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# Relative dispersion in the atmosphere

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The relative dispersion of pairs of particles in flows is of central importance when describing environmental dispersion, for example of volcanic ash. Atmospheric relative dispersion was examined previously in two balloon experiments in the Southern Hemisphere (the EOLE and TWERLE experiments). In both cases, the dispersion at scales below 1000 km grew exponentially in time, indicating the kinetic energy spectrum is steep. Subsequent analyses suggested though that the dispersion had a power law dependence on time, implying a shallower kinetic energy spectrum. The results from studies employing synthetic particles advected by reanalysis winds are similarly inconsistent, with indications of exponential growth in some cases and power law growth in others.

Here we use a different statistic—the probability density function (PDF) of pair displacements—to study dispersion the dispersion of large numbers of synthetic particles, advected by ERA-Interim reanalysis winds. The particles were deployed in the troposphere and stratosphere, both in the tropics and the extra-tropics. We examine the PDFs for the different deployments and compare them to analytical expressions derived for different turbulent inertial ranges. In line with the earlier balloon experiments, the results indicate exponential growth at the sub-deformation (1000 km) scales. At larger scales, the dispersion is anisotropic (predominantly zonal) and pair motion becomes decorrelated. Structure functions calculated from the wind data are in line with these conclusions.