

Physics Colloquium

Michigan Technological University

Thursday, September 21, 2006, 4:00 to 5:00 pm
Room 139, Fisher Hall

Modeling Physical Systems using PDF Methods: Theory and Application to Subgrid Parameterization

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Abstract

Specific examples of Probability Density Function (PDF) methods are found in many areas of physics and typically appear as conservation equations (e.g. for mass or charge) with an additional diffusive term. However, geometric case-specific derivations of these equations obscures the rich underlying probabilistic interpretation and masks applications to numerical (subgrid) modeling problems. In this seminar I review the probabilistic theory of PDF methods and present a practical framework that unifies the treatment of "randomness" for a wide range of applications, in particular the problem of subgrid modeling. This presentation begins with the fundamental definitions and equations of PDF methods describing deterministic systems. Two classes of problems often encountered in subgrid parameterization are then addressed: (i) modeling the ensemble effect of additive noise which leads to diffusive PDF evolution (Fokker-Planck methods) and (ii) modeling the PDF of a reacting scalar advected by a turbulent velocity field.

Biography

Chris Jeffery received a B.S. and M.S. in Physics from Harvey Mudd College and University of British Columbia, respectively, followed by two years in Japan as a Monbusho Research Scholar. He received a PhD in Atmospheric Sciences from the University of British Columbia in 2001 and was a Postdoctoral Fellow at Los Alamos National Laboratory from 2001 to 2004. Since that time he has been a Technical Staff Member in the Space and Remote Sensing Sciences Division at Los Alamos National Laboratory. His research interests have included homogeneous nucleation, remote sensing, lightning, and atmospheric turbulence.