

Height system connection between island and mainland using a hydrodynamic model

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Traditionally, islands have been connected to the mainland height system using hydrostatic levelling. This highly specialized measurement technique is very expensive and time consuming, which is the reason why most countries in the world decided to abandon this technique. In the Netherlands, hydrostatic levelling was abandoned more than 30 years ago. Since then the Wadden islands and many offshore tide gauges stations have not been connected to the mainland's coast.

The main alternative to hydrostatic levelling is GNSS/levelling. Unfortunately, the application of GNSS/levelling still suffers from errors in the regional quasi-geoid models which easily attain values of several centimeters or more. For many applications, an operational method is lacking that allows the maintenance of height system at the centimeter level.

Here we present a cost-effective and flexible alternative method to connect islands and offshore tide gauges stations with the height system on land. This technique uses a regional, high-resolution hydrodynamic model, which provides slopes in mean sea level (MSL) between tide gauge stations at the mainland and the islands or offshore platforms. Adding them to the MSL relative to the national height system at the mainland's tide gauges realizes a connection of the island and offshore platforms with the height system on the mainland.

Numerical results are presented for the connection of the Dutch Wadden islands with the national height system (Normaal Amsterdams Peil, NAP). Several hydrodynamic models and experimental setups are tested and validated. We show that for each Wadden island we can find several connections that allow the transfer of NAP with (sub-)centimeter accuracy.