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Bayesian optimisation of ocean models

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Accurately representing the tropical sea surface temperature (SST) remains a significant challenge for general circulation models. One of the largest sources of uncertainty is the vertical turbulent mixing. To accurately represent the distribution of ocean mixed layer depths (MLD), turbulence closure schemes necessitate careful tuning. This is commonly done manually by comparing with mixed layer depth climatologies. Advancements in machine learning research introduce a new strategy: automated tuning. VerOpt, an add-on to the Python-based ocean model Veros, uses Gaussian processes to emulate an objective function in a multi-dimensional parameter space. We demonstrate how VerOpt can be used to search the joint parameter space of the vertical & horizontal mixing and air-sea flux parameterisations. Furthermore, we discuss the technicalities and advantages associated with using a python-based ocean model that utilises JAX for GPU acceleration.

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