



Generic tools for a deterministic modelling of partially observed and poorly known dynamical systems

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Environmental systems exhibit behaviors of great complexity. This complexity can arise from the couplings occurring among the various environmental components, from intricate temporal scales interactions, and from spatial heterogeneities. Comprehension of such systems requires observations as well as modeling. However, observation of spatial environmental behaviors is often based on limited number of variables whose links and interaction dynamic are indirect and poorly known. Two complementary approaches are used to face these difficulties: on the one hand, a statistical approach aiming at rebuilding empirically a network of dynamical interaction between variables. On the other hand, theory of dynamical systems that allows reconstructing trajectory in the phase space from single time series is used as support in order to provide a substitute for the original trajectory.

Tools have been developed and are presented in two independent packages “PoMoS & GloMo”. The former package Polynomial Model Search aims at determining, from a set of N time series, the optimal polynomial structure for a model built on first-order ordinary differential equations. An evolutionary algorithm combined with a least square fitting is used for this purpose. The optimality is estimated with AIC or AIC-like criterions. The second package GloMo aims to identify Global Models from a specified model structure (Gouesbet & Letellier 1994), and to check their integrability. These tools and approaches are presented.