FG-9

Real-time wind field measurements using a scanning aerosol lidar and graphical processing unit (GPU)

Christopher F. Mauzey[1], Jennifer P. Lowe, Shane D. Mayor

Real-time vector flow fields are required for applications such as the optimization of wind energy, wind-shear detection at airports, and fast prediction of the transport and dispersion of hazardous atmospheric pollutants. In a series of recent publications, we have shown that 2-component wind fields can be derived from images produced by the Raman-shifted Eye-safe Aerosol Lidar (REAL). In this poster, we demonstrate real-time execution of the cross-correlation algorithm through the use of graphical processing units (GPUs).

An NVIDIA Tesla C2050 GPU card was installed in a Linux-based computer workstation that is located in the lidar facility at the university farm. A real-time broadcast of the lidar data (made by a separate data acquisition computer in the lidar system) is ingested by the software developed to perform the real-time wind calculations. The software achieves the needed performance by distributing the computationally intensive tasks of filtering, interpolation, and fast Fourier transforms on the GPU which has 448 cores operating at 1.15 GHz. The code was written in C++ using the Qt framework and NVIDIA's CUDA. Resulting vector flow fields are written to Network Common Data Format (NetCDF) files locally and an SQL database residing on the Physics Department server on campus. A web application, currently under development, will read the data from the SQL database and enable many people to visualize the field over the university farm in near-real-time. Our solution provides horizontal wind speed and direction over areas of several kilometers and operates in real-time.

To be presented at the GPU Technology Conference in San Jose, CA, 14-17 May 2012. This work was supported by NSF AGS 0924407.

[1]Department of Physics