

Support for Dynamic Datums in Trimble Software

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Key words: Deformation measurement; GNSS/GPS; Reference frames; Reference systems; dynamic datums

SUMMARY

Because of the effect of plate tectonic motions, coordinates of points in the International Terrestrial Reference Frame (ITRF) change continuously with time, however, in national datums, the coordinates reflect the position at a standard reference epoch. This mismatch has not been significant for commercial users of high-precision GNSS in the past, since single-base RTK is essentially a differential approach, where the base coordinate can be provided in national coordinates, and network RTK systems typically operate in national coordinate frames. It is becoming important to users with the advent of precise Point Positioning (PPP) services, which develop coordinate in the ITRF at the epoch of measurement. As a result, transforming coordinates to the national datum requires correcting coordinates for tectonic motion.

Countries such as Australia and much of Europe that lie entirely within a tectonic plate are able to incorporate the Euler Pole of the tectonic plate into the transformation equations between the national datum and the ITRF. However, for a country like New Zealand or the west coast of the USA, that lies across a plate boundary a different strategy must be adopted. In this case, the datum may incorporate a national deformation model (NDM) of how the earth is moving and this is used to project coordinates to the reference epoch. These models typically incorporate a velocity field and, where required, earthquake displacements and post-seismic deformation.

Trimble has recently upgraded its geodic transformation libraries to support dynamic datums and deformation models following a schema developed by Land information New Zealand . The model contains one or more sub-models representing different types of deformation. Each sub-model contains a grid file that defines the spatial variation of the model combined with a time function (e.g., velocity, step, ramp, or exponential decay). The secular velocity field uses the velocity time function. Any temporal changes in the velocity field can be accommodated by a ramp time function

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which is a velocity segment. Earthquakes are modeled using the step time function which is zero before the earthquake origin time, and one afterwards. In this case the grid file represents the earthquake. Post seismic decay is usually modeled using an exponential time function.

Trimble currently supports models for New Zealand, the US, Canada, Iceland, Brazil and the Nordic Countries. We intend to support other models as they are released. In our experience this will significantly increase the accuracy of PPP derived coordinates including RTX.

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