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A proof of concept for scale-adaptive parameterizations: the case of the Lorenz '96 model

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Constructing efficient and accurate parameterizations of sub-gridscale processes is a central area of interest in the numerical modelling of geophysical fluids. Using a modified version of the two-level Lorenz '96 model, we present here a proof of concept of a scale-adaptive parameterisation constructed using statistical mechanical arguments. By a suitable use of the Ruelle response theory, it is possible to derive explicitly a parameterization for the fast variables that translates into deterministic, stochastic and non-markovian contributions to the equations on motion of the variables of interest. We show how the parameterization is computationally parsimonious and has great flexibility, as it is explicitly scale-adaptive, and we prove that it is competitive versus empirical ad-hoc approaches.