Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Estimating model-form uncertainty for multi-scale systems JINLONG WU, TAPIO SCHNEIDER, ANDREW STUART, California Institute of Technology — Global climate models (GCMs) are widely used to simulate climate change. However, their predictions have large uncertainties, arising primarily in subgrid-scale (SGS) parameterizations for globally unresolvable small-scale processes. Work to quantify parametric uncertainties in these parameterizations is underway, using methods from data analysis and machine learning. Quantifying structural or model-form uncertainties is more challenging. Here we propose a nonparametric approach to model structural errors that uses Gaussian processes and ensemble Kalman sampling and that respects physical constraints (e.g., energy conservation). We illustrate how this approach can be used to quantify model-form uncertainties in low-dimensional multi-scale systems and with an idealized GCM. The results demonstrate that this approach allows us to go beyond merely calibrating model parameters toward quantifying model uncertainty more broadly.

Jinlong Wu
California Institute of Technology

Date submitted: 01 Aug 2019 Electronic form version 1.4