

Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Focused-based multifractal analysis of the wake in a wind turbine array utilizing proper orthogonal decomposition HAWWA KADUM, NASEEM ALI, RAL CAL , Portland State University — Hot-wire anemometry measurements have been performed on a 3 x 3 wind turbine array to study the multifractality of the turbulent kinetic energy dissipations. A multifractal spectrum and Hurst exponents are determined at nine locations downstream of the hub height, and bottom and top tips. Higher multifractality is found at 0.5D and 1D downstream of the bottom tip and hub height. The second order of the Hurst exponent and combination factor show an ability to predict the flow state in terms of its development. Snapshot proper orthogonal decomposition is used to identify the coherent and incoherent structures and to reconstruct the stochastic velocity using a specific number of the POD eigenfunctions. The accumulation of the turbulent kinetic energy in top tip location exhibits fast convergence compared to the bottom tip and hub height locations. The dissipation of the large and small scales are determined using the reconstructed stochastic velocities. The higher multifractality is shown in the dissipation of the large scale compared to small-scale dissipation showing consistency with the behavior of the original signals.

Naseem Ali
Portland State University

Date submitted: 01 Aug 2016

Electronic form version 1.4