Notes About CPC Seasonal Prediction

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To see the whole picture regarding CPC's seasonal prediction format, one needs to understand that we are at the intersection of practice, operational protocol, tradition, (some) rational thinking and assumptions as to what people/users understand.

1a. The deterministic mind: When skill is low the forecast should tend to climatology (or normal) as a point forecast in order to minimize the traditional RMSE.

1b. The probabilistic mind: When skill is low the forecast should tend to the climatological pdf in order to minimize the probability score (a RMSE for probabilities).

The verification measure and the way we express forecasts are one of the same thing; how we handle the low (down to zero) skill forecast is part of that.

1c. Skill in our prediction is the improvement in the attribute MSE of our prediction system over the MSE of the control prediction (usually predicting always climatology).

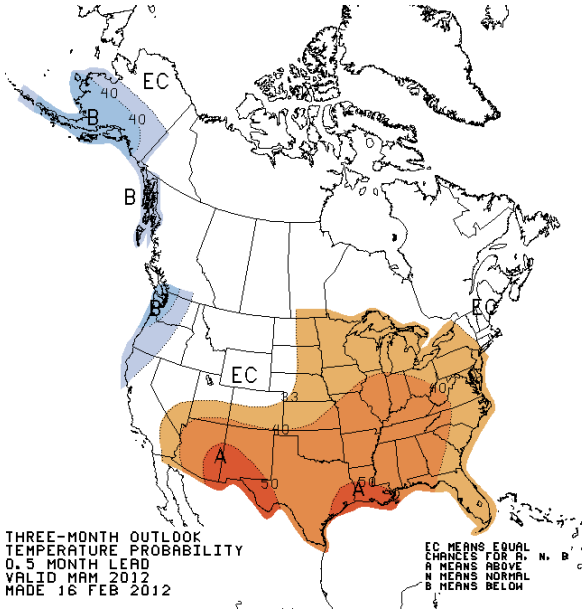
2. Article of faith: Uncertainty shall be conveyed by a probability forecast. Or more precisely a predicted pdf shall be conveyed to the user and contrasted to the climatological pdf (supposedly known to the user, and used in the absence of any other information).

3. It is thought to be hard if not impossible to convey a full (predicted or climatological) pdf to the user. So instead of analytical expressions, or umpteen bins the NWS has promoted (since 1940 at least) the use of a tercile system as a simple way to express the essence of the full pdf, B(elow), N(ear Normal) and A(bove).

4. Three classes can be designed in many ways, but here we reason our way forward with three classes that have equal chances ($1/3^{rd}$) by design in the climatological distribution. (CPC previously had 30/40/30 classes for the seasonal prediction, so this detail is not so obvious as it seems)

5. The complete forecast in a tercile system consists obviously of three numbers at each locale, or perhaps only two (because the 3^{rd} can be found because the three add up to 100%; never mind that NWS does not recommend 'do-it-yourself' forecasts.).

6. There is an unwritten rule that a forecast (even a probabilistic forecast) should be displayable on a single map. We thus have a task to represent three numbers (that add up to 100%) by one number that can be contoured. The underlying single positive number is x, the probability anomaly. The map shows contours of $x+1/3^{rd}$.



7. In drawing the map we distinguish four and only four situations:

7a. The A class has x points extra, the B class has x points less. N is unchanged.

7b. The B class has x points extra, A class has x points less. N is unchanged.

7a and 7b are of the Peter robs Paul type.

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*They arise arguably by a modest** shift and modest narrowing of the predicted pdf (relative to climatological pdf) towards warm (7a) or towards cold (7b). In these case the N class changes very little indeed, so we get away with plotting one number on a map.*

7c. The N class gets x points extra, borrowed equally (x/2) from the A and B class.

The opposite, the non-N forecast, with A and B both enhanced by x/2, is technically very possible, but not allowed in the NWS.

7d. x=0. All classes have their climatological probability (which happens to be equal chances nowadays). How you name this situation is another matter, we have had at times notation I , CP, CL and EC standing for indeterminate, climatological probabilities (both CP and CL), and presently equal chances.

8. We draw maps of x+1/3rd . Colors and letters are provided to aid the user to see whether we are, at a particular locale, in situation 7a, 7b, 7c or 7d. The user is supposed to know the rules expressed in 7a-7d !!. The advanced user who does not care about three classes and/or silly simplifications and rules can go to the POE in umpteen classes.

9. If x+1/3rd does not reach 40% anywhere we resort to the x=0 (7d) situation. Stated another way: in each area colored blue or red (brown and green for precip) there should be at least a 40% probability line.

10. We rarely put extra points (x) in the N(ear Normal class). Therefore many people have forgotten about situation 7c, and are surprised/confused about its meaning when it occurs.

It takes very high skill to reach x=7% for the near normal class. We don't have high skill. The reason we cannot forecast the N class very well is explained in Van den Dool and Toth (1991) and confirmed many times since. It boils down to vanishingly low signal to noise ratio for climatological forecasts, whether it be deterministic or probabilistic climatology forecasts.

** Special rules are in effect when the shift is not modest, but very large. This has not happened in years and will be ignored here to keep it simple.

Terminology

Pdf = probability density function (like a histogram of observed frequencies of occurrence for wisely chosen bins)

POE = Probability of exceedence

(R)MSE = (Root) Mean Square Error

Reference

Van Den Dool, Huug M., Zoltan Toth, 1991: Why Do Forecasts for "Near Normal" Often Fail? *Wea. Forecasting*, **6**, 76–85. http://dx.doi.org/10.1175/1520-0434(1991)006<0076:WDFFNO>2.0.CO;2