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Mathilde Jochaud Du Plessix, Serge Fenet, Pierre-Yves Longaretti

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Analysing the validity and robustness of the iconic *World 3* global model: what can sensitivity and feedback loop analysis say?

M. Jochaud du Plessix[1], S. Fenet[2,1], P.Y. Longaretti[1]. (1) Université Grenoble Alpes, CNRS, Inria, Grenoble INP, LJK, Grenoble, France, mathilde.jochaud-du-plessix@inria.fr. (2) Université Lyon 1, LIRIS, Lyon, France. (3)

World3 is a flagship complex model. It was the first to widely explore potential future global socio-environmental trends, and to point out in a focused and sophisticated manner the possible dire consequences of forced growth in a finite and constrained environment. Since the inception of its first version in 1971 [1], it has attracted a lot of attention, comments, praises and criticisms. Many were however based on shallow arguments, and of the few in-depth analysis of the model that have been performed, most were carried out in an early period and lead to some incorrect conclusions due to their highly generic level of assessment of the model input parameters (see in particular [2]). The interest in the model has been revived in the last decade or so, in light of the growing concerns about planetary limits and the impact of human activity on natural systems, and following an *ex post* analysis of Turner [3]. Along with the availability of recent data, this revival of interest fueled the need to re-evaluate both the robustness of the model and the validity of its conclusions. This task presents however a delicate epistemological dimension: how can we evaluate the validity of a model with only one historical instantiation, and whose focal point of projection lies in the future? We will present the first two steps in the answer to this question.

First, we have performed an extensive analysis of the parameterization choices made by the authors of the model, based on a comprehensive sensitivity analysis of the whole model, made possible by modern computing power. This relies both a one-step-at-a-time screening method and a variance decomposition method. This first analysis allowed us to identify the most influential parameters in an objective way. Second, we performed an analysis of the inner dynamics of the model based on the relative importance of its feedback loops, based on a complete loop structural dominance analysis [4]. In order to deal with the large number of feedback loops of the model, we have used an enumeration of the smallest independent loop sets.

In conclusion, we will briefly outline the next step in this study, bearing on the role of modelling choices, and discuss in light of our results the relevance of the model to the real world and emerging Anthropocene era, some fifty years after its initial development.

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