STUDY OF DENSE JET DISCHARGES PARAMETERS OF DESALINATION PROCESSES IN COASTAL WATERS. NEAR FIELD.

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Paper topic: Coastal risks and management, including climate changes

1. Introduction

Due to the effects of the climate change, the number of desalination plants will increase as an alternative to provide fresh water in many places around the world and in desertified areas. The worst consequences of using these technologies are the discharges on the marine ambient. Brine has a higher density than the receiving media and due to this difference a gravity current is formed over the benthonic communities. As consequence the most appropriate configuration ensures an adequate grade of dilution of the brine effluent. Until the moment the brine discharge near field has been studied in depth (Palomar et al., 2012), however the far field has been quite little studied.

In this paper we present some experiments analyzing the near field of the brine discharge under different conditions. Two scenarios will be tested in stationary and dynamic receiving ambient, in order to analyze the concentrations and the dilution of the saline effluents in coastal waters. This work is developed into a project (Spanish National Plan of R+D) which it will be concluded on 2014, and it embraces study the processes on far field also.

2. Experimental facilities

A wave-current flume of 25 m of length, 0.6 m of width and 0.8 m of depth was used to carry out the tests at the R+D Centre of Technological Innovation in Building and Civil Engineering (CITEEC, www.udc.es/citeec), University of A Coruña, Spain.

The chosen scale has been 1/50 according with the ranges found in previous works. The Froude similitude law was used to estimate the main physical magnitudes of experiments. The densimetric Froude number and Reynolds number are 17 and 1200 respectively. The nozzle diameter vary from 2 to 4 mm and the inclination angles of the nozzle are 30º and 45º in shallow waters experiments (H=30 cm) and 60º in deep waters tests (H=40 cm). Furthermore the behavior of the discharge is being studied under the effect of ambient currents. The difference of density between brine and receiving ambient was maintained constant in 2.7% for all tests.

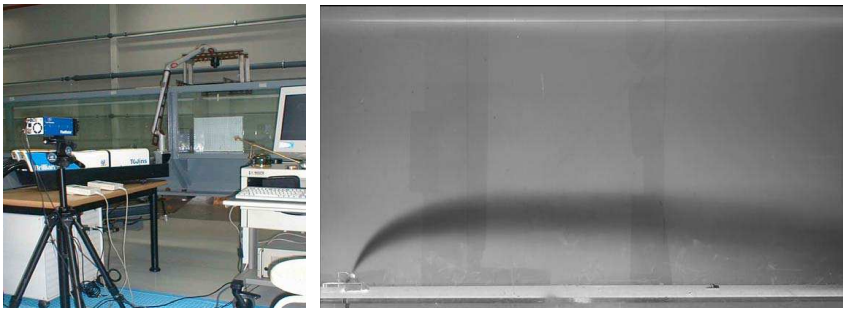

Figure 1. Experimental arrangement on wave-current channel

In order to determinate the velocity and concentration fields the Particle Image Velocity (PIV) and

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Laser Induced Fluorescence (LIF) respectively, are been used. Figure 1 shows a picture of the experimental arrangement and the brine visualization in the preliminary experiments.

3. Results

The paper will show the influence of the water depth in shallow waters and deep waters arrangements over the submerged discharge. Furthermore the ambient current velocity, as well as the geometric parameters of the discharge, nozzle diameter, inclination and velocity of the effluent, have been taken into account.

Currently the main geometric values of the jet trajectory were compared with analytical formulae developed by Kikkert (2007) and the theoretical results are adjusted very well to the experimental values obtained through usually visual techniques.

Actually the obtained data from measurements with PIV and LIF are being postprocessed (Figure 2). In this way the mixing processes between effluent and receiving water and the formation of hydrodynamic instabilities at the interface between both fluids such as the Kelvin-Helmontz instabilities will be presented. The used method to analyze the obtained data is similar to previously works of the research group and submarine outfall discharges (Figure 2).

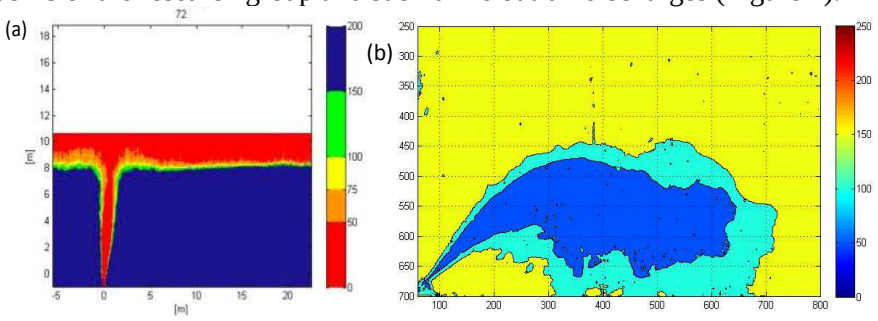

Figure 2. (a) Dilution flow map on submarine outfalls (Mera et al. 2010) and (b) jet trajectory of a submerged discharge processed with numerical tools

4. Acknowledgments

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5. References

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