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Impact of stochastic parametrisation schemes on El Nino-Southern Oscillation in the Community Climate System Model

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Stochastic parametrisations have been used for more than a decade in atmospheric models. They provide a way to represent model uncertainty through representing the variability of unresolved sub-grid processes, and have been shown to have a beneficial effect on the spread and mean state for medium- and extended-range forecasts (e.g. Berner et al, 2017, and references therein). There is also increasing evidence that stochastic parametrisation of unresolved processes could be beneficial for the climate of an atmospheric model, for example through noise-induced drift (nonlinear rectification), and through enabling the climate simulator to explore other flow regimes.

We present results showing the impact of including a stochastic parametrisation widely used by the weather forecasting community on the climate of an Earth system model. The Stochastically Perturbed Parametrisation Tendencies (SPPT) scheme is included the National Center for Atmospheric Research (NCAR) Community Climate System Model (CCSM) run at 1-degree resolution in both the atmosphere and ocean. The control version of CCSM exhibits systematic errors in the representation of the El Nino-Southern Oscillation (ENSO). SPPT significantly improves ENSO in CCSM, improving the power spectrum, amplitude, and the inter- and intra-annual variability of tropical Pacific sea surface temperatures. We trace these improvements to improved variability in the zonal winds in CCSM.

A second CCSM control simulation run at 0.25-degree resolution in the atmosphere and 0.1-degree in the ocean shows improvements to ENSO that are remarkably similar to those from including SPPT. Through mimicking sub-grid scale variability, stochastic schemes such as SPPT can go some way towards what is achieved by explicitly resolving that variability, at a fraction of the computational cost.

References:

Berner, J., et al, 2017. Stochastic Parameterization: Towards a new view of Weather and Climate Models. Bull. Amer. Met. Soc. DOI: 10.1175/BAMS-D-15-00268.1

Christensen, H. M., et al, 2017. Stochastic Parametrisation and the El Nino-Southern Oscillation. J. Climate. 30(1), 17-38 DOI: 10.1175/JCLI-D-16-0122.1