



# Mind the gap!

## A new positioning reference

### NATRF2022



#### A new positioning reference

- The **Canadian Geodetic Survey** and the United States **National Geodetic Survey** have collaborated for over a century to provide the fundamental reference systems for latitude, longitude and height for their respective countries.
- Together our reference systems have evolved to meet today's world of GPS and geographical information systems, while supporting legacy datums established using traditional surveying techniques.
- To meet future needs and the ever-increasing accuracy of GPS, the United States will adopt a new positioning reference, the North American Terrestrial Reference Frame of 2022 (NATRF2022).
- Once the United States adopts NATRF2022, a horizontal coordinate offset of 1.3 to 1.5 m will exist at the Canada-United States boundary.

#### What will this mean for users?

- Suppose a vehicle in Canada is positioned in NAD83(CSRS)<sup>1</sup> using real-time GPS and then crosses the border into the United States. Once in the United States, if no transformations are applied, it will be offset by over a metre from any features (e.g. roads) tied to NATRF2022.
- Users can manage this change by knowing what reference system they are using and applying the appropriate transformation to work in either Canada's NAD83(CSRS) or the United States' NATRF2022.
- Users need to ensure the metadata<sup>2</sup> associated with their data correctly identifies the reference frame in use.

<sup>1</sup> North American Datum of 1983 (Canadian Spatial Reference System)

<sup>2</sup> Metadata is data that provides information about other data.

#### Why is the United States adopting NATRF2022?

- Improved compatibility with Global Navigation Satellite Systems (GNSS), such as GPS, is driving this change. The geometric reference frames currently used in Canada and the United States, although compatible with each other, are offset by 2.2 m from the Earth's geocentre, whereas GNSS are geocentric.
- Real-time decimetre-level accuracies directly from GNSS satellites are expected to be available soon.
- With NATRF2022 as the reference for geospatial information, the offsets between geospatial products (such as maps) and positions obtained directly from GNSS will be minimized.

#### What about elevations?

- The United States plans to replace its vertical, levelling-based datum, NAVD 88, with the North American-Pacific Geopotential Datum of 2022 (NAPGD2022), which is a geoid-based datum and, therefore, more efficient to use with GNSS.
- NAPGD2022 is the same as Canada's CGVD2013.<sup>3</sup> Thus, the modernization in the United States will result in Canada and the United States using common systems for elevations.



<sup>3</sup> Canadian Geodetic Vertical Datum of 2013

#### What are we doing about this in Canada?

- The Canadian Geodetic Survey is working closely with the United States National Geodetic Survey in defining reference frames to ensure they will also be suitable for Canada.
- Geodetic agencies from across Canada are collaborating on reference system improvements through the Canadian Geodetic Reference System Committee, a working committee of the Canadian Council on Geomatics.<sup>4</sup>
- Once NATRF2022 is adopted in the United States, the Canadian Geodetic Survey will provide:
  - coordinates in both the adopted NAD83(CSRS) and in NATRF2022
  - transformation parameters and tools to move between NAD83(CSRS) and NATRF2022
  - the option to receive results in NATRF2022 from CSRS-PPP,<sup>5</sup> the Canadian Geodetic Survey's positioning service
- We know that for some users, changing reference systems would have major costs and impacts.
- We also know the importance of compatibility with GNSS and across our 8,891-km Canada-United States boundary.

<sup>4</sup> Members come from the governments of Canada, the provinces and the territories.

<sup>5</sup> Canadian Spatial Reference System – Precise Point Positioning Service

#### We want to hear from you!

- Send us your comments, the challenges you foresee, and any concerns to help inform our path forward to either of these organizations:
  - Canadian Geodetic Survey: [nrcan.geodeticinformation-informationgeodesique.nrcan@canada.ca](mailto:nrcan.geodeticinformation-informationgeodesique.nrcan@canada.ca)
  - Canadian Geodetic Reference System Committee: [feedback-commentaires@cgrsc.ca](mailto:feedback-commentaires@cgrsc.ca)

#### Where can I learn more?

- An introductory technical note on NATRF2022 appears in *Geomatica*. (2019, 73(3): 74-80, <https://doi.org/10.1139/geomat-2019-0021>.)
- The CGRSC website provides more details as well as contact information for CGRSC members at <http://cgrsc.ca/>.
- The United States National Geodetic Survey website is a great source of background information on their modernization plans at <https://www.ngs.noaa.gov/datums/newdatums/index.shtml>.

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