Evaluation of potential changes in hydrologically relevant statistics of rainfall in Southern Africa under conditions of climate change#

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Abstract

Scenarios of present, intermediate and future climates for Southern Africa were analysed to evaluate potential changes in hydrologically relevant statistics of rainfall that could be observed this century as a result of climate change. These climate scenarios were developed in previous studies by applying empirical downscaling techniques to relatively coarse-scale climate scenarios simulated by general circulation models (GCMs) as part of the Intergovernmental Panel on Climate Change 3rd and 4th Assessment Reports (TAR and AR4, respectively). The regional climate scenarios were available at a daily time-step and for a spatial grid resolution of 0.25° over Southern Africa, comprising South Africa, Lesotho and Swaziland. In the study, the regional climate scenarios were related to the 1946 quaternary catchments in the region since the possible hydrological impacts of climate change will ultimately be assessed explicitly by applying the regional climate scenarios in a daily time-step hydrological model. The analysis of potential changes in hydrologically relevant rainfall statistics was qualitative in nature and focused on determining where convergence exists amongst the different climate models with respect to changes in rainfall, and what the likely hydrological implications would be for the region. According to all of the GCMs evaluated in the study, more rainfall is projected for the east of the region. The greater rainfall projected for the east would be in the form of more rain days and more days with bigger rainfalls. If these scenarios are correct, the combination of wetter antecedent conditions and larger rainfall events would result in more runoff being generated and this would have implications for, *inter alia*, filling of dams and water quality. According to all of the GCMs evaluated, less rainfall is projected along the west coast and the adjacent interior, with the possibility of a slight increase in inter-annual variability. If correct, this would result in a decrease in flows and an increase in flow variability, since changes in precipitation are amplified in the hydrological cycle. As convergence in climate-change scenarios becomes apparent, there is now an arguable basis for developing appropriate response strategies for incorporation into adaptation policy. Perhaps one of the greatest challenges in this regard is now to explore the issues of uncertainty and probability in order to develop a more rigorous basis to enable proactive responses.

Keywords: climate change, rainfall, rainfall statistics, hydrology, Southern Africa, South Africa