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Global dynamics of delayed reaction-diffusion equations in unbounded domains

We consider a nonlocal delayed reaction–diffusion equation in an unbounded domain that includes some special cases arising from population dynamics. Due to the non-compactness of the spatial domain, the solution semiflow is not compact. We first show that, with respect to the compact open topology for the natural phase space, the solutions induce a compact and continuous semiflow Φ on a bounded and positively invariant set Y in $C_+ = C([-1, 0], X_+)$ that attracts every solution of the equation, where X_+ is the set of all bounded and uniformly continuous functions from $\mathbb{R}$ to $[0, \infty)$. Then, to overcome the difficulty in describing the global dynamics, we establish a priori estimate for nontrivial solutions after describing the delicate asymptotic properties of the nonlocal delayed effect and the diffusion operator. The estimate enables us to show the permanence of the equation with respect to the compact open topology. With the help of the permanence, we can employ standard dynamical system theoretical arguments to establish the global attractivity of the nontrivial equilibrium. The main results are illustrated with the diffusive Mackey–Glass equation. This is a joint work with Profs. Taishan Yi and Jianhong Wu.