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FerryBox

From On-line Oceanographic Observations to Environmental Information

Report and Draft Scientific Papers on Water Mass Movement

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Document Reference Sheet

This document has been elaborated and issued by the European FerryBox Consortium.

P 1	**GKSS**	**GKSS Research Centre** **Institute for Coastal Research**	**Coordinator**
P 2	**NERC.NOC**	**NERC.NOC – National Oceanography Centre** **Southampton University and National Environment Res. Council** formerly NERC.SOC – Southampton Oceanography Centre	
P 3	**NIOZ**	**Royal Netherlands Institute of Sea Research**	
P 4	**FIMR**	**Finnish Institute of Marine Research**	
P 5	**HCMR** (formerly NCMR)	**Hellenic Centre for Marine Research** (formerly National Centre for Marine Research)	
P 6	**NERC.POL**	**Proudman Oceanographic Laboratory**	
P 7	**NIVA**	**Norwegian Institute for Water Research**	
P 8	**HYDROMOD**	**HYDROMOD Scientific Consulting**	
P 9	**CTG** **(formerly CIL)**	**Chelsea Technology Group** **(formerly Chelsea Instruments Ltd.)**	
P 10	**IEO**	**Spanish Institute of Oceanography**	
P 11	**EMI**	**Estonian Marine Institute** (in cooperation with the Estonian Maritime Academy)	

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1 Objectives

Overview

The key project objectives in WP4 were to provide a scientific support for the principle that FerryBoxes can deliver information of immediate scientific value, based on a coordinated approach which can quantify environmental variability on a European scale. It concentrated on 3 scientific areas relevant to issues of water quality, eco-system stability and climate variability and change.

(1) Eutrophication including plankton productivity and variability in productivity in relation to physical and biogeochemical constraints.

(2) Transport of sediments (and associated contaminants) over long and short spatial and temporal scales.

(3) Determination of the stability and transport of water masses.

It implemented and tested the procedures and software developed in WP-2 and WP-3. The work was structured to provide a basis for the calibration and validation of the associated models developed in WP-5.

1.1 Task 4-5 – Analysis of Data with Respect to Water Mass Movement and Climatic Forcing

Water Masses FerryBoxes can accurately and precisely determine the variations in water mass properties, like water mass movement and formation.

Specifically:

(a) Fronts limit mixing of waters and effect sediment transport and enhance productivity

(b) Movement of fronts can be determined.

(c) Deep winter mixing results from cooling rather that specific storm events

(d) The most significant transports of water are storm driven in winter.

2 Results and Achievements

Representatives from all the partner institutions attended a meeting organised by NERC.NOC and hosted by NIOZ in February 2004 to develop a systematic basis for distinguishing the differences between the FerryBox routes and observations. These ideas were further discussed at the FerryBox Science Conference held at NERC.NOC in October 2004.

The procedure has now been applied to compare the data from the different routes for the two FerryBox years 2003 and 2004 where this data is available. It is proving to be an effective way of summarising the data as it enables the display of significant difference between the years such as the higher temperatures seen in the Bay of Biscay in 2003 and in the Gulf of Finland in 2004 and the shift in fresh water inputs in the Bay of Biscay between 2003 and 2004. From this has developed ways of presenting and summarising the data as displayed in Figures provided by FIMR in the FerryBox deliverable and report D 4-3.

Another example is provided by the Irish Sea were the data from the NERC.POL route (Howarth et al, paper 3) has helped improve the definition of the different hydrographic zones and frontal areas. The NERC.POL FerryBox operates between Birkenhead and Belfast and crosses six different hydrodynamic regions. This data has proved valuable for testing the output of numerical models (Korres et al., Paper 12).

Similar use has been made of the data from the HCMR route between Athens and Iraklion (Kontoyiannis & Ballas, EuroGOOS Conference paper 2005, “The scales of the surface temperature and salinity fields in the southern Aegean Sea as derived from Ferry-box space-series measurements”).

In the southern Bay of Biscay IEO – Gonzalez-Pola et al. (Paper 4) have used the geographical coincidence of a FerryBox route in the south-eastern corner of the Bay of Biscay with a standard hydrographical section and satellite data. The different time series have been compared to analyse the capability of the systems to provide long-term high-resolution high-quality hydrographical time-series of the upper ocean. The inter-comparison exercise is based mainly in the Sea Surface Temperature (SST) as it is a well understood parameter dominated by a strong seasonal signal. The work demonstrates the ability of FerryBox systems to capture information on local short-scale features which may be lost with other sampling systems.

In the English Channel NERC.NOC – Kelly-Gerreyn et al. (Paper 7) used the detailed time series from the FerryBox in conjunction with data for French river run off to identify for the first time that French Atlantic coast rivers are a major source of lower salinity waters which are frequently observed in the English Channel in summer and may be connected to the enhanced growth of nuisance algae in some years (Kelly Gerreyn et al., paper 9).

This work of Kelly-Gerreyn et al (paper 7) is based on the data from the NERC.NOC FerryBox servicing between Portsmouth and Bilbao provides evidence that Ferrybox data meet the aims of our target hypotheses.

It provides information of values to improving understanding of:

(1) Fronts limit mixing of waters and enhance productivity

(2) Determination of movements of fronts

This can be seen in the Figure 2-1. The frequent FerryBox measurements enables to the movement of fresher water (and associate fronts) from the French Atlantic coast to be traced into the English Channel. Work on this same ferry route looking at changes in nutrient concentrations over the winter periods in 2003, 2004 and 2005 has provided evidence to test hypotheses 3 and 4 (Hydes et al., paper 2).

(3) Deep winter mixing results from cooling rather that specific storm events

(4) The most significant transports of water are storm driven in winter.]

Nutrient concentrations is Bay of Biscay surface waters were twice as high at the end of winter 2005 as they were in 2003 and 2004, due to different in the depth to which the waters of the Bay were mixed by winter storms.

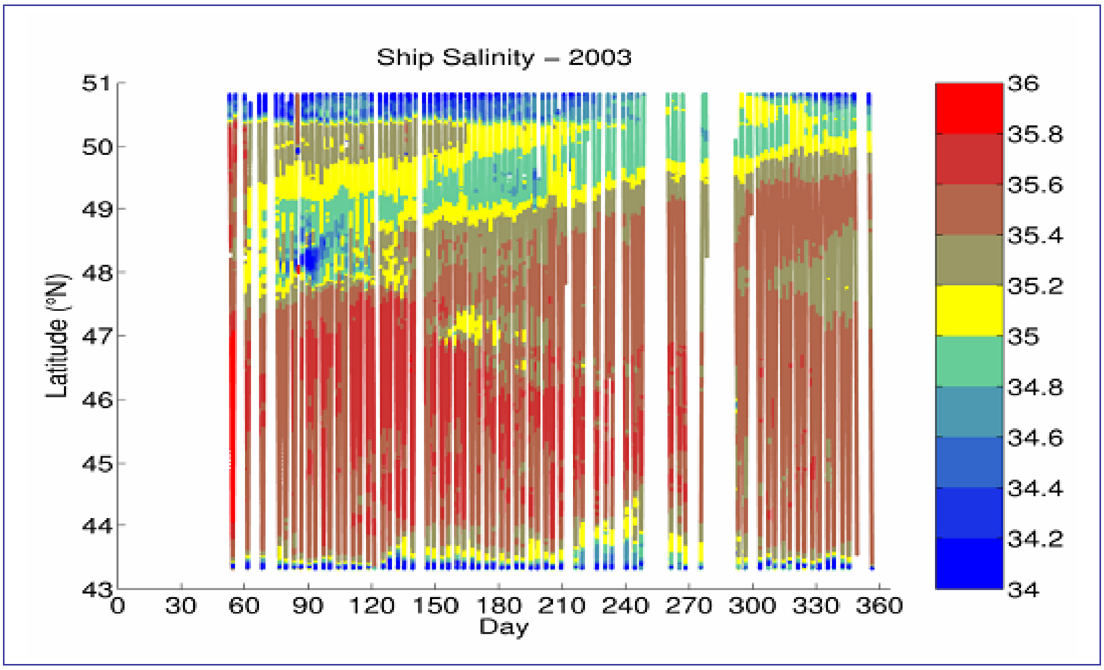

Figure 2-1: Sea surface salinity between Portsmouth and Bilbao in 2003 showing timing of the progress of low salinity waters into the western English Channel.

Please find the drafts of the scientific papers as Annex to the Final Report.