Abstract

In this work, we introduce and study the well-posedness of the multidimensional fractional stochastic Navier-Stokes equations on bounded domains and on the torus (briefly dD-FSNSE). For the subcritical regime, we establish thresholds for which a maximal local mild solution exists and satisfies required space and time regularities. We prove that under conditions of Beale-Kato-Majda type, these solutions are global and unique. These conditions are automatically satisfied for the 2D-FSNSE on the torus if the initial data has H (1)-regularity and the diffusion term satisfies growth and Lipschitz conditions corresponding to H (1)-spaces. The case of 2D-FSNSE on the torus is studied separately. In particular, we established thresholds for the global existence, uniqueness, space and time regularities of the weak (strong in probability) solutions in the subcritical regime. For the general regime, we prove the existence of a martingale solution and we establish the uniqueness under a condition of Serrin's type on the fractional Sobolev spaces.