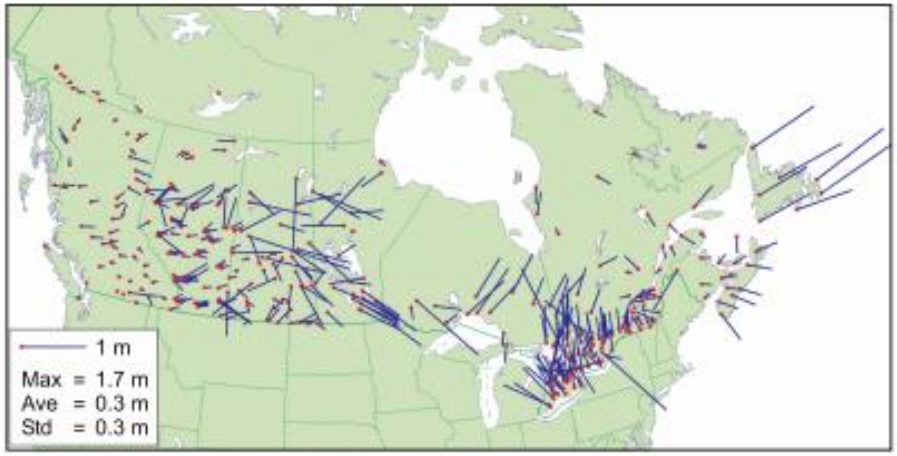
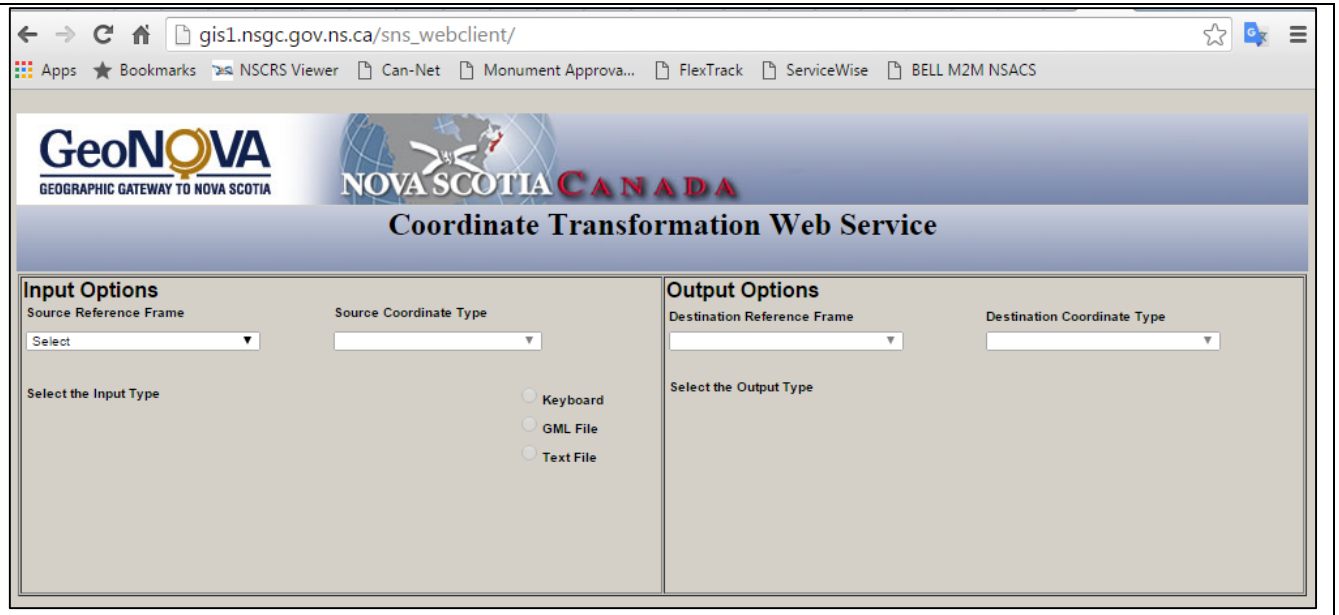
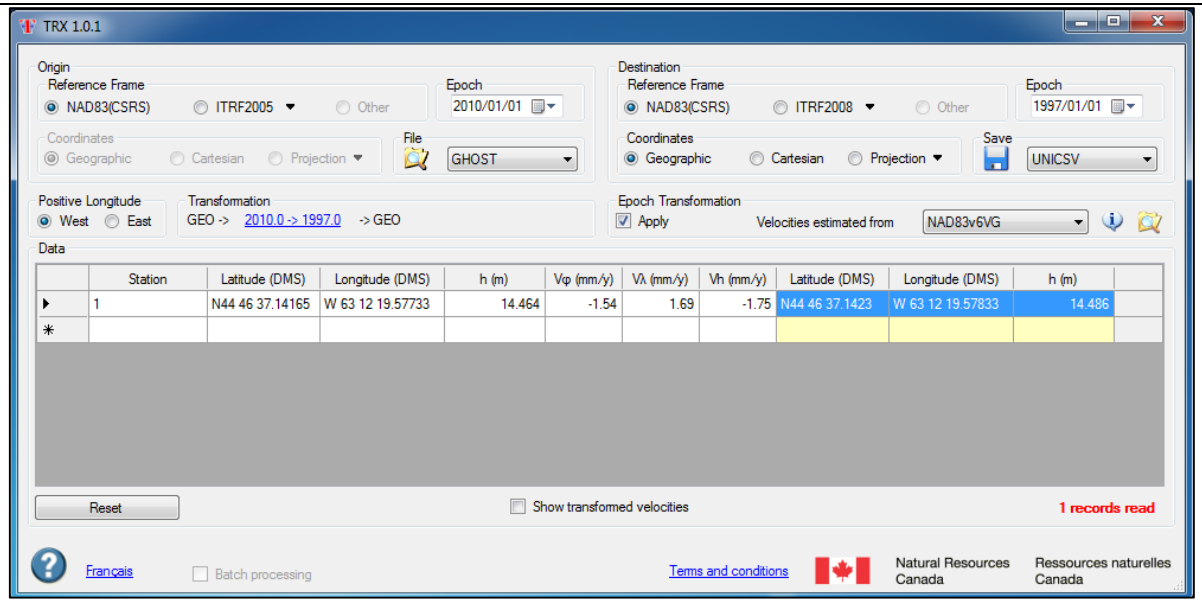
What is NAD83(CSRS)?	The North American Datum of 1983 (NAD83) is the datum that most federal and provincial mapping agencies in Canada have adopted. NAD83(CSRS) is compatible with GPS and has been endorsed by the Canadian Council of Geomatics. The Canadian Spatial Referencing System (CSRS) is based upon the NAD83 datum. The Nova Scotia Coordinate Referencing System (NSCRS) builds upon the CSRS and is also GPS compatible.
What is NAD83(Original)	NAD83(Original) is the predecessor datum to NAD83(CSRS). NAD83(Original) was realized using Electronic Distance Measurement (EDM) and theodolite observations whereas NAD83(CSRS) was realized using GPS observations. There are decimeter level differences between the two realizations. NAD83(Original) coordinates were not published by the Province but were calculated by Canadian Geodetic Survey Division. Grid shift file GS7783.gsb allows for conversions between ATS77 and NAD83(Original).  Errors in NAD83(Original) [1]
Why are there different realizations of NAD83(CSRS)?	There are several realizations of NAD83(CSRS) largely because of tectonic plate movement and an increasing number of active control stations used to determine the velocity field of the North American Plate. As the plates move over time, the position of survey monuments will change in a global coordinate system. For this reason, coordinates must be fully specified with a time stamp (“epoch”). Common epochs used in Canada are 1997.0, 2002.0, 2005.0 and 2010.0. As more Global Navigation Satellite Systems (GNSS) data is collected from an increasing number of Active Control Stations (ACSs), Natural Resources Canada (NRCan) is better able to estimate the velocity field for the North American plate. With each improvement in the estimation of the velocity field, slight changes in

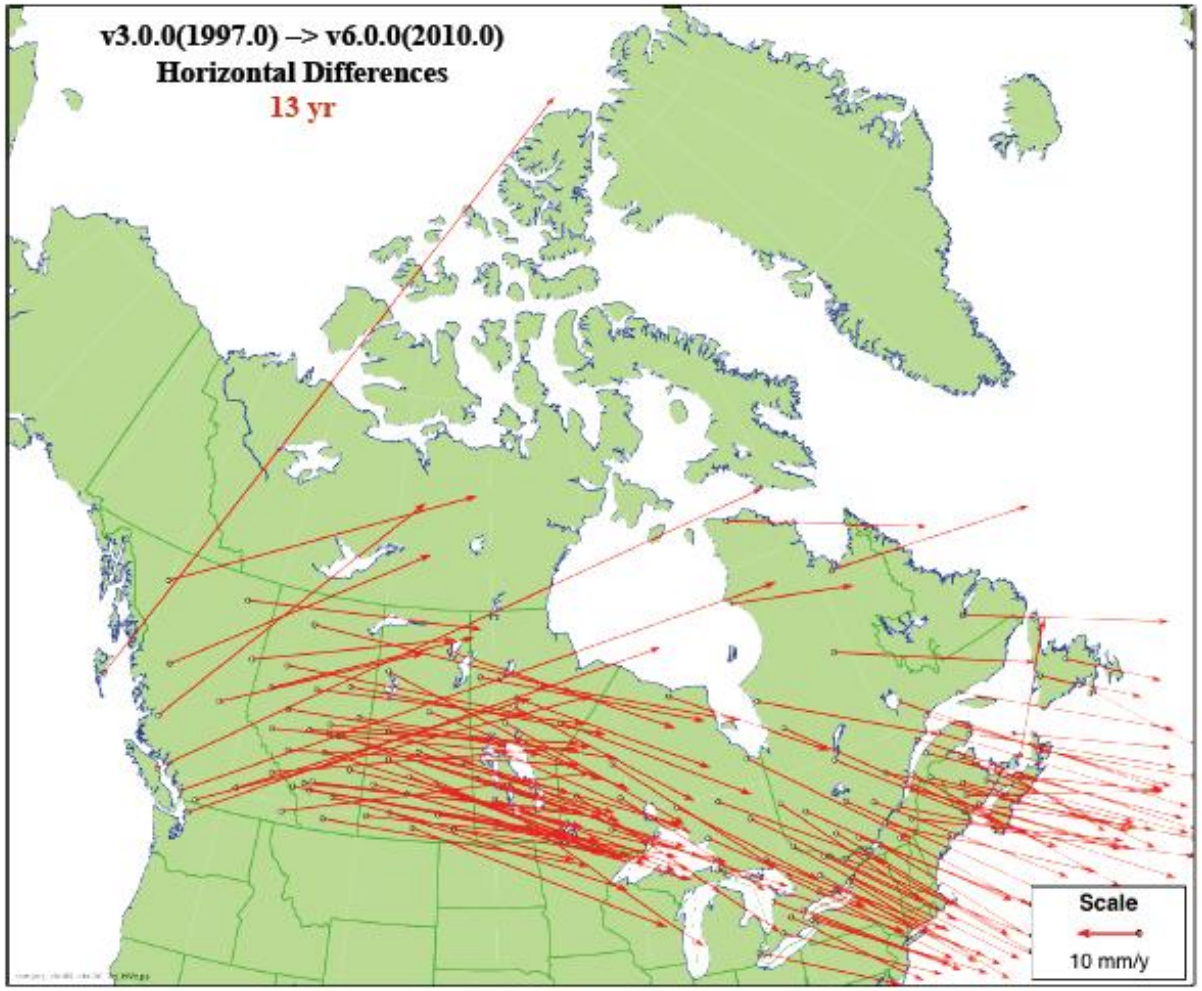
	coordinates can arise. The velocity model has a version number associated with it. In addition to having a timestamp, NAD83(CSRS) coordinates should also specify which version of the velocity model was used to transform them to the specified epoch. Presently, all Nova Scotia Active Control Stations (NSACS) and new Nova Scotia High Precision Network (NSHPN) coordinate values are calculated using V6.0.0 of the velocity model and are timestamped 2010.0. The original NSHPN was calculated using velocity model V3.0.1 and was timestamped 1997.0. These coordinates have been transformed to Epoch 2010.0 using V6.0.0 so that they are compatible with coordinates broadcast from NRTK service providers using the NSACS. The original NSHPN is in the process of being re-observed, so that its coordinates are pure NAD83(CSRS)2010.0 V6.0.0 values.
What are the benefits of NAD83(CSRS)?	Benefits of NAD83(CSRS) include: 1. **GNSS Compatibility**: The accuracy of NAD83(CSRS) is sufficient to support GNSS. 2. **Absolute Accuracy**: The accuracy of coordinate data is uniform across the Province. There are not areas of the Province with high levels of distortion. 3. **No Localization (site calibration) Required**: As a result of being GNSS compatible, it is not necessary to localize to a set of Nova Scotia Control Monument coordinate values to get repeatable results. 4. **Exchangeable Data**: NAD83(CSRS) is easily transformed to other coordinate systems (e.g.,WGS84, ITRF) to facilitate integration with data sets from other organizations across the world. 5. **Actively updated**: Because NAD83(CSRS) is based upon a network of Active Control Stations, data is constantly being collected to allow ongoing refinements to be made as necessary.
How do I access NAD83(CSRS)?	The following options exists for surveying in NAD83(CSRS) in the Nova Scotia: a) Network RTK: When users have access to cellular coverage and a NRTK subscription, it is possible to receive real-time corrections over the internet. NRTK Service Providers broadcast in NAD83 (CSRS) 2010.0 in Nova Scotia. By using NRTK, you are tied to NAD83(CSRS) 2010.0 b) Post Processing using NSACS data: A GNSS receiver can be placed at a point of interest and positioned through post processing with appropriate software. Post processing data from the NSACS is made available free of charge through NRCan's Canadian Active Control System (CACS) data distribution

	website. Some Service Providers also provide advanced functionality for downloading virtual reference station data based upon the NSACS. c) Reference and Rover Setup: A GNSS receiver can be setup over a NSHPN as a reference station. Using the published NAD83(CSRS)2010.0 coordinates, real-time corrections can be broadcast to a rover receiver to perform an RTK survey. Alternatively, a static baseline can be observed to a point of interest and post processed using published NAD83(CSRS)2010.0 coordinates for the reference station. d) Precise Point Positioning (PPP): Using a dual frequency GNSS receiver, data can be collected over a point and submitted to NRCan's PPP service. As a general guideline, 3 hours of data are required to obtain accuracies of ± 3 cm or better and 12 hours of data are required to obtain accuracies of ± 1 cm or better in all three solution components. Coordinates for the NSACS to display on survey plans can be obtained through the NSCRS Viewer to satisfy requirements for control ties to the NSCRS.
How does an ATS77 MTM survey plan compare with a NAD83(CSRS) MTM survey plan?	Because an ATS77 MTM survey plan uses the same mapping projection as a NAD83(CSRS) survey plan, the bearings and distances shown on plans created for the same lot will look nearly identical, except for inherent errors caused by the technology used to make the measurements. Coordinate values will be different by 3 to 4 metres.
Why do NAD83 and ATS77 coordinates not agree for the same location on the Earth?	ATS77 and NAD83 coordinates do not agree because they use two different models to approximate the size of the Earth and the location of the Earth's centre of mass. The model for ATS77 was created using theodolite and Electronic Distance Measurement (EDM) technology, which tends to propagate larger errors over long distances than GPS. The NAD83(CSRS) coordinate system was realized using GPS observations, which resulted in a more accurate model.
How do I transform from ATS77 to NAD83(CSRS)?	The Coordinate Referencing Program provides an online Coordinate Transformation Service which allows coordinates to be transformed from ATS77 to NAD83(CSRS)1997.0. The transformation tool uses the NS778301.gsb grid shift file. It is planned on updating the service to allow coordinates to be transformed from ATS77 to NAD83(CSRS)2010.0 once an updated grid shift file ins produced. In the meantime, coordinates can be converted between NA83(CSRS)1997.0 and NAD83(CSRS)2010.0

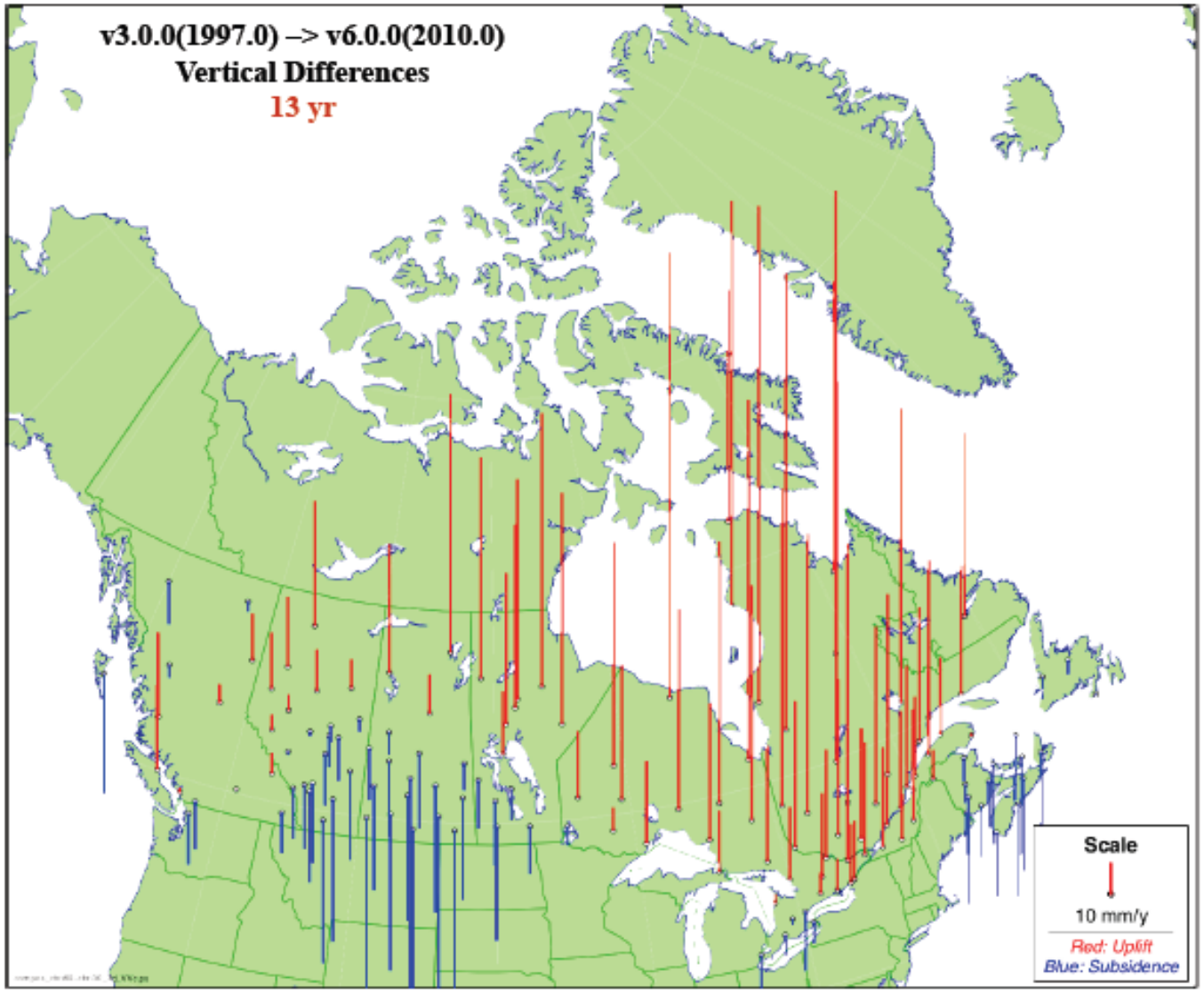
	
How do I transform between NAD83(CSRS) epochs?	Coordinates can be converted between NA83(CSRS)1997.0 and NAD83(CSRS)2010.0 using NRCan's TRX web or desktop applications. The desktop application has the advantage of allowing you to create custom MTM Projections to match what is currently being used in Nova Scotia.



Related Technical Support Documents:	- Technical Support 0002 NSACS Network - Technical Support 0010 Grid Shift Files
Useful Links:	NRCan - http://www.nrcan.gc.ca/earth-sciences/geomatics/geodetic-reference-systems/9052 Nova Scotia Coordinate Transformation Service - http://gis1.nsgc.gov.ns.ca/sns_webclient/ NSCRS Viewer: https://gis8.nsgc.gov.ns.ca/NSCRS/ NRCan PPP: http://webapp.geod.nrcan.gc.ca/geod/tools-outils/ppp.php NRCan Publication [1]: https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/geomatica.pdf
Additional Illustrations:	



Horizontal Position Differences in moving between 1997.0 to 2010.0 using V3.0.0 and V6.0.0 Velocity Models (from NRCan)



Vertical Position Differences in moving between 1997.0 to 2010.0 using V3.0.0 and V6.0.0 Velocity Models