Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Universal range scaling of dissipation elements NORBERT PETERS, LIPO WANG, RWTH Aachen — In order to extract statistics from turbulent passive scalars fields obtained from DNS simulations a new method of analysis is introduced. It consists of determining local mininum and maximum points of the fluctuating scalar field via trajectories starting from every grid in direction of ascending and descending scalar gradients. The ensemble of grid points from which the same minimum and maximum points are reached determine a spatial region which is called a "dissipation element." These are parameterized by the linear distance between the minimum and maximum points and the absolute value of the scalar difference at these points. The joint pdf of these parameters is decom-posed into a marginal pdf of the linear distance and a conditional pdf of the scalar difference. A Boltzmann-type evolution equation is presented for the marginal pdf. It is also found that the conditional mean of the fluctuating scalar difference follows the same inertial range scaling as the square root of the structure function. This scaling turns out to be more robust than that of structure functions which show no scale separation in low Reynolds number DNS. The latter is explained by the stronger correlation of the scalar field in the vicinity of extremal points, which tends to contaminate the inertial range scaling in structure function analysis. Finally, the "Extended Self Similarity" hypothesis is discussed by recontructing the scalings of higher moments and comparing it to the DNS results.

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Date submitted: 29 Jul 2005 Electronic form version 1.4