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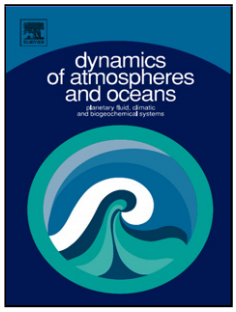

Title: Influence of Spatial and Temporal Scales on Statistical Analyses of Rainfall Variability in the River Nile Basin

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PII: S0377-0265(16)30116-6
DOI: http://dx.doi.org/doi:10.1016/j.dynatmoce.2016.10.008
Reference: DYNAT 1004

To appear in: *Dynamics of Atmospheres and Oceans*

Received date: 9-7-2016
Revised date: 25-10-2016
Accepted date: 26-10-2016

Please cite this article as: Onyutha, Charles, Willems, Patrick, Influence of Spatial and Temporal Scales on Statistical Analyses of Rainfall Variability in the River Nile Basin.Dynamics of Atmospheres and Oceans http://dx.doi.org/10.1016/j.dynatmoce.2016.10.008

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Influence of Spatial and Temporal Scales on Statistical Analyses of Rainfall Variability in the River Nile Basin

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Highlights:

- Variability in gridded rainfall was analyzed based on various spatio-temporal scales
- Empirical Orthogornal Function (EOF) was applied to analyze the rainfall variation
- As the grid size increased, the amount of variance explained by the EOF reduced
- As the data temporal resolution reduced, the amount of explained variance increased
- Rainfall variability was more explainable at regional than location-specific scale

Abstract:

In this study, empirical orthogonal function was applied to analyze rainfall variability in the Nile Basin based on various spatio-temporal scales. The co-occurrence of rainfall variability and the variation in selected climate indices was analyzed based on various spatio-temporal scales. From the highest to the lowest, the cumulative amount of variance explained by the first two principal components (PCs) for any selected size of the spatial domain was obtained for the annual, seasonal, and monthly rainfall series respectively. The variability in the annual rainfall of $1^{o}\times1^{o}$ spatial coverage explained by only the first PC was about 55% on average. However, this percentage reduced to about 40% on average across the study area when the size of the spatial domain was increased from $1^{o}\times1^{o}$ to $10^{o}\times10^{o}$. The variation in climate indices was shown to explain rainfall variability more suitably at a regional than location-specific spatial scale. The magnitudes and sometimes signs of the correlation between rainfall variability and the variation in climate indices tended to vary from one time scale to another. These findings are vital in the selection of spatial and temporal scales for more considered attribution of rainfall variability across the study area.

Keywords: Empirical Orthogonal Function (EOF); Variability Analyses; River Nile Basin; Climate Variability; Rainfall Variability; Meteorology

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