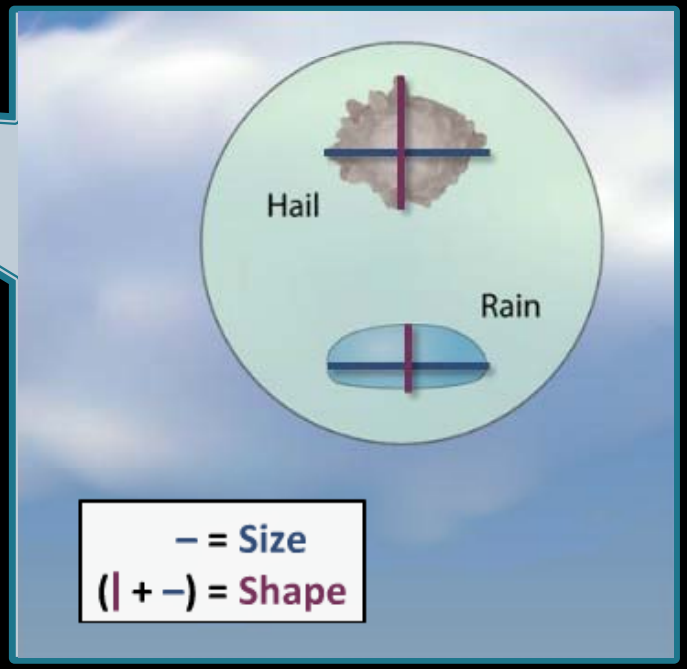

= USGS Threshold
= Observed

= Debris Flow Area

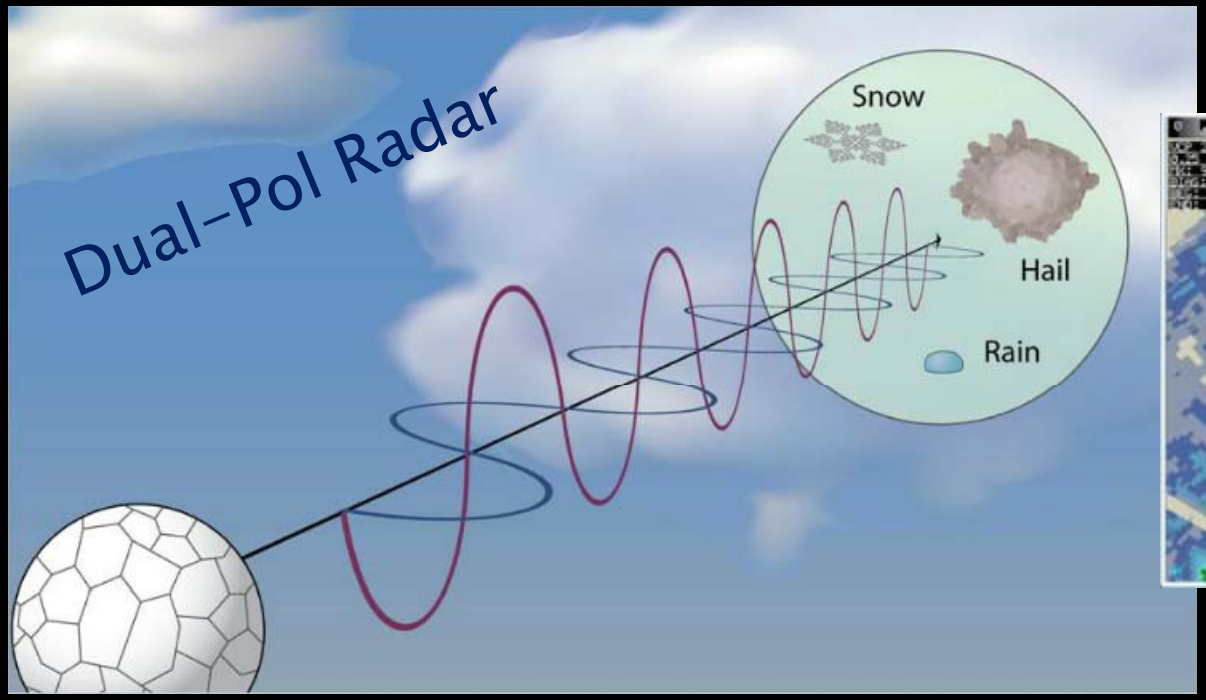
# Doppler Radar Improvements

## *"Dual-Pol" Radar Modifications*

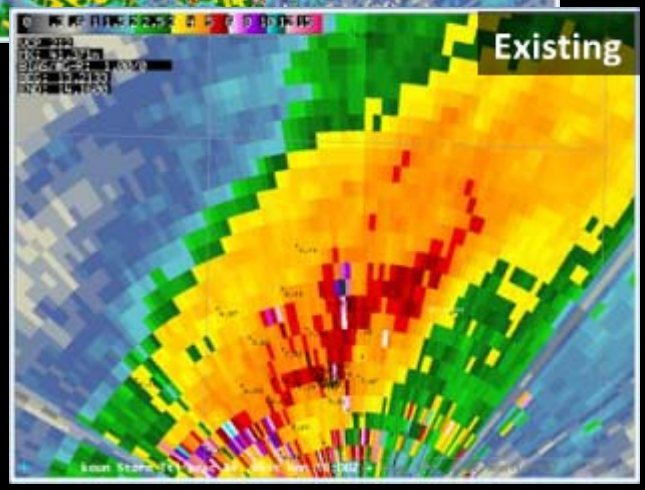



- Radar beam travels in 2 different waves orientations
- Network deployment through March 2013








*Rainfall accumulation with Dual-Pol (DP, above) and without DP (below)*

Identify non-weather targets more easily

Differentiate between rain, snow, and melting snow

Detect hail in thunderstorms

Better detect areas of heavy rain

Detect debris lofted by a tornado

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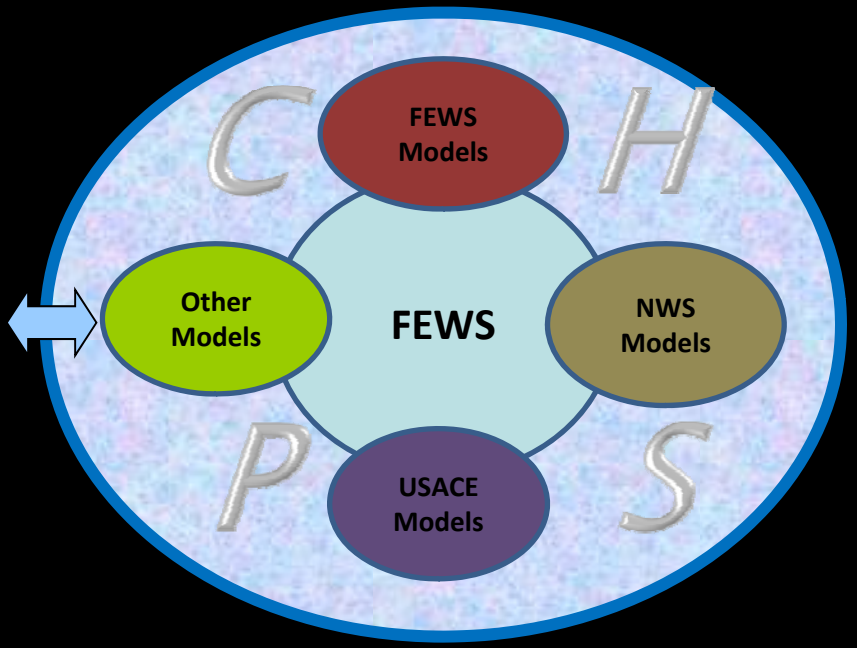
Southern California radars in process of upgrades now

# Community Hydrologic Prediction System (CHPS)

- Combing multiple hydrologic models
- 5-year effort

Models from Federal, State, Local, University and international researchers




- Investment in the future
- Fully operational at CNRFC since mid-winter 2011
- Operational at all RFCs in early 2012

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