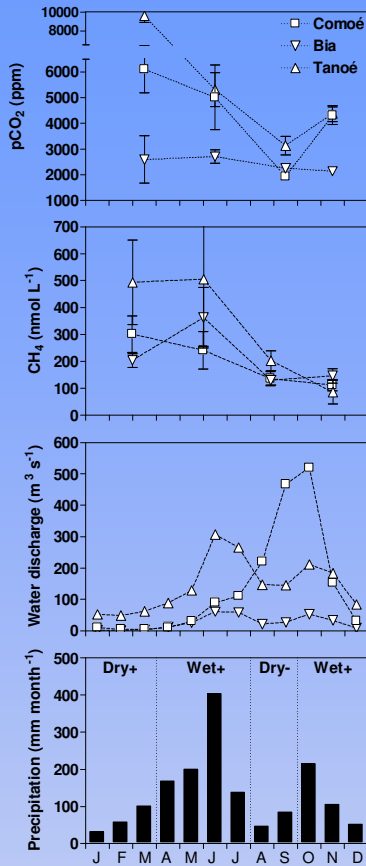


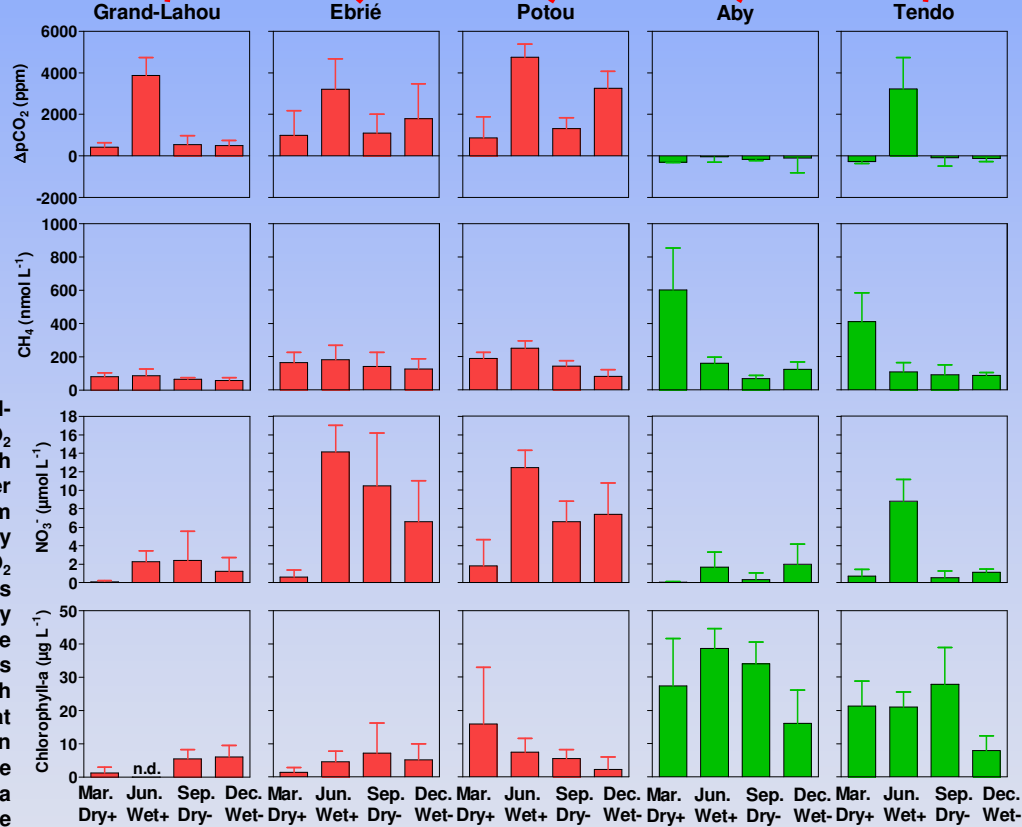
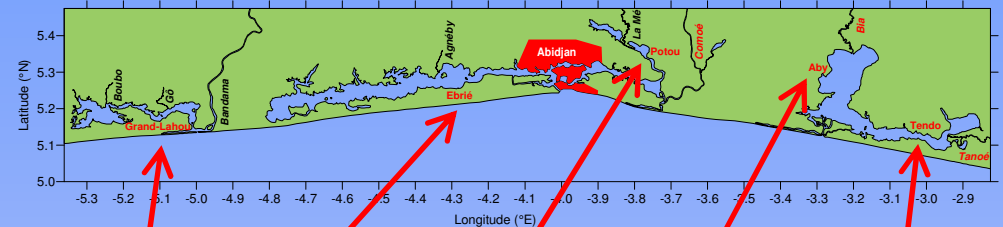
# Seasonal variability of carbon dioxide and methane in the rivers and lagoons of Ivory Coast (West Africa)

Y.J.M. Koné<sup>1</sup>, G. Abril<sup>2</sup>, B. Delille<sup>1</sup>, A.V. Borges<sup>1,\*</sup>

<sup>1</sup> University of Liège <sup>2</sup> Environnement et Paléoenvironnements OCéaniques, Université Bordeaux 1 \* alberto.borges@ulg.ac.be



In the Tanoé and Comoé rivers, the highest pCO<sub>2</sub> values were obtained during the high dry season, and lowest values during the flooding period, due to dilution. In the Bia river, the decrease of pCO<sub>2</sub> during the flooding period was much less marked due to flow regulation by the Ayamé dam 60 km upstream of the sampling site. The dam strongly decreases the seasonal variations of freshwater discharge and smoothes over the annual cycle the impact of drainage of soil CO<sub>2</sub> by groundwater. An overall decrease of CH<sub>4</sub> concentrations occurred in the 3 rivers from the low water period to the flooding period, suggesting that dilution due to increased freshwater discharge was also the major driver of the seasonal cycle.



In the Tendo, Ebrié, Potou and Grand-Lahou lagoons, the average ΔpCO<sub>2</sub> values were higher during the high rainy season (June) than the other seasons, due to strong inputs from the rivers. The Tendo and Aby lagoons were under-saturated in CO<sub>2</sub> through the year. The Aby lagoon is connected to the sea by a very shallow channel (<1m) while the Grand-Lahou and the Ebrié lagoons are connected to the sea by much deeper channels. This implies that wave and tidal action from the ocean do not propagate as intensely in the Aby lagoon system, leading to a strong and permanent haline stratification, resulting in anoxic conditions in bottom waters. The strong permanent haline stratification in the Aby lagoon promotes light availability, leading to higher rates of primary production as suggested by the higher chlorophyll-a and lower NO<sub>3</sub><sup>-</sup> values.

The Tendo, Ebrié, Potou and Grand-Lahou lagoons were characterized by low CH<sub>4</sub> values and little seasonality. During the high dry season (March) CH<sub>4</sub> were extremely high in the Aby and Tendo lagoons due to : 1) the decrease of freshwater inputs leads to a shallower mixed layer and a lesser degree of stratification, leading to enhanced diffusion of CH<sub>4</sub> across the pycnocline; 2) increase of salinity might inhibit the activity of methanotrophic bacteria; 3) higher primary production and higher organic matter export to the anoxic bottom layer (increase of CH<sub>4</sub> production).

The annual diffusive air-water CH<sub>4</sub> fluxes and air-water CO<sub>2</sub> fluxes in the rivers are positively correlated, because CO<sub>2</sub> and CH<sub>4</sub> dynamics are controlled by the same processes (inputs from soils and dilution during the flooding period). In the 5 lagoons, the diffusive air-water CH<sub>4</sub> fluxes and air-water CO<sub>2</sub> fluxes are negatively correlated. The permanent stratification of the Aby and Tendo lagoons, enhances primary production and organic carbon export across the pycnocline leading to a low CO<sub>2</sub> emission to the atmosphere (Tendo lagoon) or a sink of atmospheric CO<sub>2</sub> (Aby lagoon), but at the same time this promotes anoxia in bottom waters and leads to stronger diffusive CH<sub>4</sub> emissions than the other lagoons that are not permanently stratified.

