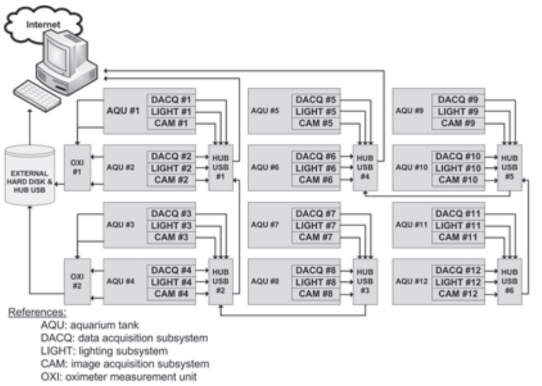


***Fig. 2. Complete system structure***

A laptop cumputer with a LabVIEW application developed [7] controls all the subsystems and stores IR signal and image data, also treats and processes the data applying a detection algorithm that uses an adaptative threshold to improve results. Finally a remote server application permits control the system and visualizes the experiments through Internet.

**Results**

Six successful experiments have been done up to the present and processed data is being analyzed by the biologists. These investigators are finding enlightening results of the emergence activity biorhythms of the Nephrops Norvegicus useful for their research and will be published in a near future. The first conclusions during the first analysis are that activity is noticeably nocturnal and the same behavior is repeated day after day following a pattern.

**Conclusions**

A distributed system has been developed, this design offers great flexibility and is easily expandable; it is enough repeating the subsystems necessary and connects them to the central computer throught USB ports. Two were the interfaces that adjusted to this design: USB and Ethernet, we implemented with the first one because gave more versatility and using the bus power lines avoid external power supply for each device.

Multiple cameras image acquisition is not supported by the software driver NI-IMAQ for USB Cameras for LabVIEW. This problem we have solved with Matlab and the image acquisition toolbox. Since is possible to call Matlab scripts from LabVIEW we have integrated all the interface, system acquistion control and data treatment in LabVIEW. At the moment only the images are stored, we are working for a vision alogrithm and a subtract of equidistant images are giving hopeful results and will permit to contrast and complement the results already obtained with infrared barriers.

Is important to indicate that the system can be used in other biological experiments solving and offering a nonexistent technology in the market.

**Acknowledgements**

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**References**

[1] E.L. Dereniak, G.D. Boreman, Infrared detectors and systems, 1996, John Wiley & Sons.
[2] E.R. Loew, Light and phtoreceptor degeneration in the Norway Lobster Nephops norvegicus (L.), 1976, Proc. R. Soc. London B. 193:31-44.
[3] N.G. Jerlov Optical Oceanography, 1968, Elsevier, Amsterdam.
[4] J.M. Angulo, S. Romero, I. Angulo, Microcontroladores PIC, diseño práctico de aplicaciones, segunda parte, 2000, Mc Graw Hill.
[5] J. Axelon, USB Complete. Everything you need to develop custom USB peripherals, 2005, Lakeview Research
[6] A. De la Escalera Hueso, Visión por computador, fundamentos y métodos, 2001, Prentice Hall.
[7] A. Mànuel, J. del Río, LabVIEW 7.1 Programación gráfica para el control de instrumentación, 2005, Thompson.

# COASTAL DYNAMICS INSTRUMENTATION IN THE BASQUE COUNTRY REGION

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One of the main objectives of Operational Oceanography is to obtain organised and long-term routine measurements of the seas, oceans and atmosphere, and provide their rapid interpretation and dissemination [1] [2] [3]. Variables such as marine currents, sea temperature and salinity, wave height and period, wind stress, heat fluxes between atmosphere and ocean are fundamental to get an accurate description of the marine and atmospheric environment, and therefore, bring an efficient Operational Oceanography System on stream. This information can be obtained by means of appropriate instrumentation, which must be of an accurate and robust quality and this requires routine maintenance tasks.

The oceano-meteorological instrumentation network in the Basque Country region (Fig.1) consists of: 1) six coastal oceano-meteorological stations located at Bilbao, Bermeo, Ondarroa, Getaria, Pasaia, and Hondarribia; 2) two offshore buoys (Wavescan), moored off Matxitxako and off Donostia, at 550 m and 450 m water depth, respectively, which provide real time data of the main oceanic and meteorological variables at fixed points, giving reference information for the Basque coastal and oceanic regions (http://www.azti.es; http://www.euskalmet.net ).
This study has been focused on data from the pilot coastal station, set up in 2001 in front of the entrance to the harbour of Pasaia (Fig.1). The location selected for the station is a light post which is mounted on a rigid structure attached to the seabed at 25m water depth. Six years time series of meteorological parameters, water temperature and currents over the water column have been processed with specific tools of quality control, statistics and components analysis. In particular, local patterns of currents have been described by studying the correlation between wind and surface currents. The information obtained from surface tracking with a bottom mounted current profiler can be very useful for modelling satisfactory wind driven circulation.

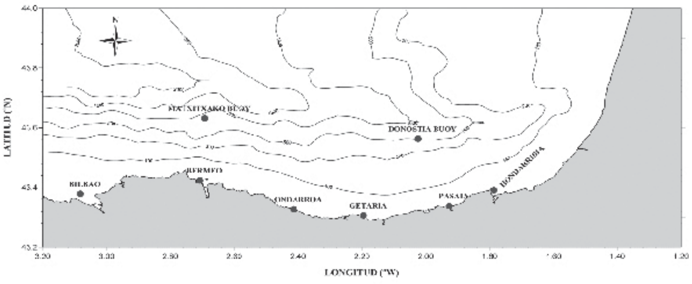


***Figure 1: Study area with coastal and offshore stations of the Basque Meteorological Agency network.***

For the corresponding instrumentation, this work included intercomparison between the bottom mounted ADCP Aanderaa DCM12 of the Pasaia station and a RDI WH600. Both were used for water profiling and surface tracking.

Moreover, the littoral patterns measured in Pasaia station have been compared to offshore patterns observed with the recently moored buoy offshore Donostia (from January 2007). The understanding of coastal particularities can be a key point for improving hydrodynamic modelling [4] [5]. In that context, the observing system will be implemented in 2008 with the addition of a high frequency radar system, which will provide information of current field, with a resolution of 6 km.

**References:**

[1] Behrens H.W.A., J.C. Borst, J.H. Stel, J.P. van der Meulen and L.J. Droppert. 1997. Operational oceanography, Proceedings of the first international conference on EuroGOOS, 7-11 October 1996, The Hague, The Netherlands. Elsevier Oceanography Series 62: 757pp.
[2] Dahlin H., N.C. Flemming, K. Nittis and S.E. Petersson. 2003. Building the European capacity in operational oceanography, Proceedings of the third international conference on EuroGOOS, 3-6 December 2002, Athens, Greece. Elsevier Oceanography Series 69: 714pp.
[3] Flemming N.C., S. Vallerga, N. Pinardi, H.W.A. Behrens, G. Manzella, D.Prandle and J.H. Stel. 2002. Operational oceanography: implementation at the European and regional scales. Proceedings of the second international conference on EuroGOOS, 11-13 March 1999, Rome, Italy. Elsevier Oceanography Series 66: 572pp.
[4] Fontán, A., J. Mader, M. González, A. Uriarte, P. Gyssels and M. Collins, 2006. Hydrodynamics between San Sebastián and Hondarribia (Guipúzcoa, Northern Spain): field measurements and numerical modelling. Scientia Marina. volume 70 (Suppl 1) of Scientia Marina
[5] González, M., A. Uriarte, A. Fontán, J. Mader and P. Gyssels, 2004. Marine Dynamics (In Oceanography and Marine Environment of the Basque Country), Elsevier Oceanography Series nº70, 133-157

# MULTIFRACTAL ANALYSIS OF SAR OF THE OCEAN SURFACE, CURRENTS, EDDY STRUCTURE, OIL SLICKS AND DIFFUSIVITY ANALYSIS

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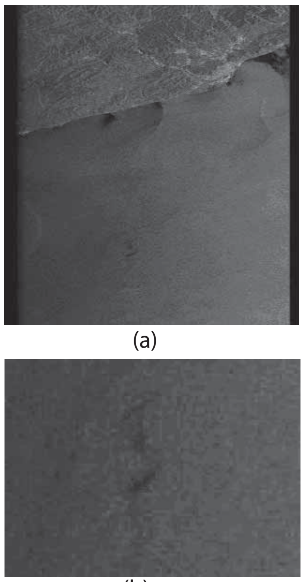
**1. Introduction**

The use of Synthetic Aperture Radar (SAR) to investigate the ocean surface provides a wealth of useful information. Here we will discuss some recent fractal and multifractal techniques used to identify oil spills and the dynamic state of the sea regarding turbulent diffusion. The main objectives is to be able to parametrize mixing at the Rossby Deformation Radius and aid in the pollutant dispersion prediction, both in emergency accidental releases and on a day to day operational basis. Results aim to identify different SAR signatures and at the same time provide calibrations for the different local configurations that allow to predict the behaviour of different tracers and tensioactives in the sea surface diffused by means of a Generalized Richardson's Law [1-3]. The diffusion of oil spills and slicks in the ocean (Figure 1) have been also investigated using the same multifractal techniques developed by [1, 3]. Different cases are studied analyzing mixedness, and multifractality [2].

**2. Results and Discussion**

Experimental and Geophysical observations are investigated with multiscale fractal techniques in order to extract relevant information on the spectral characteristics of mixing and diffusive events. Both density and tracer marked oil spills and slicks are investigated in detail using third order structure function analysis that indicates strong inverse cascades towards the large scales producing spectral variations [4]. The different local mixing processes are compared by mapping their different multifractal scaling. Several uses of this new technique are proposed [5-8] taking advantage of Zipf's Law, both for anthropogenic oil spills and other features, it is possible to predict the likely probability of oil spill accidents of different sizes, as well as the local eddy characteristics that strongly influence the turbulent horizontal diffusivity, K(x,y).



(a)

(b)

***Figure 1. Example of an oil spill affected by a local vortex south of Barcelona.***
***a) SAR ENVISAT frame.***
***b) detail at higher resolution***

Both numerical simulations [4] and laboratory experiments confirm the conditions for hyperdiffusion ( $D^2 = c\,t^{n(f,N)}$ with $n(f,N) > 3$ ) to exist, as well as the trapping associated with coherent structures and vortices in the ocean, which are well detected under the Weilburn distribution of prevailing winds in the NW Mediterranean Sea..