Heat transfer between a solid wall and a fluid in natural convection is usually characterized by a heat transfer coefficient. This notion is valid in permanent regime but can be questioned under transient conditions where the instantaneous heat flux density does not depend only on the temperature difference between wall and fluid at this time but also on the history of this temperature difference. Inverse heat conduction associated to sensitive temperature probe allow the indirect measurement of very weak heat fluxes associated to transient heating or cooling of a wall in situations generally met in power electronics or in buildings. In order to test the assumption of a constant heat transfer coefficient, an experiment is considered: a vertical plate is heated on one side (step electrical heating) while temperature on the other face, submitted to natural convection, can be measured by infrared thermography. A sensitivity analysis of the model and the inversion of simulated measurements using different regularization techniques are implemented. They are used to optimize the practical experimental situation and to adjust the inversion parameters: the choice of the time step and the type of parametrization of the problem have a strong impact on the estimation. Experimental inversion results are shown.