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Stochastic and perturbed parameter representations of model uncertainty in convection parametrisation

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It is now acknowledged that representing model uncertainty in atmospheric simulators is essential for the production of reliable probabilistic ensemble forecasts, and a number of different techniques have been proposed for this purpose. This study presents new perturbed parameter schemes for use in the convection parametrisation developed by the European Centre for Medium Range Weather Forecasts (ECMWF). Two types of scheme are developed and implemented. Both schemes represent the joint uncertainty in four of the parameters in the convection parametrisation scheme, which was estimated using the Ensemble Prediction and Parameter Estimation System (EPPES). The first scheme developed is a fixed perturbed parameter scheme, where the values of uncertain parameters are varied between ensemble members, but held constant over the duration of the forecast. The second is a stochastically varying perturbed parameter scheme. The performance of these schemes was compared to the ECMWF operational stochastic scheme, Stochastically Perturbed Parametrisation Tendencies (SPPT), and to a model which does not represent uncertainty in convection. The skill of probabilistic forecasts made using the different models was evaluated. While the perturbed parameter schemes improve on the stochastic parametrisation in some regards, the SPPT scheme outperforms the perturbed parameter approaches when considering forecast variables that are particularly sensitive to convection. Overall, SPPT schemes are the most skilful representations of model uncertainty due to convection parametrisation.