Distribution of energy and convergence to equilibria in extended dissipative systems

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We study the local energy dissipation in gradient-like nonlinear partial differential equations on unbounded domains. Our basic assumption, which happens to be satisfied in many classical examples, is a pointwise upper bound on the energy flux in terms of the energy dissipation rate. Under this hypothesis, we derive a simple and general bound on the integrated energy flux which implies that, in low space dimensions, our "extended dissipative syste" has a gradient-like dynamics in a suitable averaged sense. In particular, we can estimate the time spent by any trajectory outside a neighborhood of the set of equilibria. As an application, we study the long-time behavior of solutions to the two-dimensional Navier-Stokes equation in an infinite cylinder. This talk is based on a collaboration with S. Slijepcevic (Zagreb, Croatia).