TECHNISCHE UNIVERSITÄT DRESDEN

Institut für Strömungsmechanik, Professur für Strömungsmechanik

Vortrag

Particles in Turbulence: Macro- Consequences from Micro- Interactions

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Turbulent fluids and small particles, droplets or bubbles are common to a number of key processes in energy production, product industry and environmental phenomena. In modelling these processes, the dispersed phase is usually assumed uniformly distributed. Indeed, it is not. Dispersed phases can be focused by turbulence structures and can have a time-space distribution, which barely resembles prediction of simplified averaged modelling. Preferential distribution controls the rate at which sedimentation and re-entrainment occur, reaction rates in burners or reactors and can also determine raindrop formation and, through plankton, bubble and droplet dynamics, the rate of oxygen-carbon dioxide exchange at the ocean-atmosphere interface.
In this talk, we I review a number of physical phenomena in which particle segregation in turbulence is a crucial effect describing the physics by means of Direct Numerical Simulation of turbulence. I will elucidate concepts and modeling ideas derived from a systematic numerical study of the turbulent flow field coupled with Lagrangian tracking of particles under different modeling assumptions. Through a number of physical examples of practical interest such as free-surface flows (Figure 1), I will show that a sound rendering of turbulence mechanisms is required to produce a physical understanding of particle trapping, segregation and ultimately macroscopic flows such as surfacing, settling and re-entrainment.

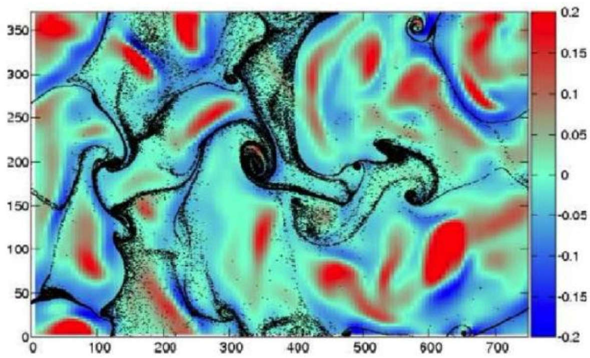

Figure 1: Light particles floating on a flat shear-free surface of a turbulent open water.

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