Long Term Behavior of a Brownian Flow with Jumps

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We consider a stochastic jump flow in an interval $(-a, b)$, $a, b > 0$. Each particle performs a canonical Brownian motion and jumps to zero when it reaches $-a$ or $b$. We study the long term behavior of a random measure $\mu_t$, which is a push-forward of a given finite initial measure under the flow. In case when $a/b$ is irrational, we show that for almost every driving Brownian path the time averages of the variance of $\mu_t$ converge to zero, and the Lebesgue measure of the support of $\mu_t$ decreases to zero as time goes to infinity. In case when $a/b$ is rational, we show that the Lebesgue measure of the support of $\mu_t$ decreases to its minimum value in finite time. In addition, if $\mu_0$ is proportional to Lebesgue measure we show that the number of connected components of support of $\mu_t$ is a recurrent process.