PHONE
+12546544615

EMAIL
celray@chawanda.com

Blackland Research Center, Temple, Texas 76502

EXPERIENCE

Professor
Vrije Universiteit Brussel
2022 Brussels, Belgium

Post-Doc Researcher
Vrije Universiteit Brussel
2021 Brussels, Belgium

PhD Researcher
Vrije Universiteit Brussel
2016 Brussels, Belgium

Asistant Teacher
Bunda College, LUANAR
2014 Lilongwe, Malawi

EDUCATION

PhD in Engineering Sciences
Highest Honours

Vrije Universiteit Brussel
2021 Brussels, Belgium

MSc inWater Resources Engineering
Magna Cum Laude

Katholieke Universiteit Leuven
2021 Leuven, Belgium

BSc in Irrigation Engineering
With Distinction

Bunda College – University of Malawi
2021 Brussels, Belgium

Celray James **CHAWANDA,** PhD

Professor, Post-Doctoral Researcher

BACKGROUND SUMMARY

Celray James was born in Zomba, Malawi. Being interested in water engineering, he studied Irrigation Engineering at Bunda College (University of Malawi) and never looked back. He, now, is a researcher and professor in the hydrology field at the Vrije Universiteit Brussel (VUB).

He Primarily works on large scale hydrological modelling focusing on impacts of climate change and land use change on water resources. He also develops software and tools to assist in hydrological modelling.

EDUCATION DOSSIER

Celray James obtained his BSc in Irrigation Engineering at Bunda College of Agriculture under the University of Malawi (Now it is under LUANAR). He then went to KU Leuven where he studied Water Resources Engineering. He obtained his master's degree in Water Resources Engineering in 2016.

He later Joined the Hydrology and Hydraulic Engineering Department (HYDR) at VUB in 2016 as a teaching assistant but also doing a PhD (more details in 'Research Dossier').

While with HYDR, Celray James assisted in teaching IUPWARE courses (Surface Water Hydrology and Surface Water Modelling). He also set up resources for research and teaching/learning including (1) E-learning platform under the 'Open Water Network' and the 'eMWARE' projects, (2) e-learning material for Python and Surface Water Modelling, (3) Software for set up of SWAT+ Model (SWAT+ AW) and calibration (SWAT+ Toolbox) used all over the world (4) IOT platform under the 'Open Water Network' project.

He graduated with highest honours and has been a post-Doc researcher. Now he is a Visiting Professor at the VUB.

RESEARCH DOSSIER

Here is a summary of the research Celray James did during his PhD.

Surface water provides several benefits to African communities, but the availability of surface water resources has undergone changes due to Climate Change (CC) and Land Use and Land Cover change (LULCC). While more studies focus on projecting impacts of CC on the water resources in Africa, there have been very few studies projecting the combined impacts of both CC and LULCC. Hydrological models are often used to assess the spatial and temporal aspects of water resources on the continent. However, development of continental scale hydrological models is limited by computational demands and data requirements for setting up and calibrating such models. Furthermore, it has recently been shown that hydrological modelling suffers from lack of reproducibility which limits the ability of hydrologists to build upon previous findings.

In this study we analyse how the African surface water resources will respond to CC and LULCC using the SWAT+ model which we set up for the African continent. We first develop a framework that boosts the provenance of model applications to improve the reproducibility of SWAT+ model studies. We then develop and test a methodology for configuring and calibrating large-scale SWAT+ model applications and for improving the human interactions such as reservoirs and irrigation.

We show that there is a significant difference in projections made by calibrated and uncalibrated large-scale models and that calibration of global and continental scale models is necessary. Adaptations were made to the SWAT+ source code to allow simulation of land use change using the Land Use Harmonisation Project data. We run projections using the SWAT+ model for Africa driven by pure CC scenarios and by a combination of CC and LULCC.

Results from CC scenarios show that the Congo River basin is likely to experience lower average river flows under all Representative Concentration Pathways (RCPs). Niger River basin is likely to experience a strong decrease in river flows under RCPs 6.0 and 8.5. Limpopo River basin is likely to experience increases in average flows under all RCPs. The Nile, Senegal, and Orange have mixed signals between RCPs, which calls for more careful planning of water resources for the future in these regions. Including LULCC in projections results in significant deviations from projections made by considering pure CC. The Congo basin has a strong decrease in evapotranspiration (ET) under LULCC and CC driven by projected deforestation, yet it has an increase in ET under CC alone. The Congo River basin experiences a shift from a decrease of river flows under pure CC scenarios to an increase in river flows when LULCC is considered. Thus, the potential impacts of LULCC should not be underestimated.

The projected changes have implications on agriculture and hence the livelihood of people on the continent. Our results highlight the need to adopt policies to halt global greenhouse gas emissions and to combat the current trend of deforestation in Africa given the high combined impact of CC and LULCC on water resources.

The following lists publications where he is an author.

Research outputs
Listing of Research outputs

Article

Research

Chawanda, C. J., Arnold, J., Thiery, W., & van Griensven, A. (2020). Mass balance calibration and reservoir representations for large-scale hydrological impact studies using SWAT+. *Climatic Change* , *163*(3), 1307–1327. https://doi.org/10.1007/s10584-020-02924-x

Chawanda, C. J., George, C., Thiery, W., Van Griensven, A., Srinivasan, R., Arnold, J., & Tech, J. (2020). User-friendly workflows for catchment modelling: Towards reproducible SWAT+ model studies. *Environmental Modelling & Software*, *134*, [104812]. https://doi.org/10.1016/j.envsoft.2020.104812

Sterl, S. H., Devillers, A., Chawanda, C. J., Van Griensven, A., Thiery, W., & Russo, D. (2022). A spatiotemporal atlas of hydropower in Africa for energy modelling purposes. *Open Research Europe*, *1*(29). https://doi.org/10.12688/openreseurope.13392.1

Nkwasa, A., Chawanda, C. J., Msigwa, A., Komakech, H. C., Verbeiren, B., & van Griensven, A. (2020). How can we represent seasonal land use dynamics in SWAT and SWAT+ models for African cultivated catchments. *Water*, *12*(6), [1541]. https://doi.org/10.3390/w12061541, https://doi.org/10.3390/W12061541

Nkwasa, A., Chawanda, C. J., Jägermeyr, J., & Van Griensven, A. (2022). Improved representation of agricultural land use and crop management for large-scale hydrological impact simulation in Africa using SWAT+. *Hydrology and Earth System Sciences*, *26*(1), 71–89. https://doi.org/10.5194/hess-26-71-2022

Yen, H., Park, S., Arnold, J. G., Srinivasan, R., Chawanda, C. J., Wang, R., ... Zhang, X. (2019). IPEAT+: A built-in optimization and automatic calibration tool of SWAT+. *Water (Switzerland)*, *11*(8), [1681]. https://doi.org/10.3390/w11081681

Nkwasa, A., Chawanda, C. J., & Van Griensven, A. (2022). Regionalization of the SWAT+ model for projecting climate change impacts on sediment yield: An application in the Nile basin. *Journal of Hydrology: Regional Studies*, *42*, [101152]. https://doi.org/10.1016/j.ejrh.2022.101152

Sterl, S. H., Vanderkelen, I., Chawanda, C. J., Russo, D., Brecha, R., Van Griensven, A., ... Thiery, W. (2020). Smart renewable electricity portfolios in West Africa. *Nature sustainability*, *3*(9), 710-719. https://doi.org/10.1038/s41893-020-0539-0

Alitane, A., Essahlaoui, A., El Hafyani, M., El Hmaidi, A., El Ouali, A., Kassou, A., ... Van Rompaey, A. (2022). Water Erosion Monitoring and Prediction in Response to the Effects of Climate Change Using RUSLE and SWAT Equations: Case of R'Dom Watershed in Morocco. *Land*, *11*(1), [93]. https://doi.org/10.3390/land11010093

Conference paper

Research

Chawanda, C. J., Nossent, J., & Bauwens, W. (2017). Baseflow Separation Tools: What do they really do? In *Geophysical Research Abstracts Vol. 19*

Unpublished abstract

Research

Chawanda, C. J., Thiery, W., & Teklesadik, A. D. (2017). *Automated implementation of irrigation in SWAT*. Abstract from 2017 SWAT Conference, Warsaw, Poland.