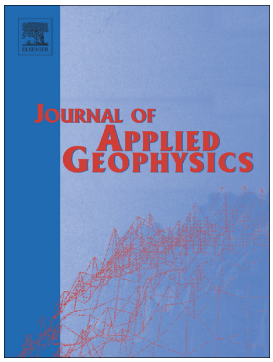


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# The use of absolute gravity data for the validation of Global Geopotential Models and for improving quasigeoid heights determined from satellite-only Global Geopotential Models

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## Abstract

The objective of this paper is to demonstrate the usefulness of absolute gravity data for the validation of Global Geopotential Models (GGMs). It is also aimed at improving quasigeoid heights determined from satellite-only GGMs using absolute gravity data. The area of Poland, as a unique one, covered with a homogeneously distributed set of absolute gravity data, has been selected as a study area.

The gravity anomalies obtained from GGMs were validated using the corresponding ones determined from absolute gravity data. The spectral enhancement method was implemented to overcome the spectral inconsistency in data being validated. The quasigeoid heights obtained from the satellite-only GGM as well as from the satellite-only GGM in combination with absolute gravity data were evaluated with high accuracy GNSS/levelling data.

Estimated accuracy of gravity anomalies obtained from GGMs investigated is of 1.7 mGal. Considering omitted gravity signal, e.g. from degree and order 101 to 2190, satellite-only GGMs can be validated at the accuracy level of 1 mGal using absolute gravity data. An improvement up to 59% in the accuracy of quasigeoid heights obtained from the satellite-only GGM can be observed when combining the satellite-only GGM with absolute gravity data.

**Keywords:** absolute gravity, GGM, gravity anomaly, quasigeoid

## 1. Introduction

Improving the modelling of the Earth's gravity field and thereby related geoid model on global and regional/local scales has been considered as one of the main tasks in geodesy. The first decade of this millennium is called the Decade of Geopotentials (e.g. Pavlis et al., 2012), in which three dedicated gravity field satellite missions: CHAMP (Challenging Minisatellite Payload; July 2000; Reigber et al., 2002), GRACE (Gravity Recovery and Climate Experiment; March 2002; Tapley et al., 2004) and GOCE (Gravity field and steady-state Ocean Circulation Explorer; March 2009; Floberghagen et al., 2011) have been launched. Since that decade the development of satellite-only and combined Global Geopotential Models (GGMs) of an unprecedented accuracy and spatial resolution is continuously growing. Nowadays, satellite-only GGMs are developed up to spherical harmonic degree/order (d/o) 330 (e.g. Gatti et al., 2016). The combined GGMs, developed with the use of satellite measurements, terrestrial gravity measurements over continents and measurements of mean sea surface from