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Assessing climate feedbacks in the HadGEM3-GA7 perturbed parameter ensemble

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We present an analysis of constraints on climate feedbacks using a new perturbed parameter ensemble (PPE) of the Met Office's HadGEM3-GA7 global climate model. The PPE comprises over 500 model variants with perturbations to 47 atmospheric model parameters, for each of which we have run several of idealised atmosphere-only experiments. We have diagnosed estimates of the climate feedback parameter (along with its components) using two 5-year experiments: one using present-day SSTs (2005-2009) and the other with a patterned 4K warming applied. We apply constraints on the resulting distributions by assessing the performance of a large number of climate variables in the present-day experiment and ruling out PPE members deemed to be implausible.

We find that higher (less negative) feedback parameter values (higher climate sensitivities) are favoured when these constraints are applied. In this presentation, we will show how the PPE can be used to explore which variables are providing the constraints and which parameters and processes are important. We will also assess the impact of structural model errors, to see if these constraints might be specific to HadGEM3-GA7 or more widely applicable to other climate models.