

Canadian Geoid Model and Its Error Estimate

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The Canadian vertical datum is realized through a gravimetric geoid model, so that orthometric heights are obtained directly from GNSS ellipsoidal heights. Canada is now adopting a new realization based on GEOID2022, a North American model developed jointly by Canada, the United States, and Mexico, in which each agency computes its own solution and the three are combined into a single continental model.

This talk reviews the Canadian modelling approach behind that contribution and presents a formal error estimate for it. The model follows the Stokes–Helmert scheme, combining a satellite-based global geopotential model with terrestrial, airborne, and marine gravity data through a degree-banded modified Stokes kernel with Wong–Gore spectral weighting; least-squares collocation is used for gridding, and a digital elevation model supplies the topographic reductions.

The uncertainty of the resulting geoid heights is derived by rigorous matrix-based least-squares error propagation. Contributions from the global model commission error, terrestrial gravity noise, the collocation step, and DEM uncertainty in the topographic and downward-continuation terms are propagated separately and then combined, yielding standard deviations ranging from about 1 cm in well-surveyed lowland areas to 14 cm in mountainous terrain.

The geoid model and its accompanying error estimates are then evaluated against the three Geoid Slope Validation Surveys (GSVS11, GSVS14, GSVS17), applying a χ^2 consistency test to the differences between the modelled geoid and GNSS/levelling. Implications for vertical datum modernization and for reporting realistic uncertainties in GNSS-derived heights are discussed.