



**NATIONAL WEATHER SERVICE**

*Building a Weather-Ready Nation*

# Communicating Confidence and Uncertainty

*in the NWS Training Center's Impact-based Decision Support Services (IDSS) Deployment Boot Camp*

AMS Annual Meeting - January 15, 2020  
Megan Taylor | NWS Training Center



@lilwxaddict

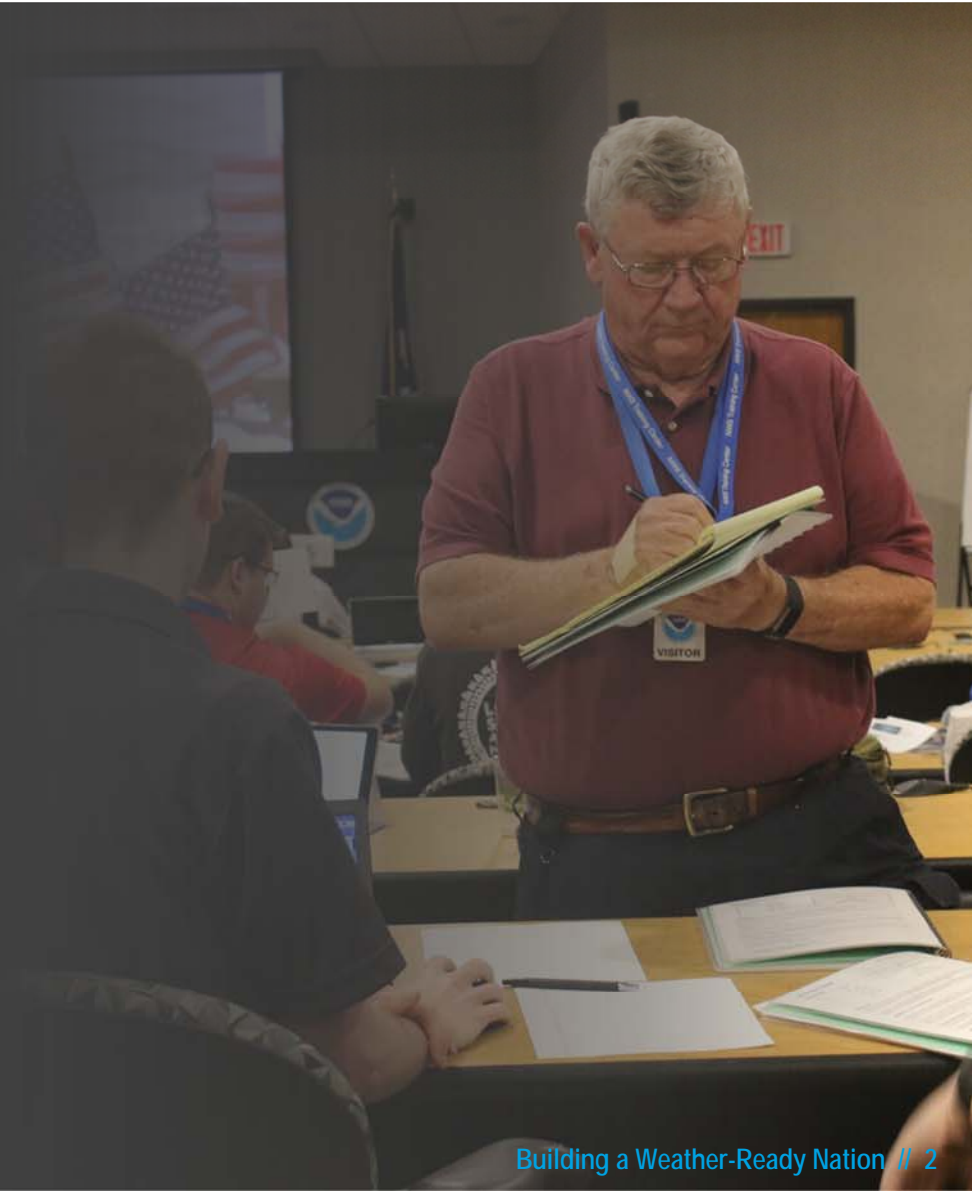


# Questions

Should we communicate uncertainty in our forecasts?

If so, how do we do that effectively?

Will people still trust our forecast?





# Research Tells Us

People understand that there is uncertainty with weather.<sup>1, 2, 3, 4</sup>

People interpret deterministic forecasts as uncertain.<sup>5, 6</sup>

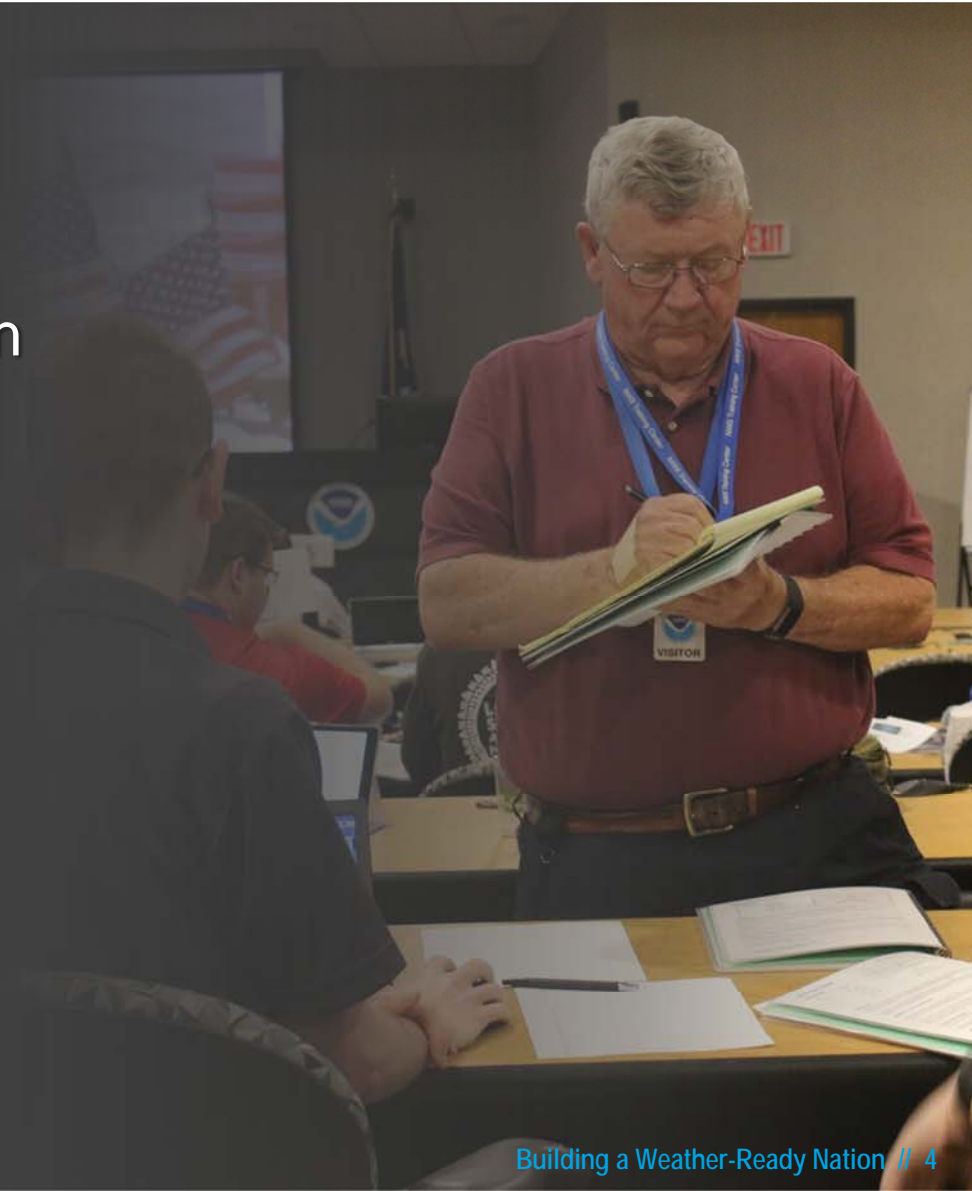
People make better decisions when given uncertainty information.<sup>7, 8</sup>

# Questions

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# IDSS Deployment Boot Camp

Intense 4 days with exercises, drills, and full-day simulations.

Focus on NWS deployment to a partner location.

One simulation includes a snow forecast with a high degree of uncertainty.

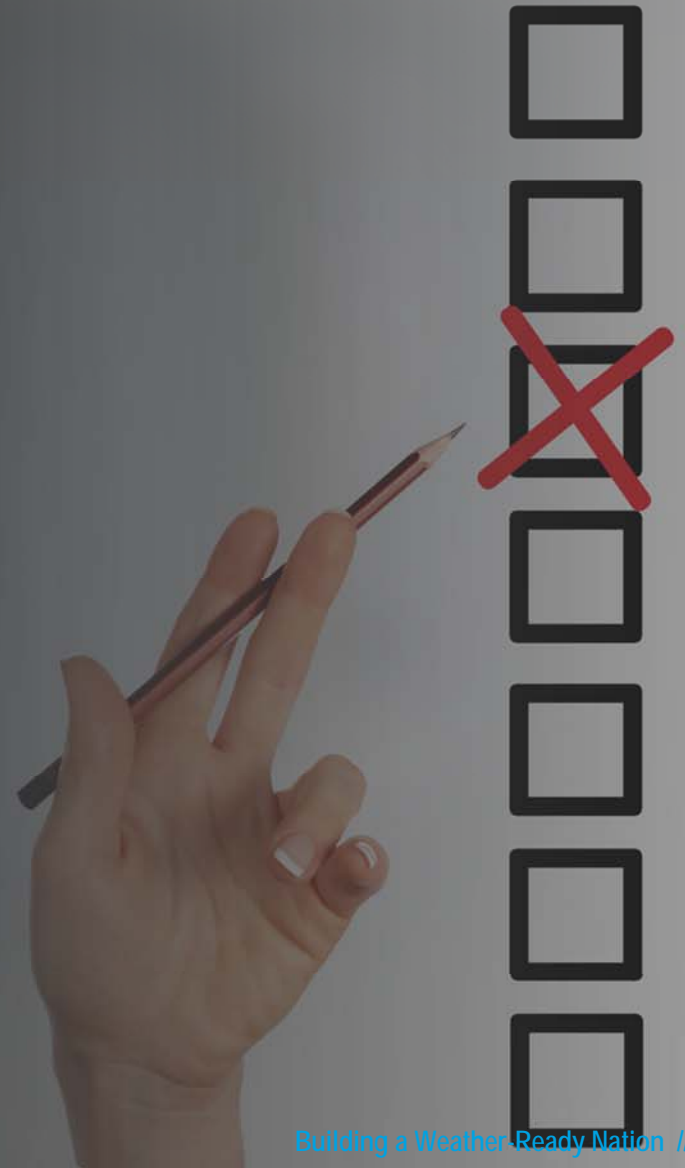
# Survey of Participants

Emergency Managers (11 responses)

Former Trainees (98 responses)

## *Caveats*

- Small sample size
- Training environment
- Relies on memory



# Survey Choices

## Deterministic

*(there will be 6" of snow for location X)*

## Range

*(there will be 4-6" of snow for location X)*

## Probability

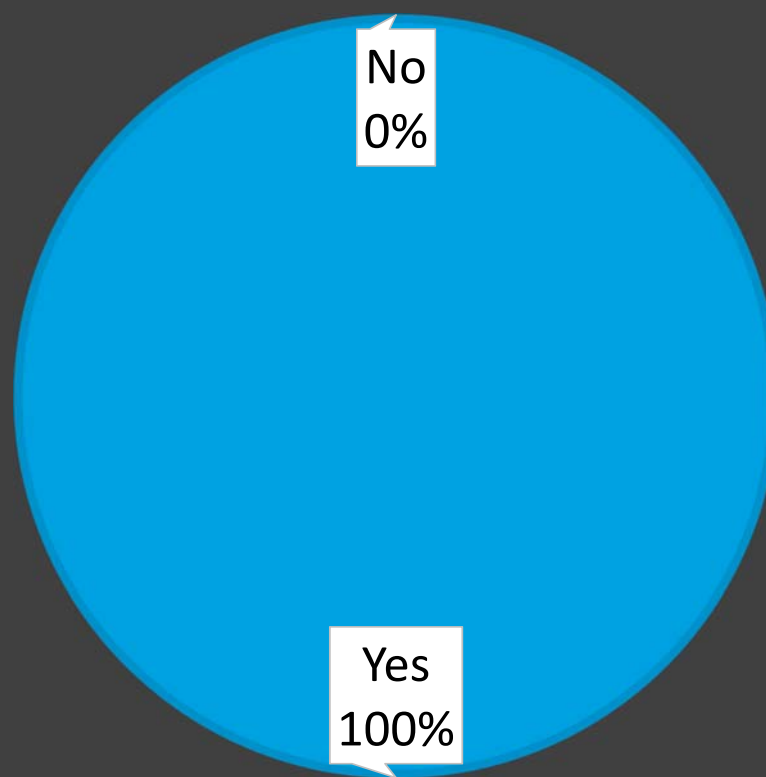
*(there is a 50% chance of 6" of snow for location X)*

## Best case vs. worst case scenario

*(the official forecast is 6" of snow, but the worst case scenario is 12" of snow)*

# DECISION MAKERS – DO YOU WANT TO KNOW HOW MUCH UNCERTAINTY IS ASSOCIATED WITH THE FORECAST?

■ Yes ■ No



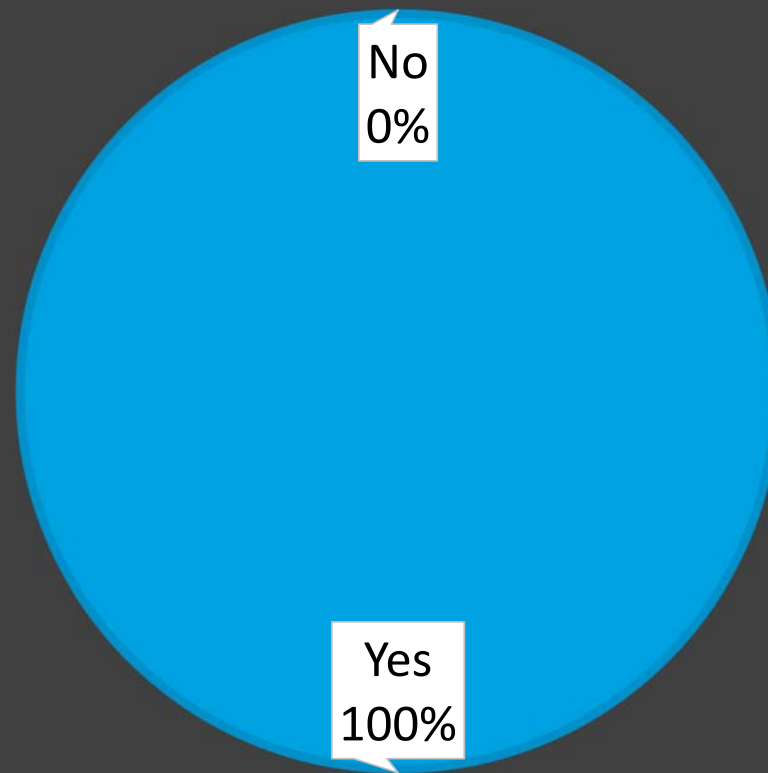


“If we know there is uncertainty with the forecast we can plan appropriately for different scenarios.”

“It makes me remain flexible in any decisions that may need to be made.”

# DECISION MAKERS – DO YOU WANT TO KNOW THE WORST CASE SCENARIO AS IT RELATES TO AN OFFICIAL FORECAST?

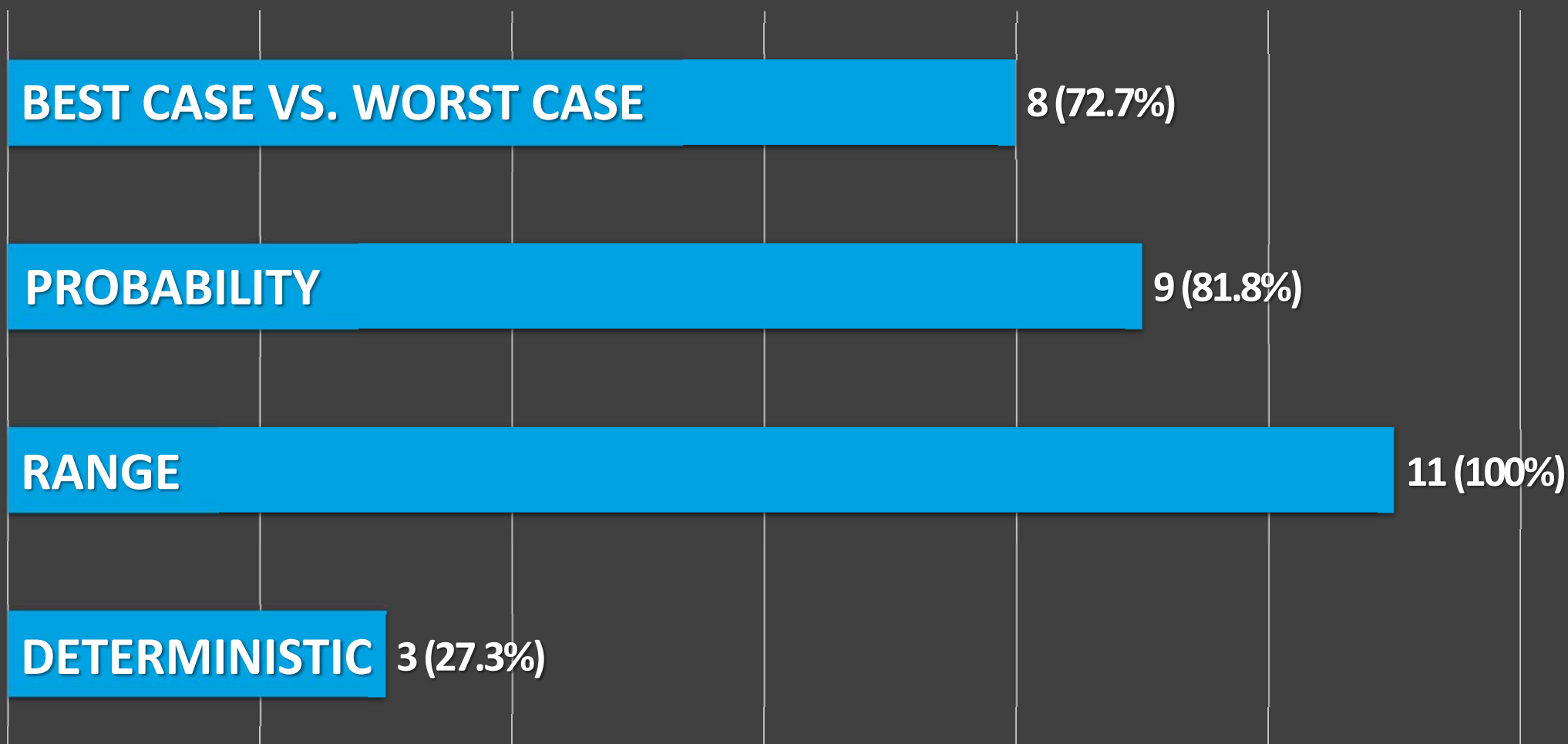
■ Yes ■ No



“It is better to be prepared for something that might not happen, then prepare for something lighter and then the worst case occurs.”

“No surprises. If there is a chance it could happen, I want to know.”

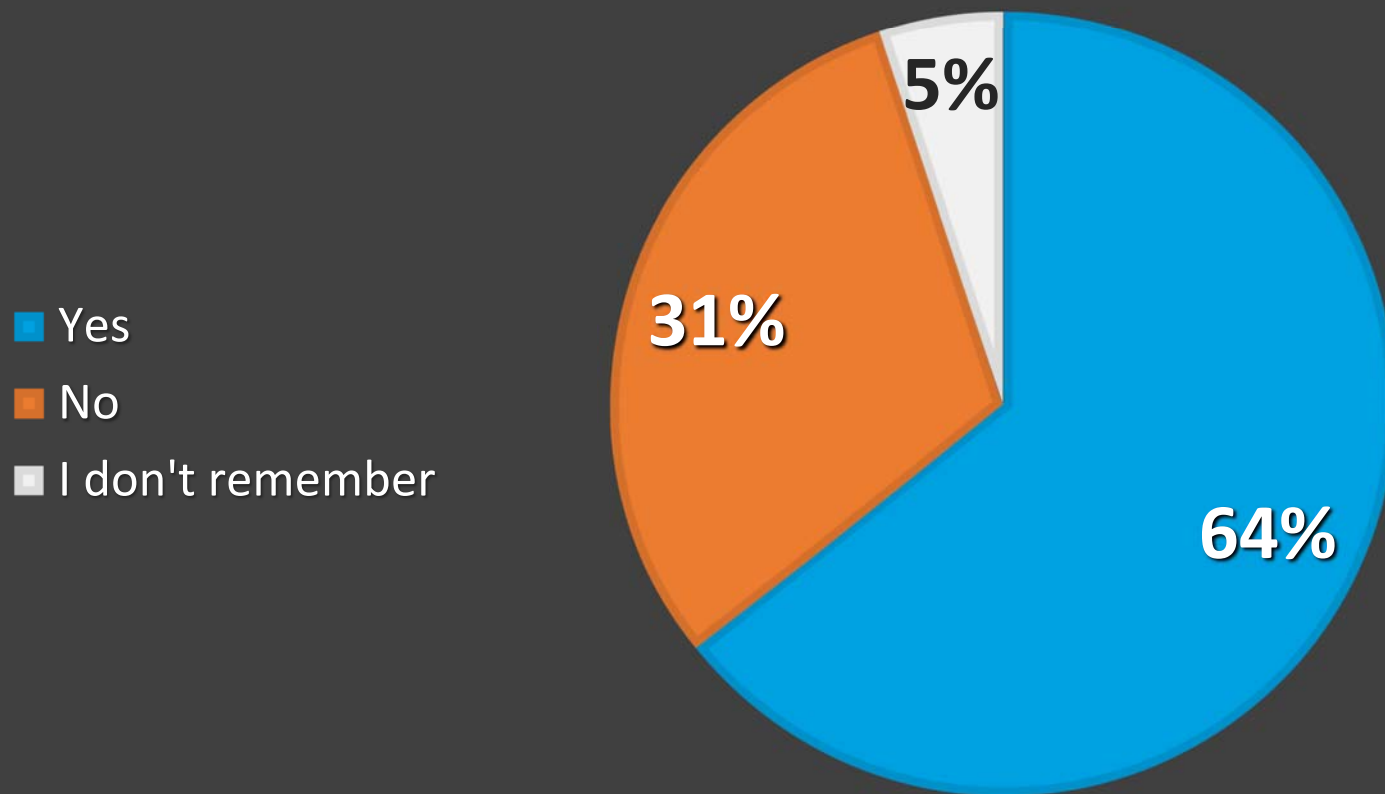
## How would you prefer to receive a forecast?



“All of the above would relate for us and helps in determining what to prepare for.”

“I don't mind knowing that the forecast has uncertainty in it. Knowing how much is always very helpful and knowing when or under what conditions that uncertainty will change is also very helpful.”

# BEFORE ATTENDING IDSS DEPLOYMENT BOOT CAMP, DID YOU HAVE PRIOR TRAINING ON HOW TO CONVEY AN UNCERTAIN FORECAST?



# Preferred Method for Expressing Uncertainty

**BEST CASE VS. WORST CASE**

88 (89.8%)

**RANGE**

79 (80.6%)

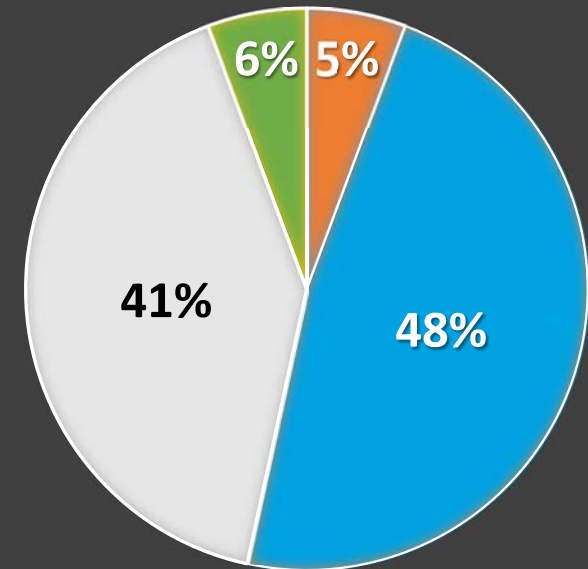
**PROBABILITY**

57 (58.2%)

**DETERMINISTIC 8 (8.2%)**

## COMBINATION

- All 4
- 3 of 4
- 2 of 4
- 1 of 4



“The biggest take away in my opinion is to communicate with your emergency management personnel before a big event so that you can learn what type of information range/probability/best vs. worst case scenario that they find the most useful as well as a verification that they understand how to interpret the products we are providing them with.”

“We use uncertainty quite a bit now that we generate the probabilistic snowfall graphics at the office. Our partners like to know what the minimum and worst case scenario are when planning for their operations.”

“Know who you're talking to and what exactly they are looking for (number vs range, etc).”

“It seems most of our closer partners like the expression of uncertainty when it is put in terms they understand.”

The method of conveying the forecast will change based on the audience. It is important to use the appropriate approach and expression of uncertainty based on the background knowledge of those individuals. Know your audience!

“A lot of our partners have expressed the desire to know what we think is going to happen (the official fcst) as well as the worst-case scenario. This is where ProbSnow has become especially useful. Being able to convey uncertainty in a clear and concise manner has actually strengthened our partnerships and relationships.”



# Remember

Bottom Line: Relationships are key.

We should express uncertainty in a way that works for the individual decision-maker.

There's no one-size-fits all method or product.

Forecasters and partners agree that a combination of methods might be needed to explain a complicated forecast.

## Citations

- <sup>1</sup>Morss, R.E., J.L. Demuth, and J.K. Lazo, 2008: [Communicating Uncertainty in Weather Forecasts: A Survey of the U.S. Public](https://doi.org/10.1175/2008WAF2007088.1). *Wea. Forecasting*, **23**, 974–991, <https://doi.org/10.1175/2008WAF2007088.1>
- <sup>2</sup>Joslyn, S. and Savelli, S., 2010: Communicating forecast uncertainty: public perception of weather forecast uncertainty. *Met. Apps*, **17**, 180-195, doi:[10.1002/met.190](https://doi.org/10.1002/met.190)
- <sup>3</sup>Morss, R. E., Lazo, J. K. and Demuth, J. L. 2010: Examining the use of weather forecasts in decision scenarios: results from a US survey with implications for uncertainty communication. *Met. Apps*, **17**, 149-162. doi:[10.1002/met.196](https://doi.org/10.1002/met.196)
- <sup>4</sup>Savelli, S. and S. Joslyn, 2012: [Boater Safety: Communicating Weather Forecast Information to High-Stakes End Users](https://doi.org/10.1175/WCAS-D-11-00025.1). *Wea. Climate Soc.*, **4**, 7–19, <https://doi.org/10.1175/WCAS-D-11-00025.1>
- <sup>5</sup>Dieckmann, N. F., Peters, E. and Gregory, R. 2015: At Home on the Range? Lay Interpretations of Numerical Uncertainty Ranges. *Risk Analysis*, **35**, 1281-1295. doi:[10.1111/risa.12358](https://doi.org/10.1111/risa.12358)
- <sup>6</sup>Joslyn, S. L., & LeClerc, J. E. 2012: Uncertainty forecasts improve weather-related decisions and attenuate the effects of forecast error. *Journal of experimental psychology: applied*, **18**(1), 126.
- <sup>7</sup>Joslyn, S., K. Pak, D. Jones, J. Pyles, and E. Hunt, 2007: [The Effect of Probabilistic Information on Threshold Forecasts](https://doi.org/10.1175/WAF1020.1). *Wea. Forecasting*, **22**, 804–812, <https://doi.org/10.1175/WAF1020.1>
- <sup>8</sup>Nadav-Greenberg, L., & Joslyn, S. L. 2009: Uncertainty forecasts improve decision making among nonexperts. *Journal of Cognitive Engineering and Decision Making*, **3**(3), 209-227.