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# Response and Sensitivity Using Markov Chains

**Manuel Santos Gutiérrez**[1,2] and Valerio Lucarini[1,2,3]
[1]University of Reading, Mathematics and Statistics, United Kingdom
[2]Centre for the Mathematics of Planet Earth, University of Reading, Mathematics and Statistics, United Kingdom
[3]CEN-Meteorological Institute, University of Hamburg, Germany

Dynamical systems are often subject to forcing or changes in their governing parameters and it is of interest to study

how this affects their statistical properties. A prominent real-life example of this class of problems is the investigation

of climate response to perturbations. In this respect, it is crucial to determine what the linear response of a system is

as a quantification of sensitivity. Alongside previous work, here we use the transfer operator formalism to study the

response and sensitivity of a dynamical system undergoing perturbations. By projecting the transfer operator onto a

suitable finite dimensional vector space, one is able to obtain matrix representations which determine finite Markov

processes. Further, using perturbation theory for Markov matrices, it is possible to determine the linear and nonlinear

response of the system given a prescribed forcing. Here, we suggest a methodology which puts the scope on the

evolution law of densities (the Liouville/Fokker-Planck equation), allowing to effectively calculate the sensitivity and

response of two representative dynamical systems.