CHAPTER 0.- INTRODUCTION AND OBJECTIVES.

To know the dispersion mechanism of substances in the water is basic to understand the environmental process and management in the marine hydrosphere, such as the coastal water bodies. In general, the substances of interest are mass, momentum and heat. More specifically, mass can represent any of wide variety of passive and reactive tracers, such as dissolved oxygen, salinity, heavy metals, nutrients and many others. Inside this group is included the “pollutants”. The definition of pollutant is a waste that is potentially harmful to life or has potentially detrimental effects on the health of the ecosystem. The distributions of the substances are associated with the natural processes that change concentrations. Theses processes can be categorised into two broad groups: transport and transformation. Transport refers to those processes that move substances through the hydrosphere and atmosphere by physical means. Transformation refers to those processes that change a substance of interest to another substance. However, it is quite often used the term transport, as well included the transformation part.

In the coastal water, such as the estuaries or lagoons, frequently appears gradients of salinity and density generally due to the mixing of the seawater and freshwater. The result, caused by the action of the gravity, is the tendency to cause vertical salinity stratification and a convection flow. In addition this flow is resulting from the interaction of tidal forcing, surface wind stress and irregular topography. Both, the complex flow behaviour and the stratification presence, has a primordial influence in the transport process.

The complexity of the phenomena of transport will be shown under analytical point of view. So, in the latest decades a numerical modelling tool for the prediction and evaluation has been developed, corresponding to the Computational Fluid Dynamics (CFD). Here such made has been used and enhanced as the purpose to improve the accuracy and stability prediction.

In this thesis is presented a study about the phenomena of the transport of pollutants in Stratified Coastal Water using a numerical model based in Finite Volume Methods and Unstructured mesh under the Eulerian philosophy. In this thesis has not been described the water model quality, that accounts the physical, chemical and biological transformation linked with the ecosystem.

The purpose of the report is to study and analyse the suitability of the numerical tools (Finite Volume and Unstructured Mesh) that have been used in a numerical model developed by the Danish Hydraulic Institute (see www.dhi.dk).

The content of the report is 6 chapters. First has been considered necessary to set up a review about the physical of the phenomena under stratification and its mathematical description (chapter 1 and 2). Next, in the chapter 3 has been described the numerical tools analysed (Finite Volume Method and Unstructured Mesh) and the numerical model used in the chapter 4. In the chapter 5 is described the development of a real
case applying the model. The application is a coastal lagoon in North Africa included in Melmarina project (www.geog.ucl.ac.uk/melmarina/index.stm). Finally, a discuss and conclusion has been done (Chapter 6).