3D dynamics in salinity diffusion influenced by anthropogenic pressures and climate change: a case study of the Aghien lagoon (Abidjan, Côte d'Ivoire) (Oral)

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ABSTRACT

In the context of population growth and climate change, ensuring the availability of drinking water for the District of Abidjan poses a significant strategic challenge. The Aghien lagoon, identified as an alternative resource, is the site of a water intake designed to sustainably strengthen the drinking water supply. However, the reopening of the Comoe river estuary in 2023 has profoundly altered the hydrodynamic behavior of the Aghien lagoon system from 2025 onwards, leading to a significant increase in salinity. To elucidate the fluctuations in salinity occurring in this lagoon, a three-dimensional model of salinity transfer and diffusion has been constructed. The model, constructed on 100 m² triangular meshes using Mike 21/3 with field data collected prior to and following the opening of the Comoe estuary, incorporates climate change assumptions based on the SSP1-1.9 and SSP5-8.5 climate scenarios. The results demonstrate a progressive decrease in the longitudinal salinity gradient from the channel towards the Aghien lagoon during periods of low water, with saltier water masses found at depth. However, at the onset of flooding, a longitudinal inversion of salinity is observed from the channel to the Aghien lagoon. However, the impact of the sea-level rise would decrease progressively from the channel towards the upstream part of the lagoon. A more pronounced increase in salinity is observed at depth in comparison to the surface, particularly in the deepest areas. This phenomenon is attributable to the fact that sea-level rise causes an increase in salinity to a greater extent at depth than at the surface. By the year 2050, the SSP1-1.9 scenario projects that the salinity at the water intake will reach 4.0 PSU at the bottom, compared with 4.7 PSU under the SSP5-8.5 scenario. The operation of this lagoon necessitates the installation of a movable weir to restrict the intrusion of seawater. The environmental impact of this intervention will require assessment.

Keywords: Salinity difusion, 3D model, Triangular mesh, Sea-level rise, Côte d'Ivoire.