

TOMÁS CHACÓN REBOLLO

ROGER LEWANDOWSKI

ELISEO CHACÓN VERA

**Analysis of the hydrostatic approximation in oceanography  
with compression term**

*ESAIM: Modélisation mathématique et analyse numérique*, tome 34, n° 5 (2000), p. 1107

[<http://www.numdam.org/item?id=M2AN\\_2000\\_\\_34\\_5\\_1107\\_0>](http://www.numdam.org/item?id=M2AN_2000__34_5_1107_0)

© SMAI, EDP Sciences, 2000, tous droits réservés.

L'accès aux archives de la revue « ESAIM: Modélisation mathématique et analyse numérique » (<http://www.esaim-m2an.org/>) implique l'accord avec les conditions générales d'utilisation (<http://www.numdam.org/conditions>). Toute utilisation commerciale ou impression systématique est constitutive d'une infraction pénale. Toute copie ou impression de ce fichier doit contenir la présente mention de copyright.

NUMDAM

Article numérisé dans le cadre du programme  
Numérisation de documents anciens mathématiques  
<http://www.numdam.org/>

*Erratum*

ESAIM: M2AN, Vol. 34, N° 3, 2000, pp. 525–537.

## ANALYSIS OF THE HYDROSTATIC APPROXIMATION IN OCEANOGRAPHY WITH COMPRESSION TERM\*

TOMÁS CHACÓN REBOLLO<sup>1</sup>, ROGER LEWANDOWSKI<sup>2</sup> AND ELISEO CHACÓN VERA<sup>1</sup>

**Abstract.** The hydrostatic approximation of the incompressible 3D stationary Navier-Stokes equations is widely used in oceanography and other applied sciences. It appears through a limit process due to the anisotropy of the domain in use, an ocean, and it is usually studied as such. We consider in this paper an equivalent formulation to this hydrostatic approximation that includes Coriolis force and an additional pressure term that comes from taking into account the pressure in the state equation for the density. It therefore models a slight dependence of the density upon compression terms. We study this model as an independent mathematical object and prove an existence theorem by means of a mixed variational formulation. The proof uses a family of finite element spaces to discretize the problem coupled with a limit process that yields the solution. We finish this paper with an existence and uniqueness result for the evolutionary linear problem associated to this model. This problem includes the same additional pressure term and Coriolis force.

**Mathematics Subject Classification.** 35Q30, 76D05.

Received: November 5, 1998. Revised: October 7, 1999.

The following acknowledgements have been omitted:

*Acknowledgements.* This work has been partially funded by the Project: CYTMAR MAR97-1055-C02-02 of Ministerio de Educación y Ciencia of Spain.

---

*Keywords and phrases.* Navier-Stokes equations, Oceanography, Compression term.

\* *Dedicated to J.L. Lions in honor to his 70th Birthday.*

<sup>1</sup> Departamento de Ecuaciones Diferenciales y Análisis Numérico Universidad de Sevilla, 41.080-Sevilla, Spain.

e-mail: chacon@numer2.us.es; eliseo@numer2.us.es

<sup>2</sup> Modal-X, Bât. G, Université Paris X, 200 avenue de la République, 92001 Nanterre, France.

e-mail: lewandow@modalx.u-paris10.fr