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Explanatory Note
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German Bight Chart Datum Model over Ellipsoid

The traditional method of tidal corrections in the German Bight is based on the so-called "Wasserstandserrechnungskarte" and resembles that using co-tidal co-range charts. Although this procedure is well established and is used throughout the German North Sea waters, the problem of limited accuracy and reliability should not be overlooked.

For several years now, efforts have been made to develop a tidal correction method using height data determined by precise differential GPS (PDGPS). First experience was obtained during the "Jadebusen" survey in 2001, which took place under special circumstances though: the survey was performed very close to a GPS reference station, and the reference surface was interpolated between points surrounding the survey area.

Two problems had to be solved to allow general use of the method:
- A reference surface, the difference between the ellipsoid and the chart datum, had to be developed, and
- data for differential correction of the GPS carrier phase data had to be provided.

Correction data are routinely distributed by the German State Survey, the so-called "Satellitenpositionierungsdienst" (SAPOS). The data are transmitted via FM in frequencies of the 2 m band or by cellular phone (GSM). In case correction data are not available, a temporary reference station has to be established whose position data are then determined.

A project aimed at developing the chart datum surface was initiated by the BSH in 2002. It was completed in early 2006. The purpose was a continuous determination of the chart datum surfaces LAT and Mean Low Water Springs. The surface was to be referred to the ETRF89 ellipsoid used by the "Satellitenpositionierungsdienst" (SAPOS).

The following data were used:
- tide gauge readings at 140 positions along the German North Sea coast and in the tidal rivers,
- the quasigeoid EGG97 as an approximation of the chart datum surface,
- a finite element numerical model of the Federal Waterways Engineering and Research Institute (BAW),
- a GPS campaign to determine the ellipsoidal heights of almost all tide gauges referred to ETRF89.

The finite element model developed by BAW covers the entire German coast and has 32,000 nodes. Hourly simulation data were computed for a one-year period. The tides are analysed for each node.

The GPS measurement campaign was carried out in order to fit the model into the ETRF89 ellipsoid. The height of the gauge zero above the ellipsoid was measured for each tide gauge. This was to make sure that the results, i.e. the chart datum heights, were referred exactly to the ellipsoid that was to be used later in the hydrographic surveys.

The first test measurements are being made currently in the North Frisian area. The results look promising, but there are still some details which remain to be solved.

References:
Ellmer, W.; Vahrenkamp, B: Surveying the "Jadebusen" as an example of hydrographic surveys for multiple uses. Proceedings Hydro 2002 Kiel.