MMM SEMINAR SERIES

Strategies for Addressing Structural and Parametric Physical Uncertainties in Climate and Weather Models

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Weather and climate models have well-known biases in their representation of physical processes. A prime offender is cloud microphysics, owing to the complexity of hydrometeor interactions as well as the approximations that underpin bulk parameterizations. To some extent, models can be improved by finding optimal values for tunable model parameters, and estimating the uncertainty in these parameters — "parametric" uncertainty. Radar observations, including polarimetric radars and radar Doppler spectra, have shown much promise in providing information related to microphysical processes and can thus be leveraged via, e.g., Bayesian estimation, to probabilistically constrain model parameters. A deeper problem is that structural assumptions are typically hard-coded into parameterization schemes, and thus cannot be systematically improved in the same manner, nor can uncertainty associated with these choices be quantified. This fundamental shortcoming of traditional parameterizations motivates the use of multi-physics ensembles in probabilistic weather forecasts — these are, in essence, attempts at spanning both parametric and structural uncertainties in physical parameterizations, but they typically cannot span these uncertainties smoothly or probabilistically. I will present work on a new microphysics scheme, the Bayesian Observationally-constrained Statistical-physical Scheme, or BOSS, and describe how it was developed specifically to facilitate characterization of parametric and structural uncertainties in a Bayesian framework. An additional benefit of BOSS is that it is "smooth" and therefore amenable to adjoint methods. I will also present work on applications of Bayesian parameter estimation to ice microphysics, cloud property retrievals, and climate model tuning.

This seminar will be webcast live at:
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Refreshments 3:15 PM
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