Trimble's Support for Modernized Datums in Africa

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Key words: Deformation measurement; Reference frames; Reference systems; semi-dynamic datums

SUMMARY

National coordinate reference systems in many African Countries are based on classical datums from the 1950-1990's that are not well configured to support GNSS based positioning. As a result, there is a movement to replace these with semi-dynamic datums, based on the ITRF and including deformation models to correct for crustal motion between the epoch of measurement and the reference epoch of the datum.

Most of Africa is on the stable Nubia plate which undergoes little internal deformation except for a broad swath of West Africa which lies over the Nubia/Somalia plate boundary and a narrow zone in northen Morocco and Algeria which lies over the Nubia/Eurasia plate boundary. Both are actively deforming, particularly the Atlas Mountains which are characterized by repeated large earthquakes, most recently the Mw6.8 Morocco earthquake of 2023.

The Trimble Geodetic Library (TGL) supports four types of deformation models. However, for nearly all of Africa, only three are relevant to our customers.

1. For countries that are located in one stable tectonic plate, the horizontal velocity is determined by applying the absolute Euler Pole for the plate in question. This is used in areas overlying the stable Nubia and Somalia plates.

2. For countries in west Africa effected by the Nubia/Somalia plate boundary not effected by earthquakes the velocity is interpolated from a grid.

3. For countries effected by significant earthquakes we use a velocity grid augmented with patches representing co-seismic displacement. This may be applicable to regions that have had large

earthquakes, particularly northern Morocco and Algeria.

The purpose of this paper is to review how Trimble intends to support modernized geodetic datums in Africa. As examples, we will focus on two countries that have modernized datums supported in TGL: Ivory Coast and South Africa.

The Ivory Coast's datum is RGCI 2022, equivalent to ITRF2014 at epoch 2010.0. Since Ivory Coast lies on the stable Nubia plate, we used the ITRF2014 Nubia pole as the deformation model. In South Africa the TRIGNET VRS gives coordinates in ITRF2014@2018.18. However, the official coordinate system for South Africa is the Hartebeesthoek94 or Hart94 system. So, there are two transformations that TGL has to support. Since South Africa is affected by the Nubia Somalia plate boundary, we implemented a velocity model to transform RTX coordinates from eom to epoch 2018.18 and then we apply a datum grid to transform coordinates from ITRF2014 epoch 2018.18 to Hart94.