

Generative AI for Lagrangian Turbulence

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We present a stochastic method for generating and reconstructing complex signals along the trajectories of small objects passively advected by turbulent flows [1]. Our approach makes use of generative Diffusion Models, a recently proposed data-driven machine-learning technique. We show applications to 3D tracers and inertial particles in highly turbulent flows, 2D trajectories from NOAA's Global Drifter Program, and dynamics of charged particles in astrophysics. Supremacy against linear decomposition and Gaussian Regression Processes is analyzed in terms of statistical and point-wise metrics concerning intermittency and multi-scale properties. Preliminary results concerning generalizability and model collapse will also be discussed.