Strong convergence of gradients for solutions of quasilinear stochastic parabolic equations

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For a given time horizon $[0,T]$, we consider the probability set-up $(\mathbf{\Omega}, \mathbf{F}, \mathbf{P})$ on which is built a $d-$dimensional Brownian motion $W = \left(W_t^1, ..., W_t^d\right)$. Let D be a bounded domain in the Euclidean space $\mathbf{R}^n (n \geq 2)$ and denote by Q_T the cylinder $D \times (0,T)$. In $Q_T \times \mathbf{\Omega}$, we consider the sequence of initial boundary value problems for the quasilinear stochastic parabolic equations

$$du_k + A\left(x, u_k, \nabla u_k\right) dt = f_k dt + g_k dW; \; k = 1, 2, ... \tag{1}$$

in the sense of distributions. Here A is a Leray-Lions second-order monotone elliptic operator, f_k (resp. g_k) are given functions (resp. d-dimensional vector-functions).

Under certain conditions, we prove that the sequences of gradient of the solutions u_k and gradient of some truncations of u_k converge strongly in some appropriate topologies as $k \to \infty$.

These results are motivated by issues arising in the emerging theory of homogenization of nonlinear stochastic evolution problems.