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The $5' \times 5'$ global geoid model GGM2016

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We provide an updated $5' \times 5'$ global geoid model GGM2016, which is determined based on the shallow layer method (Shen 2006). We choose an inner surface S below the EGM2008 geoid, and the layer bounded by the inner surface S and the Earth's geographical surface E is referred to as the shallow layer. The Earth's geographical surface E is determined by the digital topographic model DTM2006.0 combining with the DNSC2008 mean sea surface. We determine the 3D shallow layer model (SLM) using the refined crust density model CRUST1.0-5min, which is an improved $5' \times 5'$ density model of the CRUST1.0 with taking into account the corrections of the areas covered by ice sheets and the land-ocean crossing regions. Based on the SLM and the gravity field EGM2008 defined outside the Earth's geographical surface E, we determine the gravity field EGM2008S defined in the region outside the inner surface S, extending the gravity field's definition domain from the domain outside E to the domain outside S. Based on the geodetic equation W(P)=W0, where W0 is the geopotential constant on the geoid, we determine a $5' \times 5'$ global geoid model GGM2016, which provides both the $5' \times 5'$ grid values and spherical harmonic coefficient expressions. Comparisons show that the GGM2016 fits the globally available GPS/leveling points better than the EGM2008 geoid. This study is supported by National 973 Project China (grant Nos. 2013CB733301 and 2013CB733305), NSFC (grant Nos. 41174011, 41210006, 41429401, 41128003, 41021061).