

Publications MIO : Clement Aldebert (MIO) , Bob W Kooi, David Nerini (MIO) Jean-Christophe Poggiale (MIO) - Is structural sensitivity a problem of oversimplified biological models ? Insights from nested Dynamic Energy Budget models

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Abstract

Many current issues in ecology require predictions made by mathematical models, which are built on somewhat arbitrary choices. Their consequences are quantified by sensitivity analysis to quantify how changes in model parameters propagate into an uncertainty in model predictions. An extension called structural sensitivity analysis deals with changes in the mathematical description of complex processes like predation. Such processes are described at the population scale by a specific mathematical function taken among similar ones, a choice that can strongly drive model predictions. However, it has only been studied in simple theoretical models. Here, we ask whether structural sensitivity is a problem of oversimplified models. We found in predator-prey models describing chemostat experiments that these models are less structurally sensitive to the choice of a specific functional response if they include mass balance resource dynamics and individual maintenance. Neglecting these processes in an ecological model (for instance by using the well-known logistic growth equation) is not only an inappropriate description of the ecological system, but also a source of more uncertain predictions.

Keywords

Model sensitivity
Functional response
Metabolism
Bifurcations
chemostat

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