SOUTHERN AFRICAN DEVELOPMENT COMMUNITY
CLIMATE SERVICES CENTRE

Forecast Verification Module for CFT an introduction

ClimSA Technical Assistance
SADC Climate Services Centre (CSC)

Forecast skill and why do we need it?

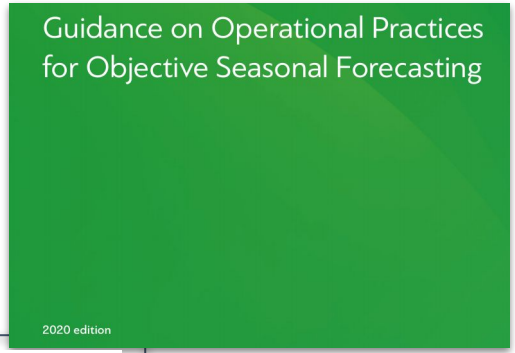
Without information about the quality of the forecasts **how is anybody to know whether to believe them**?

It is very easy to make a forecast, but it is much harder to make a good forecast, and so the onus is on the forecaster to demonstrate that their forecasts are worth using.

Forecast verification is the process of determining skill of the forecast.

What do WMO recommends?

Verification is a necessary prerequisite towards Objective Seasonal Forecasting



1. Follow a traceable, reproducible, and well-documented procedure (including model selection, bias correction, calibration and statistical downscaling) that is amenable to assessments of forecast quality (verification);

5. Ensure that forecasts are verified according to established standards, keep archives of past forecasts, and conduct post-season assessments;

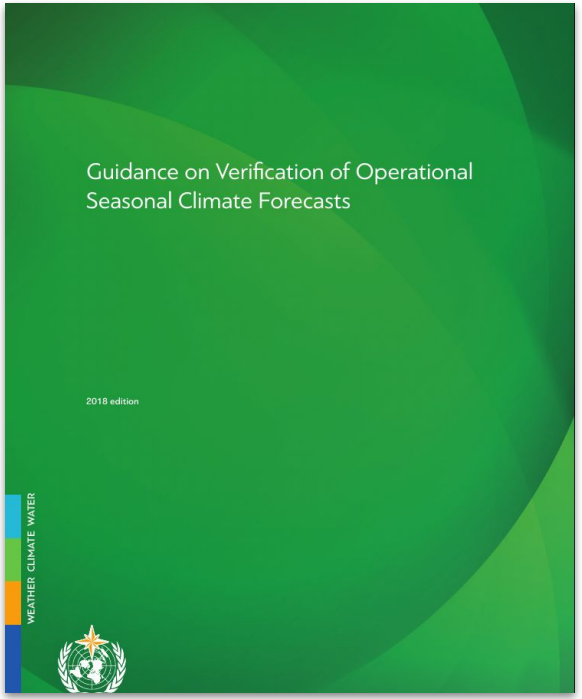
6. Provide forecast information together with historical performance (for example, skill and reliability);

What do WMO recommends?

Table 2. List of recommended scores and procedures for individual forecast maps

Score	*Questions addressed*	*Key references*
Verification maps as percentiles*	What was the verifying category? How extreme was the observed value?	
Model diagnostics	Various; in general: Did the model reproduce the observed atmospheric conditions responsible for the verifying climate anomalies?	
Hit scores for categories with highest probabilities*	How often did the category with the highest probability occur?	Mason (2012)
Hit scores for categories with second and third highest probabilities	How often did the category with the second highest probability occur? How often did the category with the lowest probability occur?	Mason (2012)
Average interest rate	What is the rate of return if paid fair odds when investing on the forecasts?	Hagedorn and Smith (2008)
Ignorance score*	Given the forecast, how much additional information is needed to determine what the verifying categories were?	Roulston and Smith (2002)

* Indicates procedures that are considered to comprise a minimal set that all operational forecasting centres should strive to calculate.



What do WMO recommends?

Percentile (quantile) maps, derived in the same way as those of the forecast, with identical (tercile) boundaries

In addition to calculating a score for the map, it is recommended that the forecast be accompanied by a corresponding map of the observed rainfall or temperature, but with the observations presented in such a way as to make them correspond to the information communicated in the forecast. Maps of anomalies or, in the case of rainfall, of percentage departures from average should not be used, because it is not clear from either of these maps which category the observation is in. These maps can be quite misleading to non-specialists who may not have much knowledge of the climatology of the region. Instead the map of observations should be contoured by the quantile to which the rainfall or temperature corresponds. The most logical way to calculate the quantiles for each location would be from the cumulative distribution function of a distribution fitted to the climatological data, but if the terciles for defining the categories when making the forecasts are not calculated from this distribution it would be advisable to use a method consistent with the way in which the forecast is defined. Linear interpolation of the empirical cumulative distribution function should therefore most likely be used. It is recommended that contours be shown for the 33rd and 67th percentiles, the 20th and 80th, the 10th and 90th, and for record-breaking values. An example of such a map for rainfall is shown in Figure 7 (Tall et al., 2012).

WMO example:

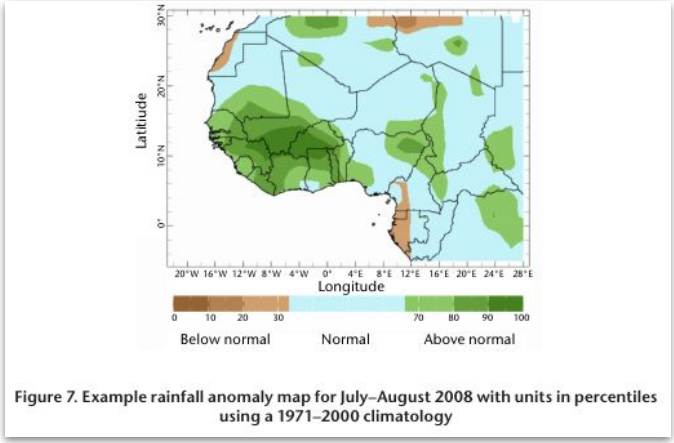


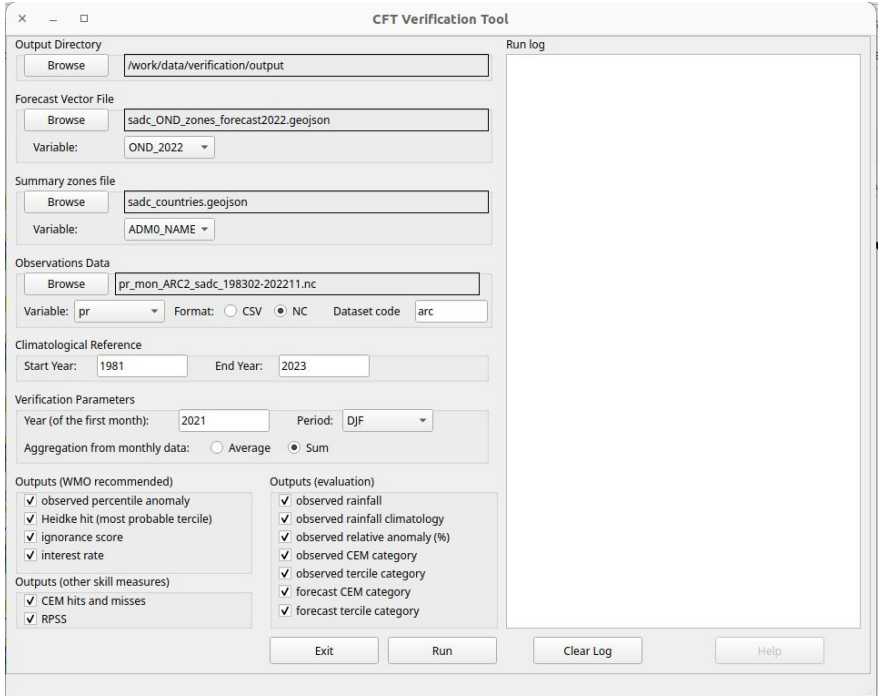
Figure 7. Example rainfall anomaly map for July–August 2008 with units in percentiles using a 1971–2000 climatology

Verification tool for CFT

Available in CFT v4.1.0 and later

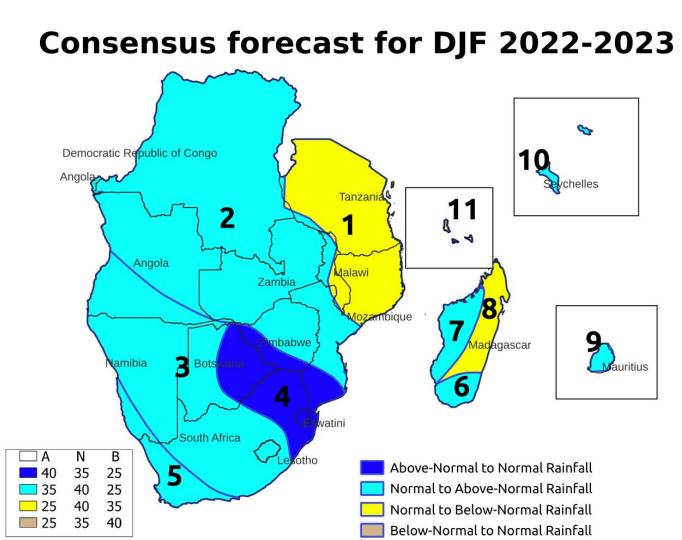
Features:

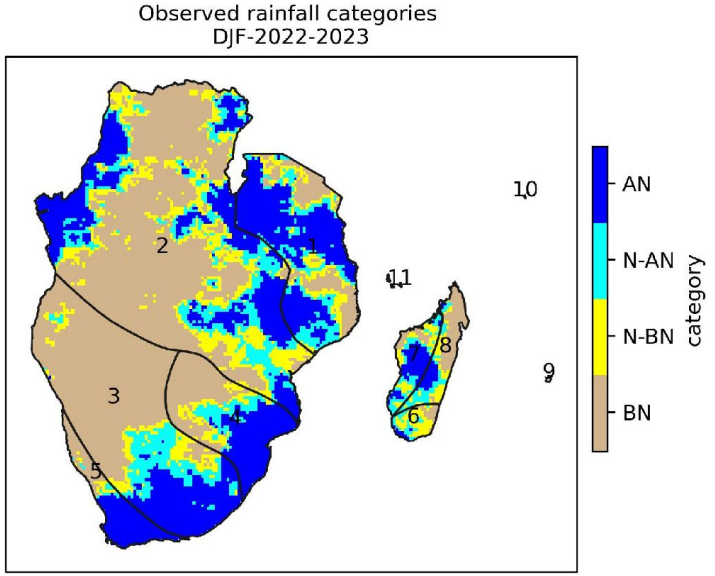
- flexible forecast and verification period (1,2 or 3 months)
- verification against observed gridded and station data
- a range of evaluation maps and skill measures, including WMO recommended
- output in form of maps, histograms and data in netCDF format



Verification Module for CFT

Improved presentation of observed data - different styles of anomaly maps, easier to compare with the forecast





Verification Module for CFT

Visualisations compatible with WMO requirements - and even better!!!

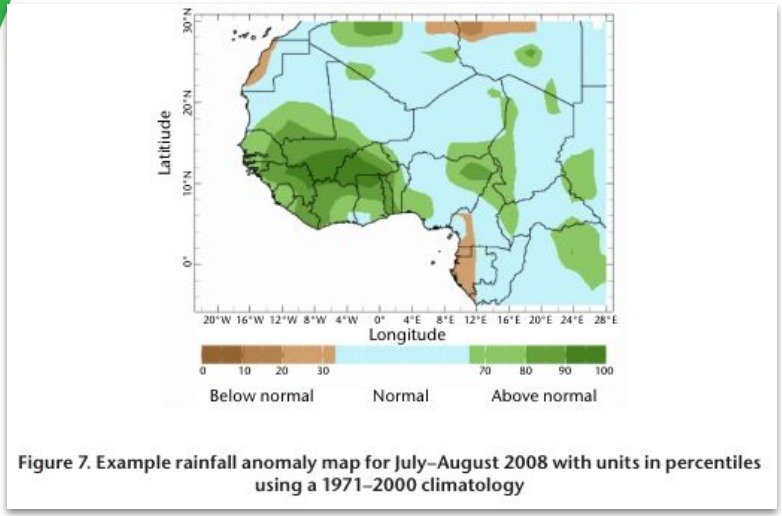
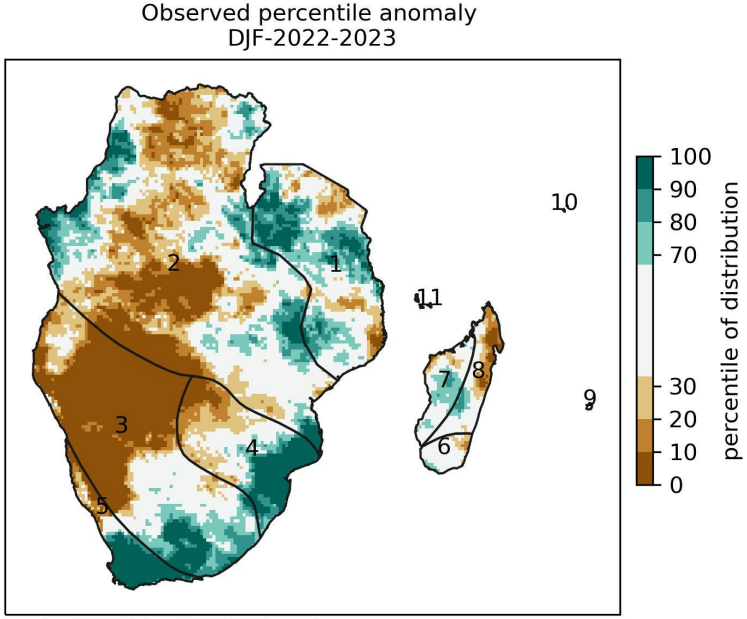
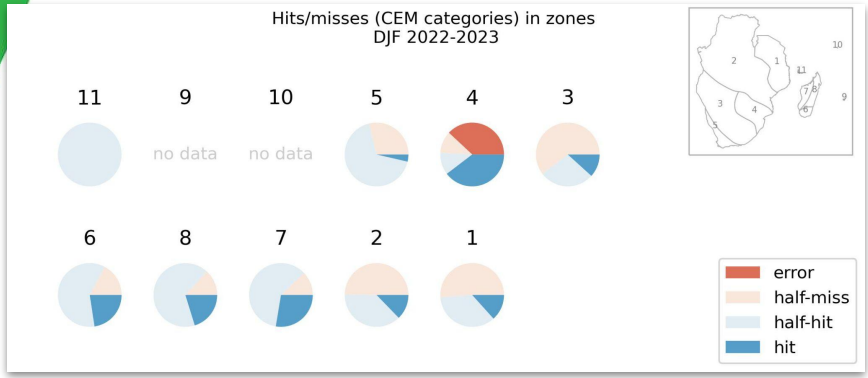


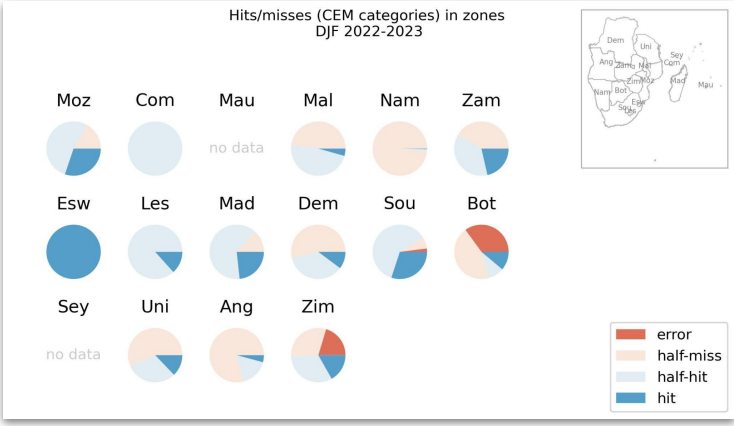
Figure 7. Example rainfall anomaly map for July–August 2008 with units in percentiles using a 1971–2000 climatology



Verification Module for CFT

Evaluation of skill for zones rather than entire domain

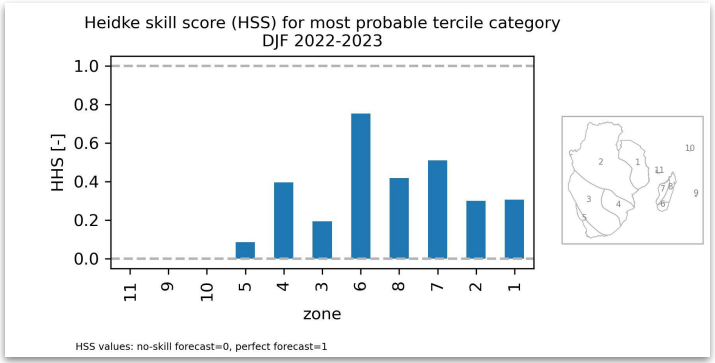


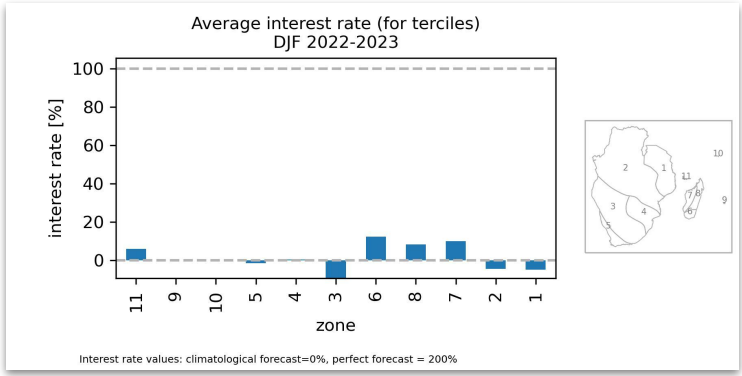


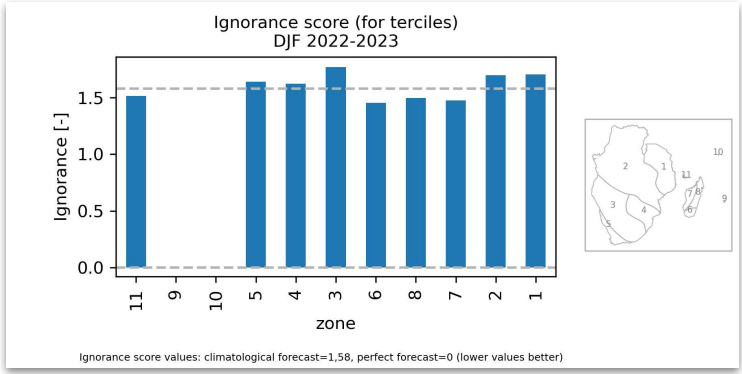
Verification tool for CFT

Use of WMO recommended skill measures:

- Heidke skill score
- Ignorance score
- Average interest rate







Download

distributed together with CFT, available from:

https://github.com/sadccsc/cft

Documentation in DRAFT form (not yet full)

https://docs.google.com/document/d/1rz1ZQAkstCnyxfZeHPznR625dbMc4Dzn/edit?usp=sharing&ouid=112522612222713324353&rtpof=true&sd=true

report bugs to wolski@csag.uct.ac.za

Thank you