Friedrich-Schiller-Universität Jena

seit 1558

Fakultät für Mathematik und Informatik

Institut für Mathematik

Seminar zur Stochastik

Dienstag, 16. Mai 2017
14 Uhr c. t.
SR 108 August-Bebel-Str. 4,

Herr Holger Metzler
(Max Planck Institute for Biogeochemistry)

„Carbon cycle as a stochastic process “

Abstract: Soil organic matter decomposition has an enormous yet not perfectly understood influence on the greenhouse effect and hence on climate change. In the hunt for a deeper understanding of the truly ongoing processes, it seems reasonable to search for the common basis that all the models of the carbon cycle in soils share. The main concept is that carbon enters the soil system, then cycles through different soil compartments, and later in time leaves the system. This cycle is usually described by a system of ordinary differential equations,

$$dx(t)/dt = B\,x(t) + \text{input}.$$

Such a system must obey the law of conservation of mass which imposes the matrix-valued function B to be "compartmental" at all times. Such a compartmental matrix can be interpreted as the generator of an absorbing continuous-time Markov chain. In that framework, we do not consider the behavior of entire masses of carbon anymore, but the random journey of one single carbon atom through the soil system. The conservation of mass of carbon turns into the conservation of mass of probabilities. With this stochastic approach, it is possible to disentangle the notions of age, transit time, and turnover time of carbon in soils. These terms have been used among scientists for many years with interchanging meaning and caused a high level of confusion. In this talk, I will present my ongoing PhD research on the topic of the carbon cycle as a stochastic process. I will present recent results on the age and transit-time distribution of carbon in a simple Earth system model and outline current research on model complexity. A key role in assessing the complexity of compartmental models is played by the information content or information entropy of the random path a particle takes when it cycles through the system: How hard is it to predict what will happen to the particle in the time span from entering the system until its exit? As a final goal, I hope to apply a superposition principle of renewal processes (like the Palm-Khintchine theorem) to find an explanation why on large scales simple linear equations seem to describe the carbon cycle best.

Alle Interessenten sind herzlich eingeladen!

Kontakt:
Ilya Pavlyukevich /Professur für Stochastik mit Anwendungen in den Naturwissenschaften / Institut für Mathematik / Ernst-Abbe-Platz 2 / 07743 Jena