State and changes in water budget and water recycling in Kenya

Context: The Wyss Academy for Nature at the University of Bern engages in interdisciplinary (ID) collaborations to explore novel opportunities for co-benefits between nature conservation and human wellbeing. Among them is the ID Water Scarcity project in Kenya. Many natural resources conflicts in the Mount Kenya region are caused by water scarcity. As pastoralists highly depend on water-related ecosystem services to sustain livelihoods, there is an urgent need to devise restoration solutions to improve moisture recycling, infiltration and harvest ground water. This ID project employs methods in climate and biodiversity science to address the following questions: 1) What are the current state and trends in water budget and biodiversity in the Ewaso Ng'iro basin, also with regards to climate change? 2) What measures can we develop to restore and monitor water and biodiversity related ecosystem services?

This MSc topic is integrated in the first workpackage of the ID Water Scarcity project, which aims at using existing observational and modelling products to assess the water budget, long-term trends and changes in water and biodiversity in the Ewaso basin and upstream.

Goals of MSc topic: 1) Collect available observations and climate simulations datasets, which will serve as a basis for the ID team to develop a scientific synthesis on current state and changes in water resources; 2) Use an already-developed Python tool to assess the state, trends and long-term changes in water budget and precipitation recycling in Kenya, with a focus on the Ewaso basin.

Method and data: The project is based on a Python tool developed by Guo et al. 2018. The tool will be run with reanalyses and climate model simulations, including km-scale simulations, as developed by Messmer et al. 2021 (Fig. 1).

Nice to have: Some knowledge in Python

Duration of project: 1 year (60 credits)

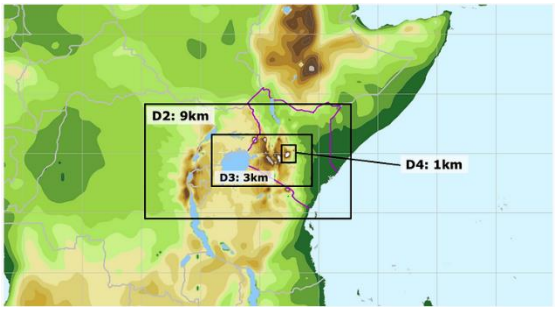

Figure 1: Modelling nesting domains and their associated spatial resolutions, as used by Messmer et al. (2021). Here are shown three domains (D2 = 9 km, D3 = 3 km, D4 = 1 km). The first domain (D1 = 27 km) covers a large part of Africa (not shown here). The purple line identifies the Kenyan border.

Location: Wyss Academy for Nature at the University of Bern

Opportunities: Integrated in an interdisciplinary team; close collaboration with Centre for Training and Integrated Research in Arid and Semi-Arid Land Development (CETRAD, Nanyuki, Kenya) and Centre for Development and Environment (CDE, Bern); Handling of big data (high-resolution model data, observations) and programming in Python.

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References:

Guo, L., N. P. Klingaman, M.-E. Demory, P. L. Vidale, A. G. Turner, C. C. Stephan, 2018. 'The Contributions of Local and Remote Atmospheric Moisture Fluxes to East Asian Precipitation and Its Variability'. *Climate Dynamics*, 51, 4139–56. https://doi.org/10.1007/s00382-017-4064-4.

Messmer, M., S. J. González-Rojí, C. C. Raible, T. F. Stocker, 2021. 'Sensitivity of Precipitation and Temperature over the Mount Kenya Area to Physics Parameterization Options in a High-Resolution Model Simulation Performed with WRFV3.8.1'. *Geoscientific Model Development*, 14, 2691–2711. https://doi.org/10.5194/gmd-14-2691-2021.