ETH zürich

Institute of Fluid Dynamics
Institute of Energy and Process Engineering

Colloquium Thermo- and Fluid Dynamics

Insights into atmospheric dynamics with frame-indifferent fluxes and structures

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Our current understanding of multi-scale transport and mixing processes in Earth's atmosphere is limited. A common theme arises, however, across all scales of motion where certain coherent structures play a dominant role in organizing the flow and the resultant transport. Recent theoretical developments have enabled novel diagnostics to rigorously quantify the impact of such structures on turbulent atmospheric flows. By focusing specifically on features that exist as frame-indifferent (objective) structures, the present research examines newly-developed analysis of numerical and experimental flow data and resulting insights on atmospheric flows. When using a frame-indifferent definition of coherent structures and fluxes, we find similar trends in the balance of momentum and heat transport in direct numerical simulations of rotating Rayleigh-Bénard convection and high Reynolds number large eddy simulations of atmospheric boundary layers with varying stability. Utilizing frame-indifferent metrics also allows us to calculate meaningful flow descriptors from extremely sparse Lagrangian particle tracking experiments with enhanced insight over previous approaches. These findings suggest continued research into the dynamics of the atmospheric boundary layer using frame-indifferent approaches will be fruitful and further aid our understanding of turbulent processes.

Nikolas Aksamit is an Associate Professor in the Institute of Mathematics and Statistics at UiT – The Arctic University of Norway. He has a multi-disciplinary scientific background having previously conducted research in mathematics, engineering, hydrology, atmospheric science, and geography departments in the US, Canada, Switzerland, and New Zealand. His research focuses primarily on enhancing our understanding of geophysical fluid flows by combining novel experimental and theoretical approaches.

Date: Wednesday, 4 September 2024
Time: 16:15 - 17:15h
Place: ETH Zurich, ML F 36
Host: Prof. George Haller

Prof. George Haller

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