1. While the POPS I give may be high they will ALWAYS be accompanied by an explanation of who gets what precipitation when especially if as in one of your cases the rain comes down heavy but for only a short period of time. Also, 80% of our DMA population lives in only part of our main forecast zone. If I don't think this part of the forecast zone is going to get rain but other parts are I will skew my POPS way down.

2. During rainy season in South Florida, the probability of rain SOMEWHERE in my forecast area can be approximated as 100%. Therefore the PoP equation becomes nearly solely dependent on aereal coverage.

3. POP is the most useless and misunderstood term in the industry. The public has no idea what it means, and they find it absurd that the NWS keeps a 30% POP when they are in rain. My experience has been that true synopticians do not use POPs, only those who do not know how to actually forecast use POPs in their forecast.

4. I am a government satellite meteorologist at a National Center that analyses and performs short term forecasts for those forecasters at local NWS offices who actually put out the forwcasts. So, even though I took this poll, you may not want to use my results in your study as I was going primarily on the strict definition that I have always known about probability of rain forecasts as being the probability of 0.01" or greater precipitaton falling in a predesignated rain guage over a period of time. (usually 8hrs).

5. Amount (quantity) of precip figures into my analysis only to the extent that I expect at least 0.01 inches at those locations.

6. I feel like our viewers tend to see higher pops as meaning "more" rain. I try to take time to attach qualifying language to the pop, such as "late afternoon thunderstorms" or "off and on rain," etc.

7. Areal coverage, duration, quantity, intensity, and climatology are all components of the statistical probability from which POP is derived, either synthesized by the human forecaster or computed objectively through MOS. Impact to user has too broad a spectrum or degree of subjectivity to be a consideration in POP formulation, but impact is increasingly an area where the meteorologist can apply expertise to advise the user.

8. I am a forecaster for the National Weather Service forecast office for the San Joaquin Valley in Hanford, CA. We often forecast lower POPs than what may be reality at times due to coordination with neighboring forecast offices and overall low to medium confidence. Also, impacts tend to be minimal in areas over the Sierra Nevada (except for outdoor enthusiasts and occasional fire starts due to lightning). Confidence is often medium at best for warm season convective patterns, while it is higher for colder season rainfall.

9. I am not a forecaster but i work as a weather observer in Botswana Meteorological services

10. I think this survey presents a lot of thought-provoking questions about the public perception of POPs. I think it's clear that the public often associates high POPs with high accumulations and/or intensities, even though this is not technically the case by the strict definition of a POP. Is this a natural tendency to associate high numbers with other high numbers, or did we as forecasters condition the public to feel this way after years of projecting our own biases in forecasts? Personally, I do not feel that the POP provides enough information to the user, and that more descriptors are needed in all precipitation forecasts. The problem is, given that the percentage system is simple and familiar, I'm not sure that the

public would be receptive to adding more information. I don't claim to have the answers, but I am glad this discussion is being raised, as it's something I have often thought about after forecasting in vastly different precipitation regimes (Southern High Plains/Pacific Northwest).

11. Model researcher, not a daily forecaster

12. For the record, I rate duration and aerial coverage equally. I always make it a point to tell my viewers when the rain will occur and how much of the day we get it.

13. Season also plays into this. You may have 100% certainty of pop up showers every day in summer but still call it 20% or 30% as a "message" number to viewers vs calling it "likely." Words may be more useful in some events than percentages>>> Very Few / Likely / Wet / Washout / Scattered / Isolated etc.

14. I teach meteorology, including forecasting, at a major university.

15. I HATE using POPs but was forced to use them by my News Director. I believe that if you take 5 people and place them in a room and ask them what a 40% chance of rain means...you will get 5 different answers. I much prefer to forecast NONE, SLIGHT, FAIR, GOOD, VERY GOOD and YES, for rain chances. Plus I prefer to forecast for the individual DAY PART, rather than an entire days worth of rain (POPS).

16. The Navy just doesn't use POPs enough for me to be all that familiar with it.

17. I will from time to time use a graphic to explain what the NWS defines as Isolated, Scattered and Numerous correlating their percentages.

18. The convective/cellular nature of storms in FL always present a POP challenge for us. Thanks for putting this together, looking forward to seeing the results!

19. I was taught the definition of percentage meant coverage over the forecast area. That is what I stress during broadcasts. For thunderstorms I do POPs for individual areas since terrain induced precip is a major factor in my DMA.

20. Working for USAF (With a BS in Meteorology), I don't deal with percentages, so this quiz would be my own interpretation of what percentages I would personally choose if I could for those situations

21. We use POPs on our 7-day all the time. It's completely subjective as opinion on what to call for varies from met to met. One persons 30% may be another persons 60%. Some mets will never use 50% as it's too wishy-washy. I still like using them but I'm not sure how much they mean to the public.

22. My forecast percentages will focus on the statistical probability that one drop of precipitation will occur in my given forecast zone. I do take into consideration areal coverage, but.that would be something that I would verbally mention in my weathercast. I do not associate percentages with duration, intensity or totals.

23. The public really makes their own opinions on what it means, but it'd be nice to have a solid written "rule" or definition.

24. 20% pops or less, no rain icon on the 7-day. Worded only.

25. I never do a straight pop on a forecast graphic without verbal qualification. Typically when I use pops, I use a specific pops graphic that either breaks down the pop for a specific time for a specific region of the forecast area or a a more broad regional graphic that indicates a pop for the time period indicated. I'll never put a pop on a 7 day forecast and just let that number slide.

26. Interesting study. My answers are based on the definition of PoP, especially since you give the precise scenario. Would I forecast a 100 percent chance of rain a day before for your 10 percent area question? No. But given the way you phrase the questions, It would be correct per the definition of a PoP. A big difference between knowing what will happen and assigning a PoP and making a forecast.

27. I think this is a great study. Too many meteorologists focus on statistical probabilities. I focus more on the perception by the viewer. he only way I ever forecast 100% chance of rain is the day of an event or if it has already started raining. Otherwise, I go with 80% simply to account for the margin of error in any forecast more than about 12 hours into the future. Also from the perception end of things, I NEVER forecast 50% simply because of the belief by many that 50% means we have no idea if it will rain or not. For similar reasons, I do not use 10% POPs due to many believing that is a cover yourself forecast, so I will usually choose between 20% or zero. I hope this helps. Go Noles!

28. Oftentimes, numbers are mis-interpreted by the public and when the forecast changes, people tend to play "the numbers game" with it. 50% chance does not mean "it might, or it might not", yet that is how it is perceived by the general public. Too much emphasis is placed on the numerical value of a POP, when we, as meteorologists, should be communicating the threat (thunderstorms, rain, snow, etc), and using additional language to express the coverage and amounts, when possible.

29. 40% Chance - Means during similar conditions in the past, at least 0.01 of rain was measured 4 out of 10 times. John Doe WFO Anchorage, AK

30. I have always felt the problem with POPs is that they include forecaster confidence as part of the formula. Two forecasters predicting the same outcome could either have different confidence levels based on their individual experience, or they may even come up with two significantly different values for roughly the same confidence given different interpretations. This makes POPs very subjective, regardless of the fact that they are defined by the formula "C x A". With that being the case, it is very difficult for users to compare a POP from one weather source to another. To do so would require that they are familiar with the meteorologist's methods as much as they know the actual forecast the meteorologist issued. This alone makes POPs useless in my opinion. It doesn't give value to the user because just about no one that we ask ever knows what POP means, evidenced by the fact that we get so many different answers when we ask. Descriptors like isolated, scattered, numerous, etc. are much more clear and consistent and for that reason I have only ever used POPs publicly when required to do so by a superior.

31. The survey didn't include a category for academics, which better describes me than private sector.

32. As a rule, our shop does not use POP when forecasting. We tend to use more general terms like, SPOTTY, LIKELY, or SLIGHT CHANCE. While using POPs can be useful, I have found that the audience is generally split on their interpretation of "areal coverage" and "point percentage", so we choose to leave it out.

33. Ask 20 different people their definition of POP and you will get 20 different answers.

34. We don't really make zone-based POP forecasts...we have grids, so those last couple questions are difficult to answer.

35. Good questions for your survey!

36. Numerical probabilities are really meant for specialized weather-sensitive users who determine thresholds for actions to take and even they do not fully understand what the probabilities represent. The general public has much less understanding of numerical POPs. Timing of precipitation, duration and intensity are as important but are really not part of the official definition of POP so those aspects of precipitation impacts are not resolved in POPs in routine forecast products. The words to describe the precipitation distribution are at least as important as the numerical value since 'scattered" can create a different perception than "a chance" yet these words frequently describe the same numerical value, which is why describing timing, duration and intensity add such value to numerical POPs.

37. Thank you for conducting this survey. I do believe that everyone's definition of POPs is different. I am not sure this is a bad thing, as long as the meteorologist explains what they mean clearly. I do not think there is enough explanation in most cases, and that is a huge area where rainfall forecasts could be improved.

38. I had issues with some of your questions. My POP conforms to the NWS definition of POP. Hence, I take into account a lot of information in making my POP forecast, but the forecast doesn't take into account impact and other information.

39. We don't use percentages on air because of the confusion.

40. BAMS around 1983 or 84. Curtis & Murphy. also http://pajk.arh.noaa.gov/Articles/articles/survey/introduction.html and I have to find my math & science teachers results for you.

41. I follow the NWS definition of POP...that is to say...the probability of receiving at least 0.01 inches of liquid for the period specified.

42. Your scenarios are purposely twisted toward the old style NWS/current style media forecast. NWS now forecasts hourly through tomorrow, and that is on a 2.5 km square grid. We can get much more precise with our forecasts now.

43. Note: On question for 2'' of rain in 10% of the area, I went high on POP since question asked for that zone or area. I look forward to hearing the public/met. comparison on this. I do agree there is often a disconnect between forecasters and users of the the info. I'll also note the NWS explanation that you often find online is good for mets, but I think it can be confusing for many in the general public.

44. Most of the time we are 100% sure we will see rain in an area as big as a DMA - ateady somewhere. So I take probability out of the pop and go with coverage expected. I would never give a pop without qualifiers - extra explanation in the weathercasts or on the graphics conveying timing, placement, duration, intensity, etc.

45. Can't wait to hear your talk Alan.

46. My thinking of POP and how the public understands it has changed over the past several years. I am trying to get away from using POP and using my descriptive words that the public understands like...isolated, widely scattered, scattered, likely, numerous, widespread...etc. The bottom line is that the public and most of our users do not understand POP or what 30% chance of rain means. Most people do understand what scattered rain showers mean.

47. You are a good man and scientist. Keep up the great work.

48. The PoP definition assumes the probability of 0.01" of rain in a 12 hour period. Many other factors like duration and intensity do not come into play statistically. Instantaneous coverage is one of them and is irrelevant to the equation.

49. I work for the NWS. I wish the PoP was not tied to areal coverage. For example, per one of the survey examples, if 90% of a zone is dry but 10% has a high probability of having a half inch of rain or more then the PoP value for 10% of the zone should be 100% but this isn't allowed. Why? Per the NWS Directive, the PoP value can't be higher than 20% (isolated coverage) for the entire zone. This doesn't make sense. As far as the people living in the 10% part of the zone where it is raining, the PoP is 100%, which is correct. Another issue is that the public forecast is tied to internal verification. Per NWS, the definition of PoP is the probability of 0.01" of rain. As far as the public is concerned, it doesn't matter if the rain is measurable or not. If it is raining, the PoP is 100%, regardless of amount. Perhaps the PoP value should refer to the probability that the ground will become wet or the 'chance of wetting rain,' which is used in NWS Fire Weather Forecasts. Another idea is to get rid of the NWS zone forecast concept. NWS forecast zones don't really mean anything to the public.

50. I hate using POPs because the public has no idea how to interpret it when you do. This comes from personal conversations with many of the people I serve in south central Kentucky. Therefore, when I launched my business, I chose not to use POPs, but focus more on terms such as isolated, scattered and widespread when referring to rain chances. The response suggests it has been well received.

51. POP is a statistic, not always practical to the end user. It is the meteorologist's job to make that stat relatable.

52. We NEVER use POP's in our weather segments on TV.

53. Gridded pops will resolve some of these issues, as well as sky grids and weather grids.

54. Great topic. Can't wait to see the results

55. I was always taught that % is areal coverage. Now my viewers do get confused at times, so I explain it a lot. I catch myself saying many times with a 30% chance for rain saying "their is a 100% chance for rain over 30% of the area." However, due to the fact that I know viewers look at % as their is a 30% chance for rain and a 70% chance it won't rain, I do alter a few minor things. I will never go with a 50% chance for rain. Even though it would be 50% coverage, most viewers look at that as he doesn't have a clue if it will rain or not. So I either go with 40 or 60%.

56. Great research! Can't wait to see the results!!!

57. As written, question 3 infers that all elements would be used when determining POPs. Not true.

58. EXCELLENT survey! Love this idea, Alan!

59. We use POPs because rain is rarely a certainty in West Texas. Last week there was widespread soaking rain, we had high confidence nearly everyone would get beneficial rain. We had 80% chance of rain and thunderstorms. We rarely go that high. The more common scenario is isolated to scattered storms. By using POPs we can give a quick way for viewers, readers and listeners to know if it's 10% chance then maybe one or two storms...compared to 40% chance where there's a decent shot at getting a thunderstorm. We face so many low-chance/high-impact days that POPs help explain what the chance is. I've never been a fan of POPs where precip is likely many days out of the year. But I do like it where there are dozens of days a year where a few people in the area will get storms but majority will miss out.

60. Been doing this for almost 40 years now. POPs are not perfect and probably not well understood by the public, but not sure if there is a better way to forecast convective precipitation. Showers and storms can be and usually are a hit or miss phenomena, unlike stratiform precipitation.

61. None

62. Comparing 12 hour PoPs (old school) to hourly PoPs is a much needed topic of discussion!

63. For me, its statistical probability during lower confidence situations. For instance, in the longer term I think there is a "chance" it could rain, but I am not sure so pops fall somewhere in our chance category of 25-54%. When there is high confidence that it is going to rain then coverage is more important when referring to pops. For example, isolated, scattered, numerous, categorical wording all correspond to percentage ranges. Iso 15-24%. Sct 25-54%. Num 55-74%. Categorical 75-100%. I will also mention that I am not sure if I'm happy with my scenario answers. Given the scenarios, I have to assume I am highly confident in what is proposed to occur. Therefore, I can say 100% for the first two. That rarely happens in our forecasting world because there is usually some limiting factor to confidence. In those scenarios it would likely be lower pops confined to more specific time ranges of when the rain would occur. The 3rd scenario was about coverage for me, and it is the ultimate dilemma in my opinion. 20% coverage, but it is going to pour on someone and that someone is going to complain that there was only a 20% chance. You can't win in that situation as a forecaster even if you nail it.

64. I've always followed the definition that PoP = probability of measurable precip occurrence anywhere X % areal coverage.

65. If I know it will rain, I should have a 100% chance of rain. However, the POP is not where the forecast ends. Each of your scenarios needs to be described in ways additional to the POP, so that people have the knowledge they need to plan their day.

66. The traditional PoP is confidence times coverage over a 12 hour period. There have been efforts to go to smaller time steps (and even MOS provides values for time ranges smaller than 12 hours), but it cannot be overlooked that most guidance forecasters have is over a broad time range (not instantaneous). As a result, there are efforts to address duration. It's very important to note that other than the requirement to have measurable precipitation (i.e. >=0.01"), items like amount, intensity and impact do not apply to the PoP. QPF handles amount. Weather type/intensity qualifiers handle intensity and impact is in the eye of the beholder.

67. POPS, to be meaningful, must be as well calibrated as possible. Factors other than true statistical probability should not be part of the equation. POP should be (chance of precipitation forming multiplied by the coverage). Period. A good POP is one in which a gambling man wouldn't know which side to bet on!! Thanks for letting us sound off on this important topic.

68. Great Alan

69. I have found that hardly anyone agrees on what it is. I have also found through informal surveys that most of the public misunderstands what POPS are.

70. I think the POP forecasts are rather useless and need to be changed to simple wording. For example... Expect scattered rain showers across the area today, chance for rain in your backyard is 20%. Rain amounts where rain occurs are expected to be less than one-fourth inch.

71. If there is very high confidence, or ongoing precipitation that will result in measurable rain, the POP should technically be 100%. If there is uncertainty, that is where statistical probability should come into play. If there is a case where you know that rain will occur but only last a couple hours, you could have high probabilities for a short time window, say during the morning, followed by low or no pops.

72. NWS taught that POPs = coverage area * chance of occurrence. That is what I used.

73. I inflate probability of precipitation by about 10% since the public will often consider whether or not they see any rain, or especially snow, regardless if it is measurable.

74. Let's get rid of PoPs and use descriptors instead: scattered, widespread, occasional, etc.

75. We forecast for the western North Pacific: Guam, the Commonwealth of the Northern Mariana Islands, Palau, the Martial Islands and the four states of the Federated States of Micronesia. Why ignore us?

76. Time issues can be partly accounted for by narrowing the time windows, 3-hour POP instead of all-day POP. Space issues can be accounted for with ancillary information. The problem comes when too many pieces of information are "understood" from one number that cannot convey all those distinct pieces of information. You can have a QPF POP - POP by threshold of amount. You can have descriptive information. User training is key. High-impact events for a particular user need to be flagged separately directly to that user - "hey, this is not an ordinary event, X is likely today" where X is not just precip but something much more specific affecting that user. Also, beware the user that calibrates POP from different sources but misapplies the calibration - we had a client who was getting biased POP from another weather vendor and when they applied their correction to our bettercalibrated POP, it gave bad results - they initially thought that meant there was a problem with our POP - user education and communication is key.

77. Feel the public does not have an understanding of the POPs product...

78. I personally don't use PoPs because of trying to fit them for a full viewing area when Pops are different in different locations. I tend to use more descriptive terms to describe when, where, and how much rain I expect.

79. Impact is the greatest factor. 100% being a rain-out to 10% being spotty (even if it's a downpour) I see it the same way if I were forecasting a severe event. How prepared should my viewers be?

80. I work In the SanFrancisco Bay Area & these scenarios are quite common!

81. Have always had problems with POPs--likely due to 26 years in AF where POP was taboo.

82. POPs are the most misused product of the profession. They are derived statistically and even when presented with absolute scenarios, we will hedge our predictions.

83. I honestly don't truly understand what "probability of precipitation" means, because I have received directly conflicting training/instruction from different experts.

84. I am a forecaster at WFO Guam not Hawaii. Guam is not an option as usual.

85. POPs should be relied on less. Give a % sure but put more emphasis on the discussion rather than the % number that the public may or may not understand.

86. I always taper POPs further out in the forecast to account for more model inaccuracies/inconsistencies. I rarely put more than 30% on Day 6 or 7 of my forecast.

87. Great questions! It really made me think about the way we use POPs and I'm not sure if we are all on the same "page" nor what's the right "page" to be on.

88. We do supply a percentage on our 7 day forecast. BUT, throughout the weathercasts we show various maps narrowing down the timing, location, likelihood, etc. For example, one map shows various percentages for the viewing area. Here in Florida we can be completely dry along the coast and have 6" of rain inland.

89. I'm the type of forecaster that will go 100% on POPs especially if we have climatological factors such as upslope flow over mountainous locations, or we have unusually high pwats associated with a frontal system.

90. I'm not a fan of POPs in any form... viewers don't understand them, mets don't understand them... I prefer to use words like spotty, isolated, scattered, widely scattered, likely, washout, etc. As soon as management realizes this, our jobs as meteorologists get MUCH simpler! Thanks for the vent session haha... Great survey!

91. POP is very confusing for the public. For showers we use the areal percentage, for stratiform we use statistical probability. I prefer POP be used for statistical probability regardless of whether it is convective or stratiform. To me POP should only be in relation to the probability of the rain occurring.

92. I only show POPs 20% or greater, and I only add a rain/storm symbol if 30% or greater chance. Always try to say "xx% chance where you are" to help relate that both statistical & areal coverage play a factor. Still not sure they get it.

93. I should note that I really don't use POP in my forecasts - I use descriptive language instead, i.e., "scattered showers are expected over the coastal areas later this afternoon lasting into the early evening hours" or "rain developing later tonight should spread over the entire forecast area by sunrise". In my view, POP is simply a way to 'hedge your bets' rather than providing your customer with a firm statement of weather expectations. FYI, POP was first developed and used by the Travelers Insurance

Company in the early 1950s and broadcast on WTIC radio (and eventually television) in the Hartford, Connecticut to Springfield, Massachusetts area and its original purpose was for areal coverage. If no precipitation was expected, no POP was provided in the forecast - and that approach is still true today in some NWS locations. If the weather is expected to be precipitation free for the forecast period over the entire forecast area, no POP is given in the forecast (and it doesn't matter if the sky is clear or cloudy).Over the past 60+ years we have conditioned the customer/public to ask "What is the probability for rain next Friday afternoon?" and we are expected to provide a numerical answer, i.e., a POP - and I'm not convinced that the POP gives the user the best answer. There are probabilities for just about everything and most of them are meaningless and therefore useless. Thanks for the opportunity to shed some light (probability 50%) on this often confusing subject.

94. I must qualify my responses by saying that I have been retired nearly 6 yrs, and my last job consisted of forecasting entirely for the aviation community so no PoPs were used. When people ask me what PoPs mean, I tell them what the real definition is, then tell them to think of it as a confidence number...i.e., the confidence of the forecaster that such & such will actually occur.

95. http://www.nssl.noaa.gov/users/brooks/public_html/prob/Probability.html

96. I am a national channel. So my challenges are different. PS National Met wasn't an option in the "where do you forecast?" question so I left it blank.

97. The problem with POPs isn't that people don't get that 80% is more than 20%. It's that we too often hang this number out there to dry, loading on its shoulders the duty to explain everything from chance of rain to coverage, timing, duration, and so on. We need to get better at sharing more about what we do know - the character of the day, the number of dry hours vs. wet hours, the intensity of precip, etc. - all things we expect a simple POP to do now.

98. In my opinion, the public treats POPS as a Raininess Index, not a pure likelihood of rain. Looking back on the day, how rainy was it on a scale of 10%, 20%, etc? That answer is what the POPs should have been.

99. Most of my POPS are in site-specific (Spot) forecasts for prescribed burning, so they deal with a small site. We often mention the POP for measueable (> .01") and then also state a typically lesser POP for Wetting Rain, defined here in NorCal as >.10". For example, I might say chance of light rain increasing to 60% by late in the day, but CWR to only 20%.

100. While the definition and understanding of POPs can be quite complicated, I believe that a 7-Day forecast with a 30% POP on one day and a 60% POP on another still gives the viewer/user an accurate representation of when they will most likely need an umbrella.

101. Thanks Alan... like this idea.

102. When I think of POP, I mainly think of the old adage, "If there is a 40 percent chance of rain, 4 out of every 10 people will experience precipitation." That is not necessarily the best way to represent POP as there are many other factors involved especially in regard to intensity and duration of precipitation. People's perception of precipitation is not solely based on the scattered nature of it such as during convective events during the warm season. The main focus for the general public is whether they get wet or not or whether the roads were covered with water while they are driving (impacts to users). I have heard much public feedback of how the weatherman was wrong in only issuing a 20 percent

probability of precipitation when they got wet during the course of the day. If someone gets wet, they feel the POP should have been much higher. This really does not depend upon the duration, but a lot more on if they were impacted.

103. factors such as intensity, duration, impact on user should be handled in the worded portion of the forecast.

104. I rarely use a pop less than 30%. And in a scenario where everyone is going to get a brief period of rain with the rest of the day sunny rain is still likely. 2 inches of rain from a rogue storm on a day that is 90% sunny I would forecast a mostly sunny day but warned if you are one of the unlucky it could be heavy or strong (typical August here). As explained in NWS manuals, AMS, and many online sources and college courses...duration/intensity/amount/sun do NOT factor in to a point probability and there is SOME correlation between point and areal coverage RE: pop in real world even if not in stats. The POP has been around since what, at least the 1960s. SO, to not understand it requires A) very young age, B) very old and forgetful C) stupidity or not paying attention to everyday life around you IE WILLFUL IGNORANCE. The public and even news people often are confused because they don't know the difference between an observation and a forecast: ("ha ha they said a 30% chance, look out the window its pouring, sure looks like 100% to me") Many newscasters and lay people also mistakenly think there is some magic terminology in weather, so they'll seem confused about a 20% chance and carry an umbrella all day. But if you told them there was a 20% chance of football team X winning the game they would not expect team X to win. Odds are odds, rain or sports its putting a number on uncertainty. We can use English to explain the caveats and details of a days expected weather WITH the POP, or without it. That's what the job is all about! We all know the models and subject pop works better in some situations than others. If people can't add and subtract from 100 to get the yes/now odds they and we as a nation have bigger problems than to pop or not to pop :)

105. Never use Pops within the body on my forecasts but do follow scattered, good chance likely, categorical etc

106. I use the following terminology in my forecasts to better communicate precipitation probability (which is hard if not impossible for the public to understand). While wordy, I'm told people tend to understand it better that the standard "20% chance of rain" terminology... An example of my text forecast.... "Mostly cloudy with numerous rain showers and thunderstorms. Some thunderstorms may be severe with larger hail and damaging thunderstorm winds. A 60% chance of rain at any given location.. where it occurs, rainfall will average 3/4 to 1 1/4 inch. High 78. Southerly wind 5 to 12 mph."

107. Survey was good. Just some additional info for you: The way I prioritize my forecast is actually weighted 33-33- 33 with my duration, quantity, and intensity. And that's probably 50-60% of my decision, with the remaining 40% being the other factors. The survey questions dealt with high QPF values (or at least high by the climatology of my office). Therefore I gave you high POP values. Had you asked the same questions with much lesser QPF amounts like 0.01"-0.05", you would have gotten a different POP response from me. As for the first POP question scenario: Chances are I would have made a 3 hour grid for the a line of storms to move through, then cleared things out. I would not forecast 80-90 pops for the whole day based on one line of storms. Thanks.

108. This is a GREAT research idea. I was just talking with some colleagues about all misunderstanding that comes from POPs. We now try to use words like isolated, scattered, etc. instead. We rank the words on a bar graph to show on air when there is rain in the forecast.

109. In Florida, you have to ride the fence of aerial coverage and stats. The public only hears blah, blah, blah, unless you go over 50%. I feel like the only 2 numbers that matter are 30% or 80%. Normal or above normal.

110. Probability of 0.01"

111. Not sure a thorough literature survey was done before creating the survey. The way NWS meteorologists have been trained is that PoP = Expected Areal Coverage x Forecaster Confidence. At extended periods, confidence is low, thus high PoPs are never forecast. See Schaefer and Livingston 1990 WAF for more info. There is a NWS Tech Memo that predates this article and is not cited. I think it was written by Dan Smith in the early 1980s.

112. My forecast scope is the CONUS since I work in a National Center...No option for this selection in question #8.

113. Thank you for asking. I've struggled with this since becoming a forecaster. Learning that I understood it differently than those who were older than me. I believe I forecast it differently than those who have been forecasters longer. Whether it's how the public views it or not, I forecast it how I view it at home. What is the chance it is going to precipitate? High Chance or low chance? What would I tell my family? Can't always do that in the job I'm in, but it's what I want to do. Thanks again for asking, I look forward to your results.

114. I answered Hawaii, but am actually on Guam where we deal primarily with transiting convective cells

115. Keep up the great work, Alan !

116. I don't use POPs because they're misleading. The public's perception of POPs and the NWS's perception of POPs are different. I say isolated, short lived, off & on, scattered, widely scattered, likely. 117 POPs suck. Descriptive text better. If POPs are required by a station, it's best to have descriptive text also.

117. Good idea

118. I lean to coverage - mainly in the warm months - we rarely have all day rains then and 'dry time' is important to clarify to the viewer. With short range forecasting we can better bracket the rain hours. If I never hear from a cement company again it will be to soon.

119. Problem is with this survey is that frankly I don't use POPs. I love that you are studying this, but frankly there are only two correct answers 0% or 100%. Everything else is wrong. I prefer to use modifiers such as scattered, few, numerous, steady and so forth. Guess I'm old school.

120. There really needs to be a standard because to the public they see POPs by one definition and meteorologist view it more from the science side. Since POPs is a big part of broadcast meteorology, there needs to be an easy way to communicate the standard to the public. Thanks for doing this research!

121. In our region, there seems to be an understanding that certain POP values may mean different kinds of rain events. I have come to adapt how I personally use POPs to match what the public believes.

122. Good luck with your project. POP is one of the most subjective concepts in the NWS and that should be pretty easy to elucidate.

123. In question 4 - I would still Forecast an 80% coverage, and I don't call it a "POP". I am VERY clear in my forecast that the day would be sunny up until a certain time...then scattered t-storms 80% coverage...then clearing. I even would have the words on my 7 Day - 80% Scattered t-storms 4pm-7pm and also have sunshine with a T-Storm icon off to the side. We make a point to explain how much of the area will see rain. When it starts, and when it stops. Also what the rest of the day looks like, is there sun, is it cloudy. We often also say on a day like that, when we pop up the 7 day very specifically that 80% does NOt mean 80% of the day it will be raining, and we point to the words on the 7 day saying 80% of the area will see rain starting at 4pm and clearing out around 7pm.

124. Some of these questions are not well-posed, with important information left out. The only definition I know of for POP is the probability that 0.01" will fall at a specific gauge during a specified time interval. None of the other extraneous factors brought up in the questions makes any difference to POPs. ie, the definition already exists, and it's not up to an individual forecaster to change the definition on their own. I used to work for the person who developed and introduced POPs to NWS, and I feel I understand the concept quite well.

125. 30% chance of leaving a comment

126. I do not use POP in the forecast. I uses descriptors to describe the pcpn. For example, scattered thunderstorms or periods of thunderstorms. I wouldn't need an umbrella for 20% chance of rain.

127. This survey does not really make sense. Any probability requires a precise definition. The probability of precipitation is the probability of >= 0.01" of precipitation at any given point within the forecast area...that area may be one point, a county, a zone.

128. PoP alone, especially over a large geographic area (e.g., 100 km by 100 km) for a large period of time (e.g., 12 hours) does not convey enough information for the examples provided. I use PoP as a statistical probability for a certain duration unless I'm certain precipitation will measure over that domain during that duration. When I reach that level of certainty I use PoP to convey areal coverage.

129. Our job is to translate scientific expressions into plain English that is readily understood by the public. Probability is not well understood by the public, and using a percentage PoP distracts from the other important aspects of a precip forecast: type, duration, aerial coverage.

130. I rarely use POPs.

131. We actually don't use POPs in our forecasts -- viewers don't understand them!

132. POPs alone don't always define the forecast. Written forecast used to closely match POPs(e.g., 60% was "likely")- no strict rules now. Also, if the event is a threat (severe tstm or flash flood) even a 20% chance must be carefully worded.

133. Our customers really do not understand POP and how they are supposed to be interpreted.

134. In my case, I have 3-4 specific points to forecast for, so I have to be creative in how I describe the weather so as to ensure my end users know what that means. On the Gulf Coast, most late

spring/summer days you could paste 20-30% POPs and be right. So in those instances, it requires being creative and going beyond just a POP. I use POPs and other descriptions less as specific variables to verify and more as a useful description of information for my audience.

135. Just that you forecast for a certain point - not an entire area. So its not 'fair' to write what would you forecast for this zone - you should be forecasting for exact latitude/longitude points. The forecasts can change everywhere!

136. I use text in the seven day to clarify the POP, and differentiate between north, south, and amount of coverage expected (i.e. Scattered Showers")

137. My response to question 7 should be disregarded because there is no choice to match my opinion. It is impossible to assign a probability in such a situation because there is no mention of the uncertainty about the stationary cluster. If I am 100% confident that rain will cover 10% of the area, and I am 100% confident that it will NOT rain elsewhere, then I make two separate forecasts. Anything less is a disservice.

138. When it comes to POPs, there is way too much emphasis on whether or not one small area will receive a measurable amount (at or above 0.01") of liquid precipitation, especially in NWS forecasts. POPs are not a "game" that one plays - they have a large impact on what users see in their forecasts. I've also noticed over the years that some TV weather persons mix areal (scattered, numerous, etc.) and probabilistic (chance, slight chance, etc.) terms when describing their forecasts, which just tends to give the impression that they don't really know what's going to happen. Most users simply want to know whether or not it is going to precipitate, how much it will precipitate, when any precipitation will start/stop or be most intense, and how widespread any precipitation might be in the area that they live/work/etc. in.

139. Never use POPs in my forecast. I go into more explanation about the forecast, give details regarding timing, duration, intensity and location of expected precipitation.

140. My coworkers and I explain that PoPs refer to areal coverage every time we use them (every day). We hope that within maybe about 10 years, at least some of the public will understand. It may be a futile effort to "reteach" the definition but we are trying regardless. The feedback has been positive.

141. Great survey/discussion to bring up!

142. POP = Area x CI of forecast

143. With NDFD, we can be specific with the PoP in some of your scenarios. 100% over that one area with 10 or zero elsewhere. Coverage terms work well, but should not be tied to PoP due to its definition of reaching a measurable precip amount. For Example, scattered showers with a 100% PoP should not be a confusing term. Instead of using PoP, say chance of measurable precipitation. Wordy, but correct.

144. POPs need to account for a trace of rain. Here in Las Vegas, our official climate station gets a trace or more of precipitation on 47 days a year, but only measurable precipitation on 27 days based on normals. However, people see rain and think it rained no matter how much fell. We also often get measurable precipitation in areas of Las Vegas on the outskirts of town when our official climate station only gets a trace. That impact need to go into the forecast for an area even if we don't verify it officially.

145. I never use percentages...I try to focus on time, duration, intensity, amount, and how it will affect my viewers (I tend to hear "wrap" a lot from my producers).

146. Orography and wind flow are also important parameters in deriving a realistic POP. Virga may produce a few drops of rain at the surface but not enough for measurable precip. In these, and other, situations orographic lift may produce measurable rain upslope but none of the leeward side. This can lead to a tricky situation if the quantitative precip is light and there is little near-surface wind velocity.

147. They are too confusing for most of our users!

148. Q3: there should have been an option to give some parameters no ranking at all. As given, I had to give a ranking to all parameters.

149. As stated in the survey, I do not use POP. There are so many interpretations and misinterpretations of what it means. I prefer to simply tell the audience whether I think it's going to rain or snow, when I think it may happen, and for how long. All of that can be communicated more effectively without attaching a probability percentage to the forecast.

150. I use Probability of Precipitation because it is mandated, not because I think of it as a great communication tool.

151. I found the first scenario (30 min rain for everyone) difficult to assign a POP to. While the statistical probability is what I typically base my POP on (thus, 100% in this scenario), it is tempered by duration. Thus I ended up at 70%. I'm interested in what the public thinks!

152. In the National Weather Service, we have the POP the can be forecasted for a single hour or multiple hours. More detail is placed in the first 36 hours. For the question with a short rainfall window, I'd have the first half of the day without much POP then gradually increase it late in the day before decreasing it just after the most likely time it is to occur.

153. Using the traditional description of POP as the chance of measurable precipitation at any one point in a given period of time (i.e. 12-hour period), POP can be very confusing to the general public. That's why one includes descriptive language too, such as "chance," "scattered,", etc., and also when the most likely time the precipitation may occur. Hopefully, this mproves the understanding to the public.

154. Frequent viewer opinion: If it didn't rain at his/her house, then it didn't rain anywhere.

155. I wish PoPs had never been invented or used. Descriptive terms like scattered, isolated, or widespread tells our customers more than there is a 30% chance for rain.

156. The public doesn't seem to understand probability theory well, which causes some forecasters to try to forecast to the public's perception and not the actual probability.

157. Great research project. I tie PoP to 0.01" and the probability that it will affect a 2.5 km grid box we forecast for. I increase them across the mountains because of climatology during the convective season. If there is a cold front or wave passage that is expected to provide larger coverages of 0.01" then I raise my PoPs pretty high. Probably much to the chagrin of my fellow forecasters who seem to think 50% is high enough. I work on the 0 to 100% scale whether its convective season or cool season. This gives a look into my mentality. The key is consistency!

158. I never forecast a 50% chance of rain. It's either higher or lower than that. 2. I often forecast a "small chance of a big storm" or a "big chance chance of a little shower." And I use those terms over and over and over. 3. Psychology plays into this as well. If a few isolated severe storms are expected on an otherwise sunny weekend, we tend to forecast higher POPs to help emphasize the potential danger. 4. I also look at the whole 7 day forecast. I sometimes raise/lower POPs on certain days to help emphasize the greatest probability of rain. 5. Whenever possible I do an hour-by-hour or daypart POP forecast to emphasize when storms are likely to develop. 6. And whenever possible we show a map with different POPs for different areas to emphasize where rain is likely to develop. 7. All of this demonstrates the advantage of a full length TV weather cast over a weather app on the smartphone. I provide more thorough information than our stupid app.

159. The way the preciptiation questions were worded was somewhat confusing. It seemed like the question was certain the rain would occur as stated. So I had to answer 100%, 100% and 10% respectively for the question, but the POP without knowing what already happened might have been considerably different.

160. The forecasting of POPS is based on the possibility of at least 0.01 inches of rain over a period of time. Unfortunately a lot of media folks drop the probably and make it seem like it will rain all day when there is just a 30-40% chance of scattered afternoon TSTMs - this does a disservice to all meteorologist. also 0.01 will not stop people from doing something but 1 inch would but the POP would be the same percentage

161. Allan I wrote a paper a couple of decades back that shows the PPP by statistical is the same as % area covered IF the POP is constant across the FORECAST AREA . It was probable in JAM..Joe Schaefer

162. Survey participant is a grad student

163. POP - chance of precipitation at any point in forecast area. Other factors should be discussed by not involved in %

164. I am a Senior Forecaster in the NWS. The POP is what it is (probability of 0.01" or more of rain at a point within a given zone over a 12-hour period). For some situations, under specific assumptions, one can argue that an expected "areal coverage" is the same thing. Most of the time, I would argue, this is not the case. Also, the way we define the POP says nothing about impact (i.e., intensity, duration, QPF, location/vulnerability, etc.). Do I agree with this? No. But, that is what we are obligated to do right now under current directives. This is the bottom line, really. We need to change our methods in such a way that the prediction and corresponding observations, climatology, etc. are tied directly to societal impacts, while also remaining statistically and scientifically sound. Thank you. Regards, John Doe (WFO Key West, FL)

165. The complexities you have isolated in your questions underscore why we don't use POPs in our forecasts or broadcasts. I find that I have an innate algorithm that immediately can output a number for a POP based on the scenarios you describe that factors in all the parameters you hit upon. Greta job and good luck!

166. I avoid using 50% as a PoP to help cut the stigma that meteorologists are just "weather guessers." So, on days where 50% is a reasonable PoP, I factor in as many parameters that I can to sway it to

40% or 60%. Otherwise, impact to viewers and statistical probability over the are of my DMA are the main factors in developing my PoP.

167. The use of hourly POPs and weather in the NWS gridded forecast database addresses many of the situations you presented. For example, a narrow line of showers would be carried in the gridded forecast as a small area of very high POPs with near zero POPs at other times and in other areas.

168. As with most surveys, a couple of the questions could use an explanation block. Good luck with the project, it has always caused confusion with most users. I was working when the concept began, and the understanding hasn't kept up with the times!!!!!

169. As I stated before, I virtually never use POPs in my on-air work, because if you ask 10 viewers what POPs are, you'll get 10 opinions. Of all the places I've worked, I have only used POPs in one of them and that isn't my current location. I choose to describe the likelihood and coverage of rain/snow events with words instead of POPs numbers.

170. We actually don't use percentages in our forecasts. We use words such as "chance," "slight chance," "good chance" or "likely" instead of numerical values, because the numbers are interpreted in so many different ways by our viewing public.

171. Questions 4, 5, and 6 do not provide adequate information to determine a correct POPs value. The questions you ask force the results to reflect areal coverage or intensity. For a respondent who sees POPs as the probability of an event occurring at a given point as a function of the synoptic situation if the scenario occurred a large number of times, these examples do not provide the necessary initial information to make a POPs forecast. In my opinion, the survey will be biased and not represent a scientific assessment of POPs forecasting. Question 8 does not permit entry of multiple areas, which is common practice for private sector meteorologists. All in all, not a good survey for research purposes.

172. POP is generally misunderstood, and should be defined for each forecast. The big question is what is the chance that it will rain on ME. Does the POP mean a chance of rain at a particular location? Does it refer to areal coverage? Both? Neither?

173. Great job Alan...totally understand what you're going for with this survey. We've discussed for many years how to better relay the POP. Would love to see if there are ideas to better communicate this difficult issue.

174. POPs are the most misunderstood feature in weather forecasting. And standardization of what it means is hard.

175. IT is painfully obvious that the majority of people do not understand POP's. I don't know what the answer is, other than give a longer explanation in our forecast as to what can be expected during time period X, Y, and Z. The official definition of POP's is not even understood by the majority of meteorologists. Thus, not sure how helpful POP is. I try to avoid using it.

176. Here in FL, there is no other way to describe the coverage of afternoon warm-season convection. People don't totally understand PoPs but they sure don't get "scattered" or "isolated" so the PoP is the best solution in our climate.

177. YouTube explanation for this. Not had many views, though. https://www.youtube.com/watch?v=u087_hQ9suo

178. The company I work for does not issue POP forecasts to clients but if we had to do so, the main thing we would be looking for is what kind of impact it might possibly have on their infrastructure and not so much the probability of occurrence. I think the views on POP forecasts are going to be different depending on the audience asked. If you ask the general public, they will want to know the probabilities of getting wet during their work day but as for the private sector, the main thing they care about it is what type of impact it will have on their business.

179. In my current market I use areal coverage because there is a 100% chance of rain somewhere in our DMA in the rainy season and it would be silly to out 100% in the forecast every day so I explain to the viewers that 40% chance of rain tomorrow means 40% coverage. In other markets I used POP to imply probability that someone sonewhere in our ADI would see rain but would always try to follow that up with an explanation of which spots were more likely as opposed to others.

180. POP for a time frame, such as 100% from 9am-11am, means that you are statistically 100% sure that for your forecast area for those 2-hrs it will rain.

181. Despite quoted definitions, I feel that every forecast and forecast entity interjects different POP interpretations into a forecast. Flurries with no accumulation might be imminent during the next 12 hours, yet because of the intensity, duration and amounts, many forecasters will never put a 90-100% POP in the forecast for that sort of event. It will be 40-60%. I believe that many mets may quote the definition, but rarely is there a forecaster that lives by it.

182. I was taught long long ago that: P=C x A (PoP equals Confidence times Area coverage).

183. The questions were difficult to answer because in the scenarios there was no indication of what models are being used for the next day's forecast, and what the local climatology is for 0.01 of precip. Also, I assumed that by "next day" you meant a 24-hour lead time.

184. Before I was a meteorologist (I'm a free agent now), I didn't understand PoP... Still don't. My main method is compare to MOS output & ensemble-derived probabilities.

185. Interesting survey. The old school 12-hour PoP is being used less in favor of much shorter duration, even hourly, PoPs. The official threshold is 0.01" but I would say most operational forecaster are calibrating for >=0.05 since this is where models begin to show better skill.

186. I very rarely if ever use PoPs in my forecast because they mean different things to different people. Instead I use qualifying terms like isolated, likely or scattered. Throwing more numbers at the consumer just confuses them

187. The "ranking" question didn't seem to work right -- whenever I tried to assign rankings, it immediately set them to 1-7 top to bottom regardless of what I did. If my confidence is very high in a particular scenario of evolution or coverage, such as during the first 24 hours, I will often use coverage descriptors ("scattered storms") rather than probabilities ("chance of showers").

188. I don't think we'll ever have the right answer for this topic, no matter how hard we try to find common ground.

189. Unfortunately POPs are a way to answer a binary question...will it rain, or will it not rain. In this era, people just want a yes or no answer, which a lot of the time is not possible. My biggest gripe with POPs is that most use the 0.01" rule. So it could lightly rain all day, not measure, and therefore technically "not rain". But try telling that to the general public. Even many of my colleagues had never heard of the 0.01" threshold that is used by many.

190. Probability and coverage are the same in expectation, so in some mathematical sense this is a silly question. It's a great sociology question, however, given how few forecasters know the relevant math.

191. What is "east central" region? A important question is the PoP period. Including your examples for coming 24 hours vs 6 or 3 hour periods would generate very different answers. It shows great weakness in communicating what we "know" in showing 1 icon with 1 PoP for 1 day in a 7 day graphic that might be on the screen for 10 seconds

192. I believe POP is affected by the user you are providing a forecast for. For example, forecasting for an area or region is different than forecasting for a specific point. While the chance of having a thunderstorm in the northern half of Virginia, for example, may be pretty good (by whatever standard that means), the chance of a thunderstorm occurring at Dulles airport is much smaller. Conveying that uncertainty to users is probably the toughest thing a forecaster does now. Models have made weather forecasting relatively straightforward. Translating that forecast into useable information for users is much more difficult.

193. The official definition of areal coverage, and viewer's perception is very different. It's confusing to most people and they all perceive it differently. Mostly, they perceive it as 50% at their house. I don't like percentages, but we're stuck with them.

194. I personally leave out daily percentages for rainfall. The general public, doesn't understand our CWA, so I choose to go with isolated, scattered, widespread, etc.

Author note-
This survey was intended to spur discussion, while gauging diversity of perspectives, and it did!