

Numerical simulation of instabilities as driving processes in the ocean surface

Philippe Fraunié

*Mediterranean Institute of Oceanography, Université de Toulon, Aix-Marseille
Université, CNRS, IRD, Toulon, France
fraunie@univ-tln.fr*

Tomas Bodnar

*Faculty of Mechanical Engineering, Czech Technical University in Prague, Karlovo
Náměstí 13, 121 35 Prague 2, Czech Republic.
, Tomas.Bodnar@fs.cvut.cz*

Yuli Chashechkin

*Ishlinsky Institute for Problems in Mechanics, Moscow, 119526 Russia.
chakin@ipmnet.ru*

Ilias Sibgatullin

*Ecole Normale Supérieure de Lyon, France.
ilias.sibgat@gmail.com*

Abstract

Due to the high resolution of coupled ocean-atmosphere models downscaling up to hundreds meters, a renew of interest is dedicated to basic processes occurring at the sea upper layer including surface and internal waves, mixing processes and coherent structures. From high resolution in situ observations using gliders, floating platforms, HF radars and oceanographic vessels cruises, a review of documented data bases is given. Starting from the Orr Sommerfeld equation as applied to the inflectional instability and depending on initial and

boundary conditions, Kelvin Helmholtz, Holmboe, Ekman and Langmuir secondary flows are especially analysed. In the end, recent investigations are discussed concerning the winter marine deep convection related to Rayleigh Bénard cells and millimetric surface waves as observed in laboratory at the air-sea interface and on the wall of crowns produced by drops impacting the free surface.

Keywords: Ocean surface, Kelvin Hemholtz instabilities, Numerical modelling.

References

- [1] C. Aldebert , G. Koenig , M. Baklouti , P. Fraunié and J.L.Devenon, *A fast and generic method to identify parameters in complex and embedded geophysical models: the example of turbulent closure in the ocean*, 13, Journal of Advances in Modeling Earth System, 2021.
- [2] R.B. Almelah and V. I. Shrira , *Upper-ocean Ekman current dynamics: a new perspective*, 887:A24., J. Fluid Mech., 2020.
- [3] T. Bodnár and P. Fraunié , *Computational assessment of mass-diffusive compressible fluids flows models*, J. Phys.: Conf. Ser. , 2024.
- [4] Yu. D. Chashechkin , A. Yu. Ilinykh , *Banded Structures in the Distribution Pattern of a Drop over the Surface of the Host Liquid*, Vol. 63. No. 7. P. 282–287, Doklady Physics, 2018.
- [5] Sentchev A., Forget P., Fraunié P., *Surface current dynamics under sea breeze conditions observed by simultaneous HF radar, ADCP and drifter measurements* , 67, 3-4., Ocean Dynamics, 2017.