Water Resources Management Focus Group Summary
Stakeholder Engagement to Inform National Water Center Hydrologic Products and Services to Meet User Needs
NOAA National Weather Service
Water Resources Services Branch and Office of Water Prediction

Water Resources Management Focus Groups: Summary of Input and Feedback

Water resource management, although often focused on water scarcity, can benefit from NWM forecasts, along with other existing products like the Drought Monitor. To gather information from stakeholders involved in water resource management, ERG worked with NOAA staff in the Colorado Basin River Forecast Center (CBRFC) and National Integrated Drought Information System (NIDIS) to plan and host a focus group at the American Water Works Association (AWWA) Sustainable Water Management Conference in March 2018. Unlike other engagements, this focus group presented experimental products external to the NWM, specifically the Water Resources Monitor and Outlook (WRMO), a product in development through a collaboration of several Western RFCs. WRMO is designed to provide forecasts of water accumulation at key locations for water resource managers and supplements other capabilities of the RFCs. One key question for the focus group participants is whether it makes sense for WRMO, designed for Western locales, to be scaled up nationally to fit within the NWM framework. The group discussed the pros and cons of scaling WRMO and determined that the hydrologic character of the Western US, and subsequently how the forecasts underpinning WRMO function, makes it difficult or impossible to scale WRMO appropriately to be equally applicable in snowmelt-dominated systems like the Colorado River and precipitation-driven systems like the Mid-Atlantic. Furthermore, although WRMO could hypothetically be useful for water resource managers outside of the Western states, the management decisions they make are not the same and WRMO may not fit well within their existing decision support systems. A summary of input, including current tools used and feedback on WRMO prototype information follows.

Summary of Major Tools Used:

- Climate change models
- Seasonal drought outlook, seasonal precipitation outlook, QPF (probabilistic models)
- FIRO, AQPF
- Snotel, drought outlook, seasonal precipitation outlook, Bureau of Reclamation reservoir operations forecasting
- Obligation to forecast 50 years in Phoenix, scenario forecasting
- Use seasonal outlooks, but find this not informative, snotel, snow depth and snow density, ESP are fantastic but lots of limitations (no dust on snow, etc.), linked ESP to IRI – but no increase in skill, trying temperature next
- RFC QPF daily, warm, snow-dominated watershed so snowpack is important and how quickly to melt out, forecast temperatures, seasonal forecasts, streamflow forecasts (but run own physically based model and compare), snodas for estimate below snotel, windi (AR tools)
- Seasonal forecast products from NWS and private sources, can't make decisions based on what's currently out there due to the great uncertainty, watching turbidity thresholds
- Manage for flood control and hydroelectric power, for water supply planning use mid-range stochastic probability tool to incorporate la nina predications (few months to year out)

- Snotel and looking at more monitoring, drought monitor. Using these to educate public and decision makers, tools can be too large scale
- Weather projections for predicting flooding and making releases. Long term planning is from a few years to end of century. Use reservoirs for flood rule curves, planning to rework them.

Feedback: Percent of normal streamflow

Dots are overwhelming but some thought it was a nice way to see overall conditions (e.g., wet here, drier there)

Questions/comments:

- What are the dots? Do they correlate to gauges? What about snotel sites?
- Shift terminology away from "normal" – call this historical average

Feedback: Change in forecasts over time

How often would you look for this information?

Depends on what's going on with the weather – incoming storm: multiple times a day, rarely in summer. Like looking at overall snapshot through. In southeast would look at weekly throughout year, more often if dry.

What are triggers? High QPF or frequent changes would cause concern, change in timing. Use this for drought monitoring for snow accumulation and start making key decisions for drought declarations if precipitation over winter is low.

- Change date and period: Would also want to see change in precipitation and temperature forecasts (using a 10 day forecast window), would like to see longer term – have found January forecasts to be pretty predictive for July conditions in intermountain west, in Bay Area, microclimates mean that shorter term is more important. The more flexible the better!
- Southeast does not have a traditional accumulation period, so this would not be applicable currently., Would like to see forecasts out 12 weeks, since this is where first probabilistic trigger is set.
- One-year forecast exists, but it is useless. Past 15 days, not looking since precipitation is rainfall driven. Would like to see S2S skill increased. Would like to see reference to forecast skill.
- Interesting, but forecasters may not use. Apply uncertainty factors to in-house deterministic forecasts; this could be used to help dial in the uncertainty factors.
- Why compare forecast to forecast and not forecast to observed?
- Participants reported looking at forecasts as often as sub-daily if conditions are changing or weekly if things are more stable
    - Determining whether conditions are changing rapidly involves other forecast products like QPF.
- "Change From" dropdown:
    - Maybe it would be good to show a longer term in addition to the short-term change (e.g., over months).
    - Some water managers are particularly interested in how things are changing between January and March, specifically in highly snow-dependent systems (comment from Colorado).
    - The more options the better!
- Participants from Seattle Public Utilities indicated they have their own deterministic model to support water supply decision-making

    - Could see how uncertainty factors like the amount a forecast has changed could be applied to their deterministic model
- The "change in forecast" feature could be useful for drought monitoring throughout the water year.
- Participant from North Carolina said they look at forecasts over weeks not months due to their hydrologic regime.
- Information past 15 days old (maximum length of forecasts) isn't as valuable.
- Regarding other parameters that could be useful:
    - Might be interested to see changes in temperature and QPF forecasts in addition to streamflow.
- Question from participant: Why not look at observed conditions in addition to forecasts?

Feedback: Site specific information

- Things participants want to see at a point:
    - Hydrograph (AHPS)
    - Previous year forecasts to compare current forecast against wet/dry years depending on conditions
    - Location-specific information (site name, management, etc.)
    - Observed conditions
- Would like to see some commonality from site to site – one participant suggested that consistency may be more important than the actual forecast period (e.g., April to July vs. April to October)
- Hydrograph is helpful, even only out to 10 days.
- Track to wet or dry year – historic data is important. Looking for analog
- Location information, stream gage info.
- When you zoom in, want to see commonality between every site – how often updated, standardize information from site to site.
- Also want to see temperature and precipitation all on one graphic

Feedback: Site specific information (data under points on the map)

- Participants want to see more information on forecast methodology and the assumptions used in the forecast.
    - Assumptions are very important to understand when reviewing forecasts – major component of understanding uncertainty
- Southeast is more interested in flow than accumulation
- Would be good to be able to toggle features
    - This is too much information to present to non-technical stakeholders, but the managers themselves don't want to lose that information. A toggle feature would allow them to customize the forecast for outreach and engagement with non-technical audiences
- Might be interesting to show the "change in forecast" graphically on this same chart – ties back to slide on "change in forecast" functionality
- Participants are interested in seeing the historical period used for the forecast

- Need more information on "black swan" events – those outside the extreme range (e.g., more than 95% confidence interval)
- **Revisit the 30-year historical period for ESP forecasts**
- Question from participant: How can we adjust these forecasts to incorporate new climate regimes? (connected to comment about 30-year historical period)

Supplemental products

- Participants reported using:
    - Seasonal T/P outlooks (Climate Prediction Center products)
    - ENSO information (La Nina/El Nino)
    - Standard Precipitation Index (SPI), Standardized Precipitation-Evapotranspiration Index (SPEI), and other indices (related to drought)
    - NRCS current conditions information (losing funding)
    - USGS stream gages
    - Reservoir levels – especially important for downstream systems (e.g., Phoenix)

Supplemental Products – comments on examples

- Soil moisture information is very valuable in Southeast
- Soil moisture may be particularly important for emergency managers (related to flood and landslide risk)
- Modeled soil moisture has substantial uncertainty and should incorporate observations
- Most users would (and many currently do) use NOHRSC snow products
- Teacup diagrams not seen as valuable – more for general audience

Should WRMO be scaled-up nationally?

- Yes – but need to be careful when making things consistent
- What would the scale-up issues be?
    - Points available now on the WRMO map aren't quite enough – there should be more points that have forecasts, especially in regulated systems
    - Should consider "points of interest" in community
        - Community members often look at forecast products even if they don't understand the underlying information, especially when looking about "points of interest" (e.g., reservoirs, recreational sites, etc.)
        - Providing information at a national scale could add to this issue
    - Questions about elevation – is there a way to show other locations with similar conditions to a location of interest (e.g., look only at other sites at roughly the same elevation)
    - Need to be careful when presenting information on "percent full" for reservoirs (teacup diagram and other reservoir conditions metrics) in areas where some reservoirs have a statutory "fill line" in addition to a bank-full level.
- Question from participant – can forcings information be made available (i.e., what drives forecast)? Could allow users to select specific years/forecasts that are similar to the current year.