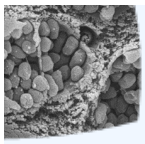
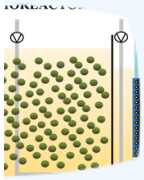
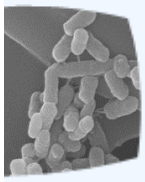






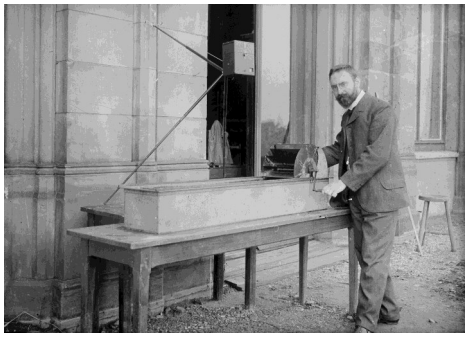
UCI Samueli School of Engineering | Department of Civil and Environmental Engineering

Presented By:
Gabriel Katul, Ph.D.
Professor
Civil & Environmental Engineering
Duke University

Environmental Engineering Seminar

Friday, January 13th, 2017
McDonnell Douglass Engineering Auditorium (MDEA)
1:30PM to 2:30PM

Co-Spectral Budgets Link Energy Distributions in Eddies to Bulk Flow Properties in Hydrology & Micrometeorology



Connections are explored between spectral descriptions of turbulence and the mean velocity profile in wall-bounded flows using a budget for the co-spectral density. The co-spectrum is derived using a standard model for the wall normal velocity variance and a linear Rotta-like return-to-isotropy closure modified to include the isotropozition of the production for the pressure-strain effects. The approach provides a relation between well-established constants such as the von Karman and Kolmogorov constants, and the Rotta constant known to vary with the flow configuration. Depending on the choices made about small-scale intermittency corrections, the logarithmic mean velocity profile or a power-law profile with an exponent that depends on the intermittency correction are derived thereby offering a new perspective on a long standing debate about the shape of the mean velocity profile in the equilibrium region[1]. The twice-integrated co-spectral budget with respect to scale and depth is then used to explain the variation in the friction factor with Reynolds number in smooth pipes[2] with attention to the switch from power-law (Blasius scaling) to log-law (Colebrook's formula). A general discussion on how to link the 'microstates' of eddies (i.e. energy distribution in eddies) to macroscopic flow properties used in operational hydrology and micrometeorology (i.e. bulk flow relations such as Manning's formula, Monin-Obukhov similarity theory, stably stratified flow properties, Strickler scaling for roughness elements, etc….) is also featured.

Gabriel G. Katul received his B.E. degree in 1988 at the American University of Beirut (Beirut, Lebanon), his M.S. degree in 1990 at Oregon State University (Corvallis, OR) and his Ph.D degree in 1993 at the University of California in Davis (Davis, CA). He is currently the Theodore S. Coile Professor of Hydrology and Micrometeorology at the Nicholas School of the Environment and the Department of Civil and Environmental Engineering at Duke University (Durham, NC). Research in Katul's lab focuses on micro-meteorology and near-surface hydrology with emphasis on heat, momentum, carbon dioxide, water vapor, ozone, particulate matter (including aerosols, pollen, and seeds) and water transport in the soil-plant-atmosphere system as well as their implications to a plethora of hydrological, ecological, atmospheric and climate change related questions.

Questions? - cee@uci.edu - (949) 824-7548