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Stochastic versus chaotic behaviour in the noisy generalized Kuramoto-Sivashinsky equation HIROSHI GOTODA, Department of Mechanical Engineering, Tokyo University of Science, MARC PRADAS, Department of Mathematics and Statistics, The Open University, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London — Random fluctuations are well-known to have significant impact on the formation of complex spatiotemporal patterns in a wide spectrum of biological, engineering and physical environments, including fluid systems such Rayleigh-Bénard convection, contact line dynamics, or waves in free-surface thin film flows. Many of these systems can be modeled by stochastic partial differential equations in large or unbounded domains, a simple prototype of which is the generalised Kuramoto-Sivashinsky (gKS) equation. Its deterministic version has been used in a wide variety of fluid flow contexts, such as two-phase flows with surfactants, free falling films and films in the presence chemical reactions, heating effects and curved substrates, amongst others. Here we study the dynamical states of the noisy gKS equation by making use of time series techniques based on chaos theory, in particular permutation entropy and nonlinear forecasting. We focus on analyzing temporal signals of global measure in the spatiotemporal pattern as the dispersion parameter of the gKS equation and the strength of the noise are varied, observing a rich variety of different emerging regimes, from high-dimensional chaos to purely stochastic behaviour.

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