

VERIFICATION OF TMA DAILY AND SEASONAL WEATHER FORECASTS FOR OND 2024 RAINY SEASON

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TANZANIA METEOROLOGICAL AUTHORITY

Outline

1. Introduction
2. Verification of Daily Forecasts issued by TMA
3. Verification of Seasonal Forecasts issued by TMA
4. Conclusion



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1. Introduction



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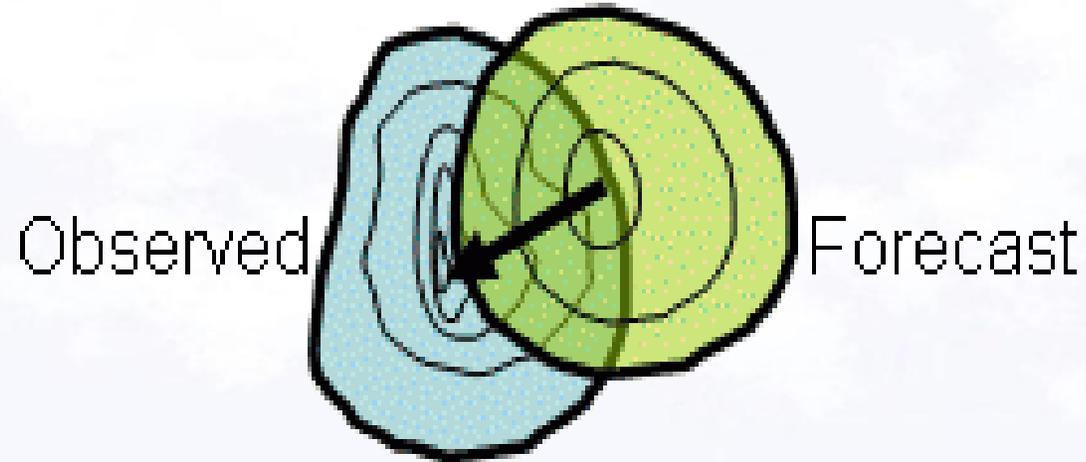


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Forecast Verification



- Comparison of the provided forecasts against **relevant independent observations**. The aim is to assess to what extent the issued forecasts were close/far from what exactly transpired in the ground.



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Goals for forecasts verification

1. Scientific:

- I. To identify strength and weaknesses of a forecast product in sufficient detail that actions can be specified that will lead to improvements in the products

2. Administrative:

- I. Performance indicator of Institution
- II. Justify cost of provision of weather and climate services
- III. Justification for additional / new equipment
- IV. Monitor the quality of forecasts and track changes



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How is the YES/NO forecast assessed?

A useful way to see what types of errors are being made before looking at measures of accuracy is to create a 2 by 2 contingency table.

		OBSERVED		
		YES	NO	Total
FORECAST	YES	Hits	False Alarms	Forecast Yes
	NO	Misses	Correct Negatives	Forecast No
	Total	Observed Yes	Observed No	Total



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Measures of Accuracy

Different performance indicators can be computed depending the types of **questions** you want to address.

$$POD = \frac{n(Hits)}{n(Hits) + n(Misses)}$$

$$FAR = \frac{n(FA)}{n(Hits) + n(FA)}$$

$$TSI = \frac{n(Hits)}{n(Hits) + n(FA) + n(Misses)}$$



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2. Verification of Daily Forecasts



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Daily forecast verification - Methodology

Daily Weather: Input and Output

Snapshot of a new Python script for daily forecasts verification

Forecast	Observation	SCORE
SH	SH	2
PC	PC	2
TS	TS	2
SHTS	SHTS	2
SH	SHTS	1
SH/SHTS/TS	PC	0
PC	SH/SHTS/TS	0

```
# Define helper functions
def calculate_statistics(forecasted, observed):
    hits, misses, half_misses, correct_negatives, false_alarms = 0, 0, 0, 0, 0
    for f, o in zip(forecasted, observed):
        if f == o:
            if f in ["PC", "Clear"]: # Correct Negative: Both are non-rain events
                correct_negatives += 1
            else:
                hits += 1
        elif f in ["SHTS", "SH", "TS"] and o in ["PC", "Clear"]:
            false_alarms += 1 # False Alarm: Event forecasted, no event observed
        elif f in ["PC", "Clear"] and o in ["SHTS", "SH", "TS"]:
            misses += 1 # Miss: No event forecasted, event observed
        elif (f == "SHTS" and o in ["SH", "TS"]) or (o == "SHTS" and f in ["SH", "TS"]):
            half_misses += 1 # Half Miss
    return hits, misses, half_misses, correct_negatives, false_alarms

# Calculate statistics for each zone
for zone in zones:
    hits, misses, half_misses, correct_negatives, false_alarms = calculate_statistics(
        forecasted[zone], observed[zone])
```



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DAILY FORECASTS VERIFICATION RESULTS [%] FOR OND 2024 RAINFALL SEASON

Zone	October	November	December	Average
NC	83.9	83.3	80.6	82.6
NEH	80.6	80.0	83.9	81.5
LVB	83.9	93.3	80.6	85.9
Average	82.8	85.5	81.7	83.3

The daily weather forecasts for OND 2024 season issued were correct by 83.3%, a decrease by 2.5% from OND 2023.



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3. Verification of Seasonal Forecasts



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Methodology

1. Compute Rainfall Percentage of Mean:

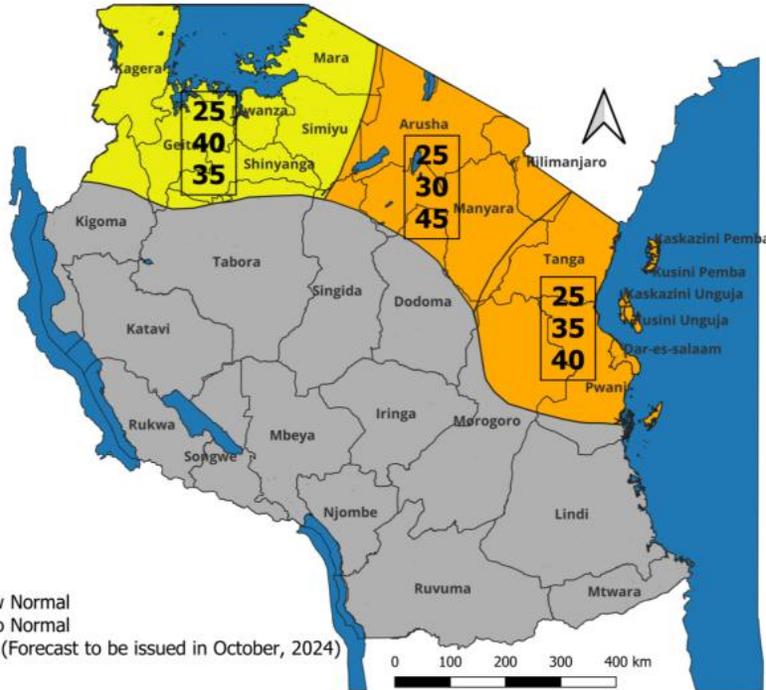
$$\text{Pct_Mean} = \frac{\text{Observed. Rainfall}}{\text{Rainfall LTM}} * 100$$

2. Group stations into: Above N, Normal and Below N.

3. Compare Forecasted vs Observed categories.

4. Compute measure of accuracy

$$\text{POD} = \frac{n(\text{Hits})}{n(\text{Hits}) + n(\text{Misses})} * 100$$



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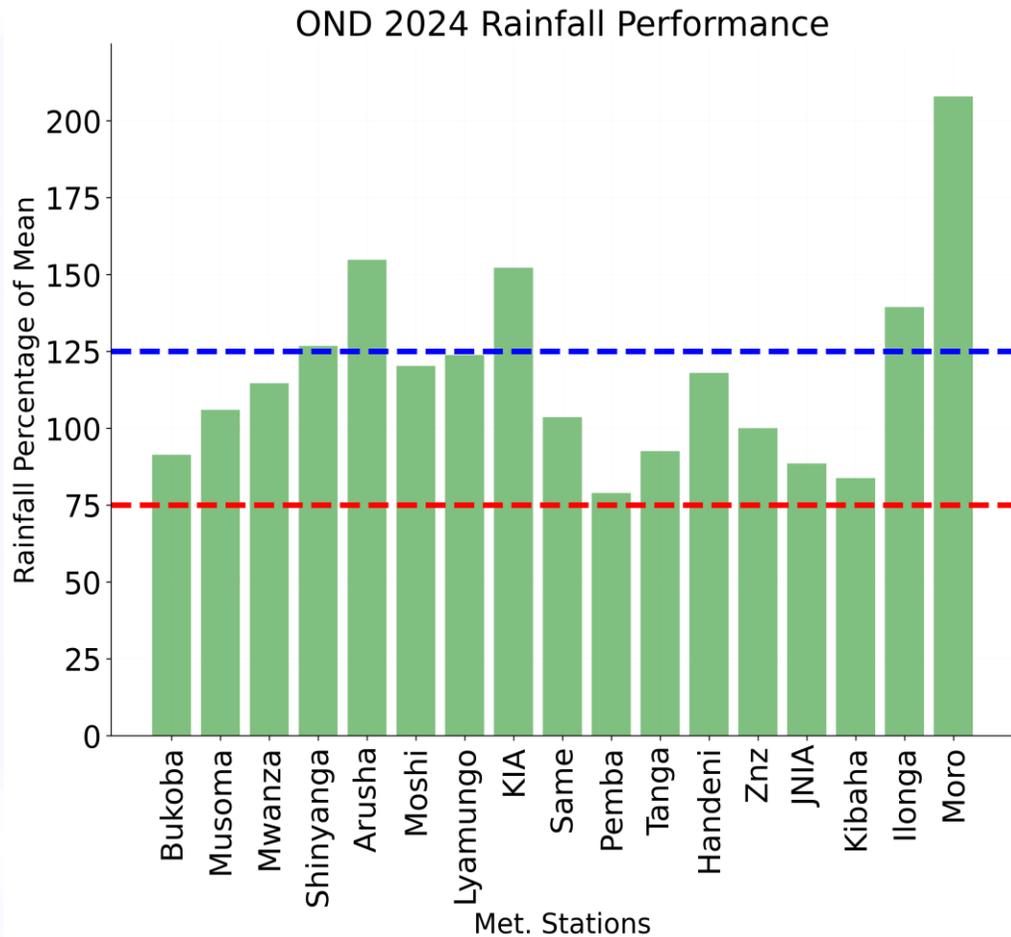


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RAINFALL PERFORMANCE FOR OND 2024 RAINFALL SEASON



1. The forecast for bimodal regions demonstrated good overall accuracy, as the majority (76% stations) of the region received mainly normal conditions.
2. However, notable exceptions were observed at Arusha, KIA, Ilonga, and Morogoro stations, which recorded above-normal rainfall. The percentage means of their rainfall relative to the long-term averages were 154.8% for Arusha, 152.2% for KIA, 139.4% for Ilonga, and 208% for Morogoro.



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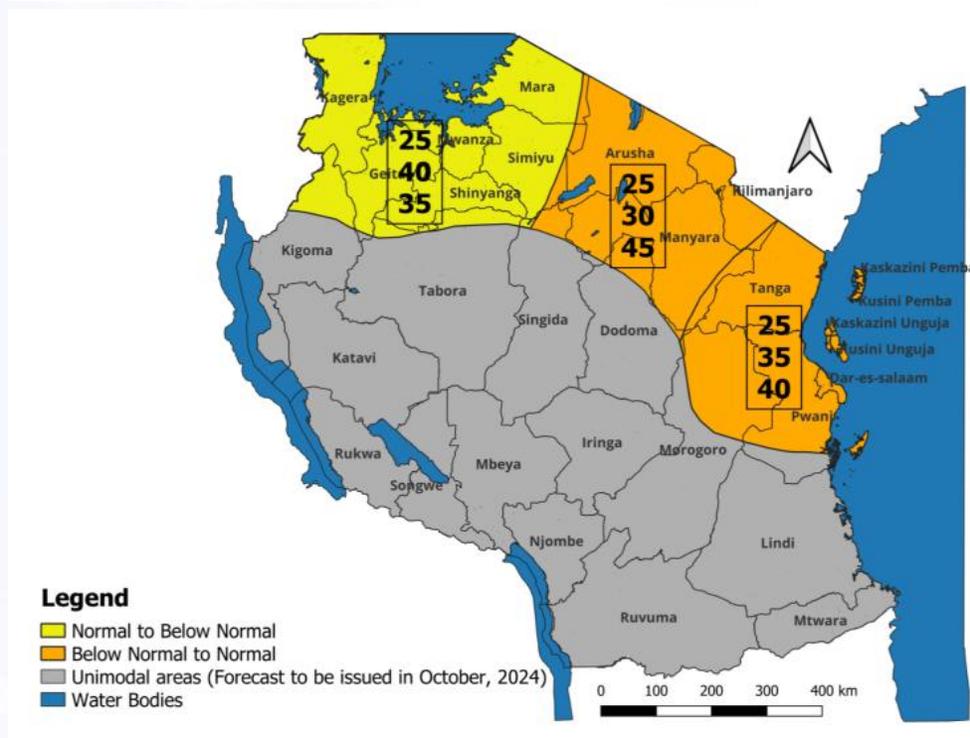
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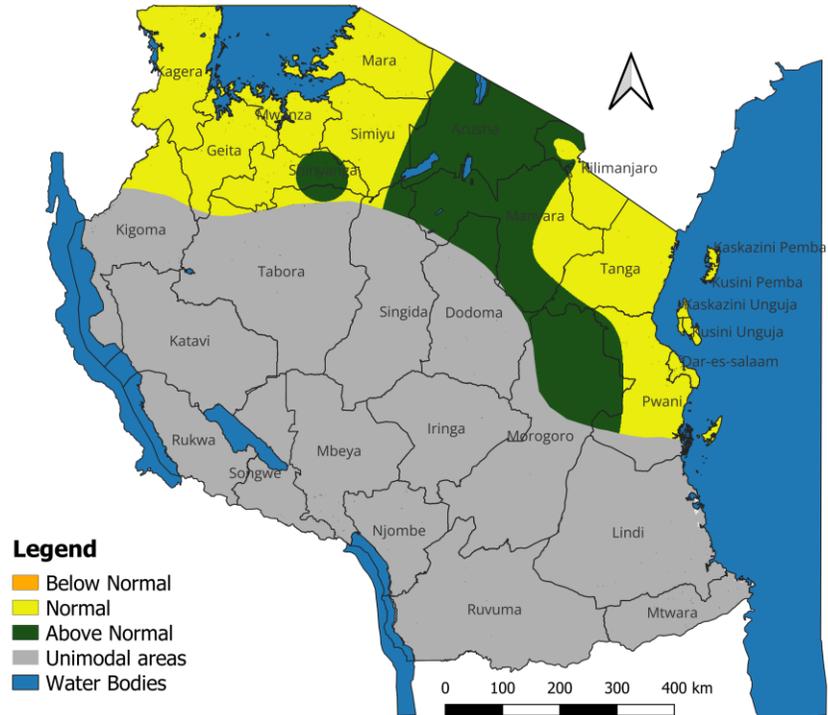


OND 2024 RAINS FORECAST AND OBSERVED

FORECAST ISSUED



WHAT TRANSPIRED



The seasonal weather forecasts for OND 2024 were correct by 93%, a drop by 5% from OND 2023.



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CONCLUSION

1. The OND 2024 rainy season progressed largely as forecasted, with dry conditions dominating the first two months (October and November) of the season, and slightly improvements in terms of rainfall amount in December. Overall, rain was poorly distributed in the season both temporally and spatially.
2. The daily weather forecasts issued from October to December, 2024 was accurate by 83.3, a decrease of 2.5 % from similar rainy season of 2023.
3. Similarly, the accuracy of the seasonal outlook was 93%, a decrease of 5% from OND 2023.



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THANKS



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