EGU2020-20291
https://doi.org/10.5194/egusphere-egu2020-20291
EGU General Assembly 2020

The interplay between geodynamics and flooding drives the dynamics of the inner Okavango Delta (North Botswana)

Olivier Dauteuil[1], Marc Jolivet[1], Mike Murray-Hudson[2], laurie Barrier[3], Aziliz Audran[1], and Aëla Radenac[1]

[1]MR 6118, Géosciences Rennes, CNRS, university of Rennes, 35042 Rennes France (olivier.dauteuil@univ-rennes1.fr)
[2]Okavango Research Institute, University of Botswana, Private Bag 285, Maun, Botswana
[3]Laboratoire de Tectonique et Mécanique, IPGP Université de Paris 75238 Paris, France

The southwestward propagation of the East African Rift System inside the southern African plateau generated the Okavango basin in a strike-slip context. This setup generates one of the largest endoreic ecosystem in Africa: the Okavango Delta alluvial fan. The sedimentary and topography dynamics of that system are driven by both annual flooding and strike-slip geodynamics. To evaluate the impact of ground deformation on the long-term evolution of the Okavango ecosystem, we estimated the 3D strain field from the deformation of a geodetic network composed of 7 dual-frequency GPS semi-permanent stations measured during 4 years. The Okavango basin is a half-graben: its SE edge being limited by a set of normal faults, while the NW limit is bounded by a right-lateral fault. This fault pattern generates strain partitioning with a stretching direction that changes from oblique to parallel to the graben trend and with the highest dilation to the NE and shortening to the SW. Integrating geophysical data, we propose a crustal model describing a strike-slip basin with a normal detachment zone connected to a steep strike-slip shear zone in the lower crust. We show that strain partitioning lead to dilating and shortening domains, which favors water flow toward the NE and progressively restricts water discharge into Lake Ngami, SW of the Delta.

At regional scale, the vertical component of the ground deformation recorded over 10 years reveals annual variations generated by the cyclic flooding, this process acting in addition to the ground deformation induced by the regional geodynamics. A preliminary numerical modeling of the ground flexure induced by the floods constrains the rheological properties of the crust. It highlights two domains with high subsidence limiting a domain with lower subsidence allowing differential water storage.

We conclude that the geodynamic deformation linked to the propagation of the East African Rift into the Okavango half-graben is a key factor controlling the hydrodynamics and ecosystem evolution of the Okavango Delta fan. This control is super-imposed to the effects of variations in sediment and water supply linked to regional climate change. More generally, we show that intra-continental endoreic systems can be highly sensible to low amplitude tectonic deformation.