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Capturing inertial particle transport in turbulent flows.[1] HARRY STOTT, ANDREW LAWRIE, ROBERT SZALAI, Univ of Bristol — The natural world is replete with examples of particle advection; mankind is both a beneficiary from and sufferer of the consequences. As such, the study of inertial particle dynamics, both aerosol and bubble, is vitally important. In many interesting examples such as cloud microphysics, sedimentation, or sewage transport, many millions of particles are advected in a relatively small volume of fluid. It is impossible to model these processes computationally and simulate every particle. Instead, we advect the probability density field of particle positions allowing unbiased sampling of particle behaviour across the domain. Given a 3-dimensional space discretised into cubes, we construct a transport operator that encodes the flow of particles through the faces of the cubes. By assuming that the dynamics of the particles lie close to an inertial manifold, it is possible to preserve the majority of the inertial properties of the particles between the time steps. We demonstrate the practical use of this method in a pair of instances: the first is an analogue to cloud microphysics- the turbulent breakdown of Taylor Green vortices; the second example is the case of a turbulent jet which has application both in sewage pipe outflow and pesticide spray dynamics.

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