Direct Numeric Simulation of Sheared Convective Boundary Layer Entrainment with GPUs

***N.J. Stewart[1], W. Lin[1], and D. Holmes[1]**

[1]School of Engineering and Physical Sciences, James Cook University, Townsville, QLD, Australia

*Corresponding author: nicholas.stewart@my.jcu.edu.au

Sheared convective boundary layers are a turbulent boundary layer that is prevalent in environmental and engineered systems. Currently, mixing and entrainment in SCBLs is not well understood, accurate parameterizations to describe the dominant turbulent processes. A better understanding of these processes will allow for more accurate atmospheric and oceanic modeling, amongst other important applications. Numerical simulation of SCBLs is a cost and time effective method of obtaining knowledge of the process of turbulent entrainment. A model was developed using the finite difference method for solving the fluid equations and verified against previously collected data. It was implemented in the CUDA programming language to leverage heterogeneous processing architectures. The high performance provided by modern GPUs allows for higher resolution models to be run while maintaining a low run time.

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