Future flooding of the Volta Delta caused by sea level rise and land subsidence

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The Volta delta(Ghana, West Africa) is increasingly impacted by sea level rise (SLR). SLR makes the Volta delta mostly vulnerable to flooding, salinization of water resources and agriculture fields, and permanent loss of lands. This would potentially threaten and present a growing risk to its population, infrastructure and economy, and even worsen due to land subsidence (LS). Relative sea level rise (RSLR) in this study is the rate of LS with respect to SLR. It is thus very important to precisely quantify LS rates together with SLR as well as planning and assessment of countermeasures. This study is in two parts, The first study presents and discusses recent LS rates in the Volta delta derived from satellite-based SAR-Interferometry and their impact on relative SLR. The second study, also assesses major hydrodynamic parameters(Wave runup, Sea Level Anomaly,tide and atmospheric conditions) that play a role in extreme coastal flooding events.
Sentinel-1 scenes acquired between 2015 and 2021 was used to quantify recent LS in the study area. The Persistent Scatter Interferometry (PS-InSAR) technique was applied, which allowed for the estimation of displacement rates of coherent backscatter targets with mm/yr precision.
Separate analyses of time series for the Keta lagoon and Songor lagoon areas give insight on the vertical land movements, with average rates of up to 4 mm/yr irregularly scattered in the coastland. LS in Volta delta is due to various causes, most prominently natural compaction of young deltaic sediments, but also aquifer over exploitation and salt mining. Furthermore, projection of future elevation projections by RSLR was assessed by combining the observed LS rates with three IPCC representative concentration pathways (RCP) scenarios. The RSLR impact assessments computed revealed that by 2100, more than 20 % of the Volta delta districts could be potentially be elevated below MSL for all the addressed RCP scenarios including the fragile but key sand barriers surrounded by water bodies. Resullts from the assessement of predominant hydodynamics factors also indicates the delta is affected by wave run during extreme coastal flooding. The study is however a preliminary investigation and recommends further analysis by local ground-based LS investigations to calibrate PS-InSAR outcome, thus improving our understanding of the areas driving key present and future changes of the Volta delta.The study is however a preliminary investigation and recommends further analysis by local ground-based LS investigations to calibrate PS-InSAR outcome, thus improving our understanding of the areas driving key present and future changes of the Volta delta.

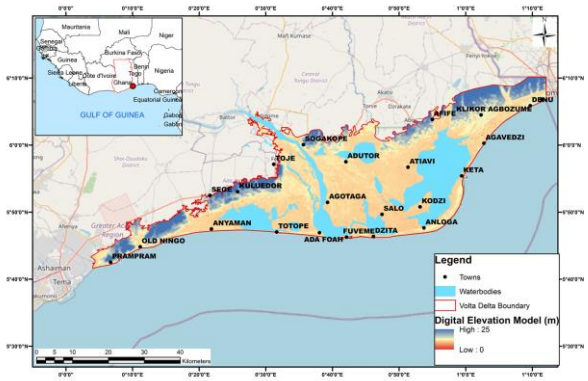

Figure 1 -The map of the Volta Delta.

SOME REFERENCES

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