IQCB
Institute for Quantitative & Computational Biosciences

Cross Disciplines Seminar
July 02, 2025
10:30 AM

Lecture Hall (00.187) at BioZentrum I, Hanns-Dieter-Hüsch-Weg 15, 55128 Mainz

Prof. Dr. Calvin Tadmon

University of Dschang, Cameroon, and
Institute of Mathematics, JGU Mainz, Germany

Health and environment friendly committed mathematics

Impact of climate change on the spread of Ebola with reservoir in a simple virus life ecology

Ebola virus disease is an overwhelming haemorrhagic fever causing serious threats to human health. Ebola virus needs optimal temperature and favourable environmental conditions to survive. It is well known that climate change affects the concentration of Ebola virus in the environment. The aim of this talk is to capture the effects of some climatic drivers such as temperature and rainfall on the spread of Ebola virus disease. We consider direct and indirect routes of contamination between and within human and fruit bat populations, and model the transmission dynamics of the disease as a system of nonlinear ordinary differential equations, coupled to a model of intra-annual variation of temperature and rainfall. The nonautonomous differential system derived is completely analysed. To begin with, we neglect the intra-annual variation of climate, and investigate the corresponding autonomous system obtained. The basic reproduction number is computed, and the existence and stability of equilibria are successfully studied. Secondly, the nonautonomous model is thoroughly investigated by mainly relying on the definition of the basic reproduction number in periodic environments. We prove the existence, uniqueness and global stability of a positive Ebola-free solution. Finally, to illustrate the theoretical findings, we perform some numerical simulations using real climate data of the locality of Beni (Democratic Republic of Congo).

Keywords: Ebola virus disease, Temperature, Rainfall, Nonautonomous system, Global positive solution, Ebola-free solution, Asymptotic behaviour, Stability

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For further information please contact
IQCB coordinator Christine Driller
iqcb@uni-mainz.de | +49 (0) 6131 - 39 26517

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