Understanding Transport via Ergodicity Defect Analysis

S. Scott (1), C. Redd (1), L. Kuznetsov (1), C.K.R.T Jones (1), **I. Mezic** (2)

(1) University of North Carolina, Chapel Hill, (2) University of California, Santa Barbara

We introduce a new, multiscale, technique to assess ergodicity in fluid flows. This technique relates directly to physical notions of residence times in subdomains of the flow field. We choose the subdomains in a structured way, so to examine the dependence of residence times on scales of observation. We pursue analysis of several well-known examples of dynamical systems that build the intuition on the behavior of the quantities we define in fields such as gyres, jets and domains with chaotic advection. The key notion is that of an Ergodicity Defect, that measures how much the system departs from uniform sampling behavior in any given subdomain of the flow field. The mathematical theory behind this notion is described.