Austin Meeting – Draft Notes

February 8, 2017

Q&A session on NWC strategic plan, NOAA water initiative, and objectives for the day

- Dr Maidment discussed his experience with the Texas Flash Flood Coalition and using the model over seven years ago. He mentioned the importance of working with local partners like LCRA and noted that the University could never stand up the model and keep it going. *Bringing technology to scale with local intel is necessary*. Not a science innovation, but technological innovation. Dr. Maidment suggested regular interactions of this group. We need it to be integrated into the NMW.
- Texas Department of Emergency Management (TDEM): Stairway to heaven slide is useful. For Emergency Manager community, really relying on NWS, but in some regard, like a black box. *Good to know overall vision and limitations. Would be great if it could be presented in San Antonio in May*.
- Lower Colorado River Authority (LCRA): direction is good. Recognize that there are many people working in the garden. "Staying in our lane" at LCRA. Managing reservoirs and predicting levels of lakes and we don't reference forecast or river levels because that's NWS job. Multiple agencies coming into it with different purposes (data, operations, EM function, etc.). *Big missing piece: reservoir ops*. How to get reservoir ops managers in touch and providing data – automated way into the NWM.
- USACE: is there funding for local level engagement? Need to engage other infrastructure groups. Big money in Texas is *transportation.* LCRA and RFC have greats staff and expertise, but staff is limited in RFC.
    - No specific appropriations. Hydrology is inherently local phenomenon. Have an opportunity to take integrated look at basin. Need to draw on local resources. Engaging big sectors of the economy. RFC is the place where you will get your forecast, NWC will provide data but it needs to be validated locally. Local prototypes may be way to do this.
- Maidment: TXDOT interested in putting gauges on new bridges to help build up observation networks

Bob Rose, and Matt Porcher (Panel)

Local perspective (Matt Porcher): Drought and water availability are greater concerns in the future. More than 75% of deaths in flash floods happen on the road. ATXfloods.com shows all low water crossings in Austin and has grown to include more communities each year, would like to expand this to all of Texas. Website is 5 years old and needs to be updated, would like to take this opportunity to expand. Perennial drought broken by occasional devastating flood.

Regional perspective (Bob Rose): One of the biggest issues is increased population growth. People moving into vulnerable areas, i.e., around lakes and river. Climate extremes over the last few years (5 year drought just ended, was one of the worst in history - showed how vulnerable water supply is). Flash flooding from more frequent intense rain events (10 to 15 inches in one storm). Need better QPF and more soil moisture accounting going into the models (whether from soil moisture probes or satellite

imagery). LCRA working with UT to put sensors out in the countryside. *Data exchange is an issue: more and more data from small networks, needs rules of engagement and standards.*

Bring as much info as possible related to interests of our stakeholders into single webpage. Need to be able to pull in USGS, NWS, local data. Need to develop standards. Motivate action by getting people the same basic message from multiple sources.

State perspective (Bob Rose for Roy Sedwick): Too much or too little water. New residents who are unfamiliar with weather, topography, flash flooding issues, and end up underestimating flood risk, do not have flood insurance, do not check floodplain maps. This requires outreach and education.

Increased development also brings challenges: changing runoff and increased vulnerability. State needs community programs, higher standards. Where will rain fall and how much? Will it flood? Need increased rain gauges, support for local NWS offices. Need to understand attributes of flood, get NWS watches and warning to be timely

Panel Comments/Question and Answer Session:

- Soil moisture content: during May floods in Wimberly. *Models did not account for ground water.* Impacted how fast water was moving and severity. Groundwater flow adds to flooding.
- Other local communities getting assistance as part of ATX Flood. What are challenges in putting together their own system?
    - Have passed along the code, but local governments are resource limited. This also siloes data; open data is important.
    - Not every jurisdiction can build their own open data platform.
- Service interoperability allows jurisdictional customization/use but everyone is working on the same base - now have to complete "gymnastics" to bring data together/crosswalk services. Funding is always the limitation, need robust platform to serve data during event.
- Texas Water Development Board has funding from state for flooding issues. Team up with TXDOT to provide interface for each county.
    - Not just about the code, need infrastructure that can handle the traffic during the event. The serving environment has to be strong.
    - TXWater.org is in infancy.
- Bexar County and City of San Antonio: expose our data through jSON server, making data flexible and available. We have a universal data feed.
- Too much data coming at emergency managers. Website public trusts so they do not have to be reaching out to us constantly. Hard to make sure every website/data source is checked during rescue and recovery. *Stage values do not mean anything to the public.*
- Guadalupe Basin: have handout/Flooding Guide for community members to help them interpret what a river stage means for their town.
- Expand all the science to the community. One common language so everyone understands it.
- North Carolina inundation mapping site being worked on in Texas currently. Everyone uses it. They see where their house is, where the roads are. Limitations is not having detailed forecasts.
- *Need event specific inundation maps.* Updated every time NWS issues new forecast by pulling map out of library (6 hours). How often would you like it?

    - Trick in managing expectations, don't want to change so often. This is one snapshot in time. Don't want it to change every time they pull up website.
- For us managing desk, as quickly as possible. But for public, keep it at different interval (1, 5 hrs. etc.). Internal tempo is higher than public tempo.
- Wimberly flood – people were warned to get out of the house. No one had baseline to say, "my house will be washed away." Inundation maps are great, but you need to communicate "run" at some point.
- Three messages: *Texas-speak message, ATX Floods, and data pages*.
- Data available at high level, bringing it down to where understandable to citizens. We have other groups that sensationalize data. Queries from elected officials, superintendents of schools leads to confusion. *Value in having info sources that are open and many people can see.*
- From USGS data collection standpoint: 4 hours used to be good, then 1 hour, now we have 1 minute data! Perception on the public side that the more the better.
- USACE was receiving calls every morning in 2015 - city officials were asking if they need to bring in pumps, do they need to close roads; they wanted specific answers. We didn't know how to manage their expectations.
- TDEM was being asked for a lot of products. *Emergency managers needed maps to know which houses to evacuate.*

Rotation Stations

I. Departure From Normal Streamflow (Station 1)

Departure from Normal Streamflow (1st product/service)

Additional data/context

- Flood managers and first responders would like to have USGS gage information overlaid and have stage data included or some other way to cross reference depth.
- Somehow designate what rainfall model is used to produce output because this is important for emergency managers to understand (they are looking at limited model information).
- Product needs a reference to flood thresholds (minor, moderate, major).
- Reference information to normal flow (need to see cfs of normal as comparison).
- Need records/historic information (record levels information), county lines and topographic reference (pull information into local applications/systems), basin boundaries and reservoirs, radar information and precipitation accumulation as overlays.
- One hour time step is not small enough for small basins. For mainstem, hourly is fine. Slice volumes into daily, 4-hour, 6-hour.
- Need peak flow information to time measurements and cumulative flow information for reservoir operations.

Uses

- Situational awareness in Emergency Operations Centers.
- Single map showing worst case scenario would be helpful for decision support.
- In dry areas, it may not mean much.

Capability

- Need automated playback function (play feature).
- Capability to query location, type in address and zoom.

Color scale/cartographic issues

- The scale matches USGS WaterWatch – visually a meaningful product.
- Color scale should be consistent with AHPS & USGS.
- Red should not represent low flow (typically think of red as representing bad situation).
- Color scale preference (green, amber, orange, red).
- Too many color categories.

Other issues

- Questions about updates to models (need transparency) and improving model output, e.g., how is model information (certainty) communicated to partners?
- Anomaly is not an easily understood term, what does it mean to user?
- Public facing – needs to be more simplified. Streamflow rate? What does "streamflow" really mean?
- Important for user to be able to bring in information to customize and add overlays
- Useful for identifying "hot spots."
- So much uncertainty – compared to annual normal (not daily normal).

Time to Exceedance (2nd product/service)

Additional data/context

- Time to peak information would be helpful and consider double peak situations.
- Density of data – need georeferenced information for public. Public may find it hard to find their location on a map.
- Antecedent Soil moisture information would be helpful to support product.
- Most important ingredients are precipitation, soil moisture, and flow.
- Need capability to ingest information & users apply internal thresholds.
- Tie in observed data to show certainty. Between observations, display uncertainty.

Uses

- Recommended as an internal tool, but should be available to public (important to be consistent with everyone looking at the same information).
- State of Texas uses 3 days out (rotate each day for situational awareness). Six to ten days are not as important (anything beyond 5 days is unrealistic). 10-days not practical for the upper (flashy) basins.
- Useful to people in the lower basins – coastal areas, not as useful for reservoir operations.
- Post analysis tool – educate on flood event.

Capability

- Need cumulative precipitation tool where you set starting & ending date/time.

Color scale/cartographic changes

- 1-15 hours: colors do not mean anything. Use a color ramp or a thicker to thinner line.
- "Not Exceeded" term needs additional information (Not Exceeded in next 15 hours). By itself, gives a false sense of no threat.
- Add "estimated" time to exceed high flow.

II. Inundation (Station 2)

Additional data/context

- Dots at stream and roadway intersections to indicate probability of over topping. Maybe provide some probability that you should not cross. Or even simple measure of "probably a flood here." Low water crossings, bridges and other river crossings should be included.
- Define what is happening at interaction points, that is where the value of this service comes in.
- In Texas, NRCS structures rated as "high hazard" in urban environments built for soil conservation purposes. Should be included.
- Historical flood information is helpful, some advocate putting 100 year flood on there.
- Timing depends on location and depends on basin size. Emergency Managers for Bastrop and Blanco maybe every hour, but the City of Austin is more like every 5-15 minutes. Maybe make the service threshold-based? Shell creek in Austin goes through downtown and has killed a lot of people. It takes 15 minutes from center of rain to hit channel and 45 minutes to get to 12th street. In an hour, done. Need to start forecasting as soon as you see heavy precipitation.
- 24 hours, time of validity, clearly marked transportation infrastructure (structures would be included in satellite imagery used as basemap).
- Emergency managers thought it would be nice to know what weather model the inundation is based on (NWM foundation is QPF from global forecast system and HRRR, use all available data.)
- Should consider culverts or bridges in areas where inundation intersects road. May not lead to actual road inundation event.
- Include the time that the forecast is valid – an hour from now? 24 hours?
- Counties' boundaries would be helpful. One of the downsides of GoogleMaps.
- Cities may want extra-territorial jurisdictions (fire, police response-area).
- Overlay with USGS gages and current observed time. So people can ingest the model data, what the forecast is at that point (USGS gage X, forecast to get to X).
- Water utility infrastructure included?
- Need awareness on front end where floodplain comes in.
- At state scale, parcel data is useful. Can see businesses and homes impacted.
- Highly populated areas, beyond the census block (population by census block is not high enough resolution – do not know where people are living in the block). Seasonal populations, e.g., Texas State (University) is highly populated during certain times of year.
- Basemap with county roads (Google has not updated county roads). Add major railroads/commuter rail?

- Add watershed divides? HUC 12.
- Including a worst-case envelope? What's the worst that's going to happen during this period. Do it once (with worst case extent), but do it every hour. Point and click under worst case scenario.
- The low, medium, high flow map.
- 2,000 NRCS passive dams. Model can include these. No current mechanism for ingestion of local information to migrate into model.

Uses

- Product/service for emergency managers to use to decide on closings. Measure of risk rather than "be careful." But different for public – they want absolutes, not probability.
- inundations in more urban areas. USACE mapped 2,000 miles of stream reach in urban areas. Inundation maps that changed with each new forecast and emergency managers were using them to evacuate people. Developed using engineering models, marry flow estimates to feed that. USACE doing this with RFC forecast points (need the flow, not inundation).
- Short window before tropical storm, saw drop down to 35% runoff. Takes about 24 hours to tweak model to get results. RFC can issue ensemble, however they tried and all customers declared they did not want the ensemble.
- Use the HRRR for situational awareness as long as have forecasts on known observed stations that allows us to go forward and interpolate flow. But real time, want to see data, almost as fast as we get a Doppler scan - 15 minutes would be great.
- These tools are even-driven, but another outlet to determine what your risk is.
- Could collaborate with the Corps to make a product with flood-control implications.

Capability

- Stream reaches – level of density is a lot. Would be great if you could query by county or basin. Most emergency managers manage their jurisdiction.
- Maybe being able to export into KMZ file?
- Would be good to have a dial. An adjustable map which gives you a range. Slider bar with depth or with time.
- Email service associated with worst case scenario envelope, e.g., different thresholds mean customers receive reports every hour.
- Like the idea of going up or down by certain threshold and that pulls from established library. What are maximum threshold or minimum threshold. Provide to our first responders who know the areas better.
- Every map comes with flexibility and also becomes a feedback mechanism when local intel is added/included to adjust the forecast. Then could that adjusted forecast get fed back to the NWM?
- If depth could be sent out as a service, that would be great, but could also say that is a local task. NWS sets up the service and then some communities have Lidar and could incorporate it in.
- Isolated communities – only one way in and out (have to figure out this at local level).

Color scale/cartographic issues

- Like the green, amber, orange, red. Color coded based on severity?
- Hard to tell at first what is being displayed. Labeled differently.
- Legend should be included.

III. Uncertainty (Station 3)

10%, 50%, 90% 3-Day QPF graphics

Additional data/context

- Good to know the high-side of rainfall possibilities depending on soil moisture conditions and reservoir levels. Multiple factors could increase the severity of a flood by many fold depending on antecedent conditions.
- Knowing location is critical.
- Deterministic helpful qualitative assessment; range adds unnecessary complexity.
- Helpful to see worst case and also to see timing and amounts within 72 hours.

Uses

- 3-map graphics of the 10/50/90 percentiles good for planning purposes but not for public purposes. Could erode forecast perception. Example: "Am I going to get low-end 4 inches or high-end 18 inches?"
- User interpretation is absolute min and max.
- Could be useful to public responders for positioning resources and planning; forcing hydrologic models.
- Useful for qualitative assessment.
- Emergency managers want to know the confidence level of the forecast and this product can both help and hurt at times.
    - Broadcast media sometimes does not help by showing multitude of rainfall accumulation models from 2 inches to 20 inches. These values are at odds with each other and then are sometimes at odds with the NWS forecasts.
- Uncertainty in location vs. uncertainty in magnitude - highlighting that QPF maps can be very important and thus need to be as accurate as possible. Where is the (flooding) problem and how big is the (flooding) problem.
- 1-3 days was generally accepted as a useful timescale among the group for planning purposes. 6-12 hours could be useful more higher confidence locations and amounts (if possible) using hi-res model guidance.

Capability

- Three different flood maps [of possible maximum flood extent/inundation] could be computed for each scenario.

Long-Range Experimental Flood Risk

Uses

- LCRA will look at long-range El Nino/ La Nina and global circulation patterns for possible wetter than normal or drier than normal conditions that may result in slight hedging of reservoir pool conservation. Used some Climate Prediction Center products.
- It was suggested that long range flood risk probability may be more used in drought situations as to when normal flow or even higher than current flow could return and that could drive some long-range water conservation or power generation policy.
- No immediate or even short term actionable planning or decisions could be made or justified off a three month outlook. Needs information that is actionable for a week time frame or less.
- Emergency managers don't think would use - maybe for "heads up," but unlikely; most concerned with short term forecast.
- Use as prediction tool for low flow concerning GW recharge for water use mgmt.

Short Range Probabilistic Forecast Models

Additional data/context

- Would like to see precipitation in plot.
- Less charts and more geospatial maps used to convey scenarios.
    - Can a flood extent or inundation map be made for the high-end, most-likely, or low-end hydrograph? How would that be interpreted?
- Helpful to have NO QPF flow trace.
- What is the driver or forcings behind the various hydrograph outputs?
- Why would a river vary that much on such a short term?

Uses

- Valuable to USACE, may use for project releases (i.e. Near-term, uncertainty difference).
- LCRA use: is it going to rain/flood on top of releases? Need to be clear about what's included in product.
- Main use is qualitative application.
- Very useful for flood planning; most stakeholders present concerned with flooding. Also maybe recreation - difficult to explain to public and less sophisticated users.
- Defining audience and labeling as such would be helpful for planners to know how to use/re-distribute to their customers.

Large Group Debrief

Rotation Station Voting	Uncertainty	Inundation	Departure from Normal Streamflow
Partners	35	35	14
NWS	4	11	10

Thoughts on Services/Products:

- Drought and water availability: uncertainty was the only one that addressed that
- Anomaly tool wasn't useful, concept interesting. Confusing how we might use it.
- We have an inherent feel for the flow, don't need a map to tell us that.
- Inundation and uncertainty are more familiar concepts and anomaly is more abstract. Take time before the information content is understood by people.
- For local NWS, anomaly is most important product. Doing very good job at identifying area we need to focus resources on in short term 1-2 days out.
- Anomaly: if you could step through the future and see flood wave that would be useful information.
- From GIS perspective – anomaly requires a lot more work to make it understandable to other people.
- Internally, helps us do our job. But maybe not worth making investment in public product associated with anomaly.

Lunch discussion

Inundation:

- Static maps are good start, maximum extent over next hours is good way to go.
- SPC has storm scale ensemble of opportunity, can set thresholds and get emails.
- Who is audience? Public vs partner?
- What's the next level in converting this to actionable information?
- NWS is doing a good job with public facing information - keep it simple.
    - Only show stream that are problem (>2x normal) in anomaly map
    - This could overhaul flood outlook product (short and medium term products)
    - People don't know what normal is, so anomaly product is not useful.
- Valuable to be able to share consumable info on social media.
- Over-warning is still a problem - overload leads to people tuning information out.
- Need to educate local EMs and mayors on how warning products will change through HazSimp, they are able to translate to their local citizens.
- San Antonio graphical products are easy to understand, would be nice to be automated to show this for hydro impacts.
- Impact statements in plain English are valuable, but these are naturally general because drainage inlets get plugged - put this on a general map.
- Alert to mobile phones to warn people they are in an inundated area?

Uncertainty:

- Communicate this in message (what you can expect generally).
- Need simple graphic that catches public eye, states and counties can do app and put this information out for their users - there is not cross agency collaboration at the state level in Texas.
- NWM is integrative framework for information at local level to work off same baseline.
- Need confidence that NWM is matching forecasts, want to integrate reservoir information.
- Texas should be case study for this - what is goal and objective? Demonstrate how engineering models can be linked.

- NWM web page is showing hydrograph, why isn't USGS stream gauge observed info included on this?
    - Flow vs. depth, but TDEM and Dr. Maidment are converting using synthetic rating curve