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High-resolution gravimetric geoid model for Japan from EGM2008 and local gravity data

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A high-resolution geoid model covering four main Japanese islands (Hokkaido, Honshu, Shikoku and Kyushu) has been developed on a 1 by 1.5 arc-minute grid from EGM2008 and terrestrial gravity data over Japan. The Stokes-Helmert Scheme in a modified form is applied for the determination of the geoid using an empirically determined optimal spherical cap and Kriging technique is used for gridding residual gravity anomalies. Comparisons between the gravimetric and geometric geoid undulations are carried out using 816 GPS/levelling points. In comparison with the previous geoid model for Japan (JGEOID2008), there is a slight improvement in the standard deviation from 8.44 cm to 8.29 cm. The standard deviation reduces to 5.81cm about a mean of 0.00 cm after planar fit.

Comparisons between the gravimetric and GPS/levelling geoid undulations are also carried out in each of the main islands except Honshu which is divided into three parts (North Honshu, Central Honshu and West Honshu) because of its size and geometry. The following is a summary of the comparisons in each area: Hokkaido 163(6.71), North Honshu 171(6.41), Central Honshu 163(7.34), West Honshu 158(5.16), Shikoku 56(8.69) and Kyushu 105(5.58), where the numbers outside the brackets represent the number of GPS/levelling points while bracketed ones are the corresponding standard deviations in cm. It is noted that although the determined gravimetric geoid represents the geoid over Japan fairly well, there is still need for more gravity data especially in the northern part of Japan to obtain a precise geoid model.

Keywords: geoid model, gravity, Kriging, EGM2008, GPS/levelling