Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Turbulent Thermal Convection with Polymer Additives[1] YVES DUBIEF, University of Vermont — We study the effect of polymers in natural convection and test a new approach for the numerical resolution of the transport of low-diffusion scalars. Our natural convection incompressible flow takes place between two infinite parallel isothermal plates. We present simulations for Rayleigh numbers up to 5×10^6 for water alone and water with polymer additives. The behavior of polymer solutions, simulated using viscoelastic models, is analog to that observed in drag-reduced polymer wall flows. The polymers damp vortices (secondary instability, quasi streamwise vortices for wall flows) caused by thermal plumes, resulting in stronger and more coherent convection cells (primary instability, streaks). The overall heat transfer is significantly reduced. For some simulations, we have used a new numerical algorithm, the Adaptive Lagrangian Gradient Transport, to resolve sharp gradients of temperature and components of the polymer stress tensor. The algorithm calculates scalar gradients using a traditional finite-difference Eulerian approach in regions where the method is numerically stable. In the rest of the flow, determined by its local topology, the algorithm reconstructs gradients at computational nodes from particles that transport governing equations for the scalar gradients of interest.

[1]This work was partially supported by NASA Epscor

Yves Dubief
University of Vermont

Date submitted: 04 Aug 2008 Electronic form version 1.4