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ClimSA

INTRA-ACP CLIMATE SERVICES AND RELATED APPLICATIONS PROGRAMME

Une initiative de l'Organisation des Etats d'Afrique, des Caraïbes et du Pacifique financée par l'Union européenne

Approach to Seasonal Forecast Verification at ACMAD

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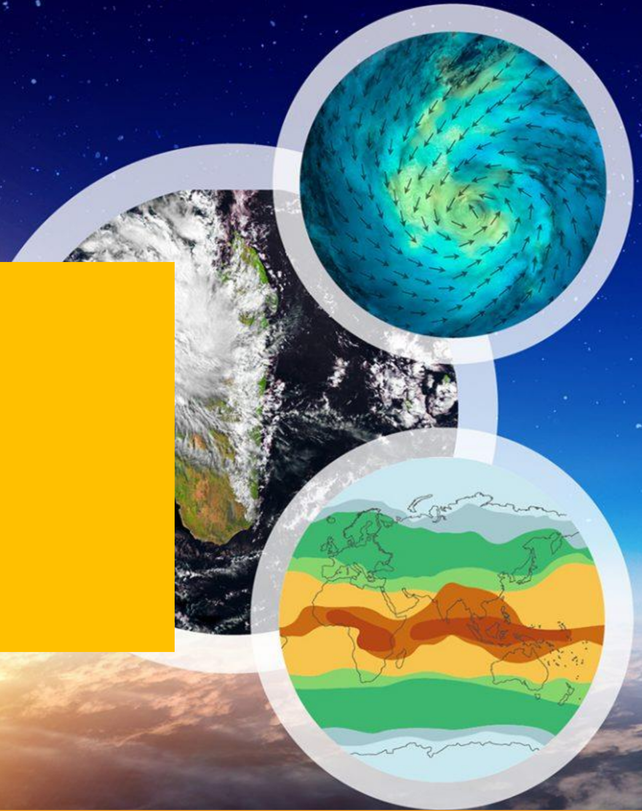


PRESAGG Training Workshop
14 to 20 February, Online

Outline

What and why LRF verification

Types of LRF verification methods

Sample products and interpretation

How to generate the verification products

Demonstration and exercises

What is LRF verification

- ***Seasonal Forecast are usually made in term of "probabilistic forecast"***

- ***So the aim here is to provide you with the tools to measure the attribute of a probabilistic forecast***

- **An accurate probability forecast system has:**

  Reliability *- agreement between forecast probability and mean observed frequency*

  Sharpness *- tendency to forecast probabilities near 0 or 1, as opposed to values clustered around the mean*

  Resolution *- ability of the forecast to resolve the set of sample events into subsets with characteristically different outcomes*

Why LRF verification (1/3)

Why we do seasonal forecast verification?

- Testing if the forecast is “consistent”
- Testing if the forecast has “quality” if it corresponds to what happened.
- Testing if the forecast has “value” if it can be used to help realize some benefit, whether economic, social, or otherwise.

Why LRF verification (2/3)

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

It's on the forecaster to demonstrate that his products are worth taking note of.

Provide fairly detailed information about the quality of forecasts

Go beyond asking "Can these forecasts be believed?" to address questions such as "How can these forecasts best be used?" and "How can these forecasts be improved?".

Why LRF verification (3/3) - Benefits

A forecast is like an experiment -- *given a set of conditions, you make a hypothesis that a certain outcome will occur.*

The process shouldn't consider to be complete until you find out whether the forecast was successful.

The three most important reasons to verify forecasts are:

to ***monitor* forecast quality** - how accurate are the forecasts and are they improving over time?

to ***improve* forecast quality** - the first step toward getting better is discovering what you're doing wrong.

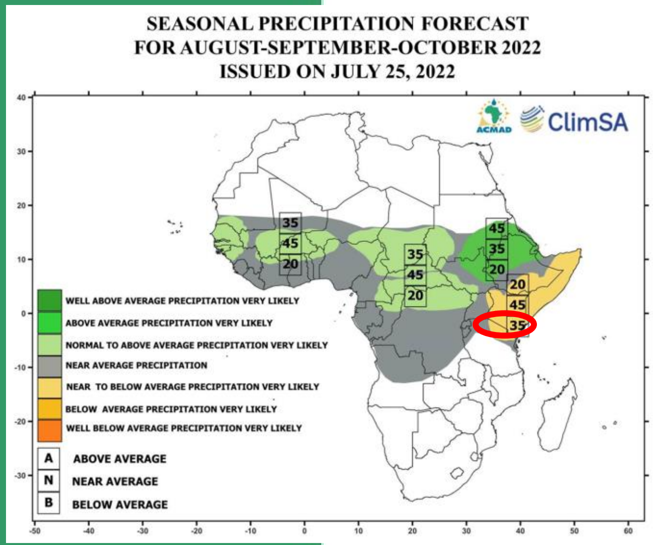
to ***compare* the quality of different forecast systems** - to what extent does one forecast system give better forecasts than another, and in what ways is that system better?

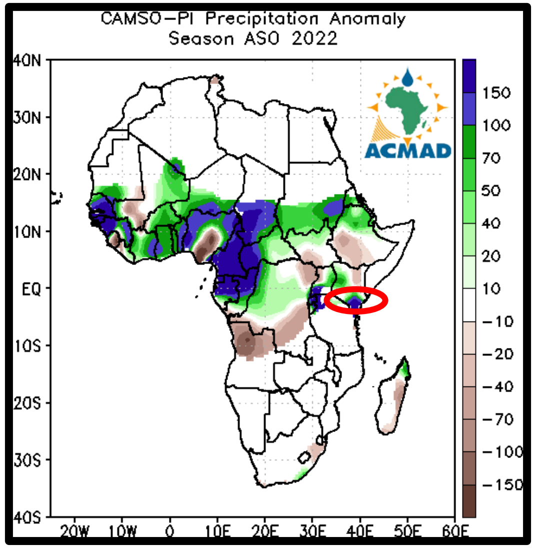
Types of forecast performance evaluation (verification)

1. Visual / qualitative verification
   - A forecast is “consistent”
2. Quantitative verification
   - A forecast has “quality” if it corresponds to what happened.
3. Impact Assessment
   - A forecast has “value” if it can be used to help realize some benefit, whether economic, social, or otherwise.

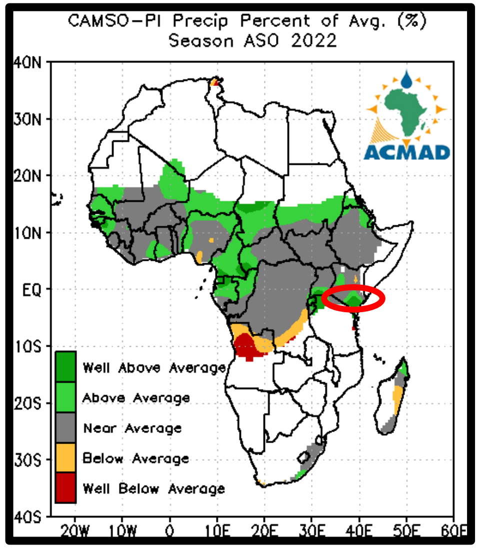
Types of verification (1/3)

Visual evaluation of a forecast

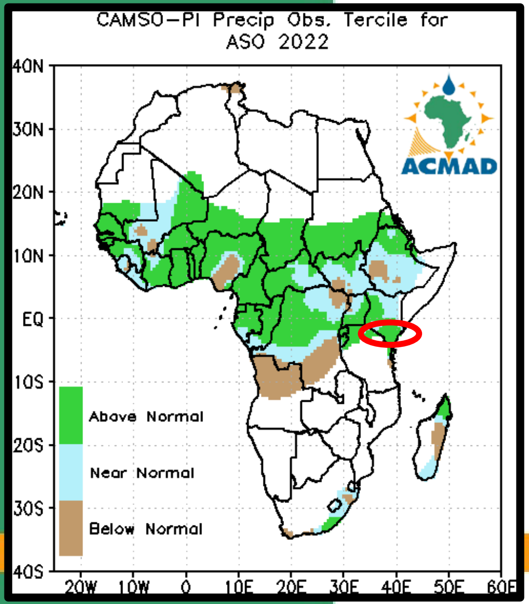




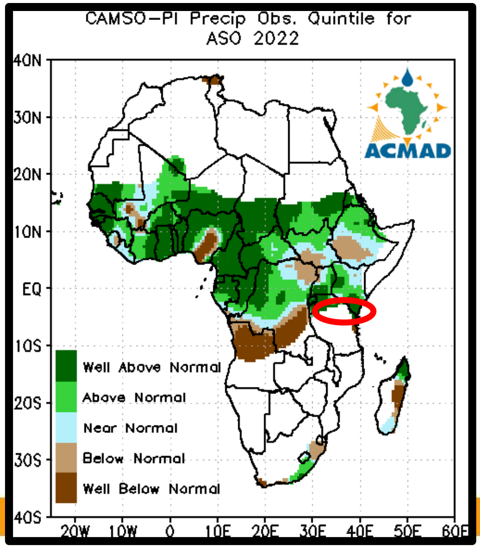
Anomaly – used to visually detect the shift (from the mean) of observed precip



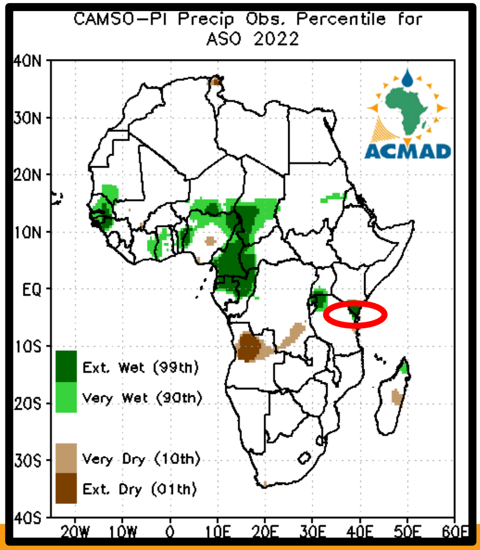
Percent of Average – Used to detect magnitude of observed shift from the mean



Tercile – used to visually detect spatial shape of observed precip

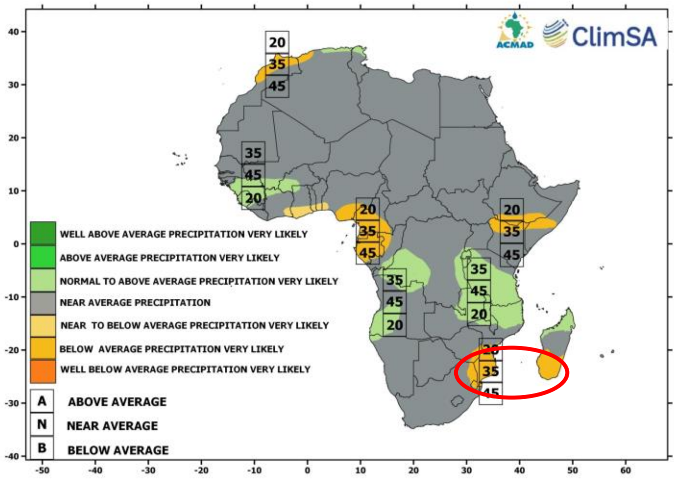


Quintile – used to visually detect the magnitude of observed precip

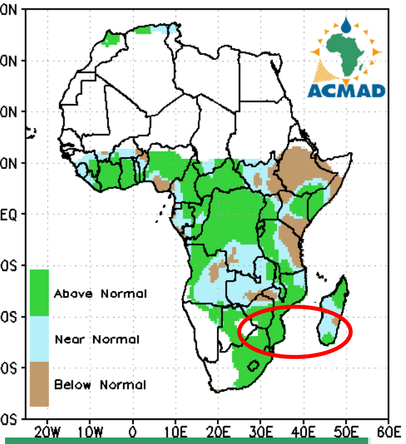


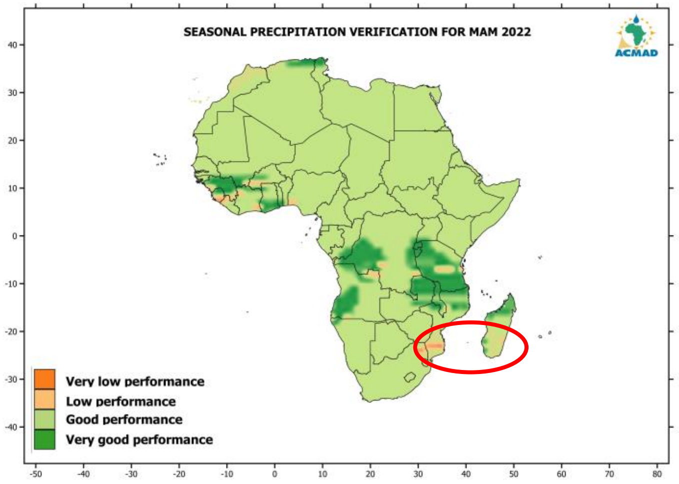
Percentile – used to visually detect magnitude of extreme observed precip (extremely wet and dry areas)

Types of verification (2/3) - Quantitative verification



CAMSO–PI Precip Obs. Tercile for MAM 2022





What are we trying to detect by verification of LRF

False alarm:

A warning or forecast issued for an event that did not actually occur.

False-alarm rate (FAR):

A measure of the quality of deterministic forecasts; specifically, the number of false alarms divided by the number of non-events. The FAR measures the proportion of non-events that were incorrectly forewarned, and should be distinguished from the false-alarm ratio, which measures the proportion of incorrect warnings.

Hit:

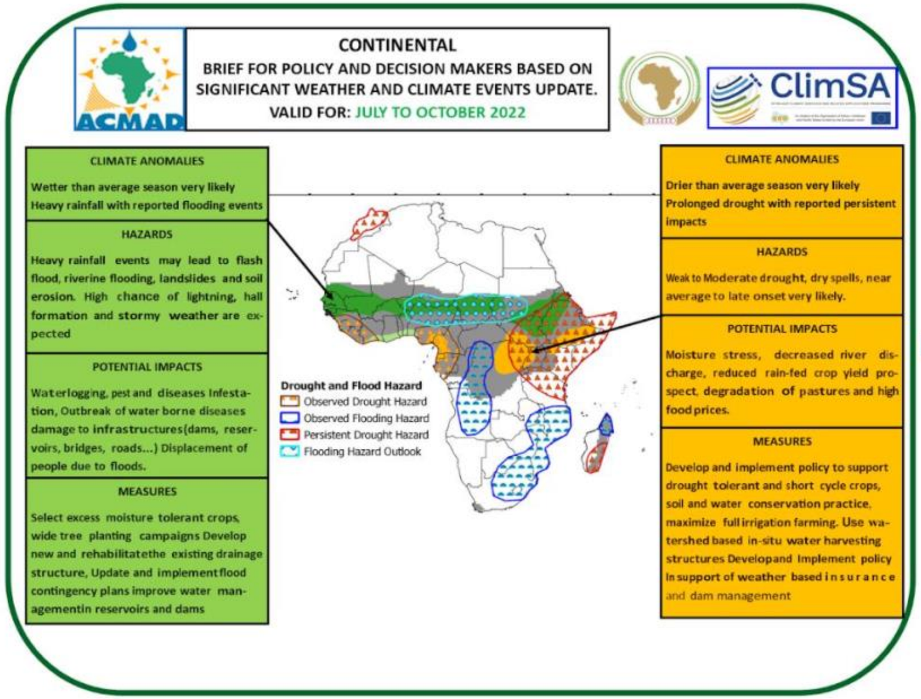
A warning or forecast issued for an event that occurs.

Hit rate (HR):

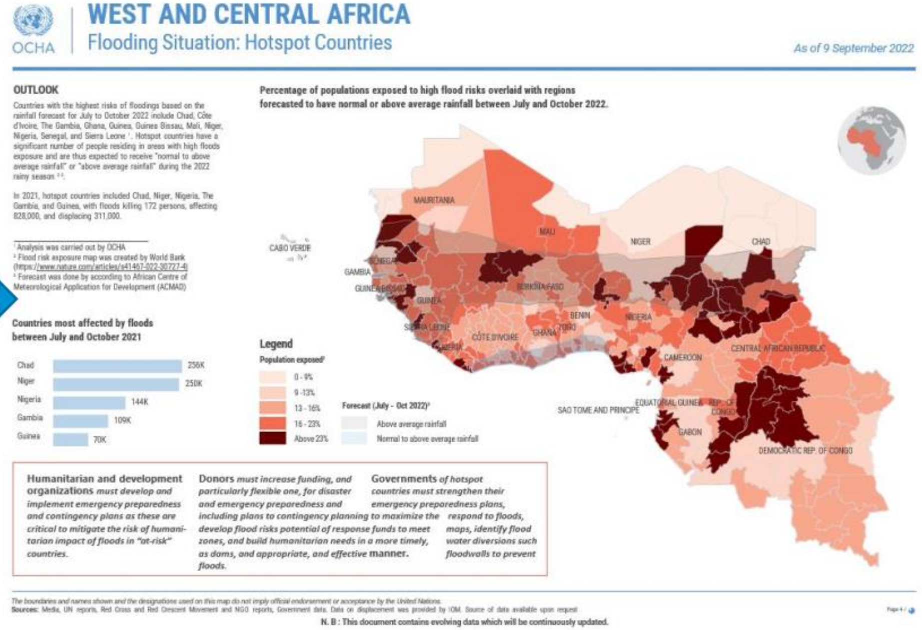
A measure of the quality of deterministic forecasts; specifically, the number of hits divided by the number of events. The HR measures the proportion of events that were forewarned, and should be distinguished from the hit score, which measures the proportion of correct warnings.

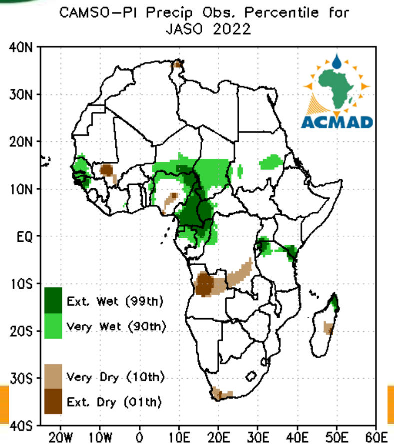
Types of verification (3/3)

Impact Assessment



Seasonal Forecast overlayed on population density





How are the verification and forecast maps produced?

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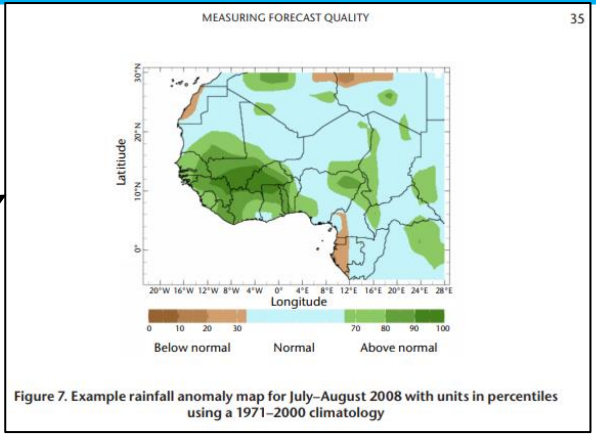
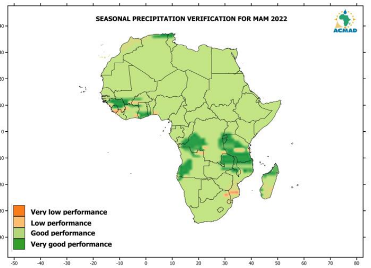
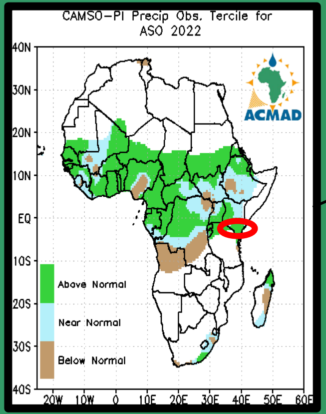
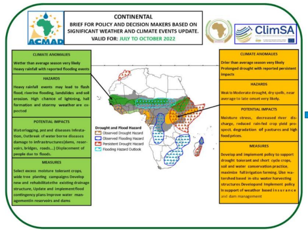
LRF Verification:

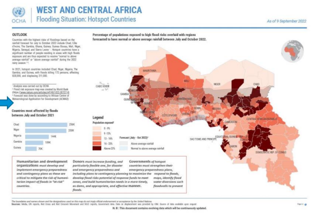
- Verification scores:-
  - WMO Guidelines on verification of LRF: library.wmo.int/doc_num.php?explnum_id=4886
- Commonly used is the Ranked probability skill score (RPSS) and Heidke Skill Score (HSS)
- Eyeballing
- Socio-economic impact assessment

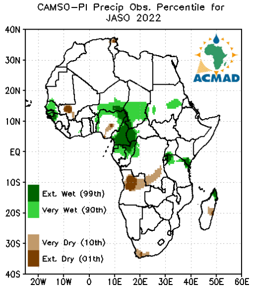












Demonstration and exercises

Quantile q-quantile computation

Computing Quantiles or q-quantile

Count the number of observations in the dataset (n).

Sort the observations from smallest to largest.

Find the first q-quantile:

- Calculate n * (1 / q).
- If n * (1 / q) is an integer, then the first q-quantile is the mean of the numbers at positions n * (1 / q) and n * (1 / q) + 1.
- If n * (1 / q) is not an integer, then round it up. The number at this position is the first q-quantile.

Quantile q-quantile computation

Find the second q-quantile:

- Calculate n * (2 / q).
- If n * (2 / q) is an integer, the second q-quantile is the mean of the numbers at positions n * (2 / q) and n * (2 /q) + 1.
- If n * (2 / q) is not an integer, then round it up. The number at this position is the second q-quantile.

Find the $(q-1)^{th}$ q- quantile:

- Calculate n * ((q-1) / q).
- If n * ((q-1) / q) is an integer, then the $(q-1)^{th}$ q- quantile is the mean of the numbers at positions n * ((q-1) / q) and n * ((q-1) / q) + 1.
- If n * ((q-1) / q) is not an integer, then round it up. The number at this position is the $(q-1)^{th}$ q- quantile.

Quartiles from q-quantile

Computing Quartiles (4-quantile)

Count the number of observations in the dataset (n).

Sort the observations from smallest to largest.

Find the first quartile:

- Calculate n * (1 / 4).
- If n * (1 / 4) is an integer, then the first quartile is the mean of the numbers at positions n * (1 / 4) and n * (1 / 4) + 1.
- If n * (1 / 4) is not an integer, then round it up. The number at this position is the first quartile.

Quartiles from Quantile q=quantile

Find the second quartile:

- Calculate n * (2 / 4).
- If n * (2 / 4) is an integer, the second quartile is the mean of the numbers at positions n * (2 / 4) and n * (2 / 4) + 1.
- If n * (2 / 4) is not an integer, then round it up. The number at this position is the second quartile.

Find the third quartile:

- Calculate n * (3 / 4).
- If n * (3 / 4) is an integer, then the third quartile is the mean of the numbers at positions n * (3 / 4) and n * (3 / 4) + 1.
- If n * (3 / 4) is not an integer, then round it up. The number at this position is the third quartile.

Exercises

Exercise 1: Compute quartiles of the following data

Luanda CHIRPS station:

1. Compute seasonal totals for MAM totals
2. Rank the MAM totals
3. Compute the quartiles (q = 4) and n=total number of years

Identify the values of the 3 positions of (q)

Q1: n*(1/q) for quartile 1 position in your data

Q2: n*(2/q) for quartile 2 position in your data

Q3: n*(3/q) for quartile 3 position in your data

Exercise 2: Compute the terciles for the following datasets

Use the steps above with q=3

Tercile 1: n*(1/q) for Quartile 1 position in your data

Tercile 2: n*(2/q) for Quartile 1 position in your data

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