National Weather Service (NWS) Hydrologic Ensemble Forecast Service (HEFS)

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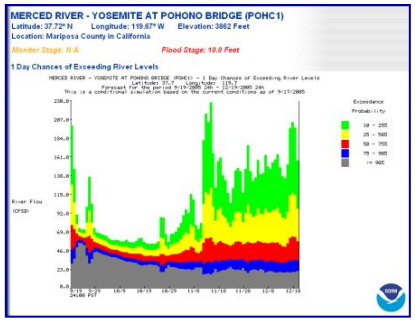
Outline

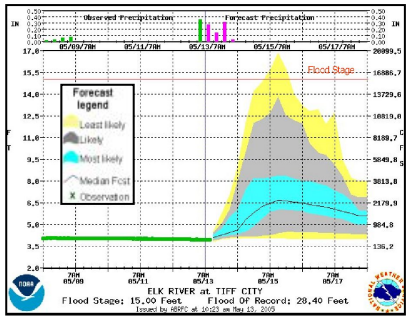
- HEFS Implementation
- GEFSv12 Operational Transition
- Next Steps and Priorities (HEFSv2)
- Potential Opportunities and Collaborations

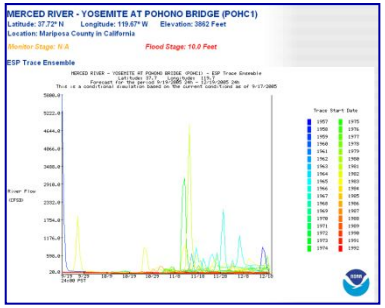
HEFS Service Level Objectives

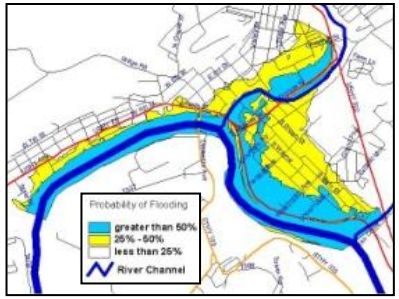
Produce ensemble streamflow forecasts that:

- seamlessly span lead times from one hour to one year
- statistically calibrated (unbiased with reliable spread)
- consistent across time and space
- effectively capture information in NWS weather/climate models
- dependable (consistent with retrospective forecasts)
- adequately verified
- aid user's decisions (compatible with Decision Support Systems)

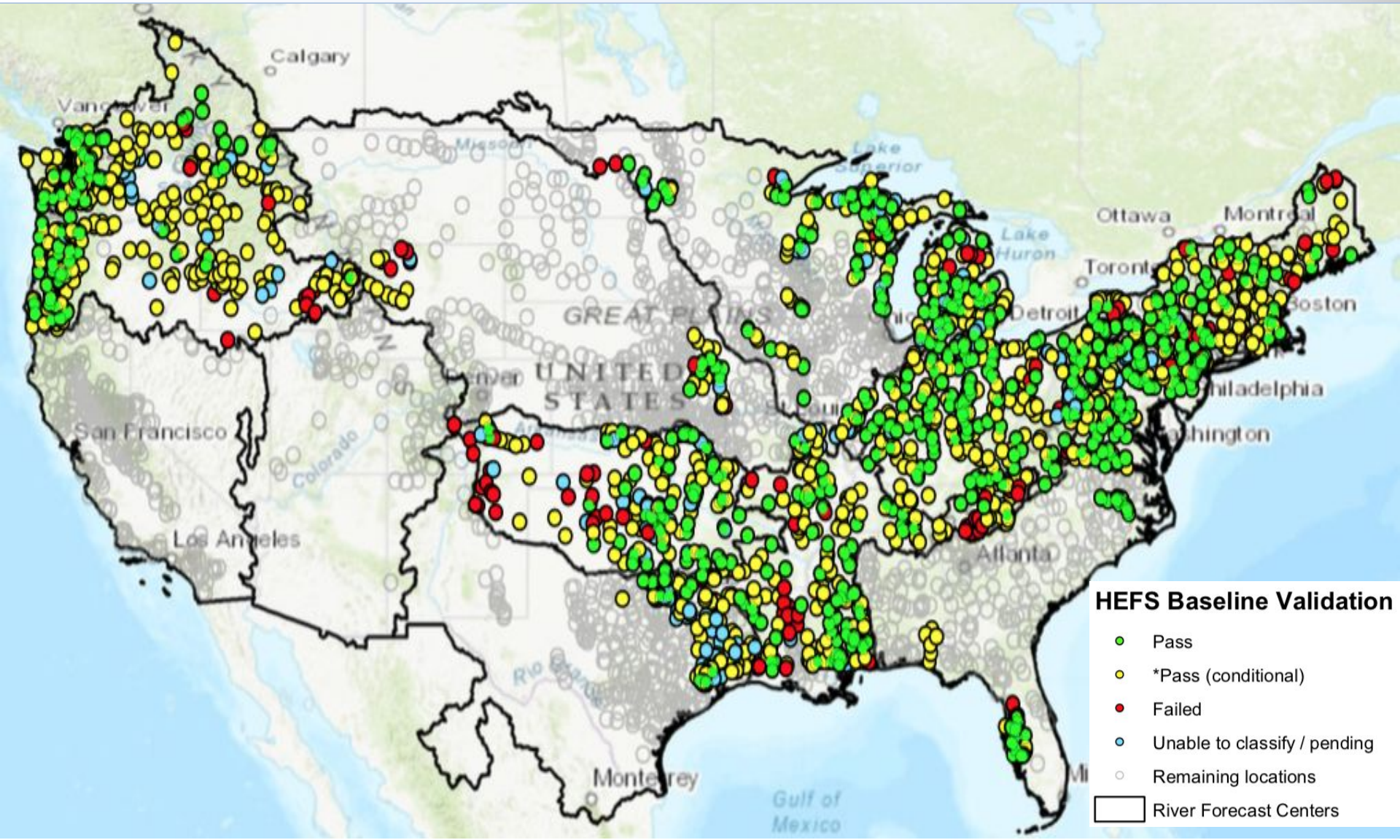




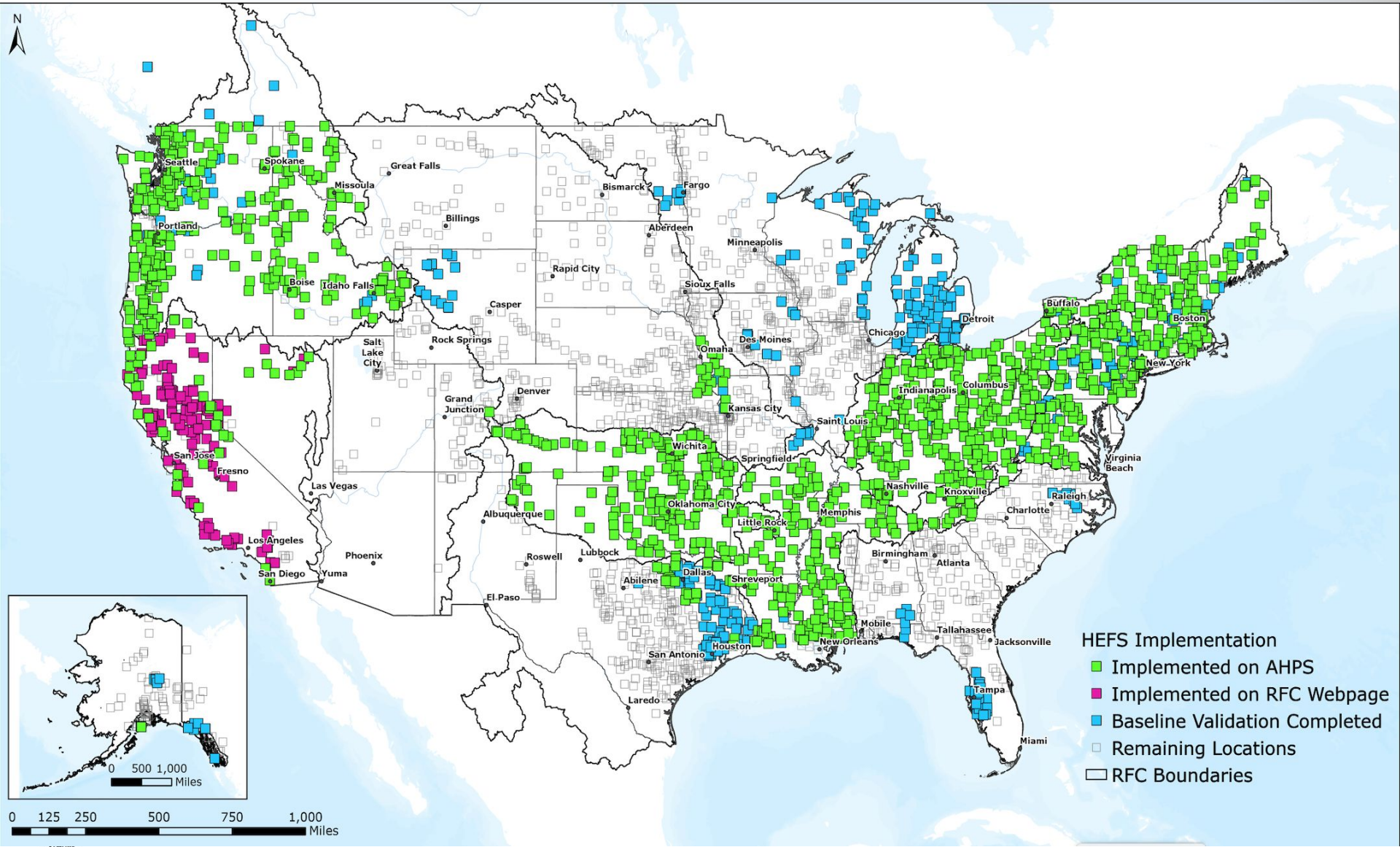




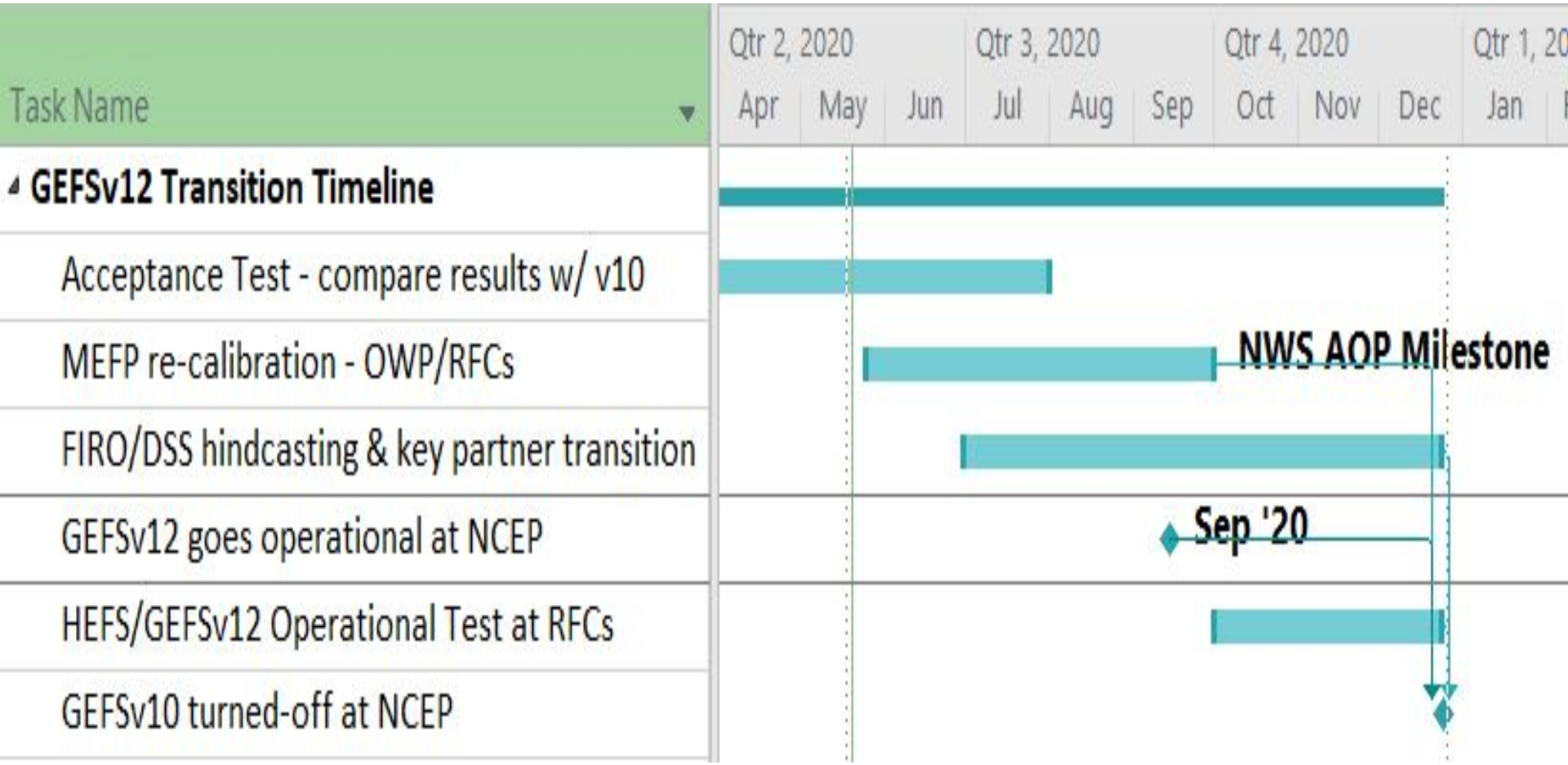
HEFS Baseline Validation Status



HEFS Implementation Status

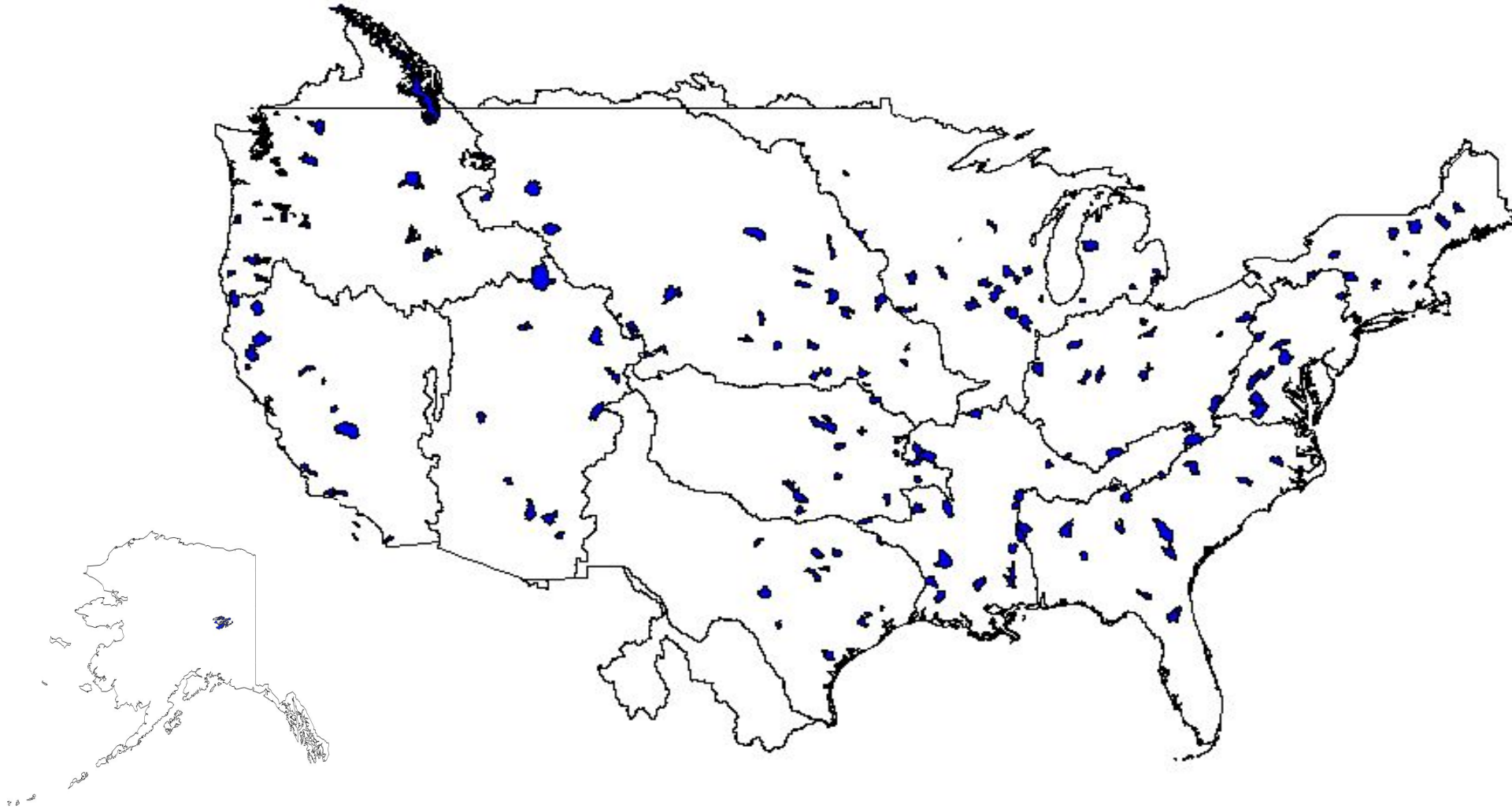


GEFSv12 Transition Implementation



HEFS Testbed (for Acceptance Testing)

200 testbed basins + FIRO/NYCDEP basins



Validation/Acceptance Testing Status

Compare results - GEFSv12 versus GEFSv10

- **Raw forcings**: GEFS mean precip and temperature, at all (200) testbed basins - **100% Complete**
- **MEFP forcings**: 15 day precip and temperature forcings at (151) testbed basins where we have latest CHPS MEFP configuration - **42% Complete**
- **HEFS streamflow**: at (137) testbed locations where we have a CHPS hindcasting configuration - **36% Complete**

Re-calibration of operational HEFS

- Re-calibrate HEFS/MEFP to GEFSv12 for ~3472 river locations and supporting sub-basins
  - Completed for 167 basins
  - Beginning hindcasts for NYCDEP and FIRO locations (MA, NE, and CN) for partner review and operations update
- Final Operational Test (RFCs configure and test real-time ingest and HEFS operations with GEFSv12)

Next Steps and Priorities (HEFSv2)

- Extend and evaluate implementation of hydrologic post-processor (including at regulated locations)
- Address MEFP performance in extreme events
- Update temperature modeling in MEFP to address limitations in steep terrain, etc
- Implement social science recommendations into current products
- Leverage Data Services for user-tailored products
- Effectively communicate uncertainty information

Potential Opportunities and Collaborations

- Reforecast thinning study with ESRL and U-Wisc
- Formalize Validation Testbed for enhancements
  - Facilitate community development (ESRL, UT, CW3E)
- Explore alternative techniques for Ensemble Forcings (refined calibrations, use NCEP output directly, etc)
- Enhance evaluation/validations with partner input
  - Which attributes of HEFS forecasts are most critical for users (applications, decisions, etc)
- Realize the full utility of HEFS forecasts for optimized decisions and detail benefits to support investment

Questions

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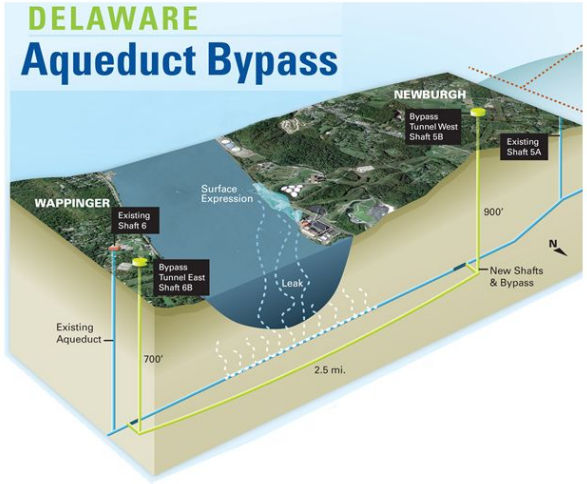
Backup slides

Example of early application of HEFS

Managing NYC water supply

- Croton; Catskill; and Delaware
- Includes 19 reservoirs, 3 lakes; 2000 square miles
- Serves 9 million people (50% of NY State population)
- Delivers 1.1 billion gallons/day
- Operational Support Tool (OST) to optimize infrastructure, and avoid unnecessary (**$10B**+) water filtration costs
- HEFS forecasts are central to OST. The OST program has cost NYC under **$10M**

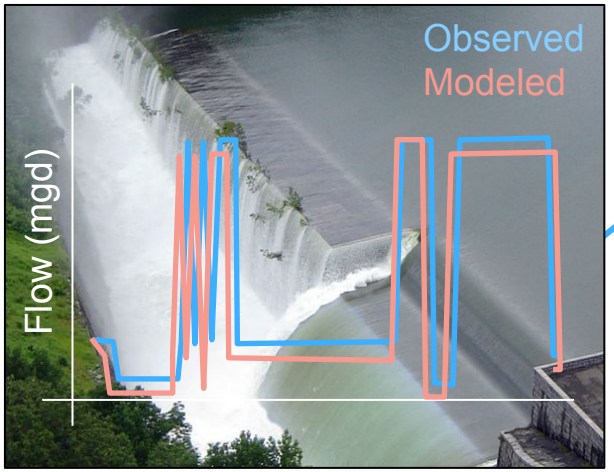
Example of early application of HEFS



"Mission critical decision to manage shutdown of RBWT Tunnel based on HEFS forecasts"

"HEFS forecasts critical to protecting NYC drinking water quality during high turbidity events"

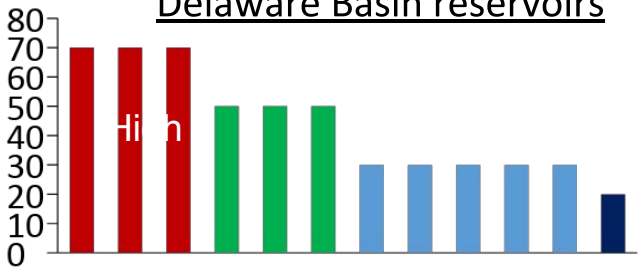
HEFS streamflow forecasts are used to optimize and validate the NYC OST for million/billion dollar applications



(Cannonsville Reservoir Spillway)

"HEFS forecasts help optimize rule curves for seasonal storage objectives in NYC reservoirs"

<u>Risk to water availability from Delaware Basin reservoirs</u>



"HEFS forecasts used to determine risks to conservation releases"

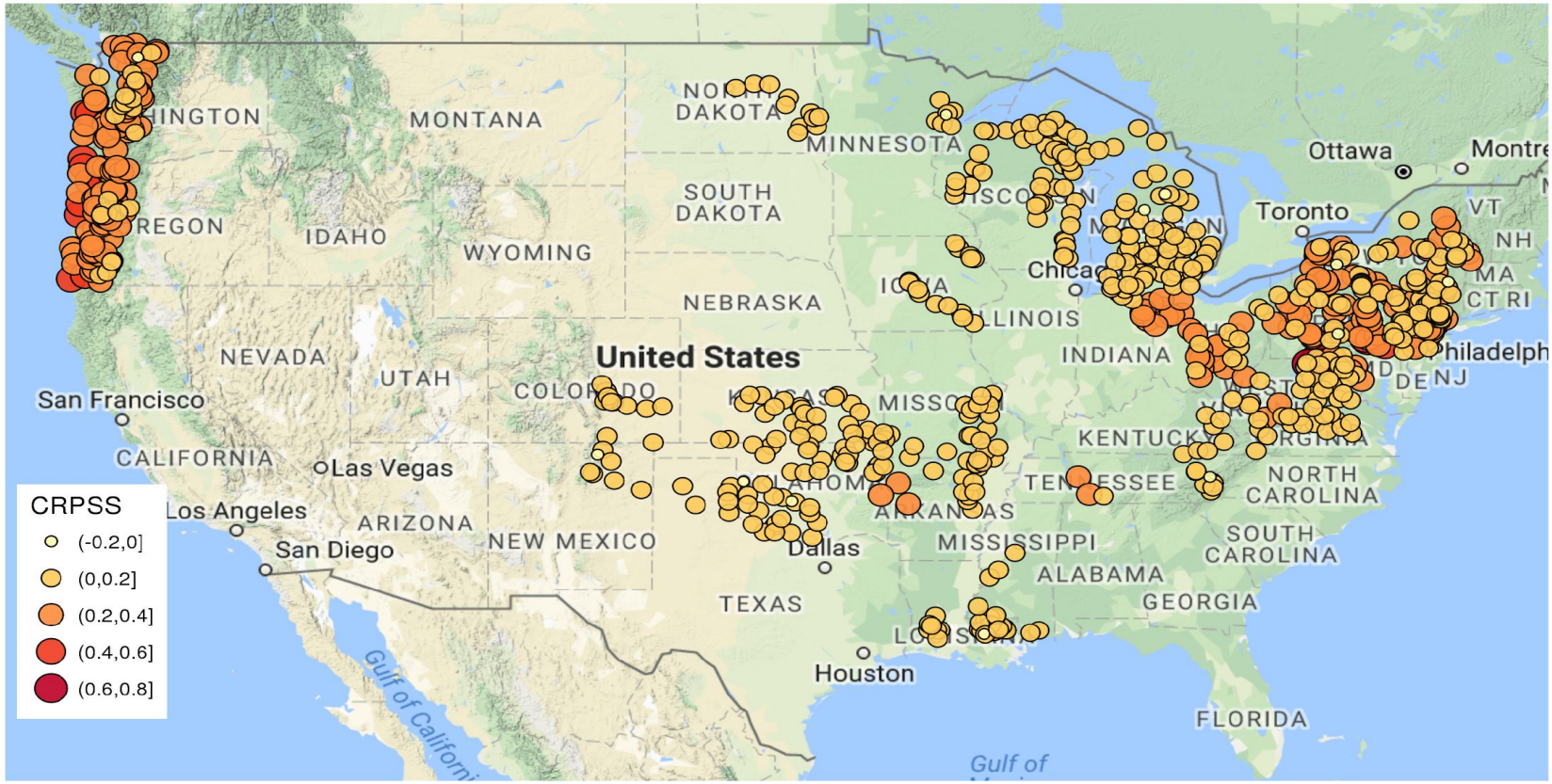
Early applications of HEFS

Forecast Informed Reservoir Operations (FIRO) in Russian River Watershed

- Multi-Agency study on Lake Mendocino
- Can we enhance reservoir operations and use of available storage by using forecasts to inform decisions about releasing or storing water?
- HEFS forecasts are central to optimized forecast-based reservoir operations
- Supports water control manual change request for Lake Mendocino
- Process can be replicated in other watersheds

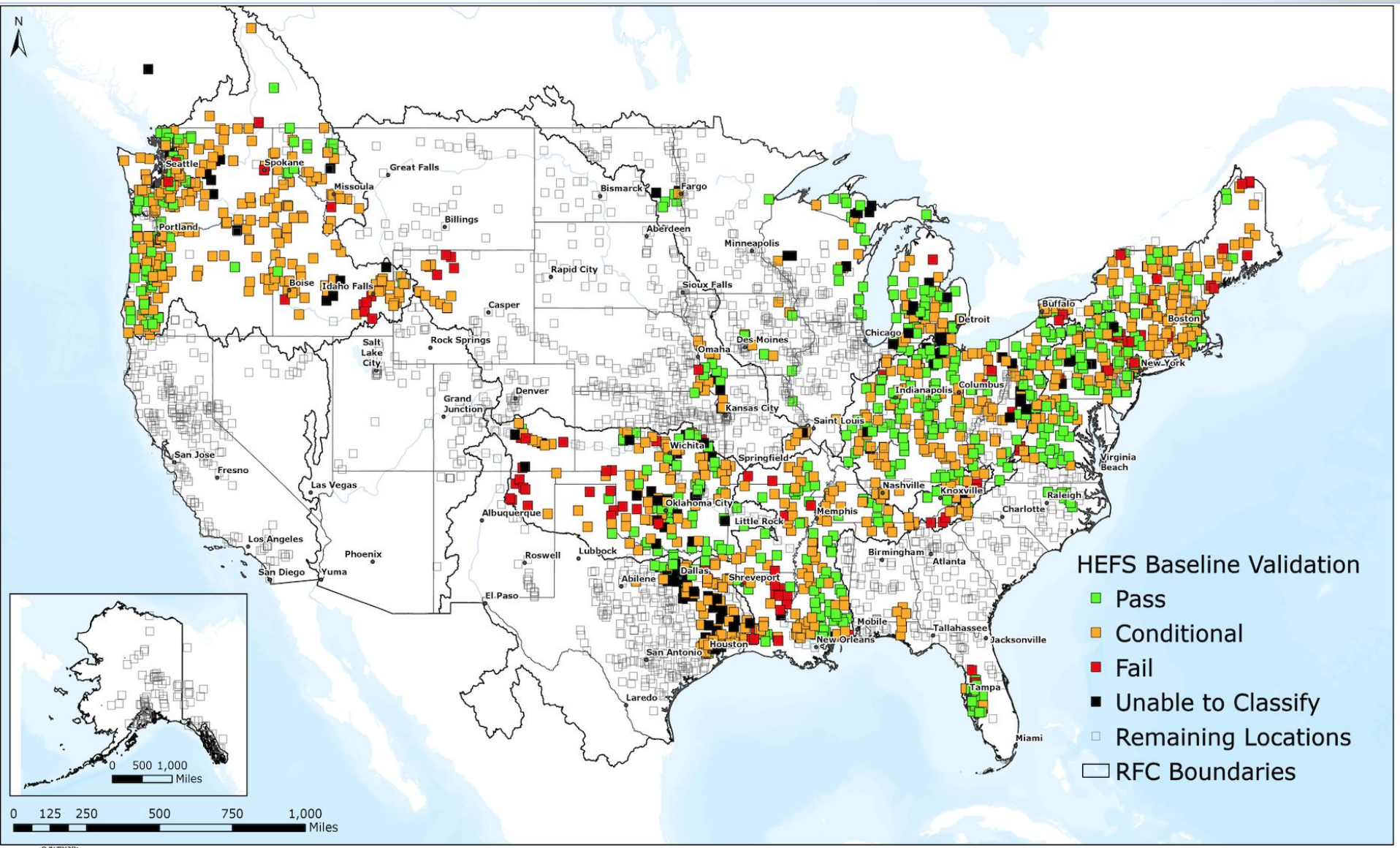
Maximum skill (CRPSS) HEFS vs. ESP

Skill everywhere, but greatest in Pacific Northwest and Northeast



Weaker skill in central plains, partly due to lower predictability of heavy, convective precipitation

HEFS Baseline Validation Status



HEFSv1 Implementation Status

- HEFS configured at 2966 locations
- Baseline validation (30 yr retrospective comparison) completed - 1762 locations
- BV Pass/Conditional Pass - 1468 locations
- HEFS products on AHPS - 1390 locations
- HEFS products on CNRFC web - Additional 242 locations (total 1602 locations)