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A minimal multiscale Lagrangian map approach to synthesize non-Gaussian turbulent vector fields[1] CARLOS ROSALES, CHARLES MENEVEAU, Johns Hopkins University — A simple method is proposed to generate synthetic vector fields as surrogates for turbulent velocity fields, based on a minimal Lagrangian map. An initial Gaussian field generated with random-phase Fourier modes is distorted by moving fluid particles of a sequence of low-pass filtered fields at their fixed velocity for some scale-dependent time interval, interpolating onto a regular grid, and imposing the divergence-free condition. Statistical analysis shows that the resultant non-Gaussian field displays many properties commonly observed in turbulence, such as skewed and intermittent velocity gradient and increment PDFs, preferential alignment of vorticity with intermediate strain-rate, and non-trivial vortex stretching statistics. Differences appear only for measures associated with intense vortex tubes that are absent in the synthesized field. These synthetic fields are used as initial conditions in DNS and LES of decaying isotropic turbulence, giving more realistic results with significantly shortened initial adjustment periods, compared with Gaussian fields initializations.

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