

# Verification of rainfall forecasts for the Vaal Dam catchment for the summer rainfall seasons of 1994 to 1998

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## Abstract

Rainfall forecasts compiled by the South African Weather Service (SAWS) are used daily by agriculture, industry, sportsmen and the general public. Because of the importance of the rainfall forecast, it is of considerable interest to know how reliable these forecasts are. The SAWS evaluates the rainfall forecasts issued by the Central Forecasting Office (CFO) on a daily basis. A hit score is determined in each of 19 rainfall districts throughout South Africa. This renders a result of approximately 60% correct forecasts for all 19 districts. This paper investigates the accuracy of the predicted rainfall percentages or rainfall classes. The 24h rainfall forecasts are verified for the summer months (October to March) of 1994 to 1998 for the Vaal Dam catchment. The rainfall distribution classes were chosen to represent no-rain, isolated rain, scattered rain and widespread rain. Results indicate that the percentage of correct forecasts is less than the values obtained by using the SAWS's hit score method. The predicted widespread rain class is less than 25% correct. The tendency exists to forecast scattered rain whenever any rain event is predicted. A rain event is seldom missed (3%), but some rain is often forecast (45%) for days, which then remain dry days. A more comprehensive rainfall forecast evaluation system is recommended.

**Keywords:** Rainfall forecasts, verification, rainfall distribution classes, Vaal Dam catchment

## Introduction

Rainfall forecasts are probably the most popular product provided by a forecasting office (Scholz, 2002). Agriculture, industry, sportsmen and the general public use the rainfall forecasts daily. The six forecasting offices of the South African Weather Service (SAWS) can receive, in total, up to 200 000 calls a month (South African Weather Service, Internal News Flashes, 2000). Many of these calls inquire about the rainfall outlook for anything from a few hours to a week ahead.

Edwards (2000) stated that the SAWS had adopted a policy, many years ago, to issue worded rainfall forecasts using the terms isolated, scattered and general rain. In a worded rainfall forecast a glossary of words and phrases is used to describe the expected rainfall. During the 1980s increasing demands were made on the Directorate of Weather Forecasting by television services in particular, as well as by the many newspapers, to produce rainfall forecasts graphically. The decision was taken to delineate areas where rainfall is predicted on a map of Southern Africa. At about this time percentages were assigned to the terms isolated, scattered and general rain. These were isolated 20% to 30%, scattered 40% to 70% and general 80% to 100%. The magnitude of these percentages assigned to the generally used verbal terms was influenced by the criteria used to issue forecasts for the aviation community. It is common practice to assign a probability, expressed as a percentage, of the occurrence of a weather event, i.e. rainfall, in the compilation of a Terminal Airdrome Forecast (TAF) (International Civil Aviation Organisation, 1998). However, a rainfall percentage forecast compiled by the SAWS for a specific area does not represent the

probability of rainfall to occur, but rather the rainfall distribution over the area.

At present, rainfall forecasts, using percentages to indicate distribution, have become the norm in South Africa. Scholz (2002) stated that in a large number of the telephonic enquiries about rainfall prediction, received in the Central Forecasting Office (CFO), the enquirer often insists on getting the rainfall prediction in terms of a percentage. At present no information exists on how reliable these forecasts are. The quality of a forecast can best be determined through statistical and other verification schemes.

A detailed discussion on verification methods used in meteorology is available in Murphy and Epstein (1967), Murphy and Winkler (1984), Murphy et al. (1985), Murphy and Winkler (1987), Murphy (1995), Sanders (1963) and Stanski et al. (1989).

Verification is only useful if it leads to some decision considering the product being verified. In meteorology, verification has two goals: an administrative goal, to monitor the overall quality of a forecast and track any changes in the quality, and a scientific goal, to identify strengths and weaknesses of a forecast so as to direct research and development (Stanski et al., 1989).

The aim of this paper is to determine the accuracy of the forecast rainfall percentages subdivided into specific rainfall classes. This was achieved by using the SAWS 24 h rainfall forecasts, which are valid for the Vaal Dam catchment and for the five summer rainfall seasons (October to March) of 1994 to 1998. The rainfall forecasts are also considered subjective because no exact or reliable numerical method exists to determine rainfall distribution and depth from weather maps, actual or prognostic. It is also widely accepted within the forecasting community that rainfall predictions from general circulation models are unreliable at the spatial scale of the SAWS rainfall districts. Therefore these forecasts are subjective in the sense that they depend largely on the interpretation and experience of the individual forecaster (Sanders, 1963). The forecast and rainfall observation data are of a categorical nature and are evaluated by using the contingency tables designed by Stanski et al.

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