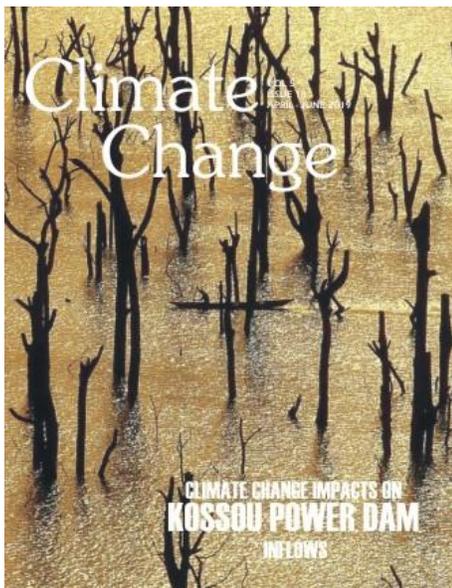# Climate Change

About the Cover

Hydropower generation is tributary by inflows of reservoir. Changes in inflows can result lead to changes in hydropower generation. In Côte d'Ivoire, energy production is largely due to hydropower dam and so the climate change is a challenge for the entire hydropower sector. This work aims to assess future climatic variability and its impacts on reservoir inflows of Kossou Dam. Historical climate data from 10 stations were used. The future climate data were produced by CLMcom-CCLM4.8 using the boundary conditions of three GCMs (CNRM-CERFACS-CNRM; ICHEC-EC-EARTH; MPI-M-MPI-ESM-LR). Simulation results for future climate under RCP 4.5 and RCP 8.5 scenarios indicate that the annual temperature may increase around 5% and the rainfall may decrease by 15 to 25 % in the future. Under RCP scenario, the inflows of Kossou dam may increase according ICHEC and MPI projections. On the other side, the CNRM indicated indicates a decrease. (Ref: Gneneyougo Emile SORO, N'Da Jocelyne Maryse Christine AMICHIATCHI, William Francis KOUASSI, Tié Albert GOULA BI. Assessment of climate change impacts on Kossou power dam inflows (White Bandama River, Côte d'Ivoire). *Climate Change*, 2019, 5(18), 82-89).

Climate Change & Hydrology

Assessment of climate change impacts on Kossou power dam inflows (White Bandama River, Côte d'Ivoire

Gneneyougo Emile SORO, N'Da Jocelyne Maryse Christine AMICHIATCHI, William Francis KOUASSI, Tié Albert GOULA BI

Hydropower generation is tributary by inflows of reservoir. Changes in inflows can result lead to changes in hydropower generation. In Côte d'Ivoire, energy production is largely due to hydropower dam and so the climate change is a challenge for the entire hydropower sector. This work aims to assess future climatic variability and its impacts on reservoir inflows of Kossou Dam. Historical climate data from 10 stations were used. The future climate data were produced by CLMcom-CCLM4.8 using the boundary conditions of three GCMs (CNRM-CERFACS-CNRM; ICHEC-EC-EARTH; MPI-M-MPI-ESM-LR). Simulation results for future climate under RCP 4.5 and RCP 8.5 scenarios indicate that the annual temperature may increase around 5% and the rainfall may decrease by 15 to 25 % in the future. Under RCP scenario, the inflows of Kossou dam may increase according ICHEC and MPI projections. On the other side, the CNRM indicated indicates a decrease.

Climate Change & Water Quality

Assessment of seasonal variation of Nsukka phreatic aquifer groundwater quality

Chidozie Charles Nnaji, Kenneth Onuigbo, John Precious Nnam

The high dependence on groundwater supply by the residents of developing countries and low-income cities expose them to various diseases as a result of the toxic substances in the water they drink. Groundwater contamination quality depends on recharge water quality, atmospheric precipitation, inland surface water and sub-surface geochemical processes. This study was aimed at determining the physicochemical quality of phreatic groundwater in Nsukka, Nigeria and to investigate seasonal variation on groundwater quality as well as the various sources of contamination. A total of 8 wells were selected for quality monitoring. Water samples for water quality were collected in May, July, September and December and analyzed for physicochemical parameters following APHA standard methods. The water samples were generally acidic with pH values of 5.52 ± 0.63, 4.56 ± 0.65, 5.20 ± 0.59 and 6.1 ± 0.54 in May, July, September and December respectively. Iron cadmium, lead and zinc violated recommended values. All the samples collected in May, July and September exceeded guideline values for cadmium while all samples collected in May, September and December exceeded guideline values for lead. Results of analyses clearly show that water quality parameters vary widely across the four sampling seasons. There was a very high correlation between Cl^- and the alkali and earth alkali metals at 95% confidence level as follows: Cl^- and K^+ ($r = 0.90$), Cl^- and Ca^{2+} ($r = 0.881$), Cl^- and Na^+ ($r = 0.844$), Cl^- and Mg^{2+} ($r = 0.664$). The drinking water quality indices results obtained ranged from 43% - 48% for NIS, 40% - 46% for WHO and 46% - 52% for EPA which shows that the water is not fit for consumption without treatment. However, irrigation water quality indices show that the water can be used for irrigation without treatment. The average values of SAR are 1.25, 0.67, 1.37 and 0.78 for May, July, September and December which indicate suitability for irrigation. Results of principal component analyses linked groundwater contamination in the area to PC1 (anthropogenic activities), PC2 (leaching of iron from lateritic soil formation), PC3 (interaction between rainwater and atmospheric gases), PC4 & PC5 (impact of industrialization). Piper's trilinear plots show that the Na^+ - Cl^- type is the most dominant irrespective of season. Alkali metals exceeded alkali earth metals in 71% of the samples while strong acids exceeded weak acids in 80.6% of the samples.

Climate Change & Adaptation/Mitigation

Climate change adaptation practices to water sector in South-Western coastal area of Bangladesh

Md. Humayain Kabir, Mohammed Abdul Baten

Climate scientists, environmentalists, climate negotiators and policy makers around the world have recognized that Bangladesh is the worst victim of climate change. In Bangladesh, South Western coastal area is the most vulnerable due to its geo-morphological characteristics. Among the different sectors, water is seriously affected by climate change. However, people of this area has adapted with this impact by different ways. This study aims at find out the adaptation practices to water sector and their critical analysis through a series of field study along with questionnaire survey and reviewing the secondary literature. The present study shows that hanging vegetables, growing local rice variety, homestead gardening, purification of pond water trough traditional knowledge, directly use of pond water through its proper management, rain water harvesting are the most popular and successful adaptation practices in terms of social, economic and environmental aspects. Although the adaptation practices by the local community are praiseworthy, the dependency on donor agencies and non-governmental organizations are a new challenge for future adaptation practice.

Climate Change & Microclimate

Microclimatic study using temperature data of Jahangirnagar University of Bangladesh

Md. Anarul Haque Mondol, Md. Saiful Islam Kazi, Maliha Fairuz Rahman, Muhammad Rezaul Rakib

Microclimate is characterize the climate of a localized area may vary on the order of one square meter to as long as the order of 100 square kilometers even. In this study, detail descriptions of the microclimatic conditions and the trends of temperature of Jahangirnagar University have been assessed. The secondary data for the last 10 years have been collected from the Weather Station of the Department of Geography and Environment of this university. The microclimatic data for both building interior and open space were selected for the study. Regression analysis was performed by Excel and other statistical software to find out the trend line analysis for climatic variability. Data analysis indicates that there are strong differentiations between the temperature of different periods and places of the study. Overall temperature was distinctly low during midnight to morning time compared to other parts of the day in the study area. Again at morning, the temperature was found lower in the building interior than open space in winter and found reverse in summer or pre-monsoon period. In summer, the temperature was found higher in building interior than open space. During usual monsoon rainfall was occurring in this area. Most of the cases the temperature was normal in the sense of ideal microclimatic conditions,but remarkable deviations were also marked during data analysis which has been defined and analyzed by the existing climatic phenomena.

Climate Change & Agriculture

Weather and agro advisory services to farmers and its benefits

Kailash Chand Pandey, Ajay Kumar Singh

This study estimates the benefits that Indian farmers derive from agriculture and weather information delivered to their mobile phones by GEAG. Climatologist conducted a controlled randomized experiment of 20 villages in East U.P. The farmers associate information with a number of decisions they make, and we find some evidence that treatment affected spatial arbitrage and crop grading. But the magnitude of these effects is good. We find statistically significant average (10-25 %) effect of this information on the crops and input cost reduced by farmers, crop value-added, crop losses resulting from rainstorms, or the likelihood of changing crop varieties and cultivation practices. The purpose of this study is to ascertain whether agricultural and weather information distributed through mobile phones generates economic benefits to farmers. We implement a randomized controlled trial of GEAG offered by the largest and best-established private provider of agricultural weather information in U.P and Bihar at the time of the experiment. Operating in U.P. and Bihar GEAG distributes weather, and crop advisory information through SMS messages. We offered free subscription to a random sample of farmers to test whether they obtain higher yield for their agricultural product using this information. Results are satisfactory.

Reduction of the vulnerability of the Egyptian cropping pattern to climate change stress

Tahany Noreldin, Abd El-Hafeez Zohry

The objective of this study was to quantify the effect of climate change in 2030 on the prevailing cropping pattern, with respect to its water requirements and cultivated areas. Furthermore, testing the effect of suggested procedures, namely using water saving techniques and implementing intercropping systems on reducing the negative effects of climate change on the cultivated area of the cropping pattern in 2030 was also done. Data on the area of 16 important crops cultivated in 2014/15 were collected. Water requirements of these crops were calculated. Climate scenario RCP6.0 resulted from MIROC5 climate model was used to calculate water requirements of the cropping pattern in 2030. The results indicated that using the suggested procedures could increase the cultivated area of the current cropping pattern by 28%. The results also showed that, in 2030, the cultivated area is expected to be reduced by 10%, as a result of increasing the water requirements of the crops. Furthermore, implementing the suggested procedures in 2030 could result in an increase in the cultivated area by 29%, compared to the area under traditional cultivation. Thus, it is recommended to use the suggested procedures to reduce the losses in the cultivated area in 2030.