Hydrological balance assessment of the Aghien Lagoon catchment at the periphery of the Abidjan metropolitan area, southern Côte d'Ivoire

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ABSTRACT

The resurgence of drinking water shortages in the Autonomous District of Abidjan, home to over five million people, has led policymakers to explore alternative water sources, notably the Aghien Lagoon. This study analyzes the variability of the Aghien Lagoon's water balance between 2015 and 2019, using hydroclimatic data acquired at sub-hourly intervals (15 minutes). Incomplete water level records were reconstructed using linear regression in R, and the various terms of the water balance were then estimated. The results show a strong correlation between the lagoon's water levels and those of the Aghien–Potou channel ($R^2 > 0.99$), indicating that nearly 80% of the water level variability is controlled by exchanges through this channel. Over the study period, cumulative rainfall is estimated at 3179.88 Mm^3, while the volumes associated with evaporation and groundwater exfiltration are estimated at 546 Mm^3 and 235 Mm^3, respectively. The Djibi and Bété rivers ensure the annual renewal of the lagoon, while direct rainfall and groundwater exfiltration play a secondary role. The observed lag between the Mé River floods and the maximum lagoon water levels suggests an indirect influence from the Comoé River. These results highlight the predominant role of the Aghien-Potou channel in the lagoon's hydrological dynamics and provide essential elements for the sustainable management of this resource.

Keywords: Aghien Lagoon, hydrological dynamics, water resources, spatio-temporal variability, Abidjan