Center for Environmental & Applied Fluid Mechanics

"Large Scale Shear Layers affect Dissipation Scaling"

Gerrit E. Elsinga
Delft University of Technology

The local dissipation rate in a turbulent flow is an important quantity, which is closely associated with local flame extinction, scalar mixing rates, as well as droplet collision and growth in clouds. One outstanding question concerns the Reynolds number scaling of intense local dissipation. This issue is of considerable theoretical and practical interest, since much of our understanding of industrial and environmental flows relies on data obtained at (much) lower Reynolds numbers.

In this talk, I will show that, at high Reynolds numbers, intense dissipation is organized in large-scale shear layers and will examine the scaling implications. Indeed, numerical data reveals that the scaling exponents for the dissipation moments and the dissipation maximum increase when these layers appear. Existing theories and models cannot explain this development, because they have either assumed or predicted constant, i.e. Reynolds number independent, scaling exponents. However, a simple layer-based model yields an increasing exponent consistent with the data. This suggests that these large-scale layers are key to quantifying intense small-scale dissipation. Further increases in the scaling exponents are envisioned at even higher Reynolds numbers when the large-scale shear layers break down into smaller structures.

Fall 2022 CEAFM Seminar Series

September 9, 2022 ✖ 3:00 PM ✖ Gilman Hall 50

https://wse.zoom.us/j/93762992307

JOHNS HOPKINS
WHITING SCHOOL of ENGINEERING