EVALUATION OF PROBABILISTIC PRECIPITATION FORECASTS DETERMINED FROM ETA AND AVN FORECASTED AMOUNTS

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MOTIVATION

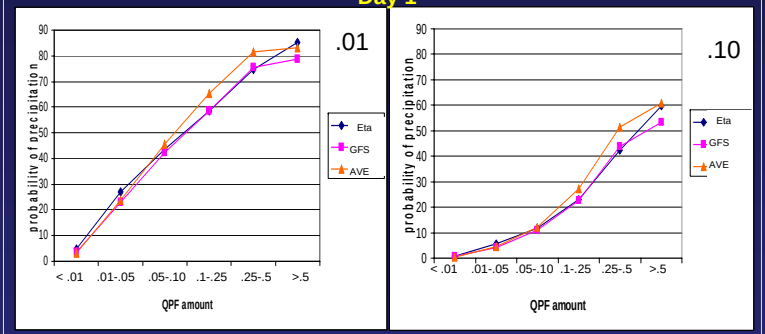
- Wilks (1990) found that heavier precipitation was likely to occur in regions with higher subjectively-determined forecast probabilities than in regions with lower probabilities
- Is the reverse true? Is precipitation more likely to occur in those areas where heavier amounts are forecasted by models than in regions with lighter amounts (or none)?
- Gallus and Segal (2004) found the QPF-probability relationship to work well for warm-season MCS rainfall in a few high resolution Eta and WRF runs.

METHODOLOGY

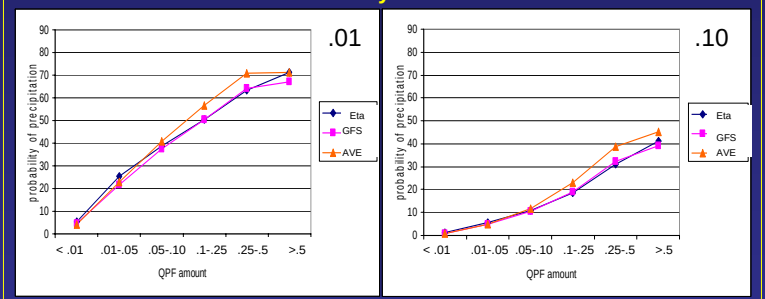
- One year (9/1/02 – 8/31/03) of Eta and GFS 40 km model output (00 and 12 UTC) was used as a training set to determine conditional probabilities of precipitation as a function of QPF binned amounts (for 3 h periods)
- Following year (9/1/03 – 8/31/04) was used to test the probability forecasts derived from the QPF amount.
- This study extends results of Gallus and Segal (2004) to entire country over entire year
- Forecasts are evaluated using Brier score decomposition, and reliability and ROC curves

Conditional Probability of Precipitation as a function of QPF amount for 3 h periods (determined from first year of data)

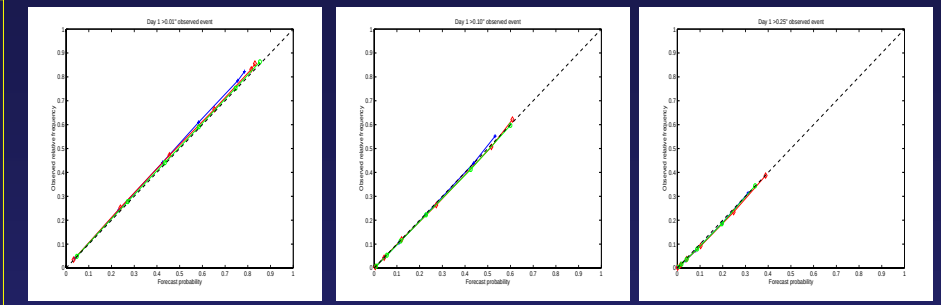
Day 1



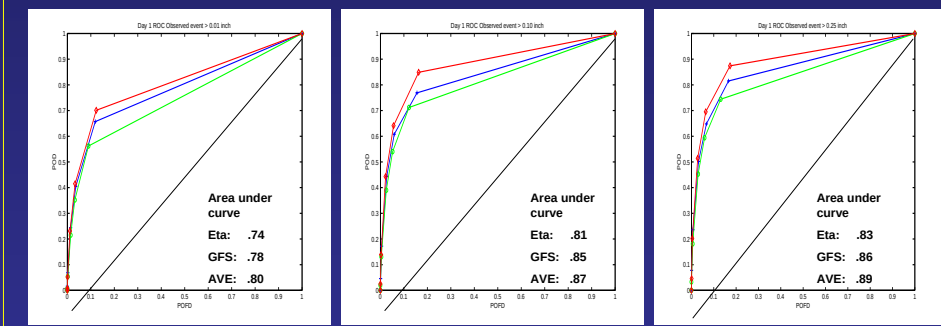
Day 2



On both days 1 and 2, for the Eta, GFS, and an average of the two models, rainfall above thresholds of .01 and .10" (and .25 not shown) occurs more frequently when the QPF amount is larger.



The probability forecasts for year 2 based on the QPF amount-probability relationship found in year 1 display almost perfect reliability for three tested 3h thresholds (Eta-green, GFS-blue, average of the two models – red)



ROC curves for the Eta (green), GFS (blue) and average of the two (red) show substantial skill for forecasts of rain above .01, .10, and .25 in. thresholds in 3 h.

	Obs. Rain Threshold (in.)	GFS	Eta	AVG
Brier Score	.01	6.66	6.95	6.43
	.10	1.87	1.93	0.69
BSS	.01	23.3	20.0	26.0
	.10	14.8	12.4	16.8
Uncertainty	.01	8.69	8.69	8.69
	.10	2.20	2.20	2.20
Reliability	.01	.005	.0008	.004
	.10	.0002	.0003	.0005
Resolution	.01	2.03	1.73	2.26
	.10	0.33	0.27	0.37

Brier Score Decomposition of accuracy of day 1 Probability of Precipitation forecasts

	Obs. Rain Threshold (in.)	GFS	Eta	AVG
Brier Score	.01	7.27	7.48	7.03
	.10	2.00	2.03	1.96
BSS	.01	16.4	13.9	19.1
	.10	9.0	7.6	10.8
Uncertainty	.01	8.69	8.69	8.69
	.10	2.20	2.20	2.20
Reliability	.01	.001	.0003	.001
	.10	.0006	.0004	.0005
Resolution	.01	1.42	1.21	1.66
	.10	0.20	0.17	0.24

Brier Score Decomposition of accuracy of day 2 Probability of Precipitation forecasts

Summary and Conclusions

- Forecasters can issue accurate and reliable probability of precipitation forecasts based on model QPF amount alone.
- Higher QPF amounts in 40 km Eta and GFS output, as in the 10 km WRF and Eta runs performed by Gallus and Segal (2004) are associated with higher probabilities of precipitation occurring.
- The technique works even better when applied to averages of QPF, suggesting it can improve ensemble forecasts

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