

Laboratory Experiments of the Convective Boundary Layer

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We discuss experiments carried out in a saline convection tank aimed to mimic the convective atmospheric boundary layer. First we discuss the set-up, the employed measurement methods like Particle Imaging Velocimetry (PIV) and Planar Laser Induced Fluorescence (PLIF) and the rules for scaling down the atmospheric case to laboratory scale and the corresponding dimensionless numbers. Next we focus on the experiments that deal with the growth-rate of the convective boundary layer. We distinguish two types of experiments which differ with respect to the initial condition: a constant stable stratification, and a two-layer system. The latter consists of two neutral layers with different density, enabling the creation of well-defined inversion jumps. In each experiment convection was forced by a homogeneous surface buoyancy flux. The entrainment rate was determined by tracking the depth of the growing boundary layer, but also by measuring the entrainment flux of a fluorescent dye. We compare the findings with the results of Large Eddy Simulations (LES) and other laboratory experiments which use thermal rather than saline convection. Finally we show results of preliminary Direct Numerical Simulations.