Geophysical Research Abstracts, Vol. 7, 05615, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05615

Multifractal and space-time stratification analysis and modelling of space-time lidar data of passive scalars

A. Radkevitch (1), S. Lovejoy (1), K. Strawbridge (2), D. Schertzer (3)

(1) Department of Physics, McGill University, Montreal, Qc, Canada,

(2) Center for Atmospheric Research Experiments, Environment Canada, Egbert, Ont, Canada,

(3) Laboratoire de modelisation en mecanique, CNRS, Paris, France

(alexrad@physics.mcgill.ca / Phone: 1 514-3986480)

We use state-of-the-art lidar data of passive scalar surrogates (aerosols). Several vertical space - time cross-sections with resolution of 3.75m in the vertical, 1s in time and spanning 3-4 orders of magnitude in scale) were analyzed. By introducing an anisotropic space-time scale function, we generalize the classical (isotropic) Corrsin-Obukhov theory of passive scalar advection to cover buoyancy driven stratified flows with Kolmogorov $k^{-5/3}$ scaling in the horizontal, Bolgiano-Obukhov

$k^{-11/5}$ scaling in the vertical and ω^{-2} scaling in time (windless conditions); this is further generalized to conditions with a mean wind (this has the effect of rotating the axes of the scale function generator).

In order to perform data analyses using this generalized notion of scale and to test the generalized Corrsin-Obukhov law, we developed and applied new method of data analysis based on a nonlinear transformation of space-time intervals. This was used to calculate 2D structure functions of various orders to both test the theory and directly determine the unit ball defining the generalized notion of scale. Using this new technique and more traditional power spectrum analysis we verify the theory to within about 10% over more than 3 orders of magnitude of space-time scales.