Questions posed to WFOs/RFCs in NWS Southern Region (Nov 2015)

1. What are the biggest challenges (e.g. program area or weather phenomena) your office faces? Do the current production suite and products adequately help you address those challenges?

2. Is the current amount of available NWP guidance from NCEP too much, too little, or the right amount?

3. What do you need in terms of models or products to meet your challenges in the next 1-2 years?

4. What do you envision your model/product needs to be in the longer term (3-5 years)?

16 responses received. The responses below were compiled by Greg Patrick, SRH STSD, with little editing.

<u>From WFO Norman OK</u>

1... while severe convection is a frequent hazard here, our forecasters believe that winter weather concerns are by far the biggest forecast challenge we face.
#2.... Too little.
#3.... We need access to more ensemble and anomaly NWP data. Many of these sources must be accessed online rather than in AWIPS .
#4.... We have to develop tools to quickly evaluate anomalies and deviations in the models. These tools could be leveraged more easily in workflow with the NBM versus the current suite of deterministic models.

<u>From WFO Birmingham AL</u>

The big thing on my mind currently is the plan to incorporate the enhanced short term at local offices. So far, I have not been blown away by our ability to model the short term QPF in a reasonable fashion. Add to that the go-ahead on ending local modeling, and the prognosis looks even worse. Do they have a plan to combat this?

<u>From Arkansas-Red Basin River Forecast Center (Tulsa OK)</u>

Looking for two things: Improved QPF from the HRRR, and Verification of probabilistic models [ensemble model output] especially QPF

<u>From STSD member at SRH</u>

1. Not sure here, but would bet winter precip type, convective mode and heavy rain are the biggest issues.
2. Too much. We have to find smarter methods of interacting with the data and finding meaningful information.
3. Short term ensemble output focusing on sensible weather/radar fields.
    a. Probability of 50 dbz above 30,000 feet, probability of precip exceeding XX value, probability of winds from a certain direction or speed etc.

b. I would lean against synoptic fields as I don't really think a mean 500mb map is all that valuable with hi-res data.

c. Climate context to deterministic or ensemble based sensible weather (anomalies) Example: What are the chances we exceed a 1 in 100 year rain event? How often does the GFS project this much rain?

4. Less push (to the offices) and more pull. I want to interact with the data to answer questions I'm being asked by core partners. Questions like, "what happens if the front arrives 2 hours early?" "What happens if the hurricane shifts 40 miles east?" "What happens if the 5 deepest members of the ensemble verify?"

<u>From Tampa Bay FL</u>

1. Fire Weather - We require several hi-res (sub 5km) model suites to compile a working ensemble for sea breeze penetration and timing. DSS-wise, this has proven to be a valuable asset for controlled burns where wind direction changes can close major highways. It's challenging to deal with multiple and interacting sea-breeze boundaries.

   Marine - Sea fog and cold advection gradient winds mixing down into bays and waterways.

2. Far too little. We need access to all of their latest hi-res guidance, including, if possible, the experimental guidance. Right now we have to download the files and send them through LDAD to ingest into AWIPS.

3. As in number 2 above, more hi-res guidance to produce neighborhood probabilities. Provides powerful DSS tools for Visby/ceiling concerns, severe storms (updraft helicity), and superior probability of precipitation forecasts.

4. The ability to have a floating window for even higher resolution runs would be ideal. The Tampa Bay pilots have big issues with sea fog in the bay during our cool season. Sea fog also has impacts on commercial shipping. Land and sea breeze circulations often drive both the extent and timing of the fog. I could see us providing DSS that include animated probabilistic guidance for visibility, but this would have to be run at very high resolutions over the bay. While there are newer guidance such as the NARRE and SREF that give some guidance toward seafog, both of these ensemble sets are far too aggressive with the prediction of seafog and hence offer a lot of potential for false alarms. New research into ways of modelling seafog would be a great asset to our bay and marine forecasts along with other offices as well. Hi-res nests could also be used to provide animated DSS graphics to show wind shifts for the fire weather community.

<u>From WFO Key West FL</u>

1. A. Resolution (spatial) - to resolve our islands and mesoscale effects they cause (mainly in wet season), we need to be modeling near 2km resolution or higher. The HRRR is around 3km (I think), but the HRRR domain doesn't go far enough south, so we have boundary

issues - thus rendering the HRRR pretty much useless over the Keys. I've spoken to Geoff DiMego about this, and one of the things he recommended (because the HRRR domain is not likely to be expanded) is to allow us to continue to run our WRF-ARW locally at 2km (which we do). Ultimately, it would be nice to run an ensemble at 2km+, but we don't have the computing power to do that locally (using various physics schemes and cumulus parameterizations).

B. Resolution (temporal) - we not only need to run at 2km or less, but we also need hourly temporal resolution. Now, we can get into all kinds of discussions here about hourly grids, but that's not my point. The meso-gamma and micro-alpha phenomenon here (cumulus lines, waterspouts, mini-supercells) also operate on much shorter times scales. It would be nice to run our model every 3hrs (with proper initialization), but that's out of the realm of our capabilities locally (again, computing power).

Another thought is that AWIPS is geared for CONUS, so we don't receive products in the proper resolution to our east - where all of our weather comes from for 6 months of the year (tropical season). This includes model and satellite data. We need high resolution in both the Atlantic and Caribbean - the products available in AWIPS do not provide this. At times in tropical season we use the internet more for data than we use AWIPS.

2. Too little. I would be surprised if anyone said too much or right amount. We have always been limited by bandwidth (SBN), so we don't even receive the NCEP products at the temporal or spatial resolution in which they are producing them. Also, the GFS is run out some 384 hrs, but for some reason we only receive 240. We've got to get past this bandwidth issue - how long have we been talking about this? I've always maintained that we could go with internet for the primary data feed (this can be done securely), and use SBN as backup in case of internet outages.
3. I think the above gives you a good idea of what we need. We need to be able to model at hi-res over our area, including Cuba (which the HRRR doesn't) because a significant aspect of our weather is affected by Cuba.
4. Any progress on the above would be a major step. I would also like to have the ability to produce our own blends using local products (modeling). This is especially important for our marine winds.

<u>More from WFO Tampa Bay FL</u>

1. Fire Weather and Fog forecasting. We need to have hi-res models that would focus on fog development and forecasting etc. Better Hi-res models would also help with better winds/mixing heights/transport winds and thus better overall dispersion forecast output.

Another challenge is sea fog development and dissipation. As mentioned above better hi-res models centered on the eastern Gulf waters would be great to have.

2. Not enough. As a Weather Forecast Office we should be able to have the best Hi-Res models available to us right in A2, without having to go through an ingest and download process. The models should all be available similar to the GFS/NAM etc.
3. Better model probability guidance for use in Sea fog forecasting. The mariners as well as the Tampa Bay Pilots have major concerns when dense sea fog impacts the Bay waters during the late fall and winter months. Having better hi-res model guidance focused on this weather element over the Bay would be greatly enhance our timing and forecasting of the fog as well as providing better DSS support to our EM's etc.
4. With ever expanding DSS delivery, I would see us needing even better hi-res model output for land and marine weather element s. This hi-res guidance could then be put to use within a DSS webinar or email briefings with portions of these briefing possibly becoming automated via the model ingest. I could also envision better detection of severe weather and issuances of warnings with the better hi-res model guidance focusing on convective parameters/development i.e. updraft helicity .

   I also feel that, NCEP and the NWS needs to be sharing experimental and parallel runs with the WFOs. Why not let the forecasters evaluate these solutions, while providing potentially superior output. A2 is designed for quickly getting new guidance to display, so why not utilize this aspect and improvement in our systems.

   Newer ensemble guidance solutions such as the NARRE (North America Rapid Refresh Ensemble) will need to be extended in time. Current 12 hour solutions are good, but we need these type of solutions out through at least and entire TAF period, especially when one considers the time-lag in when the data is actually delivered to the WFOs.

<u>From an STSD member at SRH</u>

1. I need more anomaly-based fields available to me, so that I don't have to calculate anomalies myself. I would also like to see GIS services of more model output available, perhaps as part of an effort to develop a more geospatially-friendly MAG site that leans on underlying services that could either be viewed there, or tapped elsewhere.

2. There is so much data all of it can't fit on the SBN. I would like to see MORE available via NOMADS, that I might tap via AWIPS2 Data Delivery, which one day soon I hope reaches maturity.

3. Anomaly-based output fields from the models. Also need HRRR output to at least 30 hours to support 30 hour TAFs (KDFW, KATL)

4. More anomaly-based output fields from the models.

<u>From WFO Shreveport LA</u>

1. In the winter, our biggest forecast challenges tend to be timing and precip type, because of the potential for cold air damming to our north. During the fall and spring, the forecast challenges tend to be with timing and the severe wx. Case in point, we had a couple of events this past month, were the timing of severe weather and whether or not we would be unstable enough. In both events, tornado watches were issues. In one case, we had a tornado, but nearly an hour after the watch expired. No other severe weather was reported. In the other case, the tornado watch was issued, and we had straight line with damage but no tors. *Does the suite of products meet your needs?* Yes and no. I would say for the extended, yes, and even for the short term to a degree. However, only have high res data (especially the hrrr out to 24 hours), isn't as useful as people think. I realize there maybe be feedback loops within the models to worry about, but we really need to at least 48 hours, and preferably up to 84 hours like you would get from a local wrf.

2. Again, it depends. Most forecasters in this office are still looking and primarily using the deterministic runs, even though the ensembles are there. So in a way, it is data overload, but I have other forecasters that say it is the right amount. One forecaster wishes the maps were better though.

3. I would love to see the high res models out to 48 or 60 hours. I think in our era of DSS, we need to think bigger picture, and not just in the first 12 to 24 hours with severe weather. To give our EMs as much heads up as possible with an impending weather event, we need to get comfortable putting out non-severe watches 72-96 hours out, but with this, our forecasters need to have the confidence in the models and products they are dealing with.

4. Hopefully, the high resolution models out to longer time scales, whether it is 84 hours or 120 or even on longer terms, it will help with our DSS activities.

<u>From WFO El Paso TX</u>

1. The challenges for our CWA include:
    a. A highly complex terrain ranging from 3800 to 12000 feet with populated communities all the way up 9500 feet (Sunspot).
    b. A multitude of micro-climates with multiple smaller sub modelling scale mountain ranges that are not properly accounted for by most models
    c. High degree of moisture variability due to terrain affects with arid deserts and forested mountains.
    d. Large data sparse region to our south (Mexico/E Pacific Ocean) which is where much of our moisture comes from, and is often times under forecast by models especially in the non-summer months. Low level moisture surges from the east and southeast (Gulf of Mexico) seem better modeled.
    e. A significant fire weather concern in our area that is compounded by complex terrain.
2. Model issues we have noted
    a. Problematic model convective schemes that over forecast in the summer monsoon season and under forecast at other times of the year.

b. Convective parameters do not always line up well with resulting storm intensities and tend to under forecast.
c. QPF by the models is very poor for our area. Models usually over forecast QPF for the deserts and under forecast for the mountains
d. Snow Amounts are worse and pretty much unusable. Often times generating snow with too warm temperatures. There is also inconsistent performance from system to system with some under forecast and others over forecast.
e. GFS model appears to do okay with mid and large scale features for our area even if the QPF is off.
f. HRRR model is hit and miss. It generally over forecasts precip coverage and amounts but occasionally it will catch small events. It captures trends in winds but not magnitude.
g. Forecasters have used local knowledge to compensate for model deficiencies as best we can but better QPF fields would be a great help.
h. NBM model is a step in the right direction with its improved resolution.

3. Amount of NWP Guidance available to the office
   a. Some of our forecasters would say you can't have too much model data while others use only a limited set of the data that we currently have available.
   b. More model guidance is always welcome, but it needs to be useful and relevant to what we are forecasting and for decision support.
   c. NCEP mentioned that awips is getting only around 5 percent of the data they produce. What are we missing?
4. Future Modeling needs
   a. Our biggest need is a robust very high resolution model output centered on our CWA that would better take into account our complex terrain and would be better tuned for our local climate and mesoscale/microscale effects. This would be one of those local models run out of NCEP that was mentioned at the SOO-DOH conference.
   b. We need better QPF, POP and Snow guidance from models that is tuned to our desert area but also takes into account our sky island mountain ranges.

<u>From WFO Lubbock TX</u>

The number one, by far, challenge and need from NWP is improvement in convective initiation. We are very comfortable with the current hi-res model suite and interpreting its output so improvement in timing, location and mode of convection would be the most urgent need. Also many forecasters compose their own poor-man's ensemble blend by viewing other hi-res models from NSSL, NCAR, CAPS, ESRL, etc. so a robust ensemble in the 0-18hr time period will add to IDSS abilities. With the push of NBM there is less concern from forecasters on longer range, global model improvements.

A common winter weather challenge is also low level thermal profiles especially with shallower air masses in determining depth of cold air and p-types. We also struggle with developing/closed lows in the southwest U.S. and those that emerge from Mexico where data is traditionally sparse so more comprehensive data assimilation methods especially satellite-derived data would benefit us there.

A tertiary concern is need for the better prediction of elements critical to fire weather, specifically low level thermal fields and surface RH and winds.

From two coastal WFOs (Houston TX and Melbourne FL)

Support unfunded buoys (i.e. 009, 010, ???) for marine observations, data assimilation, model initialization; model improvements; validation/verification

Develop mechanism toward delivering high-resolution 15-min analyses (of at least surface elements); near real-time analyses

Increase HRRR output thru 24 hours

Push delivery of HRRRe

Probabilistic wave heights

Improve model blending schemes for vector elements (extended forecast) to prevent averaging-out; maybe a max wind magnitude/probabilistic critical threshold guidance (>20kts) could help in the extended to supplement what we are doing due to the vector averaging that is occurring.

Support local model "configurations" to address local issues; for example, simulated radar (forecast next few hours; five minute output to match radar); deal with model terrain issues (resolving barrier islands, etc.); could do this from WFO through central server

Provide other marine elements such as wave steepness, etc.

Improve RTMA for coastal marine environment

From WFO Fort Worth TX

1. The biggest challenge as I see it is having model guidance that can accurately forecast phenomenon in the short-term (0-24hr) part of the forecast period. This includes obviously convection, but also looking down the road to digital aviation services, we will need better sources to draw from for CIG and VSBY guidance. Currently we've only got the RAP and the HRRR to fill this role. Since the HRRR is just an extension of the RAP I feel like we need more. Short-term rapid cycle high-res WRFs are being run at some individual offices, but there's no reason these can't be provided by HQ.

2. Long term model data supply is good. Again, not enough model data available for short-term purposes. Going to the web to view various CAM output is inconvenient at best and doesn't allow for easy or routine assimilation into digital products or the forecast process for some forecasters.

3. and 4. Officially supported hi-res CAM guidance and/or another rapid update type model with different physics to supplement the RAP/HRRR is going to be a huge need. We need more detailed CIG and VSBY guidance, not just output that is post-processed stuff developed off of algorithms from base fields in house.

From WFO Tallahassee FL

1. Biggest challenges

-- Winter/spring severe weather; Heavy rain; Tropical cyclones; Summertime severe

2. Too little. Large scale guidance struggles with the magnitude of heavy rain events along the Gulf Coast. Nationally supported CAM guidance is limited and does not go out far enough in time. We have learned that the true value of CAM guidance is not with individual cores or runs, but the ensembling of the available CAM guidance. This provides us with usable PoP, temperatures, QPF, and multiple severe weather probability fields. This type of output has been invaluable in a number of local severe and heavy rain events over the past 2 to 3 years.

A single HRRR run out to 18 (or even 24 hours) does not provide enough lead time for effective IDSS, nor does it provide enough sampling to help judge the uncertainty surrounding an event. Our locally developed ensembles do just this.

We only have access to limited amount of the total guidance available. We should be able to access pretty much all available guidance from within AWIPS.

3. We need true ensemble CAM guidance run nationally, with both raw data and processed probabilistic products available to all WFO's. The probabilistic product might be the most important ones.

An increase in the amount of guidance we are able to ingest into AWIPS. This includes tropical cyclone guidance (HWRF/GFDL).

4. Besides the guidance mentioned above, we need to bandwidth necessary to access and process this data.

From WFO Miami FL

1. Access to high resolution members in AWIPS from which to calculate reliable probabilities of different phenomena. Case in point, formation of sea breezes, inland penetration, timing on onset of convection. This has implications to convective, severe and Aviation wx forecasts, short term forecasts, Fire Weather support and DSS support of public events.

Due to interaction of PBL with Marine boundary layer (MBL) and vice versa and how that is represented in the models, forecasting sea fog as well as inland fog is a real challenge down here. Can better guidance be made available or developed for this? This has implications to maritime interests as well as DOT interests down here. Any time fog becomes a forecast issue we are inundated with spot forecast requests.

The same with forecasting cold air intrusions this far south. Temperatures in the 40s not to mention 30s all the way down here are highly impactful because of the nature of our agricultural interests (cold

sensitive crops). PBL/MBL interactions play a critical role in air mass modification and our ability to properly forecast how far south cold air intrusion will occur.

2. Far too little. The temporal resolution is completely not adequate. In order to truly understand the message and trends in a explicit convection model, you must see at a minimum of hourly resolution, with hourly maximum fields for the convective fields. Giving these guidance members at 3 hour temporal resolution is not useful for sea-breeze, sea-breeze storms, and internal convection processes, such as updraft helicity and updraft velocity. Plus, as with any explicit convection models, you need many solution with different microphysics to get a good idea of the potential from a system. NCEP provides only one ARW, NMM, and NMMB core.

Additionally, I cannot overemphasize enough our ability to have access to high resolution ensemble members for reliable probabilistic estimates.

One important point I like to make here too is that the AWIPS main 3D diagnostic tool is LAPS. LAPS is not updated as frequently as it should in the system and is pathetically way behind the curve relative to the latest version and capabilities available to the rest of the enterprise. NCEP's only analysis tool available to us is RTMA. But it is not a full 3D diagnostic tool.

I cannot overemphasize enough the need to have a full, well quality controlled 4D diagnostic tool in AWIPS (could it be a future version of RTMA) of at least hourly resolution enabling forecasters to make mesoscale analysis in their working platform. This tool would ingest and assimilate and increasing number of data in the future (especially with the advent of GOES-R). The benefit for maintaining situation awareness ahead of severe weather would be tremendous. Not to mention to anticipate based on good combination of pattern recognition in the mesoscale and recognition/application of conceptual models as well as models validation.

3. We need to be able to continue to run our locally tailored models. We need the bandwidth to be able to go out and get other explicit convection models, such as the NSSL WRF-ARW, UCAR WRFARW ensembles, etc. until the time we can get those in AWIPS.

Additionally, the answer to high res convective allowing models cannot be just HRRR which we only get in a limited capacity. Again, our ability to get full 3D fields from these models is important as well as our ability to get ensemble systems from them that would allow us to synthesize their information and make reliable probabilistic estimates. Until this need can be fully replaced centrally we need to be able to continue to be allowed to make up for it locally even if in a limited way.

4. I feel that, NCEP and the NWS needs to be sharing experimental and parallel runs with the WFOs. Why not let the forecasters evaluate these solutions, while providing potentially superior output? A2 is designed for quickly getting new guidance to display, so why not utilize this aspect and improvement in our systems.

Newer ensemble guidance solutions such as the NARRE, will need to be extended in time. Current 12

hour solutions are good, but we need these type of solutions out through at least and entire TAF period, especially when one considers the time-lag in when the data is actually delivered to the WFOs.

I would also add that we need tools in AWIPS and GFE that would allow us to make probabilistic assessments, sometimes even tailored for specific customers based on impact catalog from a reliable number of high resolution models accessible to us. This is a way to process the increasing amount of information coming to us over the coming years in a matter that allows us to synthesize while being able to provide and/or make better risk assessments for our customers.

<u>From WFO Mobile, AL</u>

1. Biggest challenges (not necessarily in order of importance):

•Fog development

•Convective initiation/seabreeze

•Marine winds

Most of this is somewhat dependent on boundary layer parameterization.

2. It's difficult to say whether the amount of available NWP guidance is too much, too little, or "just right." Why say this? It's the quality of data more so than the amount of data. I believe most NWS meteorologists can more-or-less "deal with" output with poor temporal or spatial resolution. If I receive poor performing output from high-resolution guidance, though, it won't be used...plain and simple.

In order to meet increasing DSS-related demands, we need the ability to access quality high-resolution (both temporally and spatially) ensemble and probabilistic information within AWIPS.

3. What do you need in terms of models or products to meet your challenges in the next 1-2 years?

4. What do you envision your model/product needs to be in the longer term (3-5 years)?

Global non-hydrostatic models will be coming. I suspect additional convection-allowing models will also follow. EMC has already stated their willingness (I believe at the National SOO Conference) to work with WFOs to evaluate experimental runs. (It's just there's no real process in place for this right now.)

Over the next couple of years, the "data fire hose" will be turned on to our meteorologists. We must begin developing tools now to assist in assimilating multiple data sources. This, in turn, will not only aid in diagnosing the evolution of high-impact events, but also improve situational awareness and accuracy of the meteorological analysis.

/end of Southern Region report