Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Diffusive Layering in Large and Small Aspect-Ratio Containers
S.U. POL, H.J.S. FERNANDO, Arizona State University, S. WEBB, Sandia National Laboratories — The diffusive interface of double-diffusive staircases is investigated using laboratory experiments and theoretical modeling. Heat/salt and petrochemical (stimulant oil)/heat mixtures are considered, with applications to oceanographic and engineering (e.g. Strategic Petroleum Reserves) flows. The goals were to study how the convective layers above the first layer can be scaled for large aspect ratio (width/height) configurations; delineate conditions under which adjoining convective layers merge; and propose scaling for layer heights for small aspect ratio cases. In the experiments a stable solute gradient is heated from below, forming multiple convective layers separated by diffusive interfaces, and the evolution of temperature and density profiles as well as velocity fields are measured. The theoretical layer heights are derived based on the argument that convective layers grow until their vertical growth is inhibited by a balance between the vertical inertia forces of convective eddies and stable buoyancy forces of diffusive interfaces. Comparisons of experimental and theoretical results are made.

H.J.S. Fernando
Ariziona State University

Date submitted: 26 Jul 2007 Electronic form version 1.4