

Evaluation of short-term weather forecasts in South Africa

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Abstract

In this paper a brief overview will be given for the reasons for doing evaluations of short-term weather forecasts as well as the methodology thereof. Short-term weather forecasts are defined as a forecast valid for the current day as well as the next day. In other words up to 48 h ahead. Results are given for South African Weather Service temperature, rainfall and severe weather forecasts as issued by head office in Pretoria. Temperature forecasts generally tend to be accurate to within a limit of 2.3°C. A comparison is made between temperature forecasts for an inland station, a coastal station and a station influenced by the escarpment. Tendencies of rainfall forecasts show that rain is forecast more often than it occurs. Comparative rainfall forecasts for a summer and winter rainfall region are shown. Severe weather events are sometimes captured well, but severe thunderstorms are not predicted with great accuracy. Once again the tendency is to over-forecast. With one of the scientific aims of forecasting evaluations being to concentrate on areas of under-performance, these statistics show that a better observation network would improve conditions for evaluation of forecasts. Further research should be focused on alternative or better techniques to forecast precipitation (general and severe) with greater accuracy.

Introduction

Weather forecasts are important in our everyday lives for planning of various activities. It is important to know what the weather forecast is in order to plan our day. However, no weather forecast has much value if one cannot rely on the information. The next question then is: How accurately can we forecast the weather in South Africa? The South African Weather Service is in the process of commercialisation and the accuracy of the forecasts will become more important to a client who will have to pay for the service in the near future. Aside from financial motivation to do evaluations, objective evaluation of weather forecast quality is done for a variety of reasons. Brier and Allen (1951) categorised these as serving administrative, scientific and economic purposes:

- **Administrative**

Comparing the reality with a forecast should be part of the procedure in every forecasting office around the country. If long-term trends of evaluation at different stations are kept, it should be easy to see if a station's performance is improving or deteriorating. If the forecasts from a specific station appear to be below the standards of accuracy previously attained, one needs to investigate the reasons for the dropping of standards. The mere existence of a checking scheme - however simple and imperfect - tends to keep the forecasters more alert and interested in maintaining and improving the accuracy of forecasts.

- **Scientific**

Together with the increase in the understanding of the physical processes of the atmosphere, one would expect more accurate forecasts. Evaluation statistics can be used to monitor the trend in forecast accuracy. Another scientific purpose is to investigate the forecast errors to determine their nature and cause. It can serve to identify the synoptic conditions under which forecasts are most likely to be wrong or when numerical weather prediction

models are not capturing certain weather phenomena adequately. This knowledge can then be used to discover the weaknesses of forecasting systems in order to decide where research emphasis is needed. Analysis of verification statistics can also help in the assessment of specific strengths and weaknesses of forecasters or forecasting systems (e.g. numerical weather prediction models). Forecasters should be given feedback on the performance of their forecasts in different situations that will hopefully lead to better forecasts in the future.

- **Economic**

The uses and users of forecasts are so diverse that it becomes problematic to determine the economic value of a forecast. In this case, the reliability of weather forecasts can be measured by their approach to the truth and expressing the result in terms of degrees Celsius or percentage of hits.

Ultimately the justification for any forecasting enterprise is that it supports better decision-making (Wilks, 1995).

Pitfalls of verification

The purpose of verification should not be to create negative competition between forecasters of forecasting offices. It should be used as a positive measure to inspire forecasters to better accuracy. According to Brier and Allen (1951) one of the greatest dangers lies in attempts to compare the relative abilities of forecasters on the basis of forecasts which are not comparable because of differences in location, season and time of day. The degree of forecasting difficulty varies so much from one forecasting circumstance to the next that a very large sample of forecasts is needed to ensure that the average weather has been approximately the same in the two sets of forecasts being compared. Even if the forecasts being compared are for the same event, there may be other factors to be considered such as whether or not equal map facilities were available to each forecaster.

Brier and Allen (1951) also mentioned that it should be decided ahead of time what measures of accuracy are needed. If the tolerances are set too wide, the verification will fail to discriminate

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