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TITLE: CUDA Simulation of homogeneous, incompressible turbulence

PRESENTATION TYPE: Poster Requested

CURRENT SECTION/FOCUS GROUP: Nonlinear Geophysics (NG)

CURRENT SESSION: IN17: High-Resolution Modeling in the Geosciences Using GPU and Many-Core Architectures

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ABSTRACT: We discuss very fast CUDA simulations of ideal homogeneous incompressible turbulence based on Fourier models. These models have associated statistical theories that predict that Fourier coefficients of fluid velocity and magnetic fields (if present) are zero-mean random variables. Prior numerical simulations have shown that certain coefficients have a non-zero mean value that can be very large compared to the associated standard deviation. We review the theoretical basis of this "broken ergodicity" as applied to 2-D and 3-D fluid and magnetohydrodynamic simulations of homogeneous turbulence. Our new simulations examine the phenomenon of broken ergodicity through very long time and large grid size runs performed on a state-of-the-art CUDA platform. Results comparing various CUDA hardware configurations and grid sizes are discussed. NS and MHD results are compared.