Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **9 (2002)** 287-312

THE GLOBAL ATTRACTOR OF THE BOUSSINESQ EQUATIONS IN AN UNBOUNDED CHANNEL-LIKE DOMAIN

Xuefeng Wang and Desheng Yang[1]

Department of Mathematics
East China Normal University
Shanghai 200062, P.R. China

Abstract. Our discussion in this paper is about the asymptotic behavior of the solutions for the Boussinesq equations in an unbounded domain. It has already been proved that when an external force decays at infinity,the semigroup generated by the Boussinesq equations acquires a global attractor and the Housdorff dimension of the attractor is finite. We shall propose some methods to prove the compactness of the absorbing set in unbounded domain. Estimates in weighted Sobolev spaces are used as a main tool.

1 Introduction

The Boussinesq equations describe the motion of a viscous incompressible fluid subjected to thermal effects. Let the domain $\Omega \subset R^2$ be defined by the inequality:

$$b_1(x_1) \leq x_2 \leq b_2(x_1), \ x_1 \in R \tag{1}$$

where b_1 and b_2 are twice continuously differentiable functions bounded over the entire axis

$$-M \leq b_1(x_1) \leq b_2(x_1) \leq M, |b_i'(x_1) + b_i''(x_1)| \leq C, i = 1, 2 \tag{2}$$

In the trip Ω,the velocity field $\bar{u}(x_1, x_2) = (u_1(x_1, x_2), u_2(x_1, x_2))$of viscous fluid and temperature $\theta = \theta(x,t)$satisfy the Boussinesq equations

$$\frac{\partial}{\partial t}\bar{u} - \Delta\bar{u} + (\bar{u} \cdot \nabla)\bar{u} + \nabla p = f(x) + h(\theta) \tag{3}$$

$$\nabla \cdot \bar{u} = 0 \tag{4}$$

$$\bar{u}(x, 0) = \bar{u}_0 \tag{5}$$

[1]Project 19571026 supported by NNSFC