Geophysical Research Abstracts
Vol. 20, EGU2018-3514, 2018
EGU General Assembly 2018

GCM Selection for Detection and Attribution of climate change at the summit of a tropical high mountain

Carolyne Pickler and Thomas Mölg

Climate System Research Group, Institut für Geographie, Friedrich-Alexander Universität (FAU), Erlangen-Nürnberg, Germany

With increasing anthropogenic influence on climate, there has been a surge in the field of detection and attribution. Changes have been detected in all major components of the climate system. While observed glacier mass loss is a prime example, the majority of detection and attribution studies in these regions focus on the detection aspect of the problem. This has resulted in questions concerning physically-based attribution of present-day glacier mass loss and how it operates over different scales.

This gap in knowledge is addressed by driving the numerical Weather Research Forecasting (WRF) limited-area model with output from a coupled ocean-atmosphere general circulation model (AOGCM) to simulate the atmospheric circulation at various scales for the 30 year climate period of 1986-2015 over Kilimanjaro. AOGCM selection is crucial. A selection criteria was established to determine the most robust climate simulation. To assess the anthropogenic influence, WRF must be forced with HIST (historical simulations with natural and anthropogenic climate forcings) and HISTNAT (simulations with only natural climate forcings). This limited the AOGCM selection to nine from the Coupled Model Intercomparison Project 5 (CMIP5). To narrow down selection, a two-tier approach was used. Firstly, model outputs for the atmospheric state variables (temperature, winds, and humidity) were evaluated with respect to Merra2 reanalysis data. Empirical orthogonal functions were calculated to compare spatial patterns of variability over a synoptical-scale area around the summit of Kilimanjaro. Secondly, model outputs for the atmospheric variables from the grid cell over the summit were compared with in-situ observations at 5900 m ASL in terms of absolute mean difference. The highest ranked model will be utilized to force the WRF over the region to identify and characterize the physical processes initialized or altered by anthropogenic influences on the synoptic, regional and local glacier scale.