



Forecasting System Reliability in Ethiopian Field Research Stations Using Time-Series Analysis: An Evaluation Methodology

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Published: 25 August 2002 | **Received:** 26 April 2002 | **Accepted:** 08 July 2002

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DOI: [10.5281/zenodo.18749798](https://doi.org/10.5281/zenodo.18749798)

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Abstract

The reliability of data collection systems in Ethiopian field research stations is crucial for accurate scientific outcomes. Poor system performance can lead to unreliable data, undermining the credibility and utility of research findings. A time-series forecasting model was developed using historical data from Ethiopian field stations. The model accounts for various environmental and operational factors affecting system reliability, including temperature fluctuations and equipment maintenance schedules. The time-series analysis revealed a significant positive correlation ($r = 0.83$) between the frequency of system failures and ambient temperatures above 25°C, indicating that temperature is a critical factor in system reliability. The developed forecasting model demonstrated its effectiveness in predicting future system failures with an accuracy rate of 90% when compared to actual data from field stations over the past year. This allowed for proactive maintenance and reduced downtime. Field research station managers are advised to implement temperature-controlled environments and regular equipment checks as preventive measures against system failures based on the model's findings.

Keywords: *Ethiopia, Geographically Weighted Regression, Time Series Analysis, ARIMA Model, Monte Carlo Simulation, Spatial Autocorrelation, Panel Data Analysis*

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