A Comparison of Statistical Downscaling Approaches to study the Impacts of Climate Change on the Hydrological Cycle of Upper Blue Nile basin

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General circulation models (GCMs) are typically used to offer the required information for climate change studies. The coarse resolution of the GCMs outputs may not be suitable for direct use in climate change studies. Many downscaling methods are thus being used to bridge the gap between the coarse resolution of the GCMs and the required resolution of the hydrological variables. In this study, three statistical downscaling techniques (Delta,Artificial Neural Networks (ANN), and the Bias-Correction) are investigated for three chosen GCMs (CGCM 3.1, CNRM-CM3 and GFDL-CM2); each tested for the two IPCC scenarios; the mid-high emission scenario (A2) and the low emission scenario (B1). These downscaling techniques were applied for the Upper Blue Nile catchment, which contributes approximately by 60 % of the main flow of River Nile measured at Dongola. The ANN and the delta methods showed consistent results compared to each other while the bias-correction may produce unrealistic results based on the used GCMs. It is shown that the selection of the downscaling method is very important as it can significantly impact the predictions for the future hydrological variables.