

Development and Evaluation of the Latest Korea National Geoid 2026, KNGeoid26

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For over two decades, the low precision and irregular distribution of land gravity and Global Navigation Satellite System (GNSS)/leveling data have posed a persistent challenge in developing geoid models. To overcome these foundational data limitations, the National Geographic Information Institute (NGII) began establishing new three-dimensional control points called Unified Control Points (UCPs) and acquiring updated gravity data for these locations in 2008. As a result, more than 18,000 land gravity data points and approximately 5,300 GNSS/leveling data points are now available. Additionally, new shipborne gravity data were acquired by the Korea Hydrographic and Oceanographic Agency (KHOA), while the Digital Elevation Model (DEM) of Korea has been continuously updated by the NGII using LiDAR and airborne photogrammetry. Furthermore, the global release of numerous Gravity Field and Steady-State Ocean Circulation Explorer (GOCE)-based geopotential models, along with updates using satellite altimetry data, has established a solid foundation for developing a new geoid model to replace the existing one. Consequently, a new gravimetric geoid model was developed based on the "Remove-Restore" technique. As the airborne gravity data obtained in 2009 were included to provide coverage of coastal regions and the area along the border with North Korea, downward continuation was performed to integrate them with other gravity datasets. Subsequently, a hybrid geoid named the Korea National Geoid 2026 (KNGeoid26) was developed for practical use in the surveying field and officially published in 2026. When developing KNGeoid26, given the availability of over 5,300 GNSS/leveling data points, the gravimetric geoid was fitted to half of the dataset—selected for its regular distribution—while the remaining half was used for precision evaluation. The Degree of Fit (DOF) at the fitting points was approximately 2.3 cm, while the precision evaluated using the independent validation points was 2.32 cm. Furthermore, to evaluate regional precision, the study areas were classified according to topography as plains, hilly areas, mountainous areas, Jeju Island, and the Ulleung/Dokdo Islands, with corresponding precision values of 2.2 cm, 2.1 cm, 3.1 cm, 3.2 cm, and 5.1 cm, respectively. With the exception of the Ulleung/Dokdo region, where previous outcomes were derived from indirect surveying, the precision remained generally consistent. Currently, the NGII is conducting new surveys and verifications for UCPs and Bench Marks (BMs), along with acquiring new gravity data in regions with low spatial resolution. Moving forward, the NGII plans to update and publish the geoid model annually by incorporating these newly acquired datasets.