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THE PRESSURE FLUCTUATIONS EXPERIENCED BY SUSPENDED PARTICLES IN HOMOGENEOUS ISOTROPIC TURBULENCE

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Abstract. The behavior of gas nuclei in a turbulent field is mainly determined by the pressure history in the fluid surrounding it. If the pressure dips, and remains long enough below a critical level, cavitation events take place. In CFD simulations the pressure field is not completely resolved and subgrid models need to account for the unresolved fluctuations. For a subgrid model of fluctuation-induced cavitation, the statistics of low-pressure events need to be quantified. In this work we present a study of such statistics in the simplest turbulent flow, homogeneous isotropic turbulence. Lagrangian histories of pressure were retrieved from DNS databases at two different Reynolds number by seeding and tracking numerous (one million) tracer particles. The results include the probability distributions of low-pressure events, of interarrival times between events and of their duration, together with their average frequencies and a discussion of their intermittency. We also extend the results to finite-sized particles by solving the Maxey-Riley equation to compute the trajectories. Application of the reported results in the prediction of cavitation inception is finally discussed.

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