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Spatiotemporal variability of climate change in the free state province of South Africa

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This paper uses gridded precipitation and temperature data to determine if climate change has occurred in the Free State Province of South Africa, in order to generate reliable information for development planning in the province. Gridded precipitation and temperature data, as well as data on drought indices for the 1960-2013 period were extracted from Climate Explorer and analyzed using ArcGIS (Version 10.3) and Statistical Package for the Social Sciences (Version 23), as well as shift detection software, first to ascertain if climate change has occurred in the province, and secondly to determine the spatiotemporal characteristics of the changes (if any). Regime Shift Detection Software was used to determine epochs from data extracted from equidistantly spaced grid points within and around the Free State Province, while Hot Spot Analysis was undertaken in an ArcGIS environment to identify climate related spatial patterns. A comparative analysis of the resultant epochs and spatial groupings revealed an average temperature shift of 0.6°C since 2003, while GiZ-Scores from Hot Spots Analysis indicated the existence of five categories of regions within the province, each with its own spatiotemporal characteristics. When Principal Component Analysis was performed on precipitation data for each epoch, the results showed a strong correlation between the climatic conditions in the regions with ENSO. The study therefore concludes that the climate change that has occurred in the province has been induced by exogenous forces. This reality needs to be considered when developing mitigation measures to combat climate change related challenges in the province.

Biography

Geoffrey Mukwada completed his PhD from University of the Witwatersrand in South Africa in 2006 and completed his Post-doctoral studies at the University of the Western Cape between 2007 and 2009, before taking up a lectureship position at the University of the Free State. He is currently the coordinator of the Afromontane Research Unit's research theme: Living and Doing Business in Afromontane Regions. He has published more than 30 papers in reputed journals and has been serving as a reviewer of several journals.

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