Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Turbulent convection driven by evaporation in water pools[1]
WILLIAM HAY, MILTIADIS PAPALEXANDRIS, Universite catholique de Louvain — Turbulent natural convection in open cavities is encountered in numerous industrial applications and natural phenomena. In this presentation we report on direct numerical simulations of the problem in hand at different Rayleigh numbers. A shear-free boundary on top of a cubic domain approximates a free surface. At the same location we estimate realistic evaporative and convective heat losses, forming the basis of a non-zero Neumann boundary condition for the temperature. Our simulations predict that the shear-free surface increases heat transfer within the domain, however the exponent in the power-law relation between the Nusselt and Rayleigh numbers, is similar to that of classical turbulent Rayleigh-Bénard Convection. The effects of the shear-free surface on the large-scale circulation, the thermal boundary layers and the flow statistics are also analyzed herein. Overall, this configuration of turbulent convection shows unique characteristics, borrowing from both turbulent Rayleigh-Bénard convection and evaporative cooling.

[1]Bel v

William Hay
Universite catholique de Louvain

Date submitted: 06 Jul 2020 Electronic form version 1.4