



# **1 Inferring stochastic-dynamical models from data: some approaches**

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The first step in model building is the formulation of the aim (conceptual understanding or prediction), which sets the model's complexity. Accordingly, the degrees of freedom of model and data need to be determined, which requires a balance between resolved deterministic modes and unresolved noise. Basic examples to deduce dynamics from data are presented. (i) The classical linear procedure is stochastic modeling with two steps in model building (theory and parsimonious adaptation): Auto-regressive and diffusion models. These models have been used to understand and reproduce dynamical properties of long term memory in the global climate system. (ii) A more recent approach is the truncation of a non-linear high resolution model and the parameterisation of unresolved modes by stochastic forcing. This is applied to a complex model of the global atmospheric circulation with the aim of long-term ensemble climate simulations otherwise inaccessible for high resolution models. In addition, this approach quantifies the stochastic parameterisation in weather prediction models to improve precipitation forecasting.