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High-resolution dynamic downscaling of future climate over key cities in west and east Africa

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Abstract

The global mean climate of the Earth is almost certainly changing due to increasing concentrations of atmospheric carbon dioxide.To better understand the consequences of those changes on the local scale, we have downscaled global circulation models (GCMs), taking into account thermodynamic terms for various energy sources (radiation, latent heat) as well as the laws for momentum and mass conservation to very high resolutions such as 8km grid size. This paper discusses results of the largest downscaling experiment ever conducted for Africa, executed on African computing infrastructures. The experiment was conducted in order to gain more insight into the regional climate futures of West and East Africa with focus on African major cities such as Dar es Salaam, Addis Ababa, Douala, Ouagadougou, and St. Louis.

There are numerous sources of uncertainty in projections of future climate change over Africa. To enhance general trust in climate change projection data, we have downscaled an ensemble of six global projections of future climate change to high resolution (about 60 to 80 km in the horizontal) over the African continent. The global projections have been obtained from coupled global climate models (CGCMs) that contributed to Assessment Report 4 (AR4) of the Intergovernmental Panel on Climate Change (IPCC). A dynamic regional climate model was used for this purpose. The downscalings were performed for the period 1961-2100. Through a process of multiple nudging, the projections have been further downscaled to a resolution of about 8 km over the target domains listed above for the period 1961-2050. For the analysis, we compared for each city key climate factors such as rainfall and temperature. Each comparison is applied to the time periods 2041-2050 and 1961-1970 respectively.

Biography

As visiting principal researcher at the Council for Scientific and Industrial Research, Meraka Institute, Ingo Simonis has been appointed scientific coordinator of international research and development programs. He is an accomplished leader in the field of geospatial interoperability with a proven track record in architecting and implementing geospatial technologies, standards and web services.