Passive Indirect Evaporative Cooler

Fernando F. Dall’Agnol[1], Aristides Pavani[1]
[1]Center for Information Technology Renato Archer, Campinas, SP, Brazil

Introduction: We simulate the optimal operating condition of an evaporative cooler in a configuration that uses no input power (passive) and segregates the humid/dry airs in different ducts (indirect cycle).

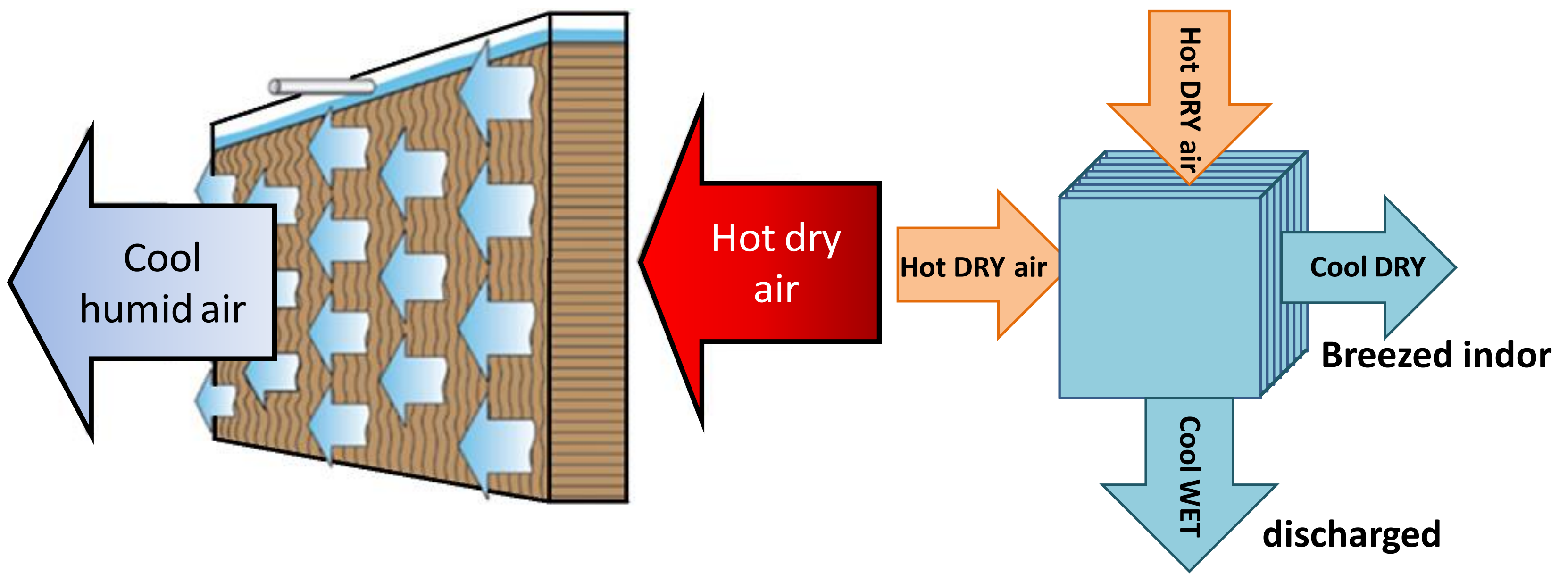

Figure 1. In the left and right respectively, a representation of the direct and indirect evaporative cooler concepts.

CAD geometry:

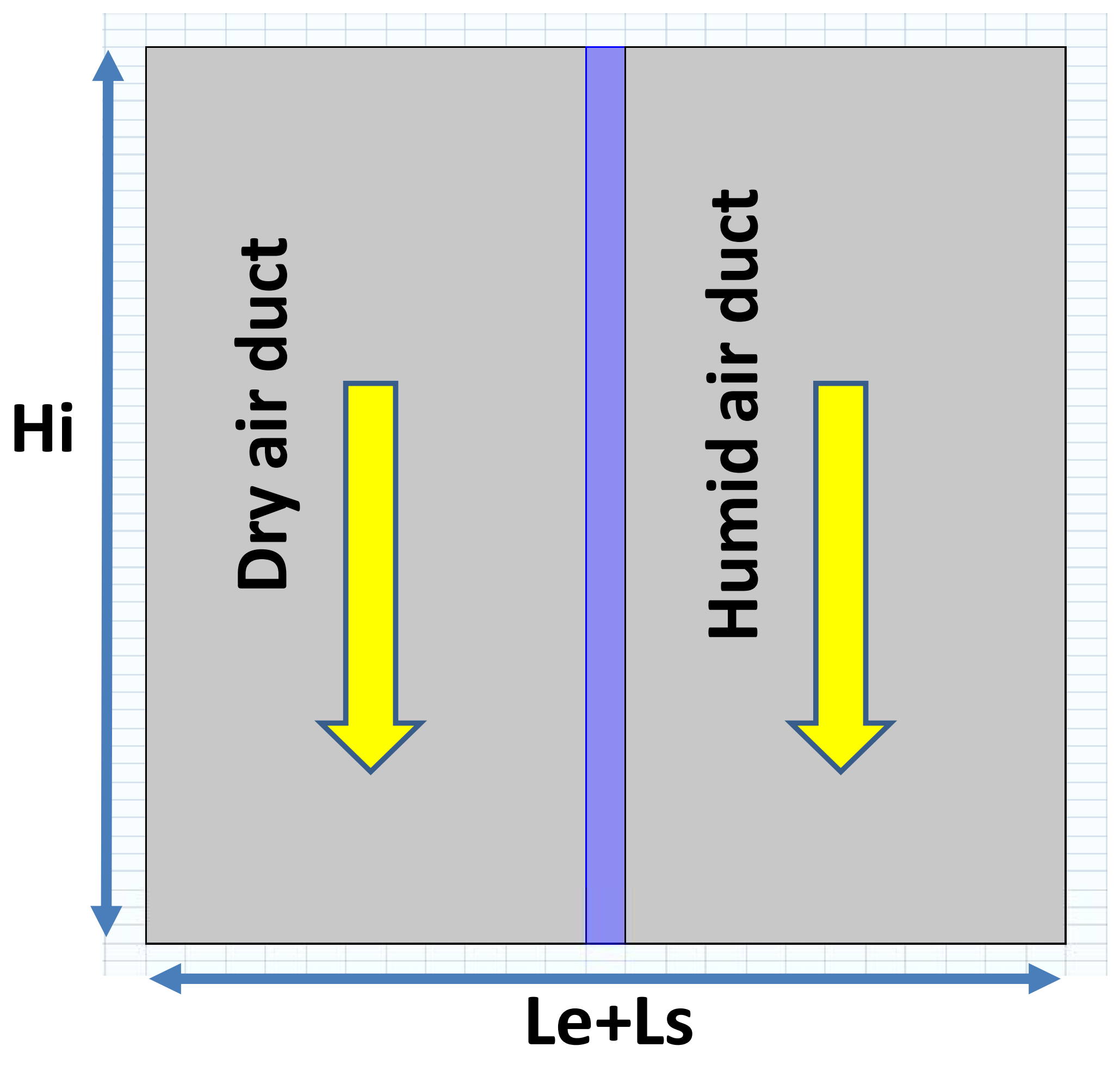

Figure 2. 2D geometry analyzed.

Domain and boundary equations:

$$-Dif\,\nabla^2 rho+\beta.\nabla rho=0$$

$$F_y=g\left[rhoair(T)-rhoair(Tamb)\right]$$

$$rho_{boundary}=rhos(Tamb)*he$$

$$rhos=rhoair\,(T)\,\frac{Ps\,(T)}{Patm}$$

$$Q=\frac{\partial rho}{\partial x}\,Dif\,(T)*Ql\,(T)$$

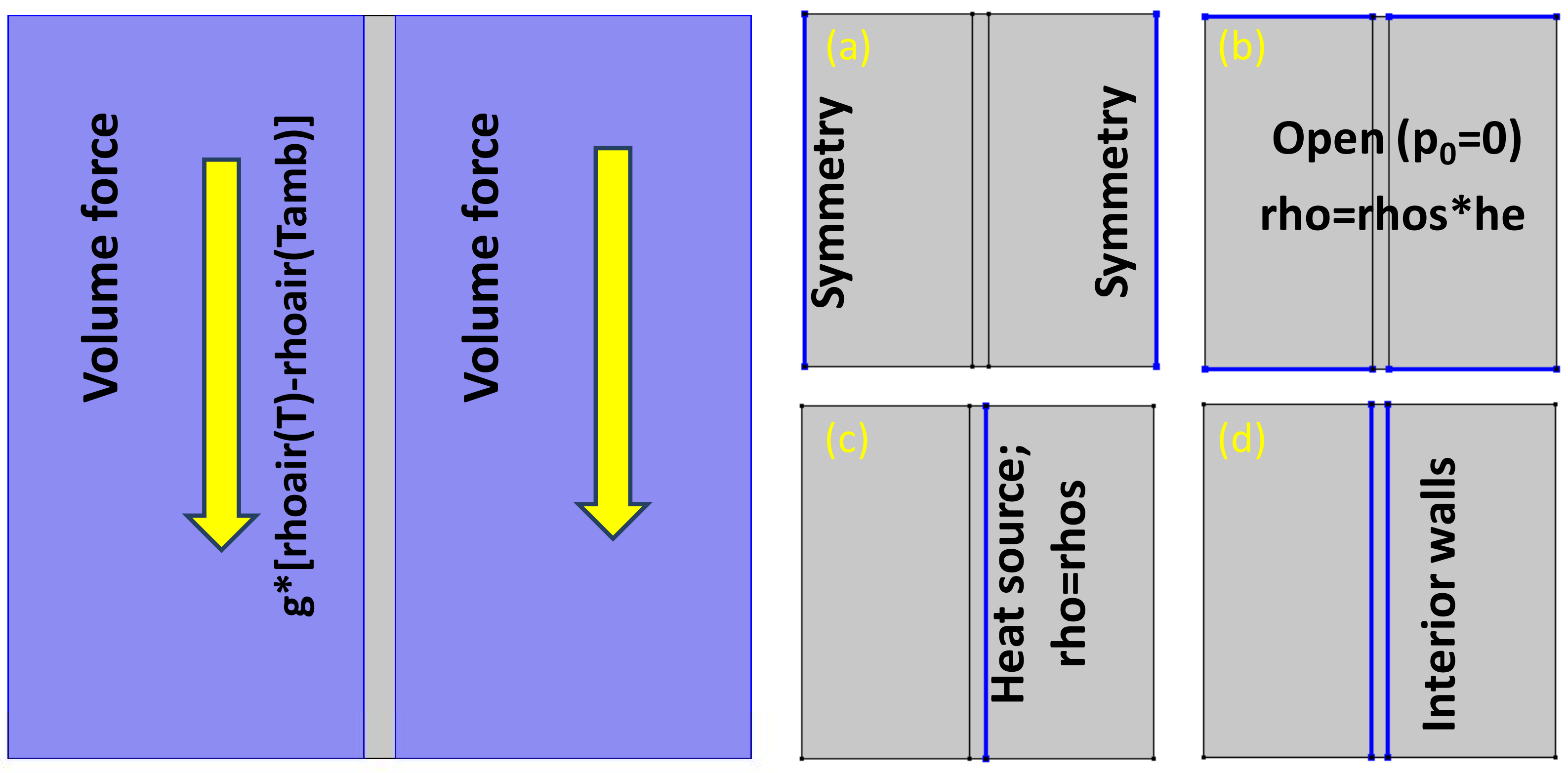

Figure 3. In the left the volume driving force of the fluid. In the right, the boundary conditions.

Results

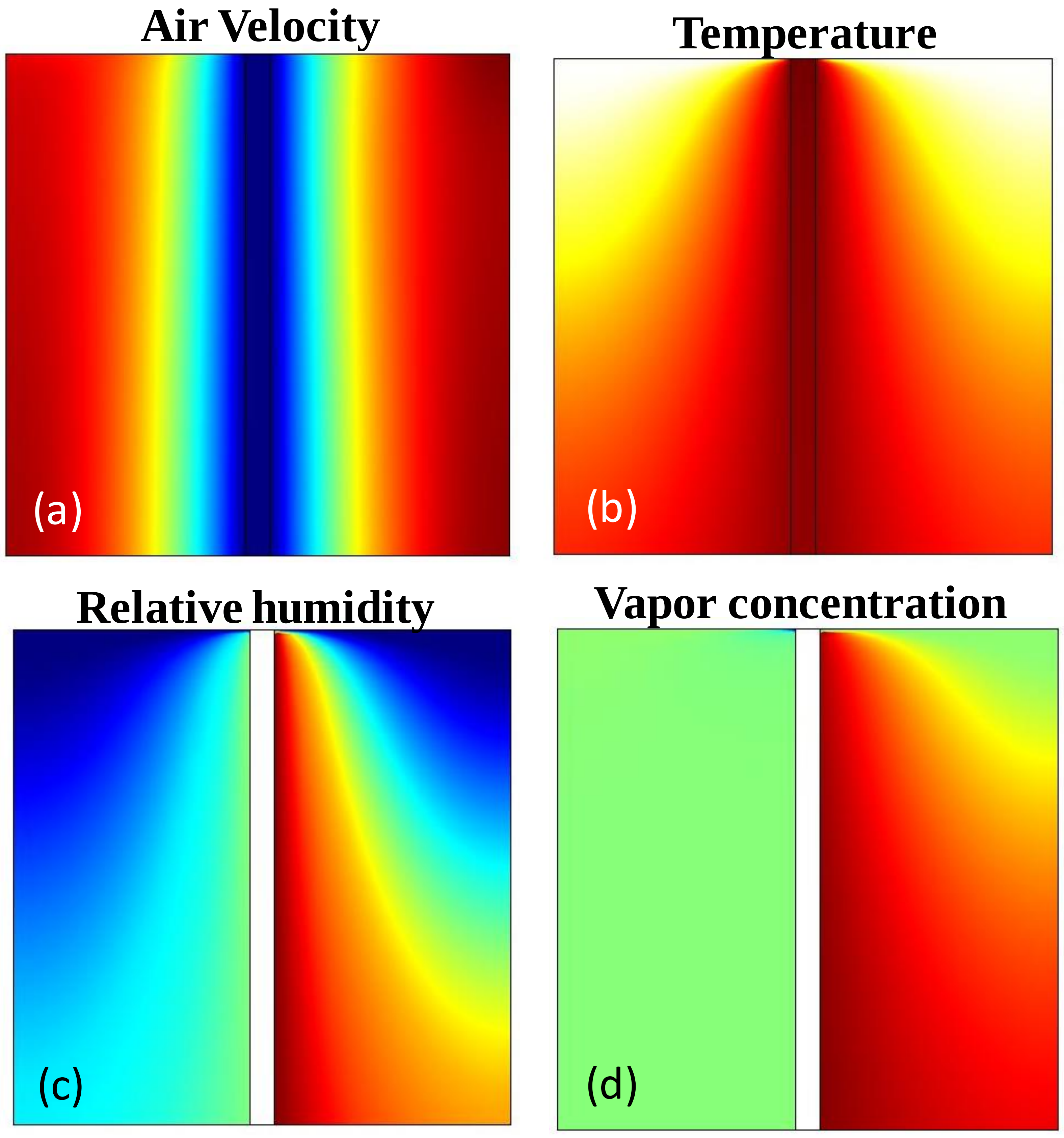

Figure 4. Distributions of the main variables involved.

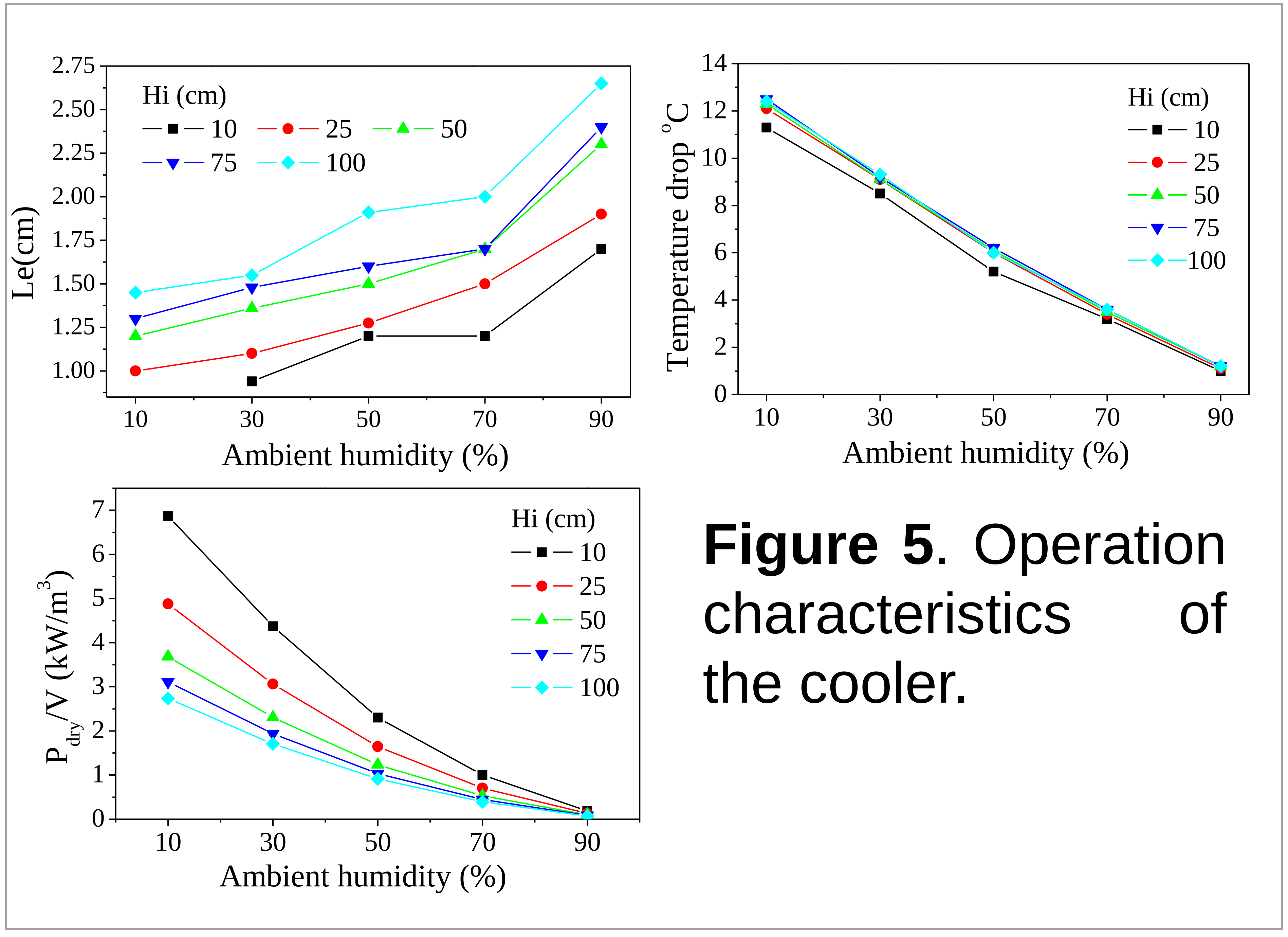

Figure 5. Operation characteristics of the cooler.

Excerpt from the Proceedings of the 2014 COMSOL Conference in Curitiba