We develop a phenomenologically motivated rigorous mathematical framework for the analysis of stochastic neural field equations with spatially extended additive noise. It is well known that in the deterministic case neural field equations allow for the existence of monotone travelling-wave solutions. As described in [1], additional extrinsic stochastic forcing terms result in two distinct phenomena: perturbations of the front shape as well as a horizontal displacement of the wave profile from its uniformly translating position. In [2] we introduce a mathematical framework which captures these effects and allows us to realise a stochastic neural field as a stochastic evolution equation on a suitable function space. By introducing a dynamic phase-adaptation process and decomposing the fluctuations into terms of different order we obtain new stability results. In particular, we will see that for small noise strength the fluctuations behave like an Ornstein-Uhlenbeck process. This analysis can also be adopted to the stochastic Nagumo equation modelling the propagation of an action potential along the axon as well as to a more general class of reaction-diffusion equations.

References