

Understanding dynamical friction during the common-envelope evolution (CEE) phase is important for modeling the orbital evolution of embedded binaries. We investigate the gravitational drag force acting on an equal-mass core–companion system using global hydrodynamical simulations of CE evolution. We compare the drag force predicted by several analytical and empirical prescriptions with that measured in the simulations and assess their applicability during different stages of the inspiral. During the slow-inspiral phase, the double-perturber linear-response model provides the closest agreement with the simulations when an effective background density is reconstructed from the monopole component of the density field using volume averages within a sphere. During the plunge-in phase, when the flow around the companion is predominantly supersonic, we compare accretion-based prescriptions in both uniform and stratified media, nonlinear corrections to linear-response theory, and empirical wind-tunnel fitting formulae. Models that account for density stratification provide the closest agreement with the simulated drag force during this phase. Finally, we construct a hybrid drag-force model that combines the plunge-in and slow-inspiral prescriptions using smooth transition functions.