the standard FitzHugh-Nagumo model including delayed inhibitor production [15], modified inhibitor dynamics [16] and advective effects [17]. Here we consider a very simple model of excitable media, consisting of an array of excitable elements with a standard activator-inhibitor, FitzHugh-Nagumo–like dynamics, spatially coupled through diffusion of the activator variable. As far as we know, such a model has not been reported to exhibit spiral breakup, nor therefore spatiotemporal chaos. We will now show that a spatiotemporal parametric noise is able to induce breakup and lead to a complex dynamical state resembling the spiral turbulence exhibited by more complicated *deterministic* models, and characterized by a power law distribution of space-time cluster sizes.

The model that will be studied in what follows is defined by

$$\frac{\mathrm{d}u_i}{\mathrm{d}t} = \frac{1}{\varepsilon}u_i(1-u_i)\left(u_i - \frac{v_i+b}{a}\right) + D\sum_{j\in N(i)} c_{ij}u_j\,,$$

$$\frac{\mathrm{d}v_i}{\mathrm{d}t} = \left[\gamma + \eta_i(t)\right]u_i - v_i\,, \tag{1}$$

where the activator and recovery variables, $u_i(t)$ and $v_i(t)$, respectively, are defined on a square two-dimensional lattice of $N \times N$ cells (only one index is used to label all sites: $i = 1, \dots, N \times N$). The local dynamics of each element is of a standard excitable type, governed by a Z-shaped u-nullcline and a linear v-nullcline on the (v,u) phase plane [18], in such a way that in the rest state both u and v are zero, the excited state is characterized by $u \approx 1$, and the refractory state by $u \approx 0$. Activator diffusion is described by the sum term in eq. (1), which extends to the first three sets of neighbours of cell i. The weight coefficients c_{ij} correspond to the second-order discretization of the Laplacian operator [19]. The spatially discrete, temporally continuous character of this model makes it suitable for the description of excitable biological tissue, such as cell tissue in the cardiac muscle [12].

The parameters of the local dynamics are considered to be the same for all elements, except for the inhibitor-production coefficient, which is assumed to fluctuate in time and space around a mean value γ. These fluctuations are represented by a Gaussian noise, white in space and time with σ^2 being the noise intensity. The effect of the noise is to change locally the slope of the v-nullcline, and it disappears if the system reaches its rest state. Therefore, no new excitation can nucleate from the rest state. We have also investigated spatially correlated noise. If the correlation length exceeds the diffusion length of the activator u, the phenomena described later on disappear.

Model (1) is numerically integrated using a semi-implicit algorithm for the activator equation [20] and an explicit algorithm for the deterministic part of the inhibitor equation. The stochastic term in that equation is dealt with by means of a suitable extension of the explicit Euler method [21]. The following parameters are chosen in what follows: $N = 128$, $\varepsilon = 0.02$, $a = 0.85$, $b = 0.1$ and $\gamma = 1$. The strength D of the spatial coupling and the standard deviation σ of the fluctuations will be used as control parameters of the system. No-flux (Neumann) boundary conditions are considered, but results similar to those presented below have been obtained with periodic boundary conditions.

The behaviour of the system in the absence of noise is the following: for small coupling D, local initial perturbations are not able to propagate through the medium, and decay after a single excursion through the excited state. Beyond a certain threshold coupling ($D_{\mathrm{th}} \approx 0.64$ for the parameters chosen here), propagation of local perturbations is possible. In this situation, suitable initial conditions lead to stable spiral waves. However, for general (*e.g.*, random) initial conditions the system usually decays rapidly (typically in less than $t = 10$ time units) towards the stable (homogeneous) steady state of the deterministic dynamics ($u_i = v_i = 0$, $\forall i$), after all propagating structures have been annihilated by collisions between one another or