

Forecast Probability for the UW SREF (*The Democracy is Dead*)

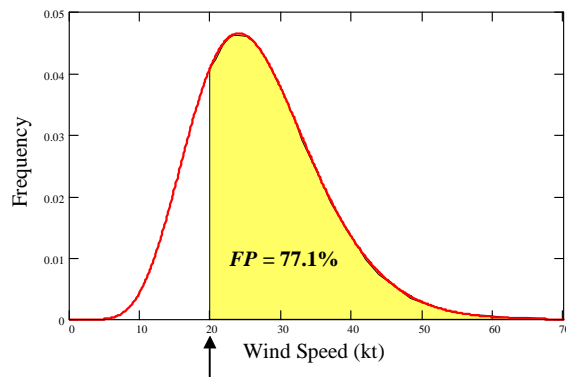
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April 24, 2003

Ideal Calculation of Forecast Probability (*FP*)

Given a very large ensemble, a PDF could be found a grid point for any parameter (e.g., wind speed, W_s).

For a certain threshold, say $W_s \geq 20\text{kt}$, the *FP* is then simply the area under the PDF to the right ($1-p$ value)



Unfortunately, we work with very small ensembles so we can't make a good estimate of the PDF. Plus, we often do not even know what PDF shape to fit.

So we are forced to estimate *FP* by other means, for a set of W_s forecasts at a point such as:

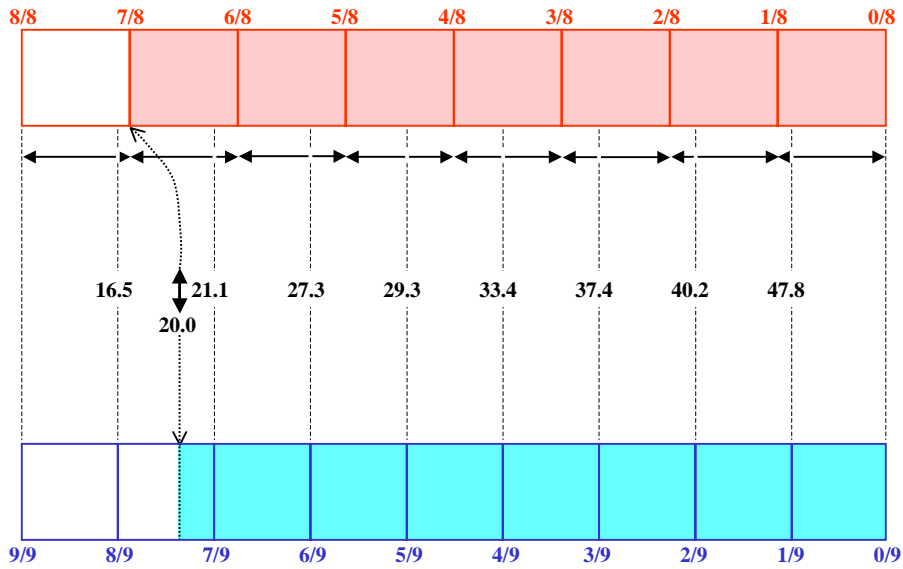
$W_s = \{16.5 \ 21.1 \ 27.3 \ 29.3 \ 33.4 \ 37.4 \ 40.2 \ 47.8\}$

Note: These are random draws from the PDF above

Democratic Voting FP

“pushes” FP towards the extreme values, so high FP is normally over-forecast and low FP is normally under-forecast.

$$FP = 7/8 = 87.5\%$$



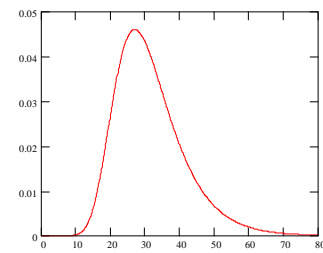
Uniform Ranks FP

a continuous, more appropriate approximation.

$$FP = 7/9 + [(21.1 - 20.0) / (21.1 - 16.5)] * 1/9 = 80.4\%$$

FP When Threshold Falls in an Extreme Rank

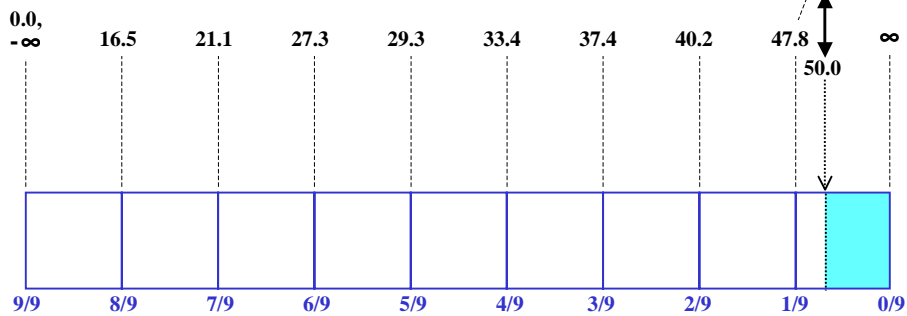
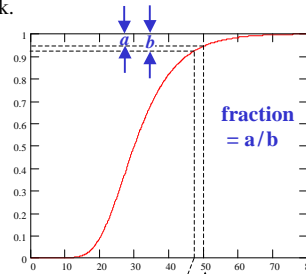
Use the tail of a Gumbel PDF to approximate the fraction for the last rank.



$$G_{CDF}(x) = \exp\left[-\exp\left(\frac{\xi - x}{\beta}\right)\right]$$

$$\hat{\beta} = \frac{s\sqrt{6}}{\pi}$$

$$\hat{\xi} = \bar{x} - \gamma\hat{\beta}$$



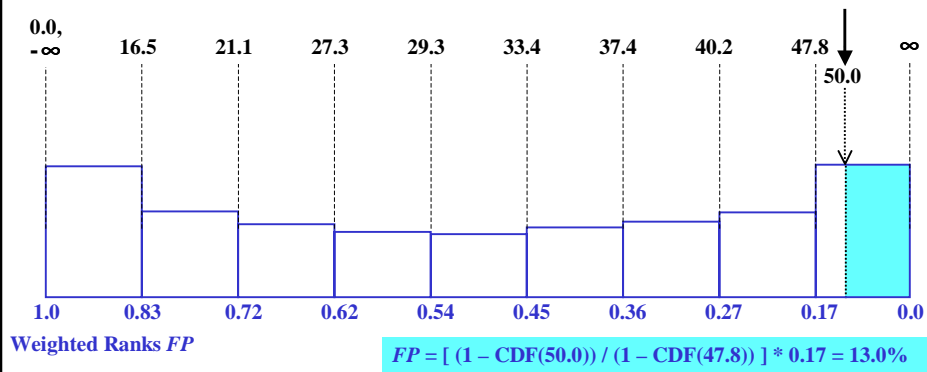
Uniform Ranks FP

$$FP = [(1 - G_{CDF}(50.0)) / (1 - G_{CDF}(47.8))] * 1/9 = 8.5\%$$

Calibration by Weighted Ranks

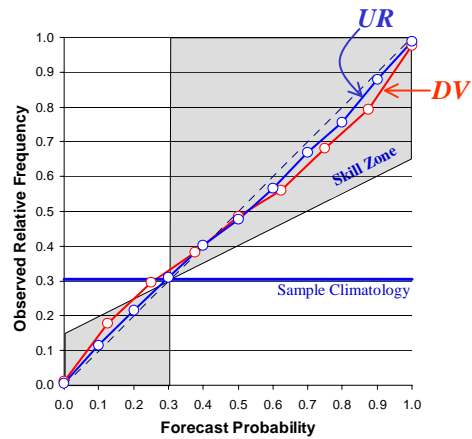
Use the verification rank histogram from past cases to define non-uniform, “weighted ranks”.

The ranks to sum up and fraction of the rank where the threshold falls are found the same way as with uniform ranks, but now the probability within each rank is the chance that truth will occur there.



Uniform Ranks vs. Democratic Voting

- Data Info
- $P(\text{MSLP} < 1002\text{mb})$
 - Verification: centroid analysis
 - 70 forecasts (Nov 25, 2002 – Feb 7, 2003)
 - Applied 2-week, running bias correction
 - 36km, Outer Domain
 - Lead time = 48h



References

- Eckel, F. A., 1998: Calibrated probabilistic quantitative precipitation forecasts based on the MRF Ensemble. *Masters Thesis*, 133 pp
- , and M. K. Walters, 1998: Calibrated probabilistic quantitative precipitation forecasts based on the MRF Ensemble. *Wea. and Fcst.*, **13**, 1132–1147
- Hamill, T. M. and S. J. Colucci, 1997: Verification of Eta-RSM short-range ensemble forecasts. *Mon. Wea. Rev.*, **125**, 1312–1327