A chaotic model for the West Africa Ebola virus outbreak

M. Huc[1], & S. Mangiarotti[1]

CESBIO, UPS-CNRS-CNES-IRD, 18 av. Ed. Belin, 31401 Toulouse cedex 9, France
sylvain.mangiarotti@ird.fr

The Ebola virus outbreak that spread into West Africa in 2014 was of unprecedented scope and unexpected. In such contexts of emergent disease, phenomenological approaches that could be applied to epidemics based on scarce data sets would be very useful. The global modeling technique is used to obtain sets of Ordinary Differential Equations of canonical form from single [1,2] time series. It was recently shown that the approach could also be applied to get coupling models from multiple time series [3].

In this study, a generalized formulation [4] of the global modeling technique is used to obtain a set of Ordinary Differential Equations for the dynamics of Ebola virus disease identified in 2014 in West Africa. Two observables are considered : the number of detected infections and the number of deaths due to Ebola virus. Based on this approach, a four-dimensional chaotic model that exhibits a complex dynamics is obtained and discussed.

Références

1. G. GOUESBET & C. LETELLIER, Global vector field reconstruction by using a multivariate polynomial L_2-approximation on nets, *Physical Review E*, **49** (6), 4955-4972, 1994.

2. S. MANGIAROTTI, R. COUDRET, L. DRAPEAU & L. JARLAN, Polynomial search and global modeling : two algorithms for modeling chaos, *Physical Review E*, **86**(4), 046205, 2012.

3. S. MANGIAROTTI, Low dimensional chaotic models for the plague epidemic in Bombay (1896–1911), *Chaos, Solitons & Fractals*, **81**(A), 184-196, 2015.

4. S. MANGIAROTTI, Modélisation globale et caractérisation topologique de dynamiques environnementales : de l'analyse des enveloppes fluides et du couvert de surface de la Terre à la caractérisation topolodynamique du chaos, Habilitation to direct Researches, Université de Toulouse 3, 2014.