Bachelor or Master thesis

Start: April or May 2024
Topic: Sediment dynamics in the Congo river basin
Supervision: Rebecca Peters, Prof. Dr. Christiane Zarfl (Environmental Systems Analysis)
Requirements: Basic GIS knowledge (ArcGIS or QGIS)

Abstract: The Congo river basin in Africa is one of the last mainly free-flowing river systems in the world and is home to a unique biodiversity. At the same time, hydropower is the region's main source for renewable electricity generation with 84 hydropower plants proposed across the basin (Peters et al., 2023). As African countries face the intertwined challenges to (1) provide electricity to more than half of its human population that currently lacks access and (2) transit to renewable based electricity generation, the expansion of renewable capacity is an important development goal. The Inga hydropower project is located close to the river basin's delta area and, with a capacity of 230 Megawatt (MW), is one of the largest hydropower projects on the continent. The proposition for an extension of the project, which would create a hydropower plant larger than Chinas Three Gorges Dam (22 500 MW), has triggered a global debate on pros and cons for its implementation: On the one hand, the Grand Inga Project could generate 45 000 MW of renewable capacity, meet most of the continent's demand for renewable electricity and promote economic development. On the other hand, environmental organisations and scientist have outlined the possible trade-offs for the environment: sediment entrapment, loss of sediments in the delta area and impacts on nutrient transport and biodiversity (Dunn et al., 2019, Showers, 2009). After the implementation plans were put on hold due to a lack of investment caused by the unstable political situation in the Democratic Republic of Congo, president Tshisekedi resumed dialogue with South Africa's president Ramaphosa in the summer of 2023 (NewAfrican, 2023). Both parties announced that the plans for Grand Inga are still on the table.
Due to limited data availability in the past, research on river and sediment dynamics in the Congo river basin remain scarce. Yet, thanks to technological advantages in satellite imagery and climate information systems, data quality and availability have improved in recent years.
To better understand how future hydropower damming, in particular from the Grand Inga dam, will impact sediment dynamics and river morphology, the proposed thesis has the aim to better understand (1) current sediment dynamics and (2) changes in sediment dynamics following dam construction and considering projections on climate change. A detailed project outline will be developed by the student according to his/her background and interests and in cooperation with the supervisors.

Literature:

- Dunn, F. E., Darby, S. E., Nicholls, R. J., Cohen, S., Zarfl, C., & Fekete, B. M. (2019). Projections of declining fluvial sediment delivery to major deltas worldwide in response to climate change and anthropogenic stress. *Environmental Research Letters*, **14**(8), 084034.
- NewAfrican. *La difficile relance du barrage Grand Inga.* Published online on July 13, 2024. https://magazinedelafrique.com/african-business/la-difficile-relance-du-barrage-grand-inga/ (last accessed on 12.03.2024)
- Peters, R., Berlekamp, J., Tockner, K. *et al.* RePP Africa – a georeferenced and curated database on existing and proposed wind, solar, and hydropower plants. *Sci Data* **10**, 16 (2023). https://doi.org/10.1038/s41597-022-01922-1
- Showers, K. B. (2009). Congo River's Grand Inga hydroelectricity scheme: linking environmental history, policy and impact. *Water History*, **1,** 31-58.
- Warner, J., Jomantas, S., Jones, E., Ansari, M. S., & De Vries, L. (2019). The fantasy of the Grand Inga hydroelectric project on the river Congo. *Water*, **11**(3), 407.
- World Bank (2020). Increasing Access to Electricity in the Democratic Republic of Congo: Opportunities and Challenges. © World Bank, Washington, DC. http://hdl.handle.net/10986/33593

Contact: rebecca.peters@uni-tuebingen.de