Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

The effectiveness of a heated air curtain DARIA FRANK, University of Cambridge — Air curtains are high-velocity plane turbulent jets which are installed in the doorway in order to reduce the heat and the mass exchange between two environments. The air curtain effectiveness E is defined as the fraction of the exchange flow prevented by the air curtain compared to the open-door situation. In the present study, we investigate the effects of an opposing buoyancy force on the air curtain effectiveness. Such an opposing buoyancy force arises for example if a downwards blowing air curtain is heated. We conducted small-scale experiments using water as the working fluid with density differences created by salt and sugar. The effectiveness of a downwards blowing air curtain was measured for situations in which the initial density of the air curtain was less than both the indoor and the outdoor fluid density, which corresponds to the case of a heated air curtain. We compare the effectiveness of the heated air curtain to the case of the neutrally buoyant air curtain. It is found that the effectiveness starts to decrease if the air curtain is heated beyond a critical temperature. Furthermore, we propose a theoretical model to describe the dynamics of the buoyant air curtain. Numerical results obtained from solving this model corroborate our experimental findings.

Daria Frank
University of Cambridge

Date submitted: 25 Jul 2014 Electronic form version 1.4