Testbeds Help Connect ESRL Research to NWS Forecast Operations

- **Testbeds can help, particularly with**
  - Creating partnerships at the forecaster/researcher level
  - incremental improvements in existing forecast tools and
  - field testing high-risk/high-reward options

- **Testbeds have taken different forms depending on the forecast problem and state of the science/technology, e.g.,**
  - Hurricane prediction is very centralized, while severe weather warnings are local
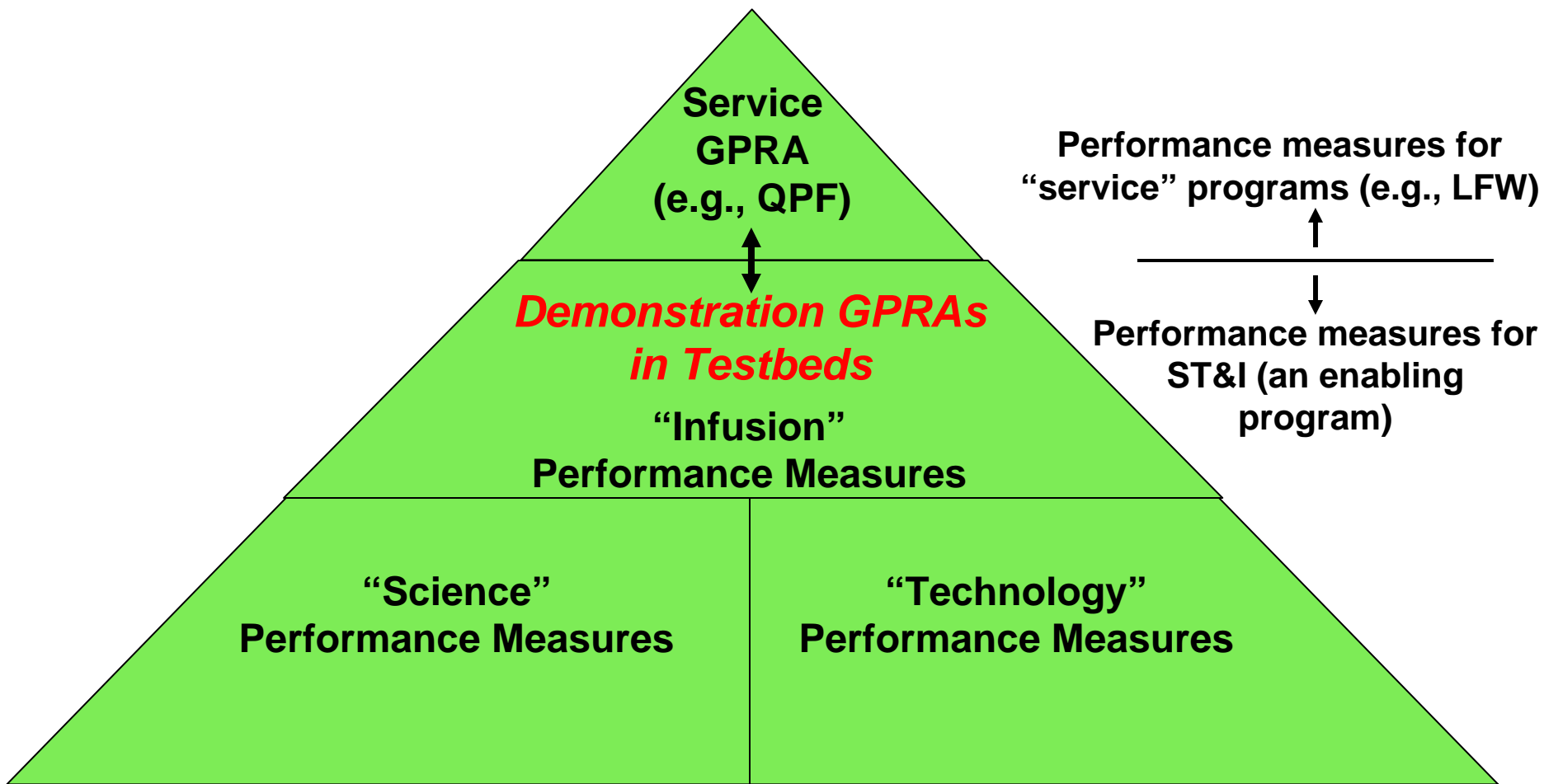 - QPE depends on advancing observing systems, while HWRF is a key for hurricanes

Testbeds Enabled or Supported by W&W/ST&I

| Testbed	Leading OAR Lab	Partner Labs	Leading NWS recipient	Key applications
Joint Hurricane Testbed (JHT)	AOML/Hurricane Research Div.	**PSD** **GSD**	National Hurricane Center	Track Intensity
Hydrometeorological Testbed (HMT)	**ESRL/Physical Sciences Div.**	**GSD** NSSL	NCEP/Hydromet. Prediction Center, RFCs	QPF Snow level Flooding
Hazardous Weather Testbed (HWT)	NSSL	**GSD**	NCEP/Storm Prediction Center, WFOs	Tornadoes Hail…
Developmental Testbed Center(DTC)	**ESRL/Global Systems Div.**	NCAR	NCEP/Environmental Modeling Center	Mesoscale modeling

ESRL PSD and GSD are leaders and partners

Linking Science, Technology & Infusion Performance Measures to NOAA GPRA Measures

Today's predictive services exist on
a foundation of earlier innovation in science and technology

Service
GPRA
(e.g., QPF)

*Demonstration GPRAs
in Testbeds*

"Infusion"
Performance Measures

"Science"
Performance Measures

"Technology"
Performance Measures

Performance measures for
"service" programs (e.g., LFW)

Performance measures for
ST&I (an enabling
program)

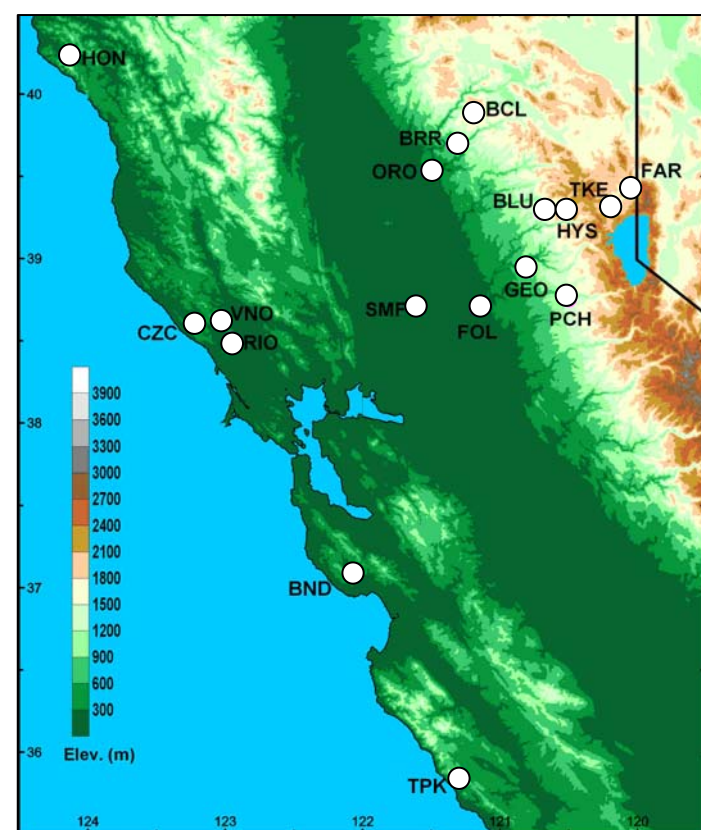# On Developing a Performance Measure for Snow Level Forecasts
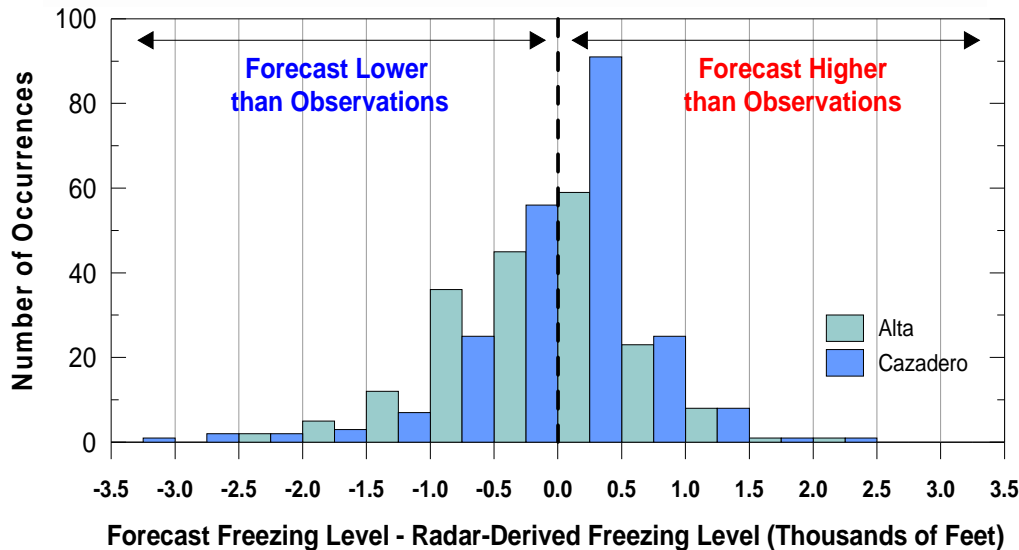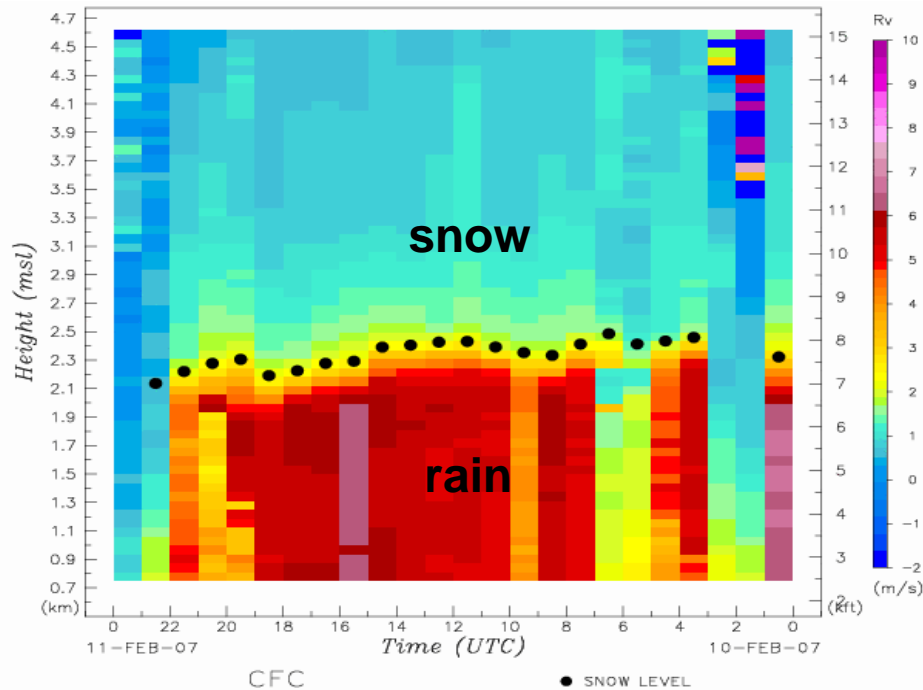
- HMT introduced a real-time, wind profiler-derived, snow-level product that is updated hourly on the internet.

- This new capability prompted NWS staff at the CNRFC to ask ESRL to quantify operational snow level forecast performance.

- Lundquist et al. (2008) in J. Hydrometeor. documented the relationship to snow at ground level

- 15% of the freezing level forecast errors were greater than +/- 1,000 ft.

- When predicted snow level is below what is observed, this translates to underestimates in stream flow, e.g., a 2,000 ft snow-level error can cause a factor of 3 runoff error (White et al., J. Tech. 2002)

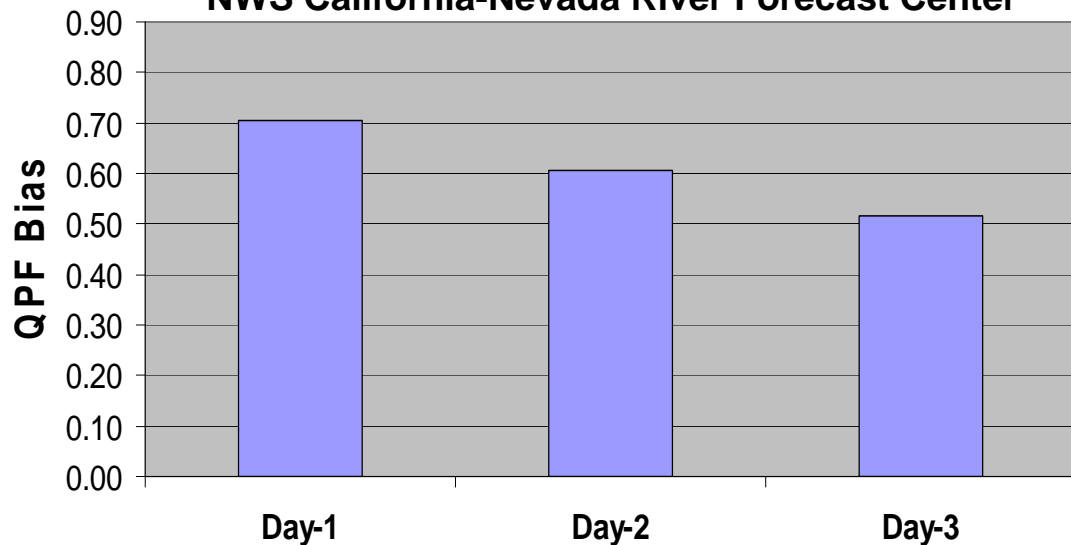*Results courtesy of Dr. Allen White and Dan Gottas (ESRL/PSD)*

On Developing a Performance Measure for Forecasting Extreme Precipitation

- HMT has worked with forecast users to identify critical needs for extreme event prediction.

- The existing performance measure for QPF (1 inch "threat score") does not address this need.

- 17 sites were used to assess QPF performance for events exceeding 1 inch, 3 inches, and 5 inches in 24 hours, at 1, 2 and 3-day lead times.

- Of 16 events with >5 inches in 24 hours, the QPF bias was low
  -0.71 (1-day lead)
  -0.60 (2-day lead)
  -0.51 (3-day lead)

- Of 16 events with >5 inches of rain in 24 h, 2 were predicted 1 day ahead
  - 5 inch POD = 0.06

On Developing a Performance Measure for Forecasting Extreme Precipitation

- HMT has worked with forecast users to identify critical needs for extreme event prediction.

Prototype QPF performance measures for extreme precipitation events are being developed and baselines are being created by HMT
-Probability of Detecting (Forecasting) a >5 inch event
-Bias of QPF in events with >5 inches rain observed

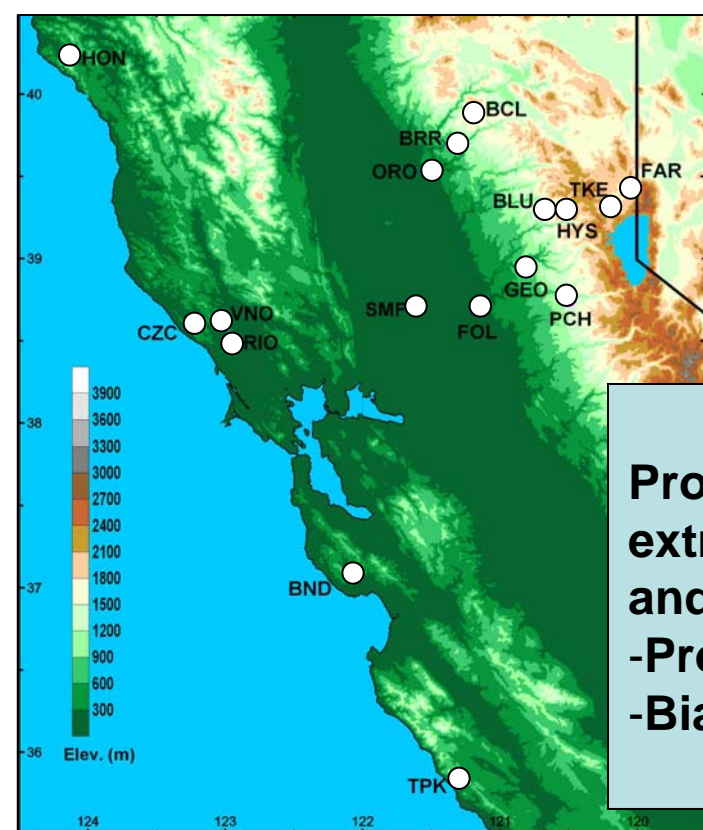- Of 16 events with >5 inches in 24 hours, the QPF bias was low
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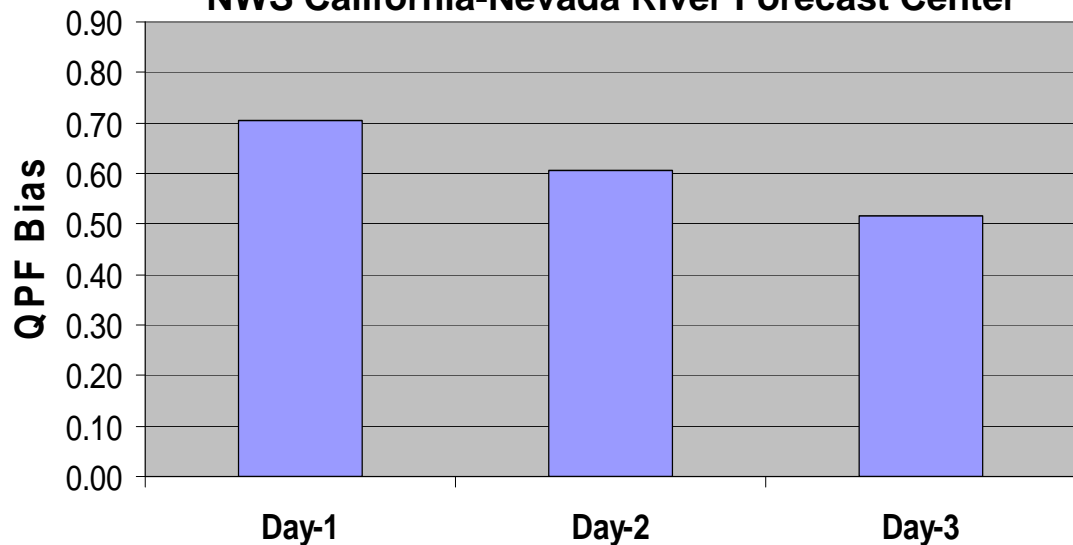 - -0.60 (2-day lead)
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NWS California-Nevada River Forecast Center

QPF Bias chart:
Day-1	Day-2	Day-3
0.71	0.61	0.51

NOAA Makes Fresh Water a Priority – Including HMT

- FY03: Weather & **Water** Mission Goal created
- FY04: ST&I Program defines **Water Resources R&D Capability** (includes HMT)
- FY06: WRDA Project developed in PPBES funds **HMT-QPE elements** starting in FY06
- FY07: **Integrated Water Resource Services** identified as one of 4 NOAA-Wide "Priority Areas"
- FY07: USWRP sponsorship of **HMT-QPF elements** begins
- FY08: NOAA supports major FY10 Program Adjustment including **HMT** (planning conducted in FY08)
- FY08: NOAA identifies Water Resources as a **Transition Theme** in preparation for new Administration
- FY09: VADM Lautenbacher's closing email notes the importance of water resources