EGU2020-15536
https://doi.org/10.5194/egusphere-egu2020-15536
EGU General Assembly 2020

Investigating the anthropogenic influence on the mesoscale over Kilimanjaro

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Anthropogenic influence on climate change has increased over time and has been detected in all major components of the climate system. High altitude mountains constitute a highly-sensitive region. This has lead to many studies, on varying scales, with detection of climate change as motivation. However, questions persist as to how this anthropogenic influence is manifested in the mesoscale over these mountains and how it transfers between various scales.

A case of study of Kilimanjaro and the glaciers on its summit is undertaken to start addressing these questions. Its unique location, an isolated peak with a summit at almost exactly 500 hPa, allows for the examination of the large and local scale climate change dynamics and how they are linked by the mesoscale circulation over the mountain. Furthemore, it has been extensively studied on the large and local scale and has decadal automated weather station records. A first step involves running the limited-area Weather and Research Forecasting (WRF) regional climate model over the East African region for the period of 1985-2015 using multiple grid nesting centred over Kilimanjaro. The lateral boundaries of WRF will be forced with output from two simulations, historical and historicalNat, of a global climate model (BNU-ESM r1i1p1) from the Coupled Model Intercomparison Project Phase 5 (CMIP5). These two simulations differ by the addition of anthropogenic forcing in the historical simulation. The model was carefully selected by a rigorous testing procedure, where analysis of the top 5 ranked models yielded a first estimate of anthropogenic influence in East Africa. Comparison of WRF output from both simulations will be undertaken to assess how anthropogenic forcing has affected dynamical (e.g. flow regimes) and microphysical processes (e.g. cloud composititon and stability) in the mesoscale over Kilimanjaro.