Maíra Aguiar
Centro de Matemática e Aplicações Fundamentais da Universidade de Lisboa, Lisbon, Portugal.
e-mail: maira@ptmat.fc.ul.pt
Sebastien Ballesteros
Centro de Matemática e Aplicações Fundamentais da Universidade de Lisboa, Lisbon, Portugal.
e-mail: sebastien.ballesteros@gmail.com
Bob W. Kooi
Faculty of Earth and Life Sciences, Department of Theoretical Biology,Vrije Universiteit, Amsterdam, The Netherlands.
e-mail: kooi@falw.vu.nl
Nico Stollenwerk
Centro de Matemática e Aplicações Fundamentais da Universidade de Lisboa, Lisbon, Portugal.
e-mail: nico@ptmat.fc.ul.pt

Modelling dengue fever epidemiology: complex dynamics and its implication for data analysis.

It is estimated that every year, there are $70-500$ million dengue infections, 36 million cases of dengue fever (DF) and 2.1 million cases of dengue hemorragic fever (DHF), with more than 20.000 deaths per year [1, 2]. In many countries in Asia and South America DF and DHF has become a substantial public health concern leading to serious social-economic costs. Mathematical models describing the transmission of dengue viruses has focussed on ADE effect and temporary cross immunity trying to explain the irregular behavior of dengue epidemics by analyzing the available data. However, no systematic investigation of the possible dynamical structures has been performed so far. Our study focuses on a seasonally forced (non-autonomous) two-strain model with temporary cross immunity and possible secondary infection, motivated by dengue fever epidemiology. We extend the previous studied non-seasonal (autonomous) model[3, 4, 5]. by adding seasonal forcing and low import rate of infected individuals, which is realistic in the dynamics of dengue fever epidemics. A comparative study between three different scenarios (non-seasonal, low seasonal and high seasonal with a low import of infected individuals) is processed and the results are shown and discussed. The extended models show complex dynamics and qualitatively a very good result when comparing empirical DHF and simulation. We discuss the role of the seasonal force and import of infected individuals in such systems, the biological relevance and the implications of the new results in the analysis of the available dengue data [6].

References

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