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## Evaluating parametric sensitivity of climate feedbacks in CNRM-CM6

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The global surface temperature response to CO<sub>2</sub> doubling (Equilibrium Climate Sensitivity or ECS) is a key uncertain parameter determining the extent of future climate change. Sherwood et al. (2020) estimated the ECS to be within [2.6K - 4.5K], but in the Coupled Model Intercomparison Project phase 6 (CMIP6), 1/3 of the General Circulation Models (GCMs) show ECS exceeding 4.5K (Zelinka et al., 2020). CNRM-CM6-1 is one of these models, with an ECS of 4.9K. In this paper, we sampled 30 atmospheric parameters of CNRM-CM6-1 and produced a Perturbed Physics Ensemble (PPE) of atmospheric-only simulations to explore the feedback parameters diversity and the climatological plausibility of the members. This PPE showed a comparable range of feedback parameters to the multi-model archive, from 0.8 W.m<sup>-2</sup>/K to 1.8 W.m<sup>-2</sup>/K. Emulators of climatological performance and feedback parameters were used together with observational datasets to search for optimal model configurations conditional on different net climate feedbacks. The climatological constraints considered here did not themselves rule out the higher end ECS values of 5K and above. An optimal subset of parameter configurations were chosen to sample the range of ECS allowing the assessment of feedback constraints in future fully coupled experiments.

### References :

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