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# GENERAL INFORMATION ON THE DATA, COLLECTED DURING THE EXPERIMENT POLRODEX '97

**Abstract**

*The HIROMB model for the Baltic Sea hydrodynamic forecast, at present being run pre-operationally in SMHI, covers completely the Polish exclusive economic zone of the sea. The measuring campaign POLRODEX '96 was organised and co-ordinated by the Maritime Institute especially for calibration and verification of numerical models in summer 1996 in the Gulf of Gdańsk. Five Polish and one Swedish institution were involved in the campaign. After the experiment, which resulted in many valuable materials, it was decided to continue such campaigns every year. In 1997, also in the Gulf of Gdańsk, a new experiment POLRODEX '97 was organised, in which thirteen institutions from Poland, Russia and Sweden participated. A list of the data, collected during the POLRODEX '97, is provided.*

## 1. Introduction

Information on the current meteorological and hydrological situation and its reliable short-term forecast is very important for search and rescue actions, combating oil and chemical spills in the sea. Measurements of the atmosphere and the sea parameters in the open sea area are very expensive. Mathematical models of the atmosphere and the sea enable us to have, at our disposal, not only the digital information on the present state over the large areas, but also the forecast for the atmosphere and the sea. Such models, however, need their validation, and it means that the expensive in situ measurements are necessary, at least in some places and from time to time.

At present, there is one, common for the Baltic states, model of hydrodynamic forecast - the HIROMB model, which is being run pre-operationally in Sweden. In summer 1996 in the Gulf of Gdańsk, especially for the model validation purposes, the measuring campaign was organised and co-ordinated by the Maritime Institute. Five Polish institutions and one Swedish institute were involved in the campaign. After the experiment, which resulted in many valuable materials, they decided to continue such campaigns every year, in order to collect validation data under different meteorological and hydrological conditions.

## 2. Scope of the experiment

In September 1997, also in the Gulf of Gdańsk area, within the open borders at 18°E and 55°30'N, a new experiment, POLRODEX '97, was organised. Thirteen institutions from Poland, Russia and Sweden participated in the experiment. The period of the most intensive measurements lasted from 22 to 26 September and the accompanying measurements were made between 2 and 30 September, 1997.

The following institutions were involved in the experiment:

a) numerical forecast:
   - Swedish Meteorological and Hydrological Institute, Norrköping, (SMHI);
   - Interdisciplinary Centre of Numerical and Computational Modelling, Warsaw University, (ICM);

b) measurements:
   - Institute of Hydroengineering, Polish Academy of Sciences, Gdańsk, (IH PAS);
   - Institute of Meteorology and Water Management (Maritime Branch), Gdynia, (IMWM MB);
   - Institute of Oceanography, University of Gdańsk, (IO UG);
   - Institute of Oceanology, Polish Academy of Sciences, Sopot, (IO PAS);
   - Marine Hydrographic Office, Polish Navy, Gdynia (MHO PN);
   - Maritime Administration, Gdynia, (MA);
   - Maritime Institute, Gdańsk, (MIG);
   - Oil and Gas Underwater Mining Company "PETROBALTIC", Gdańsk, (PETROBALTIC);
   - Polish Ship Salvage Company, Gdynia, (PSSC);
   - P. P. Shirshov Institute of Oceanology (Atlantic Branch), Russian Academy of Sciences, Kaliningrad, (PPSIO AB);
   - Sea Fisheries Institute, Gdynia, (SFI).

In total, seven research vessels made measurements for "POLRODEX '97".

The measurements included:

a) meteorological observations from the sea and the land;
b) CTD measurements;
c) current measurements;
d) water level and pressure measurements;
e) dye tracing;
f) tracing of the dummy and the life raft.

In some cases, there were also made measurements of other parameters, like oxygen concentration. They are also included into the general data set. The weather (cloudiness) during the experiment did not permit to obtain significant material of satellite images for analysis.

The data, collected during the campaign, together with the meteorological forecast of ICM and hydrodynamic forecast from HIROMB, were recorded as one general data set on the CD-ROM and distributed to all participants.

The general data set contains also meteorological and hydrodynamic forecast for the area. It means that it was possible to analyse and compare modelled and measured meteorological (wind speed and direction, air pressure, air temperature etc.), hydrodynamic and hydrological (water level, currents, temperature, salinity etc.) parameters. Dye tracing gave data necessary for validation of oil spill drift models.

The institutions involved in the experiment decided that all results collected during the experiment are free for non-commercial purposes to all participants.

It is worth mentioning that POLRODEX experiment is regarded as a contribution to HIROMB Partnership. Now, HIROMB Partnership includes Denmark, Germany and Sweden. Finland and Poland are in the process of entering the Partnership. The Partnership is open for the all the Baltic states.

## 3. Experiment activities

The activities during the experiment can be divided into several main groups, depending on the measured parameters or place (phase) of the measurements. The spatial distribution of the measurements can be seen in Fig. 1. Table 1 shows time of the main stages of the experiment.

### 3.1. Meteorological observations

As wind forcing is the main driving force for the Baltic Sea water, reliable meteorological forecast over the sea is crucial for the hydrodynamic forecast.

The following stations are included into the data set:

— Gdańsk Port Północny (Northern Harbour) - wind records between 12 and 30 September, every 10 minutes (IH PAS);

— Gdańsk Port Północny - wind records between 1 and 30 September, every 3 hours (IMWM MB);

— Hel - wind records between 1 and 30 September, every 3 hours (IMWM MB);

— ZN4 station (54°40'N, 18°50'E) - standard meteorological observations every 3 hours (incl. wind speed and direction every hour), between 22 and 25 September (ORP „Arctowski");

— BETA oil rig (55°29'N, 18°11'E) - wind speed and direction, recorded irregularly (1-10 hours interval) between 21 and 28 September (PETROBALTIC).

### 3.2. Measurements at BETA oil rig (55°29'N, 18°11'E, bottom depth approx. 78 m)

— Continuous measurements between 11 and 30 September: water temperature, salinity, pressure, current velocity and direction with 3 S4 instruments, located at approx. 11, 35 and 67 m. Pilot institution: IH PAS.

### 3.3. Measurements on the ZN4 station (54°40'N, 18°50'E, bottom depth approx. 60 m)

— Vertical profiles between 22 and 25 September from the vessel ORP „Arctowski": water temperature and salinity - every hour. Pilot institutions: MIG, IMWM MB.

— Continuous measurements between 22 and 25 September at the mooring station: water temperature, salinity, pressure, current velocity and direction with the Aanderaa instrument, located at approx. 52 m depth. Pilot institutions: IH PAS, IMWM MB.

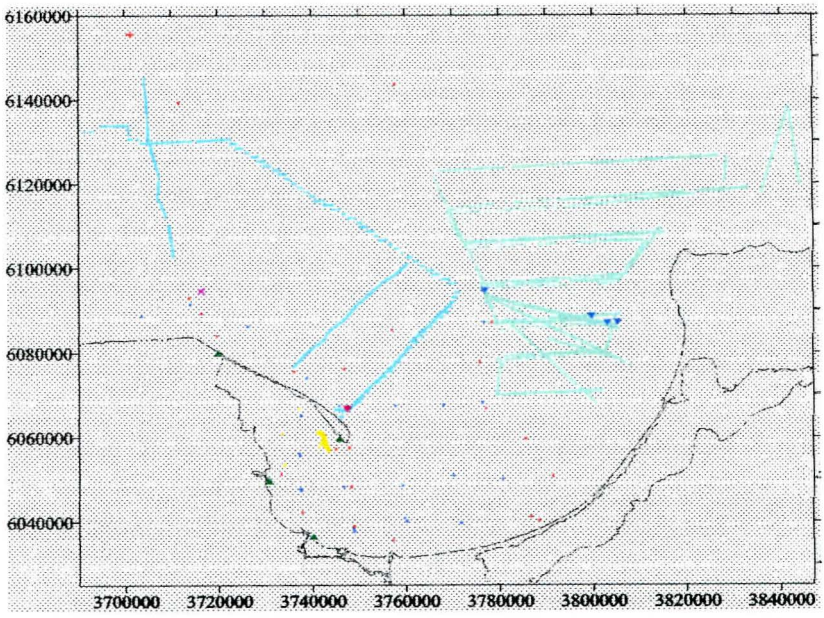


Fig. 1. The area of „POLORODEX '97" activities

Positions of mooring stations with current measurements are marked by navy blue (PPSIO AB stations) and claret (ZN4 station) triangles, the oil rig BETA is marked by the red cross. The dots correspond to CTD measurements: red ones - to the measurements made by IMWM MB, blue - IO PAS, green - PPSIO AB, navy blue - SFI, and gold - IO UG. The point of rhodamine release near Hel Peninsula is marked by the claret cross. Dark green triangles correspond to the IMWM MB and IH PAS water level stations.

— Continuous measurements at the autonomous buoy between 22 and 25 September ion: current velocity and direction with 3 BPV current meters, located at 10, 40 and 68 m depth. Pilot institution: IMWM MB.

### 3.4. Dye tracing

— Rhodamine and fluorescein solutions at both sides of the Hel Peninsula were released. Rhodamine solution was released on 22 September at the open sea and traced with the towed fluorimeter at 1 m depth. On 23 September, due to the strong wind, waves and intensive dye dilution, the process of tracing was stopped. Pilot institution: MIG.

— Next day, 24 September, fluorescein was released in the Bay of Puck, which is sheltered from strong winds and waves. The fluorescein drift was traced till 25 September. Pilot institution: IO UG.

### 3.5. Tracing of the dummy and the life raft

— The life raft and the dummy-man were released near the point of rhodamine release (pilot institutions: PSSC, MIG). Drift of objects in the sea depends mainly on their buoyancy, which is different for different objects and is time-dependent. Due to the weather

Table 1. Time schedule of performed measurements

| September 1997, days | 1 - 6 | 7-11 | 12-16 | 17-21 | 22 | 23 | 24 | 25 | 26 | 27-30 |
|---|---|---|---|---|---|---|---|---|---|---|
| Meteorological measurements in the open sea (ZN4) | | | | | X | X | X | X | | |
| Wind measurements in the open sea (oil rig BETA) | | | | X | X | X | X | X | X | X |
| Meteorological measurements at the coastal stations (IMWM MB, IH PAS) | X | X | X | X | X | X | X | X | X | X |
| Water level observations at the coastal stations (IMWM MB) | X | X | X | X | X | X | X | X | X | X |
| Mooring stations - current and CTD measurements at the fixed depths (PPSIO AB, IMWM MB) | | X | X | X | X | X | X | X | X | X |
| ZN4 station, regular CTD profiles from the vessel (MHO PN, MIG, IMWM MB) | | | | | X | X | X | X | | |
| CTD profiles and stations (PPSIO AB, IO PAS, IMWM MB, SFI, IO UG) | X | | X | X | X | X | X | X | X | X |
| Dummy-man tracing (MIG, PSSC) | | | | | X | | X | X | X | |
| Life raft tracing (MIG, PSSC) | | | | | X | X | | | | |
| Rhodamine and flurescein tracing (MIG, IO UG) | | | | | X | X | X | X | | |

conditions and different drift speed of different object, tracking of the life raft was stopped on 23 September. The experiment with the dummy-man was interrupted on 22 September and repeated between 24 and 26 September.

### 3.6. Measurements of water salinity and temperature fields

The idea of the salinity and temperature (density) investigations was to obtain as much information as possible on the thermohaline fields before and after the tracing experiments. A very large area was covered by the CTD-profiles. However, vessels participating in the experiment had also other duties and satisfactory synchronisation of the measurements could not be achieved.

— It shall be stressed that r/v „Professor Shtokman" (PPSIO AB) covered almost the whole Russian zone of the Gdańsk Deep with a very dense distribution of vertical CTD-transects.

— In the Polish zone operated: r/v „Oceania" (IO PAS), r/v „Baltica" (IMWM MB, SFI), r/v „Oceanograf 2" (IO UG).

### 3.7. Water level stations

— Water level records between 1 and 30 September from the stations of Gdańsk Port Północny, Gdynia, Hel and Władysławowo (every 4 hours) were provided by the pilot institution, IMWM MB.

## 4. Hydrodynamic and meteorological forecast

The CD-ROM data set includes:

— Time sequence between 11 September and 7 October of 6, 12, 18 and 24 h daily forecast from the HIROMB model, run in SMHI: water level, three-dimensional water temperature, salinity and current fields (at 14 depths), horizontal numerical grid of approx. 3 Nm resolution.

— Daily forecast of the mesoscale model of the atmosphere (UMPL), run in ICM - for 48 h: atmospheric pressure at sea level, wind speed and direction, time resolution 1 hour, horizontal resolution approx. 9 Nm.