PACIFIC REGION TECHNICAL NOTES

83-022
May 16, 1983

Verification of POP over the Central Interior and Columbia Mountain Region of British Columbia

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INTRODUCTION

The Central Interior forecast district represents one of the largest public forecast regions of British Columbia. Despite the need for verifying a number of sites, only one, Prince George has been chosen at this time. Most often the public forecast region is not split up into its three smaller subregions, and as a result generally one POP value is given to represent the region. Since Prince George is one of the primary population centres in this region, the verification results should indicate whether the forecasts are meaningful.

Revelstoke has also been considered as part of this verification study. It is situated near the western entrance of Glacier National Park in the Columbia Forecast district. Although significant population centres are few in this forecast district, the region has additional importance because it contains one of B.C.'s major transportation arteries with the Prairies and Eastern Canada.

Objective Probability of Precipitation Amounts (POPA) guidance from CMC are also available for these two sites. The POPA is a by-product of a statistical technique to produce a probability of receiving light, moderate, and heavy precipitation at a particular site. A comparison is made between the performance of these forecasts (based on 00Z) and the subjective ones produced by the Pacific Weather Centre at 5 a.m.

VERIFICATION PROCEDURE

As discussed in the previous Pacific Region Technical Notes, the scoring method is based on the Brier score (the mean square error). The score is broken down into two parts to gain further insight into the causes of the error. The first component is the reliability error which is proportional to the deviation between the forecast probability and the resulting observed frequency in each of the eleven 10% forecast categories. Reliability can vary between 0 and 1. The remaining component of the Brier score is the sharpness (resolution) error, which is dependent only on the observed frequency in each category. Sharpness errors range from 0 to .25, but a more realistic minimum would be around .09. Perfectly reliable POP forecasts of either 10 or 90% would yield a score of .09.

Skill scores are also generated based: firstly on a random (uneducated) prediction; and secondly on climatology. In the first instance, the

forecasters' skill is measured against a constant 50% POP prediction which could be symbolized by the toss of a coin to yield a precipitation forecast. The second standard is more representative of an educated prediction based only on the relative frequency of precipitation in the past.

A more detailed description of the verification method is contained in PRTN 83-019.

RESULTS

For all the Figures (1-4), the "a" figures present the reliability and the sharpness errors (summed to give the Brier score) for the forecast and the guidance. The "b" figures display the forecast frequency for 5 categories (0, 10-30, 40-60, 70-90, & 100%) and the reliability error associated with each category.

Verification results for Prince George are depicted in Figures 1 (Sept.-Nov.) and 2 (Dec.-Feb). Similar to the verification results of the other B.C. stations, forecasts for the Sept.-Nov. period were better than those for the Dec.-Feb. period. This is true not just for the subjective forecast, but the objective guidance as well.

Most of the skill in the subjective forecasts (Figures 1a and 2a) occurs in the Today period, and the skill falls off as forecasts are made further into the future (i.e. Tomorrow). The skill is generally poorer in the Dec.-Feb. period when compared to the previous 3 month period. The skill levels of the objective guidance are low for both 3 month periods and generally do not prove to be useful guidance.

Most of the errors in the forecasts arise in the sharpness (resolution), which is generally smaller for the subjective forecasts than the guidance. Reliability errors are generally comparable, but are generally larger than the reliability errors for other B.C. locations. Further insight in the cause of the magnitude of the Brier scores can be seen by considering Figures 1b and 2b. The majority of the objective guidance issued for Prince George fall between 40 and 60%, with forecasts of near 0 or 100% being generally rare. The subjective forecasts are generally more polarized toward either end of the scale. The reliability errors are depicted by the shading in each forecast category (the solid bar shading represents underforecasting, while the bar-dot shading is an overforecasting). The result indicates that no one particular forecast category is any more reliable than any other, but the bias of the objective guidance to predict a POP of about 50% most of the time undermines the utility of the guidance as a forecast aid. Given this forecast distribution and perfectly reliable forecasts, the sharpness errors of the guidance (also Brier score) would be always greater than .20, while the sharpness errors of the subjective forecast would range between .12 and .16. This type of improvement in the subjective forecast would result in about an 80% increase in skill, while little improvement would result in the objective guidance.

The results for Revelstoke are illustrated in Figures 3 and 4. Comparing the results between the Sept.-Nov. period (3a) and the Feb.-Dec. period (4c), the same deteriorating trend in skill is observed between the first and last period as was noted at other B.C. interior sites. The most noticeable feature is the skill levels of the objective guidance. In the Sept.-Nov. period, the skill was better in all periods than that of the subjective forecasts. Skill levels of the subjective forecast were marginally better in the Today period when compared to the objective guidance during Dec.-Feb. However, the guidance demonstrated skill through Tomorrow while skill fell off in the case of the subjective forecasts. For the most part, reliability and sharpness errors were smaller.

Figures 3b and 4b highlight the reason why the guidance is performing so well. The majority of the forecasts are greater than 40% with generally good reliability in each category. Unlike the forecasts for Prince George, the guidance forecasts for Revelstoke are not clustered around 50% but appear to be more polarized towards the end of the scale. On the other hand, the subjective forecasts appear to be nearly evenly distributed throughout the forecast groups, with a strong bias to underforecast in the 10-30% category during the Dec.-Feb. period. If the subjective forecasts had been perfectly reliable there would be about a 40% improvement in skill, while the objective guidance would have shown generally a lesser improvement.

SUMMARY

Forecasters generally show less skill in forecasting POP over the interior than they do over the coastal regions. This fact could be due to the added uncertainty of precipitation spreading into the interior or possibly due to timing of the beginning/ending of precipitation at interior locations.

For the most part, the objective guidance at Prince George is not particularly skillful with the majority of the guidance forecasts clustered around 50%. The lack of skill is consistent with the findings at Penticton. However, the guidance forecasts for Revelstoke do show skill (best during the Sept.-Nov. period), which makes the product as a reliable first guess for a POP forecast for the Columbia forecast district.

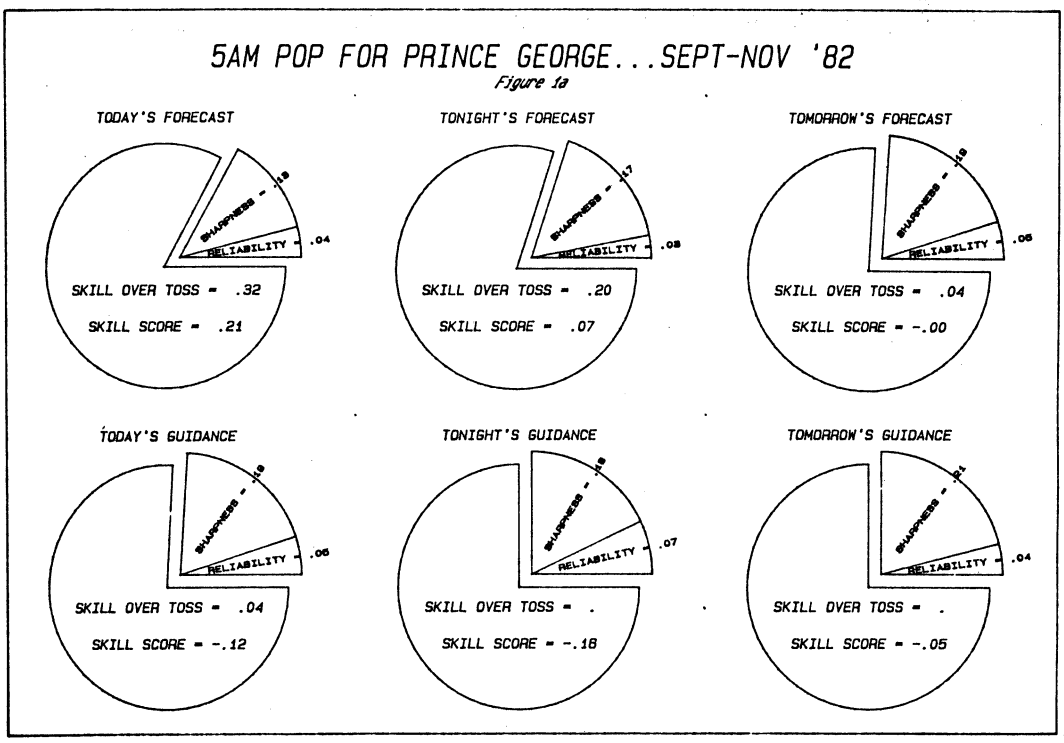
In terms of Today forecasts, the subjective forecasts are showing generally fair to good skill for both Prince George and Revelstoke, and the forecasts were generally better during the Sept.-Nov. period.

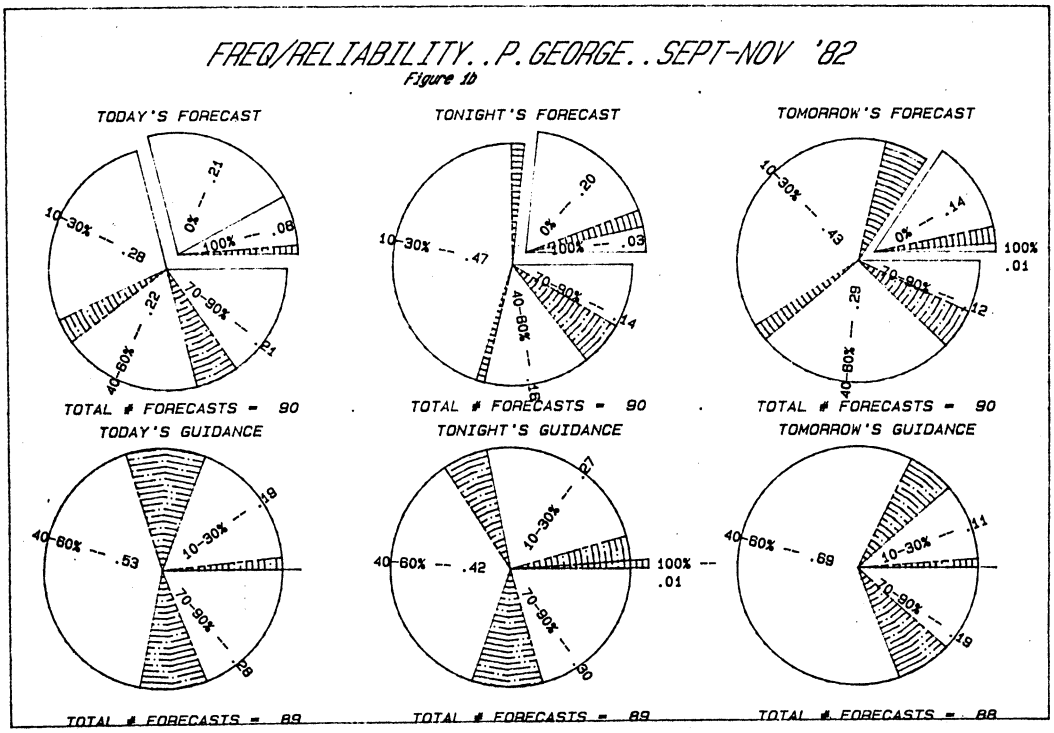
REFERENCES

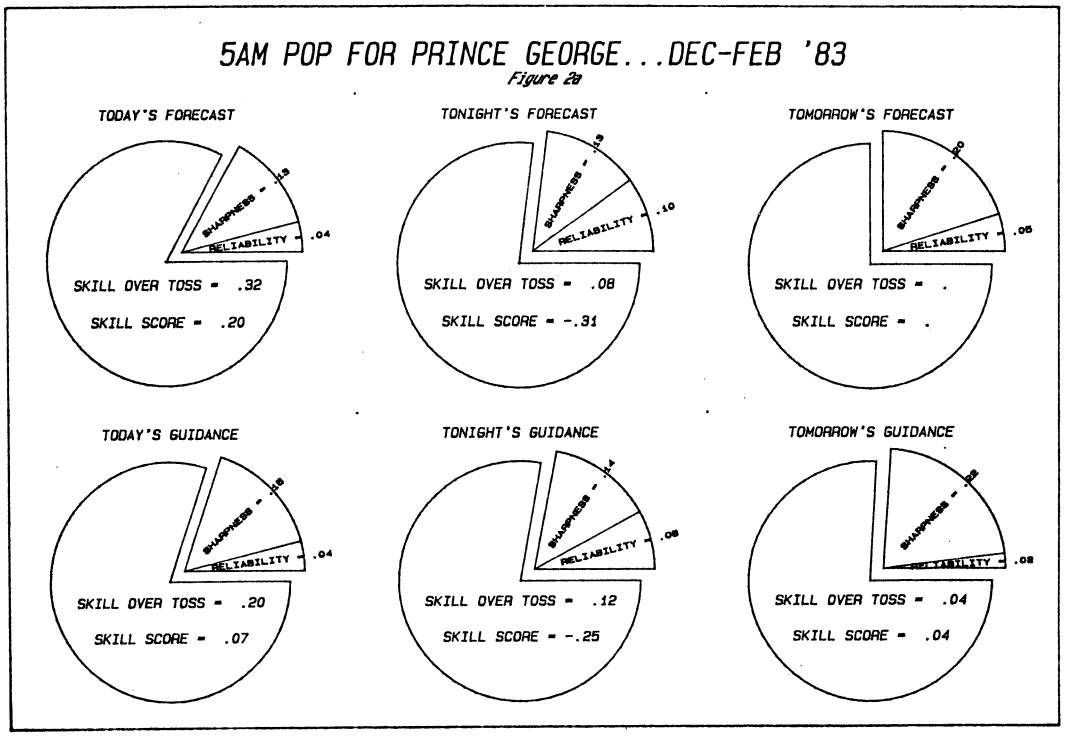
Grimes, D., 1983, Verification of POP over the South Coast of British Columbia, PRTN 83-019.

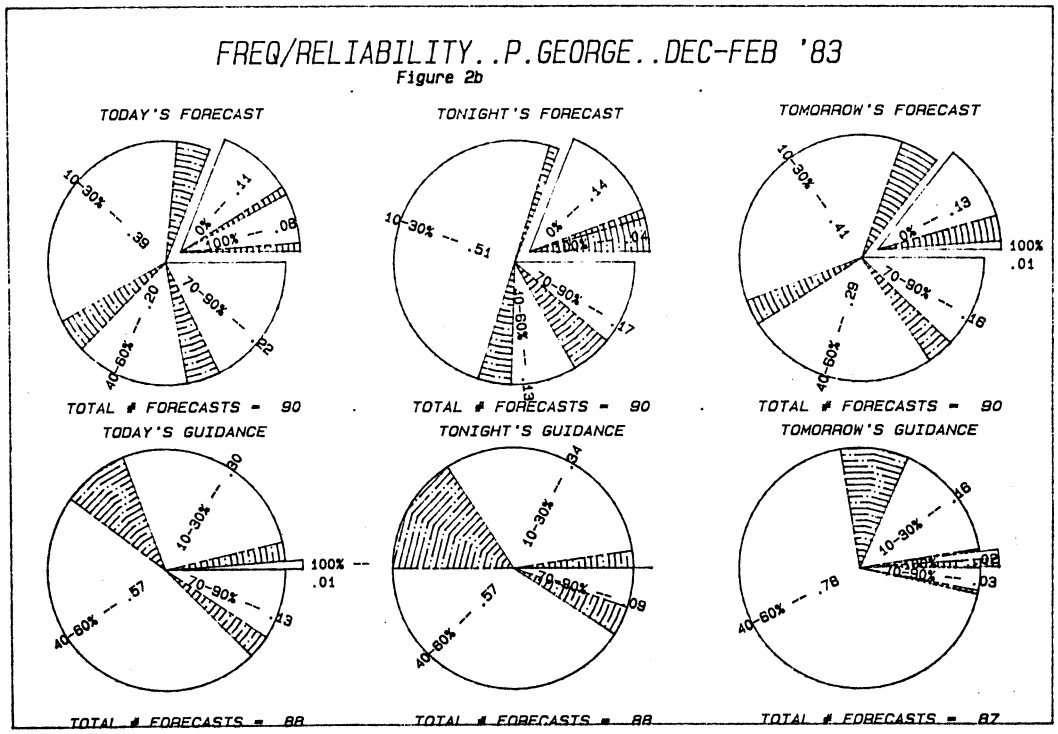
Grimes, D., 1983, Verification of POP over the Southern Interior of British Columbia, PRTN 83-020.

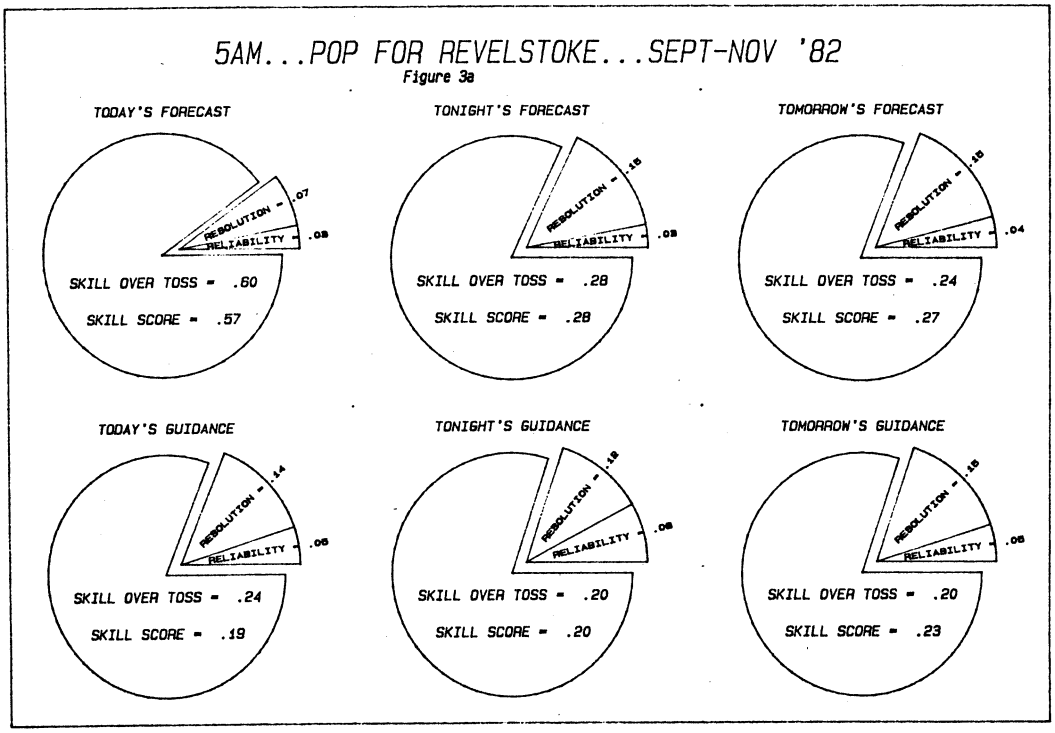
Grimes, D., 1983, Verification of POP over the North Coast of British Columbia, PRTN 83-021.

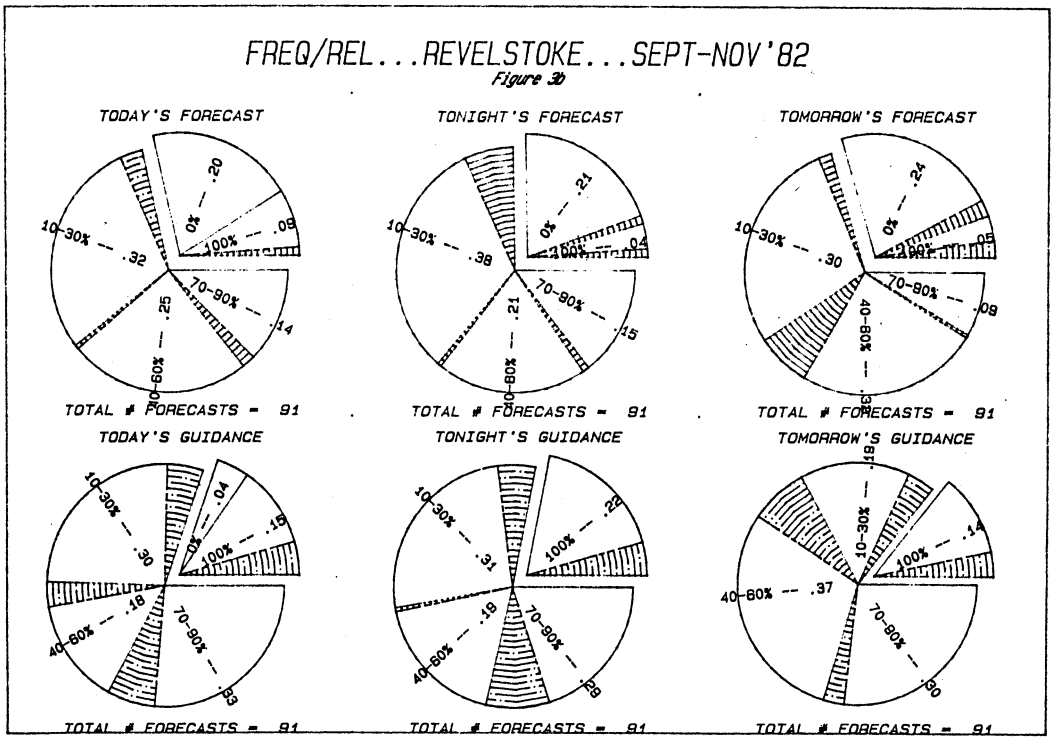

5AM POP FOR PRINCE GEORGE...SEPT-NOV '82
Figure 1a
TODAY'S FORECAST
SHARPNESS = .19
RELIABILITY = .04
SKILL OVER TOSS = .32
SKILL SCORE = .21
TONIGHT'S FORECAST
SHARPNESS = .17
RELIABILITY = .08
SKILL OVER TOSS = .20
SKILL SCORE = .07
TOMORROW'S FORECAST
SHARPNESS = .19
RELIABILITY = .06
SKILL OVER TOSS = .04
SKILL SCORE = -.00
TODAY'S GUIDANCE
SHARPNESS = .19
RELIABILITY = .06
SKILL OVER TOSS = .04
SKILL SCORE = -.12
TONIGHT'S GUIDANCE
SHARPNESS = .18
RELIABILITY = .07
SKILL OVER TOSS = .
SKILL SCORE = -.18
TOMORROW'S GUIDANCE
SHARPNESS = .21
RELIABILITY = .04
SKILL OVER TOSS = .
SKILL SCORE = -.05

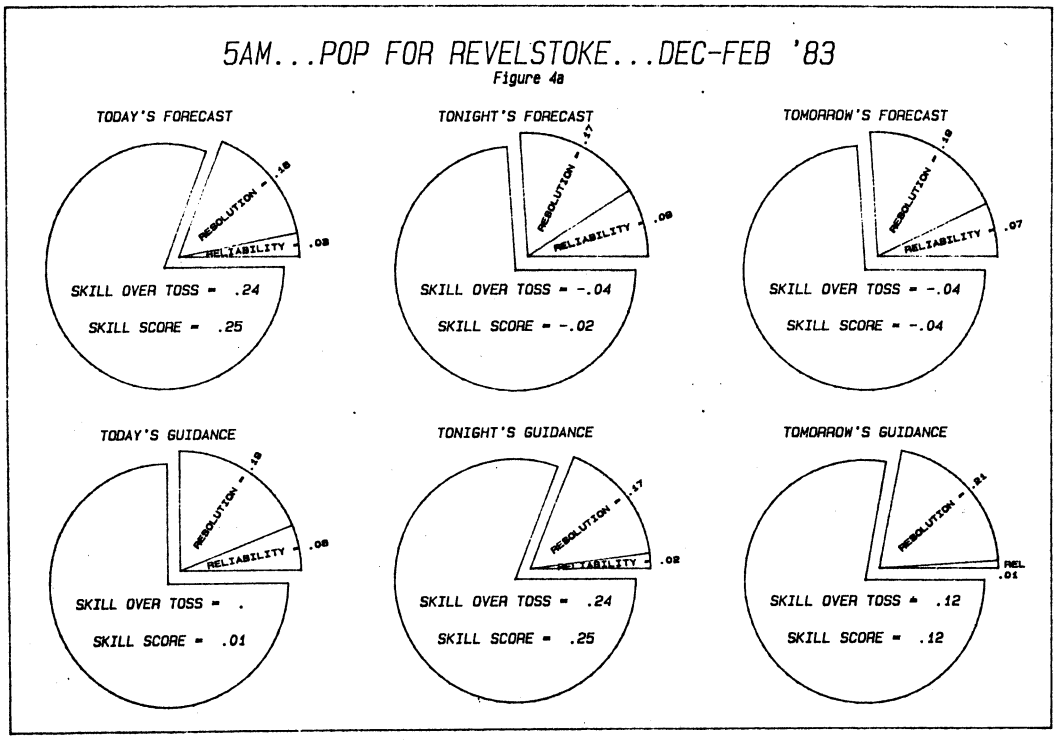

FREQ/RELIABILITY..P.GEORGE..SEPT-NOV '82
Figure 1b
TODAY'S FORECAST
0% -- .21
100% -- .06
10-30% -- .28
40-60% -- .22
70-90% -- .21
TOTAL # FORECASTS = 90
TONIGHT'S FORECAST
0% -- .20
100% -- .03
10-30% -- .47
40-60% -- .13
70-90% -- .14
TOTAL # FORECASTS = 90
TOMORROW'S FORECAST
0% -- .14
100% -- .01
10-30% -- .43
40-60% -- .29
70-90% -- .12
TOTAL # FORECASTS = 90
TODAY'S GUIDANCE
10-30% -- .19
40-60% -- .53
70-90% -- .28
TOTAL # FORECASTS = 89
TONIGHT'S GUIDANCE
10-30% -- .27
100% -- .01
40-60% -- .42
70-90% -- .30
TOTAL # FORECASTS = 89
TOMORROW'S GUIDANCE
10-30% -- .11
40-60% -- .69
70-90% -- .19
TOTAL # FORECASTS = 88

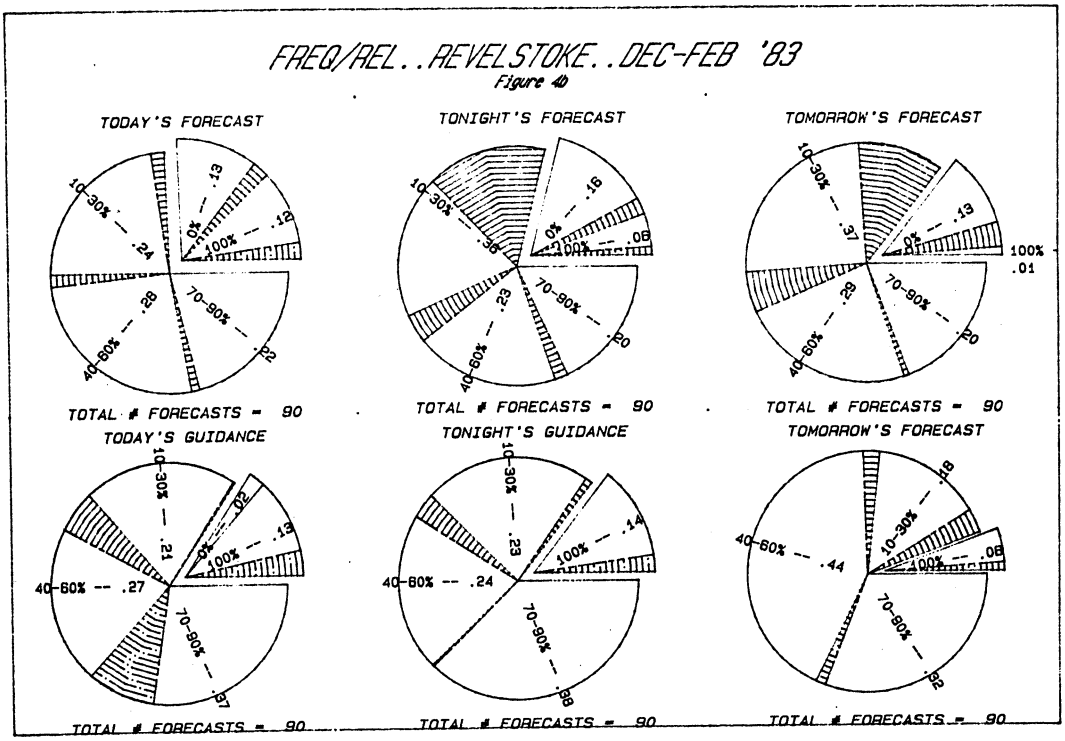

5AM POP FOR PRINCE GEORGE...DEC-FEB '83
Figure 2a
TODAY'S FORECAST
SHARPNESS = .13
RELIABILITY = .04
SKILL OVER TOSS = .32
SKILL SCORE = .20
TONIGHT'S FORECAST
SHARPNESS = .13
RELIABILITY = .10
SKILL OVER TOSS = .08
SKILL SCORE = -.31
TOMORROW'S FORECAST
SHARPNESS = .10
RELIABILITY = .05
SKILL OVER TOSS = .
SKILL SCORE = .
TODAY'S GUIDANCE
SHARPNESS = .13
RELIABILITY = .04
SKILL OVER TOSS = .20
SKILL SCORE = .07
TONIGHT'S GUIDANCE
SHARPNESS = .14
RELIABILITY = .08
SKILL OVER TOSS = .12
SKILL SCORE = -.25
TOMORROW'S GUIDANCE
SHARPNESS = .09
RELIABILITY = .02
SKILL OVER TOSS = .04
SKILL SCORE = .04


FREQ/RELIABILITY..P.GEORGE..DEC-FEB '83
Figure 2b
TODAY'S FORECAST
0% .11
100% .06
10-30% .38
40-60% .20
70-90% .22
TOTAL # FORECASTS = 90
TONIGHT'S FORECAST
0% .14
10-30% .51
70-90% .17
TOTAL # FORECASTS = 90
TOMORROW'S FORECAST
0% .13
100% .01
10-30% .41
40-60% .29
70-90% .16
TOTAL # FORECASTS = 90
TODAY'S GUIDANCE
10-30% .30
100% .01
40-60% .57
70-90% .13
TONIGHT'S GUIDANCE
10-30% .34
40-60% .57
70-90% .09
TOMORROW'S GUIDANCE
10-30% .18
40-60% .78
70-90% .03


5AM...POP FOR REVELSTOKE...SEPT-NOV '82
Figure 3a
TODAY'S FORECAST
RESOLUTION = .07
RELIABILITY = .03
SKILL OVER TOSS = .60
SKILL SCORE = .57
TONIGHT'S FORECAST
RESOLUTION = .15
RELIABILITY = .03
SKILL OVER TOSS = .28
SKILL SCORE = .28
TOMORROW'S FORECAST
RESOLUTION = .15
RELIABILITY = .04
SKILL OVER TOSS = .24
SKILL SCORE = .27
TODAY'S GUIDANCE
RESOLUTION = .14
RELIABILITY = .06
SKILL OVER TOSS = .24
SKILL SCORE = .19
TONIGHT'S GUIDANCE
RESOLUTION = .18
RELIABILITY = .08
SKILL OVER TOSS = .20
SKILL SCORE = .20
TOMORROW'S GUIDANCE
RESOLUTION = .15
RELIABILITY = .05
SKILL OVER TOSS = .20
SKILL SCORE = .23


FREQ/REL...REVELSTOKE...SEPT-NOV'82
Figure 3b
TODAY'S FORECAST
0% .20
100% .09
10-30% .32
70-90% .14
40-60% .25
TOTAL # FORECASTS = 91
TONIGHT'S FORECAST
0% .21
100% .04
10-30% .38
70-90% .15
40-60% .21
TOTAL # FORECASTS = 91
TOMORROW'S FORECAST
0% .24
100% .05
10-30% .30
70-90% .09
40-60% .32
TOTAL # FORECASTS = 91
TODAY'S GUIDANCE
0% .04
100% .15
10-30% .30
70-90% .33
40-60% .18
TOTAL # FORECASTS = 91
TONIGHT'S GUIDANCE
100% .22
10-30% .31
70-90% .28
40-60% .19
TOTAL # FORECASTS = 91
TOMORROW'S GUIDANCE
10-30% .18
100% .14
40-60% .37
70-90% .30
TOTAL # FORECASTS = 91


5AM...POP FOR REVELSTOKE...DEC-FEB '83
Figure 4a
TODAY'S FORECAST
RESOLUTION = .18
RELIABILITY = .08
SKILL OVER TOSS = .24
SKILL SCORE = .25
TONIGHT'S FORECAST
RESOLUTION = .13
RELIABILITY = .09
SKILL OVER TOSS = -.04
SKILL SCORE = -.02
TOMORROW'S FORECAST
RESOLUTION = .10
RELIABILITY = .07
SKILL OVER TOSS = -.04
SKILL SCORE = -.04
TODAY'S GUIDANCE
RESOLUTION = .10
RELIABILITY = .08
SKILL OVER TOSS = .
SKILL SCORE = .01
TONIGHT'S GUIDANCE
RESOLUTION = .17
RELIABILITY = .02
SKILL OVER TOSS = .24
SKILL SCORE = .25
TOMORROW'S GUIDANCE
RESOLUTION = .01
REL .01
SKILL OVER TOSS = .12
SKILL SCORE = .12


FREQ/REL..REVELSTOKE..DEC-FEB '83
Figure 4b
TODAY'S FORECAST
0% .13
100% .12
10-30% .24
40-60% .28
70-90% .12
TOTAL # FORECASTS = 90
TONIGHT'S FORECAST
0% .16
100% .08
10-30% .30
40-60% .23
70-90% .20
TOTAL # FORECASTS = 90
TOMORROW'S FORECAST
0% .13
100% .01
10-30% .37
40-60% .29
70-90% .20
TOTAL # FORECASTS = 90
TODAY'S GUIDANCE
0% .02
100% .13
10-30% .21
40-60% .27
70-90% .37
TOTAL # FORECASTS = 90
TONIGHT'S GUIDANCE
0% .14
100% .23
10-30% .24
70-90% .38
TOTAL # FORECASTS = 90
TOMORROW'S FORECAST
10-30% .18
100% .08
40-60% .44
70-90% .32
TOTAL # FORECASTS = 90