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Cumulative compressibility effects on population dynamics in turbulent flows PRASAD PERLEKAR, Department of Applied Physics, Eindhoven University of Technology, DAVID R. NELSON, Department of Physics, Harvard University, Cambridge, USA, ROBERTO BENZI, Department of Physics, University of Tor Vergata, Roma, Italy, FEDERICO TOSCHI, Department of Applied Physics, Eindhoven University of Technology — Bacteria and plankton populations living in oceans and lakes reproduce and die under the influence of turbulent currents. Turbulent transport can interact in a complex way with the dynamics of populations because the typical reproduction time of microorganism is well within the inertial range of turbulence time scales. We quantitatively investigate the effect of flow compressibility on the dynamics of populations. While a small compressibility can be induced by several physical mechanisms, like density mismatch or the finite size of microorganisms with respect to the fluid turbulence, its effect on the the carrying capacity (average population concentration) of the ecosystem can be dramatic. We show that a tiny compressibility can produce a finite effect on the carrying capacity, this is due to an integrated effect made possible by the long replication times of the organisms with respect to turbulence time scales. We also present a full statistical quantification of the fluctuations of the population concentration that leads to a data collapse over a broad range in parameter space.

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