THE UNIVERSITY OF UTAH
Atmospheric Sciences

SEMINAR ANNOUNCEMENT

Are the shapes of clouds impossibly complex or fundamentally simple?

Decades have passed with the climate science community remaining unable to narrow the range of plausible values for the climate sensitivity to a doubling of CO2 concentrations. The spread of values always seems to range from about 1.5 K to 4.5 K in each successive IPCC report. But why? Isn't this a basic failure of our field? The common excuse is that clouds are complicated: even as we increase model sophistication, important new sensitivities are inevitably uncovered. Perhaps we might also consider, that pursuing ever more complex deterministic calculations might not have been the best approach. Maybe a simple question like what is the climate sensitivity begs equally simple answers. In this talk I present an application of some simple ideas from equilibrium statistical mechanics to argue that tropical cloud geometric structures are fundamentally constrained by such basic atmospheric thermodynamic properties as atmospheric stability and sea surface temperatures, and that their size distributions follow power laws or exponentials that can be found throughout nature. These theoretical concepts are tested with one of the largest simulations of clouds to date and with space-based oxygen A-band observations of cloud 3D structure. A prediction is made that tropical cloud cover will increase by 3% per 1 K increase in sea surface temperature, but with no radiative climate impact. The tentative implication is zero cloud-climate feedback, at least for tropical cloud fields, in which case the climate sensitivity may be on the low end of the commonly reported range.

Dr. Timothy Garrett

Professor

Atmospheric Sciences, University of Utah

Wednesday, August 30, 2017 at 3:15pm

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Refreshments and Meet the Speaker at 3:00pm

135 South 1460 East, Room 819 (WBB), Salt Lake City, Utah 84112-0110
Phone: (801) 581-6136 Fax: (801) 585-3681 Web: www.atmos.utah.edu