GeoNOVA

Nova Scotia Coordinate Referencing System

June 2023 Update

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Topics

1. NSHPN Adjustments
2. NSACS Updates
3. Adopt a Monument
4. Coordinate Referencing Viewer
5. NATRF2022

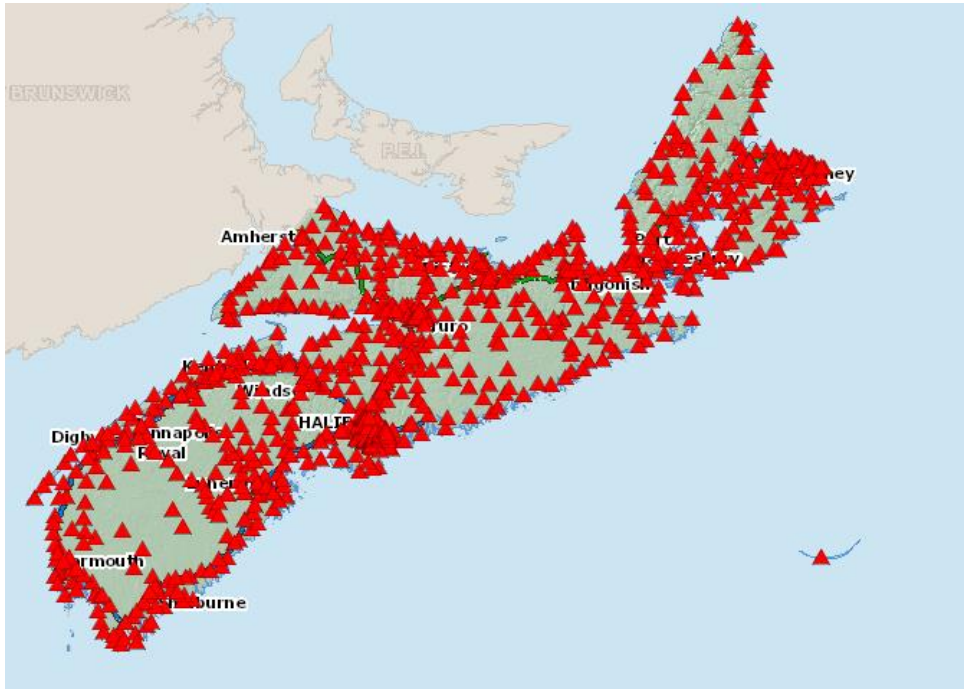
NSHPN Adjustments

- Used to upgrade former NSCCS (ATS77) monuments to NSHPN (NAD83(CSRS)2010.0 v6)

- Spring 2023 adjustment is ongoing and expected to be completed in June 2023.

- Spring 2023 adjustment should add approximately 100+ new NSHPNs to the existing network

- Observations came primarily from municipal and government surveyors



NSACS Updates

- 3 New GNSS receivers (2X Trimble Alloys, 1X Septentrio Polar Rx5e) have been purchased in Spring of 2023. Can receive all four constellations (GPS, GLONASS, Galileo, BeiDou) and will be installed in June/July.

- Proposed installation sites are currently HALI, FALL, BKSD, TRUR.

- Will be able to provide 4 constellations to users when utilizing a single baseline solution. Still not enough coverage for full network solution with all 4 constellations.

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NSACS Updates (con't)

- Current GNSS receivers (Trimble NETR9) have reached their end of life with regards to support from the manufacturer.

- NSCRS team has recognized this as a risk and will be releasing an RFP to relace the current receivers in the next few months.

- Analysis will be conducted during that time to see if any areas of the province would benefit from infill with new NSACS sites.

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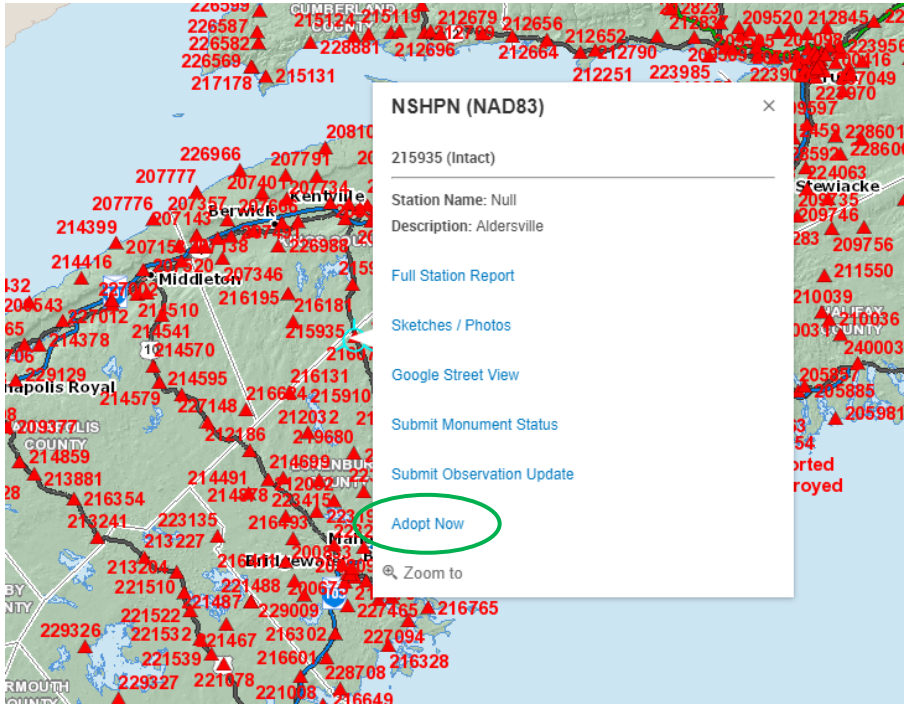
Adopt a Monument

- Crowdsourcing initiative that allows qualified surveyors to maintain NSHPN's around the province
- Surveyors are required to provide observations (2 per year), maintain monument and surrounding area and provide photos and condition updates to the Coordinate Referencing Viewer
- Data submissions can still be provided to upgrade ATS77 coordinates at NSCCS's to NAD83(CSRS)2010.0 v6 to upgrade to NSHPN status
  - Require 3 observations sets at a minimum of 10 minutes (1 second update rate) with NRTK (1 submission must be using different surveyor, equipment and day).
  - Photos need to be provided (equipment setup, general site, monument condition)
  - Outside of NRTK, static observation sets must be minimum of 30 minutes at 1 second update rate.



Adopt a Monument (cont.)

CompassView and Camera Angle Apps

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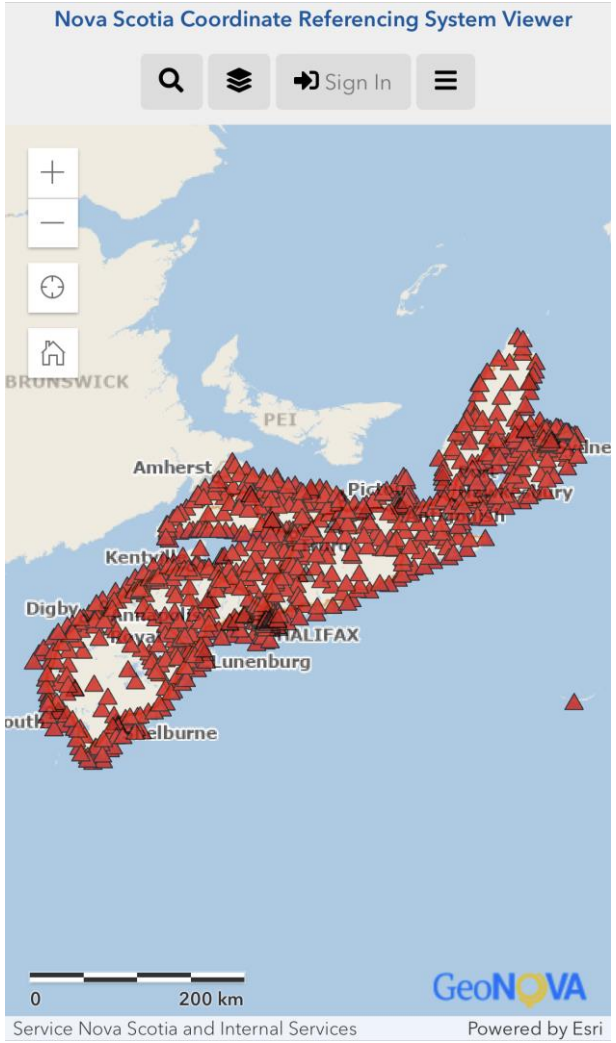
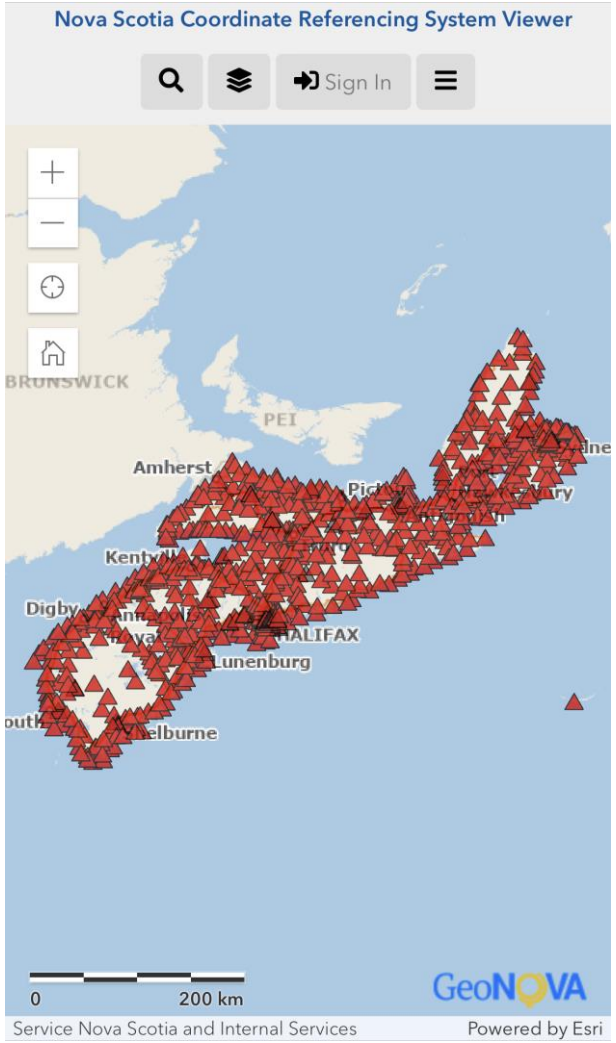
Mobile Coordinate Referencing Viewer



- Released in May of 2023 and now provides users the ability to use Apple and Android platforms
- Now provides users the ability to filter more types of monuments to show active and destroyed monuments
- User can now provide updates for damaged and destroyed monuments through their mobile devices
- Please update your bookmarks!!!

Mobile Coordinate Referencing Viewer

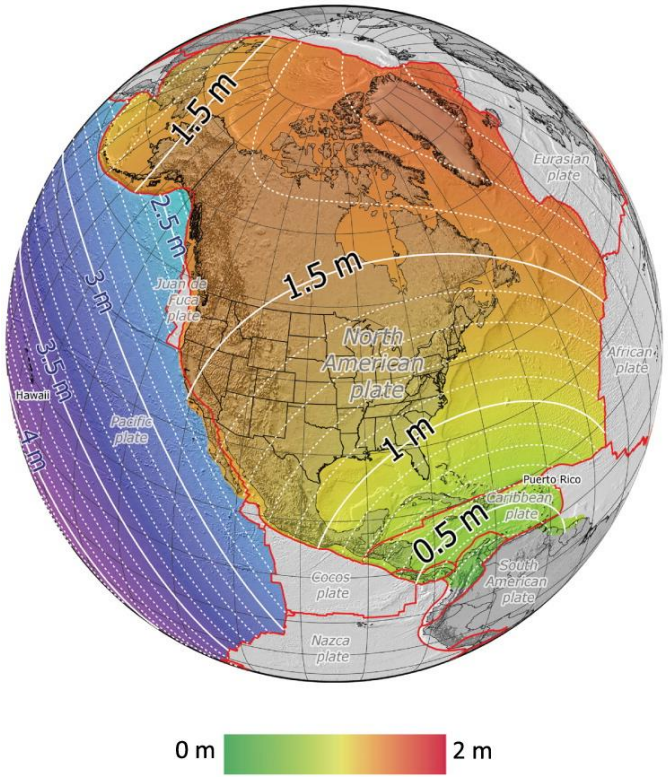


https://nsgi.novascotia.ca/nscrs-viewer

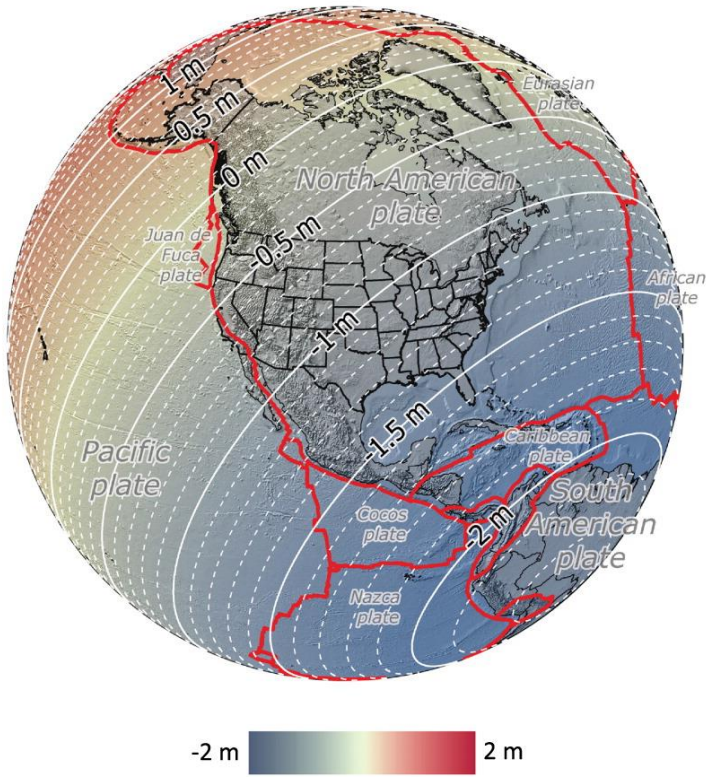
NATRF2022 – What is NATRF2022?

- Current federally adopted system in Canada is NAD83(CSRS)2010.0 v7 and is offset from CoM by ~2.2m
- NATRF2022 will aligned to ITRF2020 at epoch 2020.0 and will be truly geocentric
- Fully compatible with GNSS observations and orbits
- Differences between NAD83(CSRS) and NATRF2022 in NS will be ~1.3m horizontally and 1.1m vertically (ellipsoid)

Horizontal Change

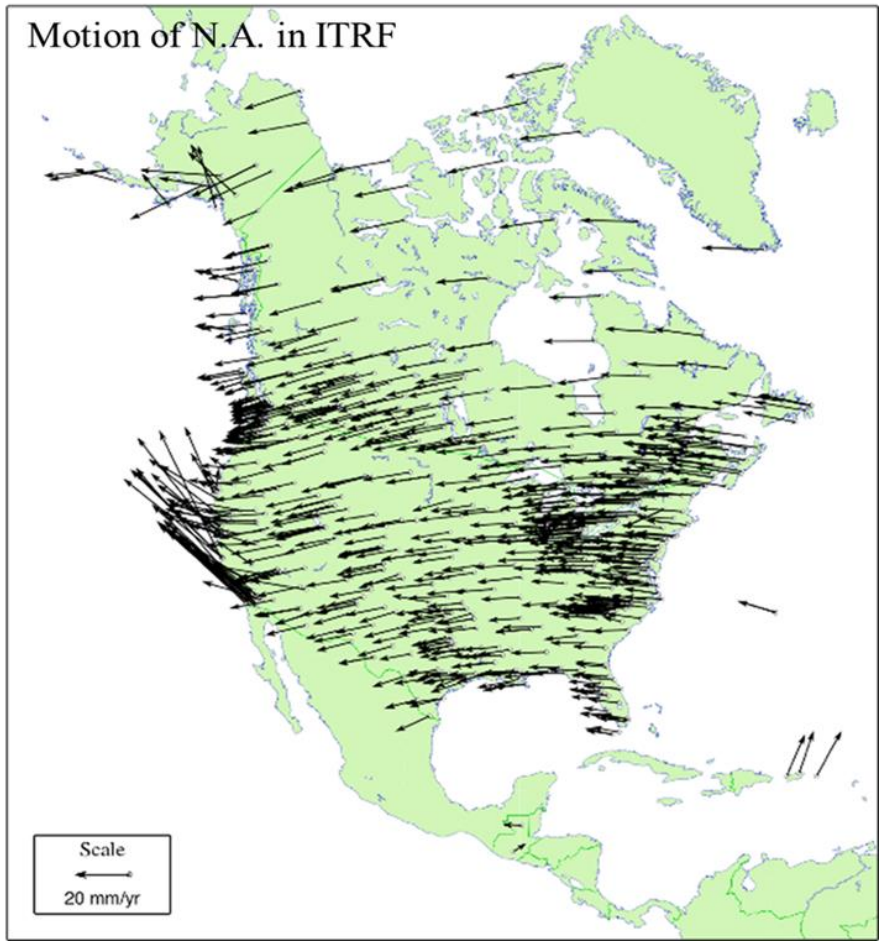


Ellipsoidal Height Change



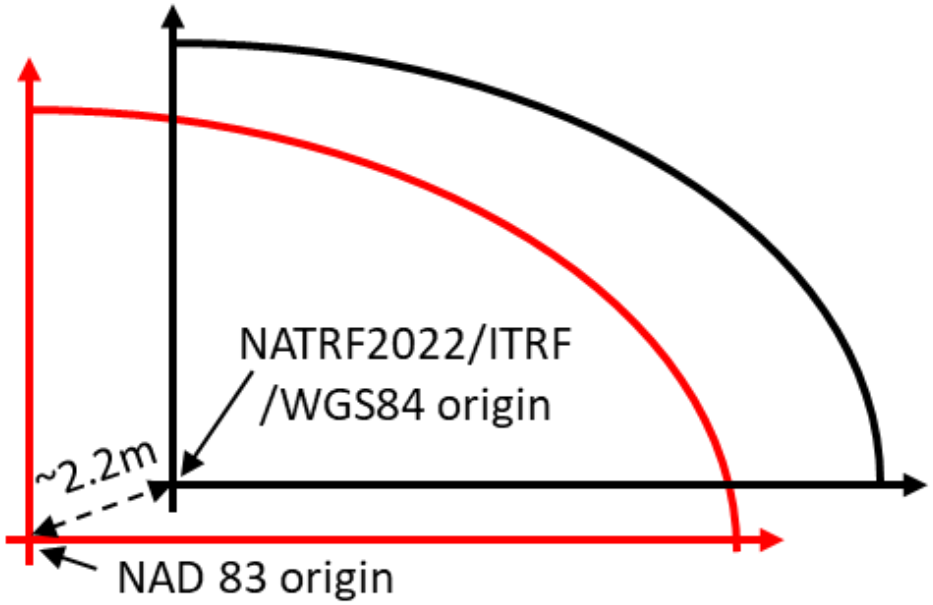
NATRF2022 – What is NATRF2022?

- Like NAD83, NATRF2022 will drift away from ITRF2020 to the motion of the North American Plate
- Dynamic reference system that will be similar to NAD83(CSRS) where coordinates change with time
- Intra-Frame Deformation Model (IFDM) will allow coordinates to be calculated at different epochs to account for changes in time
- IFDM is expected to account for more complex dynamic motions (e.g. position offsets, seasonal signals, post seismic deformations)



NATRF2022 – Why switch to NATRF2022?

- NATRF2022 is geocentric and will remove ~2.2m offset in comparison to WGS84/ITRF with NAD83
- Will be fully compatible with GNSS technology in a market that relies heavily on GNSS from both expert and mainstream users
- NATRF2022 better supports modern space based positioning solutions (e.g. commercial RTK, RTN, and RTPPP)
- Serves as an economic driver for industry in the geospatial digital economy by having a shared reference system
- No more support from federal level (CGS)



NATRF2022 – Why switch to NATRF2022?

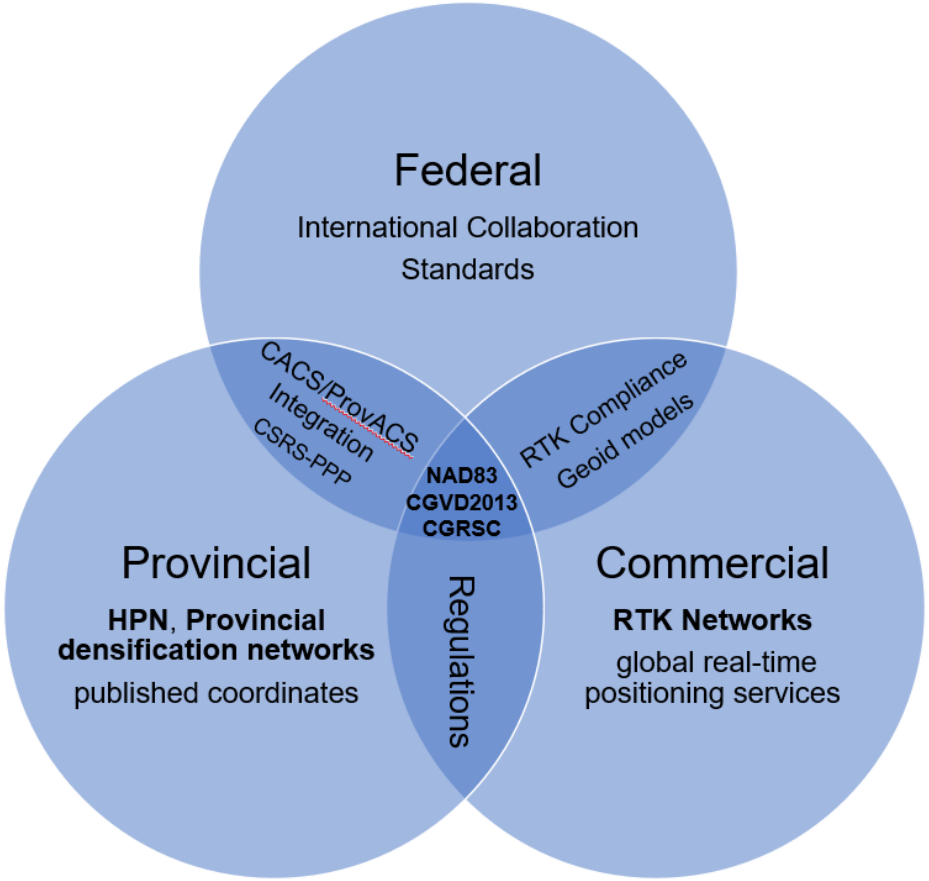
U.S. NGS Whitepaper (2010) - *Improving the National Spatial Reference System*:

“A two meter non-geocentricity, which will manifest itself as latitude, longitude and ellipsoid height errors of ± 2 meters (globally), in a world where sub-meter instantaneous positioning will be in most handheld devices, will be a glaring error to general users.”

“It is impractical to assume that the appropriate datum transformation would be coded accurately in every personal handheld positioning device to correct for this [offset]… Even today there persists software which treats WGS 84 as equivalent to NAD 83. Rather than risk life and property to such misunderstandings, NGS feels that a geocentric datum is the best approach.”

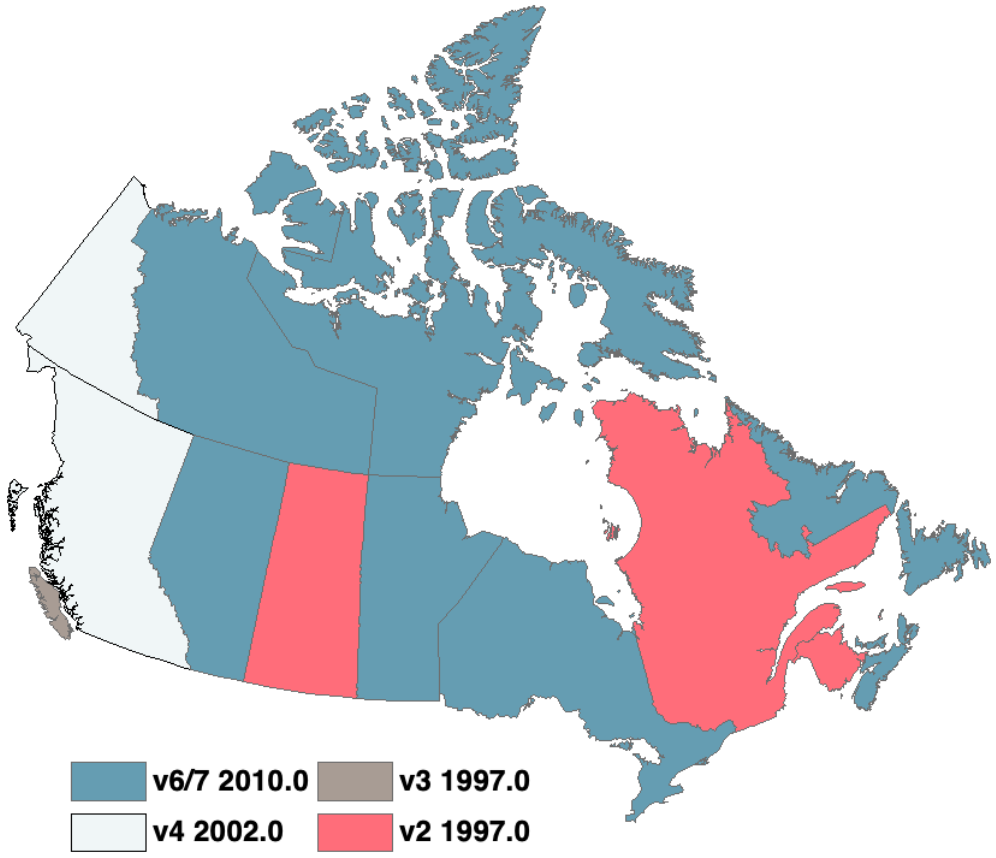
NATRF2022 – When is it being implemented?

- Canadian Geodetic Survey (CGS) has committed to adopting and implementing NATRF2022 in 2025 from a federal level
- Canadian Geodetic Reference System Committee (CGRSC) has supported the move to adopt NATRF2022 and is currently consulting with partners in all provinces
- Canadian Council on Geomatics (CCOG) has signed off on supporting the move to NATRF2022
- Provinces will have tools from CGS to begin implementing NATRF2022 in 2025



NATRF2022 – Benefits

- Unified refence frame that is geocentric and fully compatible with GNSS and ITRF realizations
- Consistency and ability to adopt a true dynamic refence frame that will see updates on regular basis to make changes more predicable and regular
- Refence frame that is more relatable for all GNSS users, both expert and mainstream
- Ability to have accurate mapping reference frames for all users in all locations
- Reference frame that can be used as an economic driver

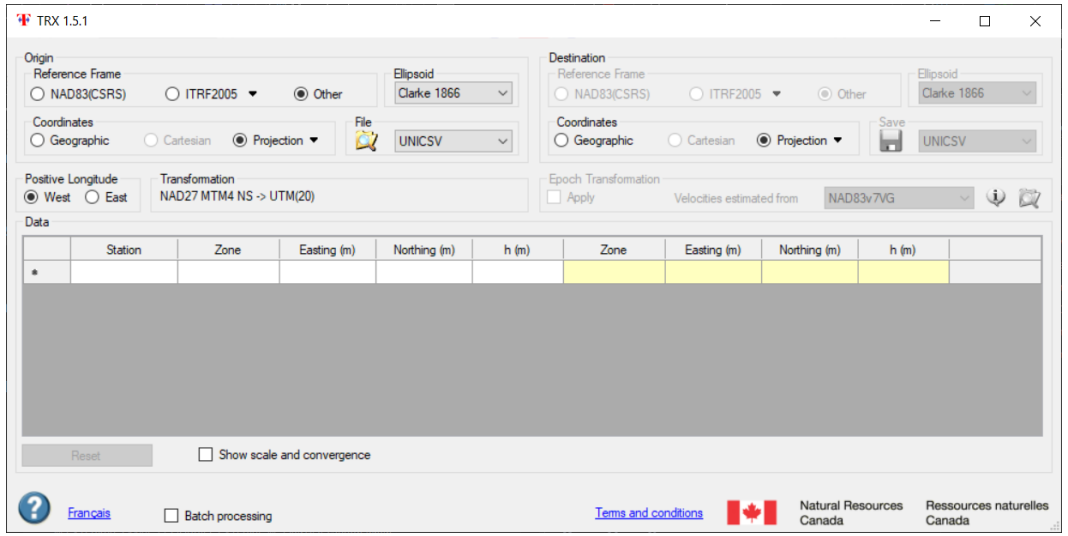


NATRF2022 – Downsides

- Still have mapping products and geospatial data that hasn't been updated to NAD83(CSRS)2010.0 v6
- Grid shifts may need to be calculated to convert older terrestrial coordinates to NATRF2022 (new grid shift format GGXF upcoming)
- Relating old survey plans to NATRF2022 (e.g. NAD83(CSRS)2010.0 v6 to NATRF2022)
- Municipalities have little resourcing and lack Geodetic knowledge

NATRF2022 – Resources

- NSCRS is in an advantageous position where we own a province wide ACS network
  - Adopt-a-Monument program can be used to update coordinates of NSHPN monuments and potential for campaigns to survey NSHPN for a mass update
- Full support from federal and provincial agencies
  - CGS to update all online/desktop tools to provide resourcing to calculate coordinates and heights (Ex. TRX, NTv2, GPS-H)
  - Will we need to develop grid shift files to convert from terrestrial based systems to NATRF2022? Currently no tool to perform this task.
- GeoNOVA has performed datum transformations of geospatial data in the past



NAPGD2022

- North American-Pacific Geopotential Datum of 2022
- Same equipotential surface value W_o = 62,636,856.0m^2/s^2 which approximates the coastal MSL for North America
- When NAPGD2022 is adopted in 2025 a new version of the Canadian Gravimetric Geoid model of 2013 (CGG2013) will be release by CGS, which is only static.
- Canada will eventually use a dynamic geoid model similar to the US
  - Difference between the static and dynamic geoid model is ~ -2mm to +1mm per year

Is this the next step to getting closer to guaranteed boundaries?

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Thank you

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