Support for Dynamic Datums in Trimble Software

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SUMMARY

The GNSS satellite orbits are determined in the International Terrestrial Reference Frame (ITRF) at the epoch of measurement (eom) which results in GNSS baselines and precise point positioning coordinates also being in the current ITRF at the eom. However, in national datums, the coordinates reflect the position at a standard reference epoch. Because of the effect of plate tectonic motions, the relationship between these systems change continuously with time. As a result, accurate datum transformations require the application of models to correct tectonic motion. These are implemented in Trimble software using a grid-based algorithm developed by Land Information New Zealand. This algorithm is generally consistent with the standards that are under development by the OGC working group on deformation modeling. Using this algorithm, we are able to support all of the tectonic models currently in use.

The models we support are divided into four broad categories.

1. First, for countries that are located in one tectonic plate, the horizontal velocity is determined by applying the absolute Euler Pole for the plate in question. Examples of this include Australia and most European countries.

2. The second category are velocity models. These are normally characterized by a constant or secular. The velocity can either be given relative to the absolute No Net Rotation (NNR) reference frame or relative to a tectonic plate, in which case the velocity field is a correction to the Euler Pole predicted displacement. An example of the velocity field relative to the NNR frame is the VEMOS field used in Chile. An examples of the hybrid models involving both a velocity field and a Euler Pole is the NKG velocity field used by the Nordic countries.

3. The third type of displacement model incorporates a velocity field augmented with grids representing earthquake displacement and sometimes post-seismic relaxation.

4. The fourth type of displacement model supports datums like JGD2011 where semidyna.exe, an online app provides estimates of the tectonic motion from the reference epoch to the current year. We implement this using a displacement grid from which we can interpolate the tectonic motion for any point.

In future we hope to incorporate estimates of uncertainties into deformation models where these are available and provide tools for users to visualize velocity and earthquake grids.

We recommend that National Agencies worldwide should reuse a similar standard approach when building future displacement models, to ease integration in vendor's products.