21st Century Observation & Modeling Activities in Support of the CA-DWR-EFREP Program: an HMT-Legacy Project for California

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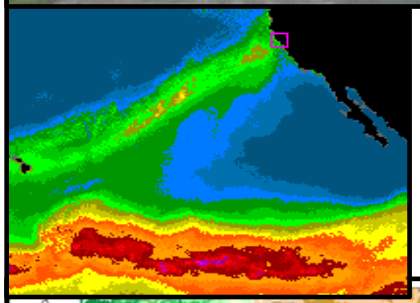
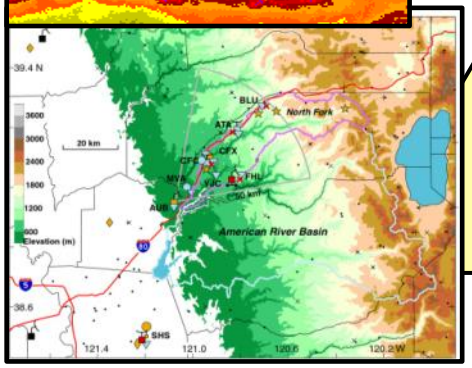
Project Management Team

Marty Ralph, Art Hinojosa, and Dan Cayan

Project Management Council

HMT Legacy: Observing System Enhancements





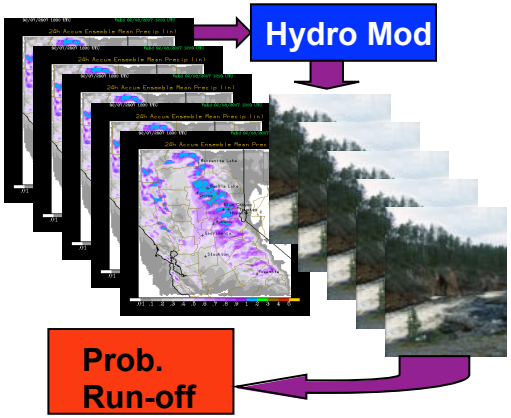
IV: Off-shore recon.

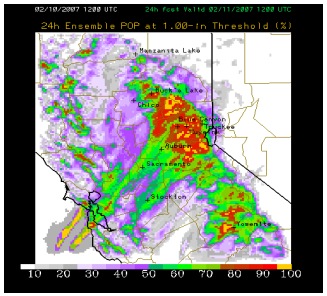
Tier III:
Newer technology
Ex: Gap-filling radars, Buoy-mounted WPs

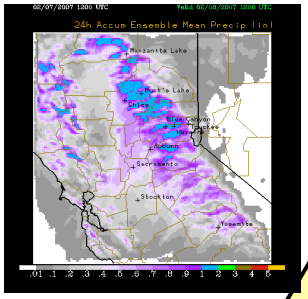
Tier II: Expand on well-defined needs with proven technology
Ex: Wind profilers, Coastal Atmospheric river observatory

Tier I: Address well-defined needs with proven technology
Ex: Soil moisture sensors at RAWS/CDF sites, GPS receivers of opportunity, snow-level radars

HMT Legacy: Modeling, Display, and Decision Support Tools







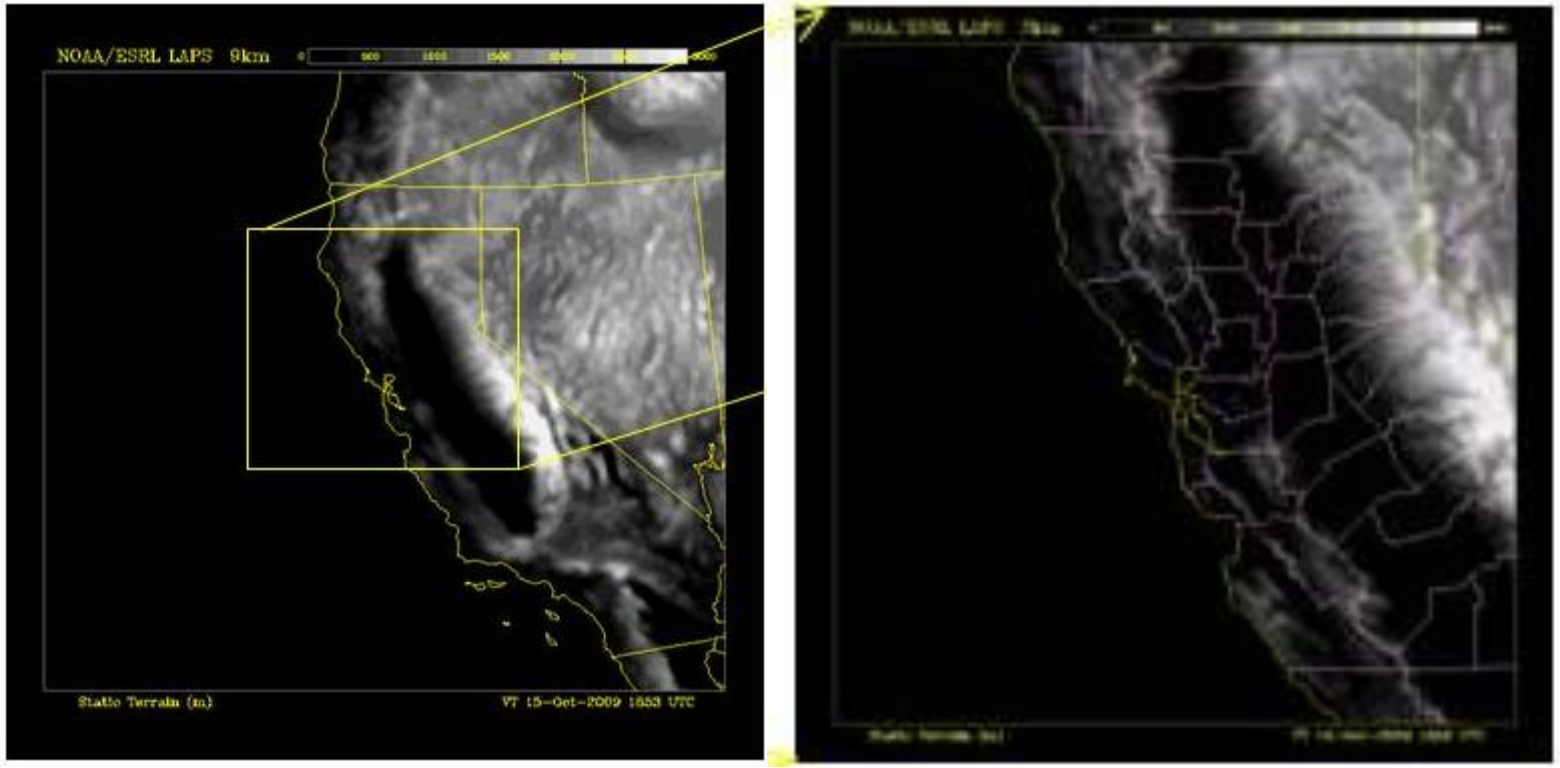
IV:
FBO/
FCO
HydroMet
driven system

Tier III:
Probabilistic hydro forecasts
Data assimilation of offshore observations
Hydro-forecast linking to FBO/FCO decisions

Tier II: Distributed (NWS) hi-Res local Models/hardware
National (low-res) and experimental (hi-res) probabilistic forecasts/hydro forecasts
Advanced data assimilation of HMT observations
Advanced verification methods

Tier I: Observation-based forecasting techniques
National product suite
Experimental hi-res/down scaled modeling
Basic model verification
Reforecasting techniques

EXPERIMENT DESIGN 2009-2010

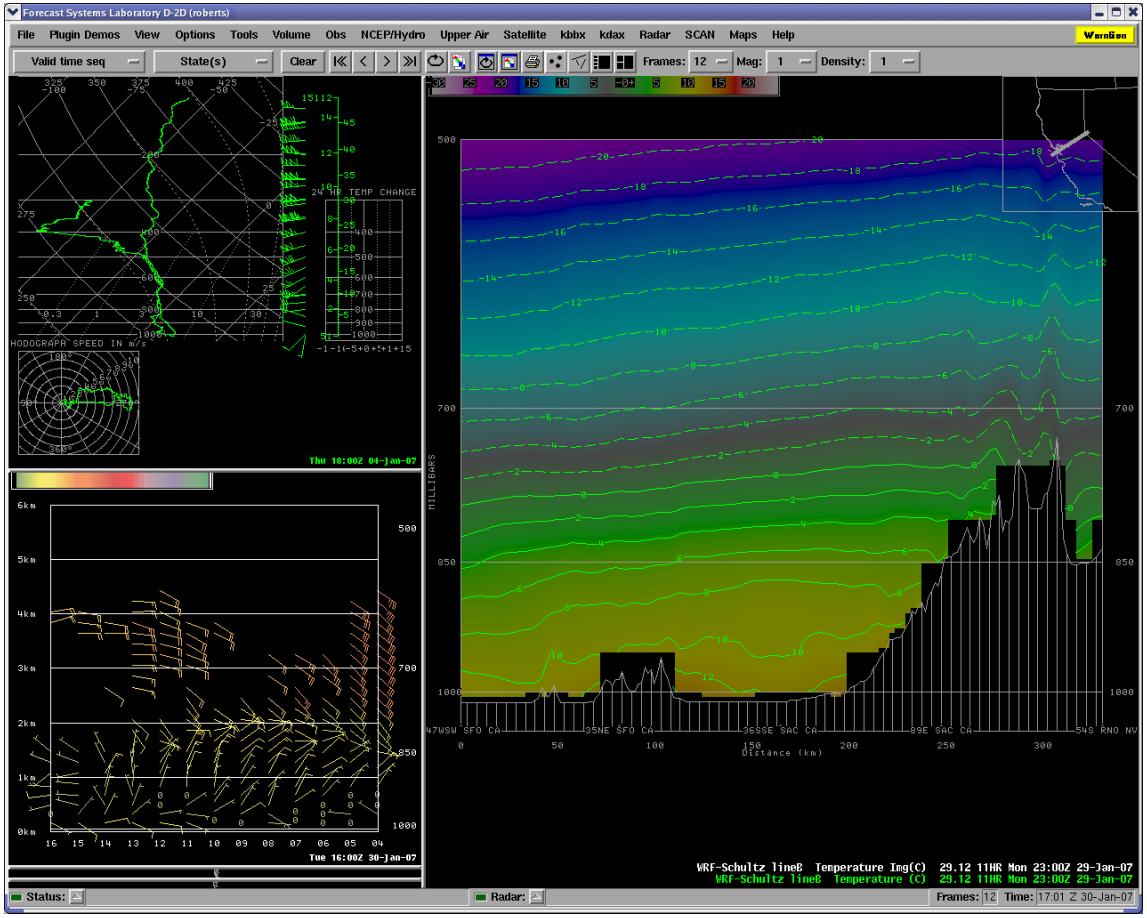


Nested domain:

- Outer/inner nest grid spacing 9 and 3 km, respectively.
- 6-h cycles, 120hr forecasts for the outer nest and 12hr forecasts for the inner nest
- 9 members (listed in the following slide)
- Mixed models, physics & perturbed boundary conditions from NCEP Global Ensemble

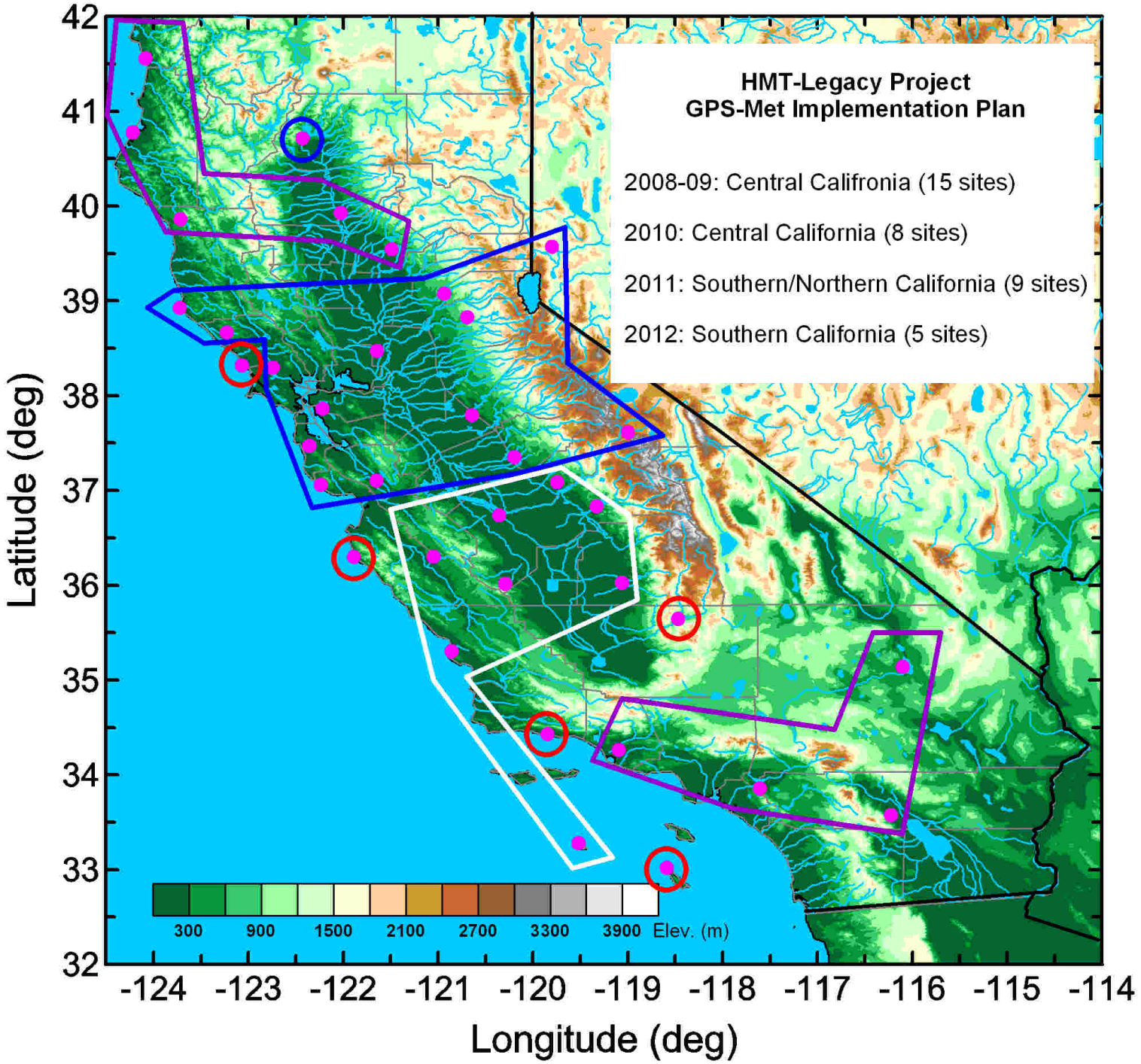
- 2010-2011 season everything stays the same except initial condition perturbations?

ALPS - Advanced LINUX Workstations



- Remote access to special HMT datasets in field offices along with regular product streams
  - Water vapor flux tool (for 2010/11)
  - HRRR model
  - MADIS datasets

- Workstations successfully deployed at five offices (Sacramento WFO and RFC; Eureka, Monterey, and Reno WFOs) during past field seasons
- "Smart pull" redesigned after 1st year – performance significantly improved


HMT-Legacy Project
GPS-Met Implementation Plan
2008-09: Central Califronia (15 sites)
2010: Central California (8 sites)
2011: Southern/Northern California (9 sites)
2012: Southern California (5 sites)
300
900
1500
2100
2700
3300
3900
Elev. (m)
Latitude (deg)
Longitude (deg)
42
41
40
39
38
37
36
35
34
33
32
-124
-123
-122
-121
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-118
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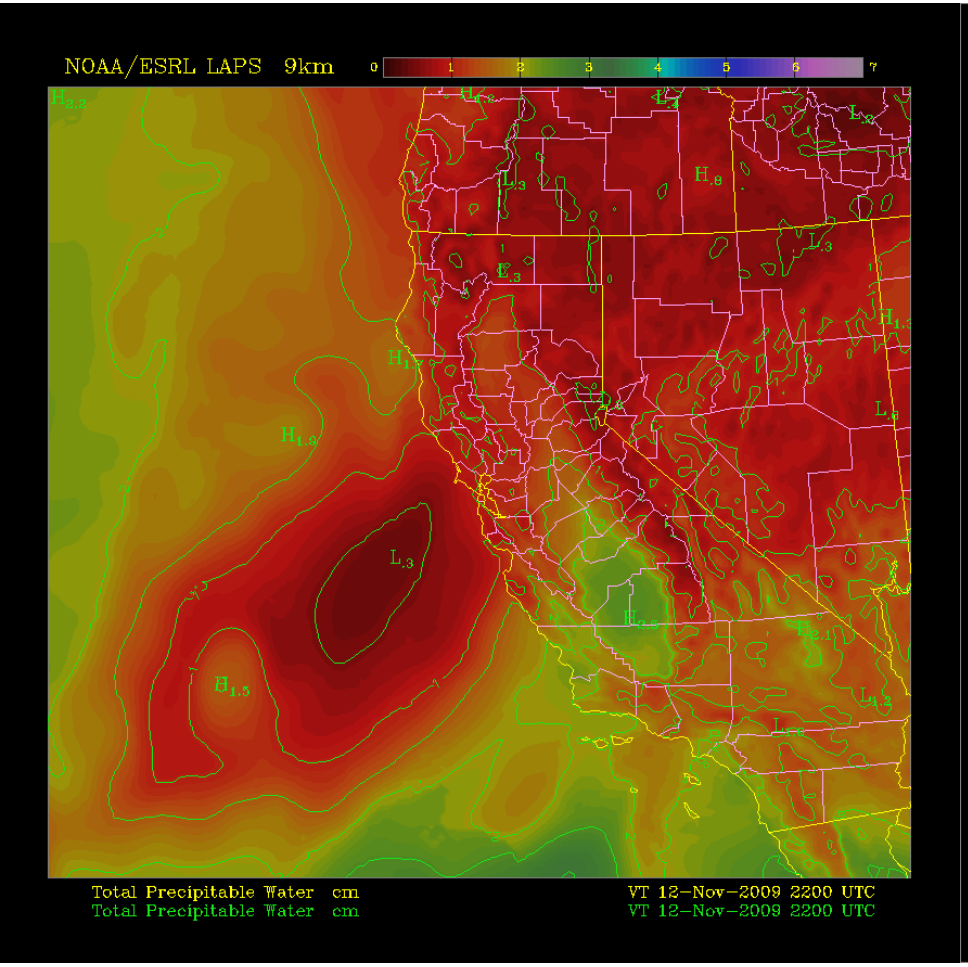
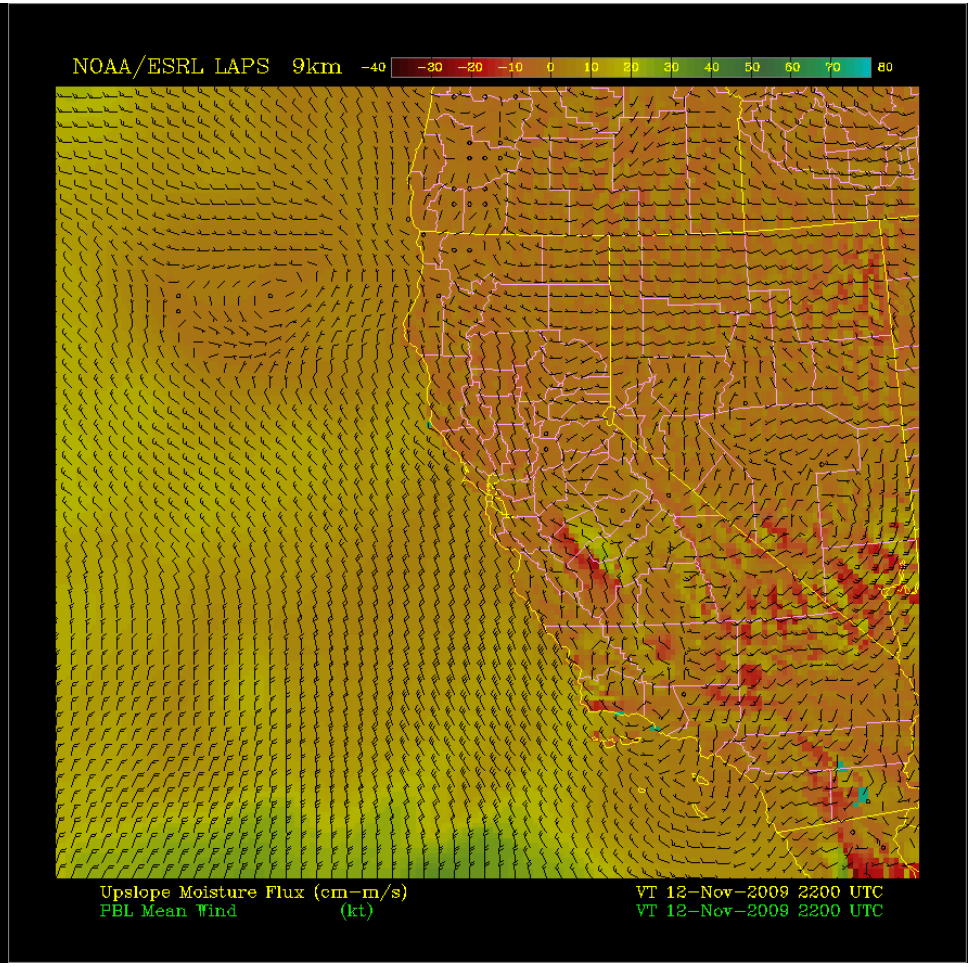
-116
-115
-114

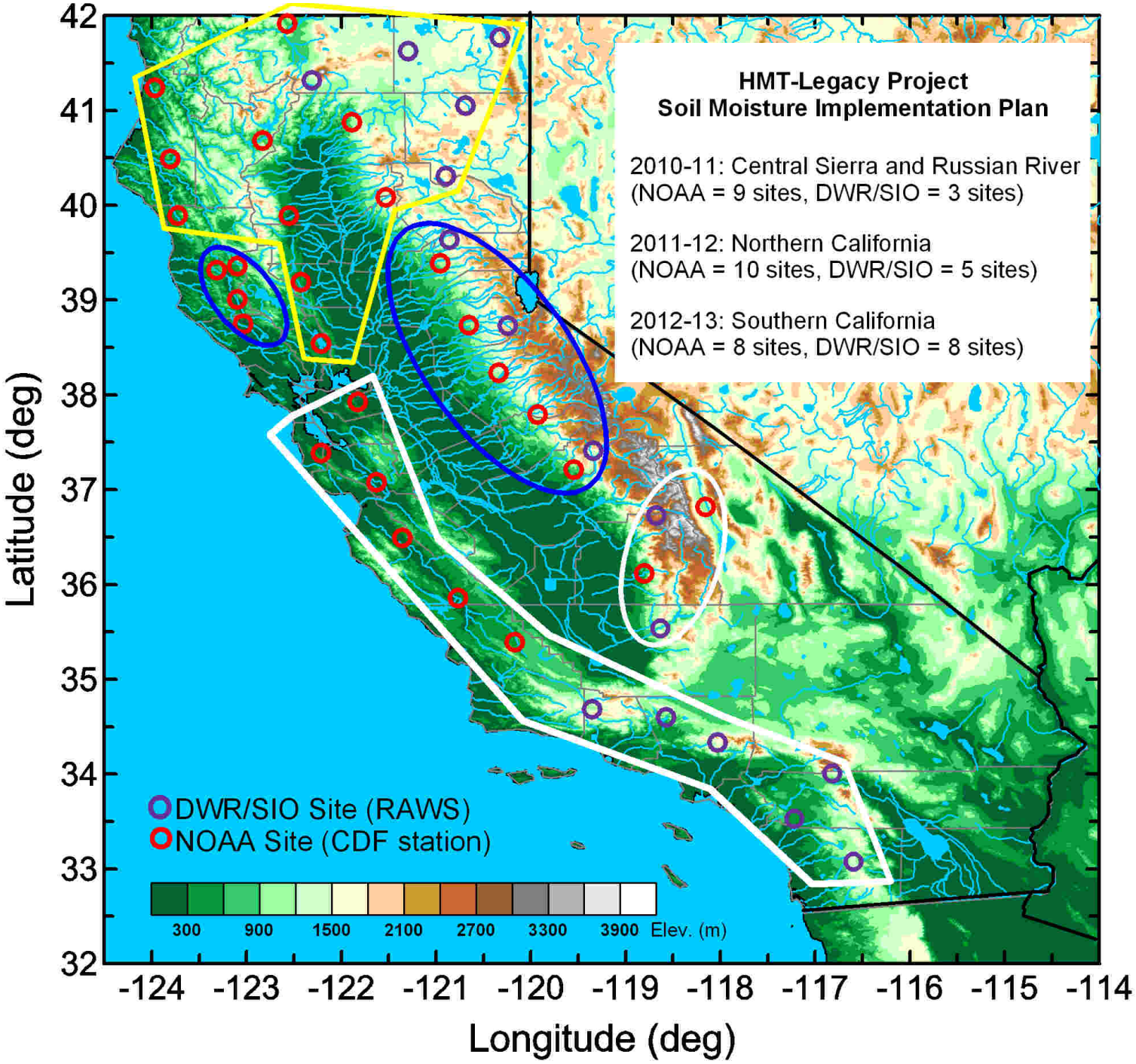
LAPS Total Precipitable Water & Upslope Moisture Flux Displays (DWR Domain)

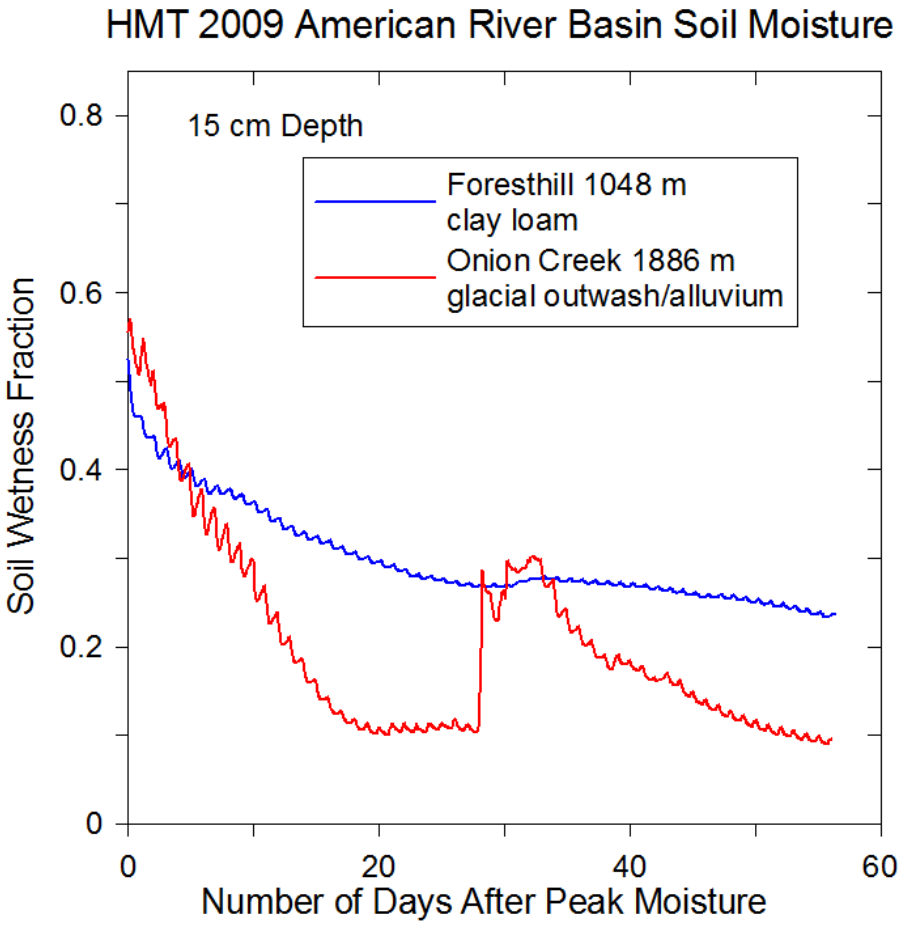


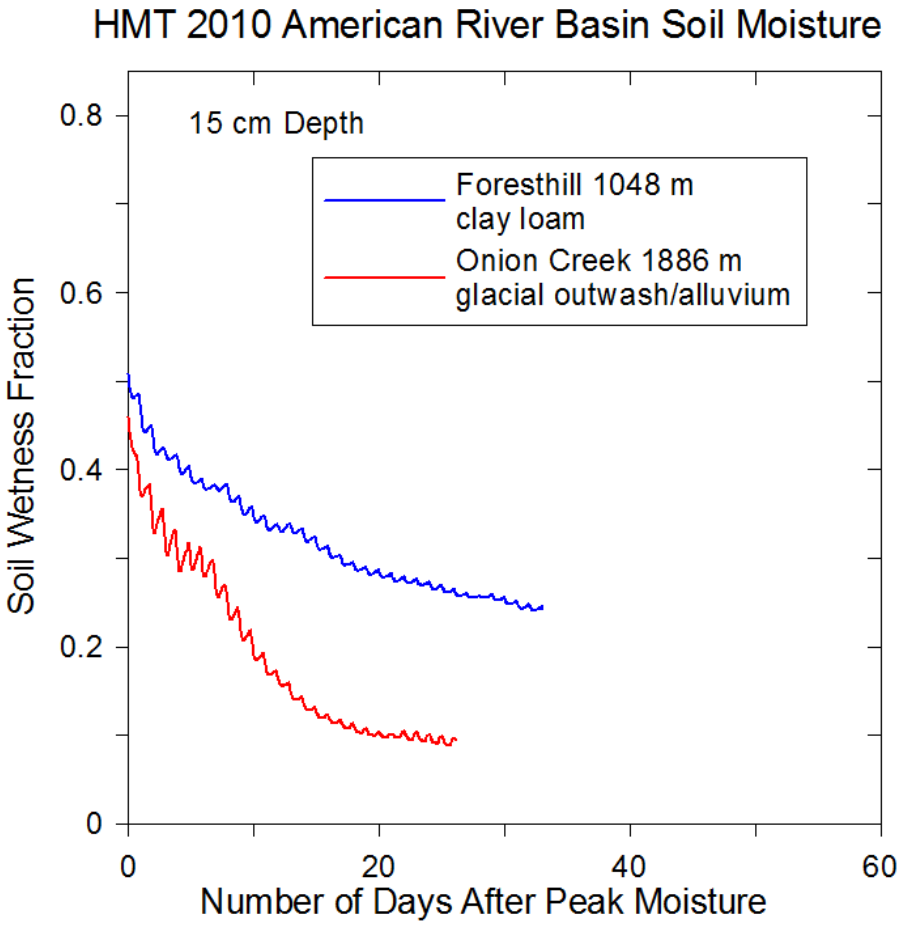
TPW (cm)



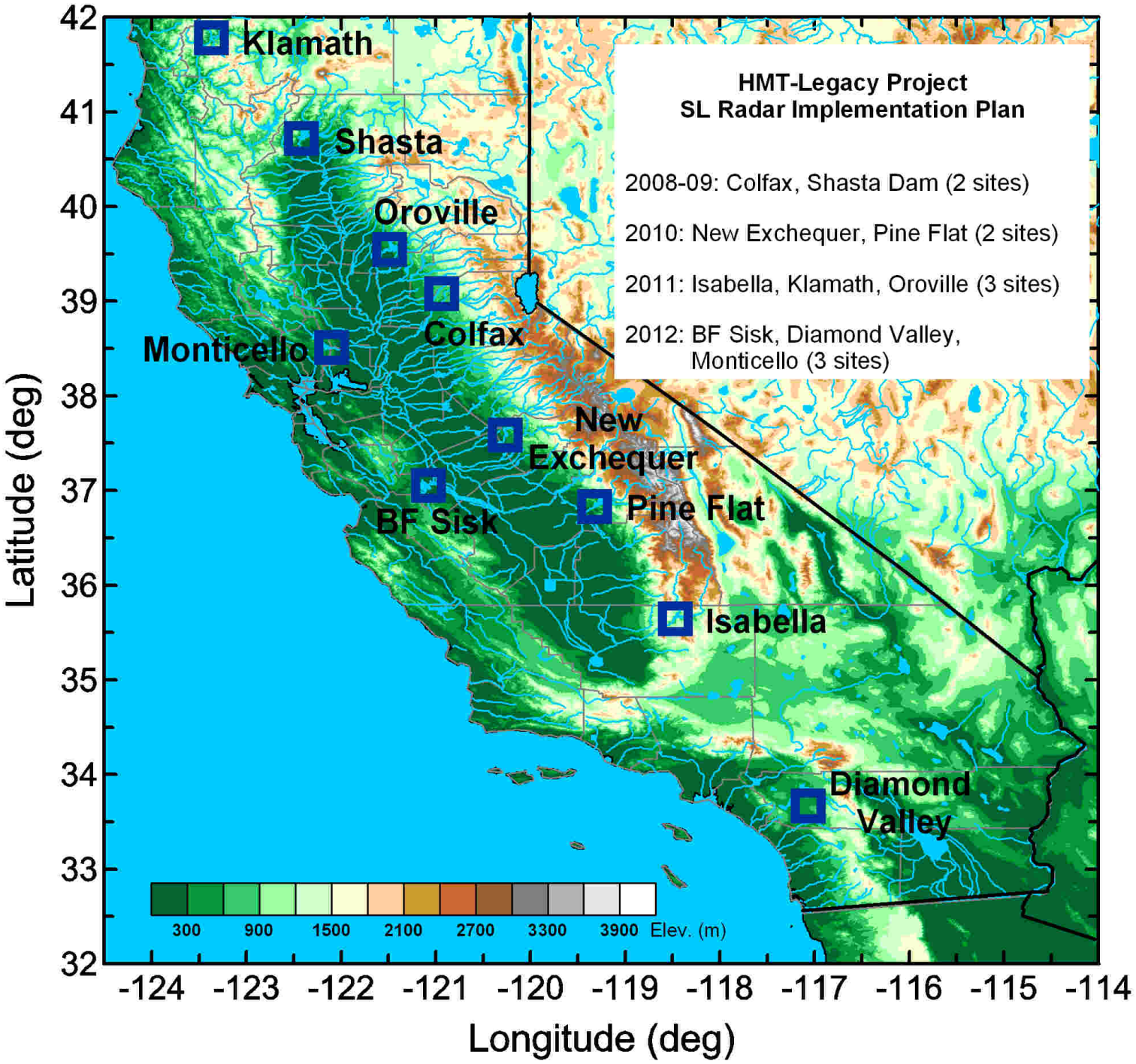
PW Flux (q x v)


HMT-Legacy Project
Soil Moisture Implementation Plan
2010-11: Central Sierra and Russian River
(NOAA = 9 sites, DWR/SIO = 3 sites)
2011-12: Northern California
(NOAA = 10 sites, DWR/SIO = 5 sites)
2012-13: Southern California
(NOAA = 8 sites, DWR/SIO = 8 sites)
DWR/SIO Site (RAWS)
NOAA Site (CDF station)
300 900 1500 2100 2700 3300 3900 Elev. (m)
Latitude (deg)
Longitude (deg)
42 41 40 39 38 37 36 35 34 33 32
-124 -123 -122 -121 -120 -119 -118 -117 -116 -115 -114

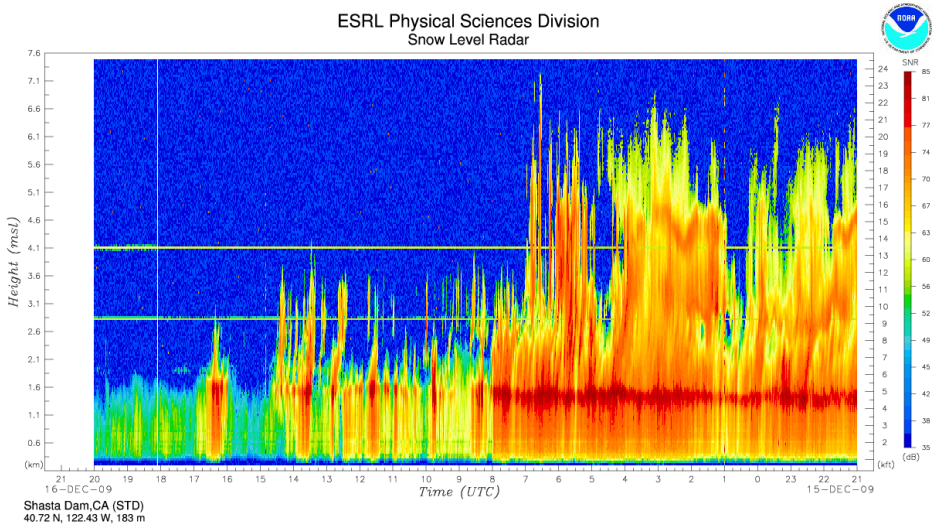




Upper Amer. Riv. basin with the glacial outwash/alluvium soil type has a much more rapid dry down and reduced storage capacity as compared to the lower basin with the clay/loam soil type. This suggests the need to monitor both altitude ranges in order to characterize soil moisture throughout the full basin.

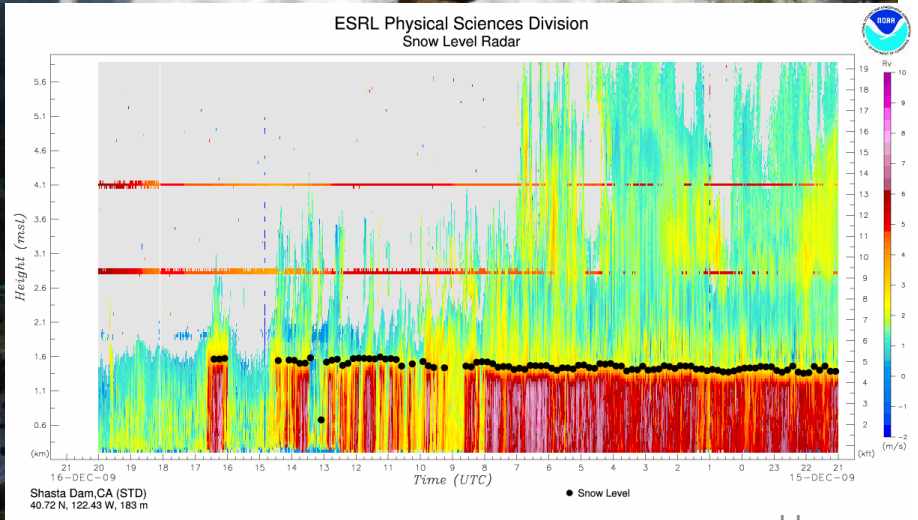

HMT-Legacy Project
SL Radar Implementation Plan
2008-09: Colfax, Shasta Dam (2 sites)
2010: New Exchequer, Pine Flat (2 sites)
2011: Isabella, Klamath, Oroville (3 sites)
2012: BF Sisk, Diamond Valley, Monticello (3 sites)
Klamath
Shasta
Oroville
Colfax
Monticello
New Exchequer
Pine Flat
BF Sisk
Isabella
Diamond Valley
300 900 1500 2100 2700 3300 3900 Elev. (m)
Latitude (deg)
Longitude (deg)
42 41 40 39 38 37 36 35 34 33 32
-124 -123 -122 -121 -120 -119 -118 -117 -116 -115 -114

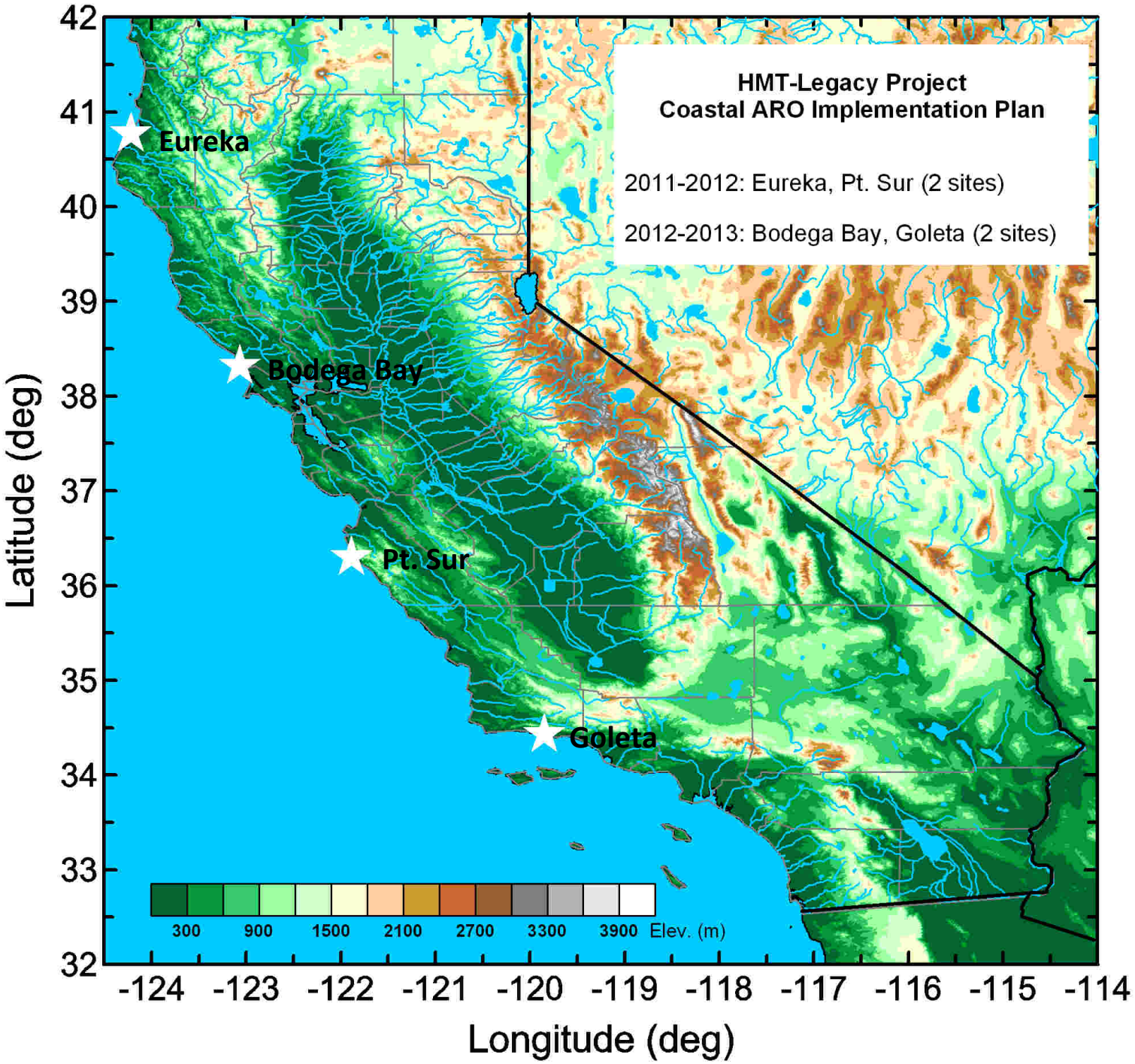
A new, relatively inexpensive, FMCW S-band radar (Snow-level Radar)



Snow-level Radar above Folsom Dam at Colfax

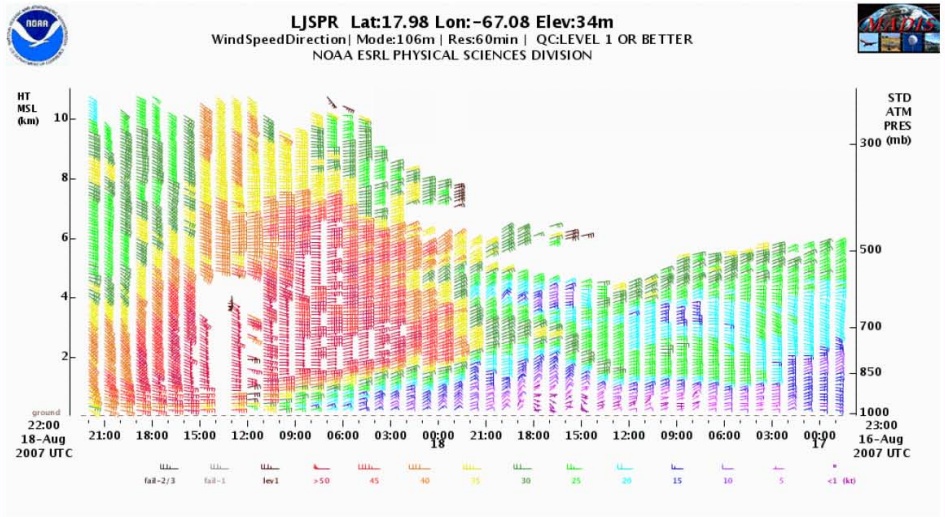
Snow-level Radar at Shasta Dam




HMT-Legacy Project
Coastal ARO Implementation Plan
2011-2012: Eureka, Pt. Sur (2 sites)
2012-2013: Bodega Bay, Goleta (2 sites)
Eureka
Bodega Bay
Pt. Sur
Goleta
300 900 1500 2100 2700 3300 3900 Elev. (m)
Latitude (deg)
Longitude (deg)
42 41 40 39 38 37 36 35 34 33 32
-124 -123 -122 -121 -120 -119 -118 -117 -116 -115 -114

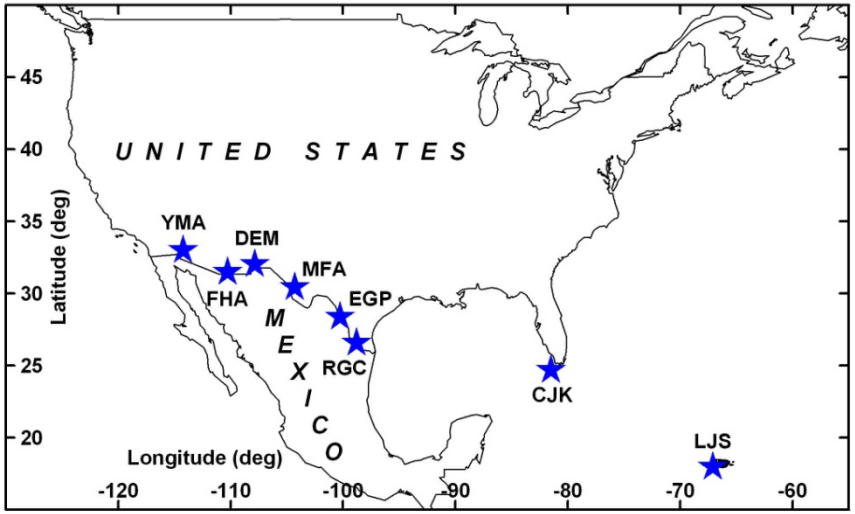
Coastal Wind Profiler Technology Evaluation

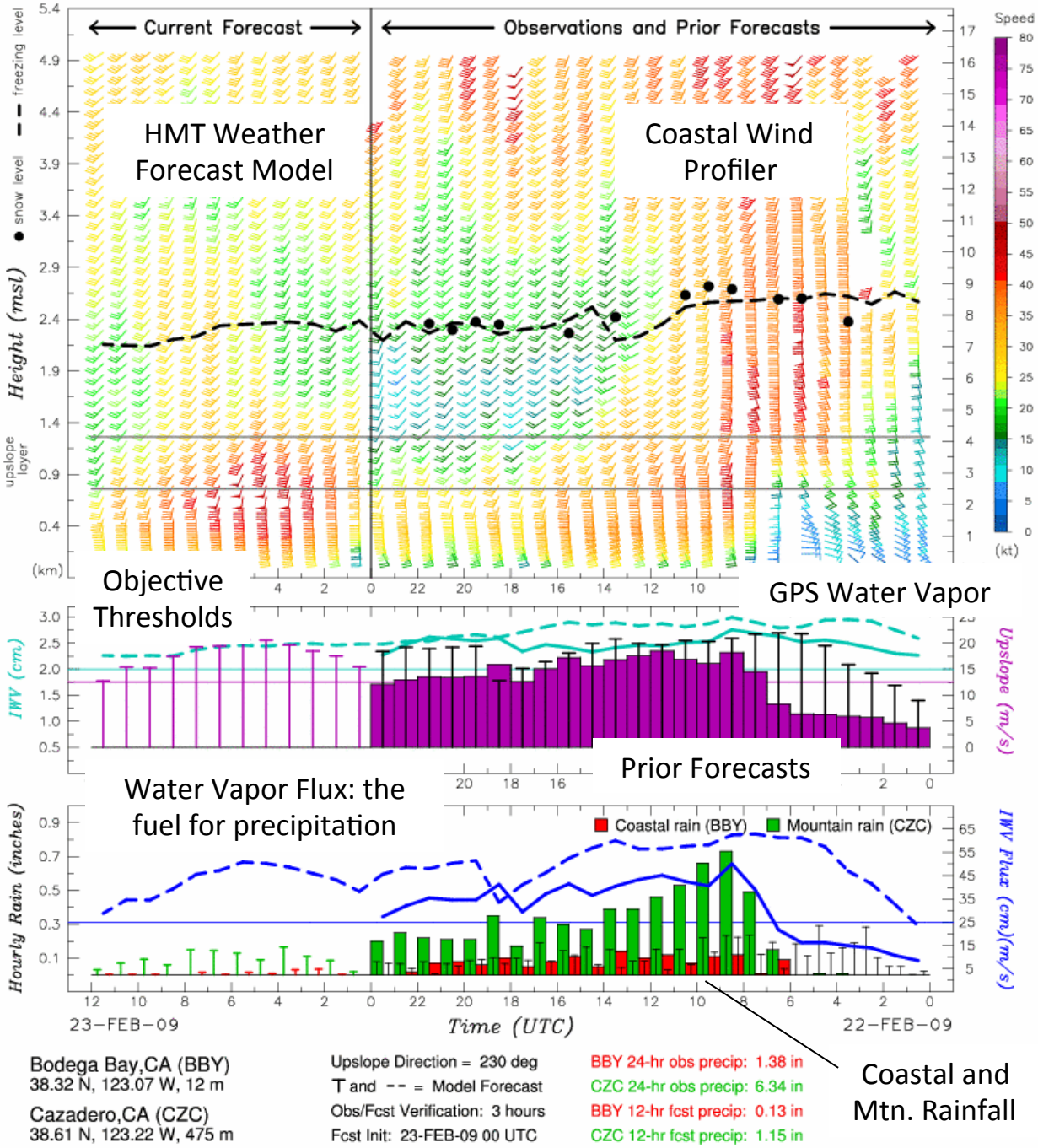
An Integrated Ocean Observing System Project
Final Report – November 2007



Prepared by the
NOAA Office of Oceanic and Atmospheric Research
Earth System Research Laboratory
Physical Sciences Division

TARS ¼-Scale 449-MHz Doppler Wind Profiler Network

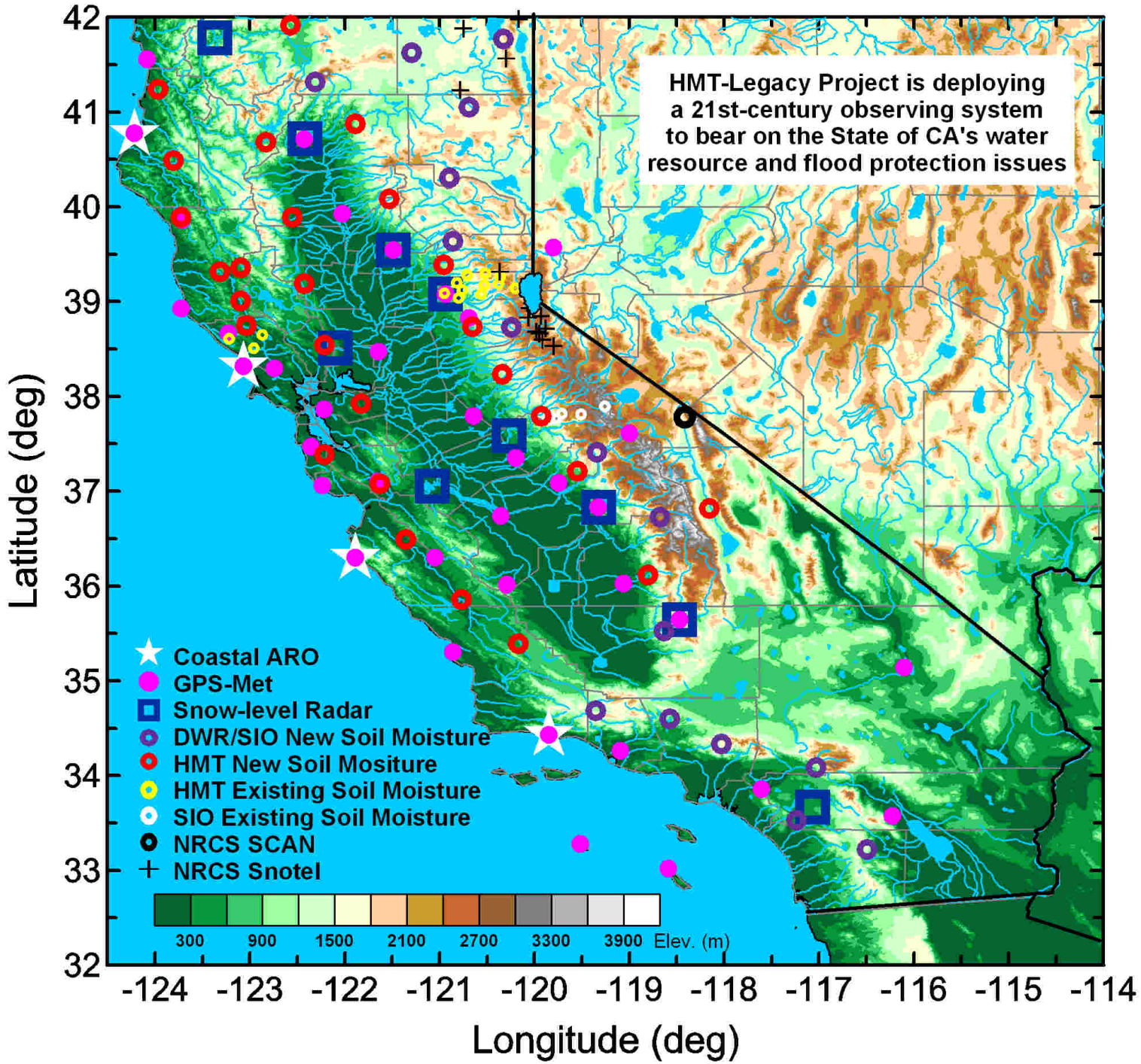




OAR and NWS reps. Allen White, Seth Gutman, and Dave Reynolds accept the 2009 NOAA Bronze Medal in April 2010 on behalf of a stellar NOAA/CIRES/CIRA team for "innovative contributions to the development of the Coastal Atmospheric River Monitoring and Early Warning System ."

Completed Integrated Observing System Projects

An unprecedented network of hydrometeorological instrumentation for the State of California that provides critical information on the forcings for high impact precipitation and runoff events as well as other weather phenomena


HMT-Legacy Project is deploying a 21st-century observing system to bear on the State of CA's water resource and flood protection issues
Coastal ARO
GPS-Met
Snow-level Radar
DWR/SIO New Soil Moisture
HMT New Soil Mositure
HMT Existing Soil Moisture
SIO Existing Soil Moisture
NRCS SCAN
NRCS Snotel
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DWR HMT-Legacy Project is Informed by 10+ Years of ESRL Field Programs and Research Devoted to Hydrometeorology:

CALJET (California; 1998)

PACJET (U.S. West Coast; 2001-2003)

IMPROVE-2 (Oregon Cascades; 2001)

CSP Pacific Northwest Pilot (Oregon Coast; 2003-2005)

HMT Pilot (Russian River, CA; 2004-2005)

CSP Southern California Pilot (2006-2008)

Debris Flow (CA; 2006-2007, 2009)

HMT-West (American River, CA; 2006-2011)

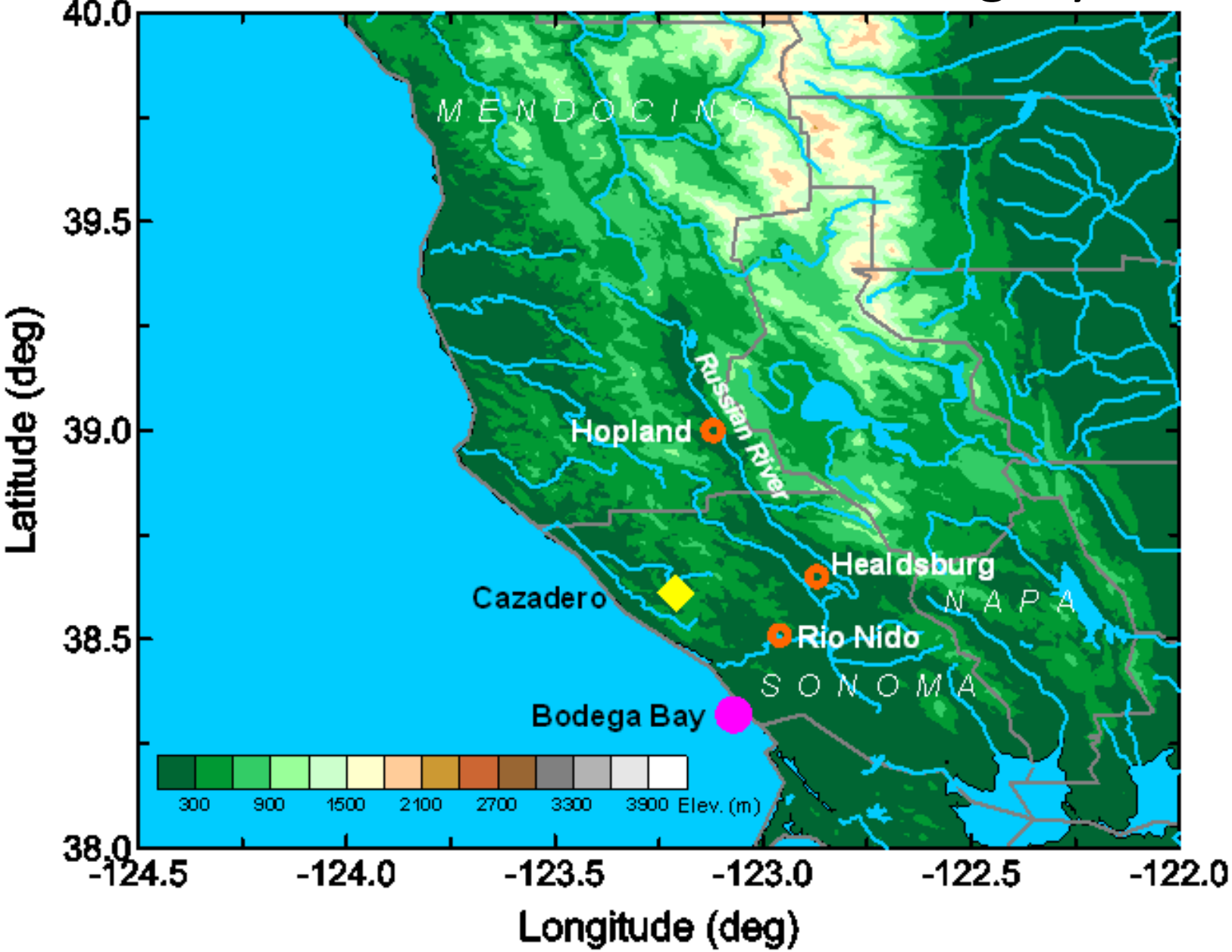
CalWater (2009-2011)

HMT-Northwest (Washington; 2009-????)

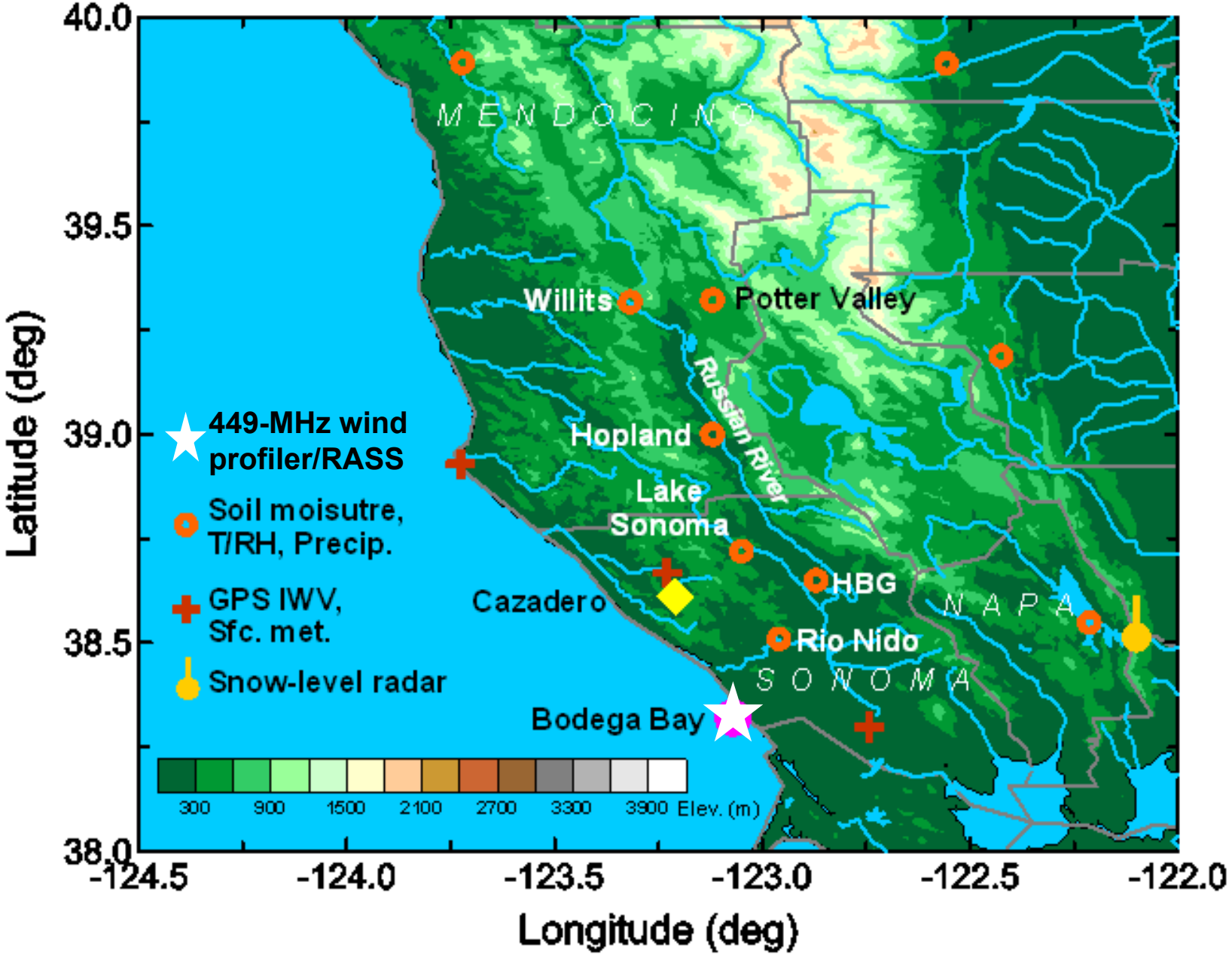
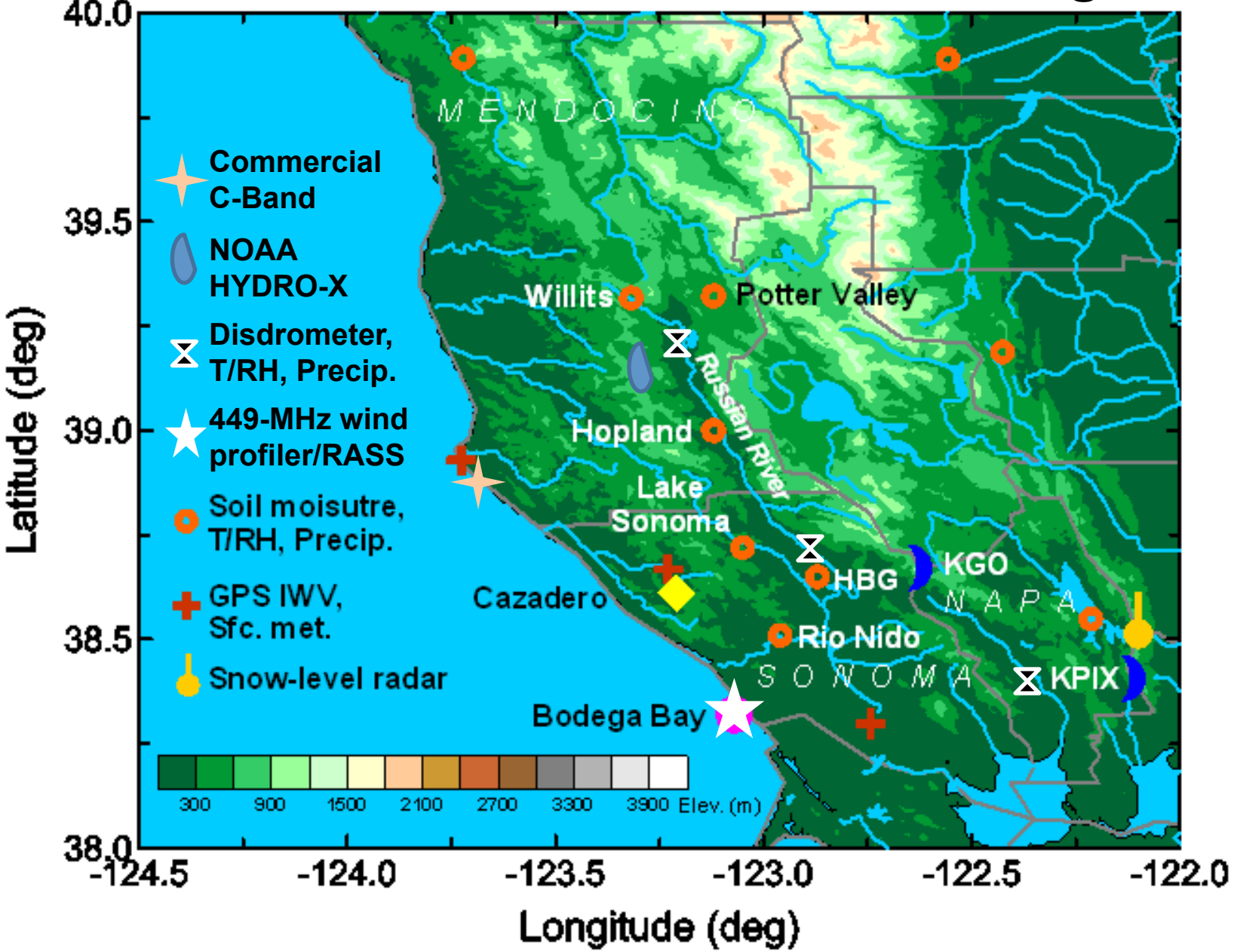
HMT Legacy Project (2008-2013)

Possible ESRL/PSD Observing System Enhancements for an IWRSS Russian River Pilot Study

Current HMT Russian River Legacy



… with DWR-EFREP enhancements



… with SCWA/NWS & HMT funding?