# THE DGPS SYSTEM IMPROVES SURVEY OF OFFSHORE DEPTHS

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## ABSTRACT

**The article presents the results of research on possible applications of corrections from the reference DGPS station at Dziwnów during measurements of depth changes in an offshore area.**

## INTRODUCTION

**The knowledge of the magnitude of changes in seabed shape in the offshore area significantly helps to take protective measures. The measurement methods applied until recently, using optical geodetic instruments for the determination sounding positions on preset profiles, were not accurate enough. In order to improve the measurement accuracy, a DGPS system has been implemented, which was preceded by tests aimed at its applicability.**

## 1. SURVEY AREA

**The research covered an area along the coast between Mrzeżyno and Dźwirzyno (the section 345 – 348 km). The profiles for soundings, determined at 500 m intervals, were generally running pe**
**rpendicular to the coast line (Fig. 1). The DGPS system accuracy was tested at the geodesic point at Mrzeżyno.**

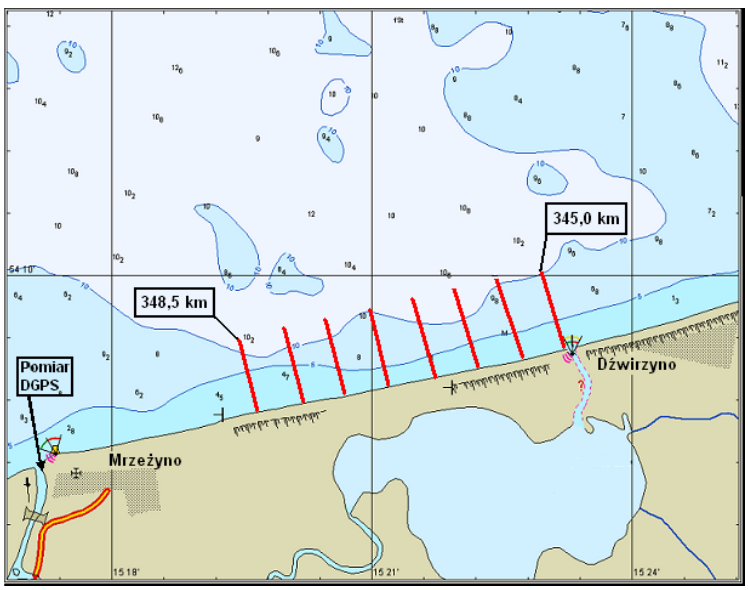


**Fig. 1. Area of survey with marked measurement points**

## 2. RESEARCH METHODS

**The data on the signal and position were registered by means of the following receivers: GPS Leica MX 9212, Leica MX 9400 N and a Leica MX 50R for the reception of reference corrections. The receiving aerial of the system was placed over Poland's geodesic network point located at the wharf in the harbour of Mrzeżyno. For the measurement point the following data were determined:**

- **average position of the measurement point,**
- **accuracy of position determination ($p$ = 95%).**

**After an analysis of the DGPS signal accuracy had been made, depth measurements were performed. The measurements were made with the above mentioned receivers in conjunction with echosounders DESO 15 and DESO 25 working on the 210 kHz frequency. The measuring equipment was fitted on vessels operated by the Maritime Office of Szczecin: *" UMS – 2"* and *"Hydrograf – 27"*. The data was gathered using the Profimap software developed by Atlas.**

## 3. RESULTS OF THE DGPS SYSTEM ACCURACY TESTS

**Figure 2 presents the statistics of distributions of the measured position of a certain point as compared to the reference geodesic position. Its accuracy was found to be 0.40 m at p = 95%. The measurements confirmed that it is possible to apply reference signals transmitted by the DGPS reference station at Dziwnów for measurements of changes in the sea depths along the coast.**

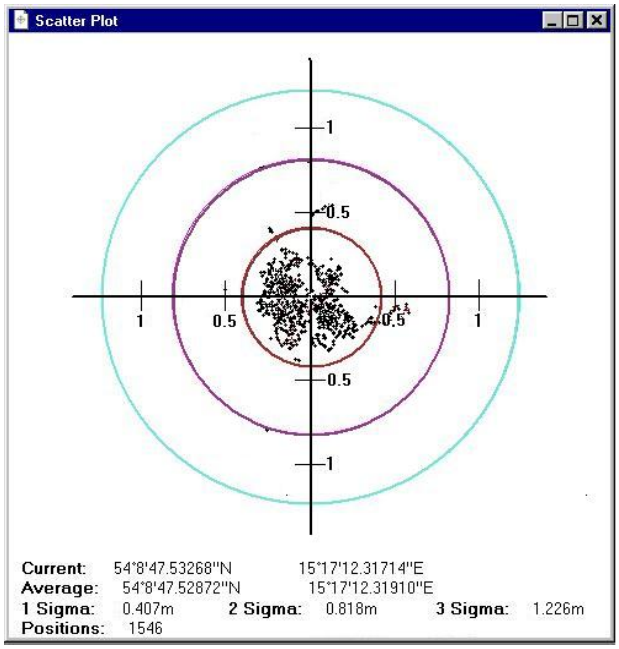


**Fig. 2. Accuracy of a DGPS system at a geodesic point in the harbour of Mrzeżyno**

## 4. DEPTH CHANGES ANALYSIS

**After an examination of the DGPS signal, depth measurements were performed. The measurement results are given in Table 1 and in charts presented below (Figures 3, 4, 5, 6, 7, 8, 9 and 10).**

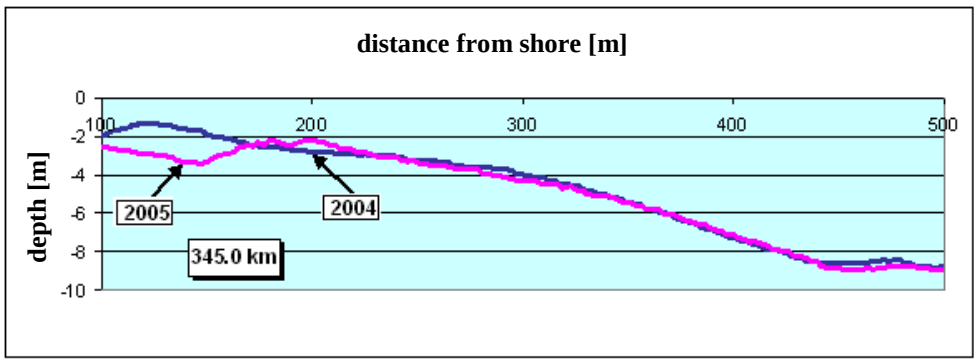


**Fig. 3. Distribution of depth measurement data at 345.0 km**

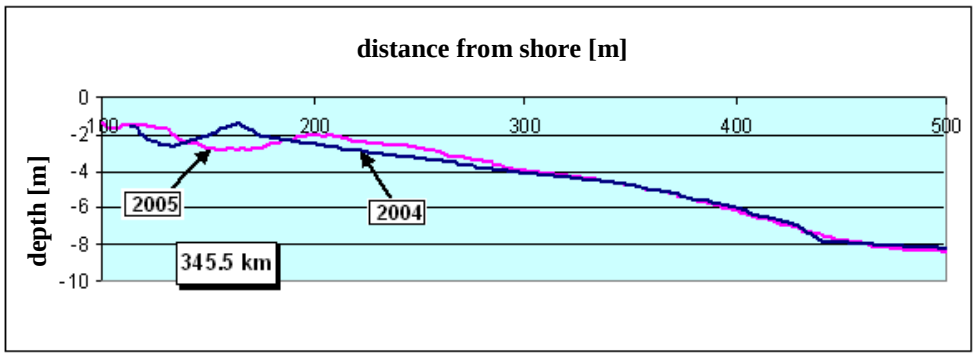


**Fig. 4. Distribution of depth measurement data at 345.5 km**

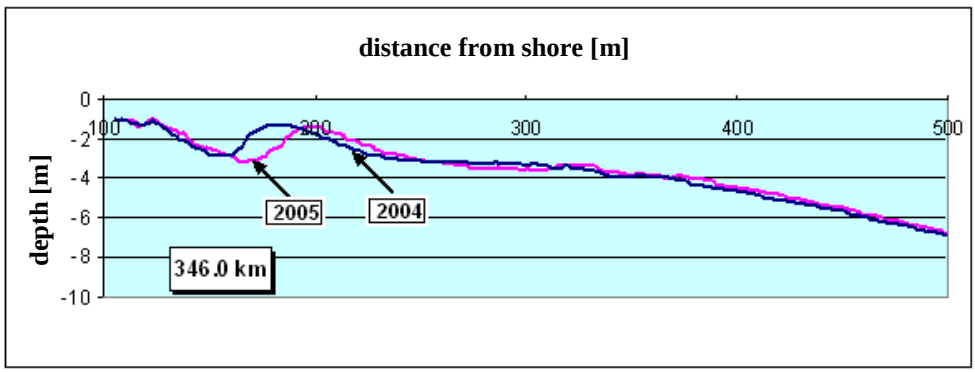


**Fig. 5. Distribution of depth measurement data at 346.0 km**

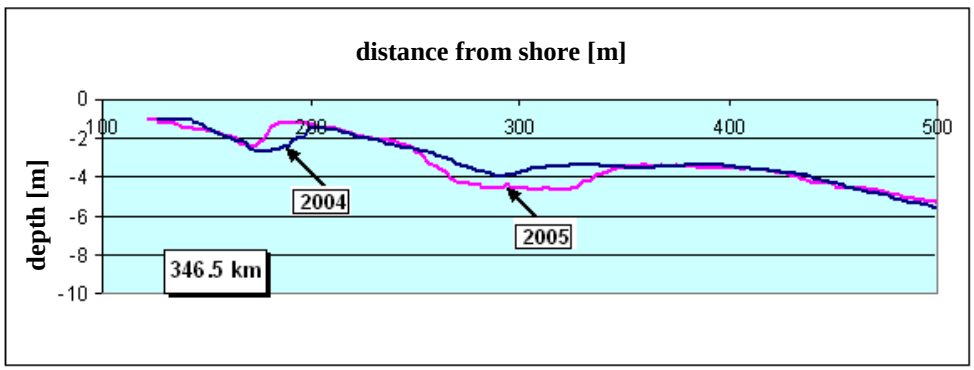


**Fig. 6. Distribution of depth measurement data at 346.0 km**

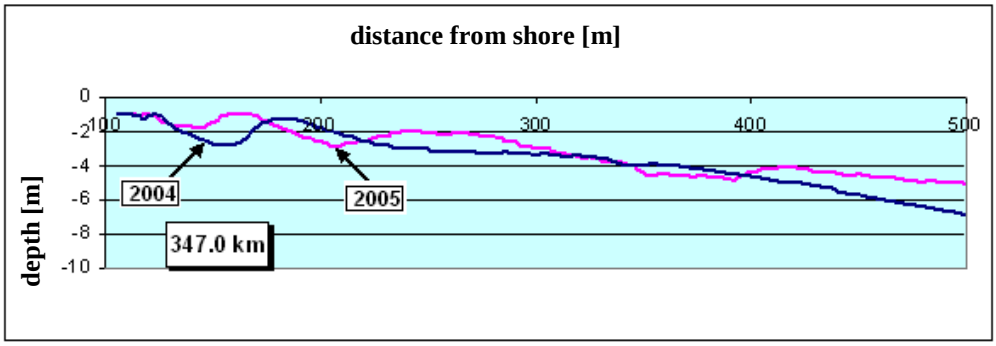


**Fig. 7. Distribution of depth measurement data at 347.0km**

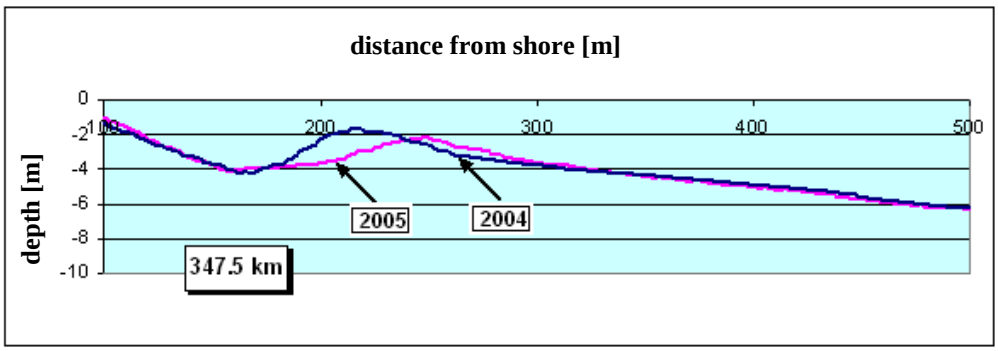


**Fig. 8. Distribution of depth measurement data at 347.5 km**

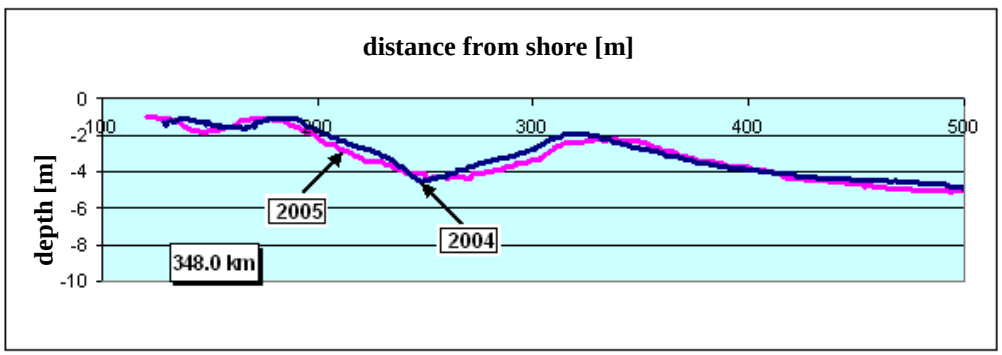


**Fig. 9. Distribution of depth measurement data at 348.0km**

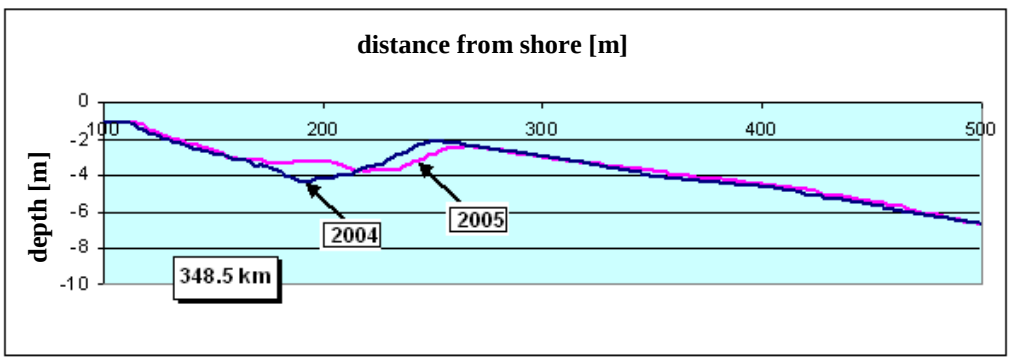


**Fig. 10. Distribution of depth measurement data at 348.5 km**

**Table 1. Changes in depths [m] in measurement points in the years 2004 and 2005**

| | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | average |
|---|---|---|---|---|---|---|---|---|---|
| 345.0 | -1.4 | 0.6 | -0.2 | -0.3 | 0.0 | 0.2 | -0.3 | -0.2 | -0.2 |
| 345.5 | -0.8 | 0.5 | 0.6 | 0.2 | 0.0 | -0.1 | 0.1 | -0.2 | 0.0 |
| 346.0 | 0.3 | 0.4 | 0.0 | -0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 |
| 346.5 | 0.0 | 0.0 | -0.1 | -0.8 | 0.0 | 0.0 | 0.0 | 0.2 | -0.1 |
| 347.0 | 1.4 | 0.5 | -1.1 | 0.3 | -0.4 | 0.2 | 1.2 | 1.7 | 0.5 |
| 347.5 | 0.0 | -1.4 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | -0.1 |
| 348.0 | -0.1 | -0.5 | 0.3 | -0.5 | 0.4 | 0.1 | -0.3 | -0.2 | -0.1 |
| 348.5 | 0.0 | 0.9 | -0.8 | 0.0 | 0.2 | 0.1 | 0.2 | 0.0 | 0.1 |
| average | -0.08 | 0.13 | -0.11 | -0.13 | 0.04 | 0.08 | 0.14 | 0.18 | |

**It was found that the largest changes in the year 2005 as compared with the year 2004 took place at 347.0 kilometer, where the depth decreased by 1.7 m, and the bottom rose on average by 0.5 m. In other profiles depth changes ranged from –1.4 to +0.9 m, averaging from –0.2 to +0.1 m.**

## CONCLUSIONS

**The research has shown that the DGPS system made it possible to execute soundings near the harbour of Mrzeżyno at specified points with position determination accuracy of 0.4 m. The measured changes in sea bottom along the section between 345.0 and 348.5 km showed minor alterations that do not impose any dangers to the safety of the coast line.**

## LITERATURE


1. **Felski A., Specht C., „Pewne aspekty optymalizacji wykorzystania systemów DGPS na Bałtyku Południowym" Zeszyty Naukowe AMW nr 3, Gdynia 1995.**
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