ON THE COHERENT STRUCTURES MOTION IN HORIZONTAL CONVECTION

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ABSTRACT: The aim of this work is to study by means of Particle Image Velocimetry (PIV) the convective circulation developing in a flow-filled volume by imposing a differential heating along one horizontal boundary (the so called "horizontal convection", see Hughes and Griffiths (2008) for review). In the present study a uniform temperature is imposed on one half of the bottom base of a Plexiglas box filled with de-gassed water, while on the other half a uniform heat flux input is provided. The experimental setup is similar to that used by Mullarney et al. (2004).

The main parameters governing the phenomenology are the Rayleigh number *Ra*, the aspect ratio of the box *H/L* (where *H* and *L* are the height and the width of the box, respectively), and the Prandtl number *Pr* of the fluid.

The results highlight that the boundary layer on the base, maintained by the action of buoyancy forces sustained by the heat flux input imposed on the bottom half base of the box, provides flow rate to the buoyant plume arising towards the top of the tank. Eventually as shown by Fig.1, the flow is characterized by:

- A strong asymmetric circulation cell with a narrow rising plume and a diffused average downward motion throughout the rest of the box;
- A horizontal outflow motion on the upper part of the volume of the box;
- The returned motion towards the cold end at an intermediate depth of the box above the bottom boundary layer.

The presence of long lifetime coherent vortical structures developing at the base of the rising plume, and convected downstream towards the upper part of the box.

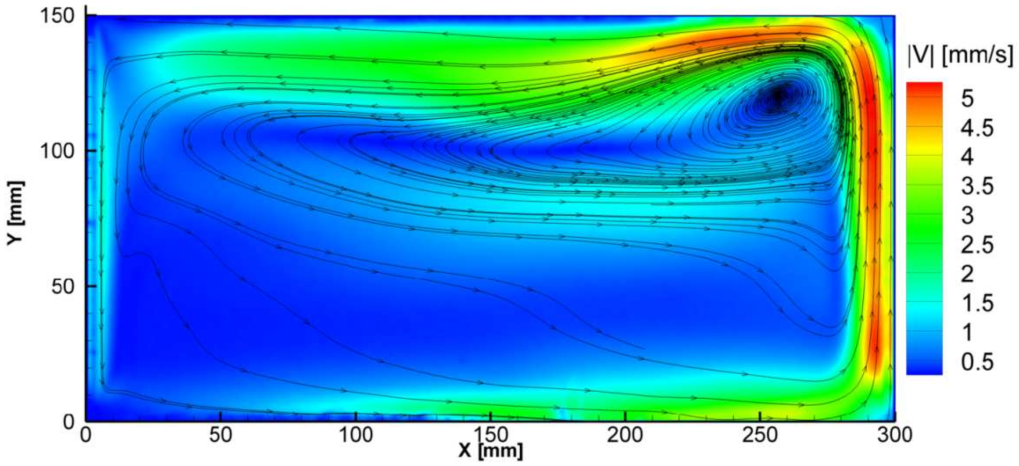

Fig 1 Contour of mean velocity amplitude and streamline at $Ra=9.2*10^{11}$ and $Pr=5$

References

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