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Temporal Evolution and Scaling of Mixing in Two-dimensional Rayleigh-Taylor Turbulence[1] QUAN ZHOU, Shanghai Institute of Applied Mathematics and Mechanics, Shanghai University, Shanghai 200072, China, QUAN ZHOU TEAM — We report a high-resolution numerical study of two-dimensional (2D) miscible Rayleigh-Taylor (RT) incompressible turbulence with the Boussinesq approximation. We present results from an ensemble of 100 independent realizations performed at unit Prandtl number and small Atwood number with a spatial resolution of 2048×8193 grid points and Rayleigh number up to $Ra \sim 10^{11}$. Our main focus is on the temporal evolution and the scaling behavior of global quantities and of small-scale turbulence properties. Our results show that the buoyancy force balances the inertial force at all scales below the integral length scale and thus validate the basic force-balance assumption of the Bolgiano-Obukhov scenario in 2D RT turbulence. It is further found that the Kolmogorov dissipation scale $\eta(t) \sim t^{1/8}$, the kinetic-energy dissipation rate $\varepsilon_u(t) \sim t^{-1/2}$, and the thermal dissipation rate $\varepsilon_\theta(t) \sim t^{-1}$. All of these scaling properties are in excellent agreement with the theoretical predictions of the Chertkov model [Phys. Rev. Lett. 91, 115001 (2003)].

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