

## Abstract

The El Niño-Southern Oscillation (ENSO) is a primary mode of climate variability in the Greater of Africa (GHA). The expected impacts of climate variability and change on water, agriculture, and food resources in GHA underscore the importance of reliable and accurate seasonal climate predictions. The study evaluated different model selection criteria which included the Coefficient of determination ( $R^2$ ), Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), and the Fisher information approximation (FIA). A forecast scheme based on the optimal model was developed to predict the October-November-December (OND) and March-April-May (MAM) rainfall. The predictability of GHA rainfall based on ENSO was quantified based on composite analysis, correlations and contingency tables. A test for field-significance considering the properties of finiteness and interdependence of the spatial grid was applied to avoid correlations by chance. The study identified FIA as the optimal model selection criterion. However, complex model selection criteria (FIA followed by BIC) performed better compared to simple approach ( $R^2$  and AIC). Notably, operational seasonal rainfall predictions over the GHA makes of simple model selection procedures e.g.  $R^2$ . Rainfall is modestly predictable based on ENSO during OND and MAM seasons. El Niño typically leads to wetter conditions during OND and drier conditions during MAM. The correlations of ENSO indices with rainfall are statistically significant for OND and MAM seasons. Analysis based on contingency tables shows higher predictability of OND rainfall with the use of ENSO indices derived from the Pacific and Indian Oceans sea surfaces showing significant improvement during OND season. The predictability based on ENSO for OND rainfall is robust on a decadal scale compared to MAM. An ENSO-based scheme based on an optimal model selection criterion can thus provide skillful rainfall predictions over GHA. This study concludes that the negative phase of ENSO (La Niña) leads to dry conditions while the positive phase of ENSO (El Niño) anticipates enhanced wet conditions