Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Multi-level segment analysis: definition and applications in turbulence LIPO WANG, Shanghai JiaoTong Univ. — The interaction of different scales is among the most interesting and challenging features in turbulence research. Existing approaches used for scaling analysis such as structure-function and Fourier spectrum method have their respective limitations, for instance scale mixing, i.e. the so-called infrared and ultraviolet effects. For a given function, by specifying different window sizes, the local extremal point set will be different. Such window size dependent feature indicates multi-scale statistics. A new method, multi-level segment analysis (MSA) based on the local extrema statistics, has been developed. The part of the function between two adjacent extremal points is defined as a segment, which is characterized by the functional difference and scale difference. The structure function can be differently derived from these characteristic parameters. Data test results show that MSA can successfully reveal different scaling regimes in turbulence systems such as Lagrangian and two-dimensional turbulence, which have been remaining controversial in turbulence research. In principle MSA can generally be extended for various analyses.

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Date submitted: 30 Jul 2015 Electronic form version 1.4