

Interactive comment on “Variability of the Lagrangian turbulent diffusivity in the lower stratosphere” by B. Legras et al.

B. Legras et al.

Received and published: 13 April 2005

The Referee correctly points out the lack of comparison with previous results of Waugh et al. and Haynes & Balluch. We have added in the revised manuscript a study of two cases from the AASEII campaign studied by Haynes & Balluch. The results are basically that diffusion of the order of 0.1 is observed outside the polar vortex but that structures exhibiting low diffusion are also present in this domain, so that we do not disagree with Haynes & Balluch. See the final discussion of the revised manuscript for more details.

1. The assumption of independent noise for all particles released from the same parcel is a necessary technical ingredient of the equivalence between diffusive equation (5) and our algorithm. The independence of noise between two different parcels is

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

plausible as they are separated by about 1km along the flight track.

2. We have corrected (4) and (5) to provide the correct compressible version.

3. The Lyapunov exponents do not measure only horizontal strain but also vertical shear.

4. The justification of scaling the vertical direction is that we are basically interested in defining a distance in terms of tracer difference rather than in metric separation. Hence the ratio that takes into account the mean observed slopes of tracer structures. Although infinite time Lyapunov exponents are independent on the norm, finite time exponents and convergence to the large time limit depend on it. Convergence is not reached after 30 days but we found that fast transient behavior is damped before. The middle Lyapunov exponent oscillates around 0 but is significantly different from 0 (in the sense that the sum of the three exponents is much closer to zero, a result which is not constrained by our calculation).

5. Variance of Lyapunov exponents is not mentioned. We have modified the text to avoid confusion.

6. Our estimation relies upon the fact that analysed winds provide an accurate representation of the synoptic scale advecting flow. If this flow contains, as it seems, spurious modes which tend to generate spurious structures, such structures are amplified by chaotic advection at all scales below the synoptic scale. In order to get rid of them in the reconstruction and to fit the observations, we need to use enhanced diffusion that might hinder the true effect of unresolved scales. We have modified the text to make it clear. Notice also the main point that the spurious transport is acting on mesoscales and hence does not average locally as a smoothing factor. It is only when averaged over large spatial and temporal extend that is can be seen as a diffusion

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 8285, 2004.

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper