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Dynamical downscaling of CAM4 over Southern Africa using WRF: Analysis of trends in precipitation extremes

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Global Climate Models are often run in coarser resolutions and hence they tend to under-represent finer scale features of atmospheric processes. However, resolving these finer scale atmospheric process are important for understanding regional climate variability. One way to overcome this issue is by downscaling the Global Climate Model simulation over the region of interest by using a regional model. In this study, twenty year historical simulation (1990 - 2009) using Community Atmospheric Model (CAM4) is downscaled over Southern Africa using Weather Research and Forecasting (WRF-ARW) model. The CAM4 model was run with a horizontal resolution of 0.9^0 x 1.25^0 and 26 vertical levels and the model was forced with HadISST and transient Green House Gas (GHG) concentrations. The CAM4 simulation is downscaled over Southern Africa using WRF model with a horizontal resolution of 27 km and 36 vertical levels. In order to understand the trends in precipitation extremes, we used a number of precipitation based daily climate indices. Precipitation based climate indices are derived from WRF downscaled data. The 20 year (1990 - 2009) trends of these indices are computed using a Generalized Linear Model (GLM). In order to compare with trends of precipitation indices derived from Tropical Rainfall Measuring Mission (TRMM) daily precipitation data, the WRF based trends are calculated for 1998-2009 period also, as the TRMM data is available from 1998 onwards. It is found that the trends of precipitation based climate indices derived from TRMM daily precipitation data are fairly comparable with the trends of those derived from WRF downscaled daily precipitation data over southern Africa. The analysis shows that southern tip of South Africa, Madagascar, and parts of Africa north of 5 S are experiencing a wet trend, while south eastern and central parts are experiencing decrease in the frequency of heavy precipitation.