AADI IN SITU HYPOXIA MONITORING SOLUTIONS APPLIED IN THE FRAMEWORK OF THE EU FP7 PROJECT HYPOX

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More than 100 investigators from 20 different partners are involved in the EU-project HYPOX (http://www.hypox.net/). A prime goal of the project is to improve the understanding and prediction of oxygen depletion in aquatic systems. Extensive in-situ monitoring is done using a wide range of platforms. This presentation intends to describe some of the systems in operation in Swedish fjords including a cabled observatory with direct data delivery to the Pangaea data base. The challenge to carry out long-term monitoring with maintained quality of oxygen and associated parameters will be discussed. Improved calibration procedures to reach better oxygen sensor accuracy and discovered artifacts at low currents will also be presented as well as results from recently developed CO2 optodes.

ENERGY FLUX IN THE GIBRALTAR STRAIT AND HOW THEY CAN BE USED AS A RENEWABLE ENERGY SOURCE

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Abstract: Within the emerging field of renewable energies, our country is pioneer in wind energy and it is relatively well placed in the solar energy ranking (both photovoltaic and csp). Other potential source of renewable energy which is virtually ignored in our country is the ocean (tidal surf) and also obtainable from the ocean currents. In this document, ocean currents as a renewable energy source in the Gibraltar Strait are studied. They must be intense, permanent and unidirectional to be profitable, therefore, we have found the places that satisfy those characteristics for installing a turbines.
Keywords: Gibraltar Strait - renewable energy - ocean currents – turbines.

INTRODUCTION.

For the extraction of energy from currents being cost-effective and technically feasible is desirable that the currents are unidirectional and intense. For example, the energy flux of a stable current and permanent of 1 ms-1 (reference figure for profitability) is about 500 Wm-2, therefore a windmill turbine blade, whose efficiency reaches values above 0,4 for three-bladed turbines (Burton et. al., 2001), which are more efficient than vertical axe ones of Darrieus type (Gorban et. al., 2001), it can give up to 60 kw in DC, equivalent to 0,52 Gwh per year. Today, the three-bladed turbine is the most profitable for generating electricity and it is the generator and system used in wind farms. When a turbine of this type is designed to work immersed in the sea, technical and cost reasons, it is desirable to maintain a fixed orientation, which places it at a disadvantage with their counterparts wind being oriented to face the wind and do not require therefore constant wind direction. A power plant based on the energy of ocean currents would have much higher yield, lifetime and lower maintenance costs were the more unidirectional currents.

It is not easy to find in the ocean areas that meet these two conditions, unidirectional and relatively high current intensity. Some examples are the major western boundary currents of the ocean basins (Gulf Stream, Kuroshio, Aghullas). The distance from the coast to where to locate the plant, which should be installed at the site near the core of the current, which tends to flow toward the outside of the continental shelf is typically tens of km, which would cause significant losses and high transport costs to bring the power generated to the grid. On our shores, certain areas of the Strait of Gibraltar with favorable conditions for the installation of power plants of this type and are located relatively close to shore. The Strait is a place where it has developed and continues to develop an intensive oceanographic research activity and its dynamics is fairly well understood. However, the places where the theory of the dynamics of water exchange predicts the existence of strong unidirectional currents are not fully described and missing details that are important when carrying out an engineering project aimed at extracting this kind of ocean energy. On the suitability of these sites and its potential as a profitable source of renewable energy is the focus of this work.

METHODOLOGY

The study was carried out considering two approaches: the first one from a numerical model with which they have mapped the flow of energy. The second, experimental data from instruments moored in various campaigns conducted by the Physical Oceanography group of the University of Malaga, which are included in the project of excellence P08RNM-03 738 (FLEGER) of the Junta de Andalucía.

The hydrodynamic model used for mapping of energy is the MITgcm general circulation model developed at the Massachusetts Institute of Technology (Marshall et al. 1997). The model has a high resolution in the direction along the axis of the Strait (dx = 50 m), lower in the transverse direction (d = 200 m) while dz = 7.5 m depth in the first 300m of the column water, gradually rising to 105 m to the bottom. Data also are high-resolution bathymetry, from the digitization of the chart published by Sanz et al. 2001.

The model reproduces satisfactorily the exchange medium and the dynamics of tides in the Strait (see Sánchez-Garrido 2009), and provides outputs of the hydrodynamic, salinity and temperature every 20 minutes during a simulation that covers a period of one tropical month. This reproduces the fortnightly cycle-neap tides.

The flow maps are in sections made in areas of interest drawn in order to describe them. These sections can be transverse, longitudinal and horizontal. These maps represent the average flow of energy distributed throughout the section, an additional distinction, as the forward direction of ocean currents, positive if it is coming to the Mediterranean and negative if it is to the Atlantic. On the other hand, we have developed maps with which to have information to help determine behavioral aspects of energy flows in each zone, for example, find the points where the percentage of times the flow is above a value threshold or, alternatively, the percentage of cases in which the currents do not deviate from the mean direction.

Parallel and from data provided by the moorings is to determine reliably the spatial and temporal distribution of the intensity of ocean currents to generate energy is most favorable to the lowest possible cost.

REFERENCES

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- *Gorban et al., 2001*
- *Sanz et. al. 2001*
- *Marshall et al. 1997*
- *Sánchez Garrido 2009*