GTP Visit Description: H. Jonker

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Geophysical Turbulence Program – 2007 NAR
Peter Suillivan (NCAR)
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The theme of the visit by Dr. H. Jonker (Delft University, Netherlands) to Dr P. Sullivan was the study of the growth rate law (entrainment law) of the convective atmospheric boundary layer. Recent laboratory experiments (Jonker et al 2004) using the Delft saline convection tank facility (see fig. 1 for a snapshot), cast significant doubts on the validity of the widely accepted Ri^{-1}-law for the growth-rate of the boundary layer, especially for large Richardson numbers (strong inversions). The experiments contradict the findings both of Large-Eddy Simulations and of thermal convection tanks (e.g. Deardorff and Willis, 1980), and appear to point to effects of finite Reynolds and Peclet numbers (which are also present in LES). During the visit these issues have been studied in detail by conducting Direct Numerical Simulations of penetrative convection (see fig. 2 for a snapshot), which clearly revealed the effects of molecular diffusion. To interpret these results in terms of the atmospheric situation of large Re/Pe-numbers, new simulations that employ much larger Reynolds numbers have been designed based on the newly available supercomputing resources. These simulations will be conducted in the near future.

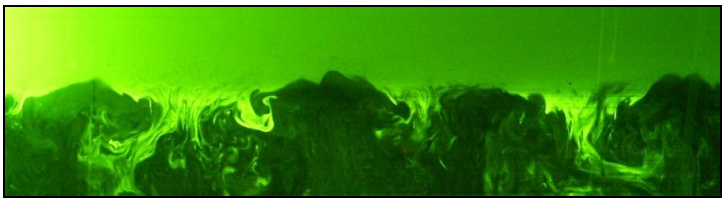

fig 1. Visualization of entrainment by means of Planar Laser Induced Fluorescence in the Delft saline convection tank.

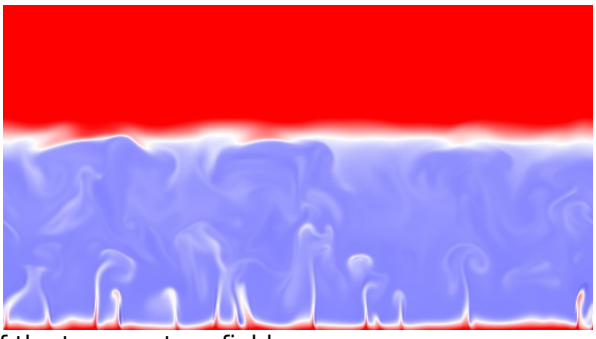

fig 2. DNS snapshot of the temperature field