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Open Access Earth System Science Data Discussions

FerryBox Data in the North Sea from 2002 to 2005

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Data coverage and parameters measured

Repository reference: continuous thermosalinograph data
Available at: Transect: Cuxhaven (GER) to Harwich (GB)
Ship name: “Admiral of Scandinavia” and “Duchess of Scandinavia”
Date/time start: 01 March 2002
Date/time end: to 24 October 2005

Abstract

From 2002 to 2005 a FerryBox system was installed aboard two different ferries traveling between Cuxhaven (GE) and Harwich (UK) on a daily basis. The FerryBox system is an automated flow-through monitoring system for measuring oceanographic and biogeochemical parameters installed on ships of opportunity. The variables were recorded in a time interval of 10-20 seconds corresponding to a spatial resolution of about 100m. The dataset provides the parameters water temperature, salinity, dissolved oxygen and chlorophyll-a fluorescence. There is a longer data gap between November 2002 and August 2003 in the time series due to a change of the vessel in October 2002. The data are available at doi:10.1594/PANGAEA.883824 and as part of the COSYNA data portal CODM at http://codm.hzg.de/codm or doi:10.17616/R3K02T.

Introduction

Monitoring of a highly dynamic system such as coastal waters requires dense sampling in space and time in order to catch short-term event, which might have a strong impact on the coastal ecosystem. Existing observations mostly lack the spatial coverage and temporal resolution required to determine the state of the marine environment and changes therein.

While running more or less the same track, in each transect the spatial and temporal resolution of observations is very high along the route of the ferries. The data of FerryBox systems are restricted to the track and to surface waters at a certain depth (inlet of the FerryBox).

Here, we present a data set of surface water temperature, salinity, chlorophyll-a fluorescence and dissolved oxygen from March 2002 to October 2005. Due to a change of the vessel in

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October 2002 there is a data gap in the time series between November 2002 and August 2003.

Materials and Methods

FerryBox / study area

Route: Harwich (51.93°N, 1.31°E) to Cuxhaven (53.88°N, 8.71°E) –

The FerryBox system was installed on the route between Cuxhaven (Germany) and Harwich (Great Britain) onboard of the ferry 'Admiral of Scandinavia' (DFDS Seaways, Copenhagen, Denmark) from Feb 2002 – Oct 2002 and on board of the ferry 'Duchess of Scandinavia' (DFDS Seaways, Copenhagen, Denmark) from Sep 2003 – Oct 2005.

The FerryBox continuously measures oceanographic parameters in a flow-through system. The water intake was from the sea-chest at the front of the ship's cooling system at a fixed depth (5m) from where the water was pumped continuously. A debubbling unit removes air bubbles, which may enter the system during heavy sea. Coupled to the debubbler is an internal water loop in which the water passes the different sensors. Biofouling is effectively prevented by automatic cleaning of the sensors with tap water, and by rinsing with acidified water after each cruise when the vessel is in the harbour. The basic sensors used measure temperature and salinity. In addition, an oxygen sensor (Clark electrode and later on an oxygen optode) is installed. Furthermore turbidity and chlorophyll-a fluorescence have been measured (Petersen et al. 2003, Petersen et al. 2014). Chlorophyll-a fluorescence data are

Table 1: Specifications of sensors in the FerryBox system as reported by the manufacturer

Parameter	Range	Unit	Accuracy	Resolution	Uncertainties or bias	Instrument, Manufacturer
water temperature	-10 to 50	°C	0.1	0.01	due to heating up in the tubes (max. 0.5°C)	Excell ETSG 2, Falmouth Scientific Inc., USA
salinity	0 to 50		0.02	0.001		
turbidity	0 to 9999	FNU	10 %	0.01	offset due to small bubbles	TurbiMax W CUS 41 , Endress&Hauser, Germany
dissolved oxygen (Clark electrode)	1.5 -625	µmol/l	1%	0.3		Oxymax W COS41 Endress&Hauser, Germany
dissolved oxygen (Optode)	0 – 500	µmol/l	8 or 5%	1		Optode 3830, Aanderra, Norway
chlorophyll-a fluorescence	0 to 200	µg/l	10%	0.5	changing fluorescence yield	SCUFA-II, Turner Design, USA
turbidity -Turner	0 to 50	NTU		0.05	offset due to small bubbles	

provided in this data set which were not calibrated against chlorophyll-a analysed in the lab. As the chlorophyll-a fluorescence yield depends on several factors (light conditions, species and physiologic status of the algae) these chlorophyll data may have high uncertainties in comparison to total chlorophyll-a. The technical specifications of the sensors are shown in Table 1.

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An automated refrigerated water sampler was used to collect seawater at predefined positions and/or in an event controlled mode for subsequent laboratory analysis and quality assurance. Housekeeping parameters such as flow rates and pressures inside the water loops were measured to supervise the system. The ferry travelled across the southern part of the North Sea covering the coastal zones of Germany and the Netherlands and crossed the inflow of the English Channel into the North Sea. The map of the route is shown in figure 1. The ferry travelled daily between the two ports, mainly overnight.

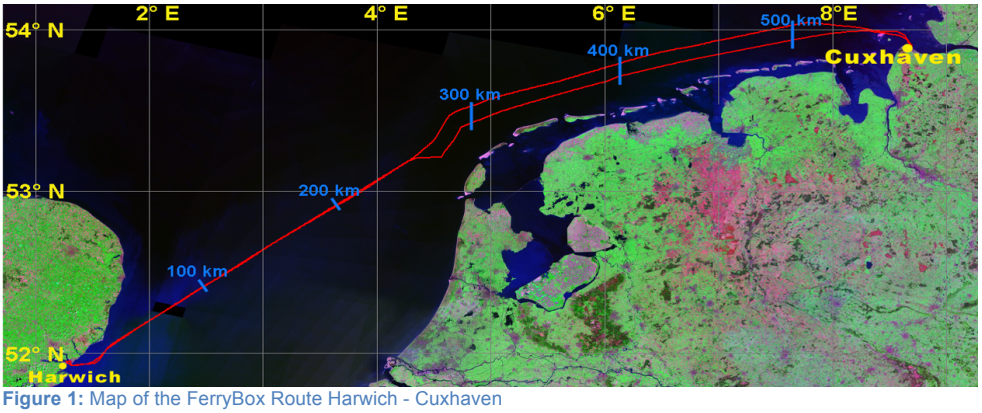

Figure 1: Map of the FerryBox Route Harwich - Cuxhaven

The FerryBox was maintained at least fortnightly and bottle samples were taken regularly from the automatically sampler for subsequent lab analysis.

The water temperature measured by the FerryBox has a bias due to heating up by the pump in the tubes connecting to the FerryBox. The temperature offset between the intake and the FerryBox were maximally up to 0.4°C, based on measurements with a sensor at the intake and the sensor in the FerryBox. Spatial resolution of recording was about 100m. Bottle samples for measuring salinity in the lab were collected in 1L glass bottles and determined with a lab salinometer (8410A Portable Salinometer, OSIL, UK). The lab salinometer was calibrated at the beginning and at the end of each run by certified reference material (CRM). An example of validation of the salinity data by analysis of bottle samples is shown in Figure 2 from three cruises in 2005. The agreement with the field measurements was always very good.

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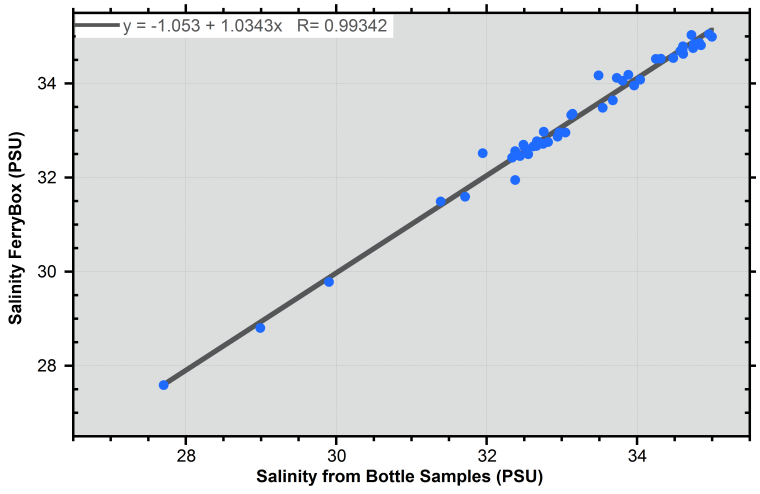

Figure 2: Validation of salinity data: Comparison of bottle samples measured in the lab with data obtained from FerryBox

The oxygen sensor (Clark electrode) was regularly calibrated against 100% water saturated air during maintenance intervals. According to the manufacture the accuracy is ±1% of the measured value. In the field the accuracy was in the order of 1-2%. As biofouling was prevented by automated regular cleaning of the entire system the oxygen sensor remained quite stable between the maintenance intervals.

The data were imported into the HZG FerryBox database and are used as a part of COSYNA described in (Baschek et al. 2017). Data are accessible via the COSYNA data portal (http://codm.hzg.de/codm) described in Breitbach et al. (2016) as well as by accessing the FerryBox database (http://ferrydata.hzg.de) directly. Figure 2 (temperature and salinity) and Figure 3 (oxygen and fluorescence) give an overview for all data using the scatter plot feature of the web interface of the FerryBox database. It is also possible to visualize transect data with the Sensor Observation Service using the FerryBox database (e.g. SOS ferrydata)

From the COSYNA database the data were exported in netCDF format following OceanSites conventions[1] to be compliant with CMEMS. These netCDF files were used to import the data into PANGAEA.

[1] http://www.oceansites.org/docs/oceansites_data_format_reference_manual.pdf

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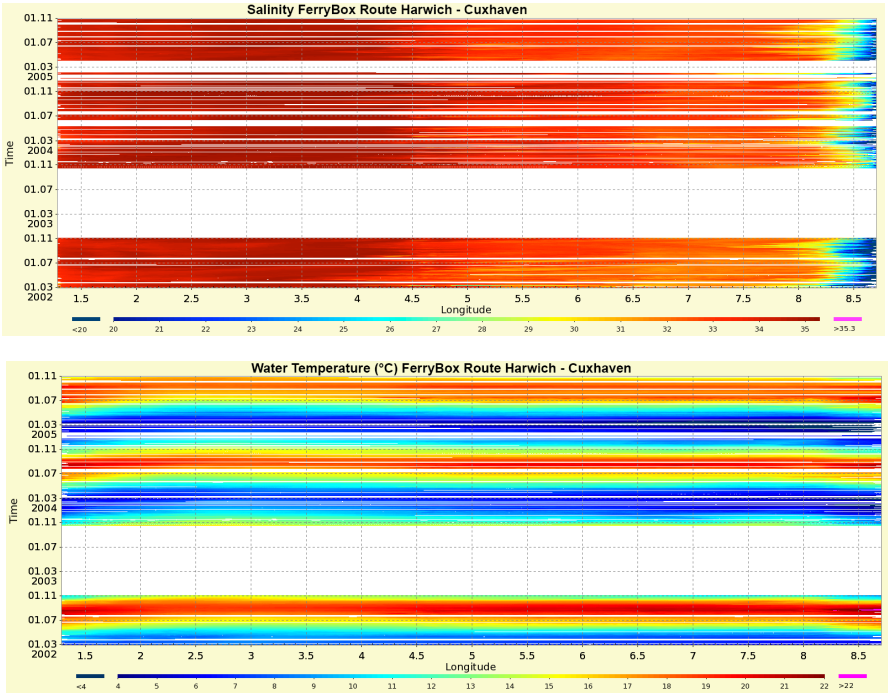

Figure 3: Water temperature (lower panel) and salinity (upper panel). Pooled data from all transects.

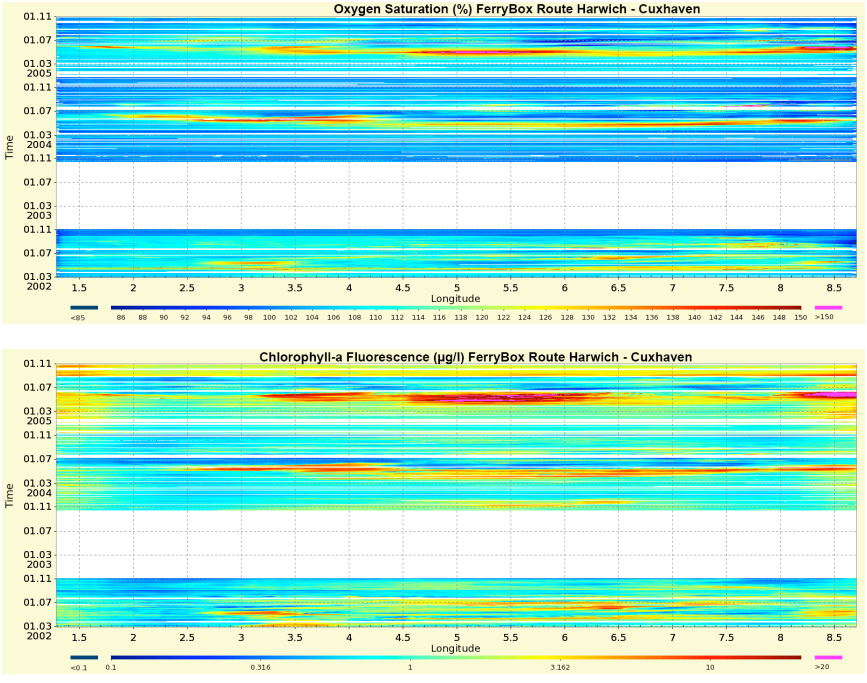

Figure 4: Oxygen saturation (upper panel) and chlorophyll-a fluorescence (lower panel). Pooled data from all transects.

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