Verification of the Caribbean Precipitation Outlook - 2000 to 2001

S. Dec. Burton, H. H. P. Burton and C. A. Depradine

Caribbean Institute for Meteorology and Hydrology

Introduction

The Caribbean Institute for Meteorology and Hydrology (CIMH) has been preparing a three-month precipitation probability outlook for the Caribbean region since 1998 with input from some of the regional meteorological services and research groups.

The outlook is produced by combining objective input (dynamic climate model output) and subjective input (experience). Precipitation forecasts from several global climate models, in the form of anomalous precipitation as a percentage of average seasonal rainfall or of probabilities of above or below normal rainfall, are used. Precipitation probabilities are estimated for a number of sub-regions based on the model forecasts, the level of agreement between the different models, and a subjective confidence in the different predictions based on current conditions and a knowledge of the local climatic conditions. In addition, the probabilities provided by the various contributors are consulted to present a consistent forecast. Figure 1 shows extracted portions from some of the model forecasts.

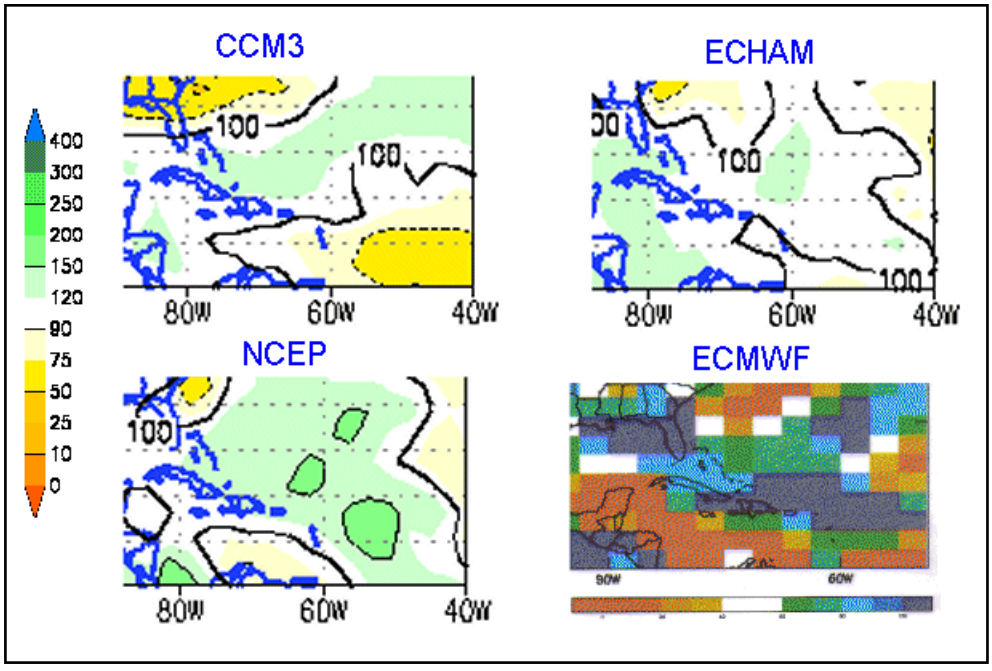

Fig. 1. Extracts of output from the CCM3, ECHAM, NCEP, and ECMWF models

The precipitation outlook is issued in the form of a map of tercile probabilities showing regions having homogeneous forecast probabilities for below, near, and above normal precipitation. The terciles separate the possible outcomes into three categories base on the historical precipitation record. The probabilities add up to 100. The format of the tercile probabilities is shown in Fig. 2.

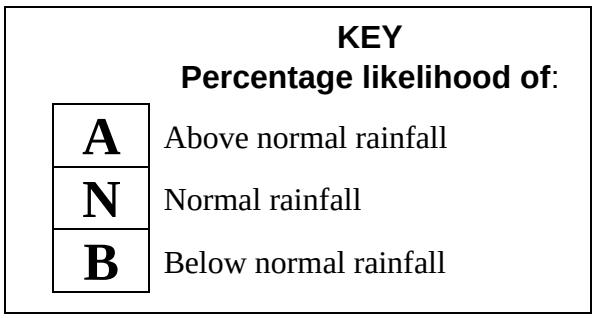

Fig. 2. Tercile probability format

An example of an outlook is shown in Fig. 3. While the probabilities within one region are shown as being uniform, this is an approximation to what is actually a more locally varying field of probability. However, climate anomalies usually occur on a large scale, and the regions are drawn to represent the average over the entire region.

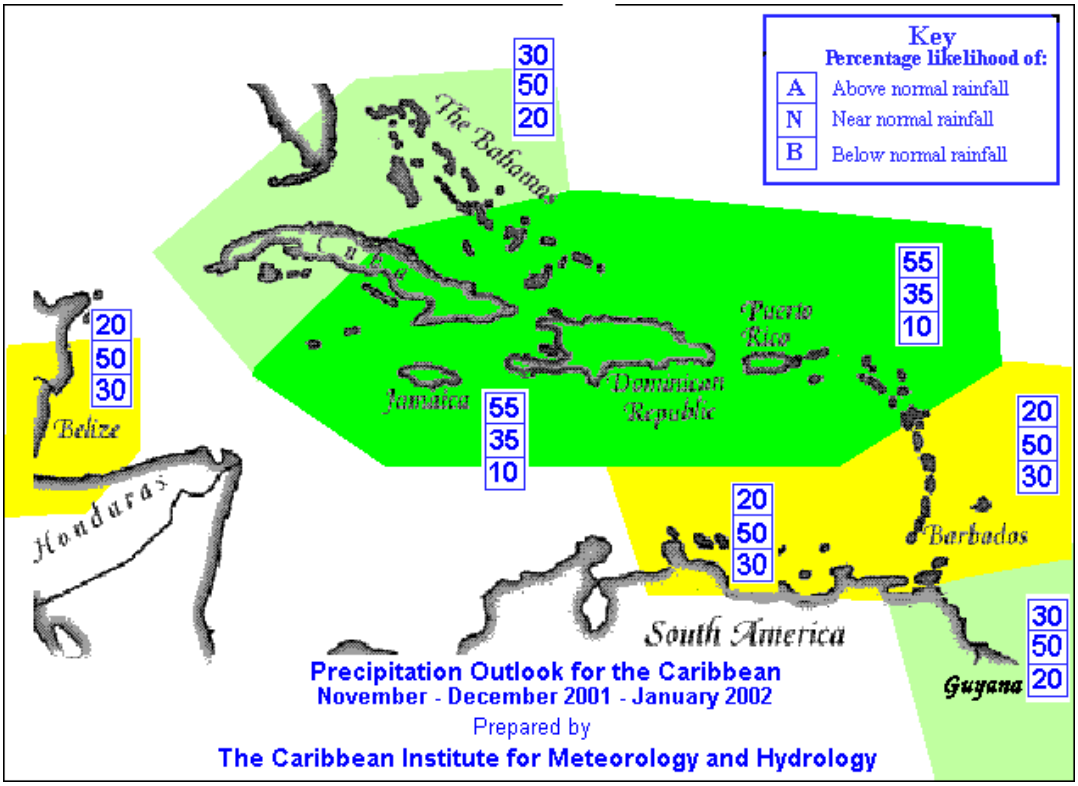

Fig. 3. Precipitation Outlook

Forecast verification is essential for monitoring forecast reliability and for ensuring credibility for users. The current probabilistic format of the precipitation outlook makes it difficult to develop a meaningful quantitative measure of its performance.

The CIMH adopted a simple approach to verify the probability outlooks for 1999 by computing the anomalies (difference between the actual three-month rainfall and the long-term average) to determine whether the observed rainfall fell within the near, above, or below normal categories as given in the projections. For verification any value falling within 10% of the long-term average was considered normal, while larger positive (negative) anomalies were considered as above (below) normal.

The purpose of paper is to examine the use of tercile intervals, computed from long-term monthly rainfall for five selected stations in Barbados, to verify the precipitation outlook for Barbados for 2000 and 2001.

Data and method

Fifty years (1950-1999) of monthly rainfall for five rainfall stations in Barbados were used to calculate an average rainfall for the island for each month of the 50 years. The five stations, Grantley Adams Airport, Claybury, Pickerings, Apes Hill, and Edgecumbe were selected based on their long-term records and representativeness of rainfall variation on the island.

The 50 years of monthly average rainfall for the island were used to calculate 3-month average rainfall. To determine the three tercile ranges, the averages for each period were ranked from the highest to the lowest values. The highest third of the 50 values for each period, i.e. the highest 17 values span the upper tercile. The middle 16 values span the range of the middle tercile and the lowest 17 values span the range of the lower tercile. The borderline between the upper and middle tercile and the borderline between the middle and lower tercile then define the tercile boundaries.

Monthly rainfall for the same five stations for 2000 and 2001 were used to verify the precipitation outlook for Barbados. Three-month averages are computed for the 2-year period.

Results

The tercile boundaries for Barbados computed from the 50 years of monthly rainfall are shown in Table 1.

Table 1. Tercile Boundaries for Barbados

Tercile Boundary	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ	DJF
UPPER	70	72	78	107	142	175	191	211	217	201	152	93
LOWER	54	50	54	75	101	131	160	172	174	150	111	75

During 2000 and 2001 the CIMH prepared twelve 3-month outlooks for the Caribbean, six in each year.

Figure 4 shows the verification results for 2000. In each figure the forecast tercile probabilities are shown in the centre column of the table. The tercile boundaries are shown on the left while on the right are the observed 3-month rainfall, placed in the appropriate tercile interval

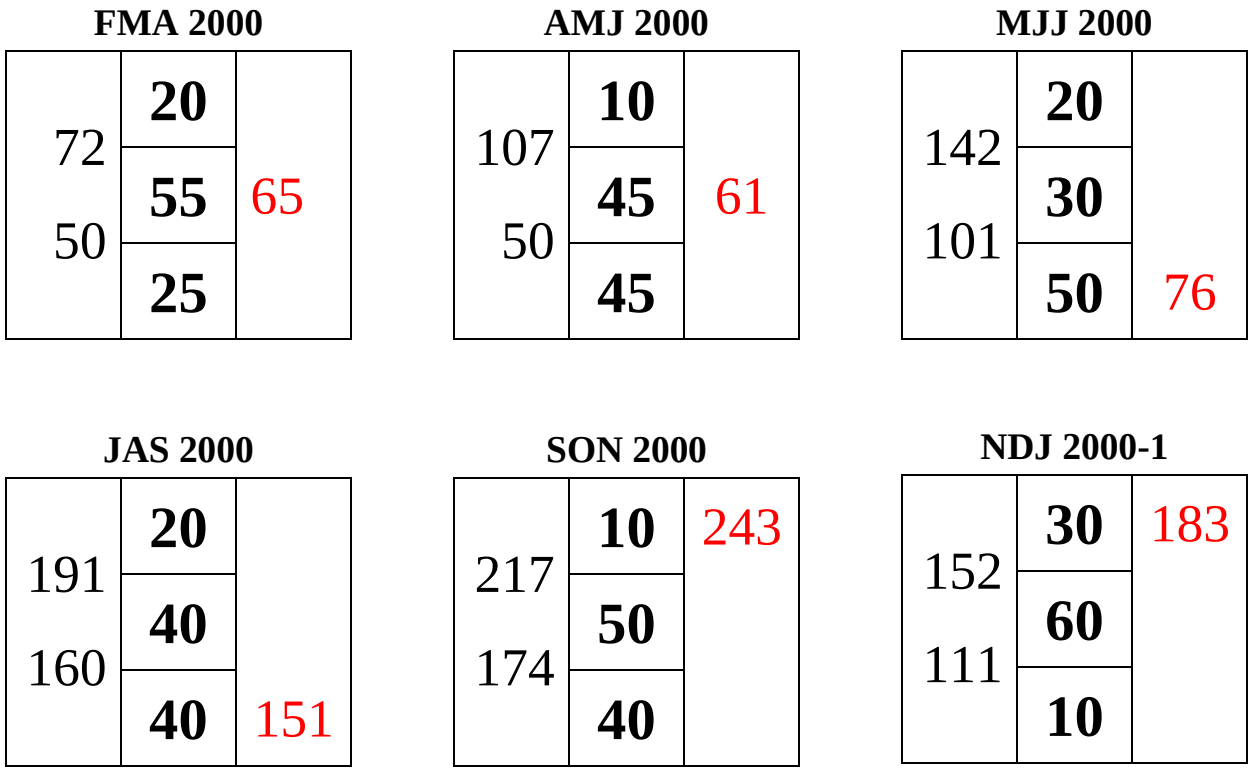

Fig. 4. Verification for 2000 Outlooks

The results show that four of the six forecasts, FMA 2000, AMJ 2000, MJJ 2000, and JAS 2000, verified for one of the highest probability categories. The SON 2000 forecast did not verify as the observed rainfall was above average, the lowest probability forecast. On the other hand above average rainfall was observed for NDJ 2000-1 while the forecast was near normal rainfall, but with a high probability of being above average.

The verification results for five of the outlooks for 2001 are show in Fig. 5.

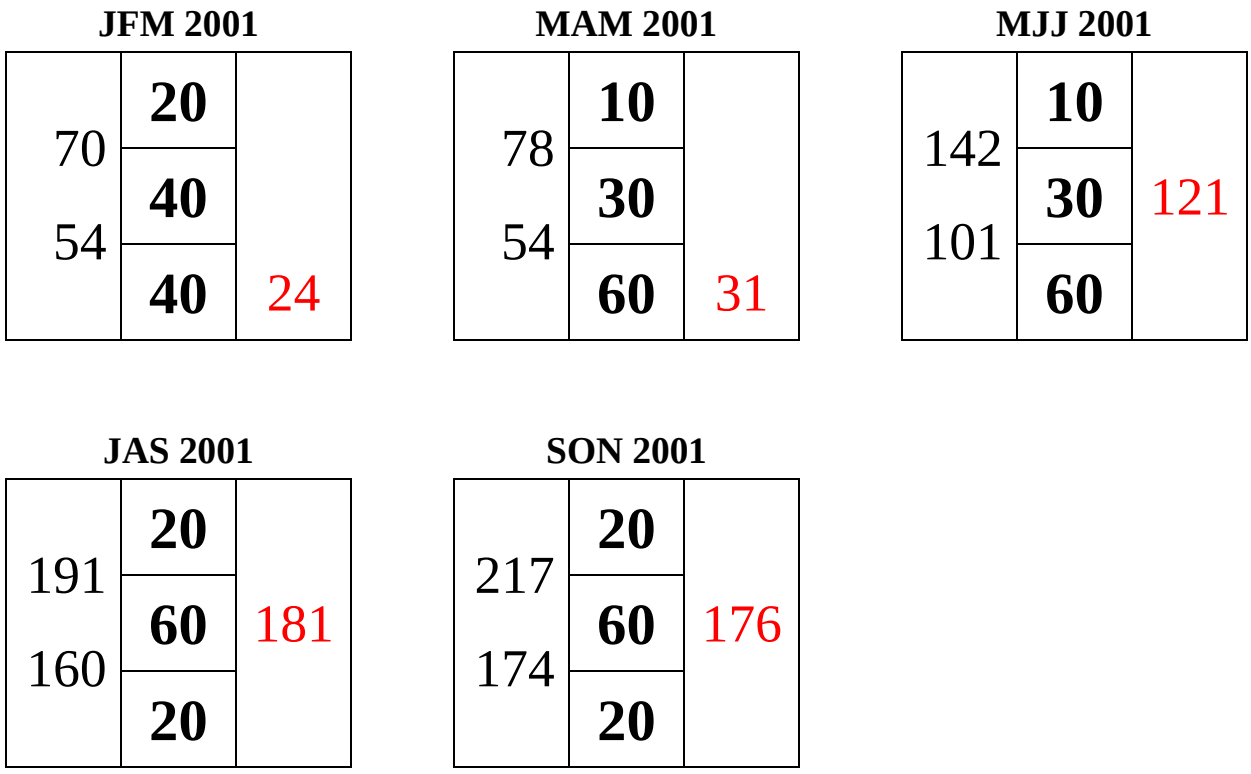

Fig. 5. Verification for 2001 Outlooks

Four of the five forecasts for 2001 verified in the highest probability category while one, MJJ 2001, verified in the second highest category.

Verification for two of the individual stations, Grantley Adams Airport and Apes Hill, shows similar results.

Conclusion

Monthly rainfall for 50 years (1950-1999) from five selected stations was used to compute average monthly rainfall for Barbados. Three-month averages were computed for the 50 years and ranked to determine island-wide tercile intervals. These intervals were used to verify the 3-month precipitation outlooks prepared by the CIMH during 2000 and 2001.

The results of the verification for eleven of the twelve forecasts prepared showed that eight forecasts verified in the tercile with the highest forecast probability, two in the tercile with the second highest forecast probability, and only one in the tercile with the lowest probability.

The results of this study, even though a small sample from one island, suggests that there is some skill (predictability) in the 3-month precipitation outlooks prepared by the CIMH. In order to justify this claim it is necessary to extend this work to other countries. This requires, as evident from this study, long-term monthly rainfall records from several stations in each country to compute tercile intervals.

The computation of quantitative skill scores for the outlook is necessary, as these scores are a true measure of the level of predictability of the forecasts. Such scores are difficult to define over as short a period as the CIMH's forecasts have been issued. A typical variation of skill by location and season would require more than a couple of years of forecasts. Nevertheless, skill scores have some meaning when averaged over all seasons and/or over large areas and so this approach may be adopted to develop such skill scores for the CIMH's outlooks over the short term.

Future studies will therefore focus on extending the verification to other countries to test the reliability of the forecasts over the region. Later skill scores will be computed as a measure of the level of predictability of the forecast.