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Diagnosing forecast model errors with a perturbed physics ensemble

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Perturbed physics ensembles are routinely used to analyse long-timescale climate model behaviour, but have less often been used to study model processes on shorter timescales. We present a method for diagnosing the sources of error in an initialised forecast model by using information from an ensemble of members with known perturbations to model physical parameters. We combine a large perturbed physics ensemble with a set of initialised forecasts to deduce possible process errors present in the standard HadCM3 model, which cause the model to drift from the truth in the early stages of the forecast. It is shown that, even on the sub-seasonal timescale, forecast drifts can be linked to perturbations in individual physical parameters, and that the parameters which exert most influence on forecast drifts vary regionally. Equivalent parameter perturbations are recovered from the initialised forecasts, and used to suggest the physical processes that are most critical to controlling model drifts on a regional basis. It is suggested that this method could be used to improve forecast skill, by reducing model drift through regional tuning of parameter values and targeted parameterisation refinement.