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# Assessment of the suitability of GOCE-based geoid models for the unification of the North American vertical datums

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Precise gravimetric geoid heights are required when the unification of vertical datums is performed using the Geodetic Boundary Value Problem (GBVP) approach. Five generations of Global Geopotential Models (GGMs) derived from Gravity field and steady-state Ocean Circulation Explorer (GOCE) observations have been computed and released so far (available via IAG's International Centre for Global Earth Models, ICGEM, http://icgem.gfz-potsdam.de/ICGEM/). The performance of many of these models with respect to geoid determination has been studied in order to select the best performing model to be used in height datum unification in North America. More specifically, Release-3, 4 and 5 of the GOCE-based global geopotential models have been evaluated using GNSS-levelling data as independent control values. Comparisons against EGM2008 show that each successive release improves upon the previous one, with Release-5 models showing an improvement over EGM2008 in Canada and CONUS between spherical harmonic degrees 100 and 210. In Alaska and Mexico, a considerable improvement over EGM2008 was brought by the Release-5 models when used up to spherical harmonic degrees of 250 and 280, respectively. The positive impact of the Release-5 models was also felt when a gravimetric geoid was computed using the GOCE-based GGMs together with gravity and topography data in Canada. This geoid model, with appropriately modified Stokes kernel between spherical harmonic degrees 190 and 260, performed better than the official Canadian gravimetric geoid model CGG2013, thus illustrating the advantages of using the latest release GOCE-based models for vertical datum unification in North America.