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Vertical stability of the Amsterdam Ordnance Datum (NAP) from time series of absolute gravity measurements

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In this presentation, we want to present our experiences and recent progress made in using absolute gravimetry to control the vertical movements of the Dutch first-order height network with the highest possible accuracy.

The geological and hydro-geological conditions in the Netherlands make the choice of the stations and the measurement of absolute gravity for vertical control very challenging. Large parts of the Netherlands are below sea level and the country is mostly composed of deltaic, coastal and eolian derived sediments during the Pleistocene and Holocene periods. Almost the whole west of the Netherlands is part of the Scheldt-Rhine-Meuse river estuary. Remains of the last ice age are found in the North and East of the Netherlands. Only in the far south of the country, rocks from the Carboniferous period outcrop. Given the softness of the soil structure, the best suitable locations for gravimetry stations joining the Dutch first-order height network are found in areas of Pleistocene fluvioglacial sand and Carboniferous rock.

We present the results of the analysis of the data record of six stations, comprising up to 25 years of data. We show that even in the presence of high micro-seismic noise caused by ocean waves, excellent results can be obtained if the measurement setup is chosen carefully. We also present the results of an analysis of the effect of groundwater level variations, which were measured at wells close to the gravity stations. Finally, we quantify the effect of soil moisture variations on the observed gravity values. For this purpose, we developed a soil moisture sensor, which can be used in standard tubes. Finally, we report about our experiences with the calibration of this sensor using an in-house developed calibration facility.