We describe a novel hybrid continuum-particle strategy for modeling diffusion of discrete objects in continuum media and discuss its application to the specific example of diffusion on fluctuating membrane surfaces. Diffusion processes in continuum media are of fundamental importance and appear in many applications. An interesting situation arises when the diffusing object is a small (discrete) particle that locally interacts with a (continuum) medium in the background while the latter exhibits its own temporal fluctuations. This presents an intrinsically multiscale problem with a wide range of time and length scales coupled to each other due the particle-medium interactions. In this talk, we first give a short overview of general coarse-graining strategies for physical problems with multiscale characteristics and then describe a hybrid method for simulation of dissipative dynamics of small particles (e.g., inclusions such as proteins) on elastic membranes having their own dissipative Langevin dynamics in a surrounding hydrodynamic medium. In the particular case of curved inclusions that impart a local curvature on the membrane surface, we show that a substantial reduction in diffusion coefficient relative to flat inclusions occurs which can be explained analytically by hydrodynamic considerations. This result disproves some previous theoretical models predicting that, on fluctuating membranes, curved inclusions should be expected to diffuse more rapidly than flat ones. We also argue that the diffusion coefficient of membrane inclusions should depend inversely on their size, which stands at odds with the classical Saffman-Delbruck result but agrees with recent experimental findings.