The Canadian Geodetic Vertical Datum of 2013 (CGVD2013) is the first major update to the vertical datum in Canada in almost 100 years. Canada is not only moving to a new vertical datum, but it is also using a modernized approach to realize it. The modernization of the height reference system is necessary to make it compatible with Global Navigation Satellite System (GNSS), which is commonly used for positioning by a growing number of users across Canada and the world. The geodetic levelling technique, which established a nation-wide network of benchmarks with known elevations, is replaced by a geoid model that describes the vertical datum with respect to an ellipsoid, which is the reference surface for GNSS positioning. Technically, height modernization replaces the need for the maintenance of benchmarks, as users can now install their own markers at more convenient locations using GNSS. The current geoid model for CGVD2013 is the Canadian Gravimetric Geoid 2013 (CGG2013).

1. Introduction

On November 28, 2013, Natural Resources Canada (NRCan) released a new height reference system for Canada, the Canadian Geodetic Vertical Datum of 2013 (CGVD2013). This new vertical datum constitutes the first major update in the definition and realization of the reference surface for elevations in Canada since the formal adoption of the Canadian Geodetic Vertical Datum of 1928 (CGVD28) by an Order in Council in 1935 [Canon 1928; 1935]. CGVD2013 represents a modern vertical datum as it is compatible with today’s positioning technique through Global Navigation Satellite System (GNSS), which includes, among others, the American Global Positioning System (GPS), Russian GLONASS and upcoming European Galileo. The modernisation of the height reference system in Canada was initially proposed in a 2002 position paper prepared by the Canadian Geodetic Reference System Committee (CGRSC), which is a federal-provincial committee under the Canadian Council on Geomatics (CCOG). Véronneau et al. [2006] summarizes the rational for height modernization in Canada.

This new height reference system is defined by an equipotential surface (geoid), representing the best fit of mean sea level (MSL) for the North American region. This reference surface is mathematically represented by a geoid model, which provides the separation between the ellipsoid and geoid in and around Canada. This separation is called the geoid height ($N$). Such a realization of the vertical datum is important because GNSS heights ($h$)