



## **Detection and Attribution of Climate Change in East Africa: GCM Selection and a First Estimate**

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Anthropogenic influence has been detected in all major components of the climate system. However, questions remain as to how it transfers between various scales. Dynamical downscaling can provide insight to these questions as it leads to greater resolution than general circulation models (GCM). To examine anthropogenic influence, historical GCM simulations (with natural and anthropogenic forcings) and historicalNat simulations (without anthropogenic forcings) can be used to force the lateral boundaries of a regional climate model. With many GCMs and simulations, model selection is crucial as it is an important source of uncertainty in downscaling and detection and attribution (D&A) studies. Several selection criteria have been established, but they focus on multi-model ensembles for diagnostic regional climate studies. When examining climate change on various scales, ensembles are not feasible. We have established a three-tier selection criteria to discern the most suitable GCM for single region D&A that examines how climate change transfers and acts on various scales.

The selection criteria has been applied to a case study in Kilimanjaro, Tanzania. These high-altitude regions are highly susceptible to climate change and have been the subject of few D&A studies. The selection, firstly, determines which models provide historical and historicalNat simulations. Only 20 models (70 realizations) from the Coupled Model Intercomparison Project 5 (CMIP5) met this criteria. Secondly, the atmospheric state variables (specific humidity, temperature, and winds) at 200, 500 and 850 hPa were compared with Merra 2 reanalysis data for East Africa. Finally, the atmospheric state variables at 500 hPa for the grid cells over the Kilimanjaro summit were compared to in-situ observations from two automated weather stations at 500 hPa (~5900 MASL). The GISS-E2-R r4i1p1 performed the strongest in the tests. To elucidate a first estimate of the anthropogenic influence in East Africa, the difference between the historical and historicalNat simulations were examined for the atmospheric state variables at 200, 500, 850 hPa for the models that ranked in the top 10 of the model selection.