SEMINARIO DE MATEMATICAS

Trajectory attractors for reaction diffusion problems from climate modeling

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Abstract

Energy balance climate models describe the evolution of a long-term mean of temperature by employing the relevant balance equations for the heat fluxes involved. The horizontal heat flux is parameterized by a diffusion operator, and here we include a bio-feedback by introducing a Volterra map V on a suitable function space. A typical example for the resulting reaction-diffusion problem is

$$\begin{cases} c(x)\partial_t u - \nabla\cdot\left[k(x)\left|\nabla u\right|^{p-2}\nabla u\right] + g(u, V(u|_{[0,\infty)}, \phi)(t)) \\ \qquad\qquad \in F(t, x, u, \overline{u}, V(u|_{[0,\infty)}, \phi)(t)) \qquad t > 0,\ x \in M, \\ \overline{u}(t,x) := \int_{-T}^{0} \beta(s,x) u(t+s,x)\, ds,\ t > 0,\ x \in M, \\ u(s,x) = u_0(s,x), \qquad\qquad -T \le s \le 0, x \in M. \end{cases}$$

One is interested in nonnegative solutions $u = u(t,x)$ (temperature in Kelvin). M is a closed, compact, oriented Riemannian surface representing the Earth's surface, the positive functions c and k represent the thermal inertia and the diffusivity of the system, respectively, F stands for the absorbed solar radiation flux, and g represents the emitted terrestrial radiation flux.

A suitable mathematical framework for establishing the existence of a global attractor will be discussed in this talk.