

The NOAA Hydrometeorological Testbed Program: Overview, Progress to Date and Future Plans

David Kingsmill

University of Colorado / CIRES
and
NOAA Earth System Research Laboratory
Physical Sciences Division
Boulder, CO

STIP Integrated Planning Team for Hydrologic Services (September 2002)

Key Information Gaps

- **Quantitative Precipitation Information (QPE & QPF)**

Unbiased Precipitation Estimates with Reliability Information

Reliable 0-6 Hour Precip. Nowcasts

Longer-term, Unbiased Model QPFs

- **Hydrologic Forecasting**

High-resolution Flash Flood Forecasts & Warnings

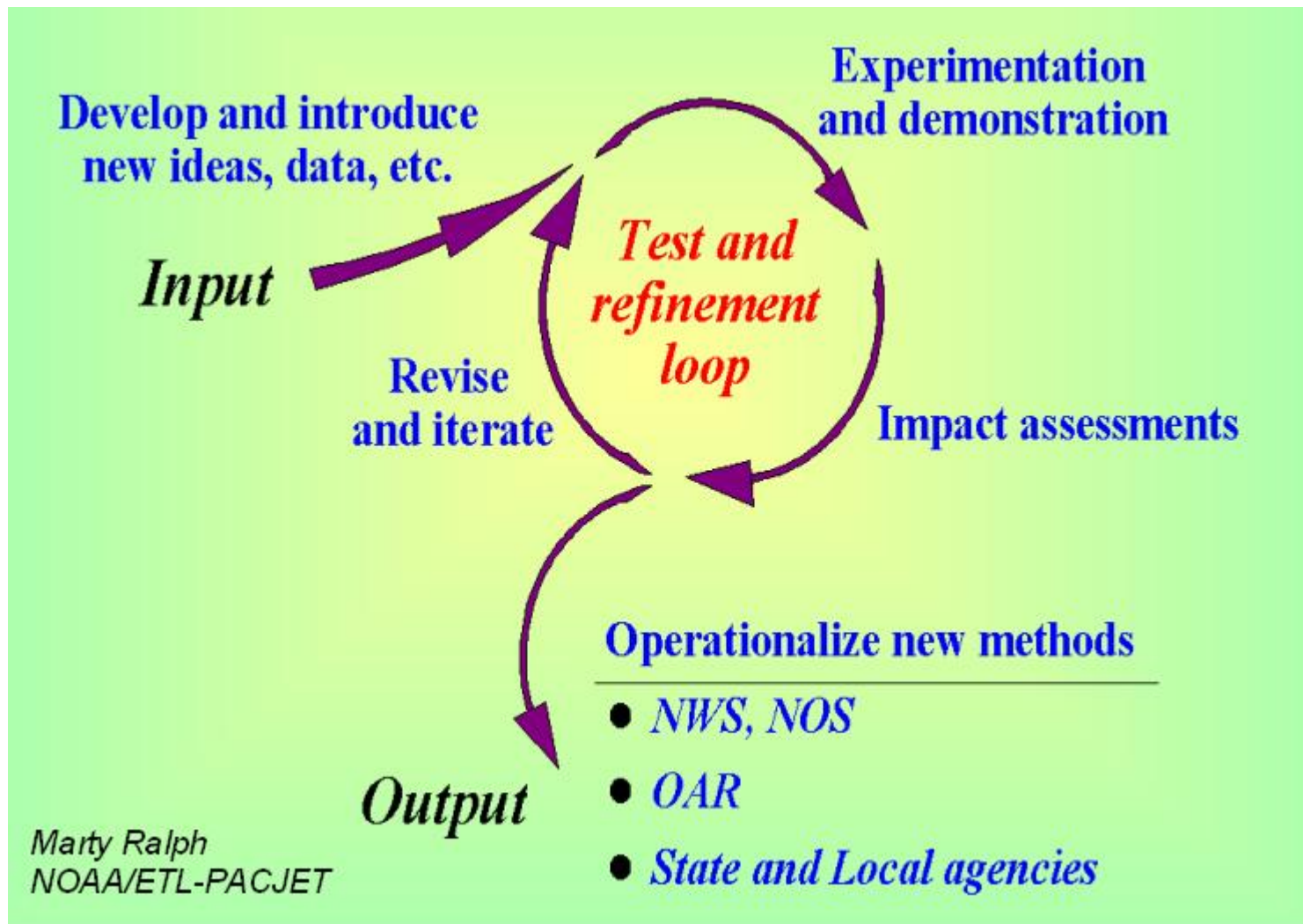
**Probabilistic River Forecasts Using 0-3 day QPF and Seasonal
Precipitation Forecasts**

STIP IPT for Hydrologic Services

Outstanding R&D Needs

- *Develop QPE Techniques That Optimally Blend Next-generation Radar, Satellite (e.g, GPM), and Rain Gauge Data*
- *Improve Short-Term Radar-Satellite Precipitation Nowcasting Techniques Blended with NWP Forecasts*
- *Develop High Resolution Hydrologic Forecast Models of Water Excess-Deficit at Ungauged Locations*
- *Develop Ensemble NWP and Hydrologic Model Forecasts with Associated Reliability Information*
- *Improve NWP Model Physics and Increase Assimilation of Existing Observational Datasets*
- *Implement Hydrometeorological Testbeds to Demonstrate & Evaluate Next-Generation Datasets, Forecast Techniques, & Models*

Test bed concept



What is HMT?

HMT is a working relationship among forecasters, researchers, private-sector, and government agencies aimed at solving operational and practical regional Hydrometeorological problems with a strong connection to end-users.

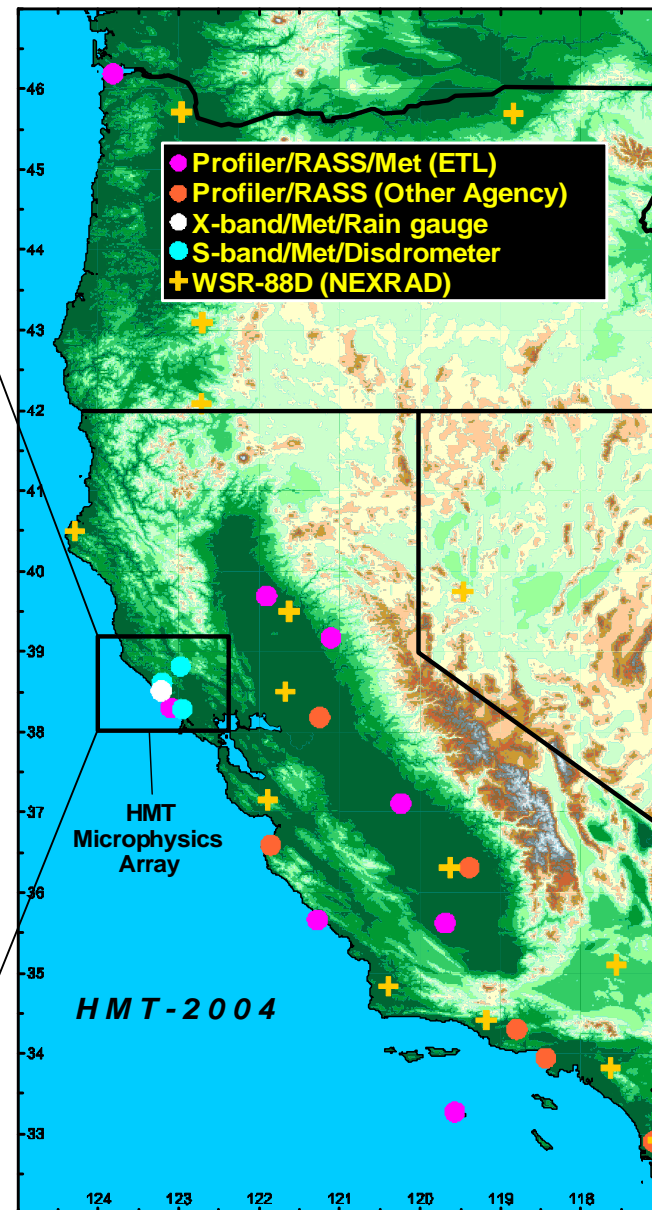
- Outcomes are improved services, products, and economic/public safety benefits, **focused on QPE/QPF**.
- HMT accelerates the transition of R&D on QPF to better operations, services, and decision making.
- Requires long-term commitment and partnerships.

Derived from USWRP Mesoscale Observing Workshop, December 2003

HMT-2004

A Hydrometeorological Testbed (HMT) for the Russian River Watershed

HMT-2004 Microphysics Array

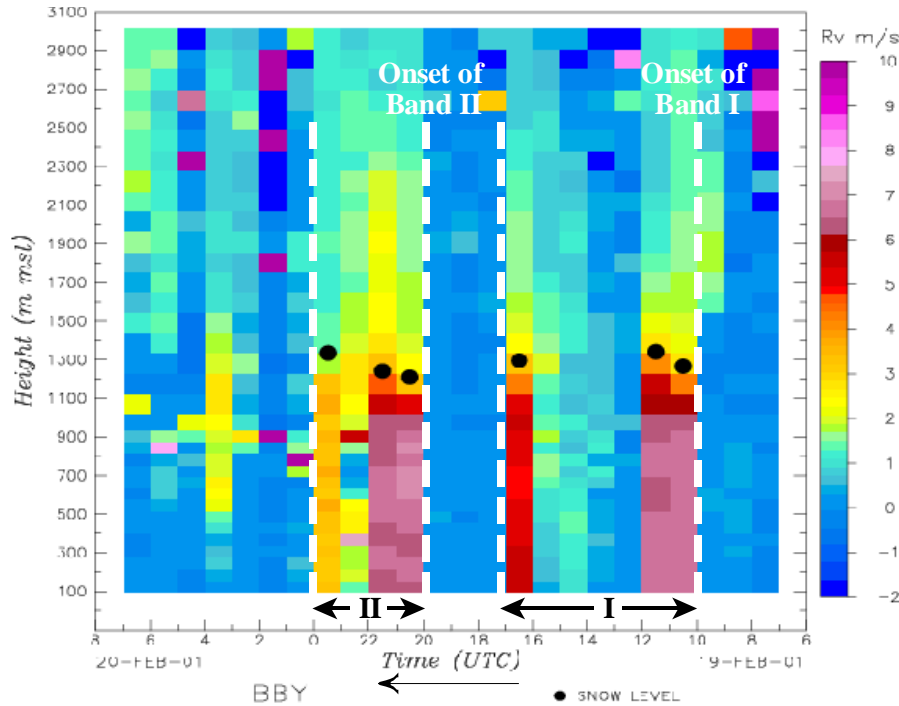


- | | |
|------------------------|-------------------|
| BBY = Bodega Bay | HBG = Healdsburg |
| BSC = Big Sulfur Creek | HLD = Hopland |
| CVD = Cloverdale | LSN = Lake Sonoma |
| CZC = Cazadero | ROD = Rio Dell |
| FRS = Fort Ross | SPT = Salt Point |
| GRK = Goat Rock | |



Measurement of melting level at the coast gives advance warning for when storm hits the Sierras

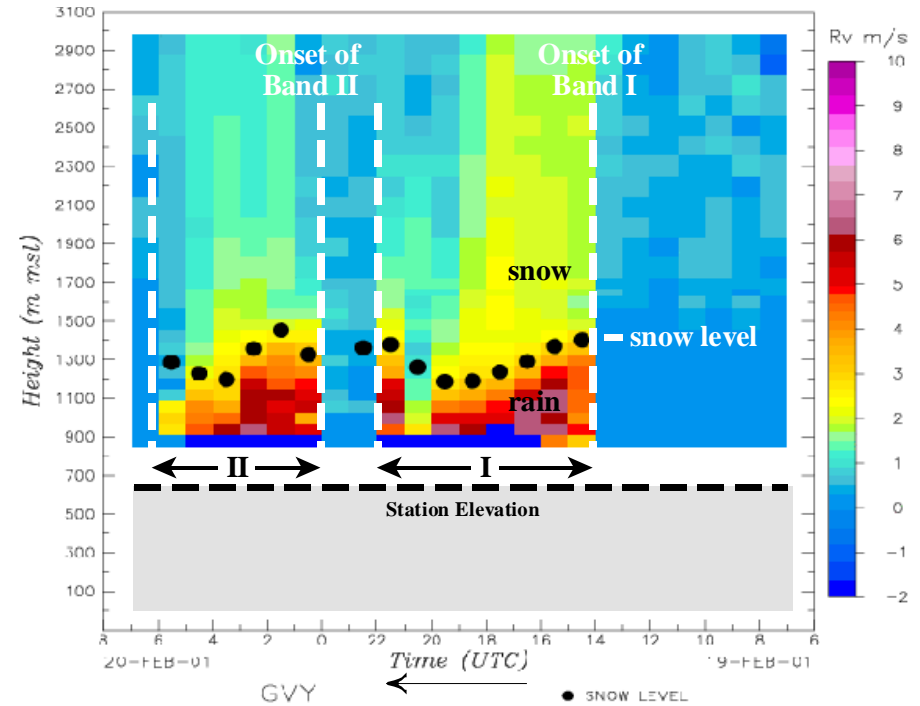
Bodega Bay, on the coast



Time (UTC)	0630	0530	0430	0330	0230	0130	0030	2330	2230	2130	2030	1930
Snow Level (m)	none	none	none	none	none	none	none	1333	none	1247	1208	none
Snow Level (ft)	none	none	none	none	none	none	none	4372	none	4070	3962	none
Sfc temp (C)	10.75	10.68	10.62	10.57	10.52	10.28	10.58	10.30	8.66	10.14	10.66	12.01

Time (UTC)	1830	1730	1630	1530	1430	1330	1230	1130	1030	0930	0830	0730
Snow Level (m)	none	none	1295	none	none	none	none	1339	1265	none	none	none
Snow Level (ft)	none	none	4247	none	none	none	none	4391	4149	none	none	none
Sfc Temp (C)	11.31	10.31	9.31	9.80	9.43	9.22	9.18	9.69	10.51	11.67	11.61	11.32

Grass Valley, in the foothills

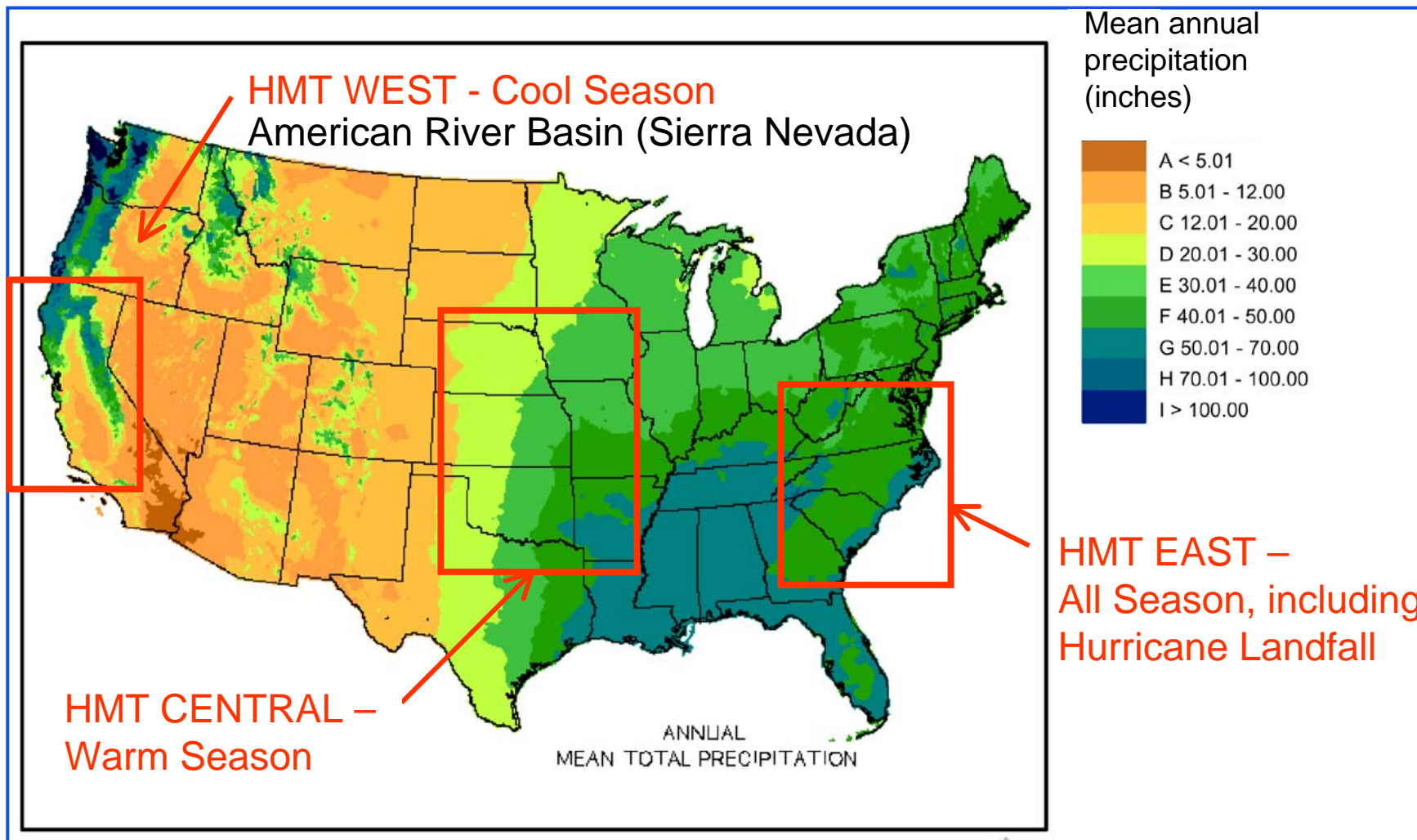


Time (UTC)	0630	0530	0430	0330	0230	0130	0030	2330	2230	2130	2030	1930
Snow Level (m)	none	1285	1228	1196	1356	1452	1325	none	1361	1378	1260	1186
Snow Level (ft)	none	4214	4027	3922	4447	4762	4345	none	4464	4519	4132	3890
Sfc temp (C)	2.38	2.29	3.80	3.89	5.26	5.51	5.08	6.62	6.50	5.00	5.37	4.31

Time (UTC)	1830	1730	1630	1530	1430	1330	1230	1130	1030	0930	0830	0730
Snow Level (m)	1189	1237	1290	1369	1400	none	none	none	none	none	none	none
Snow Level (ft)	3899	4057	4231	4490	4591	none	none	none	none	none	none	none
Sfc Temp (C)	4.56	4.73	5.14	5.69	7.52	6.83	7.27	7.42	7.55	7.45	6.80	7.09

Hydrometeorology Testbed Program (HMT)

The national Hydrometeorological Testbed program will be implemented incrementally in different regions of the U.S.

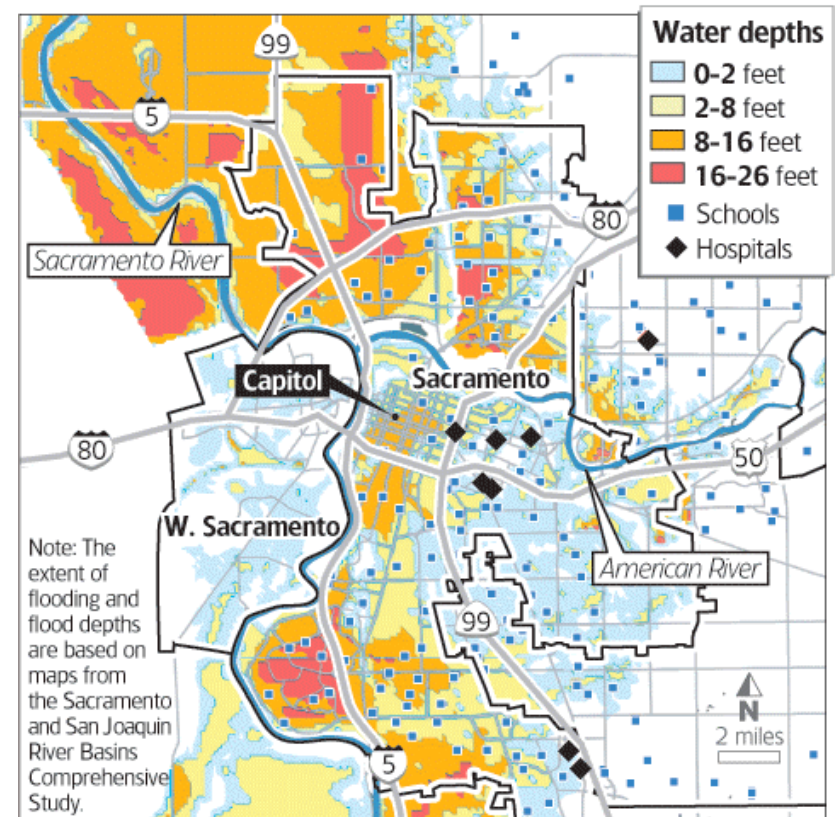


Why the American River Basin?

- Complex water resource management issues in an urban area with large societal impacts
 - Large demand for water/hydropower
 - Threat of devastating flood
 - Ecological concerns

If the levees broke

Where the water would go, and how deep it would get, if multiple levee breaks occurred under a 200-year flooding situation in our region:



Source: Department of Water Resources, Bee research

Sacramento Bee



Photo by Bryan Patrick, Sacramento Bee

HMT-West 2006

- Schedule
 - 1 December 2005 to 7 March 2006
 - Pre-declared hard-down 22-29 December
 - <http://www.etl.noaa.gov/programs/2006/hmt/>
- Observing Strategy Themes
 - High Resolution QPE
 - Melting layer mapping
 - Orographic Airflow and Precipitation Development Process Studies
- Integration with DMIP-2
 - <http://www.weather.gov/oh/hrl/dmip/2/>

HMT Observing Systems

Precipitation Disdrometers

Precipitation Gauges



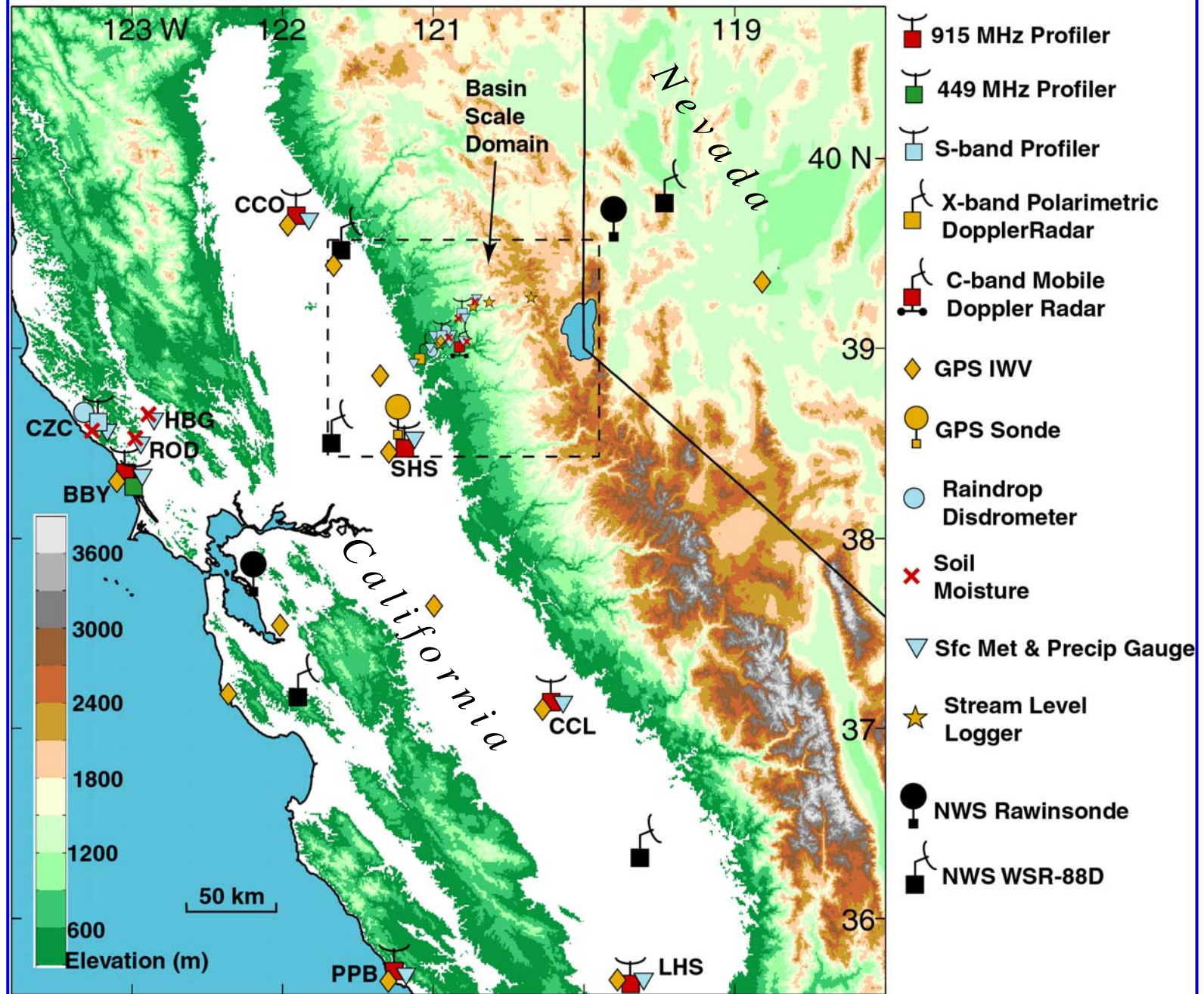
Soil Moisture,
Snow WE, Depth
Surface Energy,
Streamlevel



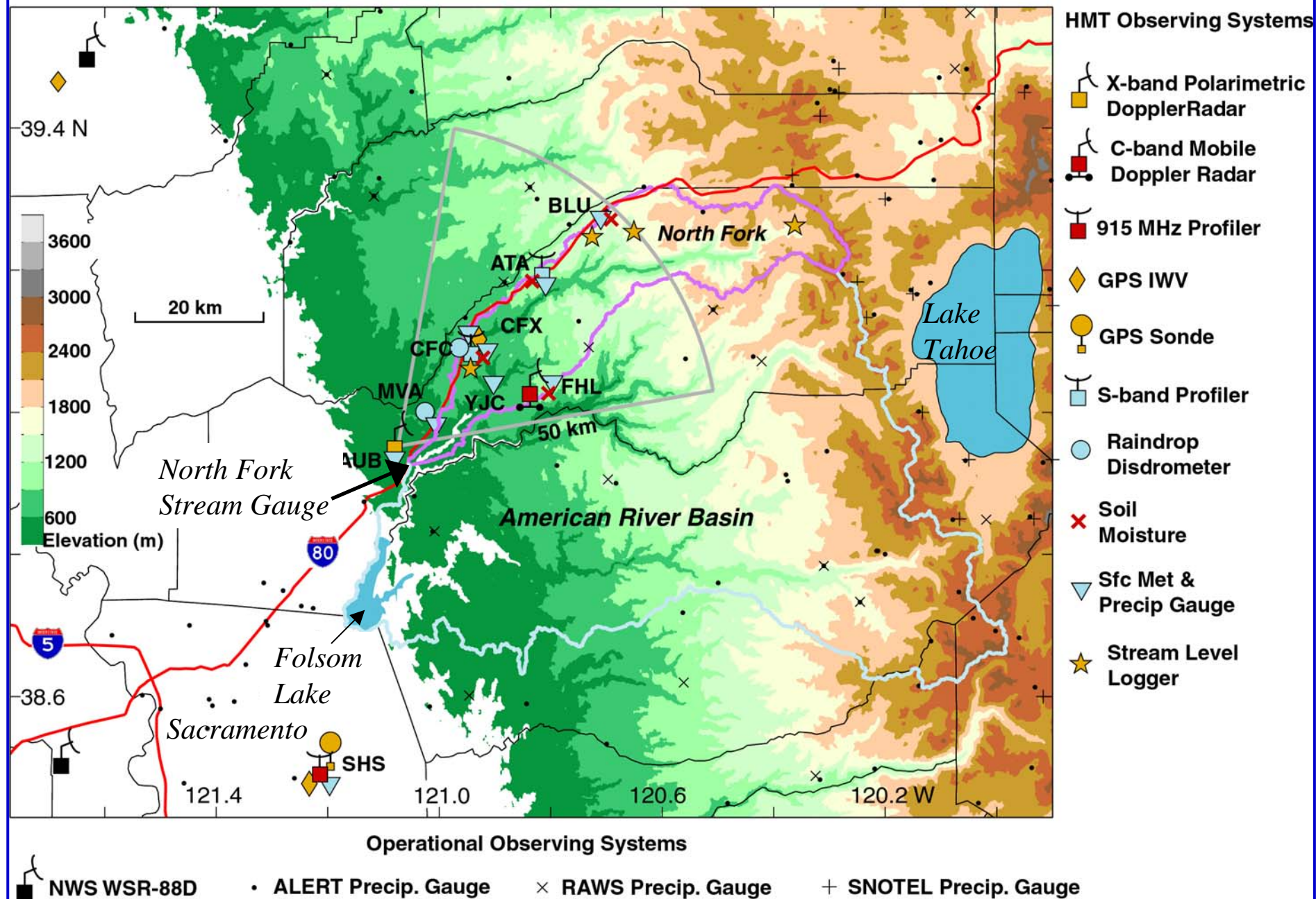
Radars, Profilers and Sounding Systems



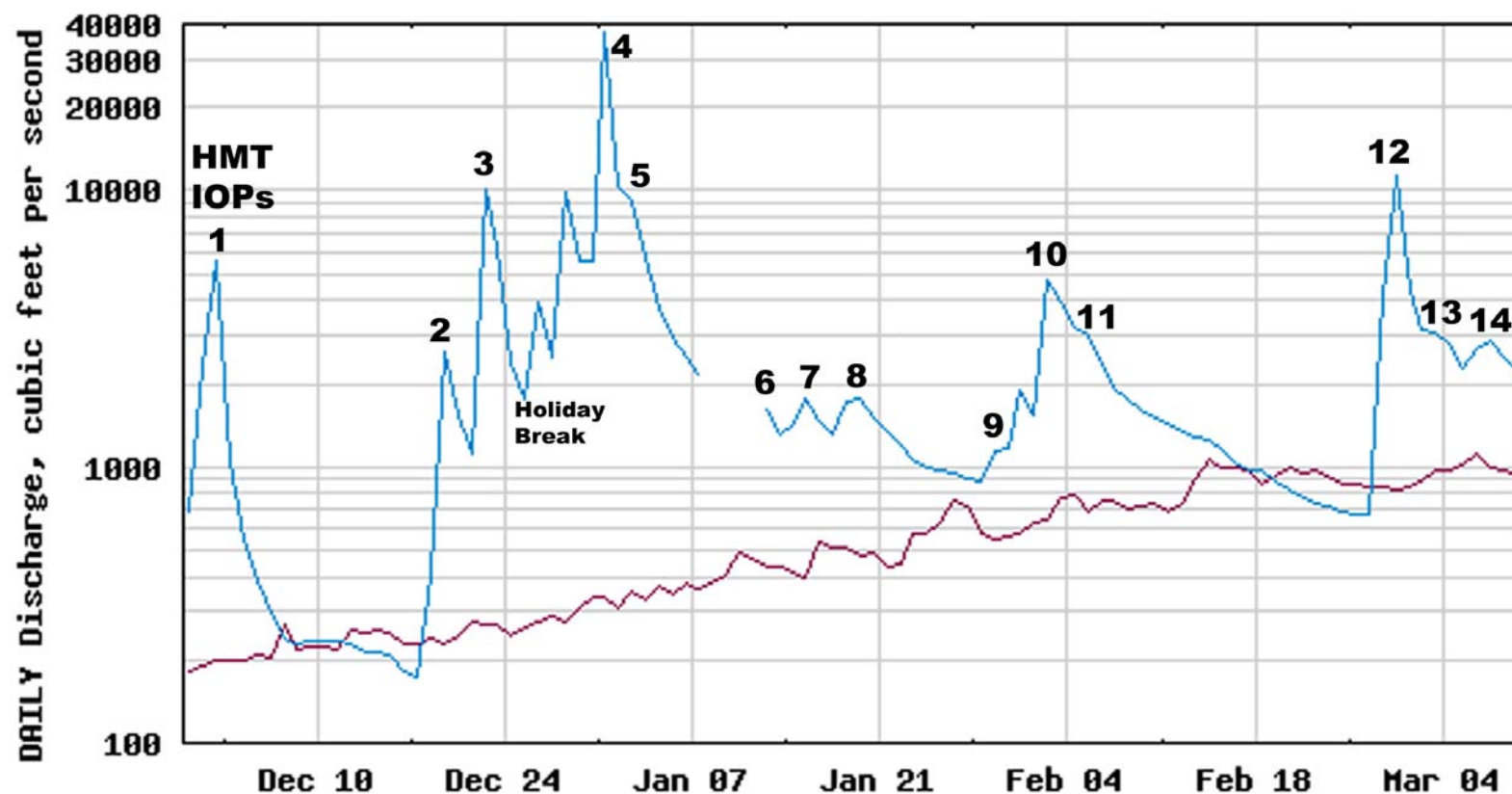
HMT-WEST 2005-2006: Regional Scale Domain



HMT-WEST 2005-2006: Basin Scale Domain



USGS 11427000 NF AMERICAN R A NORTH FORK DAM CA



----- **EXPLANATION** -----

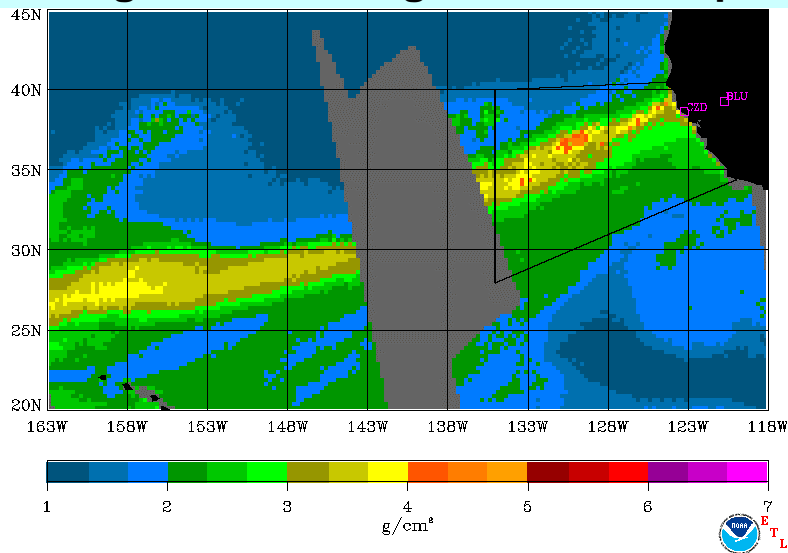
— **MEDIAN DAILY STREAMFLOW BASED ON 63 YEARS OF RECORD**

— **DAILY MEAN DISCHARGE**

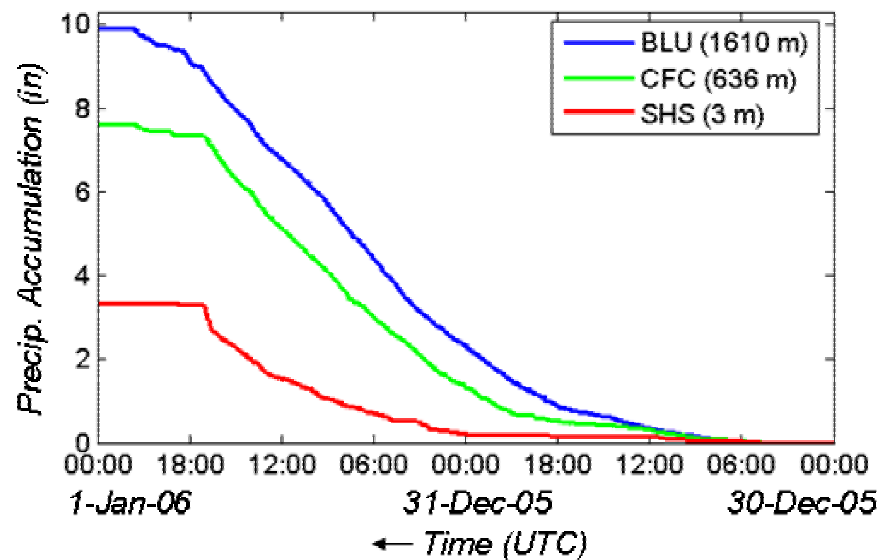
Provisional Data Subject to Revision

IOP-4 Overview

Atmospheric River: Narrow channel of high-valued integrated water vapor



Time Series of Precipitation Accumulations

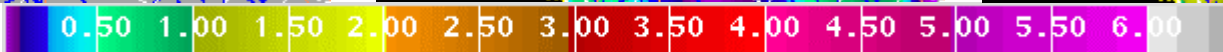
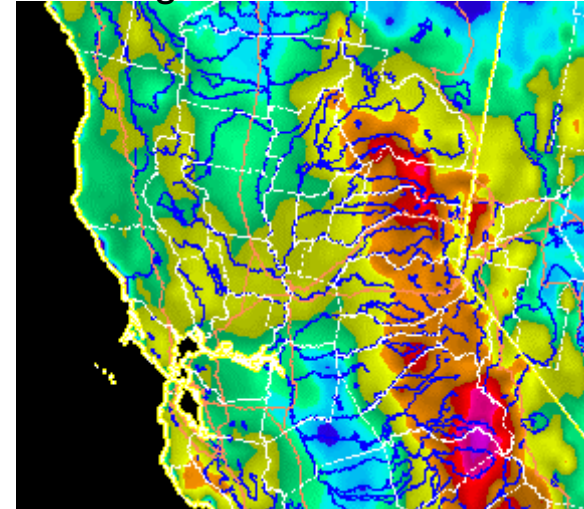
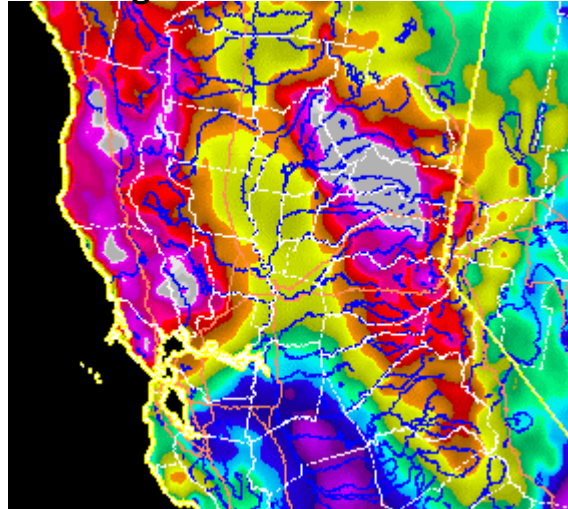
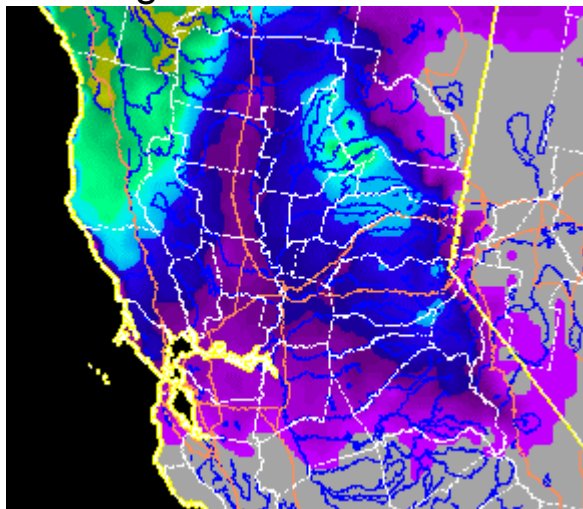


24-h Observed Precipitation Accumulations (inches)

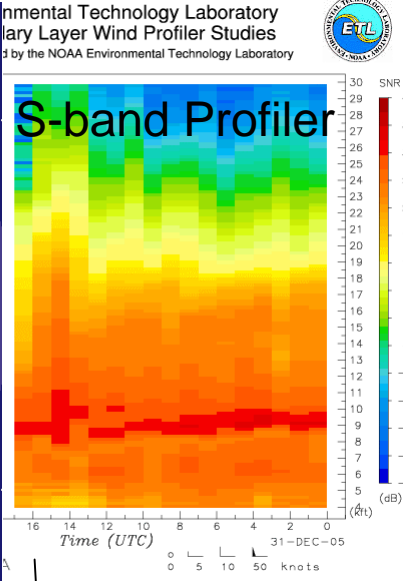
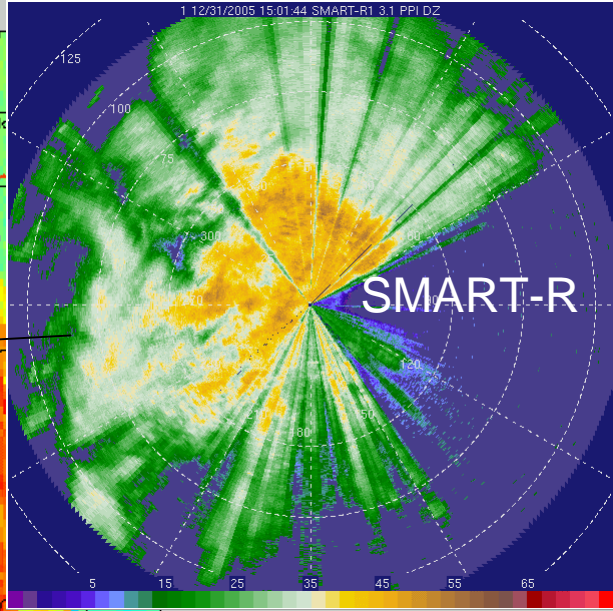
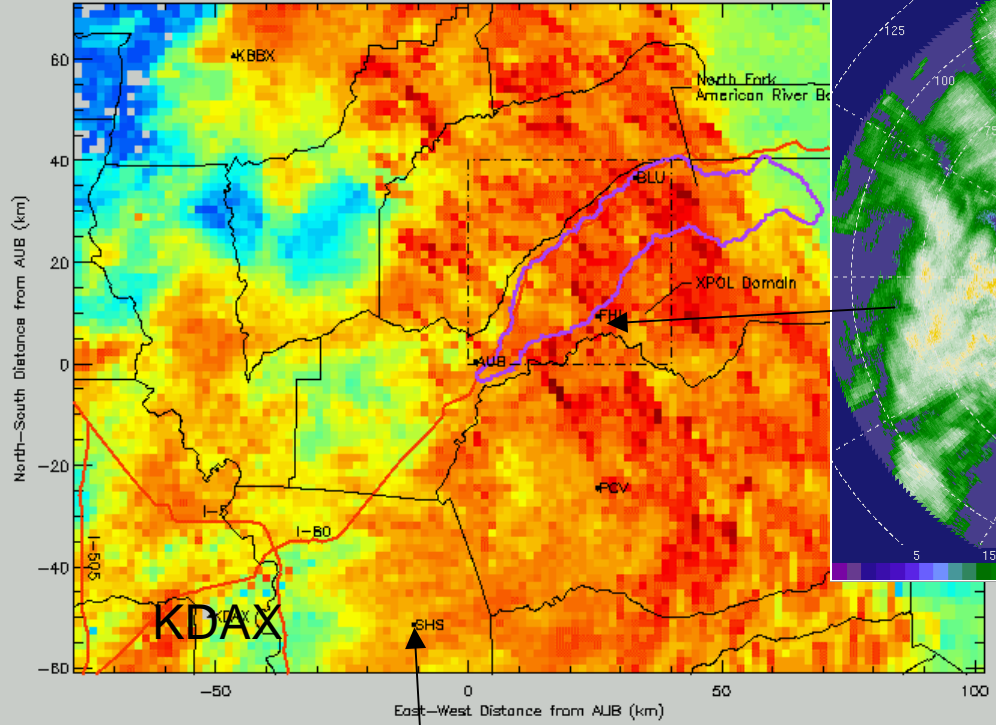
Ending 30 Dec 2005 12 UTC

Ending 31 Dec 2005 12 UTC

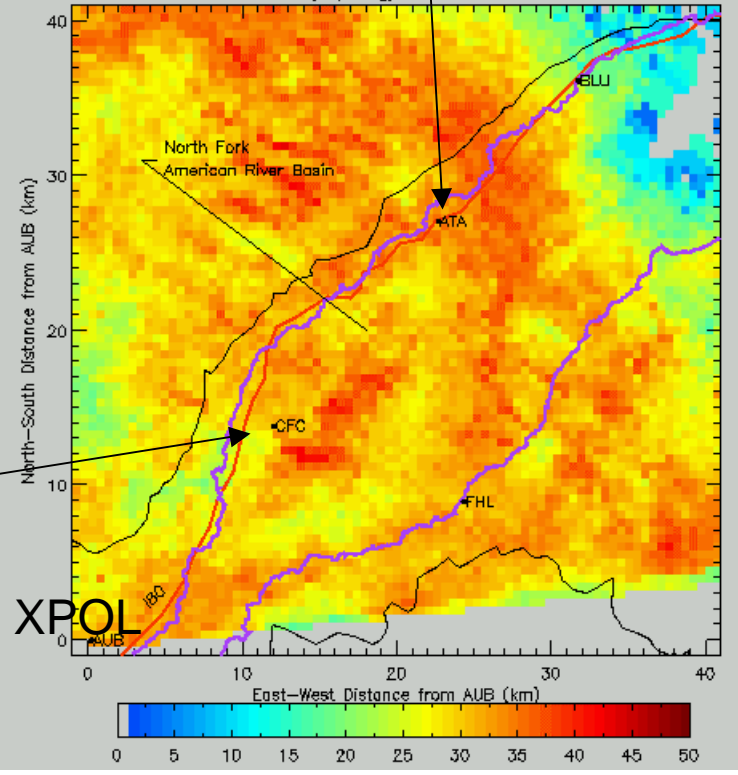
Ending 1 Jan 2006 12 UTC



KDAX 0.5° Reflectivity (dBZ_e): Sat Dec 31 15:01:15 2005



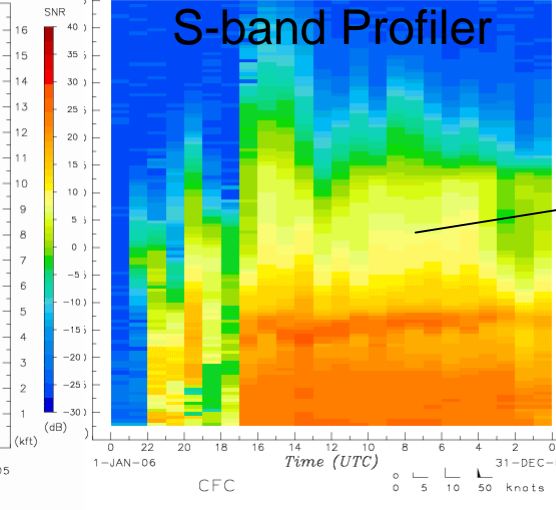
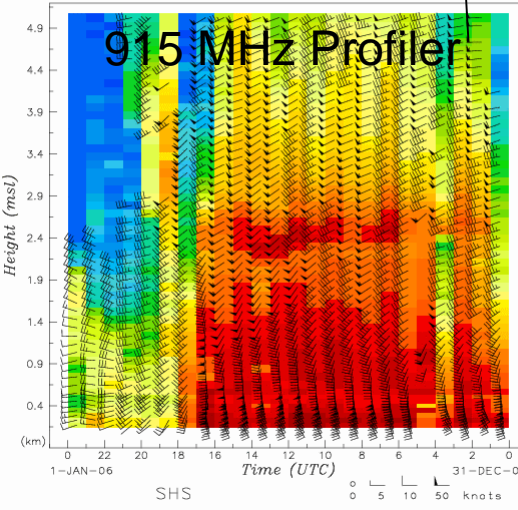
XPOL 3.0° Reflectivity (dBZ_e): Sat Dec 31 14:58:17 2005



Environmental Technology Laboratory
Boundary Layer Wind Profiler Studies
Data provided by the NOAA Environmental Technology Laboratory



Environmental Technology Laboratory
Boundary Layer Wind Profiler Studies
Data provided by the NOAA Environmental Technology Laboratory



Environmental Technology Laboratory
Boundary Layer Wind Profiler Studies
Data provided by the NOAA Environmental Technology Laboratory

Proposed Hydrometeorology Testbed Timeline

Regions of Focus

American River

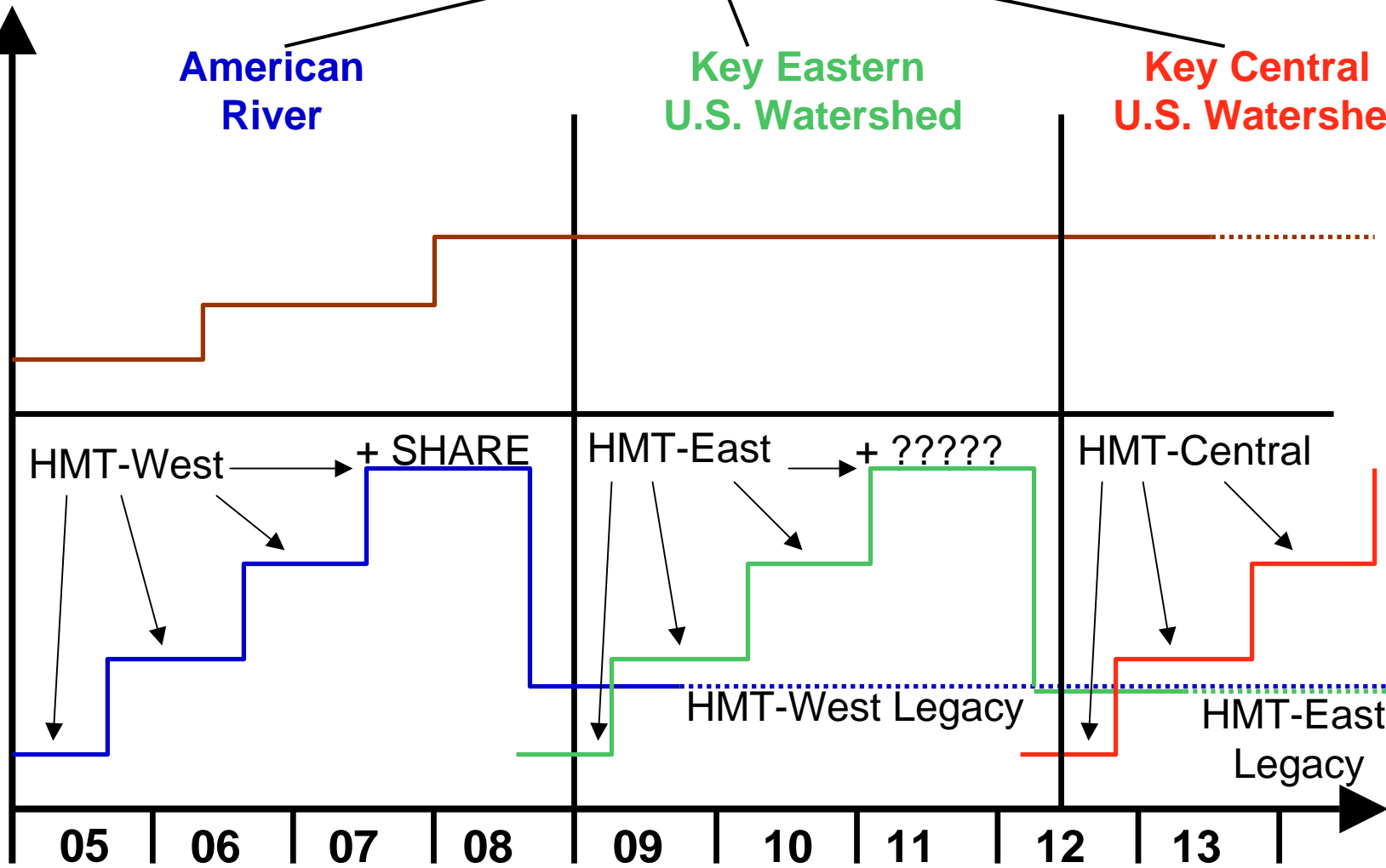
Key Eastern U.S. Watershed

Key Central U.S. Watershed

Level of effort / activity

Analysis

Field Work



05

06

07

08

09

10

11

12

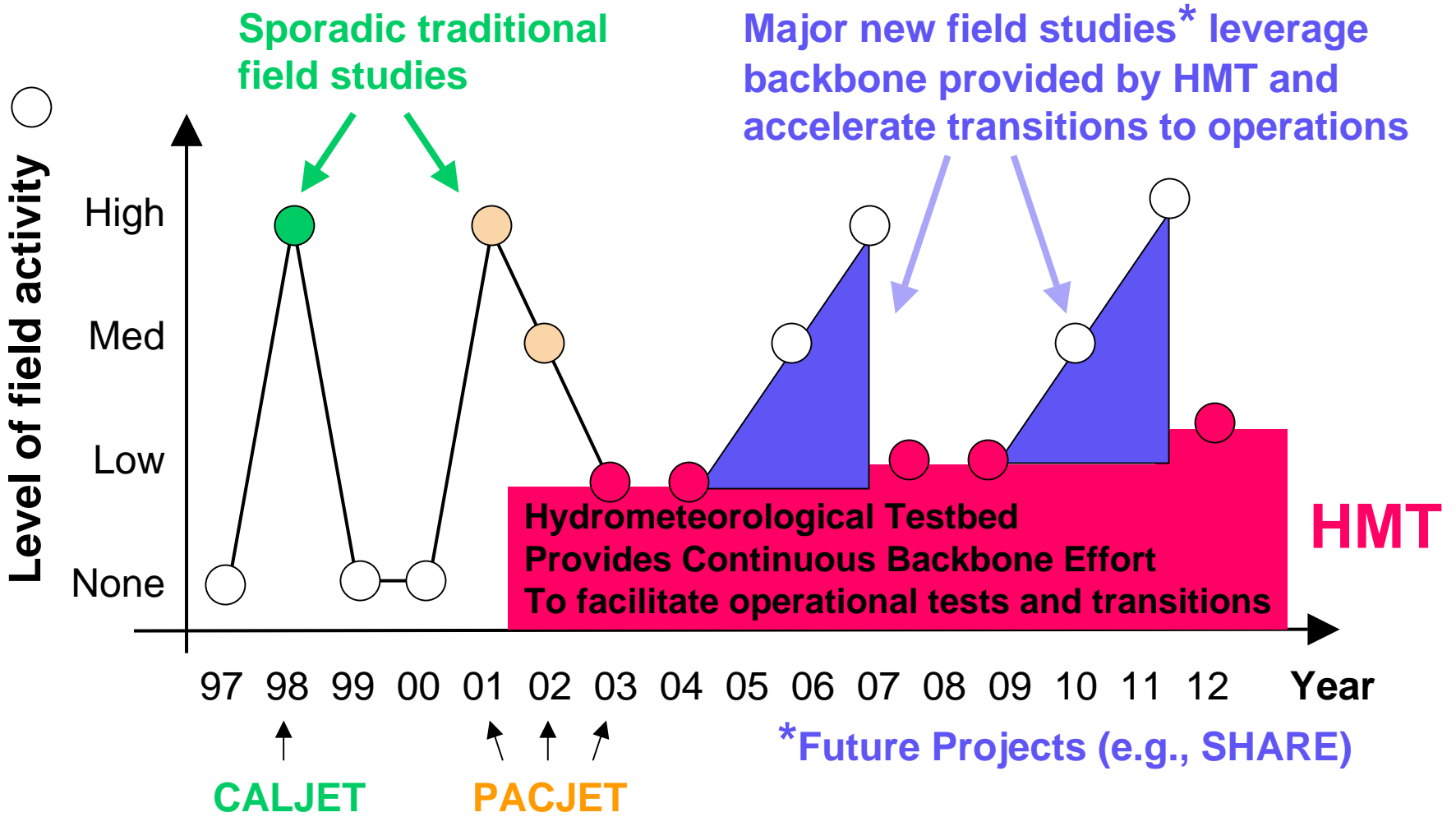
13

Fiscal Year

NOAA Hydrology Program
(Water Resources Data Assimilation)

NOAA Science and Technology Infusion Program
(Hydrometeorology Testbed)

CALJET/PACJET to HMT to SHARE



- When?
 - Cool season 2007-2008
- Overarching objective:
 - Investigate the multi-scale physics of orographic precipitation and air mass transformation associated with atmospheric rivers crossing the Sierra Nevada mountains
- http://www4.ncsu.edu/~seyuter/share_index.htm



Summary

- Hydrometeorology Testbed (HMT) Goals
 - Intensive measurements
 - Improve physical process understanding
 - Test and improve models
 - Improve forecasts
- HMT Information
 - American River Basin 2005-2008, perhaps beyond
 - <http://hmt.noaa.gov/>
 - <http://www.etl.noaa.gov/programs/2006/hmt/>
 - David.Kingsmill@colorado.edu
- Integration with DMIP-2
 - <http://www.weather.gov/oh/hrl/dmip/2/>