New Horizontal Intraplate Velocity Model for Nordic and Baltic Countries

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SUMMARY

Fennoscandian region with its surroundings is effected by the Glacial Isostatic Adjustment (GIA) resulting in intraplate crustal motions up to a few millimeters per year in horizontal coordinates and up to a centimeter per year in heights. The national reference frames in Nordic and Baltic countries are plate-fixed and based on European Terrestrial Reference System 1989 (ETRS89) and European Vertical Reference System (EVRS), as regulated by the European Union's Inspire directive. In maintenance of the national reference frames and in the most accurate georeferencing applications the GIA effect must be accounted for.

The Nordic countries have a long tradition on studying the GIA (or land uplift) phenomenon. Latest efforts have been conducted in collaboration under the Nordic Geodetic Commission (NKG) and have resulted in some common Nordic-Baltic land uplift and deformation models. For example, the NKG2005LU model has been used e.g. in levelling adjustments as the basis for Nordic European Vertical Reference Frame (EVRF) realizations and the NKG_RF03vel model e.g. for transforming International Terrestrial Reference Frame (ITRF) coordinates accurately to national ETRS89 realizations.

In late 2016, the NKG decided to release a new land uplift model package consisting three models: NKG2016LU_abs/lev, NKG_RF17vel and NKG2016LU_gdot. NKG2016LU is a model describing vertical motions either as absolute (ellipsoidal) or levelled (from geoid) heights and it was released in 2016. NKG_RF17vel is a 2D+1D model to be used with three-dimensional geometrical coordinates where the NKG2016LU_abs forms the basis for vertical part of the model. NKG2016LU_gdot describes gravity change rate due to the GIA.

In this paper we describe the development of the horizontal intraplate velocities of the

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NKG_RF17vel model. The horizontal velocities of the model are comprised of the BIFROST and the NKG GNSS Analysis Centre (NKG AC) GNSS velocity solutions and a new GIA model called NKG2016GIA_prel0907. The GIA velocities were first aligned from a GIA frame to a geodetic reference frame by a Helmert fit using GNSS velocities. Then the final adjustment was done with least-squares collocation also accounting for the GNSS velocity uncertainties. We will describe the methodology and show results of the NKG_RF17vel model. Moreover, we will discuss about its use in transformations from global ITRF coordinates to the national ETRS89 realizations. This can be seen as an implementation of a semi-dynamic reference frame or as a link between the reference frames in so called two-frame approach.