Comparison of stochastic parameterizations in the framework of a coupled ocean-atmosphere model

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A new framework is proposed for the evaluation of stochastic subgrid-scale parameterizations in the context of MAOOAM, a coupled ocean-atmosphere model of intermediate complexity. Two physically-based parameterizations are investigated, the first one based on the singular perturbation of Markov operator, also known as homogenization. The second one is a recently proposed parameterization based on the Ruelle's response theory. The two parameterization are implemented in a rigorous way, assuming however that the unresolved scale relevant statistics are Gaussian. They are extensively tested for a low-order version known to exhibit low-frequency variability, and some preliminary results are obtained for an intermediate-order version. Several different configurations of the resolved-unresolved scale separations are then considered. Both parameterizations show remarkable performances in correcting the impact of model errors, being even able to change the modality of the probability distributions. Their respective limitations are also discussed.