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Comparison of recent physically-based stochastic subgrid parameterizations

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We consider some recent methods of subgrid-scale parameterization used in the context of climate modeling. These methods are developed to take into account (subgrid) processes playing an important role in the correct representation of the atmospheric and climate variability.
The variety of available stochastic modeling and reduction methods illustrates how fruitful was the seminal work of Hasselmann about it in the 1970s. However, in view of this variety, one might wonder about their efficiency in different situations. Indeed, depending on the specific purpose that it needs to fulfill, some parameterizations might perform better than others. The present work aims to shed some light on these questions by illustrating these methods on a simple stochastic triad system relevant for the atmospheric and climate dynamics, and for which most of the calculations can be made analytically. We show in particular that the stability properties of the underlying dynamics of the subgrid processes has a considerable impact on their performances.