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Climatic impacts of stochastic fluctuations in air–sea fluxes

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Air–sea fluxes vary partly on scales that are too small and fast to be resolved explicitly in numerical models. This presentation proposes a nonlinear physical mechanism by which stochastic fluctuations in the air–sea buoyancy flux may modify the mean climate. The presentation then demonstrates the mechanism in climate simulations with a comprehensive coupled general circulation model (SINTEX-G).

In the SINTEX-G simulations with stochastic air–sea buoyancy fluxes, significant changes are detected in the time-mean oceanic mixed-layer depth, sea-surface temperature, atmospheric Hadley circulation, and net upward water flux at the sea surface. Also, El Niño Southern Oscillation (ENSO) variability is significantly increased.

The findings demonstrate that noise-induced drift and noise-enhanced variability, which are familiar concepts from simple climate models, continue to apply in comprehensive climate models with millions of degrees of freedom. The findings also suggest that the lack of representation of sub-grid variability in air-sea fluxes may contribute to some of the biases exhibited by contemporary climate models.

Reference

Williams, PD (2012) Climatic impacts of stochastic fluctuations in air–sea fluxes, *Geophysical Research Letters*, in press, http://dx.doi.org/10.1029/2012GL051813.